



# Open inguinal herniotomy: Analysis of variations

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## ABSTRACT

**Background:** Repair of congenital groin hernia/hydrocele is the most common surgical procedure performed by paediatric surgeons. There is dearth of literature comparing the outcomes of open herniotomy in children using various surgical approaches. This study was aimed at evaluating the efficacy of open herniotomy by comparing external ring incision, hernial sac twisting and whether or not double ligation has benefit over a single suture application.

**Materials and Methods:** A multi-centre prospective randomised clinical trial was conducted with a total of 428 patients having congenital inguinal hernia and/or hydrocele. Patients were randomly assigned into four groups: RO (had external ring opened, hernial sac twisted and doubly ligated), ST (had hernial sac twisted and doubly ligated without opening the ring), DL (had double ligation of hernial sac without ring opening nor twisted) while SL (had single ligation of hernial sac with neither ring opening nor sac twisting).

**Results:** A total of 458 repairs were done. Patients' age ranged from 0.25 years (3 months) to 21 years in group RO with mean of  $4.87 \pm 4.07$  (median, 4), 0.069 years (24 days) to 17 years in group ST with mean of  $4.23 \pm 4.03$  (median, 3), 0.5 years (6 months) to 16 years in group DL with mean of  $4.59 \pm 3.87$  (median, 4) and 1 year to 19 years in group SL with mean of  $5.00 \pm 4.19$  (median, 4). Operation time per repair was  $26.50 \pm 5.46$  min, range 16-40 min (median, 27 min) in group RO,  $22.18 \pm 5.34$  min, range 12-39 min (median, 21 min) in group ST while  $17.98 \pm 3.40$  min with range of 12-39 min (median, 17 min) in group DL and  $15.27 \pm 4.18$  min, range 7-40 min (median, 15 min)

in group SL  $P < 0.0001$ . The mean paracetamol dose/patient was  $3.96 \pm 1.43$ ,  $2.94 \pm 0.81$ ,  $2.18 \pm 0.69$ ,  $1.87 \pm 0.78$  in group RO, ST, DL and SL, respectively,  $P < 0.0001$ . **Conclusion:** Congenital inguinal hernia repair with opening of the external ring, hernia sac twisting and double ligation of the processus vaginalis confers no advantage.

**Key words:** Congenital, hydrocele, inguinal hernia, repair, variation

## INTRODUCTION

Congenital inguinal hernia and hydrocele repair is a common paediatric surgical procedure that was documented since 1871 by Marcy describing the high ligation of the hernia sac<sup>[1]</sup> that forms the basis of paediatric hernia repair to date.<sup>[2]</sup> Conventional description of open inguinal hernia repair in children requires that, the external inguinal ring should be incised; the processus vaginalis/hernia sac be dissected, twisted and doubly ligated.<sup>[3-7]</sup> Still, there is no uniform consensus on the repair of congenital groin hernia.<sup>[8]</sup> Some studies have described alternatives to surgical repairs of congenital hernia in clinical and experimental models,<sup>[9-14]</sup> while others have modified the open conventional hernia repair method with twisting and double ligation of the hernial sac.<sup>[15]</sup> In addition, some researchers documented the rationale behind the reasons for the various surgical approaches<sup>[8,16]</sup> but none has analysed the outcomes of the variations.

From our literature search, there have been no studies evaluating the outcome of open congenital hernia repair if the external ring is incised or not, hernia sacs/processus vaginalis if twisted or not and whether double ligation has any benefit over a single suture application to the hernia sac.

This study compares open hydrocele and/or inguinal hernia surgery without opening the external inguinal

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ring, using single ligation to the processus vaginalis instead of double ligation and without twisting the hernia sac.

## MATERIALS AND METHODS

This was a prospective randomised clinical trial from Murtala Muhammad Specialist Hospital, Kano in northern Nigeria; Scientific Centre of Paediatric and Child Surgery, Almaty, Republic of Kazakhstan and National Republican Centre for Mother and Child Health, Astana, Republic of Kazakhstan.

The study was from September 2008 to May 2014. 428 male patients with congenital inguinal hernia/hydrocele were enrolled.

Patients were divided into four groups: RO, the external ring was opened; the hernial sac was dissected off the vas deference and vessels, twisted and doubly ligated. ST, the hernial sac was dissected off the vas deference and vessels without tampering with the external ring, twisted and doubly ligated. DL, the hernial sac was dissected without tampering with the external ring; the sac was not twisted, but doubly ligated while SL had single ligation of the hernial sac with neither external ring opening nor sac twisting [Table 1].

Specialist paediatric surgeons and/or locally trained experienced senior medical officers carried out the herniotomies randomly throughout the period. Throughout the study, Johnson and Johnson Intl Ethicon® vicryl® 4/0 and 3/0 sutures were used.

Data on sociodemographic characteristics of the subjects, operation time, postsurgery pains management and outcome of surgery, including complications were recorded for all the groups.

Data analysis was conducted using a web-based epidemiologic and statistical calculator for public health OpenEpi software version 2.3 and Microsoft (MS™) Excel® 2007. Statistical test of ANOVA was used to determine associations and significant associations were presumed if  $P \leq 0.05$ .

**Table 1: Procedures within the groups**

Procedure	Groups			
	RO	ST	DL	SL
External ring opening	++	--	--	--
Hernial sac twisting	++	++	--	--
Double ligation of the hernial Sac	++	++	++	--
Single ligation of the hernial Sac	--	--	--	++

++: Means done; --: Means not done

Using raffle draw during consultations at the outpatient departments of the three (3) centres involved in the study, patients were randomly assigned into any of the four (4) groups SL, RO, ST and DL. All individuals within the age group <1-month to 21 years with a diagnosis of congenital inguinal hernia and/or hydrocele and booked for surgery were included in the study. However, emergency and female patients were excluded. Verbal informed consent to participate in the study was obtained from the parents/guardians of all recruited children <10 years. In the case of participants aged 10-17 years, consent was obtained from a parent/guardian before the subject was asked for his assent. Participants aged 18 years and above were allowed to consent for themselves. Participation in the study was entirely voluntary and participants were free to withdraw from the study at any point without any negative consequences.

Pain/local tenderness was evaluated using children and infants postoperative pain score for patients <3 years. Paracetamol® (15 mg/kg/dose every 6 h) was given to the patients with the pain scores  $\geq 4$ .<sup>[17]</sup> For patients aged 3 years, Children's Hospital-of-Eastern Ontario Pain Score was used in evaluating postoperative pain/local tenderness, and Paracetamol® (15 mg/kg/dose every 6 h) was given to the patients with pain scores  $\geq 5$ .<sup>[18]</sup> On the other hand, visual analog scale (VAS) was used to evaluate postoperative pain/local tenderness in patients older than 3 years. For pain score  $\geq 5$ , Paracetamol® (15 mg/kg/dose every 6 h) was given.<sup>[19]</sup>

## RESULTS

There were 428 patients with congenital inguinal hernia and/or hydrocele ( $n = 428$ ). Patients' ages ranged from 24 days to 21 years; the mean ages and standard deviation of the patients' were  $4.87 (\pm 4.07)$ ,  $4.23 (\pm 4.03)$ ,  $4.59 (\pm 3.87)$  and  $5.00 (\pm 4.19)$  in groups RO, ST, DL and SL, respectively. Cumulatively, 458 repairs were done with bilateral herniotomy performed on 30 patients (6.55%). Of the 30 bilateral herniotomy cases conducted, 7 (23.33%) were in group RO, 9 (30%) in group ST, 6 (20%) in group DL and 8 (26.67%) in group SL. The nature of lesions and the repairs done in the four (4) groups are presented in Table 2. The mean length of operating time per repair was  $26.50 \pm 5.46$  min,  $22.18 \pm 5.34$  min,  $17.98 \pm 3.40$  min, and  $15.27 \pm 4.18$  min in groups RO, ST, DL and SL, respectively, ( $P < 0.001$ ). The mean Paracetamol® dose/patient was  $3.96 \pm 1.43$ ,  $2.94 \pm 0.81$ ,  $2.18 \pm 0.69$  and

1.87 ± 0.78 in groups RO, ST, DL and SL, respectively, ( $P < 0.001$ ) [Figure 1]. Mean operating time and general outcomes among the groups are documented in Table 3. The mean length of follow-up for the groups was 38.93 ± 12.20 weeks in RO, 35.90 ± 12.19 weeks in ST, 36.86 ± 7.63 weeks in DL and 35.78 ± 11.57 weeks in group SL.

## DISCUSSION

Inguinal hernia and hydrocele are among the most frequent congenital pathologies in the paediatric population. The approach to surgical repair of congenital groin hernia and/or hydrocele differs with variable outcomes.<sup>[9,10,13,14]</sup> Notwithstanding the surgical approach to the repair of congenital groin hernia and/or hydrocele in children, the principle remains high ligation of the processus vaginalis with or without external oblique aponeurosis incision.

There are literatures emphasizing on repair of congenital groin hernia/hydrocele with incising and opening the external ring followed by dissection of the hernia sac,

twisting and doubly ligating the sac to avoid presumed complications and recurrences.<sup>[2-6]</sup>

Though groin hernia/hydrocele repair in children represent one of the most commonly performed surgical procedures; it has low complication rate. In groin hernia repair, recurrence is the most important aspect of the complications. Factors attributed to complications and recurrences vary. In 1994, Wright in his analysis of thirteen recurrences over a 16-year period attributed technical errors and infections to play a role.<sup>[20]</sup> In addition, Grosfeld and others elaborated factors contributing to recurrences in congenital inguinal hernia repair to include postoperative wound infection, haematoma, injury to the floor of the inguinal canal and usage of inappropriate suture materials.<sup>[21]</sup> While Steinau *et al.* in their report found out that, about 31% of total recurrences were due to concomitant diseases and incarceration with 9.4% as a result of postoperative complications.<sup>[22]</sup> However, Vogels *et al.* in their series of herniotomy in boys gave an overall recurrent rate of 0.69% that was attributed to inadvertent opening of the hernial sac during its dissection off the vas and vessels and larger size of the hernia.<sup>[23]</sup>

**Table 2: Nature and frequency of lesions among hernia and/or hydrocele patients operated using various approaches in three different centres, September 2008 to May 2014**

Groups	Hernia (%)	Hydrocele (%)	Hernia with hydrocele (%)	Total
RO	62 (59.04)	36 (34.28)	7 (6.66)	105
ST	71 (58.67)	38 (31.40)	12 (9.91)	121
DL	79 (64.22)	35 (28.45)	9 (7.31)	123
SL	69 (63.30)	26 (23.85)	14 (12.84)	109
Total				458

**Table 3: Surgical outcomes among hernia and/or hydrocele patients operated using various approaches in three different centres, September 2008 to May 2014**

Postsurgery outcome	Group RO (n = 98) (%)	Group ST (n = 112) (%)	Group DL (n = 117) (%)	Group SL (n = 101) (%)
Tearing of the processus vaginalis	2 (1.57)	1 (0.77)	2 (1.39)	2 (1.58)
Haematoma	4 (3.14)	2 (1.53)	1 (0.69)	1 (0.79)
Induration	2 (1.57)	1 (0.77)	2 (1.39)	0 (0.00)
Wound infection	5 (3.93)	4 (3.07)	1 (0.69)	2 (1.58)
Recurrence	1 (0.78)	1 (0.77)	0 (0.00)	0 (0.00)
Hydrocele	2 (1.57)	1 (0.77)	0 (0.00)	0 (0.00)
Testicular retraction	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Testicular atrophy	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Total	16 (12.56)	10 (7.68)	6 (4.16)	5 (3.95)
		32 (24.40)		5 (3.95)
				$P < 0.0001$

In our series, with a total of 2 (1.55%) recurrence rate, there were a total of seven 7 (5.31%) tearing of the processus vaginalis that were easily identified during the surgery and taken care of and such tearing had no adverse effect on the integrity of the repair. Eight postoperative haematoma 8 (6.15%) were seen mostly in groups RO and ST with surgical site infection to constitute 12 (9.27%) of the total postsurgery complication which is in keeping with reports from African set ups<sup>[24,25]</sup> where surgical site infection prevails.<sup>[16]</sup> Postoperative hydrocele was seen in three patients 3 (2.34%) that resolved spontaneously in two patients within 5-7 weeks from the date of surgery while a patient had an aspiration via scrotal approach without further recurrence.

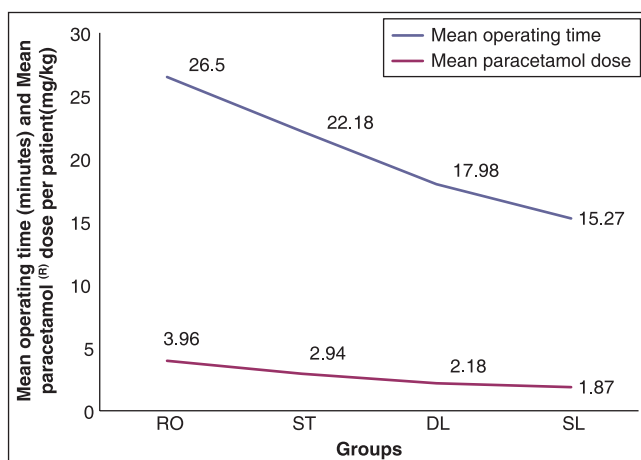
On the other hand, the repair of congenital inguinal hernia and/or hydrocele varies. Ravi and Hammer searched for a standard technique for a repair of congenital inguinal hernia and hydrocele in children. They found out that, there are only trends rather than a standard uniform approach.<sup>[8]</sup> While in 2002, Levitt<sup>[26]</sup> and colleagues surveyed 70% of North American Paediatric Surgeons and found out that, only 9% of the respondents do not incise the external oblique aponeurosis at all. In addition, only 22% of the surgeons surveyed applied a single ligature to the hernial sac and 34% were not twisting the sac. The authors attributed

tradition of learning from mentors to have contributed more to surgeon's surgical method of repair rather than prevention and avoidance of anticipated complications. Hence, the majority of surgeons surveyed were incising the external ring, twisting and doubly ligating the sac. Reasons for the external ring incision, twist and double ligation of the sac were unclear, suggesting that; the practice may have originated from surgical mentorship.

In sub-Saharan Africa, congenital surgical pathologies are carried to adulthood due to the deficit of paediatric surgeons in rural and semi-urban hospitals and anterior abdominal wall defects inclusive.<sup>[27,28]</sup> In our series, adolescents and adult patients with a history of congenital groin hernia/hydrocele were included with subsequent herniotomy in keeping with the work of Osifo and Irowa<sup>[29]</sup> without any postoperative sequelae.

Altogether, 37 (26.86%) complications were recorded in this study throughout the follow-up period. One (1) case of recurrence (1.55%) was recorded in each of groups RO and ST, with none recorded in other groups. Wound infection was recorded in 12 patients (9.27%) with 5 (3.93%) seen in group RO, 4 (3.07%) in ST, 1 (0.69%) in DL and 2 (1.58%) in SL. Haematoma formation and postsurgery induration were seen in 6 (5.71%), 3 (2.30%), 3 (2.08%) and 2 (0.79%) patients in groups RO, ST, DL and SL, respectively. Postsurgery hydrocele was recorded in 2 patients (1.57%) in group RO and 1 patient (0.77%) in group ST only.

Therefore, when the external aponeurosis was not opened, the sac not twisted and proximal sac singly ligated instead of double ligation, the mean operation time was reduced and postoperative pain management was also reduced [Figure 1].



**Figure 1: Mean operating time and postoperative pain management among hernia and/or hydrocele patients operated using various approaches in three different centres, September 2008 to May 2014**

## CONCLUSION

Hernia repair in children with opening the external oblique aponeurosis, twisting the hernia sac and doubly ligating it has no any positive effect on the quality of the repair or reduction of complications. This is not only unnecessary but is a waste of time and resources with increased postoperative pain.

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