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ADVANCES IN ANESTHESIA

Point-of-Care Ultrasonography in Pediatrics

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Keywords

• Point of care • Pediatric ultrasonography • Pediatric airway management • Antral imaging • Regional anesthesia • Gastric volume measurement • Aspiration

Key points

- Point-of-care ultrasonography can be used for various clinical applications in pediatric anesthesia.
- This article describes how ultrasonography is used in children for gastric imaging, peripheral regional anesthesia, and airway management.
- Antral sonography at the bedside allows for real-time assessment of gastric contents and potential risk for pulmonary aspiration.
- Point-of-care ultrasonography can also be used for established techniques of pediatric regional anesthesia.
- Lastly, sonographic imaging of the pediatric airway can determine airway management in many situations.

INTRODUCTION

The use of ultrasonography has enhanced the clinical practice of pediatric anesthesia. It is most commonly used in performing peripheral regional anesthetics and for obtaining vascular access. Advances in point-of-care (POC) ultrasonography allow pediatric anesthesiologists to complete physiologic and anatomic studies, in addition to these traditional tasks, without patient

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or practitioner exposure to radiation. After understanding the limitations of POC sonography, the clinician can use this tool to provide real-time physiologic information. This review describes its use in antral imaging to determine gastric volumes. This information can then be used to make immediate clinical decisions. Other uses of POC ultrasonography include basic anatomic visualization that is used for peripheral regional anesthesia and for determining airway anatomy for further intervention. The broad knowledge that can be obtained from POC ultrasonography makes it a valuable tool to the everyday practice of anesthesiology.

POINT-OF-CARE ULTRASONOGRAPHY FOR GASTRIC IMAGING

Pediatric patients presenting for emergency procedures requiring sedation or general anesthesia are at risk of pulmonary aspiration [1]. When it does occur, pulmonary aspiration can be associated with significant morbidity and mortality [2,3].

An at-risk stomach, defined as increased gastric volume or the presence of solid or thick liquid gastric content, can increase the risk of aspiration-related complications [4,5]. The upper limit of normal gastric fasting volume is controversial, but data suggest that up to about 1.5 mL/kg in the adult patient [6] and 1.2 mL/kg in the pediatric patient population are considered normal [7,8]. To this end, most institutions have fasting guidelines to reduce the likelihood of patients presenting with an at-risk stomach. Nevertheless, acute care specialists are faced with nebulous situations in which a patient may be at increased risk of aspiration including trauma patients presenting for surgery, patients who are in pain or are receiving opioids, patients with medical conditions such as diabetes that may delay gastric emptying, and situations in which the fasting period is unclear. In these circumstances, antral sonography may present itself as a clinically useful bedside tool to assess a patient's aspiration risk and to help guide airway or anesthetic management [9].

Previously studied methods to determine gastric content or volumes include polyethylene glycol dilution [10], scintigraphic tracing of gastric contents [11], endoscopic and blind aspiration of gastric contents [12], and MRI [13,14]. Compared with other imaging modalities, ultrasonography is readily available, highly accessible, and economical and does not expose the subject to ionizing radiation. In addition, there is a movement toward increased integration of perioperative sonography in various acute care settings with the goal to improve patient care and outcomes. For these reasons, ultrasonography has become a valuable instrument used in the assessment of aspiration risk in adults and special populations such as obstetric, obese, and pediatric patients [6,15].

Antral sonography: sonoanatomy and technique

Antral sonography can be described as a dynamic ultrasound scan in which the goal is to examine the antrum at rest between peristaltic contractions. The antrum can be identified by its 5 sonographic layers that are specific to

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