ANESTHESIA and SEDATION

CHI Formulary Development Project

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Council of Health Insurance

INDICATION UPDATE

ADDENDUM- February 2024

To the CHI Original Anesthesia Clinical Guidance- Issued May 2020

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Related WI:

- IDF-FR-WI-01-01SearchMethodologyGuideForNewIndications

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Abbreviations

ACH	Air Changes per Hour
ACLS	Advanced Cardiac Life Support
ADHD	Attention Deficit Hyperactivity Disorder
ASA	American Society of Anesthesiologists
BLS	Basic Life Support
CAM-ICU	Confusion Assessment Method for the Intensive Care Unit
CAS	Canadian Anesthesiologists' Society
CHI	Council of Health Insurance
CNS	Central Nervous System
CO2	Carbon Dioxide
CPR	Cardiopulmonary Resuscitation
CSA	Canadian Standards Association
DISE	Drug-Induced Sleep Endoscopy
DOAC	Direct Oral Anticoagulant
ECG	Electrocardiograph
EMS	Emergency Medical Services
FDA	United States Food and Drug Administration
FHR	Fetal Heart Rate
GI	Gastrointestinal
GMC	General Medical Council
ICDSC	Intensive Care Delirium Screening Checklist
IDF	Insurance Drug Formulary
INO	Inhaled Nitrous Oxide
ISO	International Organization for Standardization
IV	Intravenous
LAST	Local Anesthetic Systemic Toxicity
LAT	Local Anesthetic Toxicity

LMWH	Low molecular weight heparins
MRI	Magnetic Resonance Imaging
N2O	Nitrous Oxide
NEWS2	National Early Warning Score 2
NICU	Neonatal Intensive Care Unit
NMBA	Neuromuscular Blocking Agent
OSA	Obstructive Sleep Apnea
PALS	Pediatric Advanced Life Support
PCEA	Patient-Controlled Epidural Analgesia
PDL	Periodontal Ligament
PDPH	Post-Dural Puncture Headache
PIEB	Programmed Intermittent Epidural Bolus
PPE	Personal Protective Equipment
PRIS	Propofol-Induced Infusion Syndrome
RSI	Rapid Sequence Intubation
SFDA	Saudi Food and Drug Authority
TOF	Train-of-Four
UA	Upper Airway
UFH	Unfractionated Heparin
UK	United Kingdom
URTI	Upper Respiratory Tract Infection
VKA	Vitamin K Antagonist

Executive Summary

Anesthesia is the use of anesthetics, which are drugs, to prevent pain during medical procedures. There are different types of anesthesia, including local anesthesia, which numbs a specific body area; sedation, which induces a relaxed, drowsy state; regional anesthesia, which blocks pain in a larger part of the body; and general anesthesia, which renders you unconscious for more invasive surgeries. The choice of anesthesia depends on the procedure's complexity and extent. Local anesthesia is used for minor procedures, while general anesthesia is employed for surgeries involving the head, chest, or abdomen[1].

Anesthesia is administered by the healthcare provider performing the procedure for simple cases, but more complex and invasive procedures require a physician anesthesiologist or an anesthesia team, which may include fellows, residents, certified registered nurse anesthetists, and certified anesthesiologist assistants[1].

Before undergoing anesthesia, the patient should provide a list of medications and supplements, avoid food and drink for eight hours before the procedure, quit smoking temporarily, and follow the healthcare provider's guidance regarding herbal supplements and certain medications[1].

During anesthesia, providers administer anesthetics, monitor vital signs, and address any issues that may arise, such as allergic reactions or changes in vital signs[1].

After receiving anesthesia, the ability to resume regular activities depends on the type of anesthesia used. For local anesthesia, one can typically return to work immediately[1]. In the case of regional or general anesthesia or sedation, the patient should have someone drive him home, rest for the remainder of the day, avoid alcohol, and follow medication guidelines[1].

Most anesthesia side effects are temporary and can include back pain, chills, difficulty urinating, fatigue, headache, itching, nausea, vomiting, pain at the injection site, and a sore throat. However, anesthesia also carries some risks, including anesthetic awareness (awareness during a procedure under general anesthesia), collapsed lung, malignant hyperthermia (a rare reaction to anesthesia), nerve damage, and postoperative delirium (more common in older individuals)[1].

Certain factors can increase the risk of anesthesia complications, including advanced age, medical conditions like diabetes or heart disease, a family history of malignant hyperthermia, obesity, and smoking[1].

CHI issued Anesthesia clinical guidelines after thorough review of renowned international and national clinical guidelines in May 2020. Updating clinical practice guidelines (CPGs) is a crucial process for maintaining the validity of recommendations.

This report functions as an addendum to the prior CHI Anesthesia clinical guidance and seeks to offer guidance for the effective management of Anesthesia. It provides an **update on the Anesthesia Guidelines** for CHI Formulary with the ultimate objective of updating the IDF (CHI Drug Formulary) while addressing **the most updated best available clinical and economic evidence related to drug therapies.**

Main triggers for the update were summarized, being **the issuance updated versions of previously reviewed guidelines** namely the Canadian Journal of Anesthesia Guidelines To the Practice of Anesthesia (2023), the Faculty of Pain Medicine of The Royal College of Anesthetists' Best practice in the management of epidural analgesia in the hospital setting (2020), the PG09(G) Guideline on procedural sedation by ANZCA (2022), the American College of Emergency Physicians' Unscheduled Procedural Sedation: A Multidisciplinary Consensus Practice Guideline (2019), the European position paper on drug-induced sleep endoscopy (2017), the Royal college of Emergency Best Practice Guideline's Ketamine Procedural Sedation for Children In The Emergency Department (2020), the American Academy of Pediatric Dentistry (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients- Revision 2023), the Evidence-based clinical practice guidelines for the management of sedoanalgesia and delirium in critically ill adult patients (2019) the Delirium: prevention, diagnosis and management in hospital and long-term care (2023), and the French Society of Anesthesia & Intensive Care Medicine's Guidelines on muscle relaxants and reversal in anesthesia (2020).

Moreover, **new guidelines are added to the report** such as the Association of Women's Health and the Obstetric and Neonatal Nurses' Analgesia and Anesthesia in The Intrapartum Period Evidence-Based Clinical Practice Guideline (2020), the Perioperative neuromuscular blockade update of the SEDAR (2020), and the Guideline on anesthesia and sedation in breastfeeding women from the Association of Anesthetists (2020).

After carefully examining clinical guidelines and reviewing the SFDA drug list, 3 drugs have been added to the CHI formulary (section 2.1), and two new drugs are approved by the FDA: Iheezo (chloroprocaine hydrochloride ophthalmic gel) and Zynrelef (Bupivacaine and Meloxicam extended-release solution) (section 2.4). Some drugs are no longer SFDA-registered, and it is advisable to delist them from CHI formulary: amitriptyline hydrochloride, benoxinate, cimetidine, dexpanthenol and sodium hyaluronate, ectoin and sodium hyaluronate, glycerin and sodium carboxymethylcellulose, isoprenaline, mivacurium chloride, norepinephrine bitartrate and articaine hydrochloride, sodium bicarbonate and omeprazole, and sodium nitroprusside (section 2.3).

All recommendations are well supported by reference guidelines, Grade of Recommendation (GoR), Level of Evidence (LoE) and Strength of Agreement (SoA) in all tables reflecting specific drug classes' role in the administration of anesthesia and sedation.

Below is a table summarizing the major changes based on the different anesthesia and sedation guidelines used to issue this report:

Table 1. General Recommendations for Anesthesia/Sedation

Anesthesia/Sedation		
General Recommendations	**Level of Evidence/ Grade of Recommendation**	**Reference**
Adequate quantities of appropriate anesthetic, analgesic, resuscitative, and other (adjuvant) medications should be available in healthcare facilities. These include ketamine, diazepam, midazolam, morphine, and local anesthetics (lidocaine or bupivacaine).	Highly Recommended	WHO-WFSA (2018)[2]
Thiopental or propofol, appropriate inhalation anesthetics, succinylcholine, and appropriate non-depolarizing muscle relaxants such as pancuronium or atracurium are recommended to be available in healthcare facilities.	Recommended	WHO-WFSA (2018)[2]
Propofol and alternative inhalation anesthetics (sevoflurane) or alternative non-depolarizing muscle relaxants (rocuronium or cisatracurium) are suggested.	Suggestion	WHO-WFSA (2018)[2]
Where a combination of a benzodiazepine and an opioid are administered, the opioid should be given first, and the benzodiazepine only given once the peak effect of the opioid is observed.	N/A	Academy of Medical Royal Colleges (2021)[3]
The benzodiazepine and opioid antagonists, flumazenil, and naloxone, are usually reserved for emergency use.	N/A	Academy of Medical Royal Colleges (2021)[3]

Dosing regimens for children should be adjusted based on age and weight, with maximum dosages clearly defined to minimize the risk of cumulative local anesthetic toxicity.	N/A	Royal College of Anesthetists (2020)[4]
Beyond the official neonatal period (over 4 weeks of age), pre-term babies' epidural infusion rates should be considered like neonates.	N/A	Royal College of Anesthetists (2020)[4]
Like in adults, the lowest effective concentration of local anesthetic should be used for children.	N/A	Royal College of Anesthetists (2020)[4]
Patients with severe cardiovascular diseases: Provide Procedural Sedation and Analgesia (PSA) with benzodiazepine (mainly midazolam) and/or propofol, and low-dose opioid.	Very good consensus: level of evidence A, strong recommendation	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]
Patients with documented or suspected risk of obstructive sleep apnea syndrome (OSAS): minimal doses of hypnotics should be used, and opioids should be avoided. Dexmedetomidine could be considered as an alternative.	Very good consensus: level of evidence B, strong recommendation	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]
Sedation in patients with morbid obesity: propofol seems to be associated with respiratory complications also when used by anesthetists, so remifentanil and dexmedetomidine have been proposed for tailored titration of sedation and analgesia with appropriate monitoring.	Very good consensus: level of evidence A: grade of recommendation strong	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]
Patients with chronic renal failure: PSA during procedures of vascular access for hemodialysis, intravenous administration of drugs, such as midazolam and/or fentanyl, are generally preferred for their short onset time	Very good consensus: level of evidence B: grade of recommendation weak	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]

Patients with chronic hepatic disease: Midazolam is preferred because it has a shorter onset time when compared with diazepam and lorazepam.	Very good consensus: level of evidence A, strong recommendation	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]
Sedation in patients with chronic hepatic disease: propofol sedation in chronic hepatic failure (including Child-Pugh C patients) has been reported to be superior to midazolam sedation in terms of safety, efficacy and recovery.	Very good consensus: level of evidence A, strong recommendation	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]
Elderly patients (older than 70 years): The onset of action of all anesthetic drugs used in elderly patients is much slower and the intervals for successive doses (dose-titration) should be adapted accordingly.	Very good consensus: level of evidence A, strong recommendation	European Society of Anesthesiology and European Board of Anesthesiology (2017)[5]
Sedatives intended for general anesthesia include propofol, ketamine and etomidate.	N/A	Practice Guidelines for Moderate Procedural Sedation and Analgesia (2018)[6]
Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia.	N/A	Practice Guidelines for Moderate Procedural Sedation and Analgesia (2018)[6]
Administer naloxone to reverse opioid-induced sedation and respiratory depression.	N/A	Practice Guidelines for Moderate Procedural Sedation and Analgesia (2018)[6]
Administer flumazenil to reverse benzodiazepine induced sedation and respiratory depression.	N/A	Practice Guidelines for Moderate Procedural Sedation and Analgesia (2018)[6]
Opioids are the most commonly used intra-procedural systemic analgesic. Fentanyl is the opioid of choice due to its rapid onset of action, short half-life and fewer side effects compared to	N/A	Royal College of Radiologists (2018)[7]

other opioids such as morphine, diamorphine, or pethidine.		
Topical local anesthetics can be applied as creams, sprays, jellies and so on, and can be useful for needle phobic patients prior to intravenous catheter insertion or prior to infiltration of local anesthetic.	N/A	Royal College of Radiologists (2018)[7]
Ketamine can be safely administered to children for procedural sedation and analgesia **in the ED**.	Level A recommendation	American College of Emergency Physicians (2014)[8]
Propofol can be safely administered to children and adults for procedural sedation and analgesia **in the ED**.	Level A recommendation	American College of Emergency Physicians (2014)[8]
A combination of propofol and ketamine can be safely administered to children and adults for procedural sedation and analgesia.	Level B recommendation	American College of Emergency Physicians (2014)[8]
Etomidate can be safely administered to adults for procedural sedation and analgesia **in the ED.**	Level B recommendation	American College of Emergency Physicians (2014)[8]
For all children and young people undergoing a painful procedure, consider using a local anesthetic, as well as a sedative.	N/A	NICE Guidance for Sedation in Under 19 (2010)[9]
For children and young people undergoing a painful procedure (for example, suture laceration or orthopedic manipulation) in whom nitrous oxide (in oxygen) and/or midazolam (oral or intranasal) are unsuitable consider ketamine (intravenous [preferred] or intramuscular), or intravenous midazolam with or without fentanyl (to achieve moderate sedation).	N/A	NICE Guidance for Sedation in Under 19 (2010)[9]
For a child or young person who cannot tolerate a dental procedure with local anesthesia alone, to achieve	N/A	NICE Guidance for Sedation in Under 19 (2010)[9]

conscious sedation consider nitrous oxide (in oxygen) or midazolam.		
Consider fentanyl (or equivalent opioid) in combination with intravenous midazolam to achieve moderate sedation for lower gastrointestinal endoscopy.	N/A	NICE Guidance for Sedation in Under 19 (2010)[9]
Consider using a topical anesthetic before the injection to reduce needle penetration discomfort, while accounting for potential systemic absorption of topical drugs in total anesthetic calculations.	N/A	AAPD on Use of Local Anesthesia for Pediatric Dental Patients (2023)[10]
When local anesthetics are used alongside other CNS-depressing medications, lower the calculated maximum total dose.	N/A	AAPD on Use of Local Anesthesia for Pediatric Dental Patients (2023)[10]
Randomized controlled trials report improved pain relief when use of pre-incisional epidural or intrathecal morphine is compared with pre-incisional oral, intravenous, or intramuscular morphine.	Category A2 evidence	American Society of Anesthesiologists Task Force on Acute Pain Management (2012)[11]
Meta-analyses of RCTs report improved pain scores when epidural morphine combined with local anesthetics is compared with epidural morphine alone.	Category A1 evidence	American Society of Anesthesiologists Task Force on Acute Pain Management (2012)[11]
Meta-analyses of RCTs report equivocal findings for pain scores, analgesic use, or nausea scores when intravenous morphine combined with ketamine is compared with intravenous morphine.	Category C1 evidence	American Society of Anesthesiologists Task Force on Acute Pain Management (2012)[11]
Meta-analyses of RCTs report lower pain scores and reduced opioid use when IV opioids combined with calcium channel blockers (i.e., gabapentin, pregabalin) is compared with IV opioids alone.	Category A1 evidence	American Society of Anesthesiologists Task Force on Acute Pain Management (2012)[11]

We suggest using low-dose ketamine as an adjunct to opioid therapy when seeking to reduce opioid consumption in postsurgical adults admitted to the ICU.	Conditional recommendation, very low quality of evidence	Society of Critical Care Medicine (2018)[12]
We recommend using a neuropathic pain medication (e.g., gabapentin, carbamazepine, and pregabalin) with opioids for neuropathic pain management in critically ill adults.	Strong recommendation, moderate quality of evidence	Society of Critical Care Medicine (2018)[12]
We suggest using propofol over a benzodiazepine for sedation in mechanically ventilated adults after cardiac surgery. Rapid administration of propofol may cause hypotension. Propofol-related infusion syndrome (PRIS), lethal condition characterized by multiple organ system failures, should be closely monitored.	Conditional recommendation, low quality of evidence	Society of Critical Care Medicine (2018)[12]
We suggest using either propofol or dexmedetomidine over benzodiazepines for sedation in critically ill, mechanically ventilated adults.	Conditional recommendation, low quality of evidence	Society of Critical Care Medicine (2018)[12]
We suggest not using haloperidol, an atypical antipsychotic, dexmedetomidine, a β-Hydroxy β-methylglutaryl-Coenzyme A (HMG-CoA) reductase inhibitor (i.e., statin), or ketamine to prevent delirium in all critically ill adults.	Conditional recommendation, very low to low quality of evidence	Society of Critical Care Medicine (2018)[12]
The use of a muscle relaxant is recommended to facilitate tracheal intubation.	GRADE 1+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
Administering a short-acting muscle relaxant for rapid-sequence induction is probably recommended.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]

The use of train-of-four stimulation of the ulnar nerve at the adductor pollicis is probably recommended for monitoring intraoperative neuromuscular blockade.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
Except for situations requiring rapid-sequence induction or the use of a depolarizing muscle relaxant, it is probably recommended to use a non-depolarizing muscle relaxant for improved intubating conditions during anesthesia in children by intravenous induction.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
In conventional rapid-sequence induction, it is probably recommended to use suxamethonium as the first-line drug for children. In cases where suxamethonium is contraindicated, the use of rocuronium is probably recommended.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
Administration of sugammadex is probably recommended for reversing a residual neuromuscular blockade after using a steroidal muscle relaxant in patients with neuromuscular disease.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
The use of a benzylisoquinoline muscle relaxant (atracurium/cisatracurium) is probably recommended in cases of renal or hepatic failure.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
When using sugammadex in cases of renal failure, it is probably recommended to administer it at the usual dose.	GRADE 2+, STRONG AGREEMENT	French Society of Anesthesia & Intensive Care Medicine (2020)[13]
Most perioperative drugs, including anesthetics and non-opioid analgesics, transfer to breast milk in minimal amounts with no evidence of effects on the infant.	N/A	Association of Anesthetists (2020)[14]
Be cautious with drugs like opioids and benzodiazepines, especially after	N/A	Association of Anesthetists (2020)[14]

multiple doses, in infants up to 6 weeks old (corrected for gestational age). Monitor for abnormal drowsiness and respiratory depression if the mother shows signs of sedation.		
Most perioperative drugs, including anesthetics and non-opioid analgesics, transfer to breast milk in minimal amounts with no evidence of effects on the infant.	N/A	Association of Anesthetists (2020)[14]

At the end of the report, a key recommendation synthesis section is added highlighting the latest updates in the administration of **anesthesia and sedation**.

Section 1.0 Summary of Reviewed Clinical Guidelines & Evidence

Each subsection is divided into two parts: the first includes recommendations from **updated versions of guidelines** mentioned in the previous CHI **Anesthesia** report, and the second includes **newly added guidelines** that have helped generate this report.

A. Guidelines and Standards for Safe Practice

A.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 2. Clinical Guidelines Requiring Revision (Safe Practice)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.1 **World Health Organization-World Federation of Societies of Anesthesiologists** (WHO-WFSA) International Standards for a Safe Practice of Anesthesia (**2018**)[2]	N/A*
Section 1.2 Guidelines to The Practice of Anesthesia - Canadian Anesthesiologists' Society (Revised Edition 2019)	Section A.1.2 Guidelines to The Practice of Anesthesia- **Canadian Anesthesiologists' Society** (CAS) (Revised Edition **2023**)[15]
Section 1.3 Guidelines for the safe practice of total intravenous anesthesia (TIVA) Joint Guidelines from the **Association of Anesthetists** and the **Society for Intravenous Anesthesia** (**2018**)[16]	N/A*
Section 1.4 Concise practice guidance on the prevention and management of accidental awareness during general anesthesia- Published by the	N/A*

Association of Anesthetists and the **Royal College of Anesthetists** (**2019**)[4]	
Section 1.5 **Academy of Medical Royal Colleges**: Safe Sedation Practice for Healthcare Procedure Standards and Guidance (October **2013**)[3]	Recommendations re-emphasized in **2021**.
Section 1.6 Best practice in the management of epidural analgesia in the hospital setting- Faculty of Pain Medicine of The Royal College of Anesthetists (2010)	Section A.1.6 Best practice in the management of epidural analgesia in the hospital setting- Faculty of Pain Medicine of The **Royal College of Anesthetists** (**2020**)[17]
Section 1.7 Statement on Safe Use of Propofol – **American Society of Anesthesiologists** (**2019**)[18]	N/A*
Section 1.8 Guidelines for day-case surgery 2019- Published by the **Association of Anesthetists** and the **British Association of Day Surgery** (**2019**)[19]	N/A*

*: No updated versions available

A.1.1 World Health Organization-World Federation of Societies of Anesthesiologists (WHO-WFSA) International Standards for a Safe Practice of Anesthesia (2018)

Please refer to Section 1.1 of CHI Anesthesia Report.

There are no new updates[2]. The recommendations of this guideline remain unchanged[2].

A.1.2 Canadia Anesthesiologists' Society (CAS) Guidelines to The Practice of Anesthesia (2023)

Please refer to Section 1.2 of CHI Anesthesia Report.

The following recommendations are provided by the Canadian Anesthesiologists' Society (CAS) on the practice of anesthesia and are aimed at providing basic guidelines to anesthetic practice. They are intended as a framework for reasonable and acceptable patient care and should be interpreted as such to allow for some degree of flexibility in different circumstances[15].

Organization of anesthetic services

- Ensure the department of anesthesia is properly organized, integrated with other departments, and includes all necessary staff.
- Adequately staff the department based on service scope, striving for availability as required.
- Appoint a certified physician as the chief of the department, following the same procedure as other clinical departments.

Responsibilities of the chief of anesthesia

- Stay informed about relevant guidelines, accreditation requirements, and licensing authority regulations.
- Establish and enforce written policies for anesthesia practice.
- Evaluate the qualifications of anesthesia providers and recommend clinical privileges.
- Implement a systematic approach to monitor and improve the quality of anesthesia care.
- Maintain records for all anesthetic procedures.
- Carry out delegated duties to ensure safe anesthesia care.
- Promote compliance with applicable standards.
- Coordinate communication between anesthesia, biomedical engineering, and information management services.

Privileges in anesthesia

- Require physicians applying for anesthesia privileges to complete specialist postgraduate training.
- Allow for special considerations in special areas of anesthetic care such as pediatric anesthesia privileges.
- Ensure anesthetic physicians possess necessary knowledge, technical and non-technical skills for anesthesia practice.
- Technical skills include:
    - Conducting a thorough preanesthetic assessment of the patient and determining the appropriate anesthetic approach.
    - Ensuring the patient doesn't feel pain during diagnostic, therapeutic, surgical, and obstetric procedures.

    - Monitoring and supporting the functioning of vital organs during the perioperative period.
    - Managing the patient immediately after anesthesia.
    - Offering resuscitation and intensive care as necessary.
    - Alleviating both acute and chronic pain.
- Non-technical skills include:
    - Task management, which involves planning, preparing, prioritizing, maintaining standards, and utilizing resources effectively.
    - Teamwork, which entails coordinating activities with team members, sharing information, exercising authority and assertiveness, assessing team capabilities, and adhering to the World Health Organization Surgical Safety Checklist.
    - Situational awareness, which includes anticipating issues, gathering information, recognizing, and understanding the current situation.
    - Decision-making, which involves identifying options, weighing risks, making choices, and re-evaluating decisions as needed.

Physician health and wellness

- Discouraging the scheduling of non-urgent procedures during less favorable hours by healthcare facilities and operating room management, while acknowledging the constraints imposed by high demand for operating room resources.
- Promoting flexibility in staffing arrangements when feasible, allowing coverage for exhausted physicians or unexpected personal or family health-related absences.
- Organizing operating room schedules in a way that allows for necessary breaks to address personal physiological needs and have meals.
- Encouraging healthcare departments and facilities to establish anesthesia care teams, which include anesthesia assistants, to enhance both patient safety and the well-being of physicians.
- Ensuring that anesthesia physicians always have access to appropriately skilled support, especially in non-operating room settings and during off-hours for emergency cases. This is particularly important in departments where anesthesiologists are expected to provide coverage for multiple services, such as the operating room and labor and delivery.
- Creating departments that foster a culturally safe environment and have effective mechanisms in place for addressing workplace harassment and

bullying, with a zero-tolerance approach to discrimination based on factors like gender, race, culture, sexuality, or disability.

- Developing a formal system for responding to and supporting staff and residents following stressful events, including critical adverse incidents, unexpected patient deaths, and patient complaints. This includes the utilization of appropriately trained debriefing and critical incident support management personnel who can provide peer support in accordance with established frameworks.
- Offering a respectful pathway to retirement, which may include strategies for reducing on-call responsibilities and access to less complex cases when feasible and available.

Residents

- A responsible attending staff anesthesiologist must supervise residents' activities, considering patient condition, service nature, and resident experience.
- Require close communication between residents and supervising anesthesiologists.
- Define policies regarding resident activities and supervision.

Ancillary personnel

- Ensure availability of ancillary personnel as assistants to anesthesiologists.
- Consider the need for formally designated anesthesia assistants with specific training.
- Approve the scope of practice for anesthesia assistants.
- Define duties and tasks consistent with regulations and local policies.
- Delegate tasks only to personnel with appropriate approval or accreditation.

Anesthetic equipment and anesthetizing location

- Administer anesthesia in an appropriate facility.
- Ensure all necessary equipment, including emergency equipment, life support systems, medications, and supplies, are readily available.
- Maintain a cognitive aid manual at anesthetizing locations for managing critical perioperative emergencies, regularly reviewed, updated, and practiced.
- Responsibilities of designing, maintaining, and purchasing anesthetic equipment and supplies rest with the healthcare facility.
- Responsibilities of the Healthcare Facility

- Ensure that operating rooms, anesthetizing locations, and perioperative care locations meet the minimum design and construction requirements of national, provincial, and local building, plumbing, electrical, HVAC, fire, and security codes during construction or renovation.
- Verify that medical gas and vacuum systems, waste anesthetic gas scavenging systems, terminal units, head walls, low-pressure connecting assemblies, and pressure regulators adhere to CSA requirements and are certified by a CSA-approved testing agency.
- Recognize that oxygen concentrators, compliant with CSA standards, can substitute bulk oxygen supply systems, but users should be aware of potential variations in inspired oxygen fraction and inert gas accumulation when using low-flow anesthetic techniques.
- Ensure compliance with safety regulations and best practices for the storage, preparation, identification, labeling, disposal, and use of medical gases, medications, and related materials. This includes medication safety strategies, medication substitution labeling, and controlled substance security measures.
    - Safely storing controlled substances in a secure lockable safe or a locked drawer while the operating room is unattended.
    - Never leaving controlled substances unattended in any location, including those prepared in syringes or bags.
    - Emptying the contents of syringes and bags containing controlled substances before disposing of them.
    - Employing proper disposal and destruction methods for getting rid of controlled substance waste.
    - Considering a requirement that mandates the return of controlled substance waste to the pharmacy for random analysis.
    - Conducting periodic audits of a healthcare provider's records related to the use of controlled substances and their anesthesia procedures.
    - Exploring the possibility of implementing automated anesthesia cabinets or automated medication dispensing cabinets.
- For facilities providing general anesthesia with electronic anesthetic systems, these systems must comply with specific standards. Manual ventilation equipment and essential monitoring tools should be available, and equipment, supplies, and assistance for invasive procedures must be provided.

- Maintain a cardiac arrest cart with appropriate resuscitation equipment and ensure similar equipment for pediatric cases. If Malignant Hyperthermia triggering agents are used, have a 'Malignant Hyperthermia Kit' available.
- Equip facilities with a 'Difficult Airway Kit' and specialized pediatric airway equipment where needed.
- Provide Personal Protective Equipment (PPE) and implement plume scavenging systems in surgical, diagnostic, therapeutic, and esthetic settings.
- Offer infusion pump systems with drug libraries, alarms, and appropriate limits, as well as oxygen equipment for patient transport.
- Schedule regular inspections and maintenance for anesthetic and ancillary equipment and keep records of compliance.
- Make selective relaxant-binding reversal agents available for neuromuscular blockade reversal.
- Implement strategies to minimize the risk of transmitting infectious agents between patients, particularly in equipment and medication handling.
- Ensure training on the safe use of anesthesia and resuscitation equipment for all anesthesia department members.

In the context of waste gases

- Provide dilution ventilation at a minimum rate of 20 air exchanges per hour (ACH) in areas using volatile anesthetic gases or nitrous oxide (N2O).
- Avoid recirculating exhaust air during surgical operations.
- Install scavengers to capture anesthetic gases released from the anesthetic circuit or ventilator.
- Establish a maintenance program to detect and repair leaks in the anesthetic delivery system and maintain waste anesthetic scavenging unit effectiveness.
- Conduct regular monitoring of exposure to waste anesthetic gases, including individuals and room air flow patterns.
- Consider low total fresh gas flow anesthesia techniques when appropriate to reduce environmental impact and improve cost efficiency.

Preanesthetic period: discuss with patients the options for anesthesia and its associated risks and sign the consent form.

- Set policies for preanesthetic assessment.
- Document comprehensive patient medical and surgical history, physical examination findings, and relevant lab results.

- Include patient's history, medical problems, drug therapy, anesthesia-related issues, family history, and the **ASA physical status classification**.
- Verify the availability and applicability of an 'Advance Care Plan.'
- Consider anesthesiologist consultation as requested by the surgeon.
- Preoperative assessments may occur in an outpatient clinic, particularly for patients with medical issues, complex procedures, or patient requests. Involvement of minors and incapacitated adults in the consent process is necessary.
- Inform patients that they can meet with an anesthesiologist before admission.
- Final preanesthetic assessment should be conducted in the immediate preoperative period.

According to the American Society of Anesthesiologists[20]:

Table 3. Current Definitions the ASA Physical Status Classification

ASA-PS Classification	Definition
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

Preoperative testing

- Laboratory tests should be performed based on clinical necessity, considering the patient's medical condition, drug therapy, and the procedure's nature.
- Routine lab tests are discouraged for asymptomatic patients undergoing low-risk surgery.

Fasting policies

- Adjust fasting policies based on age, medical conditions, and the type of anesthesia.
- Elective procedures require specific fasting durations based on the type of ingested materials:

    - Six hours after any meal containing solids, and after ingestion if infant formula, non-human milk, or expressed breastmilk fortified with additions.
    - Four hours after ingestion of breast milk.
    - Two hours after ingestion of clear fluids for adults
    - One hour after ingestion of clear fluids for infants and children
- Unless contraindicated, encourage clear fluid intake up to two hours before elective surgery, and one hour for infants and children.
- Premedication should be ordered by the anesthesiologist.
- H2 receptor antagonists (oral or IV) are recommended for women undergoing Cesarean delivery.
- Thirty mL of oral sodium citrate (0.3 molar) is advised before emergent Cesarean delivery if general anesthesia is planned.
- Additional fasting guidelines apply to patients in active labor.

Additional regulations

- Provincial laws and facility bylaws may establish extra anesthesia regulations.

Anesthetic period

Preparation for anesthesia

- Provide patients with an explanation of the anesthetic procedure, risks, and alternatives.
- Conduct a thorough patient review.
- Ensure all required equipment, drugs, and supplies are available and functioning.
- Maintain a backup oxygen supply.
- Identify and label drugs correctly, following CSA standards.
- Consider using neuraxial connectors compliant with ISO standards.
- Adhere to equipment manufacturer recommendations.

Airway management

- Properly manage the airway, especially in cases of difficult intubation.
- Prepare for a 'cannot ventilate, cannot oxygenate' scenario.
- Ensure that equipment, training, and protocols are available for difficult airway management.

Delegation and patient care

- The primary responsibility of an anesthesiologist or anesthesia assistant is patient care.
- Anesthesiologists can delegate care to other qualified personnel but remain responsible for the patient's anesthesia.
- A structured protocol should be used for intraoperative handovers.
- Anesthesiologists should not administer anesthesia and perform concurrent surgical procedures.

Patient monitoring

- Recognize the critical importance of continuous monitoring by a physician or supervised anesthesia assistant during all anesthetics.
- Use mechanical and electronic monitors as aids to vigilance for the integrity of vital organs, tissue perfusion, and oxygenation.
- Ensure that monitoring equipment meets current standards and is used as intended by the manufacturer.
- Collaborate with healthcare facilities to provide and maintain appropriate monitoring equipment.
- Involve the chief of anesthesia in advising healthcare facilities on equipment procurement and establishing monitoring policies.
- Complete a preanesthetic checklist before anesthesia initiation to enhance patient safety.
- Emphasize the necessity of cautious dosing, vigilant monitoring, and proper reversal of neuromuscular blocking drugs for patient safety.
- Utilize neuromuscular monitoring when administering neuromuscular blocking agents.
- Consider depth of anesthesia monitoring, particularly for patients at risk of intraoperative anesthesia awareness.
- Apply monitoring guidelines for standard patient care across various anesthesia scenarios.

<u>Required monitoring equipment</u>

- Ensure the continuous use of the following monitors throughout all anesthetics: Pulse oximeter, non-invasive blood pressure measurement, electrocardiography, neuromuscular blockade monitor (if applicable), capnography (for general anesthesia and ventilation assessment), agent-

specific anesthetic gas monitor, and tidal volume and airway pressure monitoring.

- Make monitors available at each anesthetic workstation for exclusive use with no delays.
- Ensure immediate availability of equipment for invasive hemodynamic monitoring if indicated.

Perioperative temperature management

- Continuously monitor patient core temperature during general anesthesia lasting 30 minutes or longer and recommend intermittent temperature monitoring during neuraxial anesthesia.
- Employ active patient warming systems and environmental temperature control to maintain a core temperature of 36–37°C.

Patient positioning

- Acknowledge the responsibility of the operating room team in patient positioning, emphasizing the need for thorough planning and risk mitigation.
- Encourage team members to voice concerns and strategies to mitigate positioning-related risks.
- Document patient positioning, with regular rechecks to ensure ideal conditions and patient awareness of associated risks.

Records

- Chart all monitored physiologic variables at appropriate intervals, including heart rate, blood pressure, oxygen saturation, and respiratory rate.
- Document the reasons for deviations from charting guidelines in the anesthetic record.
- Accurately record all relevant information, including equipment usage, drug dosages, and total dosages of local anesthetics administered.
- Highlight the patient's level of consciousness and pertinent vital signs in the patient health record.
- Consider implementing electronic anesthesia information management systems (AIMS) to improve the quality of anesthesia records and support real-time clinical decision-making.
- Ensure that AIMS maintain a longitudinal patient database for easy historical data retrieval and coordination with other electronic patient databases in healthcare facilities.

Postanesthetic period

- Ensure that a post anesthesia care unit (PACU) is available in any facility providing anesthetic services.
- Establish administrative policies to coordinate medical and nursing care responsibilities in accordance with facility bylaws.
- Give the department of anesthesia overall medical administrative responsibility for the PACU.
- Maintain a PACU policy manual approved by appropriate medical, nursing, and administrative authorities.
- Accompany the patient to the PACU and communicate necessary information to the PACU nurse(s) as part of a structured handover of care protocol.
- Write appropriate orders for patient care.
- Consider continuous monitoring of patients during the perioperative period based on clinical needs.
- Apply supplemental oxygen, portable pulse oximetry, and other monitoring devices if clinically indicated during transport to the PACU or intensive care unit.
- Provide supplemental oxygen during transport following general and moderate/deep procedural sedation anesthesia.
- Ensure the safe application of supplemental oxygen for intubated patients during transport to minimize the risk of barotrauma.
- Delegate care to the PACU nurse only when assured that nursing staff can safely observe and care for the patient.
- Be responsible for providing anesthetic-related care in the PACU.
- Delegate the responsibility of patient discharge from the PACU following facility policy.
- Maintain the availability of supplemental oxygen and suction for every patient in the PACU.
- Ensure that emergency equipment for airway management, resuscitation, and life support is readily available in the PACU.
- Make equipment for managing the difficult airway immediately available in the PACU.
- Use monitoring appropriate to the patient's condition and ensure a full range of monitoring devices is accessible.

- Enable monitor alarms with settings appropriate to the patient's condition and age.
- Implement continuous pulse oximetry in the initial phase of recovery.
- Recommend capnography for intubated and deeply sedated patients and consider it for unconscious patients within situ supraglottic airway devices.
- Suggest an apnea monitor for preterm infants with a gestational age of less than 50 weeks.
- Maintain an accurate record of the immediate recovery period, including vital signs, treatment, and observations.
- Document any complications related to the anesthesia in the recovery record.
- Consider direct patient transfer to other care units or bypassing the PACU if appropriate care is available and documented in the anesthetic record.

Discharge of patients after day surgery

- Develop and utilize a formal care plan approved by the institution for the discharge of patients after day surgery.
- Document the discharge process in the patient care notes.
- Evaluate patients against facility discharge to home criteria using a validated assessment tool (e.g., Post-Anesthetic Discharge Scoring System).
- Provide patients with specific written instructions regarding pain management, postoperative complications, routine and emergency follow-up, the effects of alcohol and sedative drugs, and the need for supervision during the postoperative period.

Guidelines for neuraxial and peripheral nerve block regional anesthesia

- Implement a pre-peripheral nerve block checklist for patient safety.
- Confirm informed consent, patient identity, allergies, surgical procedure, block type, and location.
- Review coagulation status.
- Mark the correct side to be blocked, if applicable.
- Discuss planned and maximum safe local anesthetic dosages.
- Confirm the availability of appropriate resuscitation equipment.
- Coordinate the timing of the block with the operating room schedule.
- Monitor patients receiving peripheral nerve block regional anesthesia with noninvasive blood pressure and oxygen saturation at a minimum.

- Make supplemental oxygen and airway management equipment immediately available.
- Ensure that cognitive aids and medications for the treatment of local anesthetic systemic toxicity are readily accessible in areas where peripheral nerve block regional anesthesia techniques are performed.
- Delegate patient monitoring in accordance with existing CAS guidelines.
- Maintaining neuraxial analgesia during labor
    - Continuous Epidural Infusions (CEI), Programmed Intermittent Epidural Bolus (PIEB), and Patient-Controlled Epidural Analgesia (PCEA) involving low-dose diluted epidural local anesthetics like bupivacaine 0.125% or ropivacaine 0.16%, with or without additional substances like opioids, are linked with an exceedingly low rate of significant complications. Therefore, it's not essential for an anesthesiologist to be always physically present or immediately available during the maintenance of CEI or PIEB, with or without PCEA, if the following conditions are met:
        - There are proper protocols in place for managing patients receiving CEI, PIEB, and PCEA.
        - The anesthesiologist can be contacted when needed to provide advice and guidance.
    - However, when administering initial and top-up bolus epidural local anesthetics, the anesthesiologist must be readily available to respond appropriately, recognizing that these techniques can pose immediate life-threatening risks. Individual anesthesiology departments should establish their own policies regarding the required presence of an anesthesiologist to handle potential complications associated with neuraxial analgesia for labor and delivery. Additionally, safety measures must be implemented to secure epidural local anesthetic mixtures and supplies containing controlled substances (such as opioids) to minimize the risk of diversion.
- Oral intake during labor
    - The process of emptying solid foods from the stomach is delayed during labor, and opioid pain relievers may exacerbate this delay. As a result, women in active labor should generally be advised against consuming solid foods. On the other hand, clear fluids are processed relatively quickly by the stomach during labor. Therefore, in most cases, women should be allowed to consume clear fluids as desired while in active labor. Each healthcare facility should create its own guidelines

regarding the consumption of solid foods and clear fluids by women in active labor.

Guidelines for acute pain management using neuraxial analgesia

- Establish an acute pain service responsible for developing policies and procedures for neuraxial analgesia.
- Coordinate with surgical departments regarding patient selection, the effects of neuraxial analgesia, and the implications of other therapies.
- Educate and certify nurses caring for patients receiving neuraxial analgesia, covering topics such as risk of respiratory depression, monitoring, and management of complications.
- Use a limited number of standard solutions for drug administration.
- Implement a standardized procedure for preparation of solutions and labeling.
- Secure intravenous access before initiating neuraxial analgesia.
- Maintain intravenous access throughout the administration of neuraxial analgesia.
- Ensure that an anesthesiologist is readily available to attend to patients receiving neuraxial analgesia and specify procedures for emergent management of life-threatening complications.
- Prohibit other physicians from ordering sedatives or analgesics for patients receiving neuraxial analgesia.
- Develop policies for patients receiving prophylactic low-dose anticoagulant therapy to minimize the risk of epidural hematoma and coordinate catheter insertion and removal.
- Use tamper-proof pumps for continuous infusions of neuraxial analgesia.
- Educate nursing staff to recognize signs and symptoms of epidural hematoma and investigate any change in neurologic status or new-onset back pain immediately.
- Minimize concurrent administration of nonsteroidal anti-inflammatory drugs or other antiplatelet medication with anticoagulants in patients receiving neuraxial analgesia.
- Provide anesthesiologist consultation for patients requiring therapeutic anticoagulation or low molecular weight heparin when an epidural catheter is in place.

Guidelines for the practice of anesthesia in remote locations

- Apply basic principles, training requirements, techniques, equipment, and medications used for anesthesia practice in remote locations, which are outlined in other sections of the guidelines.
- Apply these principles to anesthesia care, including procedural sedation, delivered by anesthesiologists in various locations, including operating rooms, out-of-operating room locations, recovery facilities, and settings both within and outside of a hospital facility (e.g., offices, clinics).

Anesthesia care delivered in a non-hospital medical/surgical/dental facility

- Use the American Society of Anesthesiologists (ASA) physical status score to classify the physical status of patients.
- Typically, consider patients with ASA classifications of I and II for procedures.
- Patients with ASA III classification may be accepted under specific circumstances, at the discretion of the attending anesthesiologist.
- Exercise caution when booking patients with a known difficult airway.
- Ensure patients have a recent documented health history, physical examination, including an airway examination, and any necessary laboratory investigations.
- Develop and support a screening process for patient evaluation.
- Observe fasting guidelines.
- Ensure that anesthetic and recovery facilities meet facility standards set by the CSA and CAS guidelines for patient care.
- Use a validated scoring system for fitness to discharge patients.
- Provide written instructions for the preoperative and postoperative periods to patients.

Anesthesia care delivered outside of an operating room within a hospital or in a non-hospital facility

- Address the growing demand for anesthesia care services in remote procedural units outside of operating rooms.
- Follow CSA standards, equipment guidelines, and general CAS guidelines as closely as possible in these remote units.
- Consider patient selection and assessment, pre-procedural testing, fasting guidelines, equipment, electrical outlets, oxygen, suction, ventilation,

scavenging, medications, equipment for resuscitation, patient monitoring, the recovery facility, and anesthesia support personnel in remote locations.

- Obtain approval from the anesthesia leadership of the facility for any location outside of an operating room where anesthesiologists provide care.
- Ensure the presence of appropriately trained and experienced anesthesia support personnel or staff with training and experience in the direct support of anesthesia care.
- Establish reliable two-way communication for calling assistance and support when required.

Guidelines for environmental sustainability

- Encourage anesthesia departments to take an active role within their facilities in promoting environmentally sustainable patient care practices and choices.
- Promote the use of reusable and reprocessable equipment over single-use disposable equipment, while ensuring infection prevention practices.
- Minimize the waste of consumable resources and energy use.
- Consider responsible use of volatile anesthetic agents, choosing those with the lowest global warming potential, and utilizing low total fresh gas flow rates where appropriate.
- Recommend the use of carbon dioxide absorbents free of strong bases.
- Eliminate or minimize the use of desflurane and N2O when possible, considering local resources and clinical context.
- Consider environmentally friendlier anesthesia techniques, such as neuraxial/regional anesthesia and total intravenous anesthesia, as alternatives to volatile inhalational anesthesia when clinically appropriate, feasible, and available.
- Collaborate with facilities to implement recycling systems for glass, plastics, and all recyclable materials.

A.1.3 Association of Anesthetists and the Society for Intravenous Anesthesia Joint Guidelines for the Safe Practice of Total Intravenous Anesthesia (TIVA) (2018)

Please refer to Section 1.3 of CHI Anesthesia Report.

There are no new updates[16]. The recommendations of this guideline remain unchanged[16].

A.1.4 Association of Anesthetists/Royal College of Anesthetists Concise Practice Guidance on the Prevention and Management of Accidental Awareness During General Anesthesia (2019)

Please refer to Section 1.4 of CHI Anesthesia Report.

There are no new updates[4]. The recommendations of this guideline remain unchanged[4].

A.1.5 Academy of Medical Royal Colleges Safe Sedation Practice for Healthcare Procedure Standards and Guidance (2013)

Please refer to Section 1.5 of CHI Anesthesia Report.

The recommendations of these guidelines were re-emphasized in 2021[3].

A.1.6 Faculty of Pain Medicine of The Royal College of Anesthetists Best Practice in the Management of Epidural Analgesia in the Hospital Setting (2020)

Please refer to Section 1.6 of CHI Anesthesia Report.

Evidence levels and grades of recommendations are not outlined in the article[17].

The following recommendations are provided by the Faculty of Pain Medicine of The Royal College of Anesthetists on the management of epidural analgesia in the hospital setting[17]:

Patient selection and consent

- Patient selection for epidural analgesia should involve a careful assessment of the risks and benefits for each patient.
- In cases where the risks outweigh the benefits, alternative methods of pain relief should be considered.
- Informed patient consent is crucial for continuous epidural analgesia, recognizing that consent may not be possible in some patient groups. GMC guidance on consent for patients lacking capacity should be followed.
- The consent process should align with national and local guidelines and involve discussions about the risks, potential benefits, and late complications of epidural analgesia, with a focus on the individual patient's information needs.
- Patients must be informed of potentially serious adverse outcomes, even if the likelihood is very low, as well as less serious complications if they occur

more frequently. This should be communicated clearly and based on local and national evidence.

- The risks and benefits of alternative treatments should also be discussed as part of the consent process.
- Additional sources of information, such as patient information leaflets, should be provided to help patients make informed decisions.
- A summary of the consent discussion should be documented in the patient's records.

Personnel, staffing levels, and ward environment

- The department of anesthesia should establish clear protocols and designate personnel to support the safe use of epidural analgesia. This responsibility should be handled by a multidisciplinary Inpatient Pain Service.
- Ultimate responsibility for the epidural infusion remains with the practitioner who initiated it, but immediate patient supervision may be transferred to the Inpatient Pain Service and competent nursing staff using agreed communication methods.
- Trainees and doctors with various levels of expertise should demonstrate appropriate competencies before performing epidural procedures without direct consultant supervision. These competencies should be defined and regularly reviewed by relevant professional bodies.
- Adequate handover procedures should be in place for managing patients receiving epidural analgesia, with an up-to-date list of epidurals available.
- Registered nurses with specific training and skills in supervising epidural analgesia should be present on the ward 24/7 to ensure adequate monitoring and care for patients. They should be ready to respond promptly to adverse events.
- The ward layout should allow for close supervision of patients receiving epidural analgesia.
- Prior to a patient's return to the ward, the responsible anesthetist should ensure that the ward is adequately staffed to provide safe patient assessment and epidural management. A communication system should exist to inform the anesthetist and theatre staff if staffing is inadequate. Patients should not be discharged to a ward unable to provide appropriate monitoring and care.
- 24-hour access to medical staff, senior anesthetic advice, a resuscitation team, and appropriate imaging for detecting spinal canal space-occupying lesions should be available.

Catheter insertion

- Epidural catheter insertion should follow aseptic techniques, including surgical hand antisepsis, sterile attire, and appropriate skin preparation.
- Chlorhexidine skin antisepsis is recommended, although povidone iodine may be used if there is an allergy to chlorhexidine.
- The catheter tip should be positioned at the appropriate spinal level for the surgery, and it should be secured to minimize movement within the epidural space.
- Local infection guidelines should be followed, including the use of prophylactic antibiotics in specific situations.

Anti-coagulation and epidurals

- The dose, timing, and therapeutic effect of all anticoagulation should be considered when inserting, removing, or initiating anticoagulation with an epidural in place. Failure to consider concurrent anticoagulation use increases the risk of epidural hematoma.
- Local guidelines should reflect the best safety practices based on comprehensive guidelines from national bodies.
- Consultation with a hematologist may be necessary for patients with comorbidities that affect coagulation.

Equipment

- Standardized equipment for epidural insertion and infusion should be used throughout the institution, with staff trained in its use.
- Infusion pumps should be configured specifically for epidural analgesia, with preset limits for maximum infusion rate and bolus size. Regular maintenance should be documented.
- The epidural infusion system between the pump and the patient should be considered closed, without injection ports, and should include an anti-bacterial filter.
- Bolus injections into the system may be performed using the pump or a separate syringe following strict aseptic techniques.
- Epidural infusion lines should be clearly identified and differentiated from other types of infusions. The National Patient Safety Association has suggested the use of yellow tubing to distinguish these lines from arterial lines (colored red), enteral lines (colored purple), and regional lines (colored grey).

- Transition to the use of NRFit™ (ISO 80369-6) neuraxial connectors is recommended for preventing misconnections.
- Resuscitation equipment and medications, including 20% lipid emulsion (Intralipid), naloxone, and a vasopressor, should be readily available.

Medicines for epidural analgesia

- Hospitals should have a limited range of approved epidural solutions based on local formulary and governance processes.
- Licensed products should be prescribed when available, and the prescription of unlicensed infusions should follow GMC guidelines.
- Epidural infusions should be labeled "For Epidural Use Only" and stored separately from intravenous and other infusions.
- The lowest effective concentration of local anesthetic should be used, and drug use beyond their license should align with GMC guidance and local hospital policies. If higher concentrations are required, the infusion rate should be reduced periodically to allow assessment of motor block.
- If higher concentrations are necessary, the infusion rate should be periodically reduced to evaluate motor block.
- The utilization of medications outside of their authorized use, known as "off-label use," should align with GMC guidelines, the hospital's local policy, and be informed by the recommendations of the British Pain Society.
- Epidural infusions should be promptly connected to the epidural catheter by the clinician who inserted it to minimize the risk of errors related to the incorrect administration route of local anesthetics.
- Any adverse events suspected to be linked to epidural infusions should always be reported.

Patient monitoring

- Initially, patients should be observed for any immediate complications in a higher dependency setting, such as a recovery unit, critical care, or specialized ward, until the responsible clinician deems it safe to transfer them to a regular ward.
- Throughout the duration of epidural analgesia, patients need continuous close monitoring, with trained staff who understand its significance and the appropriate actions for abnormal values. This monitoring should cover heart rate, blood pressure, respiratory rate, sedation levels, body temperature, pain intensity at rest and during movement, motor and sensory block degree,

National Early Warning Score (NEWS2), infusion rate, and details about the local anesthetic used.

- Patients positioned with their head down for extended periods face the risk of epidural solution moving upwards (cephalad spread), potentially leading to complications.
- The insertion site should be regularly examined for signs of leakage or inflammation.
- Additional monitoring requirements should be determined based on the patient's age, condition, and the nature of the surgery.
- The frequency of observations should follow standard clinical practice, with a minimum of one check every four hours.
- Observations should be more frequent in the first 12 hours of epidural infusion, after top-up injections, changes in infusion rate, and during periods of cardiovascular or respiratory instability.
- After a bolus top-up of the epidural, monitoring should occur at a minimum of every 5 minutes during the first 30 minutes.
- Monitoring should adhere to clearly defined written protocols, and compliance with these protocols should be subject to regular auditing.
- Pain and sedation scores help identify inadequate or excessive epidural drug administration, and monitoring protocols should include specific guidance on actions to take if analgesia is insufficient.
- Sedation is often the earliest sign of opioid-induced respiratory depression.
- Monitoring motor and sensory blocks is vital for early detection of serious complications. The Bromage scale (figure 1), although commonly misrepresented, is an accepted tool for measuring motor block.

Score	Degree of motor block	
1	Complete block; unable to move feet or knees	
2	Able to move feet only	
3	Just able to flex knees; free movement of feet	
4	No block; full movement of knees and feet	

Figure 1. *The Bromage scale (retrieved from the Royal College of Anesthetists 2020 guidelines)*

- Increasing motor weakness may indicate excessive epidural drug administration or severe complications like catheter penetration, epidural hematoma, or abscess development.
- If a dense motor block does not improve after stopping ongoing epidural infusions (no reduction in motor block/Bromage score improvement for two consecutive hours), or if the motor block worsens, immediate escalation of care is necessary, with an assessment by an anesthetist.
- Protocols must be in place to manage cases of excessive motor block, and suitable algorithms and advice for these scenarios can be found in an audit report from the Royal College of Anesthetists.
- The sudden onset of severe back pain in a patient with a recent epidural should raise concerns about epidural abscess or hematoma.
- Staff should be alert to increased or breakthrough pain in an otherwise working epidural, which could indicate surgical complications like compartment syndrome. Patients experiencing this should receive prompt evaluation by a healthcare professional, with additional care when interpreting physical signs in patients at risk of neurological damage.

- All epidural monitoring should be properly documented in the patient's records.

Epidural complications and management

- Healthcare professionals caring for a patient with an epidural should quickly identify the complications listed in the table below.
- Protocols for managing these complications should be available locally and should include procedures for escalating cases to senior anesthetic staff and other medical specialties.
- All doctors responsible for patients with epidurals should receive training on recognizing and managing epidural complications.

Table 4. List of Complications (Adapted from the Royal College of Anesthetists 2020 Guidelines)

Complication	Recommendations
Hypotension	• Hypotension should be recognized and treated promptly. A fall in blood pressure greater than 20% from baseline warrants further assessment and management. • Assessment of hypotension should include the exclusion of causes other than sympathetic blockade. • Management may require the use of a fluid bolus and vasoactive drugs. Protocols should be in place to ensure the patient is managed by a suitably competent person, if these are required.
Spinal Canal Space Occupying Lesions (Including epidural hematoma and epidural abscess)	• Nursing staff should be trained to recognize signs and symptoms of spinal canal space occupying lesions in patients treated with epidurals. • Epidural abscess should be considered in all patients with signs of (otherwise unexplained) systemic infection with an epidural in situ or with infection at the epidural site. However, not all patients with epidural abscess display fever. • The presence of severe or increasing back pain, even in the absence of fever may indicate epidural infection and should be reported to the responsible anesthetist or on-call service immediately. • Other symptoms that should raise concern include inappropriate motor weakness (even when unilateral).

	• The 3rd National Audit Project identified epidural catheter removal as the time of greatest risk for epidural hematoma development (2). Local guidelines on the timing of safe catheter removal should be followed when patients are receiving anti-coagulant medication. • Clinical suspicion of a spinal canal space occupying lesion should prompt urgent discussion with a senior anesthetist. Epidural hematoma and abscess are considered neurosurgical emergencies. • Clinical suspicion of an epidural vertebral canal hematoma or abscess should be investigated firstly with an urgent MRI scan (unless contraindicated) by the team responsible for managing the epidural. If this pathology is identified, there must be urgent discussion with the local neurosurgical unit to determine further management.
Total Spinal	• Total spinal is an anesthetic emergency that should be considered in any case of respiratory arrest, cardiovascular collapse, or loss of consciousness in a patient who has recently received an epidural bolus. • The Medical Emergency or Resuscitation Team should be mobilized, and treatment in the first instance is stopping the epidural infusion and supportive measures in accordance with adult or pediatric life support guidelines. This includes securing the airway, ensuring adequate ventilation, and supporting the cardiovascular system with fluids and/or vasoactive medications.
Post-Dural Puncture Headache (PDPH)	• Any patient developing a headache following epidural anesthesia or with a known accidental dural puncture should be followed up until headache resolution. • Differential diagnoses should be considered for all patients. • Those patients not responding to conservative treatment should be offered epidural blood patch, if appropriate. • Those with unresolved symptoms should be discussed with a neurologist and undergo further investigations to exclude complications of PDPH or an alternative diagnosis when appropriate.
Local Anesthetic Toxicity (LAT)	• The Association of Anesthetists have published concise guidelines regarding the management of severe local anesthetic toxicity (20). These should be readily available in

	all areas where boluses are administered via epidurals along with an emergency treatment box including 20% lipid emulsion (i.e., Intralipid®) for the treatment of LAT.
Neuropraxia and Major Nerve Dama	• In the rare event of any form of nerve injury occurring after epidural insertion (but not related to a spinal canal space occupying lesion) urgent referral to a neurologist should be made. • Any nerve or spinal cord damage after epidural should be reported using locally established patient incident reporting systems.

Epidural analgesia in children

- All the recommendations in this guideline apply to neonates, infants, and children as well. However, methods of monitoring and assessing pain scores should be suitable for their developmental age.
- Dosing regimens for children should be adjusted based on age and weight, with maximum dosages clearly defined to minimize the risk of cumulative local anesthetic toxicity. Opioids added to the local anesthetic solution should be avoided, especially for infants weighing less than 5 kg, due to an increased risk of apnea.
- A suggested maximum rate of epidural infusion is provided, varying according to weight.
    - 0.375 mg/kg/hr of bupivacaine, levo-bupivacaine or ropivacaine for neonates and infants less than 5Kg
    - 0.5 mg/kg/hr of bupivacaine, levo-bupivacaine or ropivacaine for infants or children over 5Kg.
- Beyond the official neonatal period (over 4 weeks of age), pre-term babies' epidural infusion rates should be considered like neonates.
- Like in adults, the lowest effective concentration of local anesthetic should be used for children.
- There should be clear protocols for prescription, monitoring, and troubleshooting of pediatric epidural infusions, as well as meticulous care when handling small infants and neonates.
- Hourly assessments are recommended, especially in the first 12 hours. Infusions lasting over 5 days should be avoided due to rising infection risks.

- Motor block should be formally assessed and documented with age-appropriate criteria, and there should be a clear action plan if motor block persists or worsens.
- Effective blocks for thoraco-lumbar dermatomes can be achieved using low catheters in neonates and infants, reducing the need for high doses of local anesthetic. Caudal catheters are effective but require careful dressing to prevent infection.
- An anesthetist with the appropriate skills should be available when needed for children receiving epidural infusions.
- Patients and caregivers should receive written and verbal guidance on identifying signs and symptoms of an epidural abscess, especially after being discharged from the hospital.
- Information specific to the use of epidurals in pediatric patients should be provided to parents or caregivers, following local guidelines, with consent procedures adhering to the best practices outlined by the GMC.

Documentation, guidelines, and protocols

- Accurate records should be maintained for all events during the epidural analgesia period, including consent, catheter insertion and removal, infusion prescription, monitoring, additional doses, and any complications or adverse events.
- The use of electronic prescribing systems or standard pre-printed prescription forms is recommended to enhance safety and avoid potential misinterpretation of handwritten prescriptions.
- Documents kept on the ward and near the patient should include contact information for expert medical and nursing personnel.
- The need for local protocols and guidelines related to epidurals is emphasized in the table below:

Table 5. Suggested Epidural Protocols and Guidelines to be Produced by Local Services (Adapted from the Royal College of Anesthetists 2020 Guidelines)

Overall management of patients with epidural infusions	Protocol for the management of a failing epidural
Instructions for the use of the infusion device	Management of accidental catheter disconnection

Description of the drug concentrations used in the hospital	Instructions for removal of the epidural catheter and monitoring for complications
Description of infusion rates and how to adjust them	Insertion and removal of epidural catheters in patients receiving anticoagulants
Instructions for changing epidural solution bags or syringes	Multimodal pain management during epidural infusion
Frequency of observations	Policy on the coadministration of opioid analgesics by other routes when given as part of an epidural infusion
Maintenance of intravenous access throughout the infusion period	Pain management after cessation of the epidural infusion
Identification and management of early and late complications	Management of opioid and local anesthetic toxicity
Management of inadequate analgesia	Mobilization after epidural removal, e.g. during enhanced recovery programs

Clinical governance

- Regular clinical effectiveness audits related to epidural analgesia are encouraged, covering efficacy, patient satisfaction, complication rates, and adherence to management protocols.
- Procedures for reporting and responding to critical incidents associated with epidural analgesia should be clearly defined.

Education

- There should be documented training programs for doctors and nurses responsible for supervising patients receiving epidural analgesia.
- Training programs should include induction and regular updates, tailored to the staff's responsibilities.

A.1.7 American Society of Anesthesiologists Statement on Safe Use of Propofol (2019)

Please refer to Section 1.7 of CHI Anesthesia Report.

There are no new updates[18]. The recommendations of this guideline remain unchanged[18].

A.1.8 Association of Anesthetists/British Association of Day Surgery Guidelines for Day-Case Surgery (2019)

Please refer to Section 1.8 of CHI Anesthesia Report.

There are no new updates[19]. The recommendations of this guideline remain unchanged[19].

B. Procedural Sedation

B.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 6. Clinical Guidelines Requiring Revision (Procedural Sedation)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.9 The **European Society of Anesthesiology** and **European Board of Anesthesiology** guidelines for procedural sedation and analgesia (PSA) in adults (September **2017**)[5]	N/A*
Section 1.10 Procedural sedation: a position paper of the **Canadian Anesthesiologists' Society (CAS)** (**2018**)[21]	N/A*
Section 1.11 Practice Guidelines for Moderate Procedural Sedation and Analgesia: A Report by the **American Society of Anesthesiologists** Task Force on Moderate Procedural Sedation and Analgesia, the **American Association of Oral and Maxillofacial Surgeons**, **American College of Radiology**, **American Dental Association**, **American Society of Dentist Anesthesiologists**, and **Society of Interventional Radiology** (**2018**)[6]	N/A*

Section 1.12 Practice Guidelines for Obstetric Anesthesia- An Updated Report by the **American Society of Anesthesiologists** Task Force on Obstetric Anesthesia and the **Society for Obstetric Anesthesia and Perinatology** (**2015**)[22]	N/A*
Section 1.13 Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures- Australian and New Zealand College of Anesthetists (ANZCA) (2014)	**Australian and New Zealand College of Anesthetists** Guideline on Procedural Sedation (**2022**)[23]
Section 1.14 Unscheduled Procedural Sedation: A Multidisciplinary Consensus Practice Guideline by the American College of Emergency Physicians (2018)	**American College of Emergency Physicians** Multidisciplinary Consensus Practice Guideline on Unscheduled Procedural Sedation (**2019**)[24]
Section 1.15 The **Royal College of Radiologists**: Sedation, analgesia, and anesthesia in the radiology department -second edition (**2018**)[7]	N/A*
Section 1.16 Clinical Policy: Procedural Sedation and Analgesia in the Emergency Department (ED) - **American College of Emergency Physicians** (**2014**)[8]	N/A*
Section 1.17 Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists: An Updated Report by The **American Society of Anesthesiologists** Task Force on Sedation and Analgesia by Non-Anesthesiologists (**2010**)[25]	N/A*

B.1.1 European Society of Anesthesiology/European Board of Anesthesiology Guidelines for Procedural Sedation and Analgesia (PSA) in Adults (2017)

Please refer to Section 1.9 of CHI Anesthesia Report.

There are no new updates[5]. The recommendations of this guideline remain unchanged[5].

B.1.2 Canadian Anesthesiologists' Society (CAS) Position Paper on Procedural Sedation (2018)

Please refer to Section 1.10 of CHI Anesthesia Report.

There are no new updates[21]. The recommendations of this guideline remain unchanged[21].

B.1.3 American Society of Anesthesiologists Task Force on Moderate Procedural Sedation and Analgesia/American Association of Oral and Maxillofacial Surgeons/American College of Radiology/American Dental Association/American Society of Dentist Anesthesiologists/Society of Interventional Radiology Practice Guidelines for Moderate Procedural Sedation and Analgesia (2018)

Please refer to Section 1.11 of CHI Anesthesia Report.

There are no new updates[6]. The recommendations of this guideline remain unchanged [6].

B.1.4 American Society of Anesthesiologists Task Force on Obstetric Anesthesia/Society for Obstetric Anesthesia and Perinatology Practice Guidelines for Obstetric Anesthesia (2015)

Please refer to Section 1.12 of CHI Anesthesia Report.

There are no new updates[22]. The recommendations of this guideline remain unchanged[22].

B.1.5 Australian and New Zealand College of Anesthetists (ANZCA) Guideline on Procedural Sedation (2022)

Please refer to Section 1.13 of CHI Anesthesia Report.

These clinical guidelines aim to optimize patient care in the management of procedural sedation. They are intended to apply to all sedationists managing minimal or moderate procedural sedation in all patients, including children, irrespective of the medications used and their route of administration; however, they are not intended to apply to deep sedation. Evidence levels and grades of recommendation were not outlined. The following recommendations are provided by ANZCA on procedural sedation[23]:

Definitions

- **Minimal sedation**: A state induced by drugs where patients can respond purposefully to verbal commands or light tactile stimulation.
- **Moderate sedation**: A drug-induced state of reduced consciousness in which patients can respond purposefully to verbal commands and tactile stimulation.
- **Deep sedation**: A drug-induced state of reduced consciousness in which patients are not easily awakened and may respond only to noxious stimulation.

Aim of procedural sedation

The goal of procedural sedation is to enhance patient comfort during a medical procedure without requiring general anesthesia. Different levels of sedation, from minimal to deep, may be necessary during a single procedure, and deep sedation can unintentionally progress to general anesthesia.

Risks of sedation

There are general and specific risks associated with sedation.

General risks

- The use of sedative drugs may lead to unintended transitions from sedation to general anesthesia. This transition is a continuum, not distinct stages.
- A sedationist must be present when administering such drugs, retaining sole responsibility for sedation, including monitoring the depth of sedation, physiological variables, and the patient's condition.
- Plans for managing deeper-than-intended sedation and necessary interventions should be prepared before the procedure begins.
- All involved personnel should maintain the appropriate skills and remain attentive to the patient's condition based on various factors.

Specific risks

- Patients with obstructive sleep apnea are at higher risk of sensitivity to sedatives and associated airway difficulties. They may require medical assessment or anesthesia evaluation for sedation.
- Sedation at an inadequate level may lead to complications. If there's uncertainty, proceduralists should be prepared to refer for general anesthesia or to healthcare facilities with appropriate resources. Predictors for difficult intubation are typically checked by the anesthesiologist.

- Children are at increased risk during sedation, especially if they have specific conditions, including obstructive sleep apnea, anatomical airway challenges, obesity, prematurity, or certain age groups. These conditions encompass:
    - Obstructive sleep apnea (OSA) and sleep disordered breathing (SDB) linked to adeno-tonsillar hypertrophy.
    - Physically challenging airways.
    - Obesity, which is correlated with OSA and sleep disordered breathing.
    - Prematurity and a history of prematurity ("ex-prem"), which is a risk factor associated with a notably elevated likelihood of sedation-related adverse events from early infancy to young adulthood.
    - Age:
        - Children under the age of 12 months face a higher risk of sedation-related adverse events.
        - Children under 6 years of age, apart from having an increased risk of sedation-related adverse events compared to older age groups, are also more susceptible to deeper sedation than intended due to their relative immaturity and reduced cooperation.
- Pregnant women need special attention during sedation, particularly in the third trimester, to avoid aortocaval compression and prevent regurgitation and aspiration.

Competencies

- The safe procedural sedation competencies should be acquired by all sedationists managing sedation. These competencies should be integrated into training programs to ensure proficiency and should encompass cultural safety and indigenous considerations.

Staffing and responsibilities

- The minimum number of personnel required depends on the intended level of sedation.
- When utilizing inhaled substances like nitrous oxide or methoxyflurane in conjunction with other agents, such as opioid analgesics, there can be unpredictable shifts from minimal to moderate sedation. In such scenarios, having an assistant who is trained to monitor the patient and administer medication as directed by the sedationist to maintain minimal sedation is recommended. In this context, predefined acceptable vital sign thresholds

should be confirmed, and any deviations beyond these limits should be reported to the sedationist. This setup allows the sedationist to also act as the proceduralist, but the assisting practitioner should possess the necessary airway support skills.

- In cases involving deliberate moderate sedation, there is a risk of sedation rapidly progressing unintentionally to general anesthesia, especially when multiple medications with sedative effects are administered intravenously. Therefore, it is advisable to have a third person available for all cases of adult and pediatric sedation when the intended level of sedation exceeds minimal. Given the diverse settings and contexts of procedural sedation, all staff presents should clarify their roles and responsibilities with each other before starting the session.
- For children undergoing minimal sedation using nitrous oxide/oxygen, methoxyflurane, or a single oral anxiolytic dose, an additional third person may occasionally be needed if the child becomes distressed. However, the necessity of this third person during minimal sedation should be assessed within the sedation environment, considering the needs of the child and their family. Some particularly anxious children may feel overwhelmed by the presence of strangers, while some parents may require emotional support. These factors should be considered when determining staffing for pediatric sedation in any given setting.
    - The typical staff present for all sedation techniques, except those for minimal sedation, will usually include:
        - The proceduralist
        - An additional practitioner, who may either be the sedationist or the assisting practitioner responsible for administering sedation medications and monitoring the patient under the proceduralist's guidance, possessing the designated competencies. In this scenario, the proceduralist takes on both the roles of sedationist and proceduralist.
        - At least one additional staff member to aid as needed.
        - All staff present should have a clear understanding of their roles and responsibilities before starting the session.
    - An assistant to the sedationist is required to be readily available during sedation induction, emergence, and as necessary during the procedure.
    - Sedationists need to undergo adequate training to:
        - Fulfill the knowledge and skills outlined below Competencies.

        - Monitor levels of consciousness and cardiorespiratory status.
        - Detect and manage any complications arising from sedation.
        - Communicate effectively with proceduralists.
    - It is crucial to have a practitioner with the necessary airway and life support skills immediately available for all procedural sedation. This could be basic life support (BLS) for minimal sedation and age-appropriate advanced life support (ALS) for moderate sedation in both children and adults. The proceduralist may perform this role if they can promptly halt the procedure to perform necessary rescue maneuvers, otherwise, another practitioner with these skills should be immediately available.
    - In cases where a single practitioner performs the dual role of sedationist and proceduralist, they may prescribe or direct medication administration and delegate monitoring and immediate response to complications to the assisting practitioner. In such situations, both the sedationist and the assisting practitioner should have the relevant competencies identified below to respond effectively. However, the sedationist/proceduralist retains the responsibility for managing sedation, including interventions if required and complications if they occur.
- The primary duty of assisting practitioners is to monitor and document the level of consciousness and cardiorespiratory status and be immediately available to manage complications if needed. In facilities supporting sedation with anesthetic agents, a separate sedationist with appropriate skills, competencies, and experience is essential. If loss of consciousness, airway obstruction, hypoxemia, or cardiorespiratory insufficiency occurs at any time, all available staff must focus on treating and monitoring the patient until recovery or until another medical or dental practitioner takes responsibility for the patient's care.

Facilities and equipment

- Procedural sedation should occur in adequately sized locations, equipped with staff and resources to manage cardiopulmonary emergencies, ensuring easy access for ambulance services.
- Adequate facilities and equipment should be available, tailored to the age and condition of patients, to maintain basic life support until specialized help, equipment, and medications become accessible.

- Specific recommendations may be adjusted for instances of minimal sedation achieved through the sole use of a single orally administered anxiolytic, nitrous oxide/oxygen, or methoxyflurane.
- Essential facilities and equipment include:
    1. A room suitable for resuscitation.
    2. Sufficient lighting for observation and monitoring, with alternative options in case of power failure.
    3. Preferably, operating tables, trolleys, or dental chairs that can be readily tilted head down (not mandatory).
    4. Suction equipment and associated attachments, suitable for clearing secretions intra-orally and intra-nasally, with alternatives for power failures.
    5. Adequate oxygen supply and suitable devices for oxygen administration to spontaneously breathing patients.
    6. Equipment for inflating the lungs with oxygen, like a self-inflating bag and mask, and ready access to advanced airway management tools, including face masks, oropharyngeal airways, laryngeal mask airways, laryngoscopes, and endotracheal tubes. For children, consider a means of delivering positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP), such as a T-piece circuit. For obese adults or those with respiratory issues, consider a means of delivering CPAP.
    7. Medications for cardiopulmonary resuscitation and for benzodiazepine and opioid reversal, as well as various intravenous equipment and fluids. Pediatric facilities should have a pediatric compendium or emergency drug protocol for accurate dosing based on weight or size.
    8. A pulse oximeter.
    9. A sphygmomanometer or other device for measuring blood pressure.
    10. Immediate access to an electrocardiograph (ECG) and a defibrillator.
    11. A means of calling for emergency assistance.
    12. Facilities for measuring expired carbon dioxide throughout the facility, with the use of waveform capnography strongly recommended.
    13. Adequate patient transport accessibility within the facility.
    14. A written and ideally practiced escalation plan or clinical emergency response plan in case of clinical deterioration.

15. Specialized equipment for inhalational sedation, with considerations for the risks of chronic exposure. Specific Requirements for Inhalational Sedation (e.g., nitrous oxide or methoxyflurane):

    When using nitrous oxide:

    - The capacity for administering 100% oxygen.
    - Compliance with relevant standards for piped gas systems, including regular servicing.
    - Implementation of non-recycling high-flow air conditioning or an accepted method for scavenging expired gases within the room.

16. For nitrous oxide use:
    - Patient breathing circuits should be lightweight, have a reservoir bag for inspired gases, and provide low resistance to normal gas flows.
    - Rebreathing should be prevented using non-return valves or other mechanisms, such as a T-piece flow connection.
    - Adequate gas flow rates and anti-hypoxic devices are necessary. To minimize environmental impact, "on-demand" equipment is preferable.
    - Low gas flow alarms are recommended. If not included in the delivery device:
        - An interlink style device (or modern equivalent) preventing the delivery of a hypoxic gas mix (less than 21% oxygen) is essential.
        - An oxygen analyzer is advisable or confirmation that the system has been checked and certified for correct plumbing, especially after pipeline system work.
17. When using methoxyflurane, the facility should have a guideline for recognizing and managing malignant hyperthermia.

Patient preparation

Patient assessment

- Assessment of all patients is essential as part of routine procedural sedation management. In time-critical or life-threatening emergencies, appropriate assessments are made to suit the circumstances.

- The nature of the procedure should be considered, including its duration, likelihood of pain, immobility requirements, and the desired level of alertness, which determine the sedation goals.
- Basic assessment should encompass:
    - Past medical, surgical, and sedation histories
    - Anatomical or physical abnormalities that might affect the procedure or intended sedation level
    - History of airway or anesthesia challenges
    - Identification of chronic diseases and syndromes
    - Recording of weight and height
    - Presence of obstructive sleep apnea or excessive snoring
    - Laryngospasm history or upper respiratory tract infection
    - Prematurity history
    - Age under six years
    - Behavioral issues, previous procedural distress, and cooperation ability
    - Neurodevelopmental conditions (e.g., autism spectrum disorder, ADHD)
    - Ability to complete the procedure at the intended minimal or moderate sedation level.
    - Awareness of aortocaval compression when sedating pregnant women
    - Allergies
- For minimal sedation with multiple sedative medications or parenteral routes, additional assessment considerations include:
- Fasting guided by procedure nature and intended sedation depth. In children, fasting should follow ANZCA fasting guidelines.
- Medication history, including opioids, benzodiazepines, and other non-prescription drugs, alcohol, recreational drugs, and tobacco.
- Anxiety disorders
- Other medical or psychiatric conditions requiring evaluation by a medical practitioner.
- ASA classification and documentation

Comprehensive assessment

For moderate sedation, it should include:

- Evaluation of potential airway issues, such as a history of difficult airway, dental conditions, obesity, and difficulty swallowing for specific procedures
- Assessment of exercise tolerance or functional status
- Examination of airway, neck movement, mouth opening, and other systems based on history.
- Baseline vital signs recording, including weight and height for pediatric patients.

Pediatric considerations

- Focusing on identifying children at higher risk of sedation complications, such as laryngospasm, airway obstruction, and syndromes associated with airway difficulties.
- Recognizing that children under 12 months and those under 6 years have specific risk profiles and needs.
- Considering referral for specialist anesthesia opinion in children with chronic diseases

Patient selection

- Relative contraindications or barriers to intravenous sedation, including language barriers, previous sedation difficulties, allergies, poorly controlled medical conditions, old age, frailty, and obstructive sleep apnea.
- For pediatrics, procedural sedation is not commonly practiced for children under 3 years, except in specific cases involving experienced practitioners. Young children requiring sedation should be assessed by a qualified practitioner in a suitable setting.

Informed consent

- Patients and their caregivers should receive information about what to expect during the procedure and the level of sedation they are likely to experience. It's crucial to emphasize the significance of these discussions, particularly within the context of cultural safety and Indigenous considerations. Informed consent for both the sedation and the procedure should be obtained from the patient or someone legally authorized to provide consent, in accordance with applicable laws.
- When older adolescents are scheduled for sedation, consent may be sought from those who possess the mental capacity to provide it, often referred to as "Gillick competent minors." Recognizing differences in maturity, family

dynamics, and caregiving relationships, it's advisable to encourage minors giving consent to involve their parent or caregiver in the decision-making process. Regardless of parental consent, it's highly recommended that teenagers and children receive age-appropriate information about the benefits of the planned procedure and the associated sedation, thus seeking their agreement. Pertinent information for parents should encompass the procedure's purpose, anticipated outcomes, intended level of sedation, and available alternatives, all while considering the sedation environment, healthcare facility capabilities, staffing expertise, and resource availability.

- Sedation providers should establish processes to ensure that patients comprehend and adhere to pre-procedural preparations and fasting requirements.

Management of fasting

- Fasting requirements should match the sedation circumstances and level.
- Fasting may not be necessary for minimal sedation using a single dose of oral anxiolytic, nitrous oxide, or methoxyflurane, except when vomiting is expected.
- For intravenous sedation, fasting for solids is required for 6 hours, but patients can consume clear fluids up to 2 hours before the procedure. Modifications may apply to upper GI endoscopy.
- Pediatric patients may drink clear fluids (up to 3 ml/kg) up to 1 hour before their procedure. These fasting instructions apply to patients planning moderate sedation as well.

Technique and monitoring

- When initiating any sedation technique, several factors should be considered:
    - Having reliable venous access is preferable. However, for procedures under minimal sedation, it may be considered to proceed without venous access. Venous access is crucial for deeper levels of sedation.
    - In children, it is advisable that trained practitioners, skilled in age-appropriate equipment use, gain venous access. In emergency cases where intravenous access is challenging, intra-osseous access might be considered.
    - Since most sedation complications are related to the cardiorespiratory system, sedative and analgesic medication doses should be minimized to ensure patient comfort, particularly for those at higher risk of sedation-related complications.

- When selecting sedation agents, their duration of action should match the required duration of sedation. To prevent prolonged post-discharge sedation effects, rapid-acting agents are recommended for pediatric sedation rather than long-acting ones.
- Medications should be administered by competent sedation specialists or personnel, especially when using parenteral agents like ketamine and propofol. One healthcare practitioner should be solely responsible for monitoring the depth of sedation and the patient's condition when using these agents. Special attention is needed when combining medications and when using local anesthetics in the larynx or pharynx due to their effects on airway reflexes. Compliance with local regulations is essential for managing sedative medications.

- Monitoring
  - Regular monitoring of the sedation depth and any changes in depth is crucial during the procedure. A purposeful response to verbal commands or tactile stimulation is an early sign, but it should be distinguished from a reflex withdrawal from a painful stimulus. If a patient stops responding to stimulation or verbal commands, it indicates a loss of airway reflexes and potential respiratory and cardiovascular depression, requiring sedation adjustment. Monitoring verbal responses may be challenging in patients with intellectual disabilities, language difficulties, or young children.
  - For all patients undergoing procedural sedation, continuous monitoring of oxygen saturation with pulse oximetry, which triggers alarms for hypoxemia, is essential. When hypoxemia is detected, immediate corrective measures should be taken, which may include stopping the procedure.
  - Continuous waveform capnography is recommended for sedation when verbal contact is lost or challenging to monitor. It is especially advisable for moderate sedation in both adults and children, and for ASA 3 or ASA 4 patients.
  - Regular monitoring of pulse rate, oxygen saturation, and blood pressure using appropriately sized equipment should be performed throughout the procedure and recovery. Monitoring a child's breathing pattern and respiratory rate is crucial for children. For patients who cannot be monitored before the sedation due to practical reasons, such as small children or those with intellectual disabilities or cognitive impairments, monitoring should begin as soon as possible and continue throughout the sedation episode and early recovery.

- Depending on the patient's clinical status, additional monitors like ECG may be required.

Oxygenation and airway patency

- Maintaining airway patency is critical for oxygenation. Even when airway reflexes are intact, they can be impaired in conditions such as laryngospasm or due to loss of pharyngeal muscle tone, leading to airway obstruction during deeper levels of sedation. The use of CPAP or PEEP, as indicated in 7.6, may be necessary.
- Oxygen administration reduces the risk of hypoxemia and should be provided as much as possible during the procedure. Apnea or hypoventilation can occur during moderate and deep procedural sedation, potentially leading to hypoxemia without oxygen supplementation. However, administering oxygen before the sedation may not be beneficial for all patients and may not be possible in cases involving small children or those with intellectual disabilities.

Documentation

- The clinical record should include the names of staff involved in the sedation procedure, documentation of the patient's history, examination findings, and investigation results. It should also include a record of medication dosages and their administration times, monitoring readings, and other relevant information, as outlined in ANZCA professional document PG06(A) Guideline on the anesthesia record.

Recovery and discharge

- Recovery from sedation, which impairs judgment and causes amnesia, is a vital consideration for discharge planning.
- In cases other than nitrous oxide/oxygen as the sole agent:
    - Moderate sedation recovery should occur under the supervision of nurses with post-anesthesia care training or critical care expertise in appropriate areas.
    - This recovery should take place in a properly equipped and staffed area, which might be where the procedure was performed.
    - For minimal sedation, patients may be assisted to ambulate directly from the procedure room to a chair.
- Adequate and safe patient transfer facilities are necessary if the recovery area is different from the procedure location.

- Sufficient staffing and facilities are essential in the recovery area to manage patients who become unconscious or experience complications during their procedure.
- Authorization for patient discharge should come from the practitioner responsible for managing sedation or another qualified practitioner within their scope of practice.
- Patients should be accompanied and discharged into the care of a responsible adult who will receive written instructions. These instructions should cover topics such as eating, drinking, pain relief, resuming normal activities, and legally binding decisions.
- The responsible adult should also be informed about restrictions on driving or operating machinery.
- If a responsible adult is unavailable for discharge supervision, the practitioner managing sedation may use their judgment to determine post-sedation supervision and mode of transportation to the discharge destination (excluding driving or public transport).
- For patients who have received agents with rapid offset of action and undergone a brief or minimally invasive procedure with a low risk of adverse events, a home caregiver may not be essential.
- Protocols should be in place for safe patient transfer to higher levels of medical care if necessary.

Training in procedural sedation for non-anesthetist practitioners

- Sedationists must undergo training provided by institutions capable of meeting the Safe Sedation Competencies below.
- Training can be integrated into college curricula or provided by recognized external training providers.
- Sedationists with at least 5 years of regular procedural sedation experience, who didn't have training in their curricula, should demonstrate the competencies outlined below that are relevant to their practice.

Nursing requirements

- Nurses assisting with procedural sedation in Australia must be Registered Nurses and complete a training program that aligns with the competencies below.
- In New Zealand, Enrolled Nurses (ENs) registered with their jurisdictional authority can also assume this role within their defined scope of clinical practice.

Cooperation and support

- Sedationists can benefit from close cooperation with designated anesthetists, especially for those in remote or rural areas, to enhance their training and rescue skills, as well as to have access to backup support.

Credentialing and continuing education

- Sedationists are required to maintain regular certification in cardiopulmonary resuscitation relevant to their clinical practice.
- They should also provide evidence of ongoing professional development to support credentialing and establish defined clinical scopes of practice.

Audit

- Sedationists are strongly advised to conduct regular and effective audits of their sedation practice and adhere to local jurisdictional requirements.
- Units offering sedation services should have established systems for auditing sedation-related outcomes, with these results integrated into quality assurance and peer review processes.
- Local audit findings should inform ongoing training, education, and support for all team members involved in patient care during sedation.
- Healthcare institutions are encouraged to consider establishing acentralizedoversight committee responsible for training, local policy development, quality improvement, and auditing adverse outcomes.
- Sedationists must be aware of their obligations to report morbidity and mortality related to sedation, especially in cases of intended procedures involving higher sedation levels.

Emergency medications

Table 7 lists the emergency medications that should be included at minimum:

Table 7. Emergency Medications (Adapted from the ANZCA 2022 Guidelines)

Medication	Sedation modes			
	Opioids	Benzodiazepines	Ketamine	Propofol
Epinephrine/ adrenaline	√	√	√	√
Atropine	√	√	√	√
Naloxone	√			
Flumazenil		√		

Portable oxygen supply	√	√	√	√
Crystalloid solution	√	√	√	√

Hypoglycemia:

- Dextrose
    - 50% for intravenous administration in adults
    - 10% for intravenous administration in children at a recommended dose of 2. 5mL.Kg-1
- Oral glucose is a suitable alternative for children undergoing minimal sedation.

Recommended personnel for procedural sedation

Figure 2 shows the recommended personnel for procedural sedation:

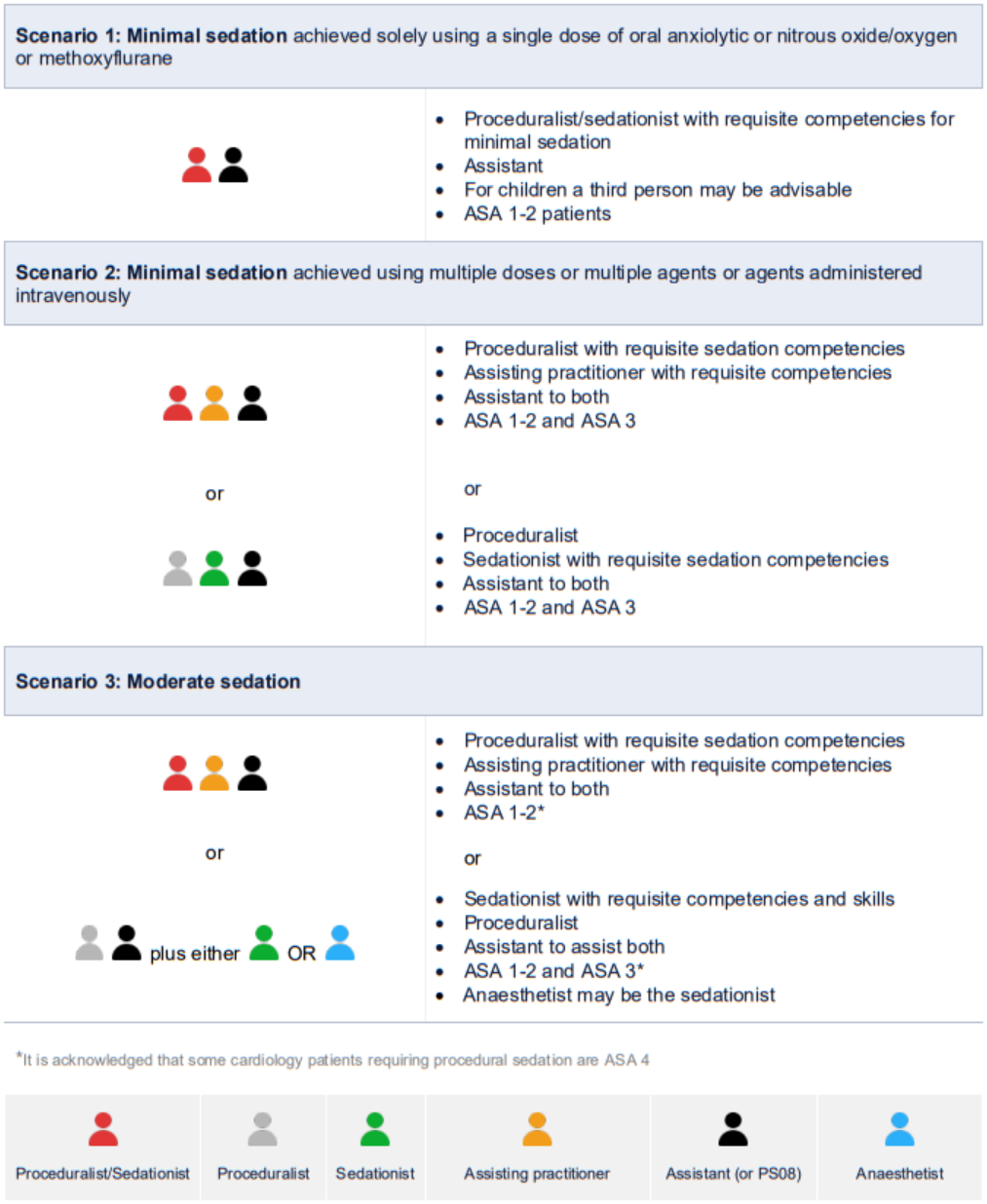

Figure 2. *Recommended personnel for procedural sedation (retrieved from the ANZCA 2022 guidelines)*

Safe procedural sedation competencies

- This section aims to ensure that:
    - Procedural sedation is administered with the highest degree of patient safety, regardless of the patient's age or the method of administration, including intravenous medications.
    - All levels of sedation, from minimal to deep, can be effectively managed.

    - Sedationists are well-versed in facility-specific regulations and requirements.
- It is understood that sedation can be necessary for therapeutic or diagnostic procedures. The terms "procedure" or "procedural" encompass both diagnostic and interventional processes.
- The risks associated with procedural sedation are directly proportional to the depth of sedation, with the primary concerns being airway management and patient comorbidities. Therefore, a tiered approach involving varying levels of skills, staffing, and techniques may be appropriate. For instance, basic life support skills may suffice for minimal sedation achieved using a single oral dose of an anxiolytic, nitrous oxide/oxygen, or methoxyflurane. In contrast, more advanced life support skills are necessary when dealing with intravenous sedation, the administration of multiple sedative agents, or deeper levels of sedation where the associated risks are greater.
- Although these competencies are intended to apply to all depths of procedural sedation, it is reasonable to adjust the guidance items for minimal sedation, achieved through the sole use of orally administered anxiolytics, nitrous oxide/oxygen, or methoxyflurane.
- As a fundamental principle, when sedating children, practitioners require competencies encompassing an understanding of normal child development, anatomical and physiological variances at different ages, knowledge of how children respond to anxiety, fear, and pain, and the pharmacological effects of sedation within their scope of practice. Practitioners should also possess age-specific experience and technical skills to manage physiological deterioration. Furthermore, they should have knowledge of the facility and environment concerning sedation and its capacity to support sedation for different age groups.
- Incorporating competencies into a curriculum: these competencies serve as the minimum requirements for practitioners to be considered competent in delivering safe procedural sedation. They were developed to accommodate a wide range of professional groups, and it is acknowledged that individual colleges and organizations may need to adjust the format of the competencies to align with the structure of their specific curriculum.
- The competencies: upon completing their training, trainee sedationists should be capable of:
    - Clearly articulate the objectives of sedation. This is especially crucial for vulnerable groups, such as children who cannot advocate for themselves, frail elderly individuals, and those with communication limitations. The goals of sedation include:

        - Ensuring patient safety and well-being
        - Minimizing discomfort and pain
        - Managing anxiety and minimizing psychological trauma
        - Modifying behavior or movement to facilitate the successful completion of the procedure.
    - Conduct a comprehensive pre-sedation assessment to identify clinical features, pre-existing conditions, and current medications that predispose patients to sedation-related adverse events. This includes:
        - Explaining the rationale for the sedation assessment.
        - Discussing the components of the pre-sedation assessment and their significance, including but not limited to:
        - Patient identification and age
        - History of previous anesthesia/sedation
        - Allergies and drug sensitivities
        - Risk of aspiration, including fasting status and pre-sedation instructions
        - Airway assessment, particularly the risk of airway obstruction during sedation
        - Notably, the existence of any written airway alerts should be sought.
        - General health, encompassing exercise tolerance, cardiorespiratory status, and current medications.
        - Outlining "red flags" in the assessment process and using assessment tools to identify patients at risk, including but not limited to:
            - Previous sedation or anesthesia-related adverse events/complications
            - Obstructive sleep apnea
            - Morbid obesity
            - Patients with limited functional reserve
            - Frailty
            - Age

- For pediatric pre-sedation assessment:
    - Recalling and explaining normal childhood development
    - Understanding and explaining the use of common non-pharmacological techniques, such as distraction or communication techniques appropriate for children of different ages.
    - Describing the anatomical and physiological changes as children progress from infancy to adolescence, including the typical range of acceptable vital signs at different ages.
    - Explaining how children respond to anxiety, fear, and pain and analyzing how these responses affect the pharmacological effects and dosage requirements of sedation.
    - Identifying "red flags" for pediatric sedation, including age groups at higher risks, obstructive sleep apnea or sleep-disordered breathing, adeno-tonsillar hypertrophy, upper respiratory tract infections (URTIs), croup, lower-respiratory tract infections, chronic diseases (cardiac, respiratory, neuromuscular, metabolic, rare syndromes, severe gastroesophageal reflux), history of premature birth (ex-prem), syndromes, congenital issues, behavioral and neurodevelopmental conditions (autism and ADHD), and previous procedural trauma and anxiety.
- Stratify patients according to their risk. High-risk patients with potential sedation-related adverse events should be referred to a specialist anesthetist. See section "Patient Preparation" for details specific to pediatric sedation.
- Determine the suitability and requirements for the desired level of sedation. This should consider the complexity of the procedure, the duration of immobility needed, the tolerance for movement during the procedure, and the expected discomfort of the procedure. Prolonged immobility, for children who cannot be positioned adequately with minimal or moderate sedation, or any procedure intolerant of movement, may necessitate general anesthesia.
- Effectively communicate the risks of procedural sedation to the patient or their parent/carer to obtain valid informed consent and address patient expectations. See section "Patient Preparation" for details on consent, and ANZCA PS26(A) "Position statement on informed consent for anesthesia or sedation."
- Describe key safety features when conducting a risk assessment of the facility's capabilities and the intended sedation environment. Sedationists should be able to:

    - Assess the suitability of the sedation environment, including the healthcare facility's capabilities and the provision of adequate staff to support safe sedation for the intended age group and the intended level of sedation.
    - Evaluate the suitability of the sedation environment for supporting unexpected emergent resuscitation and ambulance transport.
    - Describe the similarities and differences for different age groups.
    - When intending to administer moderate sedation intravenously or intramuscularly to children under 3 years of age, consult with a pediatrician, a pediatric experienced critical care specialist, or an anesthetist.
- Prepare for an episode of procedural sedation, ensuring that:
    - Monitoring and emergency equipment is available and functional in both the procedure and recovery areas.
    - The minimum recommended number of staff are present during the procedure and in the recovery area, all of whom have current, age-appropriate basic life support skills.
    - At least one practitioner present has current age-appropriate basic or advanced life support skills corresponding to the route and depth of sedation and can immediately halt their current activities in the event of an emergency.
    - Sedation and emergency medications are readily available.
    - All team members have a shared understanding of their responsibilities and the patient care plan, including escalation and emergency protocols.
- Administer sedation medications, titrating them to the desired effect, taking into consideration the differing onset times, doses, peak effects, and durations to ensure the completion of the procedure. This involves:
    - Discussing the pharmacology of intravenously administered medications for procedural sedation and variations in response based on age.
    - Discussing the pharmacology of medications administered through different routes, including oral, inhalational, intra-nasal, and rectal.
    - Analyzing the importance of alternative routes of sedation for children.
    - Describing how the use of multiple medications administered through different routes may produce synergistic or antagonistic effects.

    - Recognizing the different levels of sedation and understanding that the depth of sedation exists along a continuum from minimal to deep, and even to general anesthesia.
    - Describing the pharmacology of reversal/antagonist agents and medications used for managing medical emergencies, including their indications, duration of action, and associated risks.
- Continuously monitor patient comfort and regularly record observations in accordance with local guidelines. Understand the need for continuous presence during the procedure and continuous monitoring of the patient's status, excluding all other duties.
- Recognize age-appropriate key features of patient deterioration, initiate management or rescue procedures, and call for assistance if required. Key factors include:
    - Airway obstruction or abnormal breathing
    - Hypoventilation or apnea
    - Aspiration
    - Oxygen desaturation, either clinically observed or measured using age-appropriate oximetry, as needed
    - Changes in waveform capnography, when indicated for use
    - Alterations in the depth of sedation
    - Changes in heart rate and heart rhythm when conducting IV sedation or moderate sedation
    - Changes in blood pressure when conducting IV sedation or moderate sedation
    - Allergic reactions and anaphylaxis
    - Complaints of chest pain or shortness of breath
    - Initiating management and rescue procedures includes:
        - Basic Life Support, including age-appropriate technical skills and recent practice or requalification of basic airway opening maneuvers, age-appropriate use of suction, and age-appropriate CPR.
        - Advanced Life Support, with age-appropriate technical skills, including recent practice or requalification of basic airway opening maneuvers, the use of suction to clear the airway, the use of airway adjuncts such as sizing and insertion of

oropharyngeal airways, and effective bag-valve mask positive pressure ventilation.

    - Age-appropriate management of anaphylaxis.

- Ensure patients are safe to be transferred to a recovery area and complete a formal handover of care, along with documentation of the sedation and the plan for ongoing care. Patients should be able to maintain a patent airway with no more than minimal support.
- Ensure continuous observation and monitoring of patients in the recovery area until they meet predefined criteria for discharge. Describe the criteria required for the safe discharge of patients after procedural sedation.
- Provide written discharge information for all patients before they leave the facility with their carer, including instructions on steps to take in the event of an emergency.

B.1.6 American College of Emergency Physicians (ACEP) Multidisciplinary Consensus Practice Guideline on Unscheduled Procedural Sedation (2019)

Please refer to Section 1.14 of CHI Anesthesia Report.

The American College of Emergency Physicians (ACEP) organized a multidisciplinary effort to create a clinical practice guideline specific to unscheduled, time-sensitive procedural sedation, which differs in important ways from scheduled, elective procedural sedation. The purpose of this guideline is to serve as a resource for practitioners who perform unscheduled procedural sedation regardless of location or patient age. Evidence levels and grades of recommendations are not outlined[24]. The main recommendations are summarized below:

Patient- and family-centered care

- There is strong emphasis on patient-centered and family-centered care, and an ethical obligation to reduce pain, alleviate anxiety, and enhance patient comfort in unscheduled procedures, given the added stress of acute conditions.
- Urgent and emergent procedures require swift action to minimize patient and family distress.
- Delaying procedural sedation without evidence-based reasons can lead to prolonged pain and anxiety with minimal reduction in risk and should be avoided.

All sedation states

- Acknowledge the continuum of sedation and the potential for patients to transition between sedation states during a procedure.
- Dissociative sedation, particularly with ketamine, is valuable for urgent procedures, including children, non-fasting patients, and those with co-morbid conditions.
- The following figure shows common sedation state definitions listed in increasing order of complexity and potential risk, with their corresponding airway and ventilatory focus:

Responsiveness-Based Sedation State Definitions (best to guide sedation effectiveness)	Airway & Ventilatory Focus (best to assess safety)
Minimal sedation (anxiolysis)	
"A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination might be impaired, ventilatory and cardiovascular functions are unaffected."[34]	The airway and effective spontaneous ventilation are consistently maintained.
Moderate sedation	
"A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained."[34]	The airway and effective spontaneous ventilation are essentially always maintained.
Dissociative sedation	
"A trance-like cataleptic state induced by the dissociative drug ketamine characterized by profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respirations, and cardiopulmonary stability."[2-6]	The airway may require repositioning. Effective spontaneous ventilation is essentially always maintained.*
Deep sedation	
"A drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained."[34]	The airway may require repositioning. The ventilatory pattern may be at times slowed or irregular, but effective spontaneous ventilation is usually maintained such that assisted ventilation or other interventions are typically not required.
General anesthesia	
"A drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired."[34]	The airway and ventilatory pattern are often impaired, and patients often require assisted ventilation or other interventions.

*Transient respiratory depression and apnea have been reported 1 to 2 minutes after rapid IV administration, and for this reason IV ketamine is typically administered over at least 30 seconds.[5]

Figure 3. *Common sedation state definitions listed in increasing order of complexity and potential risk, together with their corresponding airway and ventilatory focus (retrieved from the ACEP 2019 guideline)*

Multidisciplinary field

- Procedural sedation is administered by providers from various backgrounds in diverse settings.
- It calls for collaborative, multidisciplinary institutional oversight, usually through local procedural sedation committees.
- All procedural sedation emphasizes representation and sound consideration of evidence-based procedural sedation advances within the committee.

Ventilatory adequacy versus responsiveness

- Historical guidelines relied on responsiveness for sedation depth, focusing on patient comfort but lacking precision.
- Advocate for a safety-focused approach that combines patient responsiveness and ventilatory adequacy for modern procedural sedation practice.
- Highlight the importance of continuous monitoring and physiological indicators, such as pulse oximetry and capnography, for safety.
- Suggest a shift away from responsiveness-defined sedation levels to objective physiological monitoring.

Procedural sedation depth, not drug

- Emphasize the sedation depth and ventilatory adequacy as key factors in procedural sedation.
- Reject restrictions based on specific drugs, as different medications have varying properties and effects.

Skill sets, not specialty

- Procedural sedation guidelines should specify essential skill sets for competent practitioners.
- Competency and privileges should not be solely based on a practitioner's medical specialty.
- Evaluation of competency should focus on procedural sedation knowledge, assessment, management, and rescue skills.
- These skills must address the sedation requirements, the specific procedure, and individual patient needs.
- Skill sets can be acquired through specialty training programs or additional focused training.

- Continuous skill maintenance is essential for all sedation providers to ensure safe and effective practice.
- This approach allows practitioners from various specialties to provide high-quality procedural sedation care.

Intervention-oriented definitions for adverse events

- Advances in evaluating procedural sedation adverse events involve moving from event-based definitions to intervention-based definitions.
- Intervention-based definitions better predict clinical significance and encourage standardized reporting.
- Recognize that interventions are an expected part of procedural sedation practice.

Modern procedural sedation is off-label

- Most medications used in modern procedural sedation practice are off-label due to inconsistent FDA labeling.
- Emphasize that off-label use is safe and effective when administered by trained professionals.
- Call for comprehensive FDA labeling updates to align with current procedural sedation knowledge and evidence.

SEDATION STAFFING

Two-person sedation team

- A two-person sedation team is essential for safe procedural sedation, consisting of:
    - The sedation provider responsible for overseeing the sedation encounter.
    - A sedation monitor, often a registered nurse or respiratory therapist, primarily responsible for continuous patient monitoring and documentation.
- At least one person in the team must be skilled in vascular access.

Procedural sedation provider skill set

- The sedation provider is a licensed healthcare professional with specific skill sets.
- These skills are crucial regardless of the targeted sedation depth.

- Rescue skills are essential for unforeseen patient responses.
- Skills to identify and correct deviations from the intended sedation level are required.
- Providers must recognize inadequate sedation and make necessary adjustments for patient safety.
- Recognize the skill set of emergency physicians in managing airways and ventilation.
- Emphasize that short courses like ACLS and PALS do not guarantee appropriate sedation provider skills, especially for some specialties like emergency medicine and critical care.
- Recommend that providers should focus on airway repositioning, bag mask ventilation, and airway placement as rescue skills.

Procedural sedation monitor skill set

- The sedation monitor, often a registered nurse or respiratory therapist, is a licensed healthcare professional with specific monitoring skills.
- Their primary role is continuous monitoring and documentation.
- They can assist with minor, interruptible tasks, such as sedative drug administration under direct supervision.

Procedural sedation provider privileging and credentialing

- Competencies for procedural sedation should be determined by the specific skills a practitioner must possess, rather than their medical specialty.
- Procedural sedation credentials and privileges can have a comprehensive or focused scope.
- Comprehensive privileges encompass all sedation levels, including emergency rapid sequence intubation and post-intubation management. Some practitioners may already have these skills due to their specialty training, such as emergency medicine, pediatric emergency medicine, and critical care.
- Focused privileges are suitable when a sedation provider possesses specific skills but prefers to limit their practice to a particular sedation level or drug.
- The decision on focused privileges should be based on individual practice needs, and department medical directors or hospital procedural sedation committees can determine these based on a provider's skills, experience, and competence.

- Training and proctoring can be utilized in some cases to confirm or expand these focused privileges.

Procedural sedation monitor privileging and credentialing

- The capability for a nurse, respiratory therapist, or other healthcare professional to serve as a procedural sedation monitor is a privilege based on local oversight, training, and skills verification.

Procedural sedation roles

- In the case of unscheduled moderate or dissociative sedation, the procedural sedation provider may also be the one conducting the procedure. This is possible if the procedure can be halted immediately in the event of an adverse event requiring urgent attention or resuscitation.
- While certain procedural sedation guidelines suggest that during deep sedation, the sedation provider should be solely focused on sedation management and not involved in the procedure, it is common for sedation providers to simultaneously perform brief unscheduled procedures while managing different sedation levels. This practice has been demonstrated to be safe without an increased frequency of clinically important adverse events or outcomes.
- There are situations where time-sensitive deep sedation is required, but the timely availability of a third provider or an operating room is not feasible without risking harm based on the patient's condition or causing undue pain and anxiety for the patient and their family. In these cases, the benefits of immediate procedure and sedation initiation outweigh the risks, assuming that the procedure can be interrupted if necessary. The sedation provider should be capable of immediately stopping the procedure and attending to the patient if an adverse event occurs, and additional licensed healthcare practitioners should be available for assistance in rescue.
- Nurses with the necessary skills to act as sedation monitors should be allowed to administer all medications for unscheduled procedural sedation under the direct supervision of the ordering provider. The ordering provider specifies the dosing and administration of the medications. Some state and nursing board regulations may restrict this practice without sufficient supporting evidence.

Procedural sedation practice

The following table lists requisite skills for procedural sedation:

Table 8. Requisite Skills for Procedural Sedation (Adapted from the ACEP 2019 Guidelines)

	Procedural sedation provider	Procedural sedation monitor
Cognitive skills	Must understand: • airway, respiratory, and cardiovascular physiology, and pathophysiology • the function and interpretation of continuous monitoring of cardiac rhythm, pulse oximetry, and capnography • sedative and antagonist drug pharmacology, e.g., pharmacokinetics, pharmacodynamics, dosing, administration, contraindications, adverse event profiles • sedation adverse events and when intervention is appropriate • the principles of patient pre-sedation evaluation and factors which increase sedation risk • the procedure to be performed and how it might impact the sedation course or sedation risk	Must be familiar with: • airway, respiratory, and cardiovascular physiology, and pathophysiology • the function and interpretation of continuous monitoring of cardiac rhythm, pulse oximetry, capnography, and blood pressure • the sedative drugs being used, including their dosing, administration, duration, and adverse event profiles • sedation adverse events and when intervention is appropriate • the equipment used during rescue, and where it is stored
Interactive monitoring skills	Must be able to: • monitor airway patency, identify airway obstruction, and identify and distinguish obstructive and central apnea • monitor ventilatory adequacy using continual observation of chest wall motion supplemented with	Must be able to: • monitor airway patency and identify partial or complete airway obstruction • monitor ventilatory adequacy using continual observation of the airway and chest wall motion supplemented with pulse oximetry and capnography

	pulse oximetry and capnography • monitor cardiovascular stability using physical assessment supplemented with cardiac rhythm and blood pressure monitoring • recognize when a patient is excessively or inadequately sedated	• monitor cardiovascular stability using physical assessment supplemented with cardiac rhythm and blood pressure monitoring • recognize when a patient is excessively or inadequately sedated
Rescue skills	Must be able to: • relieve airway obstruction through appropriate application of head tilt, chin lift, or placement of nasal or oral airway • perform bag mask ventilation • manage a patient who is excessively sedated, with or without active intervention as appropriate • rapidly initiate resuscitative measures for hypoxia, apnea, laryngospasm, hypotension, bradycardia, anaphylaxis, seizure, or cardiac arrest • rapidly summon additional resuscitation assistance, if required	Must be able to: • assist the sedation provider in resuscitation • rapidly summon additional resuscitation assistance, if required

Procedural sedation needs assessment

- The sedation provider must assess the specific circumstances when an unscheduled procedure is needed.
- Consider the urgency, sedation depth required, patient's level of responsiveness, procedure duration, and patient's needs (analgesia, anxiolysis, immobility).
- Evaluate the patient's risk factors based on pre-sedation evaluation.
- Assess the patient's prior experiences with sedation and any relevant allergies or contraindications.

- Evaluate anatomic or physiologic variants that may increase the risk of airway or ventilatory issues.
- Inquire about pregnancy potential in females of childbearing age.
- Consider referral for general anesthesia in high-risk cases.

Pre-sedation patient evaluation

- Perform a focused history and physical examination, including medication review.
- Patients with mild systemic disease are generally good candidates for sedation, while those with severe systemic disease are at higher risk.
- Evaluate prior sedation or anesthesia experiences, adverse events, allergies, and contraindications.
- Assess any anatomic or physiologic variants that could complicate airway management.
- Consider pregnancy potential in females, although in urgent situations, sedation may proceed regardless.
- Assess recent oral intake to determine the fasting status. Urgency may override fasting requirements.
- For patients at risk of aspiration, weigh the risks and benefits of delaying sedation after a substantial meal.
- Consider using dissociative sedation in cases where delay is not possible and aspiration risk is a concern.

Sedative regimens

- Plan the sedative regimen based on patient-specific needs and circumstances.
- Customize the regimen for each patient, as there is no single ideal sedative agent or combination for all situations.
- Multiple sedative agents may be used, including opioids, benzodiazepines, barbiturates, ketamine, propofol, dexmedetomidine, etomidate, and nitrous oxide.
- Dosing should be confirmed just before administration, calculated on a mg/kg basis for children.

Room and supplies

- Perform procedural sedation in an area equipped with essential equipment and supplies.
- Equipment should include oxygen, suction, monitoring devices, resuscitation medications, airway and ventilatory rescue equipment, and reversal agents for opioids and benzodiazepines.
- The need for intravenous access depends on the medications used, dose, and risk factors.

Non-pharmacological and other adjunctive techniques

- Use age-specific interventions to reduce fear, anxiety, and pain in children.
- Consider the use of child life specialists.
- Avoid or minimize the use of immobilization devices in children.

Interactive monitoring

- Continually monitor the patient's airway and ventilation.
- Verify the procedure, patient identity, and mark the correct site when appropriate (time-out process).

Physiologic monitoring

- Routinely use cardiac monitoring, blood pressure assessment, and pulse oximetry during procedural sedation.
- Blood pressure should be assessed at appropriate intervals, especially in high-risk patients.
- Patients with known or possible volume depletion should be rehydrated before sedation.
- Capnography provides continuous verification of ventilation and is valuable for deep sedation.
- Use of a precordial stethoscope is optional.

Supplemental oxygen

- High-flow pre-oxygenation delays oxygen desaturation and can help patients tolerate short periods of apnea or respiratory depression.
- It is recommended, especially when using capnography.

Rescue

- The procedural sedation provider must be prepared to perform rescue interventions, avoiding positive pressure ventilation if possible.

Recovery

- Monitor patients until they are no longer at risk for respiratory depression and vital signs return to pre-sedation levels.
- Provide care instructions for patients being discharged post-recovery.

Documentation

- Document the procedural sedation plan, patient evaluation, drug administration, adverse events, and interventions.
- Ensure documentation allows for quality assurance reviews.

Quality improvement

- Maintain accountability through a quality assurance and improvement program.
- Monitor sedation practice, track adverse events, ensure compliance with guidelines, and identify areas for improvement.

Future of procedural sedation research and practice

- Greater collaboration between specialties: The need for greater collaboration between different medical specialties in developing and overseeing optimal practice recommendations for procedural sedation is emphasized.
- Patient-centered outcomes: Future research should focus on patient-centered outcomes to improve the quality of the experience for patients and their families. This includes increasing patient satisfaction and reducing the frequency and magnitude of procedural awareness without compromising safety or efficacy.
- Target-controlled infusion technology: There's a need for rigorous studies on target-controlled infusion technology in procedural sedation. This technology allows for computer-driven drug administration based on pharmacokinetic modeling, potentially improving patient comfort, minimizing hypoventilation, and enabling sedation providers to focus more on patients.
- Optimal strategies for special populations: Research should better define optimal procedural sedation strategies for patients who require time-sensitive sedation despite substantial underlying illness and for pregnant patients.

- Reform in pre-procedural oral intake recommendations: Given the low risk of pulmonary aspiration and the absence of evidence for fasting impact, recommendations regarding pre-procedural oral intake should be reformed.
- Sedation provider credentialing and privileging: There should be a continued shift in credentialing and privileging for sedation providers, focusing on specific skill sets outlined in the guideline rather than specialty training alone.
- Simulation in training: Future research should clarify the role of simulation in procedural sedation training, possibly as a valuable tool for training and skill enhancement.
- Amend nursing regulations: State-based nursing regulations should be amended where necessary to allow qualified nurses to administer medications used for unscheduled procedural sedation under the direct supervision of the ordering provider.
- Risk-based framework: The document suggests that in the future, the focus should shift from a responsiveness-based cognitive framework for the sedation continuum to a risk-based framework. Computational tools for real-time risk assessments could enable tailored drug administration and interactive monitoring based on patient-specific risk.

B.1.7 Royal College of Radiologists: Sedation, Analgesia, and Anesthesia in the Radiology Department – Second Edition (2018)

Please refer to Section 1.15 of CHI Anesthesia Report.

There are no new updates[7]. The recommendations of this guideline remain unchanged[7].

B.1.8 American College of Emergency Physicians Clinical Policy: Procedural Sedation and Analgesia in the Emergency Department (2014)

Please refer to Section 1.16 of CHI Anesthesia Report.

There are no new updates[8]. The recommendations of this guideline remain unchanged[8].

B.1.9 American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists: An Updated Report (2010)

Please refer to Section 1.17 of CHI Anesthesia Report.

There are no new updates[25]. The recommendations of this guideline remain unchanged[25].

B.2 Additional Guidelines

This part includes the added guidelines to the previous CHI Anesthesia report, along with their recommendations.

Table 9. List of Additional Guidelines (Procedural Sedation)

Additional Guidelines
Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) Evidence-Based Clinical Practice Guideline on Analgesia and Anesthesia in The Intrapartum Period (**2020**)[26]

B.2.1 Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) Evidence-Based Clinical Practice Guideline on Analgesia and Anesthesia in The Intrapartum Period (2020)

Evidence levels and grades of recommendation are outlines in the table below[26]:

Table 10. Strength of Clinical Practice Recommendations

Strength of Clinical Practice Recommendations		
Strength of Recommendation Score		
A	Strong Recommendation	There is high certainty that the recommendation will provide strong benefit to the woman or newborn or both.
B	Moderate Recommendation	There is high certainty that the recommendation will provide moderate benefit to the woman or newborn or both.
C	Weak Recommendation	There is insufficient or low-level evidence to support universal adoption of the intervention. However, it may be offered based on professional judgment or the woman's preference.
NR	Not Recommended	There is strong to moderate evidence to support that the intervention be excluded.
IE	Insufficient Evidence	There is insufficient data to make a universal recommendation for this intervention, as it may have limited or unknown effectiveness.

Level of Evidence Score	
High	The evidence to support this recommendation is of high quality and includes mostly level-I studies, systematic reviews, or meta-analyses of high-level studies
Medium	The evidence to support this recommendation is of moderate quality and includes mostly level-II, II-1, II-2, or II-3 studies. May also include areas where there is limited high-quality evidence.
Low	The evidence to support this recommendation is weak or of low quality and includes mostly level-III studies, professional opinion, or case studies. The evidence may also be lacking.

The following recommendations are provided by the AWHONN on the use of analgesia and anesthesia in the intrapartum period [26]:

Safety considerations

- Recognize various safety considerations for women in the intrapartum period (A, Low level of evidence).

  The following table summarizes the recommendations for epidural infusions in the intrapartum setting:

Table 11. Recommendations for Epidural Infusions in the Intrapartum Setting (Adapted from the AWHONN 2020 Guideline)

Recommendation	Implementation
1. Initiate and verify orders	Obstetric and anesthesia care providers initiate orders, and pharmacy personnel verifies orders before an infusion is brought to the bedside.
2. Inform all health team members about changes to equipment and medications, if indicated.	Communicate all changes in medications (e.g. shortages, facility product changes) including appearance, labeling, container size, and medication concentrations.
3. Differentiate epidural bags.	Use a different size or shape of container or colored overwraps for epidural analgesia to differentiate from other intravenous medications and infusions.
4. Apply auxiliary warnings.	Use distinctive large warning labels that state, “for epidural use only” and apply the warning label over

	the seal of the access port used to spike the infusion
5. Dispense epidural infusions with appropriate epidural tubing.	Dispense epidural analgesia along with the required epidural tubing to promote administration by the correct route.
6. Limit nursing staff access to epidural analgesia medications.	The practitioner who will be administering epidural analgesia should bring the medication to the woman's bedside immediately before use. This limits handoffs and potential mix-ups with additional intravenous medications that may be in the room.
7. Establish a toxicity treatment protocol to identify and treat local anesthetic toxicity.	Ensure the protocol and required medications (i.e., lipid emulsions) are readily accessible.
8. Ensure all monitors and pumps are set with correct alarm settings and parameters.	Alerts and alarms are important tools to help keep women safe. False alarms have led to alarm fatigue in health care.

- Recognize that pregnant women in the hospital may have multiple risk factors for falls (A, Low level of evidence).
    - Pregnancy-Related
        - Shift in center of gravity
        - Loosening of ligaments
        - Increased postural sway
        - Impeded view from the enlarged abdomen
    - Antepartum
        - Balance issues
        - Muscle weakness or atrophy
        - Headaches
        - Visual disturbances
    - Intrapartum
        - Numbness from regional anesthesia
        - Hypotension

        - Dizziness from intravenous narcotics, inhaled nitrous oxide, blood loss.
        - Environmental factors, e.g., trip hazards such as tubing, monitors, and cables
    - Immediate Postpartum
  - Hypotension due to blood loss
    - Lingering effects of analgesia or anesthesia

- Consider using a standardized, validated fall risk scoring tool, preferably specific to laboring women (C, Low level of evidence).
- Assess a woman's readiness to ambulate at key times during labor. At minimum, women should be assessed at admission, after starting pain medication, inhaled nitrous oxide, or regional analgesia/anesthesia, and after birth (A, Low level of evidence).

Analgesics

- Administer IV medications for pain relief as requested by the laboring woman, and per healthcare provider orders (A, High level of evidence).

  The following table provides commonly used parenteral or systemic opioids for labor anesthesia:

Table 12. Commonly Used Parenteral or Systemic Opioids for Labor Anesthesia (Adapted from the AWHONN 2020 Guidelines)

Drug	Dosage and Route of Delivery	Onset	Duration	Elimination Half-Life (Maternal)
Fentanyl	50–100 micrograms (every hour); Alternatively, as PCA, load 50 micrograms, then 10–25 micrograms Q 10–12 minutes	2–4 minutes IV	30–60 minutes	3 hours
Morphine	2–5 mg IV; 5–10 mg IM	10 minutes IV; 30 minutes IM	1–3 hours	2 hours
Nalbuphine *Not SFDA-registered*	10–20 mg IV, SQ, or IM	2–3 minutes IV; 15 minutes SQ or IM	2–4 hours	2–5 hours

Butorphanol *Not SFDA-registered*	1–2 mg IV or IM	5–10 minutes IV; 30–60 minutes IM	4–6 hours	2–5 hours
Remifentanil	0.15–0.5 micrograms/kg Q 2 minutes as PCA	20–90 seconds	3–4 minutes	9–10 minutes

IM, intramuscularly; IV, intravenously; PCA, patient-controlled analgesia; Q, every; SQ, subcutaneous.

- Monitor for maternal and fetal effects from IV opioid medications used during labor (A, High level of evidence).
    - Consider proximity of medication administration to the time of birth.
    - Evaluate fetal heart rate (FHR) characteristics before the administration of opioids.
    - Assess maternal respiratory rate and oxygen saturation before administration of IV opioids. If respiratory rate is 8 or higher or oxygen saturation is less than 95%, consult with provider before the administration.

Regional analgesia/anesthesia (RA)

Preparation

- Perform a risk assessment to identify women needing pre-anesthesia consultation. This includes women at high risk for complications and/or with high-risk medical conditions (B, Low level of evidence).
    - Possible indications for a pre-anesthesia consultation
        - Anticoagulation therapy
        - Cardiac disease
        - Chronic pain
        - Dwarfism
        - Hypertensive disorder
        - Hepatic disease
        - Hematologic abnormalities, such as thrombocytopenia, von Willebrand disease, or sickle cell disease
        - Infectious disease or infection
        - Jehovah's Witness faith
        - Morbid obesity

        - Musculoskeletal defect of the spine
        - Neurofibromatosis
        - Neurologic disorder, such as para/quadriplegia, seizure disorder, arteriovenous malformation, aneurysm,
        - Myasthenia gravis
        - Organ transplantation (solid)
        - Obstetric complications
        - Renal disease (major)
        - Prior adverse anesthesia experience, such as malignant hyperthermia, anticipated difficult airway, obstructive sleep apnea, previous failed or difficult block, or allergy to local anesthetics.
        - Prior spinal surgery
- Understand that the timing of regional analgesia/anesthesia is individualized and may be warranted in early labor (B, Low level of evidence).
    - Early anesthesia may benefit women with hypertensive disorders, obesity, or obstructive sleep apnea or who are attempting a trial of labor after cesarean birth.
    - Regional analgesia/anesthesia is usually withheld according to the timing and dosage of heparin administration; however, anesthesia choice and facility protocols should be followed. Suggested timing includes delaying analgesia/ anesthesia as follows:
        - 4–6 hours after low doses of heparin (5,000 units)
        - 12 hours after intermediate doses of heparin (7,500–10,000 units)
        - 24 hours after high doses of heparin (total daily dose > 20,000 units) or adjusted dosing regimens
- Provide 1:1 nurse-to-patient staffing ratios during the initiation of regional anesthesia and for a minimum of 30 minutes after completion of the procedure (A, Low level of evidence).
- Verify informed consent by the anesthesia care provider. Timing may vary. (A, Low level of evidence).
- Assess fetal status and maternal baseline blood pressure, pulse, respiratory rate, temperature, oxygen status, and labor progress before administering regional analgesia/anesthesia (A, Low level of evidence).

- Assess and support oral intake of fluids and foods for low-risk laboring women (B, Medium Level of Evidence).

  The following table provides oral intake in labor practice recommendations from national organizations:

Table 13. Oral Intake in Labor Practice Recommendations from National Organizations (Adapted from the AWHONN 2020 Guideline)

Organization	Recommendation	Rationale
American College of Nurse-Midwives	Promote self-determination of oral intake, using a shared decision-making model. Evaluate all women at increased risk for operative birth and consider restrictions in this population.	1. Fasting may have detrimental effects on the labor process compared with the small risk of aspiration if general anesthesia is required. 2. Because of advances in obstetric care, aspiration is rare, making a randomized controlled trial to determine a causal relationship of oral intake and maternal morbidity unfeasible. 3. Providing nutrition and hydration decreases a woman's stress level and provides a feeling of control. 4. Energy requirements in labor may be similar to continuous, moderate aerobic exercise. Carbohydrate consumption during exercise helps improve performance, reduces fatigue, and reduces ketosis, liposis, and protein degradation. 5. Most women desire oral intake during labor, tend to choose liquids, and tend to decrease consumption as labor progresses. 6. The use of epidural anesthesia is not a contraindication to oral intake.
American College of Obstetricians and Gynecologists	Modest amount of clear liquids is supported for women	American College of Obstetricians and Gynecologists:

American Society of Anesthesiologists Canadian Anesthesiologists' Society	with uncomplicated labor. Solid food is not recommended.	1. There is insufficient evidence to suggest a safe fasting period. 2. Women at high risk for aspiration (women with morbid obesity, diabetes, or difficult airway) or who are at risk for operative delivery require further restrictions, on a case-by-case basis. American Society of Anesthesiologists: 1. There is limited literature on the recommended fasting time for clear liquids and the risk of emesis, reflux, and aspiration, so moderate amounts of clear liquids may be allowed in uncomplicated labor. 2. There is no evidence to support the safety of solid food intake during labor. 3. Women at high risk for aspiration (women with morbidity obesity, diabetes, or difficult airway) or who are at risk for operative delivery require further restrictions, on a case-by-case basis. Canadian Anesthesiologists' Society: 1. Gastric emptying of solids is delayed in labor, and opioids also cause a delay, so solid food should not be given. 2. Gastric emptying of clear liquids is not delayed, so clear liquids can be given. 3. Hospitals should develop policies about oral intake during labor.
World Health Organization	Oral intake (food and fluid) is recommended for low-risk women.	Oral restrictions have not been found to be beneficial on important clinical outcomes, so women's wishes should be respected.

- Obtain laboratory studies, as requested by the anesthesia care provider, individualized to the woman's medical condition (B, Medium Level of Evidence).
- Obtain a fetal heart rate tracing before initiating regional analgesia/anesthesia (A, Low Level of Evidence).
- Administer an IV fluid bolus (20 mL/kg or 1–2 L) as a preload, coload, or both according to anesthesia care provider orders and facility guidelines (A, High level of evidence).
    - If preload is ordered, initiate IV fluid bolus 10–15 minutes before the procedure.
    - If coload is ordered, administer a rapid infusion of IV fluid bolus in conjunction with (during and throughout) the regional analgesia/anesthesia procedure.
- Conduct a time out before administering regional analgesia/anesthesia (A, Low level of evidence).
- Assist the woman into the appropriate position during administration of regional analgesia/anesthesia, which may be the lateral, sitting, or pendant position (C, High Level of Evidence).
- Initiate pharmacologic hypotension prophylaxis based on maternal response and as ordered by the anesthesia care provider, including ephedrine and phenylephrine (A, High Level of Evidence).
- Provide additional education to the woman choosing patient-controlled epidural anesthesia (C, Low level of Evidence).

<u>Immediate maternal response</u>

- Assess for severe adverse maternal reactions during and after the administration of regional analgesia/anesthesia test dose (A, Low Level of Evidence).
    - Maternal Presentation of Adverse Reactions to Regional Analgesia
        - High Spinal/Injection into the Intrathecal Space
            - Immediate upper thoracic sensory loss
            - Loss of consciousness
            - Respiratory paralysis
            - Severe lower-extremity motor blockage
            - Total autonomic blockage

        - Intravascular Injection
            - Numbness of the tongue
            - Metallic taste in the mouth
            - Perioral paresthesia
            - Difficulty speaking
            - Dizziness
            - Hypotension
            - Maternal tachycardia or bradycardia
            - Restlessness
            - Loss of consciousness
            - Seizures
        - Systemic Toxicity of the Local Anesthetic
            - Bradycardia
            - Cardiovascular collapse
            - Contractile dysfunction and ventricular dysrhythmias
            - Hypotension
        - Pneumocephalus
            - Sudden-onset, severe headache
            - Neck pain
            - Back pain
            - Elevated intracranial pressure
            - Changes in mental status
            - Unstable maternal vital signs
    - Interventions for intravascular injection
        - Initiate the emergency response team.
        - Discontinue the anesthesia infusion.
        - Initiate resuscitation measures.
        - Administer 20% lipid emulsion therapy as ordered. One suggested lipid emulsion treatment protocol is as follows:

- Administer lipid emulsion (Intralipid) 20%, 1.5 mg/kg, IV bolus (100 mL for a 70-kg [154-lb] patient) over 1–3 minutes.
- Follow the initial bolus with IV infusion of 0.25 mL/kg per minute.
- The IV bolus may be repeated every 3–5 minutes up to a total of 3 mL/kg until circulation is restored.
- Continue the infusion until hemodynamic stability is reestablished.
- A maximum total dose of 8 mL/kg during the resuscitation period is recommended.

- Monitor maternal blood pressure after the initiation or rebolus of a regional block, including patient-controlled epidural anesthesia (A, High Level of Evidence).
- Initiate interventions to resolve maternal hypotension according to provider orders and facility, such as lateral positioning and administering non-glucose-containing crystalloid fluid boluses or vasopressors (A, High Level of Evidence).

<u>Uterine activity & fetal heart rate patterns</u>

- Assess uterine activity and fetal heart rate patterns every 5 minutes for the first 15 minutes after the initiation or rebolus of regional analgesia/anesthesia, including patient-controlled epidural analgesia (A, Medium Level of Evidence).
- Recognize potential fetal complications such as fetal heart rate tracing characteristics that fall into category II or category III (A, High Level of Evidence).
- Initiate intrauterine resuscitative measures if category II or category III (or both) characteristics occur. Judicious, short-term use of oxygen therapy may be considered (A, High Level of Evidence).
- Implement measures to increase or decrease uterine activity after regional analgesia/ anesthesia, if indicated (B, Medium Level of Evidence).
    - For tachysystole, initiate measures to reduce excessive uterine activity, including intravenous fluids, lateral positioning, discontinuation of oxytocin, and administration of terbutaline, according to provider orders or facility protocol.
    - For delayed or stalled uterine contractions, initiate augmentation according to provider orders or facility protocol.

Ongoing maternal response

- Monitor for signs of sedation and respiratory depression (A, Low Level of Evidence).
- Assess the level of motor blockade hourly throughout the period of analgesia/anesthesia. Consider using a standardized screening tool or criteria to assess the degree of block (B, Medium Level of Evidence).
- Establish baseline temperature before regional analgesia/anesthesia is administered and monitor every 2–4 hours after anesthesia (C, Medium Level of Evidence).
- Evaluate maternal pain levels using a facility-approved scoring tool. Recognize the difference between the rating of pain relief and the rating of satisfaction with pain relief (B, Low Level of Evidence).
- Be aware of some medications used an adjunct to improve labor anesthesia in women choosing PCEA. (e.g., dexamethasone, paracetamol) to improve labor anesthesia (C, Medium Level of Evidence).
- Assess urinary retention and bladder distension at a minimum of every 4 hours and assist with bladder emptying as needed (A, Medium Level of Evidence).

Second stage of labor

- Understand that regional analgesia/anesthesia may affect the duration of the second stage of labor (B, High Level of Evidence).
- Individualize nursing interventions to support women in the second stage (C, Medium Level of Evidence).

Remifentanil (PCA infusion)

Monitoring

- Ensure registered nurses (RN)s are educated to support women choosing remifentanil for pain relief (B, Low Level of Evidence).
- Provide 1:1 nurse-to-patient ratios for women receiving remifentanil (A, High Level of Evidence).
- Use tools and monitoring devices for safety as per facility guidelines. Devices may include noninvasive blood pressure monitor, electrocardiogram, pulse oximetry, and capnography (B, Medium Level of Evidence).
- Maintain continuous electronic fetal heart rate monitoring for women using remifentanil in the intrapartum period (A, Medium Level of Evidence).

Neonatal considerations

- Consider discontinuing remifentanil during the last two to three pushes to allow the medications to clear the fetus' system before birth (B, Low Level of Evidence).
- Prepare for neonatal respiratory support and have naloxone readily available.

Inhaled nitrous oxide (INO) safety

INO Safety

- Ensure nurses are educated to support the administration of inhaled nitrous oxide in laboring women (B, Low Level of Evidence).
- Evaluate for maternal and fetal contraindications before the initiation of inhaled nitrous oxide (A, Low Level of Evidence).
    - Contraindications to inhaled INO use in laboring women
        - Excessive sedation
        - Impaired level of consciousness
        - Inability to hold mask or mouthpiece to face because of musculoskeletal disease/deformity, substance impairment, or mental status changes.
        - Decreased oxygenation
        - Conditions that may create space for the collection of gas (e.g., recent pneumothorax, recent trauma, inner ear surgery, gastric bypass surgery)
        - Increased intracranial or intraocular pressure.
        - Known vitamin B12 deficiency.
        - Category III fetal heart rate tracing characteristics
        - Emphysema
        - Pulmonary hypertension
        - Recent retinal surgery
        - Pernicious anemia
        - Extensive bowel resection resulting from Crohn's disease.
- Confirm recent IV opioid medication use within the last 2hours or according to facility guidelines. Consider the benefits and risks of INO for opioid-dependent women (B, Low Level of Evidence).

Management and monitoring

- Provide education to the woman and family on possible side effects and proper techniques for INO use (A, Low Level of Evidence).
- Provide 1:1 nurse-to-patient ratios for women using INO during initiation and assessment of the woman's initial response (A, Low Level of Evidence).
- Initiate intermittent auscultation or continuous fetal monitoring according to facility protocol and maternal risk factors (A, Medium Level of Evidence).
- Consider the need for rescue analgesia for inadequate responders to INO (B, Low Level of Evidence).

Immediate postpartum care

Monitoring

- Determine maternal assessment parameters based on the type of birth, anesthesia, and complications (A, Low Level of Evidence).
- Assess for birth complications requiring extended analgesia/anesthesia such as perineal laceration repair or retained placenta (B, Medium Level of Evidence).

Discontinuation of analgesia/anesthesia

- If an epidural was used, remove the catheter when anesthesia is no longer necessary, according to anesthesia care provider orders and facility protocols (B, Low Level of Evidence).
    - Steps For Epidural Catheter Removal
        - Position the woman either sitting with the head and back flexed forward or lying down in a lateral position with the head and shoulders flexed forward.
        - Remove the tape securing the catheter.
        - Carefully grasp the epidural catheter at the insertion site and withdraw at a 90-degree angle to the insertion site.
        - If resistance to catheter removal is encountered, attempt to reposition the woman by increasing the amount of flexion. Do not force the removal.
        - If unable to remove, secure the catheter with tape and notify the anesthesia care provider.

- Safely discharge the woman from post anesthesia care when indicated (B, Medium Level of Evidence).

Complications

- Recognize potential maternal postpartum complications related to analgesia/anesthesia including urinary retention, pruritus, shivering, and headache (A, Medium Level of Evidence).
- Recognize potential neonatal complications from intrapartum analgesia/anesthesia including lower Apgar scores, an increased need for neonatal resuscitation, respiratory depression, admission to the neonatal intensive care unit, and meconium-stained amniotic fluid (A, Medium Level of Evidence).

High-risk considerations for intrapartum analgesia/anesthesia

Women with obesity

- Consider an anesthesia consultation before admission or at the time of admission to the hospital (No grading).
- Consider early placement of a neuraxial catheter. Recognize that the use of pre-insertion ultrasonography may assist with placement of the epidural catheter (No grading).
- Assist the woman with optimal positioning for safe placement of regional analgesia/ anesthesia. The sitting or pendant position may be preferred (No grading).
- Monitor for potential complications following neuraxial catheter placement, which may include hypotension, fetal heart rate abnormalities, postdural puncture headache, and catheter migration (No grading).

Substance use disorder

- Screen for SUD on admission to the obstetric unit using a validated screening tool whenever possible. If indicated, initiate urine drug testing with the woman's consent according to facility protocol and state law (No grading).
- Initiate an anesthesia consultation early after admission to facilitate adequate pain management during labor. Ideally, an evaluation should have occurred in the prenatal period (No grading).
- Recognize the impact of polysubstance use and comorbidities on pain management during labor and birth. Identify the timing of the last substance(s) used (No grading).

- Evaluate the impact of individual substances on the woman and her fetus (No grading).
- Decrease the potential for maternal withdrawal during hospitalization with the following interventions, according to provider orders (No grading):
    - Maintain the woman's daily intake of prescribed opioid replacement medications during labor, if indicated.
    - Ensure a safe interval between administration of opioid replacement therapy and opioid pain medications for labor.
    - Avoid narcotic agonist–antagonist medications.
- Recognize that substance use during pregnancy may have unique considerations associated with intrapartum analgesia/anesthesia (No grading).
    - Provide higher doses of opioids for women on opioid replacement therapy to achieve an analgesic effect.
    - Encourage neuraxial anesthesia earlier in labor to help manage pain.
    - Consider peripheral nerve blockades as an adjunct therapy.
    - Consider intrathecal pump implications on pain interventions.
- Recognize the impact that chronic opioid exposure may have on the woman and fetus during the intrapartum period (No grading).
    - Monitor for respiratory depression and sedation levels when providing additional pain medication for women on opioid replacement therapy.
    - Implement continuous fetal monitoring for the duration of the intrapartum period.

<u>Fetal Demise</u>

- Initiate pain management options based on maternal request rather than cervical change or other labor markers (No grading).
- Recognizing the woman's response to pain management interventions may be influenced by the grief process. Provide emotional and psychosocial support for pain, anxiety, and grief during the labor and birth process (No grading).
- Be aware of complications that may have caused fetal demise and may also complicate labor and birth and ensure pain management is a primary focus (No grading).

- Consider monitoring the uterus throughout the active stages of labor with the use of induction or augmentation agents or in women who are beyond 20 weeks of gestation (No grading).

C. Endoscopy

C.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 14. Clinical Guidelines Requiring Revision (Endoscopy)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.18 Guidelines for sedation and anesthesia in GI endoscopy- **American Society for Gastrointestinal Endoscopy** (**2018**)[27]	N/A*
Section 1.19 European position paper on drug-induced sedation endoscopy (DISE) (2014)	**European position paper** on drug-induced sleep endoscopy: **2017** Update[28]
Section 1.20 Multisociety Sedation Curriculum for Gastrointestinal Endoscopy- **2012** by the **AGA Institute, American College of Gastroenterology**, **American Society for Gastrointestinal Endoscopy**, **American Society for the Study of Liver Disease**, and **Society of Gastroenterology Nurses and Associates**[29]	N/A*
Section 1.21 Non-anesthesiologist administration of propofol (NAAP) for gastrointestinal endoscopy: **European Society of Gastrointestinal Endoscopy**, **European Society of Gastroenterology and Endoscopy Nurses and Associates** Guideline – Updated June **2015**[30]	N/A*

*: No updated versions available

C.1.1 American Society for Gastrointestinal Endoscopy Guidelines for Sedation and Anesthesia in GI Endoscopy (2018)

Please refer to Section 1.18 of CHI Anesthesia Report

There are no new updates[27]. The recommendations of this guideline remain unchanged[27].

C.1.2 European Position Paper on Drug-Induced Sleep Endoscopy (2017)

Please refer to Section 1.19 of CHI Anesthesia Report.

Evidence levels and grades of recommendations were not outlined[28]. The following European position paper provides recommendations on drug-induced sleep endoscopy [28]:

General contraindications

- Safety is paramount in Drug-Induced Sleep Endoscopy (DISE).
- DISE is suitable for patients with an acceptable anesthetic risk profile.
- Absolute contraindications are ASA 4, pregnancy, and allergies to Drug-Induced Sedation Endoscopy (DISE) sedatives.
- Relative contraindications may include morbid obesity, except when correctable upper airway (UA) anatomical features exist.

Required preliminary examinations and patient's selection

- Type 1, 2, or 3 sleep studies are crucial for assessing obstructive sleep apnea (OSA) severity and position dependency.
- DISE is a diagnostic tool and cannot replace a full-night sleep study.
- Clinical and endoscopic awake UA examination is essential.
- Additional clinical assessments may be necessary based on local guidelines.

Where to perform DISE

- DISE can be conducted in a safe clinical setting with standard anesthetic equipment.
- Ambience factors, like silence and darkness, should be available.
- It can be performed as a day-case or require an overnight stay based on patient's condition and concurrent surgery.

Technical equipment

- Essential equipment includes standard anesthesiologic monitoring, flexible endoscope, and infusion pump.
- EEG-derived indices are useful for assessing sedation depth.
- Recording equipment is desirable for educational and research purposes.

Staffing

- Required personnel include the clinician performing the procedure, a person to monitor the patient (anesthesiologist or clinically trained individual), and a third person to act as an assistant for maneuvers performed during DISE.

Local anesthesia, nasal congestion, other medications

- Preparatory measures like nasal decongestion and local anesthesia are described but must be used with caution.
- UA suction can assist in assessment, and endoscopes with working channels are useful.
- Atropine-like drugs are not recommended due to unknown effects on sleep physiology.
- Local anesthesia and decongestants may interfere with nasal resistance and airflow.

Patient positioning, basic and special diagnostic maneuver

- Patients should be positioned to mimic their typical sleeping habits.
- Supine position is common, but lateral positions are useful, especially for positional therapy.
- Trans-oral fiberoptic endoscopy provides additional information.
- The dynamics of the upper airway can change with different maneuvers.

Drugs

- Variability in drug choice: The literature reports a wide range of drug options and combinations for drug-induced sleep endoscopy (DISE).
- Commonly used drugs: Midazolam and propofol are the two most frequently used drugs in DISE, either individually or in combination.
- Additional drug combinations: Some practitioners also combine midazolam and propofol with other drugs such as remifentanil or ketamine to achieve sedation.

- Dexmedetomidine: Dexmedetomidine, an alpha 2 adrenergic drug, is another option for sedation during DISE. It provides both sedation and analgesia by inhibiting the locus ceruleus.
- Dexmedetomidine characteristics: Dexmedetomidine has a slightly longer onset of action (5-10 minutes), and patients may take longer to awaken after its use. In some cases, patients may not fall asleep at all when using this drug.
- Comparison to natural sleep: Most evidence comparing natural sleep to sedation in DISE has been obtained using propofol or midazolam as single agents for sedation. These drugs are recommended for DISE as they replicate the critical closing pressure during natural sleep with no significant differences in the Apnea-Hypopnea Index.
- Caution with remifentanil: The addition of remifentanil to propofol is discouraged due to its potential to increase patient desaturation, despite its ability to reduce sneezing.
- Dosage and management: The specific dosage and management of propofol and midazolam are detailed in the following section.
- Advantages and disadvantages: The table below provides an overview of the advantages and disadvantages of using propofol, midazolam, and a combination of propofol and midazolam for DISE.

Table 15. Overview of the Advantages and Disadvantages of Using Propofol, Midazolam, and a Combination of Propofol and Midazolam (P+M) for Drug-Induced Sleep Endoscopy (DISE) (Adapted from the 2017 European position paper)

Sedative agents	Advantages	Disadvantages
Propofol	• Quick safe manageable • Less muscle relaxation • Easier control of titration	• Technique dependent (MCI or TCI)
Midazolam	• Longer and more stable examination window • Midazolam antidote available	• More difficult to handle in case of overdosing • Longer hospital stay
Combination (P+M)	• Quicker and more stable mimicking of natural sleep • Midazolam antidote available	• Technique dependent (MCI or TCI) • Increases sneezing

Drug dosage suggestions

Propofol

- **Sedation mode:** The working group recommends using a syringe infusion pump with target-controlled infusion (TCI) technology as the standard mode for propofol sedation. TCI provides more stable and reliable sedation compared to manual infusion schemes or bolus techniques.
- **Effective site concentration:** Most patients achieve the adequate sedation level at an effective site concentration of 3.2µg/ml. Therefore, it is suggested to apply a starting dose of 3µg/ml, which is quicker than the more conservative 2.0 or 2.5µg/ml. However, physicians should be aware that rapid sedation may lead to an increased number of central apneas initially, creating a false image of obstruction.
- **Three possibilities for DISE by propofol:**
    - **TCI basic mode:** Starting dose of 2.0 or 2.5µg/ml (effective site concentration). Increase the dose by 0.2–0.5 µg/ml every 2 minutes until the patient starts snoring, and UA vibration and collapse are observed (variations possible based on team experience).
    - **Manually controlled infusion:** Delivering dose of 50-100 ml/h depending on the patient's response.
    - **Bolus technique:** Two proposals are presented:
        - Proposal 1: Starting dose of 30–50 mg, with an increasing rate of 10 mg every 2 minutes.
        - Proposal 2: Starting dose of 1 mg/kg, with an increasing rate of 20 mg every 2 minutes.

Midazolam

- **Bolus technique:** Starting dose of 0.05 mg/kg, observed for 2–5 minutes. Increase the rate by 0.03 mg/kg only if the patient is awake, then wait for 5 minutes. If the patient is not completely asleep, consider further increasing the rate if needed to 0.015 mg/kg.
- **Controlled infusion:** No shared experiences and evidence available in the literature.

Combination of propofol + midazolam

- **Sedation characteristics:** Combining these two drugs results in quicker sedation. However, patients tend to sneeze more frequently compared to propofol alone, which can make the exploration more challenging.

- **Administration:** Midazolam is administered first using a single bolus starting dose of 0.05 mg/kg. After 2 minutes, sedation continues with Propofol performed by TCI (effective site concentration), starting with a dose of 1.5–3.0µg/ml. If necessary, an increasing rate of 0.2–0.5 µg/ml every 2 minutes is suggested until stable sedation is achieved.

Table 16 details drug dosing suggestions:

Table 16. Drug Dosing Suggestions (Adapted from the 2017 European Position Paper)

Schedule	Drug dosage	
	Midazolam	**Propofol**
Propofol alone	N/A	TCI (effect site concentration): Starting dose: 2.0 -2.5 µg/ml If required, increase dose of 0.2 – 0.5 µg/mL every 2 minutes
		Manually controlled infusion: Delivering dose: 50 -100ml/h
		Bolus technique: Proposal 1, starting dose: 30 –50 mg, increasing rate of 10 mg every 2 min. Proposal 2, starting dose: 1 mg/kg, increasing rate of 20 mg every 2 min.
Midazolam alone	Bolus technique: Starting dose: 0.05 mg/kg Observe 2 – 5 min If required, increase dose of 0,015 - 0.03 mg/kg	N/A
Propofol + midazolam	MIDAZOLAM SINGLE BOLUS BEFORE ADMINISTRATION OF PROPOFOL: Single starting dose: 0.05 mg/kg	Propofol TCI (effect site concentration): Starting dose: 1.5 – 3.0 µg/mL If required, increase dose of 0.2 – 0.5 µg/mL

Observation window

- Stable sedation and consistent breathing pattern should be observed.
- Monitoring tools like Ramsay Score and EEG-derived indices help assess sedation level.

- Bispectral index values between 80-60 are suggested, but not optimal for every patient.
- Further research is needed on using EEG-derived indices during DISE.

List and definitions of target events

- Snoring: Pharyngeal and/or laryngeal vibration without obstruction.
- Apnea/hypopnea: Pharyngeal and/or laryngeal complete or partial obstruction.
- Collapse patterns: Various patterns including soft palate collapse (anteroposterior or circumferential), pharyngeal lateral wall collapse, tongue base collapse, epiglottic trapdoor phenomenon, secondary epiglottic collapse, and involvement of ary-epiglottic folds.

Scoring and classification systems

- Several DISE scoring and classification systems exist.
- Different systems emphasize various aspects of upper airway anatomy.
- Classification should include features like level/structure, degree (severity), and configuration (pattern, direction) of obstruction.
- Levels vs. structures and severity grading may vary among systems.
- Configuration typically includes anteroposterior, lateral, and concentric forms of obstruction.
- The VOTE (Velum, Oropharyngeal lateral walls, Tongue, and Epiglottis) system is noted for its simplicity and inter-rater agreement.
- A common starting dataset and results can be obtained using the VOTE classification with added comments.

Other techniques for UA assessment

- Various techniques for upper airway assessment include imaging, acoustic analysis, pressure manometry, and DISE.
- DISE provides three-dimensional visualization during sedation.
- Proper training for ENT surgeons is essential to obtain reliable observations during DISE.
- DISE is recommended for its comprehensive assessment of upper airway collapse during sleep.

Recommended report format

- After a DISE procedure, a report should explain the procedure and UA assessment findings.
- The report should include information on the sedative drugs used, their dosages, and any additional drugs like decongestants or anti-secretory drugs.
- The sedation level assessed by EEG-derived signals (e.g., bispectral index (BIS), cerebral state index (CSI),) should be reported.
- Any modifications to the UA obstruction pattern during different positions and maneuvers should be documented.
- A DISE classification score system should be adopted and reported to facilitate comparison between patients and operators.

C.1.3 AGA Institute/American College of Gastroenterology/American Society for Gastrointestinal Endoscopy/American Society for the Study of Liver Disease/Society of Gastroenterology Nurses and Associates Multisociety Sedation Curriculum for Gastrointestinal Endoscopy (2012)

Please refer to Section 1.20 of CHI Anesthesia Report.

There are no new updates[29]. The recommendations of this guideline remain unchanged [29].

C.1.4 European Society of Gastrointestinal Endoscopy/European Society of Gastroenterology and Endoscopy Nurses and Associates Guideline on Non-Anesthesiologist Administration of Propofol (NAAP) for Gastrointestinal Endoscopy (2015)

Please refer to Section 1.21 of CHI Anesthesia Report.

There are no new updates[30]. The recommendations of this guideline remain unchanged [30].

D. Pediatrics

D.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 17. Clinical Guidelines Requiring Revision (Pediatrics)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.22 **National institute for health care and excellence** (NICE) guidance for Sedation in under 19: using sedation for diagnostic and therapeutic procedures (Published **2010**)[9]	N/A*
Section 1.23 Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures- the **American Academy of Pediatric Dentistry** and **American Academy of Pediatrics** (**2019**)[31]	N/A*
Section 1.24 Guideline for Ketamine Sedation of Children in Emergency Departments Published: Apr 2009 (Reviewed Oct **2016**)- The **Royal College of Emergency Medicine**	Ketamine Procedural Sedation for Children in The Emergency Department- The **Royal college of Emergency Medicine** Best Practice Guideline **2020**[32]
Section 1.25 Clinical Policy: Critical Issues in the Sedation of Pediatric Patients In The Emergency Department (**2008**)-**American College of Emergency Physicians**[33]	N/A*

*: No updated version available

D.1.1 National Institute for Health Care and Excellence (NICE) Guidance for Sedation in Under 19s: Using Sedation for Diagnostic and Therapeutic Procedures (Published 2010)

Please refer to Section 1.22 of CHI Anesthesia Report.

There are no new updates[9]. The recommendations of this guideline remain unchanged[9].

D.1.2 American Academy of Pediatric Dentistry/American Academy of Pediatrics Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures (2019)

Please refer to Section 1.23 of CHI Anesthesia Report.

There are no new updates[31]. The recommendations of this guideline remain unchanged[31].

D.1.3 Royal College of Emergency Medicine Best Practice Guideline on Ketamine Procedural Sedation for Children in the Emergency Department (2020)

Please refer to Section 1.24 of CHI Anesthesia Report.

Evidence levels and grades of recommendations are not outlined[32]. The following recommendations are provided by the Royal College of Emergency Medicine on ketamine procedural sedation for children in the ED[32]:

Summary of recommendations

1. Ketamine sedation should be considered for procedures that are inherently painful or distressing, only after all other alternatives have been explored.
2. Ketamine must not be employed for sedation in the ED for children under the age of one year. Its utilization in children aged between two to five years should be entrusted exclusively to clinicians possessing significant expertise in ketamine administration for procedural sedation.
3. Ketamine sedation should exclusively occur in a designated area where full resuscitation equipment is readily available.
4. To ensure safe sedation, enough senior medical and nursing staff must be present in the Emergency Department whenever a sedation procedure is conducted.

5. For the safe execution of ketamine sedation, a minimum of three dedicated staff members is indispensable, with one responsible for administering sedation, another for patient monitoring, and a third for performing the procedure.
6. Only clinicians with extensive experience in ketamine administration, and who can proficiently manage potential complications, particularly those related to airway obstruction, apnea, and laryngospasm, should employ ketamine sedation.
7. The pre-sedation assessment should be thorough, encompassing the patient's medical conditions, regular and immediate medications, allergies, previous sedation, and anesthesia experiences (including any associated issues), as well as their ASA grade. This assessment should be systematically documented.
8. Written consent should be diligently obtained from both parents and the patient when appropriate. In addition, comprehensive patient and parent information should be provided in written form.
9. During the procedure, meticulous monitoring is essential, including assessments of respiration, heart rate, blood oxygen levels, three-lead ECG, capnography, blood pressure, and the extent of dissociative sedation.
10. Following the procedure, the child should recover in a serene and observed environment, under the continuous supervision of a qualified staff member.
11. Healthcare departments should actively engage in regular internal audits to scrutinize documentation and adherence to established standards. They should also participate in local event reporting to continually enhance their practices and procedures collaboratively, maintaining a high standard of patient care.

Introduction to ketamine

- Ketamine, a distinct dissociative drug, was introduced in clinical practice in 1970.
- Derived from phencyclidine (PCP), it operates as a dissociative sedative by binding to the N-methyl-D-aspartate (NMDA) receptor.
- It possesses properties such as anxiolysis, analgesia, amnesia, and dissociation, all within a wide safety margin.
- Primarily used for facilitating brief, painful procedures, like suturing or orthopedic manipulations.

- Prior to considering ketamine for procedural sedation, all alternative options must be exhaustively explored, including pain relief, reassurance, distraction, nitrous oxide, intranasal diamorphine, and play therapy.
- Ketamine presents unique challenges and benefits, with one of the most common challenges being agitation, with or without hallucinations, during the recovery phase.
- Children may experience transient nightmares following ketamine procedural sedation, and clinicians should be well-versed in managing potential side effects.
- Parents should be informed in writing about potential delayed effects and advised to return to the Emergency Department if any concerns arise.
- Ketamine deviates from the traditional continuum of sedation. It either induces dissociation or does not, with a narrow transition zone.
- Unlike other non-dissociative agents that allow for progressive deepening of sedation, ketamine remains static in its dissociated state.
- This distinction reduces the risk of airway and respiratory complications and adds to its appeal for clinicians.
- Ketamine offers a wide safety margin, ensuring patient safety.
- The recommended doses for analgesic sedation aim to maintain the patient's ability to safeguard their airway.
- There's a notable risk of sedation failure during prolonged procedures, and clinicians should consider general anesthesia for such cases, especially if a procedure extends beyond 20 minutes.
- Ketamine administration should be reserved for clinicians with extensive experience who can competently manage complications, especially those involving airway obstruction, apnea, and laryngospasm.
- The physician overseeing ketamine sedation and airway management should be a middle-grade or consultant with at least six months of experience in anesthesia or intensive care, in addition to current pediatric advanced life support training.
- The pre-sedation assessment should encompass co-morbidities, regular and acute medications, allergies, details of past sedation and anesthesia, and ASA grade. Obesity is an independent risk factor in procedural sedation.
- Proper documentation of procedural sedation is vital for safety, audit purposes, and maintaining high care standards.

- Clinical incident or event reporting during procedural sedation should be carried out at the local level and may involve the use of a reporting system like SIVA.
- Characteristics of ketamine sedation:
    - Dissociation – trance-like state with eyes open but not responding.
    - Catalepsy – normal or slightly increased muscle tone maintained.
    - Analgesia – excellent analgesia is typical • Amnesia – usually total.
    - Airway reflexes maintained.
    - Cardiovascular state – blood pressure and heart rate increase slightly.
    - Nystagmus is typical, usually horizontal; eyes remain open and glazed.
- Speed of action of ketamine:
    - Clinical onset (approximately) 1 minute
    - Effective sedation 10-20 minutes
    - Time to discharge (average) 90 minutes.

Indications

- Ketamine is suitable for children aged 12 months or older. However, clinical practice, along with departmental and clinician experience, may determine a practical lower age limit of 5 years.
- Ketamine is indicated for children requiring painful or distressing procedures during emergency care.
- It can be an alternative to general anesthesia for minor and moderate procedures:
    - Suturing
    - Fracture reduction or manipulation
    - Joint reduction
    - Burn management
    - Incision and drainage of abscess
    - Tube thoracostomy placement
    - Foreign body removal
    - Wound exploration and irrigation
    - Assessment of altered consciousness due to acute illness or injury

    - Patients under the influence of drugs or alcohol
- It can be combined with local anesthetic techniques, and its property of inducing cataplexy helps keep patients still, eliminating the need for physical restraint.
- Ketamine sedation is not suitable for children with a clear need for surgical procedures.

Contraindications

In addition to general contraindications, ketamine should be avoided in the following cases:

- Pulmonary hypertension
- Children under 12 months (due to increased risk of laryngospasm and airway issues)
- High risk of laryngospasm (e.g., active respiratory infection, active asthma)
- Unstable or abnormal airway (e.g., tracheal surgery or stenosis)
- Active upper or lower respiratory tract infections
- Procedures involving the mouth or pharynx
- Patients with severe psychological problems, cognitive or motor delay, or severe behavioral issues
- Significant cardiac diseases (angina, heart failure, malignant hypertension)
- Intracranial hypertension with cerebrospinal fluid obstruction
- Intra-ocular issues (glaucoma, penetrating injury)
- Previous psychotic illnesses
- Uncontrolled epilepsy
- Hyperthyroidism or use of thyroid medication
- Known prior adverse reactions to ketamine
- Altered conscious level due to acute illness or injury
- Drug / alcohol intoxication

Side effects

- Mild agitation (20% of cases)
- Hypersalivation and lacrimation (less than 10% of cases). Evidence suggests that co-administering anti-cholinergic agents like atropine is unnecessary.

- Involuntary movements or ataxia (5% of cases)
- Vomiting, which occurs in 5-10% of children during the recovery period.
- Transient rash, affecting 10% of patients. Most of these side effects typically resolve and only require observation.

Potential complications

Ketamine has historically raised concerns regarding laryngospasm and the emergence phenomenon.

- APNOEA: Occurs rarely (0.3%) following rapid IV ketamine bolus; it may require airway repositioning or brief bag-valve-mask ventilation. Administering IV ketamine over 60 seconds can prevent this issue.
- AIRWAY MISALIGNMENT / NOISY BREATHING: A rare event (<1%) that can usually be resolved with basic airway repositioning. "Ketamine breathing," characterized by deep sighing respirations, may be mistaken for stridor but is minimized through proper head positioning.
- LARYNGOSPASM: A transient and rare event (0.3%) with an even rarer incidence of intubation (0.02%). The risk is higher in children who experience posterior pharyngeal stimulation or have active respiratory diseases (e.g., URTI). These conditions are contraindications for ketamine procedural sedation. Management typically involves airway and patient positioning and occasional bag-valve-mask ventilation.
- EMERGENCE PHENOMENA: Ketamine is known to induce agitation and hallucinations as its dissociative effects wear off in both adults and children. In children under 10 years, this phenomenon is uncommon (1.6%), becoming more common beyond mid-adolescence (affecting up to 1 in 3 adults). This can be reduced through positive psychology prior to drug administration (encouraging a "happy dream") and can be mitigated with benzodiazepines during the recovery period. However, prophylactic administration is not necessary.

Procedure

1. A minimum of three dedicated staff members are essential for the procedure:
    - One doctor to manage sedation and the airway.
    - A clinician to perform the procedure.
    - An experienced nurse to monitor, support the patient, family, and clinical staff.

2. Only experienced clinicians who can manage complications, especially airway obstruction, apnea, and laryngospasm, should administer ketamine for procedural sedation.
3. Children should be managed in a high-dependency or resuscitation area with immediate access to full resuscitation facilities. Monitoring should encompass sedation level, pain, ECG, blood pressure, respiration, pulse oximetry, and capnography. Observations should be recorded every 5 minutes.
4. Consider providing supplemental oxygen before and during the procedure. Note that the use of an oxygen mask might be hindered during certain procedures (e.g., facial suturing), but evidence supports the safe use of 'room air' during ketamine procedural sedation. Discuss the procedure and ketamine use with the parent or guardian and obtain written consent.
5. Fasting doesn't reduce complications. The child's fasting status should be evaluated in light of the procedure's urgency and the child's comorbidities. Recent food intake is not a contraindication for ketamine use.
6. When time allows, use topical anesthesia to minimize pain during intravenous cannulation.
7. The literature recommends a ketamine dose of 1.0 mg/kg administered slowly via intravenous injection over at least one minute. For shorter procedures, lower doses (e.g., 0.6-0.8 mg/kg) can achieve successful sedation. Additional doses of 0.5 mg/kg via slow IV injection may be necessary after 5-10 minutes to reach the desired dissociative state.
8. Prepare the ketamine dose, calculate key resuscitation drugs, and ensure their availability. Encourage the child and parents to discuss pleasant topics to minimize unpleasant emergence phenomena. Parents should remain with the child until sedation is achieved and during recovery.
9. Ketamine's effects are typically noticeable 1-2 minutes after administration. Painful procedures should be delayed until at least 2 minutes after ketamine administration.
10. Adequate sedation is usually indicated by a loss of response to verbal stimuli, nystagmus, and slight increases in heart rate, blood pressure, and respiration rate.
11. Lacrimation or salivation may be observed.
12. Use local anesthesia where needed.
13. After the procedure, the child should recover in a quiet, observed, and monitored area under the continuous observation of a trained staff member.

Monitoring can be removed when the sedating doctor is satisfied that vital signs are normal for the child.

14. The recovery time is typically between 60 and 120 minutes, depending on the dose. The child can be discharged when they meet pre-sedation criteria:
    - Conscious and responsive.
    - Resolution of nystagmus.
    - Able to walk unassisted (older children).
    - Vital signs within normal limits.
    - Uncompromised respiratory status.
    - Pain and discomfort addressed.
15. Provide an advice sheet to the parent or guardian, recommending rest and quiet, supervised activities for the remainder of the day. The child should refrain from eating or drinking for two hours after discharge due to the risk of nausea and vomiting. There may be a persisting risk of ataxia, increasing the likelihood of falls (older children should refrain from driving for at least 24 hours).
16. Complete the medical record and local audit documentation.
17. Document all adverse events and review them, reporting them as clinical incidents when appropriate.

Ketamine doses in children:

- Intravenous initial dose: 1mg/kg given over 60 seconds.
- Intravenous supplemental dose if required: 0.5mg/kg slow injection.

Management of complications and severe emergence phenomena

- In cases where the patient experiences severe emergence reactions and significant distress, administer small increments of midazolam in doses ranging from 0.05 to 0.1 mg/kg.
- If intractable vomiting occurs after the procedure, consider using IV ondansetron at a dose of 0.1 mg/kg (up to a maximum of 4 mg) via slow intravenous injection.
- Laryngospasm:
    - If the child develops stridor, attempt to reposition the airway, gently suction secretions, and apply a high-flow oxygen mask with a reservoir bag.

- If the child's oxygen saturation remains appropriate, proceed with the procedure.
- If the stridor worsens or the child's oxygen saturation decreases, administer oxygen through a bag-valve-mask and stop the procedure. Seek assistance.
- If oxygen saturation falls below 92%, initiate gentle bag-valve-mask ventilation. Apply PEEP (positive end-expiratory pressure) if necessary and prepare for rapid sequence intubation (RSI).
- If the stridor further worsens, seek assistance and prepare the relevant anesthetic agent for RSI.

D.1.4 American College of Emergency Physicians Clinical Policy: Critical Issues in the Sedation of Pediatric Patients in the Emergency Department (2008)

Please refer to Section 1.25 of CHI Anesthesia Report.

There are no new updates[33]. The recommendations of this guideline remain unchanged[33].

E. Dentistry

E.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 18. Clinical Guidelines Requiring Revision (Dentistry)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.26 The **Scottish Dental Clinical Effectiveness Programme** (SDCEP): Conscious Sedation in Dentistry Dental Clinical Guidance- Third Edition	Reviewed and Unchanged December **2022**[34]
Section 1.27 The American Academy of Pediatric Dentistry (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients (2009)	The **American Academy of Pediatric Dentistry** (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients- Revision **2023**[10]

E.1.1 Scottish Dental Clinical Effectiveness Programme (SDCEP) Conscious Sedation in Dentistry Dental Clinical Guidance (2022)

Please refer to Section 1.26 of CHI Anesthesia Report.

This guideline had been reviewed and reaffirmed in December 2022[34]. The recommendations of this guideline remain unchanged[34].

E.1.2 American Academy of Pediatric Dentistry (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients (2023)

Please refer to Section 1.27 of CHI Anesthesia Report.

Evidence levels and grades of recommendations were not outlined[10]. The recommendations were provided by the American Academy of Pediatric Dentistry on the use of local anesthesia for pediatric dental patients[10]:

Topical anesthetics

- Topical anesthetics can alleviate discomfort during the administration of local anesthesia.
- Commonly used single drugs for topical anesthesia in dentistry include:
    - 20% benzocaine
    - 5% lidocaine
    - 4% tetracaine.
- These topical agents effectively reduce pain related to needle penetration of the oral mucosa within surface tissues, typically up to two to three millimeters in depth.
- Topical anesthetics are available in various forms, including gel, liquid, ointment, patches, and aerosols.
- The concentration of local anesthetics in topical formulations is usually higher than in injectable solutions. Careful application helps minimize the risk of toxicity.
- **Concerns with benzocaine and prilocaine**
    - Both benzocaine and prilocaine have been associated with a risk of acquired methemoglobinemia.
    - Acquired methemoglobinemia is a rare but serious condition that occurs when ferrous iron in hemoglobin becomes oxidized to the ferric state, forming methemoglobin. This altered hemoglobin cannot

effectively carry oxygen, resulting in reduced oxygen availability to body tissues.

    - Prilocaine is relatively contraindicated in patients at risk for methemoglobinemia, such as those with glucose-6-phosphate deficiency, sickle cell anemia, anemia, or very young patients, and patients showing signs of hypoxia.
    - There are significant clinical concerns regarding patients who receive both prilocaine-containing topical agents and drugs that induce methemoglobin (e.g., sulfonamides, acetaminophen, phenytoin).

- **FDA warnings**
    - The United States Food and Drug Administration (FDA) has cautioned against using topical anesthetics, including over-the-counter teething products, containing benzocaine for children under two years of age.
    - The FDA has also issued warnings about the potential toxicity of compounded topical anesthetics, mainly due to the high concentration of individual anesthetic components.
    - Compounded topical anesthetics are custom-made medications that may bypass the FDA's drug approval process.
    - The use of compounded topical anesthetics with unknown local anesthetic concentrations carries risks of complications related to overdose, including seizures, arrhythmias, and death.

Selection of syringes and needles

- The American Dental Association (ADA) has established standards for aspirating syringes used in local anesthesia administration.
- Needle gauges range from size 23 to 30, with lower gauge numbers indicating larger inner diameters. Lower gauge needles provide less deflection as they pass through soft tissues and enable more reliable aspiration.
- Needle lengths for dental procedures come in three options: long (32 millimeters [mm]), short (20 mm), and ultrashort (10 mm).
- Needle fractures during the administration of inferior alveolar nerve blocks are most common with 30-gauge needles and can occur during insertion, when the needle is bent before insertion, or due to patient movement post-insertion.

Injectable local anesthetic agents

- Local amide anesthetics used in dentistry include:
    - Lidocaine
    - Mepivacaine
    - Articaine
    - Prilocaine
    - Bupivacaine.
- Local anesthetics with epinephrine are formulated at an approximate pH of 4.5 to extend the vasoconstrictor's shelf life, but this acidity may lead to increased pain by activating acid-sensing nociceptors.
- Higher acidity in vasoconstrictor-containing local anesthetics can delay the onset of anesthesia as they transform from ionized to non-ionized forms to penetrate nerve sheath lipid membranes.
- Adjusting the pH of local anesthetics with epinephrine is under investigation to reduce pain and time to anesthesia onset. Buffered local anesthetic with epinephrine was found more likely to achieve anesthesia than non-buffered agents in some cases.
- Vasoconstrictors, such as epinephrine, are added to local anesthetics to constrict blood vessels at the injection site, reducing the risk of toxicity and prolonging anesthesia.
- Patients with specific medical conditions (e.g., hyperthyroidism, cardiovascular disease, thyroid dysfunction, diabetes, sulfite sensitivity) and those on certain medications may need medical consultation to determine the need for a local anesthetic without vasoconstrictor.
- Patients susceptible to malignant hyperthermia can safely use local anesthetics, including those with vasoconstrictor.
- When halogenated gases are used in general anesthesia, caution is necessary when using local anesthetics with epinephrine.
- Injectable prilocaine is relatively contraindicated for patients prone to methemoglobinemia.
- Long-acting local anesthetics like bupivacaine, while useful for postoperative pain in adults, are contraindicated for children and intellectually disabled patients due to the increased risk of self-inflicted injury.
- Mandibular cortical bone in children is less dense than in adults, allowing faster and more complete diffusion of injected anesthetic. This increased

permeability enables mandibular buccal supraperiosteal infiltration to be as effective as an inferior alveolar nerve block for dental procedures on mandibular primary teeth.

- Injection of a local anesthetic into an infected area can result in prolonged onset or ineffective anesthesia due to lower tissue pH, inhibiting the diffusion of the active free base form of the anesthetic and stopping nerve impulse conduction.
- Endocarditis prophylaxis (antibiotics) is not routinely recommended for local anesthetic injections in non-infected tissues for patients at risk.

Documentation of local anesthesia

- Maintaining a patient record is crucial for quality oral health care, with each appointment summarized accurately and objectively.
- Proper documentation for the administration of local anesthetics includes information like the type and dosage of the local anesthetic used.
- It may also involve recording the type of injection (e.g., infiltration, block, intraosseous), needle choice, and the patient's reaction to the injection.
- For patients where the maximum dosage of local anesthetic is a concern (e.g., young patients, those undergoing sedation), documenting their body weight and calculating the recommended total dose preoperatively can prevent overdosage.
- Recording the doses of all agents on a time-based record can enhance patient safety, particularly when local anesthetics are administered alongside sedative drugs.
- The documentation should also confirm that post-injection instructions were reviewed with the patient and parent.

Local anesthetic complications

- The safety of patients during local anesthetic administration relies on practitioners' awareness of potential complications and their efforts to prevent, recognize, and provide timely interventions.
- **Local anesthetic systemic toxicity (LAST) (overdose)**
    - Younger pediatric patients are more susceptible to adverse drug events, with most reactions occurring during or within 5-10 minutes of injection.
    - LAST can result from high blood levels due to inadvertent intravascular injection or repeated injections.

- Local anesthetics cause a biphasic reaction in the central nervous system, leading to symptoms like convulsions, dizziness, anxiety, and confusion.
- Toxicity may also cause muscle twitching, tremors, and overt seizures, followed by loss of consciousness and respiratory arrest.
- The cardiovascular response includes initial increases in heart rate and blood pressure due to injected epinephrine, followed by vasodilation, myocardial depression, and a drop in blood pressure.
- LAST can be prevented by careful injection techniques, aspiration before agent delivery, and slow injections.
- Early recognition of toxicity signs and symptoms, discontinuation of the local anesthetic, and emergency management are essential. Intravenous lipid emulsion therapy is a priority for serious LAST cases.

- **Allergy to local anesthetics**
  - Allergy to local anesthetics is a rare absolute contraindication for their use.
  - Allergy to one amide does not rule out the use of another amide, but allergy to one ester contraindicates the use of another ester.
  - Patients may report allergies even if they experienced reactions to the vasoconstrictor, preservative sensitivity, toxic doses, or intravascular injection.
  - Documentation of previous events and allergy testing can guide procedural pain management. For bisulfite allergy, a local anesthetic without vasoconstrictor is recommended.
  - Allergic reactions are not dose-related and can manifest in various ways, including urticaria, dermatitis, angioedema, fever, photosensitivity, or anaphylaxis.
  - Emergency management depends on the rate and severity of the reaction.
- **Paresthesia**
  - Paresthesia is persistent anesthesia beyond the expected duration and can be caused by nerve trauma, including needle-induced paresthesia.
  - Patients initially experiencing an electric shock sensation during injection may develop persistent anesthesia.
  - Paresthesia risk may be higher with four percent solutions like articaine and prilocaine.

    - Advising patients and caregivers about numbness duration and postoperative precautions is necessary to reduce the risk of self-induced soft tissue trauma.

- **Postoperative soft tissue injury**
    - Self-induced soft tissue trauma, such as lip and cheek biting, can occur due to local anesthetic use.
    - Duration of soft tissue anesthesia is longer than dentinal or osseous anesthesia, emphasizing the importance of observation during the numbness period.
    - Phentolamine mesylate injections can reduce the duration of local anesthetic effects.
    - A relationship between reducing soft tissue trauma and shorter-acting local anesthetics has not been proven.
    - Use of phentolamine mesylate is not recommended for patients under three years of age or weighing less than 15 kilograms (33 pounds).

Alternative techniques for delivery of local anesthesia

- Traditional methods like infiltration or nerve block techniques with dental syringes, cartridges, and needles are commonly used in pediatric dentistry.
- Various alternative techniques are available, including:
    - Computer-controlled local anesthetic delivery
    - Periodontal injection techniques
    - Needleless systems
    - Intraseptal or intrapulpal injection
- These alternatives offer better control of the administration rate, pressure, and location of anesthetic solutions, potentially improving comfort and the success of anesthesia.
- The periodontal ligament (PDL) injection, in particular, reduces the risk of postoperative soft tissue bleeding in patients with bleeding disorders.
- However, PDL injection and intraosseous methods are contraindicated in the presence of inflammation or infection at the injection site.

Local anesthesia with sedation and general anesthesia

- Local anesthetics and sedative agents both depress the central nervous system (CNS).
- When sedating children with opioids, it's advisable to adjust the local anesthetic dose downward.
- Local anesthesia is used for dental procedures under general anesthesia to address concerns about future pain sensitivity due to CNS priming and reduce postoperative pain.
- However, evidence regarding intraoperative local anesthesia administration during dental treatments under general anesthesia is inconclusive.
- Intraoperative local anesthesia may increase the risk of postoperative soft tissue trauma while the patient is still numb.

Local anesthesia and pregnancy

- Pregnancy leads to various physiological changes, including effects on cardiovascular function and metabolism.
- When considering dental treatment during pregnancy, the risks and benefits to both the pregnant patient and fetus should be weighed.
- Local anesthetics like lidocaine, mepivacaine, and bupivacaine are safe for pregnant patients when used at appropriate dosages.
- Caution is advised when the fetus has known medical complications because local anesthetics can pass through the placental barrier.
- Epinephrine in local anesthetics may affect uterine blood vessels and blood flow to the placenta, so it should be used cautiously, especially for pregnant women with hypertensive conditions like preeclampsia.
- The second trimester is considered an optimal time for non-urgent dental treatment because organogenesis is complete, and the patient can be comfortably positioned in the dental chair.
- Lidocaine is considered safe for use during breastfeeding.

Recommendations

- **Local anesthesia considerations for pediatric dental patients**
    - Proper pain control during dental procedures is crucial for pediatric patients as inadequate control can have significant physical and psychological consequences, potentially affecting their future pain experiences.

- Agents used for preventing procedural pain in pediatric patients may carry toxicity and adverse reaction risks.
- To ensure safe and effective use of local anesthetics for pediatric dental patients, practitioners should follow these recommendations:
    1. Choose local anesthetic agents based on the patient's medical history, developmental status, procedure duration, and planned use of other agents like nitrous oxide or sedatives.
    2. Administer local anesthetic doses based on the patient's body weight, adhering to the provided guidelines (table 19), and strive to use the minimum effective dose.

Table 19. Injectable Local Anesthetics (Adapted from the AAPD 2023 Guideline)

Anesthetic	Duration in minutes[a]	Maximum dose[b]		Mg anesthetic/1.7 mL cartridge	Mg vasoconstrictor/1.7 mL cartridge
		Mg/kg	Mg/lb		
Lidocaine[c]	90-200	4.4	2		
2% + 1:50,000 epinephrine				34	0.034
2% + 1:100,000 epinephrine				34	0.017
Articaine[d]	60-230	7	3.2		
4% + 1:100,000 epinephrine				68	0.017
4% + 1:200,000 epinephrine				68	0.0085
Mepivacaine	120-240	4.4	2		
3% plain				51	
2% + 1:20,000 levonordefrin				34	0.085
Bupivacaine[e]	180-600	1.3	0.6		
0.5% + 1:200,000 epinephrine				8.5	0.0085

kg=kilogram; lb=pound; mg=milligram; mL=milliliter.

[a] Duration of anesthesia varies greatly depending on concentration, total dose, and site of administration; use of epinephrine; and the patient's age.

[b] Use lowest total dose that provides effective anesthesia. Lower doses should be used in very vascular areas or when providing local anesthesia without vasoconstrictor. Doses of amides should be decreased by 30% in infants younger than six months. For improved safety, AAPD, in conjunction with the American Academy of Pediatrics, recommends a dosing schedule for dental procedures that is more conservative that the manufacturer's recommended dose (MRD).

[c] The table lists the long-established pediatric dental maximum dose of lidocaine as 4.4 mg/kg; however, the MRD is 7 mg/kg.

[d] Use in pediatric patients under four years of age is not recommended.

[e] Use in patients under 12 years of age is not recommended.

3. Consider using a topical anesthetic before the injection to reduce needle penetration discomfort, while accounting for potential systemic absorption of topical drugs in total anesthetic calculations.
4. Document the local anesthetic type, dosage, and, if administered with sedatives, record all agent doses on a time-based record.
5. When local anesthetics are used alongside other CNS-depressing medications, lower the calculated maximum total dose.
6. Reduce the calculated maximum total dose of amide local anesthetics by 30% for infants younger than six months.
7. Provide postoperative guidance on the duration of local anesthesia and strategies to minimize lip, cheek, or tongue biting risks.
8. Have established protocols for handling emergencies involving patients showing signs of local anesthetic systemic toxicity (LAST) or allergic reactions.

Additional safety considerations for pediatric local anesthesia

- The maximum safe dose of lidocaine for pediatric dental patients is traditionally 4.4 mg/kg, although the manufacturer recommends a maximum dose of seven mg/kg. AAPD, in collaboration with the American Academy of Pediatrics, suggests a more conservative dosing schedule for dental procedures to enhance safety.

- The manufacturer advises against using articaine in pediatric dental patients under four years old, and bupivacaine is not recommended for patients younger than 12.
- Compounded topical anesthetics can contain high levels of both amide and ester agents, increasing the risk of severe adverse reactions.
- Benzocaine is contraindicated for patients with a history of methemoglobinemia and children under two years of age. Prilocaine is also contraindicated for those with a history of methemoglobinemia and relatively contraindicated for individuals susceptible to methemoglobinemia due to medical history or concurrent medication use.
- Needles are prone to breakage if they are bent before injection or inserted into their hub.
- Aspiration before injection and a slow injection technique reduce the risk of adverse events related to systemic administration of local anesthetics.

F. Perioperative Pain (Epidural and Regional Techniques)

F.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 20. Clinical Guidelines Requiring Revision (Perioperative Pain)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.28 Practice Guidelines for Acute Pain Management in the Perioperative Setting an Updated Report by the **American Society of Anesthesiologists Task Force on Acute Pain Management** (**2012**)[11]	Not available

F.1.1 American Society of Anesthesiologists Task Force on Acute Pain Management Practice Guidelines for Acute Pain Management in the Perioperative Setting (2012)

Please refer to Section 1.28 of CHI Anesthesia Report.

There are no new updates[11]. The recommendations of this guideline remain unchanged[11].

G. ICU Sedation

G.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 21. Clinical Guidelines Requiring Revision (ICU Sedation)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.29 Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU-**2018** by the **Society of Critical Care Medicine**[12]	N/A*
Section 1.30 **North Wales Critical Care Network**- SEDATION GUIDELINES FOR ADULTS IN CRITICAL CARE	N/A*
Section 1.31 Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients (2013)	**Pan-American and Iberian Federation of Societies of Critical Medicine and Intensive Therapy** Evidence-based clinical practice guidelines for the management of sedoanalgesia and delirium in critically ill adult patients (**2019**)[35]
Section 1.32 NICE guidance for Delirium: prevention, diagnosis, and management [updated 2019]	**National Institute for Health and Cre Excellence** (NICE) Guideline on Delirium: prevention, diagnosis and management in hospital and long-term care (**2023**)[36]

*: No updated versions available

G.1.1 Society of Critical Care Medicine Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU (2018)

Please refer to Section 1.29 of CHI Anesthesia Report.

There are no new updates[12]. The recommendations of this guideline remain unchanged[12].

G.1.2 North Wales Critical Care Network – Sedation Guidelines for Adults in Critical Care

Please refer to Section 1.30 of CHI Anesthesia Report.

This guideline is no longer available as part of the North Wales Critical Care Network publications.

G.1.3 Pan-American and Iberian Federation of Societies of Critical Medicine and Intensive Therapy Evidence-Based Clinical Practice Guidelines for the Management of Sedoanalgesia and Delirium in Critically Ill Adult Patients (2019)

Please refer to Section 1.31 of CHI Anesthesia Report.

Evidence levels and grades of recommendations are outlined below[35]:

Table 22. Levels of Evidence and Grades of Recommendation

Level of evidence	**Description and implications**
High level of evidence	It is sure that the real effect of the intervention comes close to the estimated effect
Moderate level of evidence	It is almost sure that the real effect of the intervention comes close to the estimated effect, but it is possible that the effect may be different
Low level of evidence	The certainty of the estimated effect is limited. The real effect is probably substantially different from the estimated effect.
Very low level of evidence	There is little certainty with respect to the estimated effect. The real effect is substantially different from the estimated effect
Grade of recommendation	**Description**

Strong recommendation	There is certainty with respect to the desired effects. The intervention should be offered to all patients if favorable, or should not be used if not favorable
Conditional recommendation	There is no complete certainty with respect to the desired effect. Adherence to this recommendation probably has a greater impact upon the undesired effects, but there is not enough certainty in this respect

Sedoanalgesia is the practice of combining sedation with local anesthesia, usually in the case of surgery. The following recommendations are provided on the use of sedoanalgesia and delirium in critically ill adult patients[35]:

Benefits of sedoanalgesia

- Short and long-term benefits of adequate pain and sedation management in the critically ill adult patient:
    - Implementing strategies to prevent and manage pain in the early stages, with the addition of sedatives only, if necessary, at the minimum effective dose (Conditional recommendation, Low level of evidence).
    - Creating or adapting protocols for pain and sedation management, emphasizing sedoanalgesia, mild sedation, and avoiding benzodiazepines (Strong recommendation, Moderate level of evidence).
    - Using strategies for proper evaluation and adherence to pain and sedation management in all critical patients (Strong recommendation, Low level of evidence).
- Benefits of sedation, delirium, and analgesia protocols
    - Using protocols for evaluation and management to improve outcomes, including adequate pain control, reduced agitation and delirium episodes, lower drug exposure, shorter time on mechanical ventilation, and shorter ICU and hospital stays (Conditional recommendation, Moderate level of evidence).

Sedation

- Sedation management for adult patients with sepsis and septic shock
    - Mild sedation recommended for mechanically ventilated adult patients with sepsis and septic shock, with periodic evaluation and avoidance of deep sedation (Conditional recommendation, Low level of evidence).
- Best sedation approach for critically ill adult patients without ventilatory support
    - Use low-risk drugs like dexmedetomidine for critically ill adult patients without ventilatory support, with sedation levels monitored (Conditional recommendation, Low level of evidence).
- ABCDEF protocol

  The ABCDEF bundle includes Assess, Prevent, and Manage Pain (A), Both Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT) (B), Choice of analgesia and sedation (C), Delirium: Assess, Prevent, and Manage (D), Early mobility and Exercise (E), and Family engagement and empowerment (F).
    - Applying the ABCDEF protocol in critically ill patients to increase the days without delirium and coma, and reduce the duration of ventilatory support, ICU stay, and mortality (Strong recommendation, Low level of evidence).
    - Involving the patient's family in the critical care plan for psychosocial support (Conditional recommendation, Low level of evidence).
- Early mobilization
    - Implement passive mobilization followed by active mobilization when clinically allowed for all ICU patients (Strong recommendation, Moderate level of evidence).
    - Early mobilization recommended for surgical patients on mechanical ventilation for at least 48 hours, following an institutional protocol (Strong recommendation, Moderate level of evidence).
    - Early mobilization recommended for hemodynamically stable patients after coronary revascularization or valve replacement surgery (Strong recommendation, Moderate level of evidence).
- Benzodiazepine use in critically ill patients
    - Avoid increasing nighttime midazolam doses and prefer non-benzodiazepine drugs (Conditional recommendation, Low level of evidence).

    - If using midazolam for sedation, provide mild sedation to avoid delirium recall and not affect implicit patient memory (Conditional recommendation, Low level of evidence).
    - Avoid continuous infusion of midazolam and prefer intermittent bolus doses for sedation in critical patients (Conditional recommendation, Low level of evidence).
    - Avoid deep sedation with midazolam (Conditional recommendation, Low level of evidence).
    - Strong recommendation to avoid benzodiazepines in patients at high risk of suffering delirium (Strong recommendation, High level of evidence).
    - Use midazolam instead of thiopental for managing refractory convulsive states (Conditional recommendation, Low level of evidence).
    - Add midazolam to haloperidol to improve agitation control in palliative patients (Conditional recommendation, Low level of evidence).
- Use of remifentanil
    - Strong recommendation to use remifentanil in the postoperative period of cardiac surgery to reduce the duration of mechanical ventilation (Strong recommendation, Moderate level of evidence).
    - Suggestion to use remifentanil in combination with propofol for sedation during therapeutic hypothermia after cardiac arrest (Conditional recommendation, Low level of evidence).
    - Suggestion to use remifentanil in patients with renal failure to reduce the duration of mechanical ventilation and ICU stay (Conditional recommendation, Low level of evidence).
    - Suggestion to use remifentanil in neurocritical patients to reduce waking time and allow neurological evaluation (Conditional recommendation, Low level of evidence).
    - Suggest titrating remifentanil to the lowest effective dose possible to reduce hyperalgesia associated with its use and subsequent discontinuation (Conditional recommendation, Low level of evidence).
- Dexmedetomidine dose and duration association
    - Strong recommendation to avoid generalized use of dexmedetomidine loading doses in critical patients (Strong recommendation, High level of evidence).

- When loading doses are needed, suggest administering a dose of < 1 µg/kg during > 20 minutes (Conditional recommendation, Low level of evidence).
- Suggestion to use other sedatives when deeper sedation is required, rather than administering loading doses of dexmedetomidine (Conditional recommendation, Low level of evidence).
- Avoid maintenance doses of > 1.4 µg/kg/h and deep sedation levels based on dexmedetomidine to prevent severe bradycardia (Strong recommendation, Moderate level of evidence).
- Suggest using minimum doses of dexmedetomidine for mild sedation during maintenance, usually < 0.7 µg/kg/h (Conditional recommendation, Moderate level of evidence).
- Suggest titrating other sedatives when deep sedation is required and avoiding doses of > 1.4 µg/kg/h (Conditional recommendation, Low level of evidence).
- In patients with bradycardia and hemodynamic alterations, it is recommended to lower the maintenance dose or temporarily suspend it (Strong recommendation, Low level of evidence).
- Suggest periodically evaluating the need to continue dexmedetomidine infusion for a prolonged period (up to 7 days) (Conditional recommendation, Moderate level of evidence).
- If needed, continue sedation with dexmedetomidine for over 7 days, alternating with periods of drug suspension and monitoring for adverse effects, as there is not enough evidence to recommend a maximum time (Conditional recommendation, Low level of evidence).
- Suspend dexmedetomidine infusion if hyperthermia is suspected, especially in obese patients and after cardiovascular surgery (Conditional recommendation, Low level of evidence).

- Sedation management in special cases
  - Combine a hypnotic with an analgesic, preferably an opiate, to maintain a Richmond Agitation-Sedation Scale (RASS) score of -4 or -5 in patients requiring sedation for over 72 hours (Strong recommendation, Moderate level of evidence).
  - Use midazolam in prolonged deep sedation, possibly in combination with an opiate, propofol, and/or dexmedetomidine (Conditional recommendation, Moderate level of evidence).

    - Consider inhalation sedation as an alternative to deep intravenous sedation in cases of status asthmaticus, status epilepticus, or respiratory difficulty (Conditional recommendation, Low level of evidence).

- Amnesia vs. memory preservation
    - Promote recall of positive events and avoid complete amnesia to reduce post-intensive care syndrome (PICS) and improve patient functional outcomes after ICU discharge (Strong recommendation, Low level of evidence).
    - Administer mild sedation to reduce recall associated with sensory-perceptive disorders (delusions or hallucinations) (Strong recommendation, Moderate level of evidence).
    - Keep a log of a patient's ICU stay as part of an integral post-ICU neurocognitive rehabilitation plan (Conditional recommendation, Low level of evidence).
- Sedation management for specific conditions
    - For adult patients with acute respiratory distress syndrome (ARDS), use conscious or cooperative sedation, if possible, with deep sedation suggested for those with moderate oxygenation disorders (Strong recommendation, Moderate level of evidence).
    - Adjust the dosage of sedatives for patients subjected to extracorporeal membrane oxygenation (ECMO) due to altered pharmacokinetics and consider ketamine to reduce sedoanalgesia and vasopressor doses (Conditional recommendation, Low level of evidence).
    - Use ketamine as a coadjuvant in sedation for hemodynamically unstable patients (Conditional recommendation, Low level of evidence).
    - Exercise caution with sedatives in hemodynamically unstable patients (Strong recommendation, Moderate level of evidence).
    - Suggest using dexmedetomidine for sedation in patients with acute coronary syndrome (Conditional recommendation, Low level of evidence).
    - In the postoperative period of myocardial revascularization, recommend dexmedetomidine as the drug of choice for sedation (Strong recommendation, High level of evidence).
    - Caution is needed when using dexmedetomidine and alpha-2-agonists due to the risk of arterial hypotension and bradycardia (Conditional recommendation, Moderate level of evidence).

- Recommend using propofol and midazolam for electrical cardioversion (Conditional recommendation, Moderate level of evidence).
- Suggested propofol dose: 0.5-1 mg/kg, administered in 30-60 seconds. Low-dose opiate (alfentanil 5 μg/kg, remifentanil 0.25 μg/kg) can be safely added as an alternative without increased complications Conditional recommendation, Moderate level of evidence).
- Etomidate is similar to propofol for electrical cardioversion but has a higher incidence of adverse events, making it a second-line option. Midazolam is effective but requires longer post-cardioversion monitoring, and flumazenil should be available as an antidote Conditional recommendation, Low level of evidence).
- If administered by a physician with airway management expertise and proper equipment, midazolam is the drug of choice for sedation during electrical cardioversion Conditional recommendation, Moderate level of evidence).
- Suggestion to administer dexmedetomidine at a dose of 1 μg/kg over 10 minutes before giving a sedative to reduce arrhythmia relapse within the first 24 hours (Conditional recommendation, Low level of evidence).
- Apply a sedation strategy in all patients with intracranial hypertension for brain protection (Strong recommendation, Moderate level of evidence).
- Use barbiturates like thiopental sodium or pentobarbital only in cases of refractory intracranial hypertension (Conditional recommendation, Low level of evidence).
- Do not recommend daily interruption of sedation in patients with intracranial hypertension (Conditional recommendation, Low level of evidence).
- Use drugs with short half-lives (propofol, dexmedetomidine, and remifentanil) for severe traumatic brain injury patients, allowing frequent neurological evaluations (Conditional recommendation, Low level of evidence).
- Use frontal brain activity electronic monitoring systems to avoid under- and oversedation in patients under neuromuscular relaxation (Strong recommendation, Moderate level of evidence).
- Use these frontal brain activity electronic monitoring systems to reduce sedative doses in patients subjected to deep sedation (Conditional recommendation, Low level of evidence).

- Use validated clinical scales to assess sedation/agitation levels in critical patients under mild sedation without neuromuscular block (Conditional recommendation, very low level of evidence).

Analgesia

- Benefits of analgesia
  - Use analgesia and sedation protocols based on analgesics for adequate pain control in all critical patients admitted to the ICU (Strong recommendation, Moderate level of evidence).
  - Recommend continuous education and training for staff involved in patient care regarding the protocol and available treatment options (Strong recommendation, Moderate level of evidence).
- Analgesia strategies in critical patients
  - Always assess pain using appropriate scales according to the patient's condition (Strong recommendation, Moderate level of evidence).
  - Provide clear instructions on the evaluation, intervention, objectives, and side effects of the therapy (Strong recommendation, Low level of evidence).
  - Suggest opioid analgesics as part of the first-line treatment for non-neuropathic pain (Conditional recommendation, Moderate level of evidence).
  - If opioids are used, administer the lowest effective dose for patient comfort (Conditional recommendation, Low level of evidence).
  - Perform periodic pain evaluations for dose adjustments (Strong recommendation, Moderate level of evidence).
  - Administer analgesics before procedures that may worsen pain (Strong recommendation, Moderate level of evidence).
  - Suggested use of non-pharmacological measures such as music therapy, mindfulness, electrostimulation, and massages as coadjuvant therapy (Strong recommendation, Moderate level of evidence).
  - Suggestion to adopt a multimodal strategy and/or the ABCDEF bundle for promoting early activation of critical patients in the ICU (Strong recommendation, Moderate level of evidence).
- Optimizing opioid use

    - Recommendation to use the lowest opioid doses possible for the shortest necessary time to achieve therapeutic goals (Strong recommendation, Moderate level of evidence).
- Pain management strategies for critical patients without ventilatory support
    - Recommendation for routine pain monitoring in the ICU using validated tools to improve pain management and analgesic efficiency (Strong recommendation, Moderate level of evidence).
    - Recommendation to stratify patients based on n (e.g., acute, subacute, chronic, neuropathic, or non-neuropathic) and its intensity (e.g., mild 0-3/10 or moderate to severe > 4/10), as well as according to prior exposure to opioids (e.g., first exposure versus tolerant patient) to choose the best therapeutic option (Strong recommendation, Moderate level of evidence).
    - Recommendation to use multimodal analgesia to control pain in critical patients not on mechanical ventilation and reduce opioid use (Strong recommendation, Moderate level of evidence).
- Pain management for patients with coronary disease
    - Recommendation to avoid routine use of morphine in patients with acute myocardial infarction (Strong recommendation, Moderate level of evidence).
    - Recommendation to consider pain control strategies other than morphine, including nitrates and beta-blockers, in patients with myocardial infarction (Strong recommendation, Moderate level of evidence
    - Suggestion to restrict morphine use in ST-segment elevation myocardial infarction patients with persistent severe pain (visual analog scale [VAS] ≥ 7 points) despite anti-ischemia and antithrombotic therapies (Conditional recommendation, Low level of evidence.
    - Suggestion to use acetaminophen as an analgesic strategy in hypertensive patients with cardiovascular risk (Conditional recommendation, Low level of evidence).
    - Suggestion to avoid nonsteroidal anti-inflammatory drugs (NSAIDs) for prolonged analgesia in chronic hypertensive patients with coronary disease (Conditional recommendation, Low level of evidence.
    - Suggestion to include ketamine in the analgesic strategies for hemodynamically unstable patients (Conditional recommendation, Moderate level of evidence).

    - Recommendation for cautious use of intravenous acetaminophen in hemodynamically unstable patients (Conditional recommendation, low level of evidence).
- Analgesic management for adult patients with sepsis and septic shock
    - Recommendation for routine pain monitoring in the ICU to improve pain management and analgesic efficiency (Strong recommendation, Moderate level of evidence).
    - Suggestion to stratify patients based on pain type, intensity, and prior opioid exposure to choose the best therapeutic option (Conditional recommendation, Moderate level of evidence).
    - Suggestion to use multimodal analgesia to control pain in critical patients not on mechanical ventilation and reduce opioid use (Conditional recommendation, Moderate level of evidence).
- Analgesic management strategy for adult patients with ARDS
    - Recommendation to use opioids (especially remifentanil) for acute pain relief and adjust the dosage based on the disease stage and patient needs (Strong recommendation, Moderate level of evidence).
    - Suggestion to avoid high-dose remifentanil to reduce potential hyperalgesia (Conditional recommendation, Low level of evidence).
- Analgesic management for patients subjected to ECMO
    - Suggestion to avoid lipophilic analgesics (e.g., fentanyl) due to circuit trapping (Conditional recommendation, Low level of evidence).
    - Suggestion to use non-lipophilic analgesics (e.g., morphine) (Conditional recommendation, Low level of evidence).
    - Suggestion to adjust analgesic dosage based on time on ECMO, circuit status, and ECMO type (Conditional recommendation, Low level of evidence).
- Pain assessment in end-of-life patients with limitation of therapeutic effort (LTE)
    - Suggestion to evaluate pain, agitation, and breathing difficulty in end-of-life patients, including those with communication difficulties, through a protocolized approach (Conditional recommendation, Low level of evidence).
- Aim of analgesic treatment in end-of-life patients with LTE

- Suggested aim of drug treatment during LTE is to prevent and treat pain, distress, or breathing difficulty, and documentation of its use is recommended (Conditional recommendation, Low level of evidence).

Delirium

- Benefits of delirium management
  - Adequate delirium management is recommended for reducing the duration of mechanical ventilation, cognitive disorders, ICU, and hospital stay in the short term, and for lower mortality and improved quality of life in the long term (Strong recommendation, High level of evidence.
  - Continuous dexmedetomidine infusion is recommended for hyperactive delirium in mechanically ventilated patients for improved ventilator-free hours, earlier extubation, and faster resolution of delirium (Strong recommendation, Moderate level of evidence.
- Benefits of delirium detection and management strategies
  - Daily assessment using validated scales for delirium detection in critically ill patients, with or without mechanical ventilation, is recommended for reducing mortality and hospital stay (Strong recommendation, Moderate level of evidence).
  - Multicomponent interventions are recommended to reduce the duration of delirium and improve outcomes (Strong recommendation, Moderate level of evidence).
- Preventing delirium
  - Structural, organizational, and medical management efforts are recommended to reduce anxiety, improve patient comfort, and enhance pain control, along with optimizing the environment to reduce delirium (Strong recommendation, Moderate level of evidence).
  - Multimodal interventions, such as minimizing light and noise, covering the eyes, frequent patient orientation, and music, along with the ABCDEF strategy, are recommended for critically ill patients to prevent delirium (Strong recommendation, Moderate level of evidence).
- Preventing delirium
  - Suggestion to integrate families with unrestricted visits as a non-pharmacological therapy for delirium prevention (Conditional recommendation, Low level of evidence).

    - Recommendation to use low-dose continuous dexmedetomidine in postoperative non-cardiac surgery patients with a high risk of delirium (Strong recommendation, High level of evidence).
    - Recommendation to administer dexmedetomidine in patients undergoing noninvasive ventilation to prevent delirium and reduce the need for intubation (Strong recommendation, Moderate level of evidence).
    - Suggestion to use haloperidol for delirium prevention in patients over 75 years of age after abdominal and orthopedic surgery (Conditional recommendation, Moderate level of evidence).
- Pharmacological and non-pharmacological measures for delirium treatment
    - Recommendation to employ ABCDEF and multimodal strategies for delirium management in critically ill patients (Strong recommendation, Moderate level of evidence).
    - Recommendation to use dexmedetomidine for managing mechanically ventilated patients with hyperactive delirium (Strong recommendation, Moderate level of evidence).
    - Suggestion to consider quetiapine for patients with hyperactive delirium (Conditional recommendation, Low level of evidence).
    - Recommendation for the use of dexmedetomidine in critically ill patients with delirium (Strong recommendation, Moderate level of evidence).
- Predicting delirium
    - Recommendation to use E-PRE-DELIRIC and PRE-DELIRIC models for predicting delirium risk upon admission and after 24 hours of admission (Strong recommendation, Moderate level of evidence).
    - Recommendation to consider NICE predictive rules, APREDEL-ICU, AWOL tool, and other risk factor-based models for predicting delirium risk (Strong recommendation, Low level of evidence).
- Risk factors and strategies for preventing persistent cognitive deficit
    - Recommendation to assess risk factors associated with persistent cognitive deficit, with a focus on delirium and posttraumatic stress symptoms within the first 30 days after discharge (Strong recommendation, Low level of evidence).
    - Suggestion to prevent and manage delirium as the primary strategy for reducing the incidence of persistent cognitive deficit (Strong recommendation, Low level of evidence).

- Suggestion to promote early mobilization, reduce sedatives, improve sleep, and provide emotional and psychological support as strategies to decrease persistent cognitive deficit (Conditional recommendation, Low level of evidence).

Special populations

- Liver and renal failure
  - Suggestion to use multimodal analgesia for postoperative pain in adult patients with renal or liver failure (Conditional recommendation, Low level of evidence.
  - Not advised to use NSAIDs in patients with liver failure (Conditional recommendation, Low level of evidence).
  - Suggestion to use acetaminophen as the first-line treatment for acute pain in patients with non-alcoholic cirrhosis (Conditional recommendation, Low level of evidence).
  - Not advised to use dipyrone in cirrhotic patients (Conditional recommendation, Low level of evidence).
  - Suggestion to use tramadol at a reduced dose as a second-line treatment after acetaminophen in patients with renal failure (Conditional recommendation, Low level of evidence).
  - Suggestion to use fentanyl and methadone as safe options in patients with renal failure (Conditional recommendation, Low level of evidence).
  - Suggestion to use hydromorphone and oxycodone with caution in patients with renal failure (Conditional recommendation, Low level of evidence).
  - Not advised to use codeine, hydrocodone, meperidine, and morphine in patients with renal failure (Conditional recommendation, Low level of evidence).
  - Suggestion to use acetaminophen at extended dosing intervals and lower doses in patients with reduced glomerular filtration rate (GFR) (Conditional recommendation, Low level of evidence).
  - Suggestion to administer tramadol at different doses based on estimated GFR in patients with renal failure (Conditional recommendation, Low level of evidence).
  - Not advised to use NSAIDs in patients with renal failure (Conditional recommendation, Low level of evidence).

- Transplant patients
    - Suggestion to use paravertebral block or continuous thoracic epidural analgesia for postoperative pain in lung transplantation (Conditional recommendation, Low level of evidence).
    - Caution advised when using dexmedetomidine in lung transplantation patients due to the risk of asystole (Conditional recommendation, Low level of evidence).
    - Suggestion to administer magnesium when using tramadol for postoperative pain in lung transplantation (Conditional recommendation, Low level of evidence).
    - Suggestion to use ultrasound-guided subcostal transversus abdominis plane block (STAP) for pain management after liver transplantation (Conditional recommendation, Low level of evidence).
    - Not advised to use NSAIDs for postoperative pain in renal transplantation (Conditional recommendation, Low level of evidence).
    - Suggestion to use acetaminophen as the first-line treatment for post-renal transplant pain (Conditional recommendation, Low level of evidence).
    - Not advised to use transverse abdominis plane (TAP) block for post-renal transplant pain (Conditional recommendation, Low level of evidence).
    - Suggestion to use tramadol for postoperative pain in renal transplantation (Conditional recommendation, Low level of evidence).
    - Suggestion to use hydromorphone in the immediate postoperative period of renal transplantation (Conditional recommendation, Low level of evidence).
- Miscellaneous special considerations
    - Suggestion to use dexmedetomidine as an alternative to haloperidol for delirium management in trauma patients without traumatic brain injury (TBI) (Conditional recommendation, Moderate level of evidence).
    - Recommendation to use ketamine for additional analgesia in cases of chest trauma and rib fractures when pain control is not achieved with patient-controlled analgesia (PCA) or regional techniques in patients without acute brain damage (Conditional recommendation, Moderate level of evidence).

- Recommendation to monitor multiple trauma patients using the bispectral index (BIS) (Strong recommendation, Moderate level of evidence).
- Suggestion to initiate methadone in the first four days of mechanical ventilation to reduce ventilation times in patients who may require prolonged ventilation (Conditional recommendation, Low level of evidence).
- Recommendation to use dexmedetomidine to prevent delirium in elderly patients after non-cardiac surgery (Strong recommendation, High level of evidence).
- Recommendation to use dexmedetomidine for sedation in the perioperative period of cardiac surgery in patients over 60 years of age to prevent delirium (Strong recommendation, Moderate level of evidence).
- Recommendation to use dexmedetomidine as the preferred sedative in postpartum eclampsia patients requiring mechanical ventilation (Strong recommendation, Low level of evidence).
- Suggestion to use dexmedetomidine as a coadjuvant for the sedation of ventilated burn victims (Conditional recommendation, Low level of evidence).

G.1.4 National Institute for Health and Care Excellence (NICE) Guideline on the Prevention, Diagnosis and Management of Delirium in Hospital and Long-Term Care (2023)

Please refer to Section 1.32 of CHI Anesthesia Report.

Evidence levels and grades of recommendations are outlined in the table below[36]:

Table 23. NICE Grading Scheme for Recommendations

Grading Scheme for Recommendations			
Level	**Type of evidence**	**Grade**	**Evidence**
1	Evidence obtained from a single randomized controlled trial or a meta-analysis of randomized controlled trials	**A**	At least 1 randomized controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation (evidence level 1) without extrapolation

2a	Evidence obtained from at least 1 well-designed controlled study without randomization	**B**	Well-conducted clinical studies but no randomized clinical trials on the topic of recommendation (evidence levels 2 or 3); or extrapolated from level 1 evidence
2b	Evidence obtained from at least 1 other well-designed quasi-experimental study	–	–
3	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies	–	–
4	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities	**C**	Expert committee reports or opinions and/or clinical experiences of respected authorities (evidence level 4) or extrapolated from level 1 or 2 evidence. This grading indicates that directly applicable clinical studies of good quality are absent or not readily available
5	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities	**GPP**	Recommended good practice based on the clinical experience of the GDG.

The following recommendations are provided by the National Institute for Health and Care Excellence (NICE) guideline on the prevention, diagnosis, and management of delirium in hospital and long-term care [36]:

- **Risk Factor Assessment**:
    - Assess patients for delirium risk factors upon admission and observe at every opportunity for any changes in the risk factors.
    - Risk factors include age 65 or older, cognitive impairment or dementia, current hip fracture, and severe illness.

- **Indicators of Delirium: At Presentation**:
    - At presentation, assess individuals at risk for recent changes or fluctuations indicating delirium, such as cognitive, perceptual, physical, or social function changes.
    - Be vigilant for hypoactive delirium signs, including withdrawal, slow responses, reduced mobility, worsened concentration, and reduced appetite.
- **Preventing Delirium**:
    - Ensure patients at risk are cared for by a familiar healthcare team and minimize unnecessary room or ward changes.
    - Provide a tailored multicomponent intervention package based on clinical factors contributing to delirium within 24 hours of admission.
    - Deliver this intervention package via a trained multidisciplinary team.
    - Address cognitive impairment and disorientation through appropriate lighting, signage, reorientation, cognitive stimulation, and visits from family and friends.
    - Address dehydration and constipation by encouraging fluid intake, offering intravenous fluids if necessary, and managing fluid balance in people with comorbidities.
    - Assess for hypoxia and optimize oxygen saturation.
    - Address infection by detecting and treating infections, avoiding unnecessary catheterization, and implementing infection control procedures.
    - Address immobility by encouraging early mobilization and active range-of-motion exercises.
    - Address pain through assessment, identification of non-verbal signs in individuals with communication difficulties, and appropriate pain management.
    - Conduct medication reviews for people taking multiple drugs.
    - Address poor nutrition following NICE guidelines.
    - Address sensory impairment by resolving reversible causes and ensuring aids are available and functional.
    - Promote good sleep patterns and hygiene by avoiding disturbances during sleep and minimizing noise during sleep periods.

- **Indicators of Delirium: Daily Observations**:
    - Observe individuals in hospital or long-term care for recent changes or fluctuations indicating delirium at least daily, which can be reported by the person at risk, carer, or relative.
    - Ensure any potential delirium indicators are documented in the individual's record or notes.
- **Assessment and Diagnosis**:
    - If delirium indicators are identified, a competent health or social care practitioner should perform an assessment using the 4AT. In critical care or post-surgery recovery, use the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) or Intensive Care Delirium Screening Checklist (ICDSC) instead of the 4AT.
    - If the assessment indicates delirium, a healthcare professional with relevant expertise should make the final diagnosis, which may be the same person who conducted the assessment.
    - When it's challenging to distinguish between delirium, dementia, or delirium superimposed on dementia, prioritize managing delirium.
    - Document the diagnosis of delirium in the person's record or notes and their primary care health record.
- **Treating Delirium**:
    - **Initial Management**:
        - For individuals diagnosed with delirium, identify, and manage potential underlying causes.
        - Ensure effective communication, reorientation, and provide reassurance. Involve family, friends, and carers as needed.
    - **Distressed People**:
        - If a person with delirium is distressed or poses a risk to themselves or others, use verbal and non-verbal techniques to de-escalate the situation. Consider situations where distress may be less evident in people with hypoactive delirium.
        - If de-escalation techniques are ineffective or inappropriate, consider short-term haloperidol usage (usually for 1 week or less). Begin at the lowest clinically appropriate dose and titrate cautiously. Consider the risks associated with haloperidol use, especially in older individuals with Parkinson's disease or dementia with Lewy bodies.

- **If Delirium Does Not Resolve**:
    - For individuals in whom delirium does not resolve, re-evaluate for underlying causes, and assess for possible dementia.

- **Information and Support**:
    - Offer information to individuals at risk of delirium or those with delirium, as well as their family and/or carers. The information should inform them that delirium is common and usually temporary, describe the experience of delirium, encourage reporting sudden behavioral changes, and advise sharing the experience with healthcare professionals during recovery. Provide information about support groups.
    - Ensure that the information provided caters to the cultural, cognitive, and language needs of the individual.

H. Neuromuscular Blocking and Reversal

H.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Anesthesia Report and the corresponding recommendations:

Table 24. Clinical Guidelines Requiring Revision (Neuromuscular Blocking and Reversal)

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.33 Guidelines on muscle relaxants and reversal in anesthesia- French Society of Anesthesia & Intensive Care Medicine (9/2018)	Guidelines on muscle relaxants and reversal in anesthesia- **French Society of Anesthesia & Intensive Care Medicine** (**2020**)[13]
Section 1.34 Clinical Practice Guidelines for Sustained Neuromuscular Blockade (NMBAs) in the Adult Critically Ill Patient **2016** by the **Society of Critical Care Medicine**[37]	N/A

H.1.1 French Society of Anesthesia and Intensive Care Medicine (SFAR) Guidelines on Muscle Relaxants and Reversal in Anesthesia (2020)

Please refer to Section 1.33 of CHI Anesthesia Report.

Evidence levels and grades of recommendations are outlined in the table below[13]:

Table 25. SFAR Quality of Evidence Levels and Strengths of Recommendations

Quality of Evidence	
High	future research will most likely not change confidence in the estimated effect
Moderate	future research is likely to change confidence in the estimated effect and might alter the estimated effect itself
Low	future research will most likely have an impact on confidence in the estimated effect and will probably alter the estimate of the effect itself
Very low	the estimated effect is very uncertain
Strengths of Recommendations	
GRADE 1+ or 1-	Strong recommendation: we recommend/do not recommend
GRADE 2+ or 2-	Weak recommendation: we suggest/do not suggest
To develop a recommendation	At least 50% of participants must have one opinion and less than 20% the opposite opinion
To develop a strong recommendation	At least 70% of participants must agree (grade between 7 and 10).
Expert Opinion	If the experts did not have enough data from the literature to allow them making a recommendation, an expert opinion was then proposed and, if at least 70% of the experts agreed with the proposal, it was approved.

The following recommendations were provided by the French Society of Anesthesia and Intensive Care Medicine (SFAR) on muscle relaxants and reversal in anesthesia, while focusing on 8 questions[13]:

- **Question 1: In the absence of difficult mask ventilation criteria is it necessary to check the possibility of ventilation via a facemask before muscle relaxant injection? Is it necessary to use muscle relaxants to facilitate facemask ventilation?**

    - It is probably not recommended to assess the possibility of mask ventilation before administering a muscle relaxant. (GRADE 2-, STRONG AGREEMENT)
    - It is probably recommended to use a muscle relaxant to facilitate facemask ventilation. (GRADE 2+, STRONG AGREEMENT)
- **Question 2: Is the use of muscle relaxants necessary to facilitate tracheal intubation?**
    - The use of a muscle relaxant is recommended to facilitate tracheal intubation. (GRADE 1+, STRONG AGREEMENT)
    - The use of a muscle relaxant is recommended to reduce the risk of pharyngeal and/or laryngeal injury during tracheal intubation. (GRADE 1+, STRONG AGREEMENT)
    - Administering a short-acting muscle relaxant for rapid-sequence induction is probably recommended. (GRADE 2+, STRONG AGREEMENT)
- **Question 3: Is the use of muscle relaxants necessary to facilitate the insertion of a supraglottic device and management of related complications?**
    - Routinely using a muscle relaxant to facilitate supraglottic device insertion is probably not recommended. (GRADE 2-, STRONG AGREEMENT)
    - Administering a muscle relaxant in cases of airway obstruction related to a supraglottic device is probably recommended. (GRADE 2+, STRONG AGREEMENT)
- **Question 4: Is it necessary to monitor neuromuscular blockade for airway management?**
    - No recommendation: There is insufficient data in the literature to establish recommendations regarding the instrumental monitoring of neuromuscular blockade during tracheal intubation.
    - Experts suggest that if instrumental neuromuscular blockade monitoring is used, the corrugator supercilii muscle should be the selected site due to its sensitivity to muscle relaxants and kinetics of neuromuscular blockade, comparable to laryngeal muscle. (EXPERT OPINION)
- **Question 5: Is the use of muscle relaxants necessary to facilitate interventional procedures and, if so, which ones?**

- The use of muscle relaxants is recommended to facilitate interventional procedures in abdominal laparotomy or laparoscopy surgery. (GRADE 1+, STRONG AGREEMENT)
- The use of muscle relaxants is probably recommended to facilitate interventional procedures in ENT laser surgery. (GRADE 2+, STRONG AGREEMENT)
- No recommendation: Data in the literature are insufficient to establish a recommendation on the required intensity of neuromuscular blockade (moderate vs. deep) in abdominal laparotomy or laparoscopy surgery.

- **Question 6: Is intraoperative monitoring of neuromuscular blockade necessary?**
  - Intraoperative monitoring of neuromuscular blockade is recommended. (GRADE 1+, STRONG AGREEMENT)
  - The use of train-of-four stimulation of the ulnar nerve at the adductor pollicis is probably recommended for monitoring intraoperative neuromuscular blockade. (GRADE 2+, STRONG AGREEMENT)
- **Question 7: What are the strategies for diagnosing and treating residual neuromuscular blockade?**
  - Quantitative adductor pollicis monitoring is probably recommended for diagnosing residual neuromuscular blockade, aiming for a T4/T1 ratio of ≥ 0.9 at the adductor pollicis. (GRADE 2+, STRONG AGREEMENT)
  - After administering a non-depolarizing muscle relaxant, it is recommended to wait for spontaneous reversal equivalent to four muscle responses at the adductor pollicis following train-of-four (TOF) stimulation of the ulnar nerve before giving neostigmine. (GRADE 1+, STRONG AGREEMENT)
  - Administer neostigmine with neuromuscular blockade monitoring at the adductor pollicis, at a dose between 40 and 50 µg/kg adapted to ideal body weight, without exceeding this dose or administering it in the absence of residual blockade. (GRADE 1+, STRONG AGREEMENT)
  - In cases of very slight residual blockade, it is probably recommended to reduce the neostigmine dose by half. (GRADE 2+, STRONG AGREEMENT)
  - It is recommended to continue quantitative monitoring of neuromuscular blockade after administering neostigmine until a TOF ratio of ≥ 0.9 has been achieved. (GRADE 1+, STRONG AGREEMENT)

The following figure shows a Decision algorithm for pharmacological non-depolarizing neuromuscular blocking drug reversal using neostigmine:

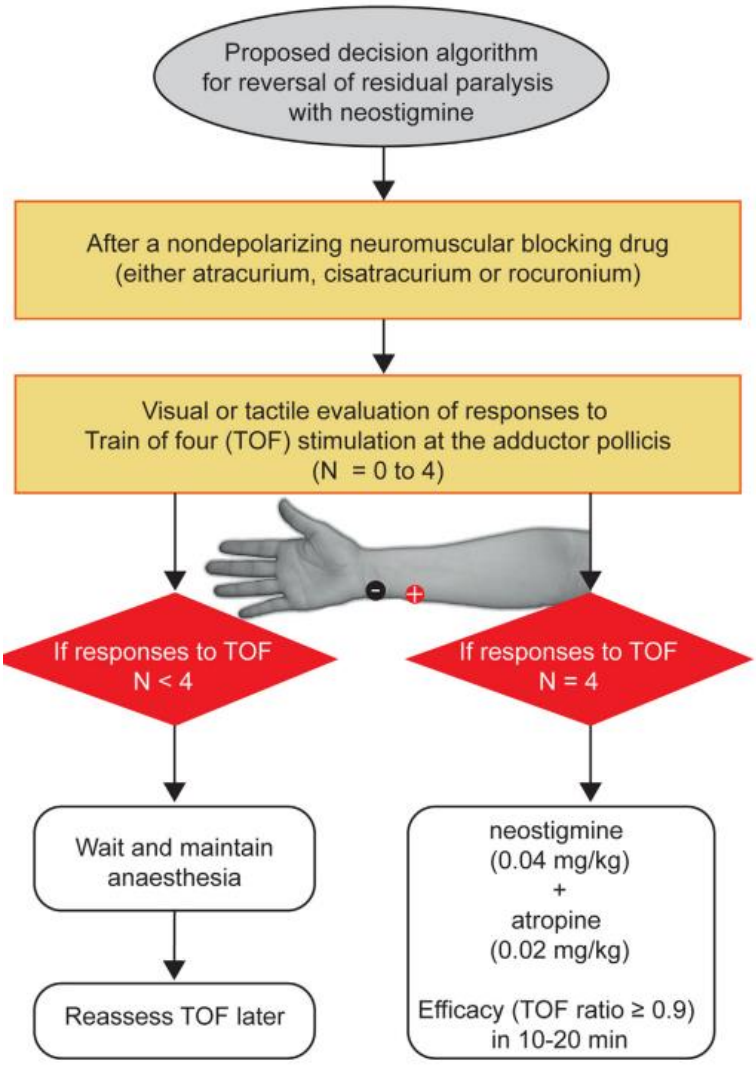

Figure 4. *Decision algorithm for pharmacological non-depolarizing neuromuscular blocking drug reversal using neostigmine (retrieved from the SFAR 2020 guidelines)*

- Adjust the dose of sugammadex according to ideal body weight and the intensity of neuromuscular blockade induced by rocuronium. (GRADE 1+, STRONG AGREEMENT)
- After administering sugammadex, it is probably recommended to continue quantitative monitoring of neuromuscular blockade to detect a possible increase in neuromuscular blockade. (GRADE 2+, STRONG AGREEMENT)

The following figure provides a Decision algorithm for pharmacological non-depolarizing neuromuscular blocking drug reversal using sugammadex:

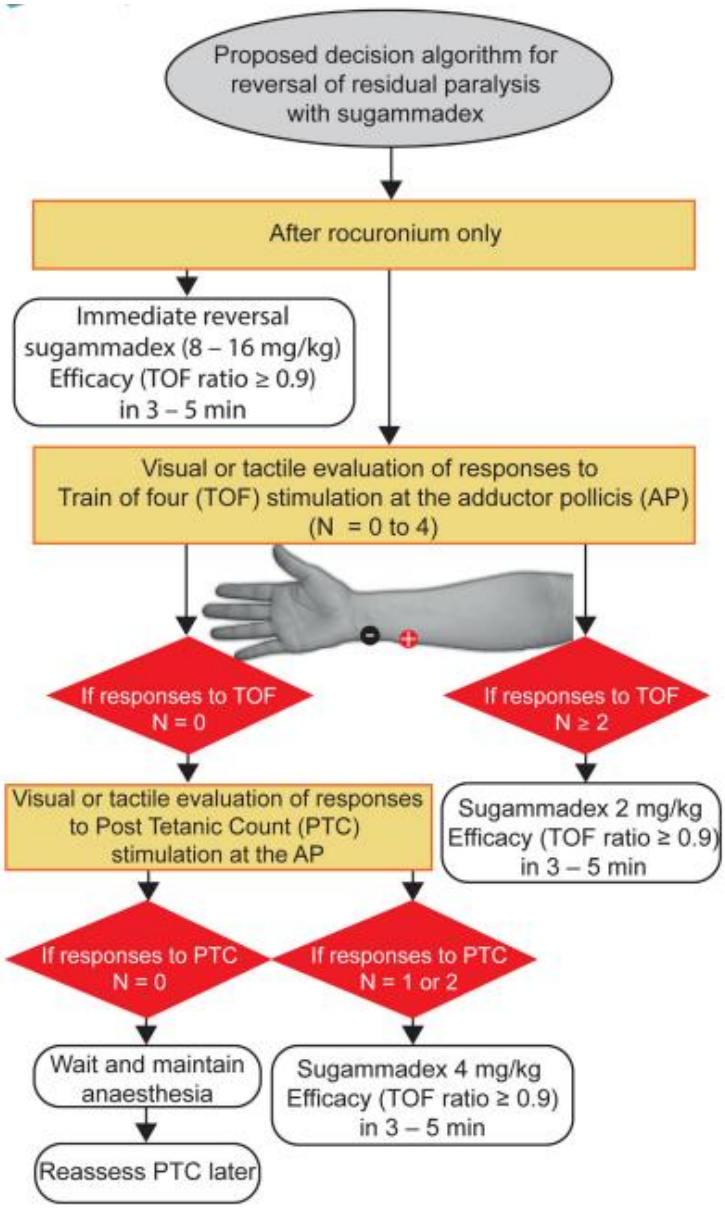

Figure 5. *Decision algorithm for pharmacological non-depolarizing neuromuscular blocking drug reversal using sugammadex (retrieved from the SFAR 2020 guidelines)*

- **Question 8: What are the indications and precautions for use of both muscle relaxants and reversal agents in special populations?**
    - It is probably recommended to administer a short-acting muscle relaxant for electroconvulsive therapy. (GRADE 2+, STRONG AGREEMENT)

- For severely obese patients (BMI ≥ 40 kg/m²), it is probably recommended to use a short-acting muscle relaxant to facilitate tracheal intubation. (GRADE 2+, STRONG AGREEMENT)
- It is probably recommended to administer suxamethonium at a dose of 1.0 mg/kg based on the actual body weight of the obese patient. (GRADE 2+, STRONG AGREEMENT)
- Experts suggest administering a non-depolarizing muscle relaxant at a dose based on the lean body weight of the obese patient. (EXPERT OPINION)
- No recommendation: There is insufficient data for recommendations regarding deep blockade for laparoscopic surgery in obese patients.
- The use of sugammadex adjusted to ideal body weight in severely obese patients (BMI ≥ 40 kg/m²) is probably recommended due to increased recovery time and the risk of recurrence of neuromuscular blockade with neostigmine. (GRADE 2+, STRONG AGREEMENT)
- Except for situations requiring rapid-sequence induction or the use of a depolarizing muscle relaxant, it is probably recommended to use a non-depolarizing muscle relaxant for improved intubating conditions during anesthesia in children by intravenous induction. (GRADE 2+, STRONG AGREEMENT)
- In rapid-sequence induction, the use of a rapid-onset muscle relaxant is recommended for children. (GRADE 1+, STRONG AGREEMENT)
- In conventional rapid-sequence induction, it is probably recommended to use suxamethonium as the first-line drug for children. In cases where suxamethonium is contraindicated, the use of rocuronium is probably recommended. (GRADE 2+, STRONG AGREEMENT)
- No recommendation: There is insufficient data for recommendations regarding the use of muscle relaxants in children for facemask ventilation, insertion of supraglottic devices, management of related complications and surgical procedures, as well as the need for neuromuscular blockade monitoring for intraoperative tracheal intubation and the diagnosis and treatment of residual neuromuscular blockade.
- Suxamethonium use is not recommended in cases of primary muscle damage (myopathies) or up-regulation of nicotinic acetylcholine receptors at the motor end plate (chronic motor deficit). (GRADE 1-, STRONG AGREEMENT)

- Monitoring of neuromuscular blockade is probably recommended following muscle relaxant use in patients with neuromuscular disease. (GRADE 2+, STRONG AGREEMENT)
- Administration of sugammadex is probably recommended for reversing a residual neuromuscular blockade after using a steroidal muscle relaxant in patients with neuromuscular disease. (GRADE 2+, STRONG AGREEMENT)
- The use of a benzylisoquinoline muscle relaxant (atracurium/cisatracurium) is probably recommended in cases of renal or hepatic failure. (GRADE 2+, STRONG AGREEMENT)
- It is recommended not to modify the initial dose in renal or hepatic failure patients, irrespective of the type of muscle relaxant used. (GRADE 1+, STRONG AGREEMENT)
- When using sugammadex in cases of renal failure, it is probably recommended to administer it at the usual dose. (GRADE 2+, STRONG AGREEMENT)
- No recommendation: There is insufficient data in the literature to establish recommendations regarding the use of muscle relaxants in the elderly.

H.1.2 Society of Critical Care Medicine Clinical Practice Guidelines for Sustained Neuromuscular Blockade (NMBAs) in the Adult Critically Ill Patient (2016)

Please refer to Section 1.34 of CHI Anesthesia Report.

There are no new updates[37]. The recommendations of this guideline remain unchanged[37].

H.2 Additional Guidelines

This part includes the added guidelines to the previous CHI Anesthesia report, along with their recommendations.

Table 26. List of Additional Guidelines (Neuromuscular Blocking and Reversal)

Additional Guidelines
Spanish Society of Anesthesiology and Resuscitation (SEDAR) Recommendations on Perioperative Neuromuscular Blockade (**2020**)[38]

H.2.1 Spanish Society of Anesthesiology and Resuscitation (SEDAR) Recommendations on Perioperative Neuromuscular Blockade (2020)

Evidence levels and grades of recommendation are outlined below[38]:

- Quality of evidence A = High
- Quality of evidence B = Moderate
- Quality of evidence C = Low

The following recommendations are provided by SEDAR on perioperative neuromuscular blockade[38]:

Perioperative Neuromuscular Blockade Strategy:

- **Recommendation 1:** Use neuromuscular blocking agents (NMBAs) for tracheal intubation and to prevent airway lesions in all patients, including critically ill patients (A).
- **Recommendation 2:** Do not use NMBAs routinely for supraglottic airway device insertion; reserve them for airway obstruction or tracheal intubation (A).
- **Recommendation 3:** Employ rapid action NMBAs in rapid sequence induction, in combination with a hypnotic agent (A).
- **Recommendation 4:** Opt for a deep level of neuromuscular blockade in laparoscopic surgery (B).
- Monitoring of Neuromuscular Blockade:
- **Recommendation 5:** Continuously monitor neuromuscular blockade when NMBAs are used during surgery (B).
- **Recommendation 6:** Use quantitative monitoring with ulnar nerve stimulation and assessment of the response in the adductor pollicis brevis muscle, with acceleromyography as the clinical standard (B).

Reversal of Neuromuscular Blockade:

- **Recommendation 7:** Aim for recovery to at least a TOF Ratio (Train-of-Four Ratio) ≥ 0.9 to prevent postoperative residual neuromuscular blockade (A).
- **Recommendation 8:** Administer pharmacological reversal of neuromuscular blockade at the end of general anesthesia before tracheal extubation if TOF Ratio ≥ 0.9 has not been achieved (A).
- **Recommendation 9:** Use anticholinesterase drugs for reversal only at TOF ≥ 2 and if TOF Ratio ≥ 0.9 has not been achieved (A).

- **Recommendation 10:** Prefer sugammadex over anticholinesterase drugs for reversing neuromuscular blockade induced by rocuronium (A).

I. Pregnancy and Breastfeeding

I.1 Additional Guidelines

This part includes the added guidelines to the previous CHI Anesthesia report, along with their recommendations.

Table 27. List of Additional Guidelines (Pregnancy and Breastfeeding)

Additional Guidelines
Association of Anesthetists Guideline on Anesthesia and Sedation in Breastfeeding Women (2020)[14]

I.1.1 Association of Anesthetists Guideline on Anesthesia and Sedation in Breastfeeding Women (2020)

Evidence levels and grades of recommendation are not outlined[14]. The following recommendations are provided by the Association of Anesthetists on anesthesia and sedation in breastfeeding women[14]:

- Encourage normal breastfeeding post-surgery.
- Avoid the need to express and discard breast milk after anesthesia.
- Most perioperative drugs, including anesthetics and non-opioid analgesics, transfer to breast milk in minimal amounts with no evidence of effects on the infant.
- Be cautious with drugs like opioids and benzodiazepines, especially after multiple doses, in infants up to 6 weeks old (corrected for gestational age). Monitor for abnormal drowsiness and respiratory depression if the mother shows signs of sedation.
- Avoid codeine use in breastfeeding women due to concerns about excessive sedation in some infants linked to metabolic differences.
- Routinely inquire about breastfeeding in women with infants under 2 years during preoperative assessment.
- Prefer opioid-sparing techniques for breastfeeding women. Local and regional anesthesia have benefits and minimal interference with the woman's infant care abilities.

- Opt for day surgery when feasible to maintain normal routines. A responsible adult should stay with the woman for the first 24 hours. Be cautious with co-sleeping or sleeping while feeding in a chair, as responsiveness may be reduced.
- Ensure accessible breastfeeding support for lactating women undergoing medical and surgical procedures.
- Provide patient information leaflets and resources detailing the compatibility of anesthetic agents and analgesics during breastfeeding, along with guidance on breastfeeding support in the perioperative period.

Section 2.0 Drug Therapy

This section comprises three subsections: the first one contains the newly recommended drugs, the second one covers drug modifications, and the third one outlines the drugs that have been withdrawn from the market.

2.1 Additions

2.1.1 White Petrolatum, Mineral Oil (Eye Ointment)

Scheduled eye care that includes lubricating drops or gel and eyelid closure is recommended for patients receiving continuous infusions of NMBAs. (strong recommendation, low quality of evidence)[37].

2.1.2 Wool Fat Hydrous (Eye Ointment)

Scheduled eye care that includes lubricating drops or gel and eyelid closure is recommended for patients receiving continuous infusions of NMBAs. (strong recommendation, low quality of evidence)[37].

2.1.3 Suxamethonium Chloride

In conventional rapid-sequence induction, it is probably recommended to use suxamethonium as the first-line drug for children (GRADE 2+, STRONG AGREEMENT)[13].

2.2 Modifications

There are no modifications recommended for the previous CHI Anesthesia Report.

2.3 Delisting

The medications below are no longer SFDA registered[39], therefore, it is advisable to delist the following drugs from CHI formulary. *Please refer to* ***Drug Therapy in Anesthesia- Section 2*** *of CHI Anesthesia original clinical guidance*.

- AMITRIPTYLINE HYDROCHLORIDE
- BENOXINATE
- CIMETIDINE
- DEXPANTHENOL, SODIUM HYALURONATE
- ECTOIN, SODIUM HYALURONATE

- GLYCERIN, SODIUM CARBOXYMETHYLCELLULOSE
- ISOPRENALINE
- MIVACURIUM CHLORIDE
- NOREPINEPHRINE BITARTRATE, ARTICAINE HYDROCHLORIDE
- SODIUM BICARBONATE, OMEPRAZOLE

2.4 Other Drugs

2.4.1 Chloroprocaine Hydrochloride Ophthalmic Gel (Iheezo) 3%

FDA-approved in 2022, it is an ester anesthetic designed for ocular surface anesthesia, supplied as a topical ophthalmic gel. The recommended dose involves applying three drops to the planned procedure area, with the option for reapplication as necessary. The mechanism of action involves blocking nerve impulses, including pain, temperature, touch, and proprioception. The most common side effect is mydriasis (pupil dilation). Clinical trials demonstrated that Iheezo rapidly and effectively provided anesthesia for cataract surgery, with no patients requiring additional treatment during the procedure[40].

2.4.2 Bupivacaine and Meloxicam (Zynrelef) Extended-Release Solution

FDA-approved in 2021, it combines bupivacaine, a local anesthetic, and meloxicam, a nonsteroidal anti-inflammatory drug (NSAID). It is used in adults for soft tissue or periarticular instillation to provide postoperative pain relief for up to 72 hours after specific surgical procedures, including bunionectomy, open inguinal herniorrhaphy, total knee arthroplasty, foot and ankle surgery, small-to-medium open abdominal procedures, and lower extremity total joint arthroplasty. It is administered as an extended-release solution for single-dose application at the surgical site[41]. Bupivacaine blocks nerve impulses, offering localized anesthesia, while meloxicam, an NSAID, inhibits prostaglandin synthesis to reduce inflammation and pain[41]. Common side effects include constipation, vomiting, and headache, and Zynrelef is contraindicated in cases involving coronary artery bypass graft (CABG) surgery[41]. Clinical trials showed that Zynrelef effectively reduced postoperative pain and opioid use in patients undergoing bunionectomy, inguinal herniorrhaphy, and total knee arthroplasty[41].

Section 3.0 Key Recommendations Synthesis

- **World Health Organization-World Federation of Societies of Anesthesiologists (WHO-WFSA) International Standards for a Safe Practice of Anesthesia (2018)**
    - Ketamine, Diazepam, Midazolam, Morphine, Local anesthetics such as lidocaine or bupivacaine are highly recommended.
    - Thiopental or propofol, appropriate inhalation anesthetics, succinylcholine, and appropriate non-depolarizing muscle relaxants such as pancuronium or atracurium are recommended.
    - Propofol and alternative inhalation anesthetics (sevoflurane) or alternative non-depolarizing muscle relaxants (rocuronium or cisatracurium) are suggested.
    - A strong opioid (e.g., morphine) may be required for severe postoperative pain and appropriate healthcare workers (e.g., post-anesthesia recovery nurses) should be trained in assessment of pain and patient monitoring after opioid administration.
- **Academy of Medical Royal Colleges: Safe Sedation Practice for Healthcare Procedure Standards and Guidance (2021)**
    - Where a combination of a benzodiazepine and an opioid are administered, the opioid should be given first, and the benzodiazepine only given once the peak effect of the opioid is observed.
    - The benzodiazepine and opioid antagonists, flumazenil, and naloxone, are usually reserved for emergency use.
    - The routine use of flumazenil for reversal of sedation with benzodiazepines is not without potential side effects.
    - Incident data suggests that flumazenil is frequently used to treat inadvertent benzodiazepine overdose, and, on occasion, no account is taken for the shorter half-life of flumazenil, compared to midazolam, leading to residual re-sedation.
- **Best practice in the management of epidural analgesia in the hospital setting- FACULTY OF PAIN MEDICINE of The Royal College of Anesthetists (2020)**
    - Epidural Analgesia in Children
        - Dosing regimens for children should be adjusted based on age and weight, with maximum dosages clearly defined to minimize the risk of cumulative local anesthetic toxicity. Opioids added to

the local anesthetic solution should be avoided, especially for infants weighing less than 5 kg, due to an increased risk of apnea.

- A suggested maximum rate of epidural infusion is provided, varying according to weight.
    - 0.375mg/kg/hr of bupivacaine, levo-bupivacaine or ropivacaine for neonates and infants less than 5Kg
    - 0.5mg/kg/hr of bupivacaine, levo-bupivacaine or ropivacaine for infants or children over 5Kg.
- Beyond the official neonatal period (over 4 weeks of age), pre-term babies' epidural infusion rates should be considered like neonates.
- Like in adults, the lowest effective concentration of local anesthetic should be used for children.

- **The European Society of Anesthesiology and European Board of Anesthesiology guidelines for procedural sedation and analgesia (PSA) in adults (September 2017)**
    - Patients with severe cardiovascular diseases (very good consensus: level of evidence A: grade of recommendation strong)
        - Provide Procedural Sedation and Analgesia (PSA) with benzodiazepine (mainly midazolam) and/or propofol, and low-dose opioid.
        - Dexmedetomidine has been proposed as an adjuvant, but it should be used cautiously as its use has been reported mainly in pediatric patients and it is currently off-label in Europe.
    - Patients with documented or suspected risk of obstructive sleep apnea syndrome (OSAS) (very good consensus: level of evidence B: grade of recommendation strong)
        - Minimal doses of hypnotics should be used, and opioids should be avoided.
        - Dexmedetomidine has been used with a good safety profile and could be considered as an alternative choice for PSA if OSAS is documented.
    - Patients with morbid obesity (BMI greater than kgm2) (very good consensus: level of evidence A: grade of recommendation strong)

- Avoid the supine position and place the patient in a beach chair position, prefer endotracheal intubation as the default choice of airway management, avoid long-acting sedatives.
- Avoid drugs with respiratory depressant effects on the breathing frequency and/or tidal volume and avoid drugs that induce or reinforce airway obstruction in non-intubated patients.
- Propofol for sedation seems to be associated with respiratory complications also when used by anesthetists, so remifentanil and dexmedetomidine (as off-label use in Europe) have been proposed for tailored titration of sedation and analgesia with appropriate monitoring of breathing and depth of anesthesia despite the fact that both drugs are associated with acute respiratory events and their use should be judiciously evaluated in obese patients where the risk for possible difficult ventilation and intubation can be challenging.

- Patients with chronic renal failure (very good consensus: level of evidence B: grade of recommendation weak)
  - Propofol and alfentanil used to achieve a similar degree of sedation and analgesia have been reported to induce lower SpO2 values and apnea/hypoventilation in CRF patients than in control patients.
  - For PSA during procedures of vascular access for hemodialysis, intravenous administration of drugs, such as midazolam and/or fentanyl, are generally preferred for their short onset time, although the maximal effect of midazolam, as estimated by pharmacokinetic and pharmacodynamic models, is about 13 min. No difference has been reported in distribution, elimination or clearance of unbound midazolam between normal patients and CRF patients given intravenous doses of 0.2mgkg.
  - The pharmacokinetics of single-dose fentanyl is not affected in CRF. Similar to midazolam, fentanyl is primarily metabolized by the liver.
  - Major, mainly cardiovascular and/or pulmonary, adverse effects associated with the administration of either midazolam or fentanyl have been reported to increase when the two drugs are being combined, particularly in high risk CRF patients, and there is need for careful intraprocedural and post-procedural respiratory monitoring and management of these patients.

- Patients with chronic hepatic disease (model for end-stage liver disease score 10) (very good consensus: level of evidence A: grade of recommendation strong)
    - Midazolam is preferred in most centers because it has a shorter onset time when compared with diazepam and lorazepam and it has potent amnestic properties. However, prolonged plasma half-life may increase the risks of adverse effects in hepatic dysfunction.
    - In minimal hepatic encephalopathy, procedural sedation with midazolam caused exacerbation of symptoms for up to 2 h after the end of the procedure.
    - Propofol used for sedation has a more favorable pharmacokinetic profile requiring no dose adjustment in renal or hepatic failure.
    - Propofol sedation in chronic hepatic failure (including Child C patients) has been reported to be superior to midazolam sedation in terms of safety, efficacy and recovery.
- Elderly patients (older than 70 years) (very good consensus: level of evidence A: grade of recommendation strong)
    - An appropriate dose reduction for midazolam and propofol for endoscopies in elderly patients has been extensively studied. The onset of action of all anesthetic drugs used in elderly patients is much slower and the intervals for successive doses (dose-titration) should be adapted accordingly.

- **Practice Guidelines for Moderate Procedural Sedation and Analgesia 2018 A Report by the American Society of Anesthesiologists Task Force on Moderate Procedural Sedation and Analgesia, the American Association of Oral and Maxillofacial Surgeons, American College of Radiology, American Dental Association, American Society of Dentist Anesthesiologists, and Society of Interventional Radiology**
    - Sedatives not intended for general anesthesia include benzodiazepines (e.g., midazolam, diazepam, flunitrazepam, lorazepam, or temazapam) and dexmedetomidine.
    - Analgesics administered with sedatives include opioids such as fentanyl, alfentanil, remifentanil, meperidine, morphine, and nalbuphine.
    - Sedative/Analgesic Medications Intended for General Anesthesia

- For these guidelines, sedatives intended for general anesthesia include propofol, ketamine and etomidate.
- Sedatives not intended for general anesthesia (e.g., benzodiazepines, nitrous oxide, chloral hydrate, barbiturates, and antihistamines) are included either as comparison groups or in combination with sedatives intended for general anesthesia.
- Analgesics (e.g., opioids, nonsteroidal anti-inflammatory drugs, and local anesthetics) are included either in comparison groups or in combination with sedatives intended for general anesthesia.
- When moderate procedural sedation with sedative/ analgesic medications intended for general anesthesia by any route is intended, provide care consistent with that required for general anesthesia.
- Assure that specific antagonists are immediately available in the procedure room whenever opioid analgesics or benzodiazepines are administered for moderate procedural sedation/analgesia, regardless of route of administration.
- Use reversal agents in cases where airway control, spontaneous ventilation or positive pressure ventilation are inadequate · Administer naloxone to reverse opioid-induced sedation and respiratory depression.
- Administer flumazenil to reverse benzodiazepine induced sedation and respiratory depression.
- After pharmacologic reversal, observe and monitor patients for a sufficient time to ensure that sedation and cardiorespiratory depression does not recur once the effect of the antagonist dissipates.

- **The Royal college of radiologists: Sedation, analgesia and anesthesia in the radiology department -second edition (2018)**
  - Benzodiazepines are the most commonly used sedative agents possessing both anxiolytic and amnesia properties.
  - Midazolam is the benzodiazepine of choice because of its rapid onset of action and short elimination half-life (1-4 hours). Other benzodiazepines are available, but none have any significant advantages over midazolam, and some have significant disadvantages.

- A typical dose of midazolam is 1-2.5 milligrams (mg) given over two minutes.
- Differing strengths of the midazolam preparation can lead to incorrect dose being administered and therefore it is strongly recommended that only 1mg/ml strength should be used.
- Propofol: Few sedation teams have sufficient experience and expertise to use propofol and at present this should remain an 'anesthetist only drug'
- Ketamine: Induces a dissociative state and analgesia and causes only minimal respiratory depression but can cause hyper tonus, movement, bronchodilation and sympathetic stimulation. Therefore, it is suggested that ketamine should be an anesthetist only drug.
- Opioids
  - Fentanyl is the opioid of choice due to its rapid onset of action, short half-life and fewer side effects compared to other opioids such as morphine, diamorphine or pethidine.
  - Rarely, fentanyl can cause skeletal muscle rigidity resulting in 'stiff chest syndrome' which may require succinylcholine administration and airway intubation.
- Topical local anesthetics can be applied as creams, sprays, jellies and so on, and can be useful for needle phobic patients prior to intravenous catheter insertion or prior to infiltration of local anesthetic.

- **Clinical Policy: Procedural Sedation and Analgesia in the Emergency Department (ED) - American College of Emergency Physicians (2014)**
  - Level A recommendations.
    - Ketamine can be safely administered to children for procedural sedation and analgesia in the ED.
    - Propofol can be safely administered to children and adults for procedural sedation and analgesia in the ED.
  - Level B recommendations.
    - A combination of propofol and ketamine can be safely administered to children and adults for procedural sedation and analgesia.
    - Etomidate can be safely administered to adults for procedural sedation and analgesia in the ED.

- **European position paper on drug-induced sleep endoscopy (2017)**
    - Midazolam and propofol are the two most frequently used drugs in DISE, either individually or in combination.
    - Some practitioners also combine midazolam and propofol with other drugs such as remifentanil or ketamine to achieve sedation.
    - Dexmedetomidine, an alpha 2 adrenergic drug, is another option for sedation during DISE. It provides both sedation and analgesia by inhibiting the locus ceruleus.
    - Caution with Remifentanil: The addition of remifentanil to propofol is discouraged due to its potential to increase patient desaturation, despite its ability to reduce sneezing.
- **National institute for health care and excellence (NICE) guidance for Sedation in under 19: using sedation for diagnostic and therapeutic procedures (2010)**
    - For children and young people who are unable to tolerate a painless procedure (for example, during diagnostic imaging) consider one of the following drugs, which have a wide margin of safety:
        - chloral hydrate for children under 15 kg
        - midazolam.
    - For children and young people who are unable to tolerate painless imaging with the above drugs (chloral hydrate or midazolam), consider one of the following, used in specialist techniques, which have a narrow margin of safety:
        - propofol
        - sevoflurane
    - For children and young people undergoing a painful procedure (for example suture laceration or orthopedic manipulation), when the target level of sedation is minimal or moderate, consider:
        - nitrous oxide (in oxygen) and/or
        - midazolam (oral or intranasal).
    - For all children and young people undergoing a painful procedure, consider using a local anesthetic, as well as a sedative. • For children and young people undergoing a painful procedure (for example, suture laceration or orthopedic manipulation) in whom nitrous oxide (in oxygen) and/or midazolam (oral or intranasal) are unsuitable consider:

        - ketamine (intravenous or intramuscular), or
        - intravenous midazolam with or without fentanyl (to achieve moderate sedation).
    - For children and young people undergoing a painful procedure (for example suture laceration or orthopedic manipulation) in whom ketamine (intravenous or intramuscular) or intravenous midazolam with or without fentanyl (to achieve moderate sedation) are unsuitable, consider a specialist sedation technique such as propofol with or without fentanyl.
    - For a child or young person who cannot tolerate a dental procedure with local anesthesia alone, to achieve conscious sedation consider:
        - nitrous oxide (in oxygen) or
        - midazolam.
    - Consider intravenous midazolam to achieve minimal or moderate sedation for upper gastrointestinal endoscopy.
    - Consider fentanyl (or equivalent opioid) in combination with intravenous midazolam to achieve moderate sedation for lower gastrointestinal endoscopy.
- **The American Academy of Pediatric Dentistry (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients- revision 2023**
    - Choose local anesthetic agents based on the patient's medical history, developmental status, procedure duration, and planned use of other agents like nitrous oxide or sedatives.
    - Administer local anesthetic doses based on the patient's body weight and strive to use the minimum effective dose.
    - Consider using a topical anesthetic before the injection to reduce needle penetration discomfort, while accounting for potential systemic absorption of topical drugs in total anesthetic calculations.
    - Document the local anesthetic type, dosage, and, if administered with sedatives, record all agent doses on a time-based record.
    - When local anesthetics are used alongside other CNS-depressing medications, lower the calculated maximum total dose.

- **Practice Guidelines for Acute Pain Management in the Perioperative Setting An Updated Report by the American Society of Anesthesiologists Task Force on Acute Pain Management (2012)**
    - Randomized controlled trials report improved pain relief when use of pre-incisional epidural or intrathecal morphine is compared with pre-incisional oral, intravenous, or intramuscular morphine (Category A2 evidence).
    - Meta-analysis of RCTs reports improved pain scores when IV PCA morphine is compared with intramuscular morphine (Category A1 evidence).
    - Meta-analyses of RCTs118–122 report less analgesic use when pre-incisional plexus blocks with bupivacaine are compared with saline (Category A1 evidence); findings are equivocal for nausea and vomiting (Category C1 evidence)
    - RCTs report equivocal findings for pain scores and analgesic use when post-incisional intraarticular opioids or local anesthetics are compared with saline (Category C2 evidence).
    - Meta-analysis of RCTs reports improved pain scores when pre-incisional infiltration of bupivacaine is compared with saline (Category A1 evidence); findings for analgesic use are equivocal (Category C1 evidence)
    - Meta-analysis of RCTs reports improved pain scores and reduced analgesic use when preincisional infiltration of ropivacaine is compared with saline (Category A1 evidence)
    - Meta-analyses of RCTs report improved pain scores (Category A1 evidence) and equivocal findings for nausea and vomiting and pruritus (Category C1 evidence) when epidural morphine combined with local anesthetics is compared with epidural morphine alone.
    - Meta-analyses of RCTs report improved pain scores and more motor weakness when epidural fentanyl combined with local anesthetics is compared with epidural fentanyl alone (Category A1 evidence); equivocal findings are reported for nausea and vomiting and pruritus (Category C1 evidence).
    - Meta-analyses of RCTs are equivocal for pain scores (Category C2 evidence) and a higher frequency of pruritus when epidural sufentanil combined with ropivacaine is compared with epidural ropivacaine (Category A1 evidence).

- Meta-analyses of RCTs report equivocal findings for pain scores, analgesic use, or nausea scores when intravenous morphine combined with ketamine is compared with intravenous morphine (Category C1 evidence).
- Meta-analyses of RCTs report lower pain scores and reduced opioid use when IV opioids combined with calcium channel blockers (i.e., gabapentin, pregabalin) is compared with IV opioids alone (Category A1 evidence); no differences in nausea or vomiting are reported (Category C1 evidence).
- Both the consultants and ASA members strongly agree that (1) regional blockade with local anesthetics should be considered as part of a multimodal approach for pain management; (2) dosing regimens should be administered to optimize efficacy while minimizing the risk of adverse events; and (3) the choice of medication, dose, route, and duration of therapy should be individualized.

- **Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU- 2018 by the Society of Critical Care Medicine**
  - A "multi-modal analgesia" approach has been used in the perioperative setting to reduce opioid use and to optimize postoperative analgesia and rehabilitation.
  - We suggest using nefopam (if feasible) either as an adjunct or replacement for an opioid to reduce opioid use and their safety concerns for pain management in critically ill adults (conditional recommendation, very low quality of evidence).
  - We suggest using low-dose ketamine (0.5 mg/kg IVP x 1 followed by 1-2 µg/kg/min infusion) as an adjunct to opioid therapy when seeking to reduce opioid consumption in postsurgical adults admitted to the ICU (conditional recommendation, very low quality of evidence).
  - We recommend using a neuropathic pain medication (e.g., gabapentin, carbamazepine, and pregabalin) with opioids for neuropathic pain management in critically ill adults (strong recommendation, moderate quality of evidence)
  - We suggest not routinely using IV lidocaine as an adjunct to opioid therapy for pain management in critically ill adults (conditional recommendation, low quality of evidence).

- We suggest using an opioid, at the lowest effective dose, for procedural pain management in critically ill adults (conditional recommendation, moderate level of evidence).
- The 2013 PAD guidelines suggest (in a conditional recommendation) that nonbenzodiazepine sedatives (either propofol or dexmedetomidine) are preferable to benzodiazepine sedatives (either midazolam or lorazepam) in critically ill, mechanically ventilated adults because of improved short-term outcomes such as ICU length of stay (LOS), duration of mechanical ventilation, and delirium.
- We suggest using propofol over a benzodiazepine for sedation in mechanically ventilated adults after cardiac surgery (conditional recommendation, low quality of evidence).
- We suggest using either propofol or dexmedetomidine over benzodiazepines for sedation in critically ill, mechanically ventilated adults (conditional recommendation, low quality of evidence).
- We suggest not using haloperidol, an atypical antipsychotic, dexmedetomidine, a β-Hydroxy β-methylglutaryl-Coenzyme A (HMG-CoA) reductase inhibitor (i.e., statin), or ketamine to prevent delirium in all critically ill adults (conditional recommendation, very low to low quality of evidence).
- We suggest using dexmedetomidine for delirium in mechanically ventilated adults where agitation is precluding weaning/extubation (conditional recommendation, low quality of evidence).
- We make no recommendation regarding the use of melatonin to improve sleep in critically ill adults (no recommendation, very low quality of evidence).

- **Guidelines on muscle relaxants and reversal in anesthesia- French Society of Anesthesia & Intensive Care Medicine (2020)**
  - The use of a muscle relaxant is recommended to facilitate tracheal intubation. (GRADE 1+, STRONG AGREEMENT)
  - Administering a short-acting muscle relaxant for rapid-sequence induction is probably recommended. (GRADE 2+, STRONG AGREEMENT)
  - Administering a muscle relaxant in cases of airway obstruction related to a supraglottic device is probably recommended. (GRADE 2+, STRONG AGREEMENT)

- The use of muscle relaxants is recommended to facilitate interventional procedures in abdominal laparotomy or laparoscopy surgery. (GRADE 1+, STRONG AGREEMENT)
- Intraoperative monitoring of neuromuscular blockade is recommended. (GRADE 1+, STRONG AGREEMENT)
- R6.2: The use of train-of-four stimulation of the ulnar nerve at the adductor pollicis is probably recommended for monitoring intraoperative neuromuscular blockade. (GRADE 2+, STRONG AGREEMENT)
- After administering a non-depolarizing muscle relaxant, it is recommended to wait for spontaneous reversal equivalent to four muscle responses at the adductor pollicis following train-of-four (TOF) stimulation of the ulnar nerve before giving neostigmine. (GRADE 1+, STRONG AGREEMENT)
- Adjust the dose of sugammadex according to ideal body weight and the intensity of neuromuscular blockade induced by rocuronium. (GRADE 1+, STRONG AGREEMENT)
- After administering sugammadex, it is probably recommended to continue quantitative monitoring of neuromuscular blockade to detect a possible increase in neuromuscular blockade. (GRADE 2+, STRONG AGREEMENT)
- It is probably recommended to administer a short-acting muscle relaxant for electroconvulsive therapy. (GRADE 2+, STRONG AGREEMENT)
- Except for situations requiring rapid-sequence induction or the use of a depolarizing muscle relaxant, it is probably recommended to use a non-depolarizing muscle relaxant for improved intubating conditions during anesthesia in children by intravenous induction. (GRADE 2+, STRONG AGREEMENT)
- In rapid-sequence induction, the use of a rapid-onset muscle relaxant is recommended for children. (GRADE 1+, STRONG AGREEMENT)
- In conventional rapid-sequence induction, it is probably recommended to use suxamethonium as the first-line drug for children. In cases where suxamethonium is contraindicated, the use of rocuronium is probably recommended. (GRADE 2+, STRONG AGREEMENT)
- Suxamethonium use is not recommended in cases of primary muscle damage (myopathies) or up-regulation of nicotinic acetylcholine

receptors at the motor end plate (chronic motor deficit). (GRADE 1-, STRONG AGREEMENT)

- Monitoring of neuromuscular blockade is probably recommended following muscle relaxant use in patients with neuromuscular disease. (GRADE 2+, STRONG AGREEMENT)
- Administration of sugammadex is probably recommended for reversing a residual neuromuscular blockade after using a steroidal muscle relaxant in patients with neuromuscular disease. (GRADE 2+, STRONG AGREEMENT)
- The use of a benzylisoquinoline muscle relaxant (atracurium/cisatracurium) is probably recommended in cases of renal or hepatic failure. (GRADE 2+, STRONG AGREEMENT)
- When using sugammadex in cases of renal failure, it is probably recommended to administer it at the usual dose. (GRADE 2+, STRONG AGREEMENT)

- **Guideline on anesthesia and sedation in breastfeeding women 2020 Guideline from the Association of Anaesthetists**
  - Encourage normal breastfeeding post-surgery.
  - Avoid the need to express and discard breast milk after anesthesia.
  - Most perioperative drugs, including anesthetics and non-opioid analgesics, transfer to breast milk in minimal amounts with no evidence of effects on the infant.
  - Be cautious with drugs like opioids and benzodiazepines, especially after multiple doses, in infants up to 6 weeks old (corrected for gestational age). Monitor for abnormal drowsiness and respiratory depression if the mother shows signs of sedation.
  - Avoid codeine use in breastfeeding women due to concerns about excessive sedation in some infants linked to metabolic differences.
  - Opt for day surgery when feasible to maintain normal routines. A responsible adult should stay with the woman for the first 24 hours. Be cautious with co-sleeping or sleeping while feeding in a chair, as responsiveness may be reduced.

Section 4.0 Conclusion

This report serves as **an annex to the previous CHI Anesthesia report** and aims to provide recommendations to aid in the administration of **anesthesia and sedation**. It is important to note that these recommendations should be utilized to support clinical decision-making and not replace it in the management of individual patients requiring **anesthesia and sedation**. Health professionals are expected to consider this guidance alongside the specific needs, preferences, and values of their patients when exercising their judgment.

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Section 6.0 Appendices

Appendix A. Prescribing Edits Definition

I. Prescribing Edits (ensure consistent use of abbreviations, e.g., CU, ST)

Some covered drugs may have additional requirements, rules, or limits on coverage. These requirements and limits may include:

Prescribing edits Tools	Description
AGE (Age):	Coverage may depend on patient age
CU (Concurrent Use):	Coverage may depend upon concurrent use of another drug
G (Gender):	Coverage may depend on patient gender
MD (Physician Specialty):	Coverage may depend on prescribing physician's specialty or board certification
PA (Prior Authorization):	Requires specific physician request process
QL (Quantity Limits):	Coverage may be limited to specific quantities per prescription and/or time period
ST (Step Therapy):	Coverage may depend on previous use of another drug
EU (Emergency Use only):	This drug status on Formulary is only for emergency use
PE (Protocol Edit):	Use of drug is dependent on protocol combination, doses and sequence of therapy

II. Adult and Pediatric Quantity Limit?

This is either the adult or pediatric maximum amount of a drug that can be administered per day based on a maximum daily dose. If there is no clinical evidence supporting the quantity limit for that relevant indication, this column will be left as Blank.

III. What information is available in the notes?

“Notes” section provides details of the prescribing edits, extra important drug information and special warning and precautions.

IV. Drug interactions

- A: No known interaction
- B: No action needed
- C: Monitor therapy
- D: Consider therapy modification
- X: Avoid combination

V. Defined Daily Dose

The Defined Daily Dose (DDD) is to be set based on the WHO recommendations https://www.whocc.no/ddd/definition_and_general_considera/

VI. REMS

A Risk Evaluation and Mitigation Strategy (REMS) is a drug safety program that the U.S. Food and Drug Administration (FDA) can require for certain medications with serious safety concerns to help ensure the benefits of the medication outweigh its risks.

Appendix B. Anesthesia Scope

Comparison of the 2020 and the 2023 Report

2020	Changes Performed	2024	Rationale
Section 1.0 Anesthesia Clinical Guidelines			
A. Guidelines and Standards for safe practice			
World Health Organization-World Federation of Societies of Anaesthesiologists (WHO-WFSA) International Standards for a Safe Practice of Anesthesia (2018)[2]	**N/A**	**N/A**	
GUIDELINES TO THE PRACTICE OF ANESTHESIA- Canadian Anesthesiologists' Society [Revised Edition 2019]	**Updated**	**GUIDELINES TO THE PRACTICE OF ANESTHESIA Revised Edition 2023 Canadian Anesthesiologists' Society (CAS)**[15]	**Non-SFDA registered- Not NUPCO**: - Sodium citrate
Guidelines for the safe practice of total intravenous anesthesia (TIVA) Joint Guidelines from the Association of Anaesthetists and the Society for Intravenous	**N/A**	**N/A**	

Anesthesia [2018][16]			
Concise practice guidance on the prevention and management of accidental awareness during general anesthesia- Published by the Association of Anaesthetists and the Royal College of Anesthetists [2019][4]	**N/A**	**N/A**	
Academy of Medical Royal Colleges: Safe Sedation Practice for Healthcare Procedure Standards and Guidance [October 2013]	**N/A**	**Recommendations re-emphasized in 2021.**[3]	
Best practice in the management of epidural analgesia in the hospital setting- FACULTY OF PAIN MEDICINE of The Royal College of Anesthetists [2010]	**Updated**	**Best practice in the management of epidural analgesia in the hospital setting- FACULTY OF PAIN MEDICINE of The Royal College of Anesthetists [2020]**[17]	**NUPCO**: - 20% lipid emulsion (Intralipid) - Levo-bupivacaine
Statement on Safe Use of Propofol – American society of	**N/A**	**N/A**	

anesthesiologists [2019][18]			
Guidelines for day-case surgery 2019- Published by the Association of Anesthetists and the British Association of Day Surgery [2019] [19]	**N/A**	**N/A**	
B. Procedural Sedation			
The European Society of Anaesthesiology and European Board of Anaesthesiology guidelines for procedural sedation and analgesia (PSA) in adults [September 2017][5]	**N/A**	**N/A**	
Procedural sedation: a position paper of the Canadian Anesthesiologists' Society (CAS) [2018][21]	**N/A**	**N/A**	
Practice Guidelines for Moderate Procedural Sedation and Analgesia 2018 A Report by the American Society of Anesthesiologists Task Force on Moderate	**N/A**	**N/A**	

Procedural Sedation and Analgesia, the American Association of Oral and Maxillofacial Surgeons, American College of Radiology, American Dental Association, American Society of Dentist Anesthesiologists, and Society of Interventional Radiology[6]			
Practice Guidelines for Obstetric Anesthesia- An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology [2015][22]	**N/A**	**N/A**	

Guidelines on Sedation and/or Analgesia for Diagnostic and Interventional Medical, Dental or Surgical Procedures- Australian and New Zealand College of Anaesthetists (ANZCA) [2014]	**Updated**	**PG09(G) Guideline on procedural sedation 2022**[23]	NonSFDA, Non-NUPCO: - nitrous oxide
Unscheduled Procedural Sedation: A Multidisciplinary Consensus Practice Guideline by the American College of Emergency Physicians [2018]	**Updated**	**Unscheduled Procedural Sedation: A Multidisciplinary Consensus Practice Guideline by the American College of Emergency Physicians (2019)**[24]	NonSFDA, Non-NUPCO: - nitrous oxide NonSFDA, NUPCO: - etomidate
The Royal college of radiologists: Sedation, analgesia and anesthesia in the radiology department -second edition [2018][7]	**N/A**	**N/A**	
Clinical Policy: Procedural Sedation and Analgesia in the Emergency Department	**N/A**	**N/A**	

(ED) -American College of Emergency Physicians [2014][8]			
Practice Guidelines For Sedation And Analgesia By Non-Anesthesiologists: An Updated Report By The American Society Of Anesthesiologists Task Force On Sedation And Analgesia By Non-Anesthesiologists [2010][25]	**N/A**	**N/A**	
	Missing	**Association of Women's Health, Obstetric and Neonatal Nurses Analgesia & Anesthesia In The Intrapartum Period Evidence-Based Clinical Practice Guideline 2020**[26]	NonSFDA, Non-NUPCO: - nitrous oxide inhaled. - Nalbuphine - Butorphanol SFDA - Phenylephrine hydrochloride Nupco - 20% lipid emulsion
C. Endoscopy			
Guidelines for sedation and anesthesia in GI endoscopy- American Society for Gastrointestinal Endoscopy [2018][27]	**N/A**	**N/A**	

European position paper on drug-induced sedation endoscopy (DISE) [2014]	**Updated**	**European position paper on drug-induced sleep endoscopy: 2017 Update**[28]	No new medications.
Multisociety Sedation Curriculum for Gastrointestinal Endoscopy- 2012 by the AGA Institute, American College of Gastroenterology, American Society for Gastrointestinal Endoscopy, American Society for the Study of Liver Disease, and Society of Gastroenterology Nurses and Associates[29]	**N/A**	**N/A**	
Non-anesthesiologist administration of propofol (NAAP) for gastrointestinal endoscopy: European Society of Gastrointestinal Endoscopy, European Society of Gastroenterology and	**N/A**	**N/A**	

Endoscopy Nurses and Associates Guideline – Updated June 2015[30]			
D. Pediatrics			
National institute for health care and excellence (NICE) guidance for Sedation in under 19: using sedation for diagnostic and therapeutic procedures (Published 2010)[9]	**N/A**	**N/A**	
Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures- the American Academy of Pediatric Dentistry and American Academy of Pediatrics (2019)[31]	**N/A**	**N/A**	
GUIDELINE FOR KETAMINE SEDATION OF CHILDREN IN EMERGENCY DEPARTMENTS Published: Apr 2009	**Updated**	**KETAMINE PROCEDURAL SEDATION FOR CHILDREN IN THE EMERGENCY DEPARTMENT- The Royal college of Emergency**	Non-SFDA, non-NUPCO - Intranasal diamorphine - nitrous oxide inhaled.

(reviewed Oct 2016)- The Royal college of Emergency medicine		**Best Practice Guideline medicine 2020**[32]	
Clinical Policy: Critical Issues In The Sedation Of Pediatric Patients In The Emergency Department (2008)-American College of Emergency Physicians[33]	**N/A**	**N/A**	
E. Dentistry			
The Scottish Dental Clinical Effectiveness Programme (SDCEP): Conscious Sedation in Dentistry Dental Clinical Guidance- Third Edition	**N/A**	**N/A** **Reviewed and unchanged December 2022**[34]	
The American Academy of Pediatric Dentistry (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients [2009]	**updated**	**The American Academy of Pediatric Dentistry (AAPD) Guideline on Use of Local Anesthesia for Pediatric Dental Patients-revision 2023**[10]	No new medications.
F. Perioperative Pain (Epidural and Regional techniques)			
Practice Guidelines for Acute Pain Management in the Perioperative Setting An Updated	**N/A**	**N/A**	

Report by the American Society of Anesthesiologists Task Force on Acute Pain Management (2012)[11]			
G. ICU Sedation			
Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU-2018 by the Society of Critical Care Medicine[12]	**N/A**	**N/A**	
North Wales Critical Care Network- SEDATION GUIDELINES FOR ADULTS IN CRITICAL CARE		**Not found**	
Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients [2013]	**Updated**	**Evidence-based clinical practice guidelines for the management of sedoanalgesia and delirium in critically ill adult patients (2019)**[35]	NonSFDA, NUPCO: - Etomidate - Pentobarbital SFDA-registered: - Oxycodone - Tramadol - Acetaminophen

NICE guidance for Delirium: prevention, diagnosis and management [updated 2019]	**Updated**	**Delirium: prevention, diagnosis and management in hospital and long-term care (2023)**[36]	No new medications.
H. Neuromuscular Blocking and Reversal			
Guidelines on muscle relaxants and reversal in anesthesia- French Society of Anesthesia & Intensive Care Medicine [9/2018]	**Updated**	**Guidelines on muscle relaxants and reversal in anesthesia- French Society of Anesthesia & Intensive Care Medicine (2020)**[13]	SFDA-registered: - suxamethonium
Clinical Practice Guidelines for Sustained Neuromuscular Blockade (NMBAs) in the Adult Critically Ill Patient 2016 by the Society of Critical Care Medicine and Wolters Kluwer Health, Inc[37]	**N/A**	**N/A**	
Missing	**Missing**	**Perioperative neuromuscular blockade. 2020 update of the SEDAR (Sociedad Española de Anestesiología y Reanimación) recommendations**[38]	No new medications.

I. **Pregnancy and Breastfeeding**			
	Missing	**Guideline on anesthesia and sedation in breastfeeding women 2020 Guideline from the Association of Anaesthetists**[42]	No new medications.
Other Drugs (FDA-approved): - Iheezo (chloroprocaine hydrochloride ophthalmic gel), 3%[40] - Zynrelef (bupivacaine and meloxicam) extended-release solution[41]			

Appendix C. MeSH Terms PubMed

The following is the result of the PubMed search conducted for guideline search:

Query	Filters	Search Details	Results
anesthesia [MeSH Terms]	Guideline, in the last 5 years, English	("anesthesia"[MeSH Terms]) AND ((y_5[Filter]) AND (guideline [Filter]) AND (english[Filter]))	66

Appendix D. Treatment Algorithm