

# Testicular Atrophy following Unilateral Herniotomy in Children: A Single Surgeon's Experience

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## Abstract

**Background:** A reduction in testicular mass (testicular atrophy) may occur as a complication of hydrocele/hernia repair in children (herniotomy). The aim of this study was to evaluate for testicular atrophy in children who underwent herniotomy for hernia or hydrocele repair.

**Materials and Methods:** This was a prospective study of children aged 15 years and younger who had unilateral herniotomy at the pediatric surgery unit of a teaching hospital in Enugu, Nigeria. Preoperatively and postoperatively (at least 6 months apart), the volumes of both testes were assessed using ultrasound. These specific testicular volumes were compared to determine the degree of change in unilateral testicular volumes relative to the contralateral testis. For the index study, any reduction in testicular volume of more than 20 percent is considered testicular atrophy.

**Results:** A total of 258 cases of herniotomies were seen during the study period. The mean age of the patients, at diagnosis of testicular atrophy, was 2 years, range of 1 to 3 years. About one-fifth (53) of the patient showed more than 20% reduction in testicular volume relative to the contralateral testis. There was more hydroceles than hernias and all the patients had herniotomy. Stitch related complications were the most common post-operative complication.

**Conclusion:** Herniotomy for pediatric inguinal hernia and hydrocele is one of the most commonly performed surgical procedures in children. However, this procedure is not without complications, testicular atrophy may occur. This study has shown that up to 20% of the children who underwent herniotomy may come down with testicular atrophy.

**Keywords:** children; herniotomy; experience; single surgeon; testicular atrophy

## 1. Introduction

Eighty-five percent of the testicular mass is made up of seminiferous tubules and testicular volume is a reflection of its functional status both in adults and children. These functional statuses of the testis include spermatogenic and hormonal functions [1, 2]. Testicular atrophy occurs when there is more than 20% reduction in testicular volume compared with baseline volume or the normal contralateral testis [3, 4]. Testicular atrophy may occur after infarction, inflammation, cryptorchidism, varicocele or trauma [3]. It is important to note that testicular volumes differ according to age and stage of sexual development and comparing both testes, each testis may have different volume [5]. The clinical importance of testicular atrophy is the association with reduced spermatogenesis and reduced fertility in adult life [3]. Herniotomy is the surgical procedure for the treatment of hernias and hydrocele in children. Herniotomy involves separation of the vas deferens and testicular vessels from the patent processus vaginalis with

high ligation of the latter. The procedure may cause injury/damage to the surrounding structures such as the vas deferens and testicular vessels which may result in ischemia and subsequent atrophy of the ipsilateral testis. Although there are 2 arterial loops that supply the testis: the testicular artery on one hand, artery to the vas and cremasteric artery on the other hand. In practice, damage to the testicular artery more often than not results in testicular atrophy. The aim of this study was to evaluate for testicular atrophy in children who underwent herniotomy for hernia or hydrocele repair.

## 2. Materials and Methods

This was a prospective study of children aged 15 years and younger who had herniotomy between January 2016 and December 2020 at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria. Only children who had unilateral herniotomy were recruited; those with bilateral herniotomy were excluded. Consecutive patients with hernia/hydrocele for herniotomy who

presented during the study period were recruited into the study. Children who had herniotomy in the peripheral hospital before presentation to ESUTH for further care were also recruited into the study. However, patients older than 15 years of age and those with complicated inguinal hernias were excluded from the study. ESUTH is a tertiary hospital located in Enugu, South East Nigeria. The hospital serves the whole of Enugu State, which according to the 2016 estimates of the National Population Commission and Nigerian National Bureau of Statistics, has a population of about 4 million people and a population density of 616.0/km<sup>2</sup>. The hospital also receives referrals from its neighboring state.

**2.1. Pre-operative protocol**

On presentation to the outpatient clinic with hernia or hydrocele, the patient was evaluated and an ultrasound to assess the volumes of both testes was performed. The ultrasound machine used was a commercially available, real time scanner with 7.5-MHz linear transducer (TITAN; Sonosite Inc, Bothell, WA, USA). The ultrasound measurement of testicular volume were calculated using the Lambert formula: Length (L) x Width (W) x Height (H) x 0.71, where L is the longitudinal diameter, W is the anteroposterior diameter and H is the transverse diameter. At least, two measurements of each of the diameters were made and the average taken. This minimized observer variations. The testicular volume was calculated automatically by the ultrasound machine and documented in centimeter<sup>3</sup> (cm<sup>3</sup>). Informed consent was obtained from the patients' caregivers. Statistical Package for Social Science (SPSS) version 21 (manufactured by IBM Corporation Chicago Illinois) was used for data entry and analysis. Data were expressed as percentages, median, mean, and range.

**2.2. Operative procedure**

Under general anesthesia and through an inguinal incision, the spermatic cord was mobilized, the patent processus dissected out and high ligation of the processus performed. The surgical site was closed in layers.

**2.3. Post-operative protocol**

Analgesics and antibiotics were given. The patients were treated as day cases. At 6 months post orchidopexy, a repeat ultrasound was performed to assess for any change in the ipsilateral testicular volume relative to the contralateral testis. Any loss of testicular volume of more than 20%, when compared to the contralateral testis, is considered testicular atrophy.

**2.4. Data collection**

The information extracted included the age of the patient, clinical diagnosis, duration of symptoms before presentation, time interval between presentation and surgery, operative procedure performed, complications of treatment and testicular volumes.

**3. Results**

**3.1. Patients' demographics**

A total of 258 cases of herniotomies were seen during the study period. All the patients were males. The mean age of the patients, at diagnosis of testicular atrophy, was 2 years, range of 1 to 4 years. The median duration of inguinal swelling prior to presentation to the hospital was 4 months with a range of 1 month to 18 months and the mean duration from presentation to surgery was 2 months (range: 1-3 months).

**3.2. Testicular volumes**

Details of the testicular volumes are shown in Table 1.

Mean testicular volume	
At presentation [pre-op]	1.6 ± 0.4 cm <sup>3</sup>
At least 6 months post-op	
205 (79.5%) patients	1.6 ± 0.2 cm <sup>3</sup>
53 (20.5%) patients	1.2 ± 0.3 cm <sup>3</sup>

**Table 1:** Testicular volumes (pre-op and post-op)

Following herniotomy and measurements of the testicular volumes (at least 6 months post-op), about one-fifth (53) of the patient showed more than 20% reduction in testicular volume relative to the contralateral testis.

**3.3. Clinical diagnosis, side of the pathology and source of referral (n=53)**

Amongst the patients that developed testicular atrophy, 41 (77.4%) were performed in the peripheral hospital and were subsequently referred our facility whereas 12 (22.6%) herniotomies were performed in the teaching hospital. Thirty-two (60.4%) patients had hydrocele whereas 21 (39.6%) patients had inguinal hernia. The lesions were on the right side in 31 (58.5%) patients and on the left side in 22 (41.5%) patients.

**3.4. Operative procedure performed**

All the patients had herniotomy. Patients who had narrowing the inguinal ring (herniorraphy) in addition to the herniotomy were not considered.

**3.5. Complications of treatment**

Six (11.3%) had stitch related complication and 4 (7.5%) had surgical site infection. The rest of the patients (81.2%) did not develop any complications.

**4. Discussion**

Testicular atrophy is an uncommon but well recognized complication of inguinal hernia repair and this may result in litigation [6]. Histologically, testicular atrophy manifest as changes in maturation arrest of the germinal epithelium. There is loss of spermatids in the lumen of seminiferous tubules. In severe testicular atrophy, there is loss of deeper layer of cells, vacuolization of the germ cell layer and presence of multinucleated giant cells. At the sclerotic end stage of testicular atrophy, only residual interstitial cells remain. Apart from loss of vascular supply, other agents that may cause testicular atrophy include infective process, hormonal drugs, anticancer drugs, dopamine antagonist, antidepressants and antihypertensives. In testicular atrophy, the testis shrinks. This shrinking is due to loss of germ cells and Leydig cells. The germ cells produce spermatozoa while Leydig cells produce testosterone. The clinical implications of testicular atrophy are the lower or no production of spermatozoa and testosterone depending on the severity of the testicular atrophy.

In most of the children, in the present study, who developed testicular atrophy, their herniotomies were performed in the peripheral hospitals. The fact that these herniotomies may not have been performed by pediatric surgeons may explain higher incidence of testicular atrophy from peripheral hospital. Most surgeries in peripheral hospitals are carried out by general practitioners and non-pediatric surgeons. In the current study, the mean age at which testicular atrophy was noticed was 2 years. Hydroceles and hernias are more common in infants and consequently more surgeries for these are performed in infants. Bokar et

al also reported that inguinal hernias and hydroceles present during the first year of life [7]. The impact of vascular injury to the testis during herniotomy is usually noticed some months after herniotomy. Hence, the age at which testicular atrophy was noticed. From the time the parents noticed the inguinal/scrotal swelling, it took an average of 4 months for the patients to present to the hospital. Parental poverty and ignorance may explain the delayed presentation. The mean duration from presentation to the hospital to operative treatment was 2 months. All the patients were treated as elective cases and the short interval was required to investigate and optimize the patients. The long waiting list may also be responsible for the delay in treatment.

Relative to the contralateral testis, about 20% of the children showed more than one-fifth reduction in testicular volume. In other words, there was testicular atrophy in 20% of the patients. The criterion for testicular atrophy used in the index study is consistent with that used by Lee et al [8]. That is a reduction of testicular volume of greater than 20% when compared to the contralateral testicular volume [8]. Reid et al also reported the risk of testicular atrophy as a consequence of inguinal hernia repair [6]. Maneuvers during hernia repair such as overzealous dissection of a distal hernia sac, dislocation of the testis from the testis into the wound and previous scrotal surgeries are associated with higher incidence of testicular atrophy [6]. The etiology of testicular atrophy following inguinal hernia repair is mostly due to vascular injury. However, other researchers have reported testicular atrophy following orchitis [9, 10]. The pathogenesis of testicular atrophy in orchitis includes edema, congestion, perivascular and interstitial infiltration of lymphocytes [10]. There is also compartment syndrome due to barrier effect of the tunica albuginea of the testis [9, 11]. Other causes of testicular atrophy may include trauma, testicular torsion and varicocele.

About two-thirds of the patients had hydrocele whereas one-third had inguinal hernia. The etiopathogenesis of hydroceles and hernias are basically the same in children; both result from persistent patency of the processus vaginalis [12]. Hydroceles contain fluid while hernias contain bowel or/and omentum and the standard surgical practice is ligation and resection of the patent processus vaginalis (herniotomy).

Stitch related wound complication such as stitch sinus, stitch abscess and stitch granuloma are quite common following herniotomy. One study from Cairo, Egypt documented these stitch complications in pediatric inguinal hernia repair [13]. The authors reported the progression from stitch sinus to stitch abscess or granuloma [13]. Even in laparoscopic hernia repair, stitch complications have been reported in stitches used for port closure [14].

## 5. Conclusion

Herniotomy for pediatric inguinal hernia and hydrocele is one of the most commonly performed surgical procedures in children. However,

this procedure is not without complications, testicular atrophy may occur. This study has shown that up to 20% of the children who underwent herniotomy may come down with testicular atrophy. Future studies will elucidate the factors that may influence the risk of testicular atrophy.

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