

## Current Trend in the Management of Huge Recurrent Inguinal Hernia in Infants, a Case Series

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### Abstract

#### Introduction

The most common hernia repairs performed today in the pediatric population are for an inguinal hernia. The incidence of hernia recurrence of children is 1%<sup>[1]</sup>. The use of prosthetic cone mesh for repair of a huge recurrent congenital inguinal hernia in infants is still rare. Also, laparoscopic intervention in pediatric necessitates available equipment and well-trained staff<sup>[2]</sup>. Here we focus on the ability to use a cone mesh plug for the large internal ring in male infants with recurrent huge congenital inguinal hernia without opening of the inguinal canal.

#### Patients and methods

The study included 8 boys with a recurrent huge congenital inguinal hernia, their ages ranged from 2 months to 2 years. The inclusion criteria are any infant with a recurrent large indirect hernia as having disrupted internal ring that is >3 cm or two finger breadths in width (the tip of the little finger) according to the European Hernia Society (EHS) classification of groin hernia, plus he has a long sac with inguinoscrotal's presentation. Partial exposure to the large internal ring without opening of the inguinal canal by the assist of mini retractor through the external ring, the mesh plug was inserted to occlude the defect for recurrent huge cases. The mean follow-up period was 2 months.

#### Discussion

The application of mesh plug technique in the repair of difficult cases of recurrent indirect inguinal hernia in boys is easily applicable, safe and not expensive. Some surgeon<sup>[3,4]</sup> applied the mesh plug by opening the inguinal canal.

We find that in male infants no need for opening the inguinal canal to avoid more iatrogenic weakness for the groin, as external ring allows partial exposure to the internal ring by the assist of a mini retractor.

#### Conclusion

A cone mesh plug technique can be applied easily and safely for male infants with recurrent huge congenital inguinal hernia without the need to opening the inguinal canal.

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### Introduction

An operation for a groin hernia is one of the most commonly performed general surgical procedures in both children and adults<sup>[5-7]</sup>. An Inguinal Hernia (IH) in children is a congenital lesion resulting from a persistent Patent Processus Vaginalis (PPV)<sup>[8]</sup>. The reported incidence of an inguinal hernia varies from 3% to 5% in full-term newborns, 13% among newborns born of less than 33 weeks of gestational age<sup>[9]</sup>, and 30% of infants of less than 1000 g birth weight<sup>[10]</sup>.



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A number of associated disorders including undescended testis, cystic fibrosis, bladder exstrophy, increased abdominal pressure (meconium ileus, necrotizing enterocolitis gastroschisis/omphalocele), increased peritoneal fluid (ascites, peritoneal dialysis and the presence of a ventriculoperitoneal shunt) and connective tissue disorders (Ehlers-Danlos syndrome, Hunter-Hurler syndrome, Marfan syndrome and mucopolysaccharidosis) may contribute in the presence of an inguinal hernia<sup>[11]</sup>. Zollinger et al. defined the large indirect hernia as having disrupted internal ring that is greater than 4 cm or two finger breadths in width, plus it has a long sac with inguinoscrotal's presentation<sup>[12]</sup>.

The European Hernia Society (EHS) proposed the tip of the index finger as the reference for the size of the internal inguinal ring in open surgery since the usual size of the tip of the index finger is mostly around 1.5 cm<sup>[13]</sup>.

**Table 1:** The European Hernia Society (EHS) groin hernia classification<sup>[13]</sup>.

EHS Groin Hernia Classification	Primary		Recurrent		X
	0	1	2	3	
L					
M					
F					

- P = Primary Hernia
- R = Recurrent Hernia
- L = Lateral/ Indirect Hernia
- M = Medial/ Direct Hernia
- F = Femoral Hernia
- 0 = No Hernia Detectable
- 1 = < 1.5 Cm (One Finger)
- 2 = < 3 Cm (Two fingers)
- 3 = > 3 Cm (More than two Fingers)
- X = Not Investigated

An inguinal hernia repair is associated with operative complications, including hernia recurrence, vas deferens injury, and testicular atrophy, the rates of which vary from 1% to 8%<sup>[14-17]</sup>. Long-term complications include chronic pain and infertility in adulthood<sup>[18]</sup>. Most recurrent congenital hernias are indirect and probably result from tearing off a friable sac, slipping off the ligature at the neck of the sac or failure to ligate the sac high at the internal ring<sup>[19]</sup>.

Laparoscopic intervention in pediatric necessitates available equipment and well-trained staff<sup>[2]</sup>. Mesh-plug hernioplasty was first introduced into the 1970s and then promoted as a repair for all varieties of inguinal hernias in the 1990s<sup>[20,21]</sup>. Rutkow and Robbins have reported the short and long-term safety and efficacy of the traditional mesh-plug hernioplasty<sup>[22]</sup>.

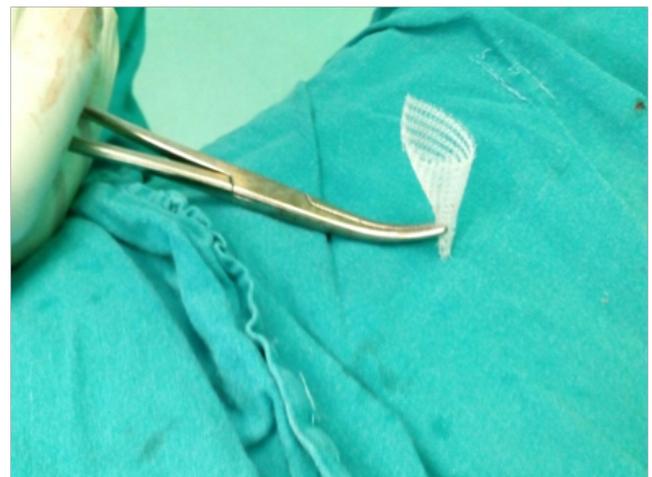
## Patients and Methods

This randomized control trial study was carried out at the pediatric surgery unit, surgical department, Assiut and Asswan University Hospital, Egypt, during the period from October 2016 to March 2017. The study included 8 boys with a recurrent huge congenital inguinal hernia, their ages ranged from 2 months to 2 years. The inclusion criteria are any infant with recurrent large indirect hernia as having disrupted internal ring that is >3 cm or two finger breadths in width (the tip of the little finger) according to European Hernia Society (EHS) classification of a groin hernia, plus he has a long sac with inguinoscrotal's presentation.

A written consent was taken from the parents after given them information about the operative procedure and its hazards. All operative interventions did by an experienced pediatric surgeon.

## Surgical technique

A small piece of prolene mesh (1 cm x 2 cm) was designed to form a small cone with obliterated tip (Figure 1) and prepared to be used as a plug to obliterate the internal inguinal ring. The skin incision was planned to include the previous scar, the cord structures were identified an inferior to the external ring. The indirect sac was freed as possible from the cord structure then twisted and ligated at the neck of the sac. The cord displaced upward and laterally, through the external ring using small mini retractor, so partial exposure of the large internal ring without opening of the inguinal canal, the mesh plug was inserted to occlude the defect. The plug was secured with 2 - 3 interrupted prolene stitches into the edges of the internal ring to eliminate the possibility of plug migration in the inguinal canal. After good haemostasis the testis was pulled down in the scrotum and the wound was closed in layers.



**Figure 1:** Prolene cone mesh plug.

Postoperatively the infant was taken paracetamol rectal suppository\6hrs; (amoxicillin and clavulanate) syrup\8hrs, antiedematous syrup Amylase Alpha (maxilase)\8hrs. The infant discharged at the 2<sup>nd</sup> postoperative days, the first follow-up check were performed one week after operation in the outpatient clinic of Assiut and Asswan University Hospitals, Stitches removed at the 10<sup>th</sup> postoperative days, and follow up continue every week for one month postoperative to detect postoperative

complication like scrotal oedema, hydroceles, hernia recurrence, mesh infection, foreign body reaction, sinus tracts, changes in the size of the testis and mesh migration. The average duration of follow-up was 2 months.

**Results**

A total of 8 boys from Upper Egypt, with a recurrent huge congenital inguinal hernia operated by an experienced pediatric surgeon, their ages ranged from 2 months to 2 years, mean age (11 months), 2 cases of these 8 cases have hydrocephalus with Ventriculoperitoneal (VP) shunt. All boys had large internal inguinal rings. Operative time ranged from 25 - 30 minutes. The procedures were easy and smooth; our junior physicians learned the procedures easily.

Follow up at 1<sup>st</sup> weeks postoperative, 10 days for surgical stitches removal, 3<sup>rd</sup> and 4<sup>th</sup> week's postoperative and 2<sup>nd</sup> month postoperative. The mean follow-up period was 2 months. During follow-up period no complication discovered like hernia recurrence, scrotal oedema, hydroceles, mesh infection, foreign body reaction, sinus tracts, changes into the size of the testis and mesh migration, except for one case who had right recurrent huge congenital hernia operated by cone mesh, developed postoperative oedema resolved after 3 weeks by antiedematous measures, but still had redundant right inguinal and scrotal skin. Also, this child had congenital diffuse hypopigmented lesions all over his body. Also, this child was the only one that had appendectomy during his recurrent inguinal hernia repair from a protruded bowels loop through a hernia patulous ring defect operated by the experienced pediatric surgeon that fears from a higher risk of developing postoperative acute appendicitis due to operative manipulations or in later life with difficult appendectomy due to the mobile caecum. (Figure 2 - 7)



**Figure 3:** Exposure a large internal ring.



**Figure 4:** A cone mesh plug inside a large internal ring.



**Figure 2:** Exposure of a large internal ring by using miniretractor through an external ring.



**Figure 5:** After fixation of the mesh inside the internal ring.



**Figure 6:** 1<sup>st</sup> postoperative week follow up, no postoperative oedema or hydrocele.



**Figure 7:** 3<sup>rd</sup> months postoperative for another case with redundant scrotal skin and congenital hypomelanosis.

## Discussion

Infants with large hernias present a challenge to the pediatric surgeon. As there is scant literature regarding these hernias in children, their management may be challenging. Repairing giant hernias using conventional methods is associated with a high recurrence rate<sup>[23]</sup>. The recurrence was reported to be 0.68 – 4% in different studies<sup>[24-27]</sup>.

The definitive reason for recurrence after inguinal hernia surgery still remains unclear and it has not been possible to identify single parameters or risk factors as being responsible. The identified risk factors of recurrence range widely and include controllable technical risk factors such as surgical technical methods<sup>[28,29]</sup>, methods of anesthesia<sup>[30]</sup>, surgeon experience<sup>[31]</sup>.

Furthermore, a wide range of uncontrollable patient-related risk factors such as growth failure, prematurity, malnutrition, bladder exstrophy, cryptorchidism, and seizure disorders with spasticity<sup>[32]</sup>.

Grasfeld et al. suggest that certain potentially predisposing factors played a role in the recurrences. The first factor was improper ligation of the sac at the internal ring and the second one was the presence of a large internal inguinal ring (type 2 and 3) according to EHS classification of a groin hernia<sup>[13]</sup> but we think that this hernia classification and estimation of the size of internal ring is underestimated in pediatrics as it is specific for adult population and we need more future researchers for more specific groin hernia classification in pediatrics. The other factors that Grasfeld et al. studied that proved important to recurrence were inheritance weakness or fragility of tissues in patients with connective tissue disorders or conditions associated with increased intra-abdominal pressure such as VP shunt, ascites, posterior urethral valve, weight lifting, and pulmonary diseases causing chronic cough<sup>[32]</sup>.

Adequate high ligation at the internal ring, snuggling of a large internal ring, avoidance of injury to the canal floor, and closure of the internal ring in girls are important operative considerations in preventing indirect hernia recurrence. Selected patients with connective tissue disorders, poor nutrition, and increased intra abdominal pressure (ascites, VP shunts) associated with weak floor tissues should undergo iliopubic tract repairs to prevent recurrence. The preperitoneal repair is advantageous to patients with multiple recurrences<sup>[32]</sup>.

Huge and recurrent hernias, however, usually allow time for adequate surgical preparation. These hernias are also amenable to modern prosthetic repairs<sup>[23]</sup>.

The use of mesh during laparoscopic hernia repairs is associated with a reduction in the risk of hernia recurrence in comparison with non-mesh methods of hernia repair. However, there is no apparent difference when laparoscopic methods are compared with open mesh methods of hernia repair. The data available show less persisting pain and numbness following a laparoscopic repair and return to usual activities is faster<sup>[33]</sup>. However, the laparoscopic approach is abandoned by some author's especially in boys also; it necessitates available equipment and well-trained staff<sup>[2]</sup>. We do not have pediatric laparoscopic equipment at Aswan University Hospital due to poor resources of our hospital.

The application of mesh plug technique in the repair of difficult cases of recurrent indirect inguinal hernia in boys is easily applicable, safe and not expensive. There was any need for high ligation of the sac or repair of the disturbed anatomy of the inguinal region thus avoiding damage to the cord structures or the floor of the inguinal region<sup>[3]</sup>. Some surgeon<sup>[3,4]</sup> applied the mesh plug by opening the inguinal canal.

We find that in male infant no need for opening the inguinal canal in the presence of large internal ring to avoid more iatrogenic weakness for the groin and more disturbances to the anatomy of the inguinal region, as external ring allows partial exposure to the internal ring in infants by the assist of mini retractor.

The presence of a normal vermiform appendix in an inguinal hernia sac is uncommon, with a reported incidence of 0.6 to 1 % of inguinal hernias<sup>[34,35]</sup>. It has generally been associated with large indirect inguinoscrotal hernias. Amyand's hernia pre-

dominantly occurs on the right side<sup>[36]</sup>. This is probably because right-sided inguinal hernias are more common than left-sided hernias, and the appendix is normally found on the right side and exceptionally on the left side due to situs inversus<sup>[37]</sup>. Regarding appendectomy, the indications for the procedure in cases of Amyand's hernia depends on the mode of presentation. In cases involving patients with normal appendices, appendectomy is not necessary. On the other hand, appendectomy is required in cases involving acute appendicitis<sup>[38]</sup>. Acute appendicitis within an inguinal hernia accounts for 0.1 % of all cases<sup>[39]</sup>. The presence of pus and perforation of the appendix are absolute contraindications for mesh-based hernia repair procedures<sup>[40]</sup>. Whether to remove or leave behind a non-inflamed appendix is confusing. The patient's age, the size of the appendix, life expectancy, and lifelong risk of developing acute appendicitis influence the surgeon's decision of performing appendectomy. If one plan to do appendectomy for a normal appendix, then there are chances of infection to an otherwise clean surgery so, it is ideal to replace the normal-looking appendix and do hernioplasty. Those in favor of appendectomy, however, feel that surgical handling will traumatize the appendix partially. So, it is better to deal with appendectomy with utmost care taken to prevent contamination. As younger patients have a higher risk of developing acute appendicitis at a later age, an appendectomy may be considered, whereas, in elderly individuals, the appendix may be left intact<sup>[39]</sup>. So, it is a surgical dilemma for the surgeon to decide whether to save or remove a normal-looking appendix which might have become traumatized while handling and may present as appendicitis in the postoperative period or we unnecessarily remove a normal appendix and open the gut and thus increase the chances of wound infection. We remove the appendix to one of our case of recurrent giant right inguinal hernia as it was looking absolutely normal and also we were very gentle while handling and removing the appendix to avoid contamination also, we made a mesh plug technique successfully without any postoperative complication.

Finally, we are preparing for a prospective study about mesh plug technique in a pediatric population with long term follow up to detect a delayed postoperative complication as mesh migration and foreign body reaction.

## Conclusion

To prevent recurrence in case of huge congenital inguinal hernia in male infants with a large internal ring, for a hernia operated on the first time snuggling of a large internal ring by partial exposure to external ring can be done without the need to opening the inguinal canal.

If a hernia is recurrent a cone mesh can be applied easily and fixed to a large internal ring by 2 - 3 stitches without the need to opening the inguinal canal to prevent more weakness and more disturbances to the anatomy of the inguinal region.

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## Conflict of interests

No conflict of interest.

## Sources of funding

No funding has been used for this research.

## Ethical approval

No ethical approval has been applied for this case series study, only the written and oral consent by the relatives of the patients.

## Consent

A written consent has been obtained from the patient's relatives for operative intervention and for the publication of this case series and accompanying images and is available for review on request.

## Author contributions

Sarah Magdy Abdelmohsen, pediatric surgery, Aswan University hospital, Egypt. She was the operator and responsible for the Study design, data collection, interpretation and writing of the paper.

Mohamed Abdelkader Osman, Headmaster of pediatric surgery, Assiut University hospital, Egypt. He was operator, supervisor, reviewer and observational.

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