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Enhanced recovery in children: how could we go further?

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The concept of enhanced recovery after surgery (ERAS) has been established in adult surgery since the 1990s, starting with Kehlet's studies on colorectal surgery. ERAS is based on the premise that patient postoperative outcome can be improved through the modulation of the physiological response to surgical stress. This multimodal approach begins in the preoperative period and continues both intraoperatively and postoperatively in the form of an overall rehabilitation plan. Since then, the majority of adult surgical specialties have set up ERAS guidelines. Nevertheless, the scientific literature on pediatric ERAS has not followed the same dynamic. The question of how to go further in pediatric ERAS therefore should be considered. It is likely that part of the answer lies in the peculiarities of pediatrics. To enable the development of an ambitious pediatric ERAS, a collaborative and multidisciplinary effort involving clinicians, parents and their children must be implemented.

ERAS is a multidisciplinary approach to patient management in the perioperative period aimed at the rapid recovery ad integrum of the patient's functional condition. Initially described for colorectal surgery,[1] the benefits of ERAS are now well demonstrated in several surgical specialties for adults.[2] The application of ERAS guidelines is the key to reduce hospital length of stay and cost through early mobilization, early feeding and early discharge.[3] The implementation of ERAS in adults is a success, but this is not yet the case in pediatric surgery. The existing literature on pediatric ERAS is limited. Only five studies were included in a recent literature review.[4] Among those studies, only 5.6 rehabilitation elements against 23.8 in the adult papers were found in the rehabilitation protocols. Kehlet insisted on the fact that all patients should be included in ERAS pathway.[5] However, most pediatric ERAS studies have focused on healthy patient populations.[6] While many studies have shown benefits following the implementation of ERAS in pediatric surgery, these studies do not provide a high level of evidence. In the first studies published evaluating fast-track rehabilitation protocol in children, control groups were constituted from national databases.[7] More recent studies compared data before and after the implementation of an enhanced recovery program within a unique institution. Indeed, a study recently applied an 18-point ERAS program for colorectal pediatric elective surgery.[8] Thanks to the ERAS protocol, the median number of assisted recovery procedures received per patient increased from 5 to 11, while the median length of stay significantly decreased from 5 to 3 days. If the results of the few studies published thus far on pediatric ERAS are encouraging,[9–11] the question arises how could we go further in pediatric ERAS? The answer can be found within the peculiarities of pediatric surgery: (1) the predominance of outpatient surgery, (2) the low postoperative mortality rate, (3) the wide variety of populations ranging from newborns to young adults, as well as (4) the role of parents and child psychology in the success of this type of programs. This is why pediatric ERAS guideline development and implementation require collaborative and multidisciplinary work.

Establishing which outcomes are the most pertinent for pediatric surgical patients and which are most amenable to study requires careful consideration.[12] More than 80% of surgical children are indeed outpatients and their rate of unexpected admission is less than 1%.[13] That is why the large majority of pediatric surgeries concern outpatient surgeries in healthy patients. So the original impetus by Kehlet of discharging surgical patients home early cannot be achieved overall for all pediatric patients because relatively few of them are hospitalized.[14] How ERAS might be considered in the outpatient population is likely very different from other pediatric populations that are currently being managed with ERAS, such as colorectal adolescent patients, urology patients, craniofacial reconstruction patients

and neonatal patients. The objectives of ERAS in these two populations are different. In outpatient surgery, the focus should rather be centered on postoperative nausea and vomiting, as it is the case for adenotonsillectomy,[15] pain assessment and satisfaction of parents, patients and team members. Although it is regularly considered in the adult literature, mortality is of little interest in children because it is fortunately a rare event.[16] In addition, while the medical complications encountered in adults are extremely rare in children, this is not the case for surgical complications. These complications are mainly infections[17] or the consequences of bleeding at the surgical site. These complications need to be detected and treated quickly to avoid any increased morbidity for the patient. For example, neonates are at high risk of surgical site infections with a reported rate as high as 13.5%.[18] One of the main features of the pediatric ERAS is the need to adapt recovery programs to physiological and pathophysiological peculiarities of the different age groups. The most obvious example is neonatal surgery.[19] Newborns encounter considerable challenges: thermoregulation,[20] as well as cardiovascular[21] and respiratory systems. This is the reason for creating ERAS guidelines for neonatal intestinal surgery patients.[22] While it is necessary to take into account the physiological peculiarities, it is also important to take into account the psychological peculiarities of children, as we know how patient adherence is important in ERAS.[23] In addition, there is another major difference between pediatric and adult ERAS, which is the role of parents. Parents are relevant partners in the implementation of ERAS program and their active collaboration is a key contributor to young children's adherence and ERAS success. Furthermore, the limits of parents' roles in the postoperative period as caregivers need to be clearly defined. The development of pediatric outpatient surgery has already shifted the responsibility for analgesia management, refeeding and detecting postoperative surgical complications on the shoulders of parents. Parents must therefore be accompanied beyond the hospital gates if one wishes to offer efficient and safe pediatric ERAS. To succeed, various actions need to be implemented. First, the prior acceptance by parents of the principle of pediatric ERAS. Indeed, being involved in the care of their own child can be a source of anxiety for some parents. If parents agree to be involved in their child's rehabilitation, they will need to be given some nursing education before discharge. Education should enable them to detect whether something wrong is happening in the postoperative period. Parents should be able to contact immediately experienced nursing staff who can act as a liaison with the medical-surgical team. Many studies have explored parents' involvement in the care of their children, including after early discharges. For example, safety and parental satisfaction with early discharge of preterm infants on nasogastric tube feeding and outpatient clinic follow-up was evaluated.[24] One hundred and nineteen preterm infants were discharged on nasogastric tube feeding from a tertiary care neonatal unit. Parental satisfaction was evaluated by a standardized questionnaire. Early discharge of preterm infants with nasogastric tube feeding together with outpatient clinic follow-up was very well accepted by parents and appears to be safe. This kind of study confirms that parents have a key role to play in the success of the pediatric ERAS.

The successful implementation of pediatric ERAS must therefore take into account the peculiarities of pediatrics. This is probably the reason why its implementation is slower than in adults. Taking up such a challenge tomorrow will require multidisciplinary efforts by involving pediatricians and surgeons during perioperative stages. One of the best examples of the elaboration of guidelines is embodied by Short's studies. In a first report,[25] 257 surgeons completed a survey rating their willingness to implement 21 adult ERAS elements in the case of an adolescent undergoing elective colorectal surgery. Seven elements remained controversial: bowel preparation, prolonged perioperative fasting, thromboprophylaxis, standardized anesthetic protocols including regional anesthesia, routine nasogastric tube, a zero-fluid balance model to guide postoperative management and tight glycemic control with insulin in the intensive care unit setting. Then, a 16-member multidisciplinary expert panel, which included surgeons, gastroenterologists, anesthesiologists, nursing and patient/family representatives, was constituted.[26] A modified Delphi process including extensive literature review, iterative rounds of surveys, and expert panel discussions was used to establish ERAS elements that would be appropriate for children. In final, five of the seven controversial elements were appropriate for inclusion in a pediatric ERAS protocol. This method allowed definition of an appropriate ambitious ERAS protocol including 19 elements for use in adolescents undergoing elective intestinal surgery. Consequently, a prospective implementation study of this protocol is currently underway in 18 hospitals (Clinical Trials number NCT04060303). Thanks to similar studies, the scientific literature on pediatric ERAS will be able to catch up with the adult literature. Indeed, many adult ERAS elements can be and already are safely implemented in children outside of an official ERAS protocol,[27] while some elements remain controversial. Some groups are calling for randomized controlled trials to fill the lack of evidence pertaining to the use of certain elements in children.[4 28] Having access to randomized controlled studies for each element of the pediatric ERAS would be ideal. Nevertheless, it is a costly and time-consuming approach. The type of multidisciplinary work proposed by Short is probably an effective way of quickly setting up ERAS guidelines while subscribing to the imperatives of a strong scientific method thanks to the constitution of a panel of experts. These two visions of pediatric ERAS research are not antinomic and can be carried out in parallel, for example, by conducting randomized controlled studies on recovery elements that would have been rejected by the expert panel.

To conclude, even if the adult literature has already provided convincing evidence that the implementation of ERAS is feasible, pediatric ERAS has not developed as fast as adult ERAS. Although some studies have focused on pediatric ERAS, well-designed quality improvement pediatric ERAS multicentric prospective studies using predefined protocols and patient-centered outcomes are lacking. Only a multidisciplinary collaborative approach among anesthesiologists, surgeons, practitioners, parents and children will make it possible to carry out enhanced recovery protocols adapted to each category of pediatric population in order to build up a strong scientific literature.

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