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Current perioperative care of infants with pyloric stenosis: comparison of survey results

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ABSTRACT

Background: Considerable variation in the perioperative management of infants with pyloric stenosis (PS) led the authors to undertake a survey of pediatric anesthesiologists to determine if consensus-based guidelines could be developed.

Materials and methods: Physicians who are members of the Society for Pediatric Anesthesia or the Association of Pediatric Anaesthetists of Great Britain and Ireland completed an online questionnaire through SurveyMonkey regarding current management of patients with PS.

Results: There were significant differences in the use of anticholinergic premedication, the selection of induction technique, and the use of adjuvant regional analgesia between the members of both organizations.

Conclusions: The authors recommend creating an international multiinstitutional registry to prospectively record and track perioperative management of patients with PS to facilitate the development of clinical practice guidelines.

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Introduction

Pyloric stenosis (PS) is one of the most common gastrointestinal abnormalities appearing in the first 6 months of life. The cardinal features of PS are projectile vomiting, visible peristalsis, and a hypochloremic, hypokalemic, metabolic alkalosis. Ultrasonography has permitted earlier diagnosis and treatment of PS. Therefore, clinical findings, such as visible peristalsis, as well as metabolic and electrolyte disturbances, may be less pronounced on presentation. The latter may allow for more rapid resuscitation before definitive surgery.

The obstructed pylorus and associated vomiting may increase the possibility of aspirating gastric contents during the induction of anesthesia. The overall incidence of pulmonary aspiration during the perioperative period in infants and children has been reported to vary between 1 in 2632 and 1 in

4932, respectively.^{1,2} In their review of perioperative pulmonary aspiration, Kelly and Walker³ identified bowel obstruction and a full stomach as patient risk factors for aspiration. Cook-Sather *et al.*⁴ reported an average gastric fluid volume of 4.8 mL/kg during blind gastric aspiration of patients with PS, independent of preoperative nasogastric suctioning or fasting duration. At least in theoretical terms, infants with PS should be considered to have a full stomach; therefore, a classic rapid-sequence induction (RSI) employing preoxygenation and cricoid pressure (CP) without ventilation has been recommended to secure the airway and minimize the risks of aspiration.⁵ Modifications of this approach include the use of positive-pressure ventilation with or without CP. Recently, Engelhardt⁶ has criticized the use of CP during RSI because it interferes with ventilation and intubation and offers no clear improvement in clinical outcome. On the other hand, mask

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inhalation induction preceded by careful emptying of the stomach has been used safely in several pediatric centers for patients with PS presenting for anesthetic care.⁷ However, in the absence of contraindications to RSI, the routine use of this method has been questioned, given the potential for aspiration.⁸

Further controversy may surround the choice of neuromuscular blocking agent for RSI. Conditions for endotracheal intubation in the pediatric patient are better with succinylcholine when compared with rocuronium.⁹ Although larger rocuronium doses may improve the conditions for endotracheal intubation, rocuronium may be less desirable for short surgical procedures, as prolonged neuromuscular recovery has been documented especially in newborns and small infants regardless of the dose.¹⁰

This group of patients may also be at risk for postoperative apnea that may be modified by the anesthetic agents selected for induction and maintenance.^{11,12} The use of intraoperative opioids has been associated with postoperative respiratory complications.¹³ These concerns have led to an increase in the use of non-narcotic analgesics and local or regional analgesia to supplement general anesthesia.¹⁴ Recent concerns regarding the neurodevelopmental effect of general anesthesia have led to renewed interest in regional anesthesia as a primary anesthetic approach.¹⁵ Various authors have described spinal, caudal, and epidural approaches, but these techniques have typically included deep sedation.¹⁶⁻¹⁸ The use of neuraxial anesthetic techniques without general anesthesia for pyloromyotomy is not likely to be adopted unless it has been clearly demonstrated that this would reduce the frequency or severity of neurodevelopmental changes. However, specific agents that are not associated with neuroapoptosis, such as dexmedetomidine, might be considered in conjunction with regional anesthesia, such as transverse abdominis plane blocks, should ongoing studies demonstrate significant changes in neurodevelopment after general anesthesia.

Given the limited evidence-based medicine available to guide clinical care, expert consensus would permit the development of guidelines to reduce variation in management and potentially minimize adverse outcomes in this group of patients. The present study queried members of the Society for Pediatric Anesthesia (SPA), which primarily comprised of pediatric anesthesiologists from the United States and Canada, and the Association of Pediatric Anaesthetists (APA), which primarily comprised of pediatric anesthesiologists from Great Britain and Ireland, to determine the current perioperative anesthetic management of infants presenting for pyloromyotomy.

Material and methods

After institutional review board approval, a survey was submitted to the SPA and APA for approval to distribute it to the members of each organization. Each survey was modified to meet the requirements of the research committee of each society. The final version of each survey was posted on SurveyMonkey for each organization, and the members were asked to complete the survey by direct e-mail communication

from their respective society. The separate links allowed the authors to easily identify responses from both organizations. The survey was divided into three main sections: preoperative assessment including questions about electrolyte targets, scheduling, and operative approach; intraoperative assessment including questions regarding gastric emptying, anesthesia induction, airway management, and pain management including regional anesthesia techniques; and demographic assessment including training and experience. The full text of the surveys can be viewed in the [Supplementary Material](#). Responses of the APA members were collected from 8/2014 through 12/2014 and those of the SPA members were collected from 6/2015 through 10/2015, based on differential timing of requests for revision and subsequent approval from the two societies. No reminders or follow-up surveys were sent to the members of either organization.

Induction methods were assessed using multiple-choice questionnaire in which multiple responses could be selected. These responses were recoded to characterize the predominant type of method used as RSI only, inhalation only, RSI and inhalation, or none. Induction, maintenance, and neuromuscular blocking agents were assessed using questions for which respondents were prompted to state how often they used each agent (from 0% to 100% of the time), with responses required to sum to 100%. As most practitioners reported using just one or two agents, responses to these questions were recoded to identify a primary agent (used >50% of the time), multiple agents reported with no single agent being the primary agent, or no agents reported. Data were considered missing for yes-or-no variables when neither "yes" nor "no" was selected. Data on induction, maintenance, and neuromuscular blocking agents were considered missing when no responses (percent of time using a particular agent) were provided for any of the possible choices. All other responses were considered valid. Responses were tabulated using Stata/IC 13.0 (StataCorp LP, College Station, TX).

Results

There were 586 responses from 2897 members of the SPA who had e-mail addresses on file at the time the survey was distributed (response rate 20.3%). There were 169 responses from 1087 members of the APA of Great Britain and Ireland (response rate 15.5%). [Table 1](#) compares practitioner responses by professional affiliation, with the number of non-missing responses to each item presented in the Valid N column. Members of the SPA and APA were similar on four measures of professional experience and practice setting: the number of years in practice (SPA mean = 15.6 ± 10.5 years; APA mean = 17.1 ± 8.8 years), pediatric fellowship training, an exclusive pediatric practice, and the type of practice site (a free-standing pediatric hospital, an adult facility, or a mixed pediatric and adult facility).

Members of both organizations indicated that the preoperative assessment includes routine electrolyte evaluation ([Table 1](#); SPA = 98.3% and APA = 98.8%). Responses indicated that specific electrolyte levels were used to assess the adequacy of resuscitation and readiness for the operating room by both groups (SPA = 86.2% and APA = 87.1%). The majority of

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