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Current concepts in the management of inguinal hernia and hydrocele in pediatric patients in laparoscopic era

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ABSTRACT

The surgical repair of inguinal hernia and hydrocele is one of the most common operations performed in pediatric surgery practice. This article reviews current concepts in the management of inguinal hernia and hydrocele based on the recent literature and the authors' experience. We describe the principles of clinical assessment and anesthetic management of children undergoing repair of inguinal hernia, underlining the differences between an inguinal approach and minimally invasive surgery (MIS). Other points discussed include the current management of particular aspects of these pathologies such as bilateral hernias; contralateral patency of the peritoneal processus vaginalis; hernias in premature infants; direct, femoral, and other rare hernias; and the management of incarcerated or recurrent hernias. In addition, the authors discuss the role of laparoscopy in the surgical treatment of an inguinal hernia and hydrocele, emphasizing that the current use of MIS in pediatric patients has completely changed the management of pediatric inguinal hernias.

Introduction

A surgical intervention for inguinal hernia (IH) and hydrocele is one of the most common operations performed in children.[1] Inguinal hernia and hydrocele have a common etiology,[2] and the surgical correction of both pathologies is similar.[3] The advent of minimal access techniques has changed conventional management for the treatment of inguinal hernia in particular.[4,5] The incidence of inguinal hernia in children less than 18 years of age ranges from 0.8%–4.4%.[6] About 85% of children with an inguinal hernia present with a unilateral hernia. The incidence of incarceration in untreated hernias in infants and young children varies between 6% and 18%, but it increases to approximately 30% in infancy.[7]

Bilateral inguinal hernia is significantly more common in younger patients with an incidence of about 50% in children younger than 1 year.[8] In patients undergoing unilateral hernia repair, there is a 5%–20% chance that a hernia will develop on the contralateral side requiring a second operation and anesthesia for repair.[8,9] In the pediatric population, the traditional inguinal approach is an excellent method for hernia repair.[10] However, there is a potential risk of injury to the spermatic cord and vas deferens, hematoma, wound infection, iatrogenic cryptorchidism, testicular atrophy, and recurrence of the hernia.[11,12]

Laparoscopic inguinal hernia repair (LH) in children was introduced as an alternative to conventional open hernia repair (OH). It was first described by Montupet in 1993.[13,14] Many technical variations have been described for LH repair,[15] and can be categorized as either intracorporeal or extracorporeal/percutaneous. Montupet initially described the technique of intracorporeal repair, consisting of a purse-string suture in the peri-orificial peritoneum at the level of the internal ring.[4,14] Schier[13] introduced his technique, consisting of an “N”-shaped suture on the peri-orificial peritoneum. Becmeur et al.[16] described laparoscopic division and resection of the hernia sac at the level of the internal ring, with subsequent closure of the peritoneal edges. The extracorporeal techniques all involve the placement of a suture circumferentially around the internal ring and tying the knot using percutaneous techniques.[17]

Many variations of this approach have been described. Recently, Ostlie and Ponsky reviewed the literature,[4] and stated that there was insufficient evidence to support one approach over another.

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However, the addition of the peritoneal incision intentionally created at the level of the internal inguinal ring, as reported by Esposito,[18] seems to result in a more durable repair.

The proposed advantages of the laparoscopic technique include visualization of contralateral defects, identification of less common (direct and femoral) hernias, diminished postoperative pain, improved cosmesis, more rapid return to normal function, and a lower rate of complications (particularly in infants and complex cases). Potential disadvantages include possible increase in length of operative time and costs, learning curves, and the need of orotracheal intubation for anesthesia.[14] The indications for, and contraindications to LH are controversial and the superiority of LH versus OH continues to be debated.[19,20] This article aims to evaluate current concepts in the management of inguinal hernia and hydrocele in an era of minimally invasive surgery.

Diagnosis

The diagnosis of inguinal hernia is clinical. In general, patients with hernia are adequately assessed by history and physical examination.[1] Their history often reveals the sudden, intermittent appearance of a bulge in the inguinal region or in the scrotum during diaper change or after bathing. Bulging is also usually seen during crying or with defecation.[21] In cases of incarcerated hernia, an intestinal obstruction may be present, with vomiting and an abdominal distention. If the hernia is incarcerated at the time of examination, a mass is usually palpated in the inguinal region[22] (Figure 1). In girls, a small mobile mass often appears in the groin or labia, which usually represents an ovary.[23] The differential diagnosis of hernia from a hydrocele is important. In case of hydrocele, there is a painless swelling within the scrotum. It is larger in the evening than in the morning. Clinical examination reveals a fluctuant painless swelling, which may or may not be reducible. Transillumination reveals a fluid-filled scrotum that may be bilateral, particularly in infants[24] (Figure 2).

Anesthesia

The majority of infants and children undergoing surgical treatment of hydrocele and hernia require pre-anesthetic medication and general anesthesia.[25] Separation anxiety can be quite significant, and many factors (genetic, personality, previous experience, and parenteral anxiety) may influence its severity. Pre-anesthetic tranquilizing medications include the benzodiazepines and other agents. Oral midazolam is a common pre-anesthetic medication, with dose ranges of 0.25–1.0 mg/kg. Upon arrival to the operating room pulse oximetry, heart rate, and non-invasive arterial blood pressure are monitored. Anesthesia is induced with sevoflurane 8% in oxygen 6 L/min via face mask. Sevoflurane is currently one of the volatile agents of choice in pediatric anesthesia for inhalation induction. It is suitable because it has a pleasant smell, does not irritate the airways and its blood-gas partition coefficient is slightly greater than that of desflurane or nitrous oxide. Vascular access is obtained (22 or 24-gauge IV) after loss of the eyelash reflex, and opioid is given to maintain a suitable depth of anesthesia.

Fig. 1. An incarcerated hernia appears as an irreducible mass in the inguinal region.

Fig. 2. Transillumination reveals a fluid-filled scrotum and confirms the diagnosis of hydrocele.

Airway management using a laryngeal mask or endotracheal tube are both acceptable alternatives.[26] The relative ease of insertion and lower rate of airway complications compared to endotracheal intubation makes laryngeal mask use a logical choice, but an endotracheal tube is the safest strategy for the patient with a full stomach, an irreducible inguinal hernia, and for laparoscopic surgery.

Anesthetics produce dose-dependent and drug-specific changes in respiratory mechanics and in the central control of the respiratory center. Inhaled anesthetics decrease muscle tone within the airways, chest wall and diaphragm, in addition to inhibiting central respiratory drive and responsiveness to ventilatory stimulants such as carbon dioxide. Intravenous anesthetics may also alter respiratory function, while opioids produce a dose-dependent depression of medullary respiratory centers, also resulting in decreased responsiveness to partial pressure of carbon dioxide ($PaCO_2$). For these reasons, regional anesthesia is often used in combination with general anesthesia for pediatric surgery and has been shown to reduce general anesthetic requirements, opioid use, postoperative nausea and vomiting and pain.[27,28]

Pain is a major concern in patient recovery. By providing optimal pain management, providers can improve patient and parent satisfaction, mobility, compliance, hemodynamic alterations from stress responses, and potentially even wound healing. Regional anesthesia is often used to supplement general anesthesia and provide postoperative analgesia. The most common forms used are regional nerve block or caudal anesthesia performed after the induction of general anesthesia.[29] Local anesthetic for regional nerve block after herniorrhaphy is introduced at a puncture site 1-cm medial to the anterior superior iliac spine. Because the nerves most commonly run below the external oblique, the needle is advanced until a “click” is felt as the needle passes through the external oblique and the local anesthetic is injected. Caudal block is performed by injecting local anesthetic into the epidural space via the sacral hiatus. Standard dosing provides neuraxial blockade of sensory input at and below the T10/umbilical dermatome.[30]