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Case report

SUBCUTANEOUS ENDOSCOPICALLY- ASSISTED LIGATION AS A SURGICAL CHOICE FOR RIGHT-SIDED INGUINAL HERNIA IN A 2.5-YEAR-OLD FEMALE CHILD: A CASE REPORT

Aleksovski Zlatko[1], Angjelov Martin[1], Simeonov Risto[1,2], Jovcheski Lazo[3], Simeonova Kamelija[4], Jordanovska Natali[5], Petkovska Sandra[6]

[1]PHI Clinical Hospital Acibadem Sistina, Department of Pediatric Surgery, Skopje, Republic of North Macedonia
[2]Faculty of Medical Sciences, Goce Delcev University in Stip, Republic of North Macedonia
[3]PHI University Clinic for Pediatric Surgery, Faculty of Medicine, Ss. Cyril and Methodius University in Skopje, Republic of North Macedonia
[4]PHI Clinical Hospital Acibadem Sistina, Department of Child and Adolescent Psychiatry, Skopje, Republic of North Macedonia
[5]PZU "Atelas", Centar za Bolka, Skopje, Republic of North Macedonia
[6]PHI Public Health Center Skopje, Republic of North Macedonia
e-mail: aleksovskizlatko@hotmail.com

Abstract

Inguinal hernia is among the most common pediatric surgical conditions, with a higher incidence in males; however, it carries significant morbidity when present in females due to the risk of ovarian involvement. Traditional open herniotomy has long been the golden standard for surgical treatment; however, minimally invasive approaches such as subcutaneous endoscopically-assisted ligation (SEAL) have gained attention for their esthetic advantages, reduced postoperative pain, and comparable recurrence rates. This case report focuses on a 2.5-year-old female child with a right-sided inguinal hernia treated successfully with SEAL. This case report highlights the diagnostic process, surgical technique, postoperative course, and discusses the advantages and limitations of SEAL compared to the conventional methods. It underscores the feasibility and safety of SEAL in young female patients and contributes to the growing body of evidence supporting minimally invasive pediatric hernia repair.

Keywords: inguinal hernia, female child, SEAL, conventional, endoscopically treatment, pediatric surgery

Introduction

Inguinal hernia in children results from a patent processus vaginalis, allowing abdominal contents to protrude into the inguinal canal. The incidence is approximately 1-5% in full-term infants, with a male predominance. In females, inguinal hernia often contains the ovary or fallopian tube, raising concerns about possible torsion or ischemia.

Traditional open herniotomy (OH) remains widely practiced, but laparoscopic techniques have evolved over the past three decades. Among these, subcutaneous endoscopically-assisted ligation (SEAL) represents a minimally invasive approach that avoids intra-abdominal dissection while achieving high ligation of the hernia sac[1]. SEAL combines the benefits of laparoscopy-magnified visualization and contralateral exploration with the simplicity of extracorporeal knotting[2]. Our case report describes the application of the SEAL technique in

a 2.5-year-old female child, emphasizing operative details, outcomes, and the broader implications for further pediatric surgical practice.

Case report

A 2.5-year-old female child was referred to the Pediatric Surgery Department at the Clinical Hospital Acibadem Sistina in Skopje, with a history of intermittent swelling in the right groin, noted by her parents over the past several months. The swelling was more pronounced during crying and physical activity, and subsided while rest. No history of pain, vomiting, or bowel obstruction was reported. On physical examination, a reducible right inguinal swelling was been noted. The contralateral side appeared normal. No signs of incarceration or strangulation were present during the physical examination. The child was otherwise healthy, with no significant past medical or allergy history. The left side showed no evidence of inguinal hernia. Routine preoperative blood work was within normal limits. An indication for operative treatment was discussed, and the patient underwent an elective surgical treatment.

Fig. 1. Skin (stab) incision

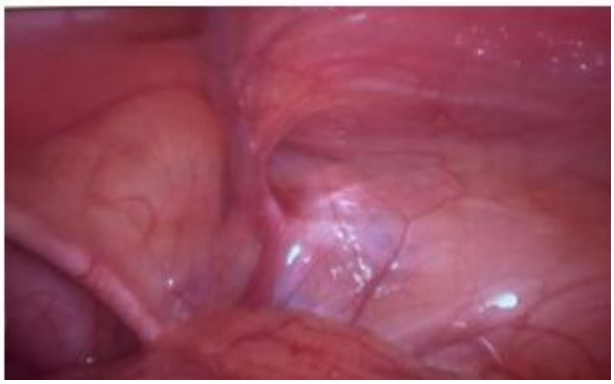

Fig. 2. Open internal inguinal ring

The patient was placed under general endotracheal anesthesia. Small umbilical incision was made and a 5-mm laparoscope was introduced through an umbilical port. The peritoneal cavity was inspected, confirming a right-sided patent processus vaginalis. The contralateral side was closed. A small stab incision was made with a zero ETHIBOND using a needle holder from the outside into the peritoneal cavity, under laparoscopic guidance. The suture was then looped around the internal inguinal ring, capturing the broad ligament and brought out through the skin, ensuring complete closure without injury to adjacent structures. A second trans-ring suture was performed and the knot was buried subcutaneously. After the procedure was completed, the child was awakened and transferred to the Post-Anesthesia Care Unit (PACU).

The perioperative and postoperative periods were uneventful, with a total duration of the procedure approximately 20 minutes, with minimal blood loss. No intraoperative complications occurred. The child recovered well, and oral feeding resumed within 6 hours. Analgesia requirements were minimal, and the child was discharged on the same day. At the one-week postoperative follow-up, the patient remained asymptomatic, with no recurrence or complications. Cosmetic outcome was excellent, with only a tiny scar in the inguinal crease.

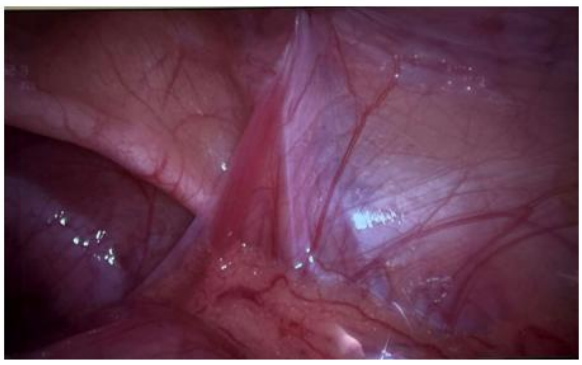

Fig. 3. Closed internal inguinal ring

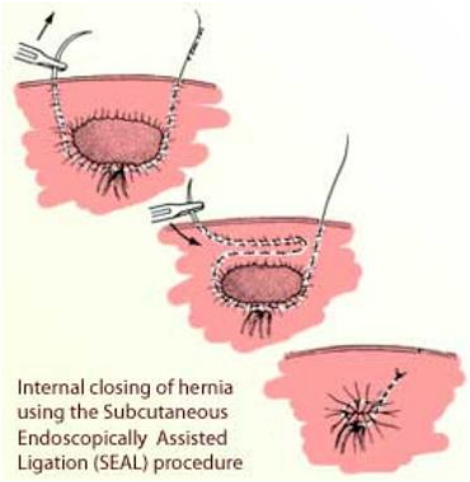

Fig. 4. SEAL procedure[7]

Discussion

Inguinal hernia repair represents one of the most common pediatric surgical procedures worldwide. While males are more frequently affected, females present unique challenges due to the risk of ovarian herniation. Early surgical intervention is recommended to prevent further complications. Open herniotomy is the golden standard, offering reliable outcomes. However, drawbacks include larger incisions, risk of injury to cord structures, and less favorable esthetic outcomes.

Laparoscopic hernia repair was first introduced in the 1990s, allowing contralateral exploration and intracorporeal suturing. The SEAL (Subcutaneous Endoscopically-Assisted Ligation) technique, developed much later, simplifies the procedure by avoiding intra-abdominal knotting. It involves extracorporeal ligation of the internal ring under endoscopic guidance, reducing operative time and technical complexity (Table 1).

Table 1. SEAL *vs*. traditional technique

Technique	Advantages	Disadvantages
Laparoscopic repair (SEAL)	Visualization of contralateral side, minimal scarring, one trocar required 5 mm	Requires peritoneal entry
Open herniotomy	Simple, widely available	Larger scar, more pain

Advantages of the SEAL technique include:

- Cosmetic benefit: Minimal scarring due to small stab incisions and almost invisible intraumbilical (5 mm port intraumbilical) incision. The stab incision is done intraumbilically rather than above or below the umbilicus to avoid potential visible scarring.
- Reduced pain: Less tissue dissection compared to open repair.
- Contralateral exploration: Ability to detect and repair occult hernias.
- Safety: Avoids injury to vas deferens and vessels in males, and to ovarian structures in females.
- The same technique can also be applied in male patients.
- Efficiency: Shorter operative time compared to intracorporeal laparoscopic suturing.

Limitations of SEAL technique:

- Requires laparoscopic equipment and expertise.
- Potential risk of incomplete closure if sutures are not properly placed.
- Long-term recurrence rates, while low, require ongoing surveillance.

Several studies have demonstrated the efficacy of SEAL. Harrison MR *et al.* (2005) reported that SEAL is a technique for high ligation of the patent processus at the internal ring without a groin incision or dissection of the vas deferens and vessels. Under endoscopic visualization through a single umbilical port, a suture is guided extraperitoneally around the internal ring, avoiding the vas deferens and vessels[1]. With increasing interest, there has been a proliferation of various techniques in the laparoscopic repair of inguinal hernia in children. This proliferation has been driven by refinements in methods of ligation of the patent processus vaginalis at the internal inguinal ring in order to improve results and the outcome of treatment. The various techniques include extracorporeal or intracorporeal suturing and knotting, three- or single-port procedure, sac inversion and ligation technique in girls, flip-flap technique, and use of tissue adhesives. Meta-analyses confirm comparable recurrence rates to open repair, with added benefits of minimally invasive surgery (Table 2).

Table 2. Comparison between extracorporeal and intracorporeal techniques [2]

Technique	No. of ports	Sutures	Duration (min)	Recurrence	Remarks
Extracorporeal	2 or 1	Nonabsorbable	23.8-40.2 23.8 Unilateral 40.2: Bilateral	0-2%	Does not require laparoscopic suturing skills
Intracorporeal	3 or 1	Nonabsorbable	48,5+4: Unilateral 61.0+13,8 Bilateral	0-5,7%	Requires good laparoscopic suturing skills

In a systematic review by Esposito C *et al*., fifty-three studies met the inclusion criteria. Regarding operative time of unilateral inguinal hernia repair, no significant difference was found between LH and OH (P=.33). In contrast, in bilateral hernias, LH was faster than OH (P=.01). Regarding the recurrence rate, no significant difference was observed between the two techniques (P=.66), whereas the rate of other complications was significantly higher in OH compared to LH (P=.001). Laparoscopy has the advantage to identify and treat rare hernias (direct, femoral, ‘‘en pantalon’’), which are seldom reported in studies focused on inguinal OH. In laparoscopic series, the incidence of contralateral patency in cases of unilateral hernia ranged between 19.9% and 66%. In our opinion, the higher wound infection rate following OH may be due to the fact that the laparoscopic scars are located higher on the abdominal wall compared to inguinal scars, which are within the diaper area; therefore, they are subject to urine or fecal contamination, which may lead to a higher infection rate. In fact, studies including infants at a similar age reported fewer wound infections in LH compared to OH (0% in Esposito *et al*.[50] *versus* 2.3% in Nagraj *et al*.[3]).

In another study, a total of 141 patients underwent diagnostic laparoscopy with intent to perform a SEAL repair. Seventeen patients were lost to follow-up. Of the remaining 124 patients, 66 had SEAL repairs, 35 had open repairs, and 23 had a SEAL repair with contralateral open repair. Patient age, BMI, gender, history of prematurity, and history of incarcerated hernia were similar between the SEAL and open groups. In 62%, hernias were successfully repaired using the SEAL technique. Hernia recurrence was seen in 3 of 123 total SEAL repairs and in 1 of 74 open repairs. The recurrence rate for SEAL repairs (2.4%) was not significantly different from the recurrence rate for open repairs (1.4%). No preoperative patient-level factors predicted technical inability to perform a successful SEAL repair. In this series, the recurrence risk of SEAL compared to open repair was low and not statistically significant[4]. For practitioners with minimally invasive experience, SEAL should be considered a safe and

successful option for inguinal hernia repair in pediatric patients undergoing routine diagnostic laparoscopy[2].

Ozgediz D. *et al*.[5] suggest that SEAL is a safe and effective technique for inguinal hernia repair in the pediatric population.

In a study by Gause CD *et al*., forty-one patients were randomized to unilateral OH (n = 10), unilateral LH (n=17), bilateral OH (n=5) and bilateral LH (n=9). Acetaminophen doses, LOS, complications, and parent/caregiver scores did not differ among groups. Laparoscopic unilateral hernia repair demonstrated a shorter operative time, a consistent finding for overall laparoscopic repair in univariate (p=0.003) and multivariate (p=0.010) analyses. No cases of testicular atrophy were documented at 2 (SD = 2.7) years[6,7].

In our patient, SEAL provided a safe, effective, and cosmetically superior repair. The rapid recovery and absence of complications reinforce its value in pediatric practice.

Conclusion

Subcutaneous endoscopically-assisted ligation is a feasible and effective technique for inguinal hernia repair in pediatric patients. In this case involving a 2.5-year-old female child, SEAL offered excellent esthetic results, minimal pain, and no recurrence at 6 months. SEAL should be considered a valuable alternative to open herniotomy, particularly in centers entitled with laparoscopic expertise and well-experienced surgeons. Further long-term studies are warranted to establish its role as a standard of care.

Conflict of interest statement. None declared.

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