

**Laparoscopic and needlescopic hernia repair for pediatric inguinal hernia:
A systematic review with meta-analysis**

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Abstract

Background: congenital inguinal hernia is considered to be among the commonest paediatric surgical procedures in daily practice. Open herniotomy with high ligation of the hernial sac is the gold standard treatment against which all modalities of laparoscopic repair should be compared. With the advances of minimally invasive laparoscopic techniques, less complications and better cosmesis has become the point of study.

Objective: was to review the current literature about laparoscopic and needlescopic techniques and highlighting its surgical outcomes.

Data source: English midline search using the keywords inguinal hernia, paediatric age, laparoscopy, minimally invasive surgery, needlescopic repair in PubMed, Google scholar, research gate and science direct during the period 1997- 2020.

Study selection: article of high quality, randomised controlled trial are only included

Data extraction: data were collected, organised according the type of study and extracted systematically from these studies

Data analysis: performed with the IBM SPSS 20.0 software.

Conclusion: Laparoscopy has become a good substitution for the open method in the last years due to its advantages and by time minimally invasive manoeuvres became a good substitution for the conventional type of laparoscopic repair as they are easier for the laparoscopic beginners, carry less learning curve, almost have the same results, recurrence rate and have better cosmeses.

Keywords: Inguinal hernia; Herniotomy; Laparoscopy.

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Introduction

Inguinal hernia is a common surgical problem in infant and children. Approximately more than 30 % of all inguinal hernias appear before the 6th months. Inguinal hernia in children is mainly caused by patent or partial closure of congenital peritoneal encapsulation (**Harb and Batikhe, 2019**).

In three of four children with unilateral inguinal hernia, a contralateral hernia defect can also be demonstrated (**Sokratous et al., 2019**).

The open herniotomy and high ligation is the gold standard procedure in children with a high success rate with low incidence of complications (**Wang et al., 2018**). Currently, due to the development of minimally invasive hernia repair, the method has replaced the standard one to somewhat gradually. The meta-analysis of **Yang et al. (2011)** reported that the laparoscopic hernia repair is more efficient in treatment of bilateral hernias with a lower incidence of presence of contralateral hernia than conventional open method. Due to advances in paediatric laparoscopic instrumentation and increased experience with the technique of laparoscopy, many centres routinely perform laparoscopic repair in children (**Schier, 2000**).

Needlescopic techniques considered a progressive step of minimal invasive as regard the cosmetic issue especially in children. According to our best knowledge, few studies comparing the surgical outcomes of both techniques. In this study, we highlighted the current opinion about laparoscopic and needlescopic hernia repair in paediatric age

Material and Methods

Literature search

This literature review of English literature was done. Laparoscopic and needlescopic repair as different techniques to repair congenital inguinal hernia in paediatrics were compared.

Eligibility criteria:

Revised randomized trials and prospective studies that compared two or more laparoscopic

hernia repair techniques in paediatrics with inguinal hernia were considered eligible, other study designs were excluded. Primary outcome result to be measured included recurrence rate, Secondary outcome measures were: operative time, intraoperative complication, wound infection and cosmeses.

Statistical analysis

All analyses were performed with the IBM SPSS 20.0 software.

Results

Literature search

The search strategy contained 83 articles, and after removal of duplicates 65 articles were reviewed. The remaining 65 full-texts articles have been evaluated for eligibility of which 60 articles meet the inclusion criteria. Sixty articles including 15973 patients were eligible to be included in this systematic review and pooled data-analysis.

Study characteristics

The total number of patients included 15973 children who underwent laparoscopic hernia repair using different operation techniques. By sorting the included studies in needlescopic and laparoscopic hernia repair, 6760 children underwent needlescopic hernia repair in different techniques compared to 9213 children that underwent laparoscopic hernia repair in different technique

Primary outcome results (recurrence rate):

As regard conventional laparoscopic hernia repair techniques all over the world since 1997 till 2020 showed recurrence rate from **zero** up to **4.4 %** at its worst rate. While needlescopic techniques in repair at the same time period showed surprising showed no significant difference as it ranged from **nil** up to **4.3%** as shown in (**Table.1**).

Secondary outcome measures (operative time):

As regard conventional laparoscopic hernia repair operative time ranged from **5.8**

minutes to 39.4 minutes with mean operative time 27.17 ± 11.08 minutes for unilateral cases and 35.8 ± 16.96 minutes for bilateral cases ranged from 17.3 minutes to 65 minutes. Regarding needlescopic techniques the operative time ranged from 4.3 minutes to 56.5 minutes with mean operative time 24.12 ± 15.59 minutes for unilateral cases and 34.71 ± 23.41 minutes ranged from 6.72 minutes to 106.2 minutes as shown in (Table.1).

Talking about major intraoperative complications or wound infection no difference was found between the two methods.

As regard cosmeses needlescopic techniques was found to have better cosmeses than conventional laparoscopic hernia repair.

In our ongoing research we used the following words: inguinal hernia, paediatric/child, laparoscopic/laparoscopy, needlescopic. No approval of or informed consent of patient was required as it's a literature study. The PRISMA flow diagram is shown in figure 1

Results: Only good articles were selected, these including 55 papers (32 case series, 12 review articles, 8 comparative studies, and 3 meta-analysis)

Discussion

The incidence rate is almost larger in boys than girls, right sided inguinal hernias are more common than left sided ones, and 15–20% of children present with bilateral hernias. Given the high prevalence, inguinal hernia repair is one of the most common surgical procedures performed by paediatric general surgeons (van Batavia et al., 2018).

The laparoscopic approach allows for diagnosis and management of contralateral internal ring, recurrent cases (Zendejas et al., 2010). In the past 20 years, laparoscopy has evolved to be used as both a diagnostic tool and a conceivable approach to many paediatric surgeries, including herniorrhaphy.

Laparoscopic technique has many advantages, including the possibility of inspection of contralateral defects, less dissection of

spermatic cord, identification of rare (direct or femoral) hernias, improved cosmeses, fast recovery, and reduced complications (Shalaby et al., 2019).

Laparoscopic hernia repair

Paediatric laparoscopy has been first described in 1923 by Kelling but its use has increased since last two decades. A laparoscopic approach offers several advantages over an open procedures; potentially reduces the surgical stress and fluid shifts that may accompany it; in addition there is less need for postoperative analgesia, reduction of postoperative respiratory and wound complications; shortens postoperative convalescence, including an intensive care unit stay; rapid return to normal diet and decreased overall hospital stay and better cosmetically better with early postoperative ambulation. Several paediatric laparoscopic inguinal hernia repair techniques have been introduced over the last 20 years (Chan et al., 2005; Gupta and Singh, 2009). The first use of Laparoscopy was to investigate the contralateral deep ring by Lobe and Schropp (1992), by placing optical umbilical trocar; or through the hernia sac before ligation, thus requiring a 70° lens to investigate the other side (Tam and Chan, 2017).

Laparoscopic Management of congenital inguinal hernia

Herniotomy is the standard treatment against which all alternative modalities of treatment are evaluated (McClain et al., 2014). It was 1997, when El-Gohary described the first laparoscopic repair of pediatric inguinal hernia. At first it was only limited to females for fear of vas and vessels injury in males. In 1998, Schier reported the technical use of laparoscopic herniorrhaphy on females and on boys in 2000.

Schier used one optical trocar and two instruments to place a Z-stitch on the deep ring intracorporeally Montepet and Esposito, (1999) were the first to use laparoscopy in the inguinal hernias repair in male children using an intracorporeal purse-string suture to close the inguinal ring (El-Gohary, 1997; Schier, 1998; Montupet and Esposito, 1999).

In 2003, Prasad et al described the use of extracorporeal suturing. Since then, many devices have been specified and modified to make the extracorporeal technique less technically difficult and/or to ensure improved ligation of the hernia sac (**Prasad et al., 2003; Harrison et al., 2005; George, 2016; Li et al., 2014**).

A lot of laparoscopic techniques have been used in the past two decades for inguinal hernia repair especially in children. Mostly the techniques fall into two categories intracorporeally (IC) and extra corporeally (EC). And we summarize some of these techniques in table 2.

Yet, it is not a standard practice for paediatric inguinal hernia (**Ostlie and Ponsky, 2014**).

Needlescopic inguinal hernia repair

It's been recently recognized that minimal traumas with better cosmesis during laparoscopic herniorrhaphy to have more concerns from the surgeons taking advantage of how to safely and effectively complete a herniorrhaphy with less traumas and no scars has become the new point of study (**Peng et al., 2016**).

Esposito is recognized to be the first performer of needlescopic congenital inguinal hernia repair using two 3-mm trocars placing them 3-4 cm infra umbilical on the left and right side and then **G. Ferzli** began the second series of the technique by using two 2-mm needlescopic ports inserted through puncture wounds (**Esposito and Montupet, 1998; Ferzli et al., 1999**).

Through the next two decades many techniques had been evolved intracorporeally like **Yip** who made a peritoneal flap and flipped it over the defect, **Becmeur** who made sac division and peritoneal ligation, **Riquelme** excise the sac

without peritoneal closure just deperitonealization, **Lipskar** operated only on girls and performed inversion and ligation, **Wheeler** performed division of peritoneum and purse string suturing, **Montaño** performed a peritoneal lesion over the defect without suturing, **Rafik** invented a low-cost homemade instruments with diameter 1.4 for the repair and finally **Shalaby and Negm** invented a new technique of congenital inguinal hernia repair in females using the snare of the endoscope .

Some of the previous surgeons who had their imprints in intracorporeally methods also have imprints extracorporeally. **Prasad** used the Awl needle to place the sutures, **Harrison** performed subcutaneous endoscopically assisted ligation of internal ring (**SEAL**), **Takehara** came with the (**LPEC**) laparoscopic percutaneous extraperitoneal closure using a special instrument that has a wire loop to hold the material at the tip and called it **LPEC needle** and **Dr.Rafik shalaby** who invented many manuevers in the technique of congenital inguinal hernia repair used the Reverdin needle to close the defect. The surgeons are competing to make surgeries easier, less traumatic and with better cosmeses.

Conclusion

Laparoscopy has become a good substitution for the open method in the last years due to its advantages and by time minimally invasive manuevers became a good substitution for the convevtional type of laparoscopic repair as they are easier for the laparoscopic beginners, carry less learning curve, almost have the same results, recurrence rate and have better cosmeses.

Table 1. Summarized details of the studies included in this systematic review and pooled data-analysis.

Variables	Laparoscopic N= 9213	Needlescopic N= 6760	P-value
Recurrence rate	4.4 %	4.3%.	0.746
Unilateral Operative time (minutes)	N= 5528 27.17±11.08	N= 4056 24.12±15.59	0.56
Bilateral Operative time (minutes)	N= 3685 35.8±16.96	N= 2704 34.71±23.41	0.92

*statistically significant at <0.05.

Table 2. Summary of some laparoscopic techniques in paediatric inguinal hernia repair

Author/s	Year	IC or EC or others	Technique description	Number of incision	Recurrence
El-Gohary	1997	IC	Ligation of hernia on girls	3	3.5%
Schier	1998	IC	Z-stitch on femals	3	0%
Montupet and Esposito	1999	IC	Purse-string	3	4.4%
Chan et al.	2003	IC	Purse-string and hydrodissection	3	NA
Yip et al.	2004	IC	Flip flap	3	0%
Becmeur	2004	IC	Sac division and ligation(reproduce open technique)	3	NA
Riquelme et al.	2010	IC	Excision of sac without ligation of sac	3	NA
Lipskar et al.	2010	IC	LIHIL (girls only)	3	0.83%
Wheeler et al.	2011	IC	Division of peritoneum and purse string ligation	3	0%
Montaño et al.	2018	IC	Sutureless inguinal hernia repair with creation of a peritoneal lesion	3	0%
Shalaby and Negm	2020	IC	Snaring (girls only)	3	0%
Prasad et al.	2003	EC	Placement of extraperitoneal suture using 'Awl needle'	2	NA
Harrison et al.	2005	EC	SEAL of the internal ring using Tuohy needle	1	NA
Takehara et al.	2006	EC	LPEC with LPEC needle	2	0.73%
Shalaby et al.	2006	EC	Extraperitoneal placement of sutures with Reverdin needle	2	NA
Li S et al.	2014	EC	LASSO	1	1/207
Park et al.	2016	Others	Glue hernioplasty: injection of glue to deep ring (girls only)	2	0%
Novotny et al.	2017	Others	Burnia: inversion and cauterization of the sac(girls only)	1	0%

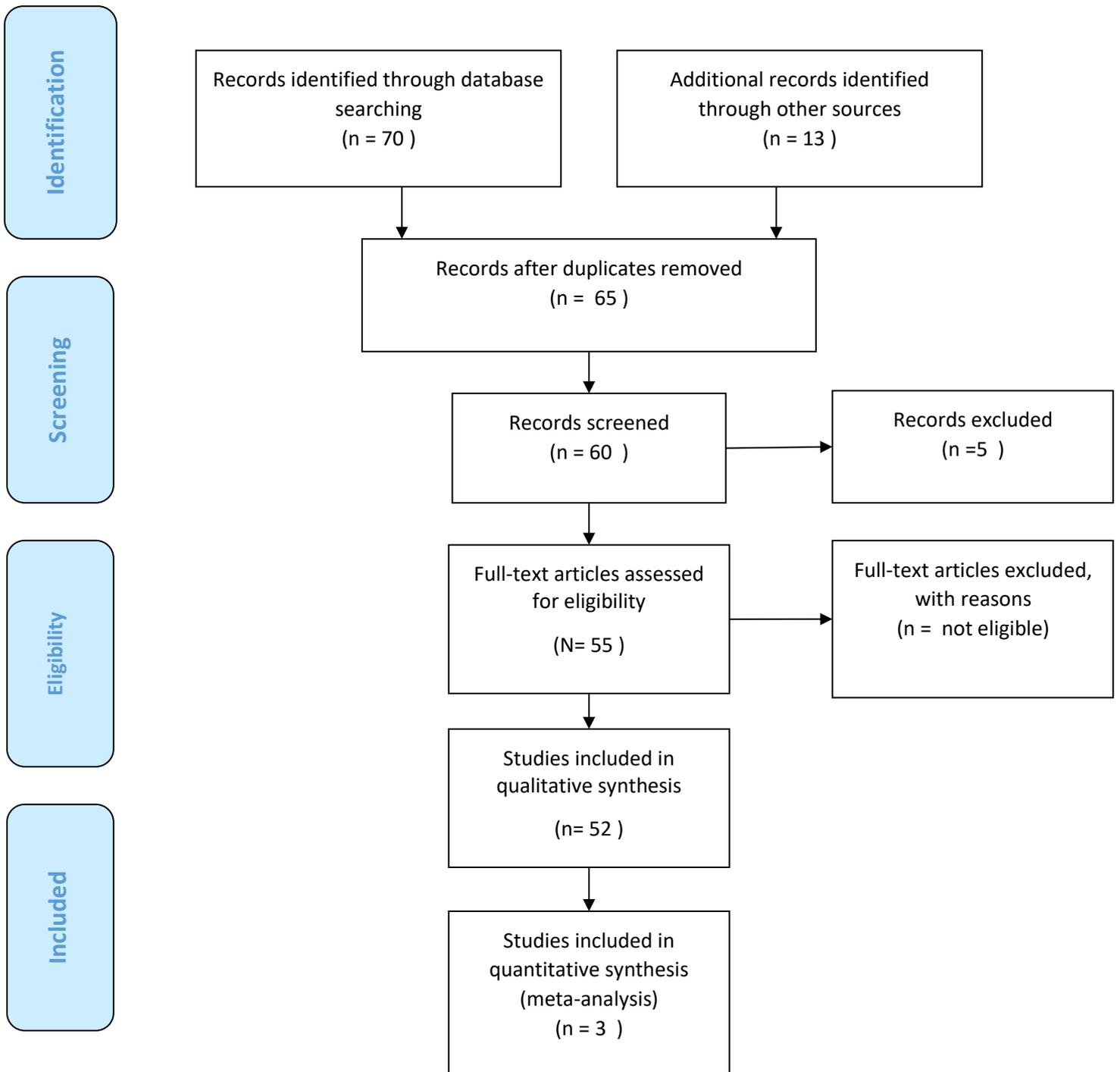


Fig. 1. Flow diagram of the study selection

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