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ORIGINAL RESEARCH

Sutureless versus purse string with complete sac dissection in laparoscopic inguinal hernia repair in children: a randomized clinical trial

Karam Elsayem[1] · Yehia S. Abdelmotaal[1] · Sherif Kaddah[2] · Mohammed M. Elbarbary[2] · Heba Taher[2]

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Abstract

Introduction Pediatric inguinal hernia is a common surgical condition with a cumulative incidence of 4.2%. Minimal invasive surgery is playing a growing role in the treatment of this condition. We compared the outcomes of laparoscopic sutureless herniotomy and purse string with sac dissection repair with regards to complications and operative time.

Methods One hundred fifty-two patients were operated on in two centers with two different techniques: sac dissection and purse-string suture, and sutureless repair. Operative time and recurrence were the main outcomes for comparison.

Results Sutureless repair has a shorter operative time (29 ± 10 min) compared to purse string repair (38 ± 13 min). The recurrence rate showed no statistical significance difference. However, the recurrence rate of sutureless repair was three times higher than that of purse string repair, and all recurrences were in large defects of 10–15 mm.

Conclusions Sutureless repair is safe for defects up to 10 mm with excellent operative time. However, it had an unfavorable outcome in larger defects.

Keywords Laparoscopic hernia · Pediatric hernia · Sutureless herniotomy · Purse-string hernia

Introduction

Pediatric inguinal hernias are reported with a cumulative incidence of 4.2% in the first 7 years of life [1]. The open approach for inguinal hernia repair is still considered the gold standard for most pediatric surgeons [2]. In the '90's, laparoscopy became more popular and was introduced to the repair of pediatric inguinal hernias [3]. Laparoscopic repair of pediatric inguinal hernia has many advantages, including reduced possibility of injury to the cord structures, especially in recurrent cases, improved post-operative pain; examination of the contralateral side in unilateral inguinal hernias, and better cosmesis [4].

Multiple techniques have been employed for treating hernias with techniques resembling the open technique with sac separation and peritoneal closure using intracorporeal, and extracorporeal suturing [5].

Sutureless laparoscopic inguinal hernia repair, first used by Riquelme, was followed by several studies with good outcomes. The technique's hypothesis is that peritoneal scarring and regeneration are enough to cause closure of the internal ring, provided enough separation between the sac and the abdominal peritoneum is established [6].

Purse string with dissection of the hernia sac was used as the standardized technique in our study and was the first technique to be introduced for laparoscopic inguinal hernia repair in children with minimal complications and a 1.5% recurrence rate [7]. Sutureless repair avoids suturing-related injury to the vas and vessels in the internal ring and improves operative time.

This study was performed to explore the efficacy of the sutureless repair with regards to acceptable recurrence rate and being furLine 63ther less invasive.

Karam Elsayem and Yehia S. Abdelmotaal have equally contributed to this work and are joint first co-authors.

✉ Yehia S. Abdelmotaal
yehia.soliman@med.suez.edu.eg

[1] Faculty of Medicine, General Surgery Department, Pediatric Surgery Unit, Suez Canal University, Ismailia, Egypt

[2] Faculty of Medicine, General Surgery Department, Pediatric Surgery Unit, Cairo University, Cairo, Egypt

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Patients and methods

This non-blind randomized clinical trial was conducted at Cairo University Specialized Children's Hospital, Cairo, Egypt, and Suez Canal University Teaching Hospital, Ismailia, Egypt, from January 2019 to June 2022. The Ethical and Research committee approved the study as a part of a doctoral degree thesis. We included 152 participants in the study with unilateral and bilateral inguinal hernias and no other major congenital anomalies. The study included patients from the elective list with no history of recurrence or irreducibility, who were randomized into two equal groups each for one of the two techniques. Group A was operated on using a standardized technique of sac dissection and purse string suturing, and Group B was operated on using sutureless repair. The sample size was calculated using https://clincalc.com/stats/samplesize.aspx.

After signing the informed consent from the legal guardian, patients were randomly assigned to either of the two groups using an online randomization tool (http://www.randomization.com).

For groups, basic data and history were obtained, including bilateralism, history of irreducibility, history of recurrence, and history of previous abdominal surgery. We performed an ultrasound for the ring size. We obtained a pre-operative ultrasound for all patients for whom we measured the size of the ring and was included in comparing the outcomes of the two techniques. All patients were operated on by a consultant or specialist under consultant supervision.

Using general anesthesia, the patient was placed in a supine 20-degree Trendelenburg position. A 5 mm port was inserted by Hasson technique infra-umbilical and pneumoperitoneum was achieved to with pressure range of 8–10 mmHg according to patient age, followed by the introduction of a 30-degree scope. Two instruments were introduced into the abdomen under vision on both sides of the rectus sheath without ports.

In both techniques, the surgeon started dissection of the internal ring peritoneum above the vas and vessels, separating the peritoneum of the internal ring from the sac (herniotomy). In Group A (control group), a purse string suture was placed at the level of the internal ring peritoneum without any further dissection. In Group B (Study Group), a complete dissection and stripping of the sac from the vas and vessels, leaving at least 1 cm between the internal ring peritoneum and the remaining sac. Patients with bilateral inguinal hernias were operated on with the same technique for both sides.

The patients were followed up for a period of 12 months to record the data of recurrence or complications. All data were collected regarding intra-operative complications, early postoperative complications, and recurrence. The first visit was after 1 week of the surgery. Subsequent visits were at 3, 6, and 12 months after the surgery. Patients who needed follow-up during the COVID-19 pandemic were contacted by phone to ask about any recurrent bulging in the inguinal region and were rescheduled for visits after the end of the pandemic restrictions.

The detailed data collected for analysis for each patient included the age, gender, side, size of the defect with pre-operative ultrasound examination, intraoperative time, and contralateral subclinical hernia discovered during the operation, intraoperative complications, early postoperative complications (scrotal edema, hematoma), and recurrence. Patients were then sub-grouped according to ring size for further assessment of the recurrence factors.

Data were coded and entered using the Statistical Package for the Social Sciences (SPSS) version 25 (IBM Corp., Armonk, NY, USA). Data were summarized using mean, standard deviation, median, minimum, and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. The Chi-square test was performed for comparing categorical data. *P* values less than 0.05 were considered statistically significant.

Results

We operated on 152 patients with a minimum age of 2 months and a maximum age of 8 years. The mean age of the patient was 25.4 ± 23.2 months. Of the 152 patients, 117 (77%) were males. Sixty-seven were operated in Cairo Specialized Children's Hospital and 85 were operated in Suez Canal University Hospital, 98 patients had a pre-operative right inguinal hernia, 43 had left-sided and 11 had a bilateral hernia. There was no difference in the demographic data of both groups.

We assessed the size of the defect using ultrasound for all patients, and out of 163 hernias, the defect size was 5 mm in 41 (25.2%), 5–10 mm in 82 (50.3%), and 10–15 mm in 40 (24.5%). There was no significant correlation between age and ring size. Figure 1 showing ring size distribution in relation with age.

There was no intraoperative complication reported in our patients. Of the 131 patients with inguinal hernia, 21 (14.9%) had a contralateral patent processus vaginalis.

Operative time for Group B sutureless repair was shorter in both unilateral and bilateral patients and the difference was statistically significant. (Table 1).

In post-operative follow-up, there was one patient with testicular hydrocele that resolved spontaneously after 3 months and one patient with port site hernia: both were in the sutureless group. This was statistically insignificant.

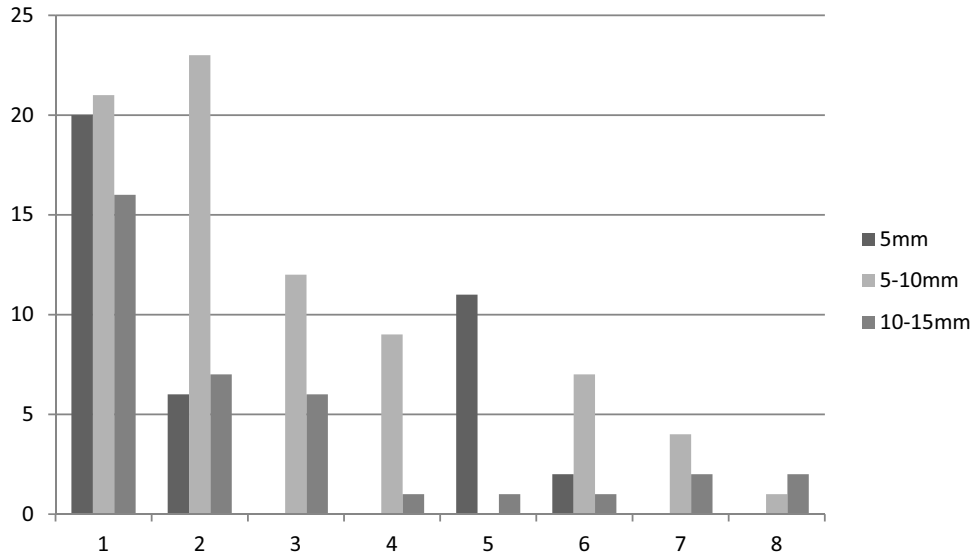

Fig. 1 Ring size in the patient cohort (Y-axis: patient numbers) in relation to the age (X-axis: age in years)

Table 1 Operative time in minutes for 141 unilateral hernias and 11 bilateral hernia

Operative time	Purse string	Sutureless	Significance
Unilateral	33 ± 7	26 ± 7	0.01*
Bilateral	58 ± 7	40 ± 11	0.01*
Total	38 ± 13	29 ± 10	0.01*

*Statistically significant difference *P* value > 0.05 using *t* test

Table 2 Recurrence rate in relation to ring size in 163 hernias

Size of the defect	Purse string	Sutureless	Significance
5 mm	0/21 (0.0%)	0/20 (0.0%)	
5–10 mm	0/42 (0.0%)	0/40 (0.0%)	
More than 10 mm	1/18 (5.6%)	3/22 (13.6%)	0.192[a], 0.3[b]
Total	1/81(1.1%)	3/82 (3.3%)	0.31[a], 0.62[b]

There was a low-significant correlation between age and recurrence. All our recurrences were in patients less than 1 year. The Chi-square test showed a *P* value of 0.047

[a]Chi-square Pearson test

[b]Fisher's exact test

Recurrence rate showed no statistical significance between both groups either in total number or in the subgroups (Table 2). The total number of operated defects was 184 with 4 recurrences (2.1%).

Discussion

Minimal invasive surgery has become a daily practice in pediatric surgery nowadays. [3] Starting from the late '90 s, the pediatric inguinal hernia has been approached by different minimally invasive techniques, and still, there's no preference for one technique or another. The minimally invasive approach gave the advantage of exploring the contralateral ring, decreased operative time, and less manipulation of the cord structures [4]. However, most pediatric surgeons still gave more trust to open repair, as reported by Zani et. al. [8].

In this study, we used the technique of sac separation and purse-string suture, using the intracorporeal knot as the gold standard. This technique mimics open repair and has been proven successful in plenty of studies. Montupet [7], Abd-Elrazek [9], and Lee [10] were among others reporting the excellent outcomes of this technique.

The study group was a less popular and newly invented technique of sutureless repair. This was investigated with variable outcomes. Riquelme [11], Montaño [6], and Marte [12] reported excellent outcomes. However, Elbatarny [13] reported negative outcomes that forced the team to discontinue the study.

In our study, 152 patients were included, and 163 hernias were diagnosed pre-operatively. Of these, 141 had a unilateral hernia and 11 had bilateral hernias.

Regarding operative time, Elbatarny [13] reported a longer operative time for both techniques. The mean operative time for the sutureless group was 34.6 min and 39.4 min for the purse string group. Riquelme [11] reported a longer operative time than what we found during this study, as he reported a mean operative time of 40 min. Esposito [14] reported a very short operative time for purse string repair of 20 min, the mean operative time. While Shehata [15] reported a similar operative time to our technique with 38.8 min of mean operative time for unilateral patients.

Out of 152 patients who were operated on in this study, 4 (2.4%) patients developed recurrence. However, it is worth

mentioning that our entire recurrence rate was for patients with an inguinal ring size of 10–15 mm. Purse string repair showed a recurrence of 1.1%, which is a good outcome with only one recurrence. However, the outcome of sutureless repair is mostly affected by the ring size as it showed a very high recurrence rate of 18.8% in defects 10–15 mm.

Riquelme [11], Bukowski [16] reported no recurrence in the sutureless technique when the ring size was less than 10 mm, and this was similar to our study. In phase II of the Shehata [15] study, where the sutureless repair was limited to patients with an inguinal ring less than 15 mm, they reported a 1.2% recurrence rate, which is much less than ours. Elbatarny [13] reported a very high recurrence rate in sutureless inguinal hernia repair (15%) although this series had a small sample size and the defect size was up to 15 mm.

The purse string repair reports varied in their rate of complications and recurrence. In a study by Abd-Alrazek, [9] they reported a recurrence rate of 0%. However, they reported hydrocele after surgery in 8% of patients undergoing internal ring sac dissection and purse-string closure. Esposito [14] recorded a lower complication rate of 1.5% in his 1800 patient study with only 0.3% recurrences. Most of his complications were due to infection and granuloma from the port site and umbilicus.

Patients with a ring size greater than 10 mm had a very high recurrence rate in both groups. The follow-up was limited due to COVID-19 and many patients were followed up over the phone. In addition, many patients preferred open repairs and refused to join the study during the explanation of laparoscopy associated complications.

Conclusions

1- Sutureless repair has good outcome in defects less than 10 mm in size and can be performed in shorter operative time.
2- Purse string repair has an excellent outcome with regards to recurrences.
3- Recurrence rate in defects more than 10 mm in sutureless repair is concerning and although was statistically insignificant.
4- Sutureless repair is still technically challenging and time demanding and not suitable for large size defects.

Declarations

Conflict of interest Authors have no conflict of interest or financial funds to declare.

Ethical approval Research and ethical committee reference number: D-11-2020.

Financial declarations None.

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