



Herniotomy in resource-scarce environment: Comparison of incisions and techniques

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ABSTRACT

Background: There are various methods for surgical treatment of hernia and hydrocele in children with variable cost-effectiveness, recovery and cosmetic outcomes. This study analyses our experience with mini-incision/invasive herniotomy in children in resource-limited centre. **Materials and Methods:** Seven hundred and eighty-four $n = 784$ patients underwent herniotomy via conventional and mini-invasive methods were assigned into Group A and Group B. Three hundred and seventy-six $n = 376$ (47.95%) in Group A while four hundred and eight $n = 408$ (52.04%) in Group B. Eight hundred and seventeen (817) herniotomy was performed. Demographic data, hernia/hydrocele sides, volume of surgical suture used, surgery duration, and complications analysed. **Results:** Right side hernia and/or hydrocele were 464 (59.18%). 287 (36.60%) had left sided while 33 (4.21%) had bilateral hernia and/or hydrocele. There were 14 bilateral hernia repair in Group A and 19 in Group B. The lengths of operation time for unilateral repair ranged from 14 to 54 min in Group A (median, 23 min) and 7-44 min in Group B (median, 15 min) with a mean surgical duration of 15.48 ± 4.16 min in Group B versus 23.41 ± 5.94 min in Group A ($P < 0.001$) while the range of the lengths of operation time for bilateral repair in Group A was 20-54 min (median, 36) and 12-30 min (median, 21) in Group B with a mean duration of 36.35 ± 9.89 min in Group A versus 20.42 ± 4.83 min in Group B $P = 0.00563$. 376 sachets

of 45 cm suture material were used in Group A versus 137 in Group B. There were total of 87 (23.13%) complications in Group A versus 3 (1.47%) in Group B $P = 0.000513$. Superficial wound infection and abscess were 9 (2.36%) and 16 (4.25%) in Group A versus none (0) in Group B. **Conclusion:** Mini-incision/invasive herniotomy in children and adolescents is fast, cost-effective with satisfactory cosmetic outcome and limited complications

Key words: Children, herniotomy, mini-invasion

INTRODUCTION

Paediatric surgeons perform hundreds of congenital inguinal hernia/hydrocele repairs each year using various methods and techniques. However, whichever method is used, the basic principle remains ligation of processus vaginalis described as far back as in the year 1871.^[1]

Due to a recent advancement in surgical instrumentations, perfections in surgical techniques, low infection rates, desire for improvement in cosmetic outcomes; different approaches to the repair of inguinal hernia/hydrocele in children have been suggested both in experimental models and clinical practice with variable cost-effectiveness, general and cosmetic outcomes.^[2-16]

In the treatment of congenital inguinal hernia/hydrocele, timing for surgery and if the operation should be performed with an open approach or laparoscopically with a concept of minimal invasiveness is a critical issue needing discussions and further research.^[17-20]

Laparoscopic hernia repair in children was said to be associated with less pain, satisfactory postoperative recovery with good wound cosmesis in comparison with conventional open approaches.^[7] Still some authors elaborated technical problems and complications associated with laparoscopic surgery which included and not limited to possible injuries to the vas and

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gonadal neuro-vascular structures, postsurgical hydrocele and high recurrent rates.^[8]

We are presenting our experience and statistical analysis of open, none-laparoscopic mini-invasive surgical approach for herniotomy in children from resource-limited hospital using microsurgical instrumentation. Therefore, minimum invasive hernia repair in children without laparoscopy is feasible in resource-scarce set ups and is associated with low complications.

MATERIALS AND METHODS

This was a prospective randomised study of seven hundred and eighty four $n = 784$ patients with congenital inguinal hernia/hydroceles. Three hundred and seventy-six $n = 376$ (47.95%) had conventional Ferguson/Mitchell-Bank repairs using wound retractors Mannerfelt™ 12 mm × 12 mm in width with conventional surgical skin incisions ≥ 15 mm (Group A). Four hundred and eight $n = 408$ (52.04%) had mini-incision Mitchell-Bank repair using microsurgical instruments with minimal skin incisions ≤ 5 mm (Group B) using wound retractors Ragnell™ 3 mm × 5 mm in width [Figure 1]. The patients were enrolled into the study from April 2009 to January 2014 (57-month period).

Total of seven hundred and seventy five $n = 775$ (98.85%) male and nine $n = 9$ (1.14%) female patients were operated. Male to female ratio was 86:1.

All the patients had herniotomies as day cases.

Throughout the period *Johnson&Johnson Intl Ethicon*® Vicryl™ 4/0 and/or 3/0 suture 45 cm length were used and were divided into half for two hernia/hydrocele repairs using a free surgical needle for a second repair



Figure 1: Micro-surgical instruments for mini-invasive herniotomy: Retractors' widths are ≤ 3 mm while tooth tissue forceps ≤ 0.8 mm tips

in Group B. The herniotomies were carried out by a specialist paediatric surgeon and/or locally trained senior medical officers randomly.

Under general anaesthesia with the patient in the supine position; midline, pubic tubercle, and anterior superior iliac spine were marked out. The spermatic cord structures were located by palpation and traced to the level of superficial inguinal ring by diminishing silk feeling at the level of the ring. Measurements were taken over and directly on the superficially palpated inguinal ring with a surgical marker [Figure 2a]. Routine cleaning and draping were achieved. Surgical skin incision between 3 mm and 5 mm was made directly over the palpated external inguinal ring [Figure 2b]. The incision was carried down through the dermis to expose the subcutaneous fat. Microsurgical instruments and retractors were inserted into the skin incision to bluntly and gently dissect the surgical field. Camper's fascia was exposed and sharply dissected. The Camper's fascia was spread with scissors to expose the Scarpa's fascia. The Scarpa's fascia was then grasped with tooth microsurgical tissue forceps, cut and then gently spread with micro-scissors to expose the arc of superficial inguinal ring. Fascia and fibres of cremasteric muscle/or round ligament were identified, spread apart to reveal the hernia sac (processus vaginalis) anteromedially. The hernia sac (processus vaginalis) was grasped, taking a gentle bite of the tissue (hernia sac) with a curved artery forceps. In male patients, the cord structures were slightly elevated into the wound and placed on a fingertip of a fore-finger [Figure 3]. The spermatic fascia was identified. The vas deferens and vessels were dissected away from the sac while using the tip of the finger as a "protective device" against injury to the cord structures and as a tool for dissection. The sac was checked for contents, the vas and vessels were re-identified, followed by placing clamps across the

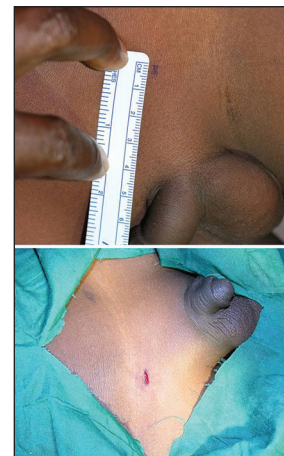


Figure 2: 3-5 mm skin incision directly over the external ring

sac and dividing it [Figure 4a and b]. The proximal sac was ligated at the level of the external ring and a gentle traction of the cord contents from the scrotal/testicular end was done. A single subdermal suture was applied to close the wound. No wound dressing was necessary [Figure 5a]. Paracetamol® syrup was given for 24 h [Video 1].

Demographic data, sides of operations, operation time, volume of surgical sutures and complications were recorded and analysed between the two groups using a web-based epidemiologic and statistical calculator for public health OpenEpi version 2.3.

Postsurgery pain/local tenderness was evaluated using Children and Infants Postoperative Pain Score for patient <3 years. Paracetamol® (15 mg/kg/dose every 6 h) was given to patients with the pain scores ≥ 4 .^[21]

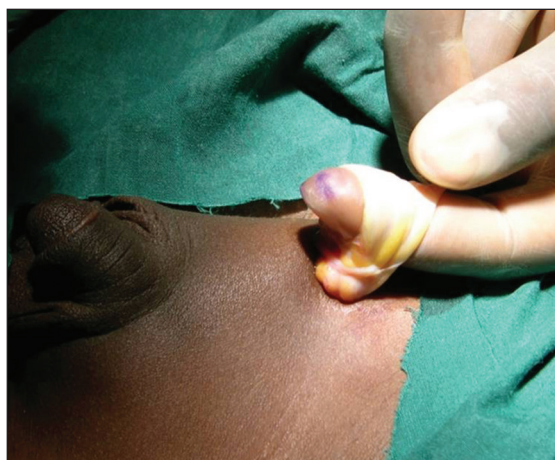


Figure 3: Processus vaginalis brought out to the surgical field. Note the secured vas deference and the “gentle bite-traction” from the artery forceps. The tip of a finger is used as a protective/dissecting device

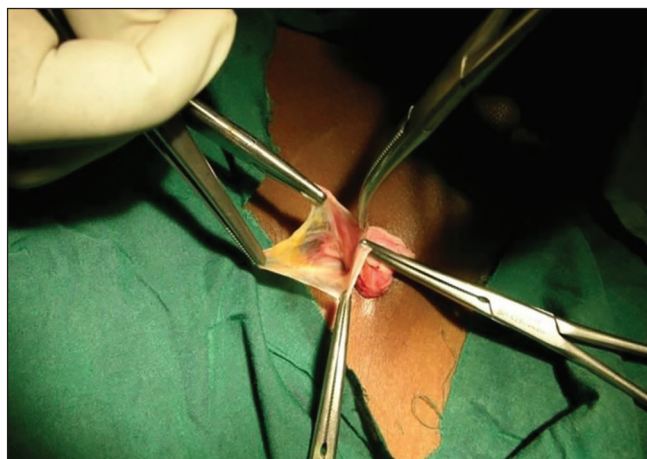


Figure 4b: Hernia sac inspection prior to ligation. Note the secured vas deference and vascular structures

Children’s Hospital-of-Eastern Ontario Pain Score for patients of 3 years of age was used and Paracetamol® (15 mg/kg/dose every 6 h) was given to patients with the pain scores ≥ 5 .^[22]

Visual analogue scale was used for older patients. Pain score ≥ 5 Paracetamol® (15 mg/kg/dose every 6 h) was given to patients.^[23]

Patients were followed-up by the attending surgeons for 1-week, 1-month, 6 months, 12 months and 24 months postoperatively and were encouraged to report to our hospital in case of any suspicion of a lesion at the surgical site.

Postoperative complications including recurrence were recorded and analysed.



Figure 4a: Omentum being evacuated from the scrotum via mini-invasiveness. Hernia sac inspection prior to ligation. Note the secured vas deference and vascular structures

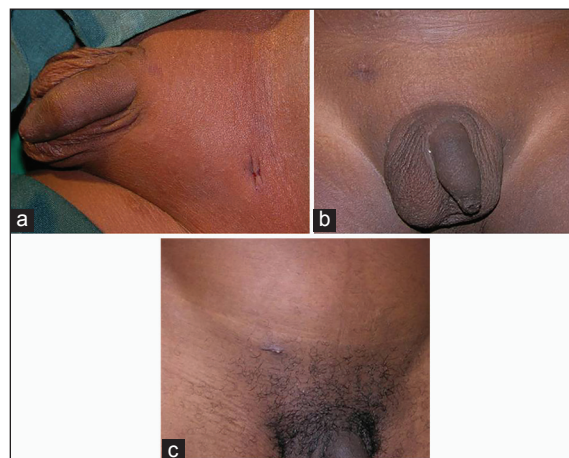


Figure 5: Post surgery: (a) Immediate without a need for surgical dressing; (b) 9 days after surgery; (c) 13 days after congenital herniotomy in an adolescent with satisfactory cosmetic outcomes. Note the healed wound with an incrustation “peeling up” of a dry mini-scar

One hundred and seven $n = 107$ (13.64%) patients were not seen physically during the follow-up period, out of which seventy nine $n = 79$ (10.07%) were lost, while parents of 28 patients $n = 28$ (3.57%) sent verbal messages through third party of their satisfactions.

An informed consent was obtained from parents and elder patients. Randomisation was done by raffle draw using squeezed papers for the two groups.

The study was approved by the Ethics Committee of Hospitals Management Board.

Obese, large hernia defects and emergencies with intestinal and or ovarian strangulation were excluded from the study.

RESULTS

There were seven hundred and seventy five $n = 775$ male patients with congenital inguinal hernia/hydrocele and nine $n = 9$ female patients that were enrolled. The median age of the patients was 3 years with age range 0.42 years (5 m) to 21 years in Group A and 0.5 years (6 m) to 17 years in Group B. Right side hernia and/or hydrocele were 464 (59.18%), 287 (36.60%) had left sided, while 33 (4.21%) had bilateral hernia and/or hydrocele. Total number of herniotomies done was eight hundred and seventeen (817). There were differences in mean operation time between the two groups. Lengths of operation time ranged from 14 to 54 min in Group A (median, 23 min) and 7-44 min in Group B (median, 15 min) with a mean surgical duration of 23.41 ± 5.94 in Group A versus $15.48 \text{ min} \pm 4.16$ Group B ($P < 0.001$) in unilateral repair while 36.35 ± 9.89 min in Group A versus 20.42 ± 4.82 min in Group B for bilateral repairs $P = 0.00563$.

Mean Paracetamol® dose/kg/patient in Group A was 3.77 ± 1.35 versus 1.88 ± 0.73 in Group B ($P < 0.001$) for unilateral herniotomy and mean Paracetamol® dose/kg/patient was 4.14 ± 1.65 in Group A versus 2.68 ± 0.88 in Group B for bilateral repair $P = 0.00257$.

Three hundred and seventy-six (376) sachets of suture material were used in Group A, while 137 were used in Group B.

There were total of 93 (24.55%) complications recorded in both groups in which 87 (23.13%) in Group A versus 6 (1.47%) in Group B. Post-surgical site oedema was 17 (4.52%) in Group A versus 3 (0.73%) in Group B.

There was 7 (1.86%) accidental tearing of processus vaginalis during surgery in Group A versus 2 (0.49%) in Group B. Post-surgical hydrocele was 6 (1.59%) in Group A versus 1 (0.24%) in Group B. Recurrence was 8 (2.12%) in Group A versus none (0) in Group B. No post-surgical wound infection and or abscess in Group B while 9 (2.39%) and 16 (4.25%) were seen in Group A, respectively. No mortality was recorded in the both groups [Table 1].

DISCUSSION

Surgical repair of inguinal herniae and hydroceles has been perfected in modern paediatric surgery practice. Still, paediatric surgical scientists are constantly looking forward for less traumatic and cost-effective methods with increased cosmetic outcomes in treating children with congenital inguinal hernia and hydrocele. However, given the low complication rate of hernia repair in children, any new approach to diagnosis or surgical treatment must meet or exceed a high standard with less expense to justify cost-conscious health care systems.^[24]

Repair of inguinal hernia was documented as far back as 1871 by Marcy describing the high ligation of an unopened hernia sac,^[1] which forms the basis of paediatric hernia repair to date. However, modern hernia surgery began in the 19th century when an accurate understanding of anatomy of the inguinal canal became available leading to various innovations and adaptations.^[1] In addition, currently, minimally invasive techniques using laparoscopes have provided an alternative method for surgical repair of paediatric inguinal hernias and hydrocele.^[11,14,15] However, researches on advantages of laparoscopic inguinal hernia repair versus conventional were said to have

Table 1: Operative time, pain management and complications

Variants	Group A ($n = 376$) (%)	Group B ($n = 408$) (%)	P
Operative time (min)	23.41±5.94	15.48±4.16	<0.001
Paracetamol dose/patient	3.77±0.07	1.88±0.38	<0.001
Tearing of the procesus vaginalis	7 (1.86)	2 (0.49)	
Haematoma	15 (3.98)	0	
Seroma	5 (1.32)	0	
Oedema	17 (4.52)	3 (0.73)	
Testicular retraction	4 (1.06)	0	
Wound infection	9 (2.39)	0	
Wound abscess	16 (4.25)	0	
Recurrence	8 (2.12)	0	
Hydrocele	6 (1.59)	1 (0.24)	
Mean (outcome)	9.66	0.66	0.000513

shorter operation time in bilateral hernia repair, lower rate of metachronic hernia, quicker recovery, lesser pain, low complication and lower recurrence rate with an improvement in cosmetic outcomes.^[7,9,11,25,26]

Either done laparoscopically or openly, the standard surgical treatment for inguinal hernia repair is limited to the ligation of the hernia sac (processus vaginalis).

Various methods exist for the ligation of the processus vaginalis in children viz Ferguson and modified Ferguson through skin crease incision, opening of the external oblique and the ring, high ligation of twisted sac doubly tied and as much of the distal sac. The other method is a modified Mitchell-Bank repair without opening the external oblique and exposing the internal ring.^[27-29]

Some authors advocated laparoscopic methods while few recommend scrotal approaches for the repair of hydrocele in children for cosmetic reasons and reservation of ilioinguinal nerve and possibility of elimination of any damage to the cord structures.^[10,30-34] Still, there is no uniform consensus on the repair of congenital hernia/hydrocele. Ravi and Hamer in their survey of 264 consultant surgeons found out that, various surgeons perform herniotomy differently with no standard surgical technique for inguinal herniotomy in children.^[19]

Recurrence rate in conventional open herniotomy is rare accounting for 1-2.5%.^[35,36] Grosfeld *et al.*^[37] in their analysis of 62 cases attributed postoperative wound infection, haematoma, injury to the floor of the inguinal canal and type of suture material used for the repair to contribute in recurrence. Again, Steinau *et al.*^[38] found out that incarceration, concomitant diseases and infections rather than the technique to account for a recurrence. In 2009 Vogels *et al.*^[39] suggested that, inadvertent opening of the hernial sac during its dissection off the vas and vessels and larger size of the hernia could have played a role.

Hence; minimum surgical invasion with minimum tissue handling provides optimum healing condition of surgical wound with low postsurgical complications [Figure 5b and c]. As such, in our series, the external oblique and inguinal rings were not tempered with. No Sac twisting and or double ligations of the proximal hernia sac were done, and the distal sac was not tempered with in Group B. No recurrence, haematoma, infection and postsurgical testicular retractions were seen.

There were total of 93 (24.55%) complications in Group A versus 6 (1.47%) in Group B $P < 0.0005$.

Therefore, repair of congenital inguinal hernia/hydrocele can have satisfactory results with minimal invasiveness in children and young adults in resource limited centres. To achieve this, the incision should be directly and precisely at the level of the external inguinal ring. This is in contrast to descriptions of conventional congenital inguinal hernia/hydrocele repairs, where the role of skin incision sites were not stated, but almost always been mentioned that, the skin incision should be made on a prominent skin crease^[27-29] which is not an alignment with the inguinal canal/ring in both older children and adolescents.

Hence, adopting the micro-surgical instrumentation, incision over the external inguinal ring with mini-invasiveness for herniotomy in children and adolescents in our centre reduced the length of operation time, surgical suture materials, postoperative pain, postsurgical complications with satisfactory healing and cosmetic benefits.

CONCLUSION

Mini-invasive herniotomy in resource-limited set-ups is feasible and has satisfactory cosmetic outcomes, quick recovery, and zero recurrence without surgical site infection. It can be a procedure of choice in such centres.

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