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Pediatric Sedation in Computed Tomography Scans

Janelle Smith

Misericordia University

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What is Computed Tomography (CT)?

- Computed Tomography utilizes ionizing radiation to obtain cross-sectional images of internal structures of the body.
- CT images provide a better visualization than typical x-ray images and oftentimes utilize the administration of iodinated contrast to highlight vessels through arterial and venous phases.

What is Pediatric Sedation?

- “Sedation is a medically controlled state of depressed consciousness or unconsciousness. The level of sedation can be categorized as per the American Society of Anesthesiologists” (Bailey et al., 2016, p. 1).
- Pediatric patients are put into a relaxing state to aid in comfort allowing for the production of diagnostic images.

Stages & Types of Pediatric Sedatives:

Table 1 Levels of sedation

	Responsiveness
Minimal sedation	Normal response to voice
Moderate sedation	Purposeful response to light touch or verbal commands
Deep sedation	Purposeful response to repeated commands or painful stimuli
General anesthesia	Unarousable

Image 1. Different stages of sedation and responsiveness to each stage are displayed within the chart (Choudhary & Boski, 2022, p. 103).

- For neonates to three months of age, oftentimes nonpharmaceutical calming mechanisms such as swaddling and comforting the patient can be utilized.
- Other mechanisms of nonpharmaceutical sedation includes audiovisual aids, toys, breathing exercises, positive reinforcement, and preparatory education (Ageel, 2024).

Risk vs. Benefit

- “A consistent anesthetic approach will often optimize interpretive results among radiologists” (Gregory & Andropoulos, 2020, p. 80107g).
- Using sedatives will prevent the need to repeat scans by relaxing pediatric patients.
- Repeating CT scans results in increased ionizing radiation doses to pediatric patients.
- Less iodinated contrast will be injected with the use of sedatives when repeat scans are not needed.
- “The practice of anesthesia generally involves the consideration and use of medication to ensure patient safety and comfort during their medically necessary procedure” (Beaulieu et al., 2024, p. 1580).

Pros & Cons of Pediatric Sedation for CT Scans

Pros:

- Easing anxiety experienced by pediatric patients due to fear of separation from parents and unfamiliar environment
- Alleviates pain
- Reduces physical discomfort
- Minimizes chances of emotional distress
- Temporary immobilization (Hermans et al., 2022).

Cons:

- Respiratory depression/hypotension
- Allergic/adverse reactions
- Prolonged recovery
- Fasting requirements
- Parental anxiety
- Monitoring requirements
- Additional costs to the overall procedure (Ageel, 2024)

Potential Side Effects

- “Cardiorespiratory depression due to hypoventilation, hypoxemia, and/or hypotension and hypothermia” (Beaulieu et al., 2024, p. 1584).
- Impair vascular tone
- Diminish pharyngeal tone (Beaulieu et al., 2024).
- Apnea
- Oxygen desaturations
- Airway obstruction
- Bradycardia & Hypotension (Michaud et al., 2023).

Parental/Guardian Consent

- National guidelines are in effect when consent is required for pediatric sedative administration.
- In India, children under the age of 18 require written & informed consent from a parent or guardian (Choudhary & Boski, 2022).
- In the United Kingdom, children who are 16 years or older & competent maintain ability to give written, verbal & informed consent (Choudhary & Boski, 2022).
- Administration route of anesthesia is to be discussed making parents & guardians aware of all potential risks and side effects.
- “In emergency situations, where the child is incompetent, & parents are not available the procedure & SAGA can be performed in the best interest of the patient” (Choudhary & Boski, 2022, p. 105).
- In the US, providing verbal communication in addition to consent forms is required from parents or legal guardians of the pediatric patient (Ageel, 2024).

Sedative Statistics for Pediatrics in CT

- The Pediatric Sedation Research Consortium (PSRC) gathered research concluding that out of 49,805 documented sedations in 2009, 10.3% were performed by anesthesiologists. This rate declined to 2.2% of pediatric sedations being completed outside of the OR by 2017 (Ageel, 2024).
- “The rate of failure of adequate image acquisition has been reported to be as low as 1 to 3% in some studies, and even frequent as 10 to 20% in others” (Choudhary & Boski, 2022, p. 102).

Administration & Monitoring Requirements

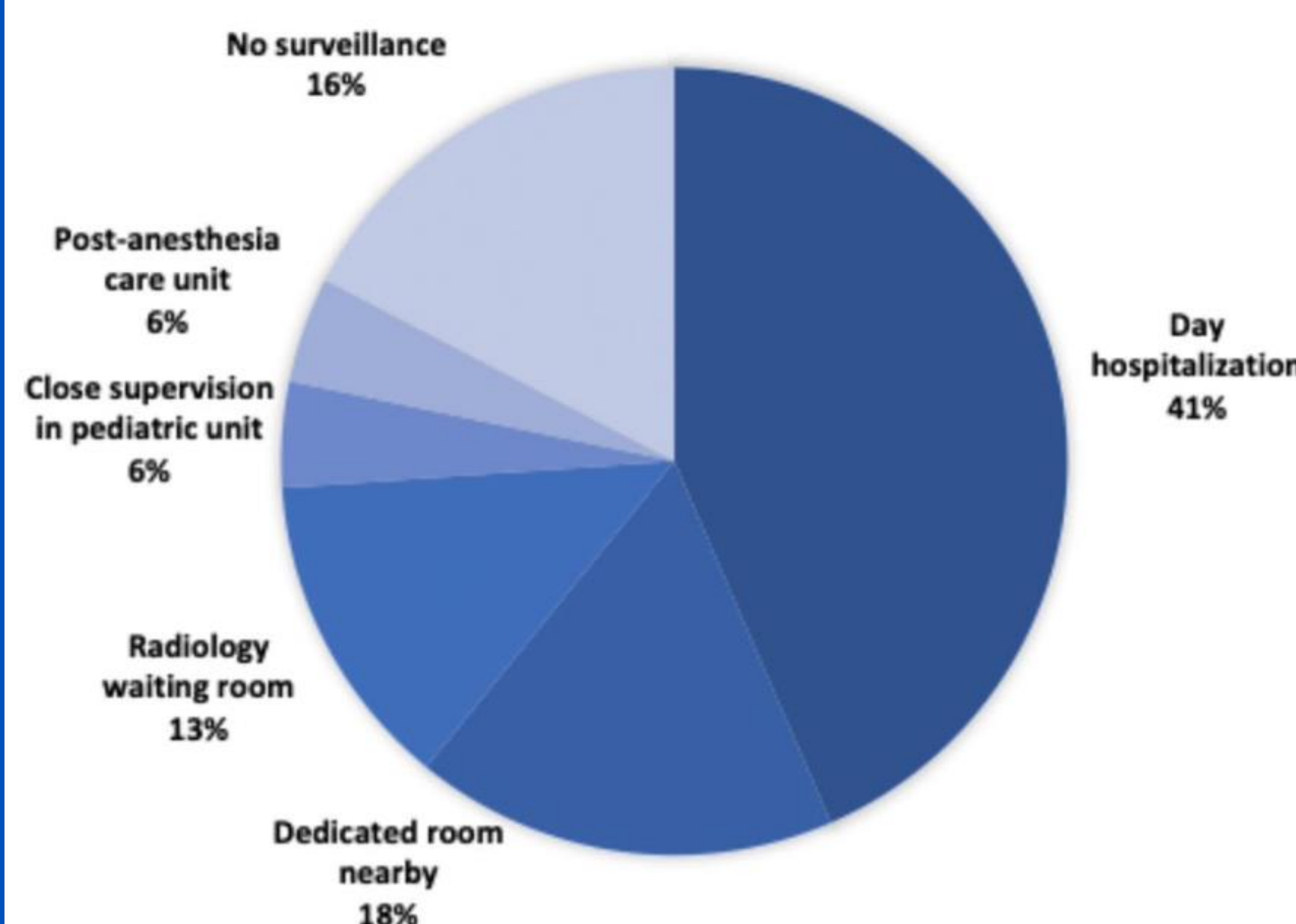


Image 2. This pie chart represents post-sedation monitoring locations (Michaud et al., 2023, p. 1672).

- “With each level of sedation, there is a decrease in the child’s response, airway protection and an increasing need for cardiovascular support” (Bailey et al., 2016, p. 1).
- Heart rate and oxygen saturation must be monitored throughout the procedure (Hermans et al., 2022).
- ECG, pulse oximetry, respiratory rate, blood pressure and pain level assessment should be maintained throughout the sedation process.

Indications & Contraindications

Indications:

- Anxiety/fear
- Involuntary movement/non-compliance
- Medical conditions

Contraindications:

- Known allergies and/or adverse reactions to sedation medications
- Hepatic & cardiac abnormalities
- Central nervous system dysfunction
- Respiratory or renal dysfunction (Hermans et al., 2022).

What does motion artifact look like on a CT image of a pediatric patient?

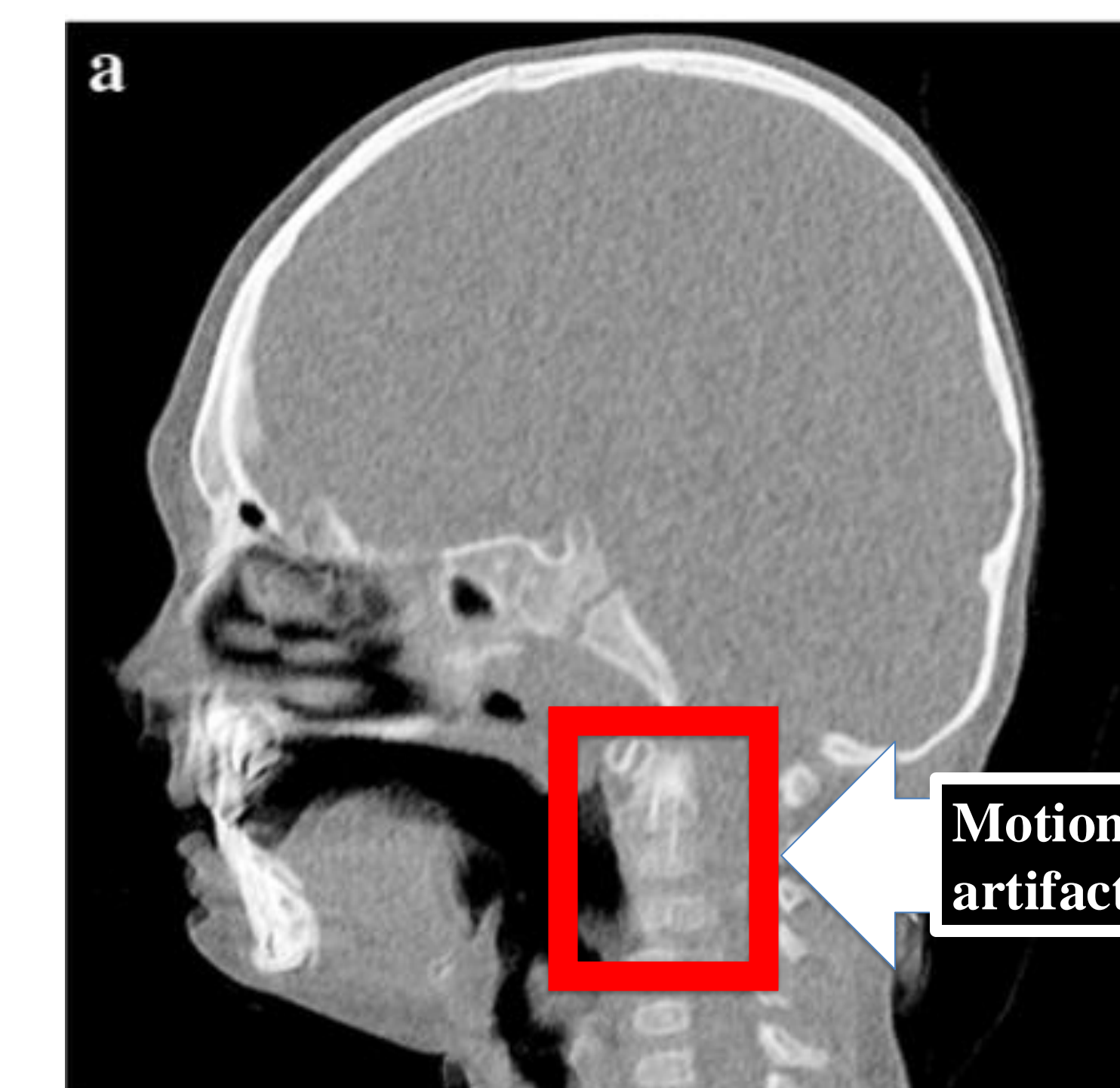


Image 3. This sagittal CT image demonstrates motion artifact of the anterior portion of the cervical spine. Motion artifact makes the diagnosis process for radiologists difficult to distinguish between abnormalities and normal findings during CT studies (Barreto et al., 2021, p. 92).

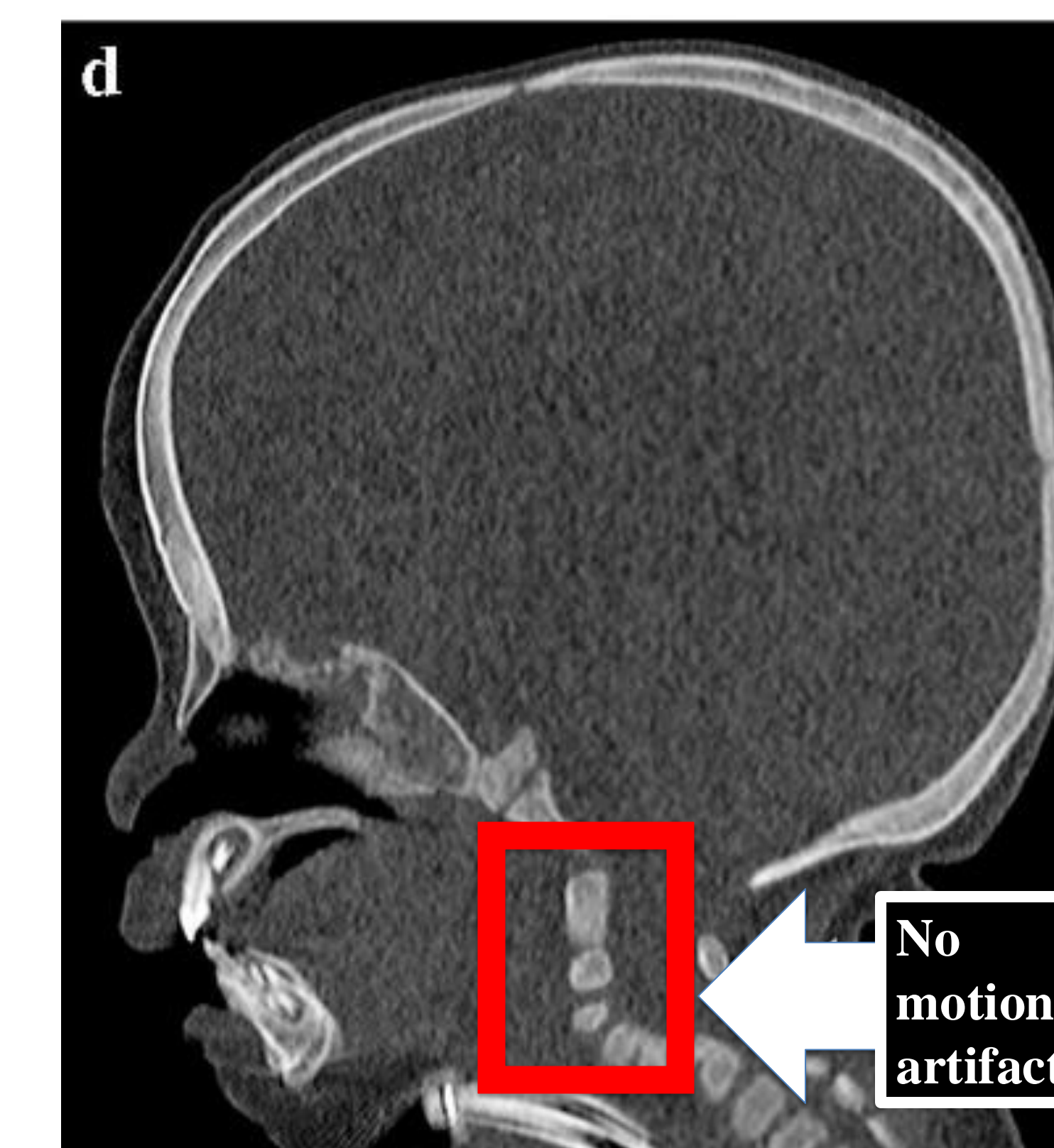


Image 4. This sagittal CT can be compared to Image 3 above. The cervical spine is demonstrated without motion artifact, allowing for a more accurate diagnosis (Barreto et al., 2021, p. 94).

Conclusion

- Although sedation for pediatric patients may seem overwhelming, when pediatric patients are in medical distress, sedation for CT scans can aid in the process of diagnosis.
- Pharmaceutical sedation may only be necessary after non-pharmaceutical sedation attempts have been exhausted.
- With proper monitoring equipment and regulations, pediatric sedation can improve image quality and reduce patient dose.
- Pediatric patients will maintain cooperation through the use of sedatives during CT scans.