The contribution of intraoperative transinguinal laparoscopic examination of the contralateral side to the repair of inguinal hernias in children

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Background: **Bilateral inguinal hernias are relatively common in children. This fact has led to a controversy of more than 50 years concerning the necessity of bilateral surgical exploration during the repair of unilateral inguinal hernias in children. The advent of transinguinal laparoscopic visualization of the contralateral side is a turning point and a major contribution to the subject, offering the opportunity to reassess the systematic bilateral exploration and the "wait and see" policies currently in use at most services of pediatric surgery.**

Data sources: **The current information concerning intraoperative transinguinal laparoscopic evaluation of inguinal hernias in children was summarized in a didactic way. A MEDLINE search (PubMed) from 1995 to the present days was conducted.**

Results: **A patent processus vaginalis (PPV) is not equal to a future symptomatic hernia. There is still no definitive evidence on which PPVs will become a hernia (5.8% to 11.6%) and which remain clinically insignificant. Diagnostic intraoperative transinguinal laparoscopic evaluation of the contralateral side is today the most simple and accurate way to reduce the incidence of negative explorations.**

Conclusion: **Diagnostic intraoperative transinguinal laparoscopic evaluation of the contralateral side during pediatric inguinal hernia repair is a simple, accurate, fast, and effective method to assess the contralateral processus vaginalis, improving decision-making, reducing the number of negative explorations, and sparing the surgeon the embarrassment associated with the appearance of a metachronous hernia at a later date. It is easily learned and should be part of every pediatric surgeon's practice.**

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***Key words*: bilateral exploration;**
inguinal hernia;
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Introduction

Bilateral inguinal hernias are relatively common in children, with a frequency of 0.8% to 4.4%, higher in the first year of life, with a peak in the first month. This fact, backed by the strong influence of some prominent pediatric surgeons, led to a controversy lasting nearly 50 years concerning the necessity of bilateral surgical exploration during the repair of unilateral inguinal hernias in children. The advent of laparoscopic visualization of the contralateral side is a turning point and a major contribution to the subject. This review summarizes the current information concerning intraoperative transinguinal laparoscopic examination of the contralateral inguinal ring during inguinal hernia repair in children, suggesting a reassessment of systematic bilateral exploration and the "wait and see" policies currently in use at many services of pediatric surgery around the world.

Surgical exploration of the contralateral groin in children with unilateral inguinal hernias

Rothemberg and Barnet, as far back as 1955, reported their personal experience in the treatment of inguinal hernias in children. All infants under 1 year of age and 65.8% of children over 1 year of age were found to have hernias on both sides during exploration. Their conclusion was that bilateral exploration should be performed.[1] Minton and Clatworthy[2] reported in 1961 a series of 600 children who underwent bilateral operation for an

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obvious unilateral inguinal hernia and in whom a patent processus vaginalis (PPV) was found on the contralateral side in 59.3% of children from birth to 16 years of age. The incidence was 77% in the first 3 months of life. They found bilateral exploration justified if the surgery could be expeditiously accomplished. Sparkman[3] reviewed the pros and cons of exploring the contralateral side in 1962, concluding that it should be the surgeon's choice to either accept or reject the policy of routine exploration. McVay[4] in 1965 was the first to question the routine bilateral exploration of inguinal hernias. He found the incidence of bilateral hernias to be only 18%, not justifying exploration of the contralateral side. Many years later, McGregor and the same McVay reviewed their 32-year span experience in the treatment of infant hernias, finding bilateral exploration not justified for two reasons: first, a number of unnecessary procedures would be performed; and second, the risk of bilateral testicular trauma would be too great.[5] In 1993, Surana and Puri[6] reviewed 551 patients who underwent unilateral inguinal herniotomy and found that only 9.8% of them subsequently developed a contralateral hernia, making their case against routine contralateral exploration.

Classical indications for contralateral exploration include children less than 1 year of age, girls with left inguinal hernia and children with ventriculoperitoneal shunts, peritoneal dyalysis or ascitis. The first indication is changing as the result of a new policy due to transinguinal laparoscopic examination (TIL) of the contralateral side during repair of inguinal hernias in children. The most efficient approach to the problem of systematic bilateral exploration would be to define a patient group with high risk for metachronous hernias (MHs) and then apply diagnostic tests or TIL to that group of patients. If the surgeon does not believe in this more selective approach to the asymptomatic side, then closer follow-up would be justified. We have been through all the different approaches of the last decade and came to the conclusion that a long standing controversy does not justify a "wait and see" approach to the problem. Advantages of contralateral examination include detection of a "subclinical" hernia and hence potential reduction of complications, a decrease in the number of operations required and alleviation of parental anxiety. Avoiding the risk of injury to the contralateral spermatic cord structures and the relatively low risk of a MH are the main advantages to limiting the repair to only the symptomatic side. Systematic bilateral exploration and the "wait and see" policies have their price. The controversy and the therapeutic options are still open, but the laparoscopic evaluation of the other side at least gives you the opportunity to "see" the contralateral side and make decisions based on what you see and in what your personal experience tells you. It brings you down from a more philosophical to a more practical decision, a better decision based on surgical experience. Transinguinal diagnostic laparoscopy is a feasible and easy technique in children, with a minimal complication risk. We suggest its use as the most reliable method for the evaluation of the contralateral inguinal region in children when repairing inguinal hernias.

The largest cohort study in the literature,[7] a retrospective study of 6302 patients presenting with inguinal hernia to a single surgeon's practice over 35 years, concluded that as the overall rate of MHs in children is low (5.2%) and the risk of incarceration is 0.7%, they do not advocate routine contralateral exploration. They also found that a primary left-sided hernia is associated with two-fold increased odds of developing a contralateral hernia, with a median time of 1 year. Therefore, this higher risk population should receive a closer follow-up over this period. They agreed with Burd et al[8] in that patients at "low" risk for MHs are appropriate candidates for a "wait and see" approach, while those at "high" risk for MHs would benefit from laparoscopic exploration of the contralateral side.[9] Looking at the subject from yet another angle, the important parental perspective regarding the controversial issue discussed here was reported by Holcomb et al[10] in 2004. When presented all the different options regarding management of a unilateral inguinal hernia, parents preferred laparoscopic examination and repair of the contralateral region, if needed, more for convenience than for concerns about a second procedure and anesthesia. A complete and fascinating historical overview on the treatment of pediatric inguinal hernias was reported by Rathauser[11] in 1985.

Potential complications associated with routine exploration of the contralateral groin

Routine exploration of the contralateral groin when performing inguinal hernia repair in children presents a 1.6% risk of vessel injury. Other potential complications include testicular atrophy (1%-2%), decreased testicular size (2.7%-13%), testicular malposition, and wound infection. The vulnerability of the vas deferens, the most important issue when assessing the validity of contralateral exploration of unilateral inguinal hernias in children, was assessed experimentally by Shandling and Janik.[12] They found that even finger compression of the vas deferens for 30 seconds can cause variable inflammatory reactions and potential secondary obstruction, not only grasping or clamping with a hemostat, as usually believed. They revealed a 10% incidence of vessel luminal narrowing following even gentle manipulation of the cord during dissection. Their work was a major contribution to hernia surgery in

children, leading to a reappraisal of the handling of the vas deferens during inguinal surgery and questioning the value of routine exploration of the opposite groin during unilateral inguinal hernia repair in children.

The natural history of the processus vaginalis

The natural history of a PPV and its relationship to the development of an inguinal hernia is unknown. Crucially, it is not known which PPVs become hernias and which remain clinically insignificant.[13] Therefore, the success of contralateral exploration cannot be measured by how many PPVs are closed, but by how many MHs are prevented. The processus vaginalis obliterates spontaneously from the internal ring to the testis after testicular descent has been completed. Continuous patency of the processus vaginalis constitutes a potential inguinal hernia. Approximately 80%-94% of newborns have a PPV, of which around 60% will obliterate in the first 2 years of life.[14,15] Rowe and Clatworthy[16] in 1971 clarified the natural history of the processus vaginalis and the relationship of patency to hernias, hydroceles, and other local anomalies. Nakayama and Rowe[17] reported that a PPV exists in about 60% of infants with unilateral inguinal hernia, and in the remaining third the PPV remains without developing into a clinically apparent hernia. The reported incidence of MH (5.8%-11.6%), much lower than the reported patency of the processus vaginalis (48%-61%), supports the dict that a PPV is not necessarily an inguinal hernia,[18-20] and questions the validity of bilateral inguinal exploration. Morphologic features of the internal ring such as measurement of sac depth were initially regarded as the criteria in determining a true patency. Fuenfer et al[21] considered a processus vaginalis as patent if the depth exceeded 1.5 cm beyond the internal ring. Nixon et al[22] documented marked variability of morphology of the internal ring ranging from closed to a widely open hernia sac in a series of 1500 children. They considered a processus vaginalis as patent when no termination is visualized or when bubbles are expressed from the internal ring under scrotal or inguinal compression. Practical experience shows that transinguinal laparoscopic examination of the contralateral side is a very effective way of learning more about the PPV, leading to better decision-making and prevention of MHs and possibly to more scientific criteria in the near future.

Preoperative and intraoperative means to determine the presence of a contralateral patent processus vaginalis (a potential inguinal hernia)

These means were developed in order to avoid routine and unnecessary exploration of the contralateral groin. Contrast herniography,[23,24] pneumoperitoneum (Goldstein's test),[25,26] and probing of the contralateral groin with Bakes dilators[27] are all of historical value today. Ultrasound of the groin for the evaluation of the contralateral groin before surgery was reported by Erez et al[28] in 1993. A correct sonographic diagnosis (positive or negative) was obtained in 185 (93%) of 200 children. Accurate sonographic criteria for the preoperative diagnosis of contralateral PPV were reported in a study of 642 pediatric patients in 2002.[29] Laparoscopic inguinal evaluation of the asymptomatic contralateral side was first reported by Lobe and Schropp[30] in 1992. They reported an accuracy of 96% without complications.

Transinguinal laparoscopic evaluation of the contralateral side during inguinal hernia repair in children

In 1993 Chu et al[31] reported laparoscopy through the hernia sac of the involved side, a natural extension of Goldstein's test, for evaluation of the other groin, significantly decreasing the probability of complications. Thus transinguinal laparoscopy was born. Groner et al[32] reported the technique of groin laparoscopy, discussing the advantages of this technique for contralateral groin evaluation in pediatric inguinal hernia repair. Many reports have been published on this technique, which was confirmed for the examination of the contralateral side in the repair of inguinal hernia in children.[33-36] An obvious peritoneal opening or funnel defect at the internal ring, bubbles, crepitation, a peritoneal veil that could be raised with mild traction on the cord structures to expose the opening, and concentric peritoneal rings distal to the internal ring, were the positive laparoscopic findings reported by Wolf and Hopkins.[37] Liu et al[38] provided some tips on helpful maneuvers for visualizing the base of the ring during transinguinal explorative laparoscopy, such as lifting the skin of the lower abdomen, compressing the inguinal area and applying traction to the spermatic cord. Advantages of examining the contralateral groin include avoiding a second anesthesia, sparing the parents the anxiety associated with a second operation, and sparing the physician the embarrassment associated with the appearance of a second hernia at a later date. Assessing the efficacy of perioperative laparoscopic examination of the contralateral internal ring during inguinal hernia repair in children, Grossman et al[39] concluded that the addition of laparoscopy significantly lowered the incidence of negative explorations. Wulkan et al[40] found that transinguinal laparoscopy

prevented unnecessary contralateral groin exploration in 60% of their patients. Laparoscopy was only aborted if a narrow hernia sac orifice was found near the internal ring or if a hernia sac was torn near its base during initial dissection. Other reports described the increasing popularity of this method worldwide.[41-49] A clear diagram of the procedure is shown in Fig. 1. Laparoscopic images of patent and closed processus vaginalis were seen during intraoperative transinguinal laparoscopic evaluation (Figs. 2 and 3). Fig. 4 shows bubbles coming out through an obviously open PPV.

Metachronous inguinal hernia development

A systematic review of the risk of developing a MH in children was reported by Ron et al[50] in 2007, who analyzed the data of 22 846 children. The overall incidence of MHs was 7.2%, 6.9% in boys and 7.3% in girls. Children with a left-sided inguinal hernia had a significantly higher risk of developing an MH than those with a right-sided hernia (10.2 vs. 6.3%, respectively). Overall, in both boys and girls, 14 contralateral explorations were required to prevent one MH.

The risk of developing an MH appears unchanged in early childhood, with a slight reduction after 12 years of age. Children with a left-sided hernia have the greatest risk of developing a contralateral hernia, but ten explorations are still required to prevent one MH. Most MHs occur in the first 5 years after unilateral hernia repair. An investigation on the mechanism of contralateral manifestations after unilateral herniorrhaphy in children based on laparoscopic evaluation was reported by Watanabe et al[51] in 2007. Their results suggest that the widening of the PPV during the closure of the symptomatic side may accelerate the development of MHs. Their theoretical mechanism and Kemmotsu's report[52] that contralateral hernias often occur soon after the initial unilateral repair both suggest that the initial hernia repair itself may influence the manifestation of MHs soon after the initial hernia repair. The overall incidence of positive morphological changes in children older than 3 years was 13%. The predicted incidence of contralateral hernia in their series was 11.2%.

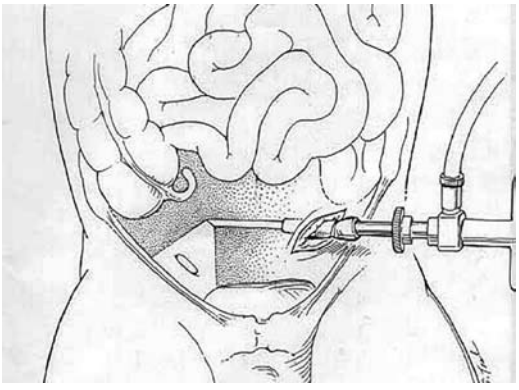

Fig. 1. A diagram of the transinguinal laparoscopic evaluation of the contralateral side (Adapted from Rescorla et al[33] with permission).

Fig. 2. Laparoscopic view of the left internal inguinal ring. The vessels and vas deferens are entering the ring with a patent processus vaginalis.

Fig. 3. Laparoscopic view of the right internal ring. The vessels and vas deferens are in the ring with a closed processus vaginalis.

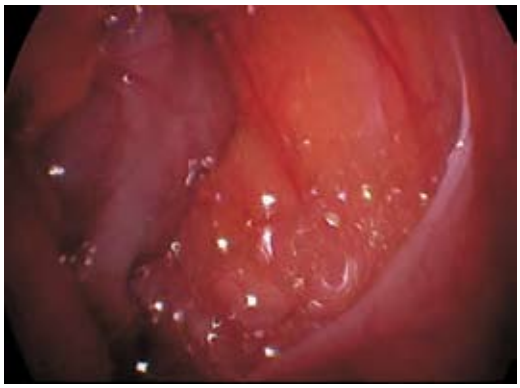

Fig. 4. Laparoscopic view of bubbles coming out through an obviously open processus vaginalis.

Conclusion

Taking into account such possible surgical options as repair of unilateral hernia only, repair of unilateral inguinal hernia with contralateral exploration and repair if indicated, or unilateral inguinal hernia repair with laparoscopy through the ipsilateral hernia sac and repair of the PPV if discovered, it was not our intention to be heavily skewed to one side of an argument, but to give our opinion, based on our experience of many years using all the different management policies reported in the literature, and provide pediatricians and pediatric surgeons alike with the opportunity to reassess their management policies in the laparoscopic era. Diagnostic laparoscopy is associated with decreased cost, morbidity and complications. It is a reliable and feasible technique and does not add any considerable operative time. A PPV is not equal to a future symptomatic hernia. The surgeon confronted with a PPV may still be operating on a PPV that only eventually may develop into a MH (5.8% to 11.6%). The search for the potential candidate with a future MH, already presenting with PPV, has yet to be answered, but the standard of care should be based on the maximum we can offer our patients. Transinguinal laparoscopic exploration of the contralateral internal ring during unilateral inguinal hernia repair in children seems a better alternative to routine bilateral inguinal exploration or the "wait and see" policies and should be part of every pediatric surgeon's therapeutic armamentarium when treating inguinal hernias in children.

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