Udruženje inžinjera medicinske radiologije u FBiH

Radiološke tehnologije – Časopis iz oblasti radiološke tehnologije

Volumen 17 | Novembar/Studeni 2026. godine

EFFECTIVENESS OF SEDATION AND ANESTHESIA IN CT DIAGNOSTICS

Authors: Vesna Majher Tomić1 , Darko Tomić1,2 , Haris Porobić3, Armin Papračanin3

1 Croatian Hospital "Dr. Fra Mato Nikolić" Nova Bila

2 Faculty of Health Studies University of Mostar

3 Clinical Center of the University of Sarajevo

Submitted: 25.October. 2026.

Accepted: 02.November.2026.

DOI: https://doi.org/10.48026/issn.26373297.2026.1.17.5

ABSTRACT

CT diagnostics requires the patient to remain still during the imaging. For some patients, this is not possible without pharmacologically assisted sedation or even general anesthesia - primarily children and adolescents, adults disturbed by fear and pain, and those with neurological or cognitive disorders. Sedation (eng. procedural sedation) is a controlled pharmacological induction of depression of consciousness in order to facilitate the diagnostic procedure, whereby the patient mostly retains the basic reflexes of breathing and circulation. Sedation is categorized into degrees from minimal (anxiolysis) to deep sedation, which is a medical procedure by which drugs reduce the patient's consciousness to a state of deep sleep, where the patient reacts only to strong or painful stimuli., while general anesthesia implies complete unconsciousness and often the need to maintain the airways.

The safety of sedation is ensured by following the protocol: monitoring the highest possible level of consciousness and vital functions, readiness for intervention (secured venous access, oxygen, ventilation) and dosing from the minimum necessary level of sedation. Pediatric standards (AAP) require recording vital signs every 5 minutes in deep sedation and 10 minutes in moderate sedation, with mandatory equipment and personnel trained in resuscitation. After the procedure, the patient is monitored until the previous level of consciousness returns and parameters stabilize, and discharge is allowed only after satisfactory recovery (e.g. using the Altdret or similar score).

Keywords: sedation, anesthesia, state of consciousness, CT diagnostics

This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

Print: ISSN 2232-8726

Online: ISSN 2637-3297

SAŽETAK

CT dijagnostika zahtijeva od pacijenta da ostane miran tijekom snimanja. Kod nekih pacijenata to nije moguće bez farmakološke potpomognute sedacije ili čak opće anestezije – primarno se radi o djeci i adolescentima, strahom i bolom uznemirenim odraslima, te onima s neurološkim ili kognitivnim poremećajima. Sedacija (eng. procedural sedation) predstavlja kontroliranu farmakološku indukciju depresije svijesti radi olakšavanja procedure dijagnostike, pri čemu pacijent uglavnom zadržava osnovne reflekse disanja i cirkulacije. Sedacija se kategorizira u stupnjeve od minimalne (anksioliza) do duboke sedacije to predstavlja medicinski postupak kojim se lijekovima smanjuje svijest pacijenta do stanja dubokog sna, gdje pacijent reagira samo na jake ili bolne podražaje., dok opća anestezija podrazumijeva potpunu besvijest i često potrebu za održavanjem dišnih puteva.

Sigurnost sedacije osigurava se poštivanjem protokola: monitoriranjem najviše moguće razine svjesti i vitalnih funkcija, spremnošću na intervenciju (osiguran venski put, kisik, ventilacija) i doziranjem od najmanje potrebnog stupnja sedacije. Pedijatrijski standardi (AAP) zahtijevaju bilježenje vitalnih znakova svakih 5 minuta u dubokoj te 10 minuta u umjerenoj sedaciji, uz obaveznu opremu i osoblje osposobljeno za reanimaciju. Nakon završene procedure pacijent se prati do povratka prethodnog stupnja svijesti i stabilizacije parametara, a otpust dozvoljen tek nakon zadovoljavajućeg oporavka (npr. korištenjem Altdretovog ili sličnog skora).

Ključne riječi: sedacija, anestezija, stanje svijesti, CT dijagnostika

1. INTRODUCTION

The growing interest in safe sedation outside the operating room, such as the CT room, has resulted in a number of guidelines; the ASA and ESA issue global recommendations for procedural sedation, and the AAP/AAPD periodically update guidelines for children before painless procedures (such as CT). It is important to distinguish the indications: for CT, these include uncontrolled pain, fear (e.g., claustrophobia), uncooperativeness due to age or dementia, and specific needs. Contraindications are relative: acute dehydration or severe cardiovascular/respiratory pathologies that increase the risk of sedation.

Proper patient selection and preparation (anamnesis, physical examination, ASA classification) are key steps before starting sedation. Sedation in CT diagnostics is necessary in order to obtain a high-quality radiological-diagnostic finding. In this collaboration, sedation and the speed of performing CT diagnostics depend mostly on the dexterity of the medical radiology engineer, who knows exactly what is necessary in order to obtain the highest quality radiological diagnostic image. Comparatively, radiological standards (such as RCR and ACR recommendations) require the presence of an experienced team and adequate monitors during each medical sedation. Fasting is recommended for 2 hours for clear liquids and a minimum of 6 hours for solid foods, to reduce the risk of aspiration, although there is discussion about reducing the necessary time without food for emergency examinations. Informed consent is necessary due to possible complications of sedation, especially if deep sedation or anesthesia is planned.

The aim of this work is to systematically process all aspects of sedation and anesthesia in the context of CT scans. First, we will present available methods and protocols,

include data on efficacy and safety from clinical studies and guidelines, and connect recommendations with clinical outcomes through discussion.

2. EFFECTIVENESS OF SEDATION AND ANESTHESIA IN CT DIAGNOSTICS

Sedation and anesthesia for CT scans are used to allow imaging of patients who are unable to remain still on their own – most commonly children, patients with anxiety, claustrophobia or pain. The main goals are to reduce mobility, discomfort and anxiety, thereby improving image quality and patient safety. There are defined levels of sedation (minimal, moderate, deep) and general anesthesia, with moderate sedation (patient awake, responsive to stimuli) most often sufficient for CT scans. Indications for sedation include restlessness or inability to cooperate (pain, cognitive impairment, fear), and contraindications are relative and relate to a high risk of respiratory or cardiovascular collapse and incompatibility with fasting for an elective procedure. (1)

The pre-procedural protocol includes an assessment of the general condition (ASA classification), fulfillment of fasting conditions (eg 2 hours of clear liquids, 6 hours of solid food), and informed consent. Continuous monitoring of vital parameters (SpO_2, ECG, respiratory rate, NIBP, capnography in deeper sedation) is mandatory during sedation. (2)

In the equipment must be available a set for resuscitation, oxygen, anesthesiology apparatus, equipment for maintaining the airways and a set for anaphylactic shock. Intravenous sedatives are most often used: propofol, midazolam, ketamine, and a number of drugs for analgesia (fentanyl, paracetamol), and in children also drugs for oral/intranasal administration (midazolam, dexmedetomidine). Propofol (injection anesthetic) has a rapid onset (30 s), short duration and rapid recovery, but without analgesia and with the risk of hypotension; midazolam (benzodiazepine) provides anxiolysis and amnesia but is slower acting (2–3 min) and can cause respiratory depression, especially in combination with opioids; ketamine (a dissociative anesthetic) provides analgesia and maintains the airway, but induces salivation and may cause agitation upon awakening. (2,3)

Dexmedetomidine (selective α_2-agonist) provides sedation with preserved breathing, but slows the heart rate. For sedation, inhaled analgesics nitrous oxide/paradise gas (N_2O 50:50) are also available. Adult doses eg propofol 1–2 mg/kg IV, midazolam 0.02–0.1 mg/kg IV, ketamine 0.5–2 mg/kg IV, fentanyl 1–2 µg/kg IV; pediatric doses adjusted for body weight or unspecified if unavailable. A combination of drugs (eg propofol + midazolam + fentanyl or propofol + ketamine) is usually used as a scheme, whereby the dosage is titrated to the effect. The advantage of monolithic agents (eg only propofol or only midazolam) is simpler administration, but less analgesia; combinations enable a smaller dose of each drug, but significantly increase the risk of respiratory depression. Reversible antagonists (flumazenil for benzodiazepines, naloxone for opioids) must be available, while there is no specific antidote for propofol or dextramethomidine. The advantages of each drug and their interactions (for example,

Print: ISSN 2232-8726
Online: ISSN 2637-3297

potentiation of respiratory depression by benzodiazepines and opioids) must be known, as well as contraindications (allergies, neurological status). (1)

The medical radiology engineer prepares the room and the CT device itself, in order to speed up the diagnosis as adequately and accurately as possible. By selecting the appropriate CT protocols, the medical radiology engineer completes the diagnostic examination with an evaluation of the quality of the diagnostic images.

The proven effectiveness of sedation was confirmed by the data: in a prospective study, 331 children for CT were successfully sedated in 95.8% of cases without the need for reimaging. Comparative research shows that the use of sedatives (propofol, midazolam, chloral, ketamine) significantly reduces movements and artifacts, improving the quality of images in CT and MRI scans. A meta-analysis by Chinese authors states that dextramethomidine achieves faster sedation than propofol, but with a similar length of total sedative effect. However, the use of anesthesia in children is associated with regulatory warnings due to possible effects on neurocognitive development, which has led to a gradual decrease in the rate of sedation/anesthesia for diagnostic tests. Numerous clinical guidelines (ASA, ESA, RCR, AAP) point out that staff must be thoroughly trained, that careful evaluation before the procedure and strict monitoring during and after sedation are necessary. In practice, the formation of local protocols and multidisciplinary teams for sedation is recommended, with the constant provision of adequate infrastructure (equipment for emergency interventions, capnography, notifications for staff). (3)

Overview of available anesthesia procedures

According to defined standards, sedation encompasses a wide range of conditions from superficial anxiety sedation (patient fully conscious, minimally suppressed) to deep sedation (patient responsive to severe pain). This level continues continuously into general anesthesia, in which the patient is completely unresponsive and requires full respiratory support. For routine CT diagnostics, moderate sedation is usually sufficient, i.e. a state in which the patient is calm, anxious – without fear and without involuntary movements, but awakens on verbal commands. Deep sedation is reserved for more extreme cases (e.g., an unreasonable patient, an extremely restless child) when moderate sedation is not sufficient. (3,4)

Sedation is carried out using the "monitored anesthesia care" approach - the patient is under the continuous supervision of competent staff and anesthesiologists with resuscitation equipment provided. A key recommendation is the formation of a multidisciplinary sedation team that defines local protocols, educates staff and oversees implementation.

Indications and contraindications

Indications for sedation in CT diagnostics primarily relate to patients who are unable to cooperate: children, mentally impaired or psychotic patients, and anxious or claustrophobic adults. Also, if a hospital procedure is required for CT (e.g., CT colonography with contrast injection, CT biopsy) and pain is expected, sedation may be indicated for analgesia. There are no absolute contraindications to moderate sedation except for severe shock, uncontrolled arrhythmias, or other conditions where even a moderate drop in blood pressure or respiratory depression is dangerous. Patients with severe COPD, severe cardiac and respiratory diseases (e.g., decompensated heart failure) require very careful consideration and possibly an anesthesiological approach to control the airway.

For urgent abdominal CT scans, consideration may be given to waiving strict fasting (e.g., for clear fluid) if delay would compromise the diagnosis; however, the long-term risks of aspiration have necessitated strict protocols requiring 6–8 hours of fasting before sedation/anesthesia. If the patient has not fasted in accordance with instructions for an elective procedure, the scan is usually postponed to prevent the rare but potentially catastrophic complications of aspiration.

Monitoring and security protocols

The safety of sedation is ensured by standardized monitoring. The following are essential: continuous monitoring of SpO_2 by oximetry, electrocardiogram (ECG), and respiratory rate ; and automatic measurement of arterial pressure every 3–5 minutes . Since the patient can easily be transferred to a state of deep sedation, capnography (measurement of exhaled carbon dioxide) is also recommended for early detection of hypoventilation or apnea. The bispectral index (BIS) for quantifying the level of sedation is mentioned as controversial, therefore it is not insisted on. In patients with diabetes, glucose control before, during, and after the procedure is not forgotten. Each administration of medication is recorded in the documentation for visibility of doses. It is particularly important to continuously assess the level of consciousness and pain/disorder (e.g., every 5–10 min), since the transition to deeper sedation may be imperceptible without a score of consciousness. (5)

In addition to monitoring, the ward must have regularly checked safety instruments and medications available : resuscitation carts with basic intubation and ventilation equipment, a defibrillator, appropriate oxygen masks, nasal catheters, triangular air cushions, antiseptics, infusion sets for emergency pressure relief, and an aspiration device with probes (150 mmHg).

The RCR regulations specifically emphasize pre- and post-procedural standards : vital signs must return to baseline before the child is discharged. Each child must be awake (or in their previous state of consciousness) at discharge, and side effects of sedation (nausea, vomiting) should be controlled. The attending parent or guardian is given clear instructions for home care. (6)

Print: ISSN 2232-8726
Online: ISSN 2637-3297

According to the guidelines, a thorough pre-sedation assessment (history, examination of the circulatory and respiratory status, weight, allergies, gastrointestinal status, medications) must be performed before the start of sedation. Special attention is paid to the assessment of the airway (tonsil size, mouth, children with Down syndrome or mucopolysaccharidoses have an increased risk of obstruction). If deep sedation is planned, it is also recommended to establish an intravenous line before the procedure to allow for a faster response to complications.

Common sedatives and anesthetics: doses, properties and activities

The table summarizes the main drugs for sedation/anesthesia and their characteristics (to provide a basis for comparison in the chapter). Only valid adult doses are listed here; pediatric doses are listed where specifically indicated or are listed as unspecified if data are not available. (7)

In general, propofol is the most commonly chosen agent for modal sedation because of its rapid onset and the possibility of rapid progression or recovery. The effect persists for 5–10 minutes after an IV dose (1–2 mg/kg), or is maintained by continuous infusion (25–75 µg/kg/min). The disadvantage is the complete loss of the analgesic component and the risk of hypotension, so it is often combined with an opioid (e.g. fentanyl) for analgesia. Due to its rapid decay, it allows for rapid recovery (even better than midazolam). There is no specific antidote, and support is only symptomatic. (7,8)

Benzodiazepines (e.g. midazolam) act slowly and more persistently than propofol – IV onset ~2–3 min, effect 30–60 min. They provide good anxiolysis and amnesia, which is useful in traumatized or anxious patients. A good starting dose is 0.02–0.1 mg/kg (adult ~1–5 mg), titrated to effect. The combination of benzodiazepines and opioids strongly promotes respiratory depression, so strict dosing and monitoring are required. Flumazenil (0.2 mg bolus) can reverse the action of midazolam in case of overdose. However, the return of anxiety after flumazenil can interfere with performance, so this antagonist drug is used with caution.

Opioids (fentanyl) are used mainly as analgesics (e.g. for contrast injection disorders or pain shock) and as an additive to sedation. Initial dose 1–2 µg/kg IV, i.e. ~50–100 µg in adults, with onset of action ~2 min. Naloxone (0.1–0.2 mg) reverses opioids in clinical respiratory depression, but at the same time reverses analgesia.

Ketamine (0.5–2 mg/kg IV for sedation) provides analgosedation with preserved airway tone and normal breathing (recommended in hypotensive patients because it raises blood pressure). The onset of action is very rapid (~1 min), and the sedative effect lasts 10–20 min. Common side effects include increased salivation and hallucinatory awakenings, which are often treated with midazolam to reduce them. Naloxone is not used with ketamine, and medications such as diazepam can reduce awakening difficulties.

Dextramethomidine is a selective α_2-adrenergic agonist with analgesic, sedative and anxiolytic effects. It is often administered by infusion (mainly 0.5–1 µg/kg as a bolus and 0.2–0.7 µg/kg/h for maintenance), and can also be administered intranasally (1–3 µg/kg)

for less stressful procedures. Unlike other sedatives, it bypasses significant respiratory depression, which is appreciated in children with respiratory risk. The disadvantages are a slow start (about ten minutes) and a relatively long duration of action (hours). Compared to propofol, dextramethomidine has a slightly slower onset and longer recovery. The main side effects are hypotension and bradycardia (10–30% with decreased cardiac output); they are often compensated conservatively without special antagonists. (9)

Pentobarbital (a barbiturate) was once used for pediatric sedation (3–5 mg/kg IV; ~60 mg/kg orally) because of its easy availability, but it has significant side effects (prolonged respiratory depression, hypotension) and has now been replaced by safer drugs. There is no antidote.

Etomidate is a hypnotic with an extremely rapid onset (~30 s) and short duration (5–10 min), does not cause hypotension, and is therefore occasionally used for short, painful procedures. The main side effects are myoclonus and adrenal suppression (single bolus – given only once). It is used very selectively (often in the ER, but not so much in CT sedation).

Entonox (a mixture of N_2O and O_2) is used through a nasal mask or aspirator, 50% nitrous oxide. It acts very quickly (minutes), causing analgesia and moderate sedation, and is eliminated quickly after discontinuation. The advantage is low invasiveness and the effect stops immediately, the disadvantage is insufficient depth of sedation (not enough for CT by itself) and the risk of air trapping in cavities (contraindicated in pneumothorax, air embolism, intestinal obstruction, pneumoperitoneum, head injury, respiratory and cardiac disorders).

Auxiliary analgesia (paracetamol 1 g orally/IV, NSAIDs) is often administered before contrast for preventive pain control; it does not affect patient awareness and does not require monitoring. (10)

Drug reversal: Flumazenil is given in small bursts (0.01–0.02 mg/kg to a max of 1–3 mg) to reverse the effects of benzodiazepines, with caution for reversal of anxiety. Naloxone (0.01–0.02 mg/kg) removes the effect of opioid drugs with the possible instant awakening of pain. In case of anxiety or deep sedation with respiratory depression, ventilation and oxygenation are performed first of all , and antagonists are used only if respiratory insufficiency has become critical. Neither propofol nor dextramethomidine have specific antagonists, and in case of overdose we act symptomatically (BVM ventilation, inotropes, etc.).

In the selection of sedatives, the interaction must also be taken into account: for example, the combination of benzodiazepines and opiates produces synergistic respiratory depression, while ketamine increases salivation if atropine is not administered. Antihypertensives, alcohol and some psychotropic drugs potentiate the sedative effect.

Print: ISSN 2232-8726
Online: ISSN 2637-3297

Procedural logistics and protocol

Before the patient arrives at the CT room, systematic pre-procedural preparation is carried out : identity and purpose of the procedure are confirmed, the fasting questionnaire (time of last food/liquid intake) is repeated, potential problems are addressed (e.g., whether there is a blocked vein or allergy to contrast). Blood pressure, pulse, saturation, and respiratory system values are examined (lung auscultation, assessment of the degree of inspiration). What will happen is explained to the patient (or parents). (7,8)

ASA status and contraindications for sedation are recorded in the medical documentation (or work report). If the patient is taking some specific medications (anticoagulants, metformin, etc.), care is taken to discontinue or adjust them. (10)

RCR guidelines allow for longer or shorter fasts depending on the assessment of risk and urgency of the procedure. In practice, electronic reminders or printed instructions to parents help ensure that the patient arrives at the unit on an empty stomach. According to the AAP, the minimum time is 2 h of clear liquids and 6–8 h of a heavy meal; incomplete fasting adversely affects the patient's mood and the success of sedation.

After arriving in the radiology department, the patient is usually placed with an IV cannula (at least 22G for adults, 24G for children) before the administration of sedation. The patient is connected to the monitor: the ECG electrodes, the pulse oximeter are examined, the blood pressure cuff is placed and the correctness of the capnograph (eg through a nasal probe). Oxygen is provided (nasal probes are placed with 2–4 L/min of oxygen before sedation) as a prophylactic measure of hypoxia. Ambu-balloon and oxygen are ready. (9,10)

Informed consent: Before the procedure, the physician (anesthesiologist) must obtain signed consent from the patient or guardian after explaining the purpose of the sedation and potential risks (e.g., recurrent sedation, effect on breathing, apnea). For elective CT sedation, a written order from the anesthesiologist is not required, but it is documented that the patient has been informed responsibly. (7)

Sedation process: Medications are titrated according to the patient's level of consciousness. Typically, a lower dose of sedative is started (e.g., propofol 0.5–1 mg/kg IV) and carefully increased until the patient is calm without risk of respiratory depression. In combination regimens (e.g., midazolam + fentanyl), a benzodiazepine is given first, followed by an opioid, with continuous monitoring of the signal. In some protocols, an inhaled analgesic (N_2O/O_2) is given to achieve initial calm, followed by an IV sedative. It is important not to give too much at once, as respiratory depression is a negative consequence.

After imaging is completed, the patient is moved to the post-operative monitoring area (PACU). The parameters are further monitored and documented until the final recovery. A recovery period of 15–30 minutes is usually sufficient for short procedures (such as a CT scan), followed by discharge criteria.

Patient Discharge: According to the protocol, the patient should not be discharged until he/she meets the standards for a recovered patient: normal cardiocirculatory, respiratory, and hemodynamic parameters, presence of reflexes, and restoration of preprocedural level of consciousness. He/she should be able to answer questions and communicate verbally. The child should be able to sit with little assistance and without pallor or dizziness. The discharge instructions explain to the patient (or parent) that physical activity should be avoided, that he/she should not drive, and that he/she should monitor for possible side effects such as nausea or drowsiness (a threefold increase in the median recovery time after midazolam/narcotic is a known phenomenon). If an opiate was used, it is advisable to have an antagonist available and monitor for possible hypoventilation for some time. (8)

3. DISCUSSION

The effectiveness of sedation in CT diagnostics has been confirmed by numerous clinical works. Gupta et al. showed a high degree of success in a prospective audit in 2020: in 331 children sedated with propofol, ketamine and midazolam for CT, 95.8% of the examinations were successful without recurrence. Combinations of sedatives were used in 60% of cases, and 5.5% of mildly serious adverse events (transient respiratory depression, vomiting) occurred, without lasting consequences. These results indicate that in a multidisciplinary environment (anesthesiological supervision, monitoring) sedation gives a very high efficiency with an acceptable risk.

A meta-analysis by Zhao et al. (2024) compared two commonly used sedatives – propofol and dextramethomidine – in children and the elderly for CT/MRI examinations. It was concluded that both drugs significantly improved patient compliance and reduced motor artifacts, and that dextramethomidine had a faster induction of sedation (shorter onset) compared to propofol, although the final length of sedation and recovery time were not significantly different. This supports the trend to increasingly use α_2-agonists in pediatric sedation due to their safety (low incidence of apnea). The Japanese authors pointed out that dextramethomidine is "respiratory-preserving" while propofol provides "high efficacy and rapid recovery". In practice, a low-dose propofol bolus combo with intranasal dextramethomidine is therefore often used to combine their advantages.

On the other hand, although sedation is effective, the ASA and FDA issue warnings about the possible neurotoxic effect of repeated or long-term use of anesthetics in children, which has been reflected in the reduction of routine use of anesthetics during pediatric diagnostics (see Zitek et al.). Interestingly, Zitek et al. (2023) analyzed trends in pediatric hospitals and concluded that the proportion of imaging (CT/MRI) with sedation/anesthesia in the period 2012–2022 slightly but significantly decreased (from ~15% to ~10%) due to greater caution after warnings about potential psychoneurological consequences. Since CT is more radiation risky than MRI, this tendency shows that experts try to avoid unnecessary anesthesia when possible, using alternative methods (eg psychological preparation of the child, VR reality, "feed-and-wrap" in infants).

Print: ISSN 2232-8726
Online: ISSN 2637-3297

Comparative studies of sedative regimens reveal that monolithic protocols (one drug) in general sedation in children are not ideal due to the wide range of responses and side effects. Jung et al. (2020) indicate that classic sedatives (pentobarbital, midazolam) are easy to administer, but have lower success rates and longer recoveries with significant side effects. The authors recommend considering combined protocols in pediatric MR/CT practice. Also, the combination of midazolam and dextromethormidine as a "brain-sparing" regimen shows promising results in controlling children's behavior during imagery.

The question of the indication for sedation in adult patients with claustrophobia or uncooperativeness is also significant. RCR guidelines state that oral anxiolytics are often sufficient for outpatient examinations, but that patients with dementia or restlessness require more intensive anesthesia with appropriate physician consent. Research on the actual relationship between sedation vs. non-drug methods in these cases is still scarce.

Safety aspects (monitoring and complications) are supported by guidelines and practice. Protocols such as those in the RCR or ASA standards are used, which emphasize minimum monitors and mandatory equipment checks. Also, maintaining daily equipment checklists and staff training are key indicators of sedation quality.

In conclusion, a systematic review of data and guidelines suggests a high efficacy of sedation in CT diagnostics with a low incidence of serious complications when protocols are followed. However, open questions remain: is there a single "optimal" combination of drugs for different patient groups? What is the ultimate effect of multiple repeated sedation in children? Large multicenter RCTs are needed (e.g., comparing propofol versus newer sedatives such as remimazolam) and consensus on the best comparative metrics (image quality, recovery time, family satisfaction). New technologies (tele-sedation, artificial intelligence in supervision) and evolution of guidelines (e.g., updates of the AAP or local protocols) are open topics for future research.

4. CONCLUSION

Sedation and anesthesia are essential tools for successful CT diagnostics in patients for whom maintaining immobility is problematic. Moderate sedation (with combinations of propofol, benzodiazepines, opioids and/or ketamine) is the primary solution. The key to safety lies in the implementation of comprehensive protocols: pre-sedation evaluation, proper preparation (starvation-fasting), continuous monitoring (SpO_2, capnography) and readiness for emergency intervention. The ASA, ESA and AAP–AAPD guidelines clearly recommend that sedation be performed by a professional team with resuscitation facilities available.

We recommend that local centers adopt these standards: establishing sedation teams and training staff, monitoring performance statistics (evaluating incomplete scans, incidents), and regularly updating procedures. Encouraging the introduction of minimally invasive strategies (e.g., guiding through the procedure without medication,

especially in mature patients), and educating families about the importance of fasting and post-procedural instructions, may further reduce risks and complications.

Looking ahead, research should include comparative studies of different sedatives (newer selective sedatives such as remimazolam or adrenergic antagonists), as well as long-term outcomes of repeated sedation in children. Current knowledge supports the conclusion that with proper use of sedation/anesthesia, CT examinations can be safe and effective, with minimal adverse effects.

LITERATURE

1. Karunanithy N, Howell L, Walsh M, editors Sedation, analgesia and anesthesia in radiology . 3rd ed. London: Royal College of Radiologists; in 2024
2. Gupta A, Sen I, Bhardwaj N, et al. Prospective audit of sedation/anesthesia practices for children undergoing computerized tomography in a tertiary care institute. J Anaesthesiol Clin Pharmacol . 2020;36(2):156–161. doi:10.4103/joacp.JOACP_16_19. (Study of sedation success in children; reports 95.8% successful sedation for CT, 5.5% adverse events.)
3. Zhao Q, Meng F, Han H, Han L. Meta-analysis of dexmedetomidine vs. propofol for sedation in pediatric/elderly CT and MRI: onset and recovery. Biomed Pap Med Fac Univ Palacky Olomouc . 2024;168(2):82–90. doi:10.5507/bp.2024.034.
4. Zitek T, Skidmore B, Englum B, et al. Trends in anesthesia/sedation for CT and MRI in pediatric EDs, 2012–2022. JAMA Pediatrician . 2023;177(7):715–723. doi:10.1001/jamapediatrics.2023.1837.
5. Benzoni T, Agarwal A, Cascella M. Procedural Sedation. StatPearls . 2025 Jan 1 [Internet]. (Review of general guidelines for sedation; definition of sedation levels, vital importance of proper examination before and after the procedure).
6. American Society of Anesthesiologists. Continuum of depth of sedation: Definition of general anesthesia and levels of sedation/analgesia (2004). ASA Standard . (Definitions of minimal, moderate, and deep sedation vs. general anesthesia).
7. Coté CJ, Wilson S; AAP/AAPD Guidelines Work Group. Guidelines for monitoring and management of pediatric patients before, during, and after sedation for diagnostic and therapeutic procedures. Pediatrics . 2006;118(6):2587–2602. doi:10.1542/peds.2006-2780.
8. Jung SM, Sung Ahn B, et al. Drug selection for sedation and general anesthesia in children undergoing ambulatory MRI. J Yeungnam Med Sci . 2020;37(3):159–168. doi:10.12701/yujm.2020.00171.
9. Karunanithy N, Howell L, Walsh M, et al. Sedation, analgesia and anesthesia in radiology: A review of sedation in pediatric imaging. No. J Radiol . 2012;85(1016):e260–e268.
10. Royal College of Radiologists (RCR). Safe sedation, analgesia and anesthesia provision in radiology (2013).

Print: ISSN 2232-8726
Online: ISSN 2637-3297