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REVIEW ARTICLE

Embracing change: the era for pediatric ERAS is here

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Abstract

The concept of Enhanced Recovery After Surgery (ERAS) has increasingly been embraced by our adult surgical colleagues, but has been slow to crossover to pediatric surgical subspecialties. ERAS® improves outcomes through multiple, incremental steps that act synergistically throughout the entire surgical journey. In practice, ERAS® is a strategy of perioperative management that is defined by strong implementation and ongoing adherence to a patient-focused, multidisciplinary, and multimodal approach. There are increasing numbers of surgical teams exploring ERAS® in children and there is mounting evidence that this approach may improve surgical care for children across the globe. The first World Congress in Pediatric ERAS® in 2018 has set the stage for a new era in pediatric surgical safety.

Keywords ERAS · Enhanced recovery after surgery · Care pathways · Quality and safety · Outcomes

The concept of Enhanced Recovery After Surgery (ERAS) has increasingly been embraced by our adult surgical colleagues. To date, however, the concepts of ERAS have been slow to crossover to pediatric surgical subspecialties.

On November 30th, 2018 in Richmond, Virginia, the first World Congress for Pediatric Enhanced Recovery After Surgery (ERAS®) was held, bringing together experts in standardized perioperative pediatric care from across the globe. The aim of this meeting was to set the stage for a revolution in pediatric surgical care, by forming a working group for ERAS® pediatric surgery within the ERAS® Society (www.erassociety.org).

ERAS® follows a holistic approach to the treatment of surgical patients. The origins of ERAS® are rooted in the concept that patient outcomes can be improved through the modulation of the physiologic response to surgical stress [1]. Early on, ERAS® pioneers recognized that this approach required consideration of a multitude of factors simultaneously as well as involvement of stakeholders in the patient experience to effect change in outcomes. Rather than focusing on a single intervention, ERAS® improves outcomes through multiple, incremental steps that act synergistically throughout the entire surgical journey (preoperative, intra/perioperative, and post-operative phases of care). In practice, ERAS® is a strategy of perioperative management that is defined by strong implementation and ongoing adherence to a patient-focused, multi-disciplinary, and multimodal approach. This requires a team-based culture that includes not only those who directly care for a patient, but also the patients themselves, who are active participants in the process, not simply passive recipient of care.

The impact of ERAS® on patient outcomes has been considerable. Guidelines from the ERAS® Society were first established in adult colorectal surgery and have since expanded into multiple areas of surgery including

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gynecology, orthopedic surgery, and cardiac surgery [2]. Some of the earliest benefits observed with ERAS® were shortened length of stay (LOS) and reduced cost through early mobilization, early feeding and early discharge [3]. Further development and study of these guidelines has shown improved outcomes in mortality and multiple measures of morbidity as well as improved patient and care-giver satisfaction [4] and cost savings [5].

For an approach that has been transformative in surgical care for adults, the impact ERAS® has made in pediatric surgery has been surprisingly limited. A literature review by Shinnick et al. in 2016 demonstrated that there were, at that time, only a small number of studies examining the impact of ERAS® protocols in children. Despite adoption of only a few ERAS® elements, these studies showed its benefits in reducing length of stay and decreasing use of narcotics [6].

Determining which outcomes are most important for pediatric surgical patients and which are most amenable to study require careful consideration when creating ERAS® Society guidelines for children. All recommendations within ERAS® guidelines directly or indirectly address key, measurable outcomes. Most pediatric surgical patients are healthy with few comorbidities. Mortality is difficult to study in this population when perioperative death is rare; morbidity is easier to measure. Infectious complications are some of the most common and important adverse events effecting these patients [7]. Infections are captured in many of the quality improvement databases (i.e., the National Surgical Quality Improvement Program, NSQIP), although a common nomenclature is required when comparing outcomes across countries and databases. LOS is also easily measured, and can be improved upon relatively quickly. However, LOS is a complicated outcome, impacted by multiple different contributors including comorbidities, social factors, and care pathways. Additional outcomes that are easily overlooked, but have great importance include those related to parent, patient, and team-member satisfaction. These outcomes are important in their own right. In addition, buy-into a care pathway allows for the optimal introduction and acceptance of best practices and allows for integration of new evidence-based care practices, as they evolve [8].

Without a doubt, implementing ERAS® requires a shift in culture that is based on collaboration, not traditional silos of care. Resistance to adopting ERAS® from pediatric surgeons and anesthesiologists often hinges on the perceived impact of ERAS® on operating room efficiency and the uncertain merit of individual elements for children such as fasting guidelines [9, 10]. There is also a widespread belief that the value of guidelines, checklists, and other tools is limited in a population that, on the whole, is healthy and has a low risk of adverse events [11]. Many clinicians believe that evidence-based practices are already widely adopted, that they are "already doing ERAS® protocols", and that many guidelines are redundant [12]. And yet, best practices are not always followed, and medical errors and adverse events do occur in the pediatric population at a rate that is higher than it should be [7, 13–15]. The rates of adverse events in the population of hospitalized Canadian children have been measured at close to 10% with the highest rates seen in surgical patients [16]. Neonates are at particularly high risk with rates of surgical site infections reported as high as 13.5% [17, 18]. The morbidity associated with these infections is reflected in a length of stay for these infants that is three times longer than the stay of their uninfected counterparts [17].

Adolescents, children, and infants all have unique issues that must be addressed in surgical care pathways. Physiologically, neonates encounter considerable challenges when exposed to operative stress; their immune systems are immature, their circulation is transitioning from the intrauterine to the extrauterine state, their thermoregulation is depressed and their respiratory systems may be underdeveloped, among numerous other physiologic challenges [19–21]. In addition, the energy requirements for growth and neurodevelopment must compete with those of healing, making nutritional management complex [22, 23]. Physiologic concerns impact children at all the stages of development, and change throughout childhood and adolescence.

Pediatric surgical care is as complex sociologically, as it is physiologically, with evolving patient participation and a key role assumed by parents as advocates and decision makers. Parents are often very supportive of guidelines and practices that include parent involvement [24]. However, ERAS® guidelines put additional pressures on parents. Increased protocol complexity before and after surgery that increasingly shifts care out of hospital can become a challenging parent and patient responsibility [24]. Older children and adolescents require a nuanced approach to communication and decision-making. As children age and mature, they are increasingly able to understand and participate in care decisions and, eventually, assume autonomous decision-making [25]. The evolving needs of children and their families in the implementation of care pathways must be carefully considered [25].

There is good reason to believe that children will benefit from ERAS®, as has been shown in the few studies that have explored this topic [6]. There is also good reason to believe that some aspects of pediatric ERAS® guidelines may be different from those of adults, both in terms of content and the mechanism through which these guidelines are used [21].

ERAS® or ERAS®-like guidelines have been developed within a number of pediatric specialties and many traditional ERAS elements have been adopted from adult guidelines especially for adolescents. The majority of these guidelines have been created specifically for single sites [26, 27]. Following a multi-disciplinary American Academy of Pediatrics symposium in 2017, a multi-center working group was organized by Raval et al. and has taken a broader view,

created a colorectal guideline designed for staggered adoption at 18 sites across the United States [12]. To create this guideline, an expert group of pediatric surgeons assessed existing colorectal ERAS® Society guideline elements and performed an evidence—review of controversial practice. This group eventually agreed that 14 out of 21 elements should be adopted for an adolescent colorectal care pathway [12]. Although the resulting ERAS® guideline was remarkably similar to existing adult ERAS® Society guidelines, the implementation strategy identified some key differences required to make the guideline work for adolescent patients. The focus on shared parent and patient decision-making resulted in a protocol that would be embraced by a patient population that increasingly assumes responsibility for its own care [28]. Similar approaches to adaption of adult ERAS® protocols for use in pediatric patients have been undertaken with considerable success for scoliosis surgery and urogenital reconstruction, and many others [27, 29, 30].

Neonatal ERAS®, however, has required a different approach to guideline creation due to the dramatic differences in physiology and unique qualities of the care teams involved. Gibb et al. developed a protocol for ERAS® guideline creation that has resulted in a neonatal ERAS guideline for intestinal resection surgery [21]. Using the ERAS® Society framework, new elements were developed addressing neonatal needs in the preoperative, intraoperative, and post-operative periods. This process resulted in a guideline that in some ways looks familiar, but in other ways, is dramatically different. The Neonatal ERAS® guideline contains new elements encouraging the early introduction of breast milk, urinary sodium monitoring and mucous fistula feeding for patients with stomas as well as limiting unnecessary antibiotics, and optimizing hemoglobin management, as well as numerous other unique recommendations [21]. The development of this first Neonatal ERAS® guideline opens the door for future care pathways targeting this population.

Through the process of creating ERAS® Society guidelines for children, we recognize how much remains to be learned about optimal pediatric surgical care. There are numerous practices for which the data are sparse or of poor quality (e.g., the duration and timing of perioperative antibiotics, the use of post-operative urinary catheters, and bowel preparation prior to surgery) [21, 28]. Extrapolation from adult data can be undertaken for numerous ERAS® elements (e.g., timing of preoperative antibiotics). However, there are other practices for which it is clear that better data are needed to make recommendations for care practices (e.g., which preoperative prep solution is best for neonates), or unique patient populations that may require different approaches (anorectal malformations and motility patients). The lack of high-quality evidence can lead to a lack of buy-in from key stakeholders and rejection of guidelines. The end result is a situation that is characterized by numerous, idiosyncratic, and variable approaches to surgical care. And yet, we have seen time and time again that care pathways can decrease unwanted variability and improve outcomes for both children and adults [2, 31, 32]. Guidelines also help us focus our attention on where there is a need for new evidence.

Several groups across the globe have already taken part in the creation and adoption of guidelines and standards that tackle aspects of pediatric surgical care outside of an ERAS® process. The Euroconsortium and the Canadian Congenital Diaphragmatic Hernia (CDH) Collaborative have both made evidence-based recommendations regarding the care of infants with CDH) [33, 34]. Similarly, APSA has created guidelines for pectus carinatum deformities as well as other pediatric surgical conditions [35], and standards for the provision of pediatric surgical care have been published by groups including the Royal College of Surgeons in the United Kingdom [36]. These are just some examples of the world-wide readiness for ERAS®. The potential global impact of pediatric ERAS® can extend to address some of the specific concerns encountered in low- and middle-income countries.

At the first ERAS® Society Pediatric World Congress in Richmond, a working group of clinicians and investigators from across the world formed the first Pediatric ERAS® Society Committee, and laid the strategic foundations to guide the development of Pediatric ERAS. There are key areas, where ERAS® protocols have been developed, or could easily be created. Beyond this, the Pediatric ERAS® Society Committee will start to tackle recommendations and principles that hold true across the broad scope of pediatric surgical care. There is incredible potential for ERAS® to improve surgical care for children across the globe. November 30th, 2018 was a first step towards a new era in ERAS® as well a new era for pediatric surgical patients, their families, and the teams that care for them.

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Compliance with ethical standards

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Human and animal rights Although prior studies are referenced, this article does not contain any studies with human participants performed by any of the authors.

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