

A Clinical Study of the Different Types of Inguinoscrotal Swellings and Their Management in a Tertiary Care Referral Center

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Abstract

Background: Inguinal hernias and hydrocele in children remain one of the most common congenital anomalies observed by pediatricians and surgeons requiring surgery.

Materials and Methods: 44 cases of inguinoscrotal swelling attending the pediatric surgery OPD or admitted in the wards of K. J. Somaiya Hospital and Research Center, Sion, Mumbai (tertiary care center), from October 2014 to April 2015 year were selected on the basis of the simple random sampling method. All patients below 12 years of age, both male and female attending surgery OPD with complaints of swelling in the inguinoscrotal region associated with symptoms as well as those found accidentally on examination were included. The age/sex distribution, birth history and side distribution, exact site of swelling, and operation performed were evaluated and compared with standard published literature. A predesigned pro forma was used to collect this information for individual cases.

Results: The incidence of inguinoscrotal swelling in pediatric patients was maximum in toddler age group (38.6 %), male (88.6%), term child (79.5%), and right side (59.1%) with a maximum number of swellings being in the inguinal region (77.3%). Of the 44 cases, 2 were diagnosed as inguinal hernia, 5 as congenital hydrocoele, 3 as encysted hydrocele of the cord, and 4 as undescended testis.

Conclusion: Inguinal hernia and hydrocele along with associated conditions such as undescended testis and hypospadias are common congenital anomalies requiring surgical intervention. Inguinal herniotomy, whether open or laparoscopic, is considered safe and effective with less recurrences.

Key words: Inguinoscrotal swelling, Tertiary care centre, Pediatric hernia, Laproscopic hernia surgery

INTRODUCTION

The disease which makes the subject of the following tract, is one in which mankind are, on many accounts, much interested. No age, sex, rank, or condition of life, is exempted from it; the rich, the poor, the lazy, and the laborious, are equally liable to it; it produces certain

inconvenience to all who are afflicted by it. It sometimes puts the life of the patient in such hazard, as to require one of the most delicate operations in surgery; and it has in all times, from the most ancient down to the present, rendered those who labor under it subject to the most iniquitous frauds and imposition.^[1]

Inguino-scrotal swelling is one of most common surgical problems encountered in children.^[2] Of all the inguino-scrotal swellings, inguinal hernia and hydrocele top on the list in frequency. They represent the conditions most requiring surgical repair in the pediatric age group.

Hernia is Latin term meaning rupture of a portion of structure. It can be defined as an “abnormal protrusion of

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a viscus or part of a viscus through a normal or abnormal opening in the wall of its containing cavity.”^[3] As a result of improved neonatal intensive care, more and more premature babies are being delivered, and consequently, the incidence of neonatal inguinal hernia and hydrocele is increasing.

Pediatric hernias and hydrocele are fundamentally the results of incomplete or abnormal obliteration of the patient peritoneal diverticulum called processus vaginalis which accompanies that the test is on its journey into the scrotum.

A similar process occurs in a female but without the external phase of descent. In a female, a potential pocket associated with the round ligament, known as a diverticulum of Nuck corresponding to the processus vaginalis of males predisposes to formation of inguinal hernia in a female. Normally, the fusion of the processus continues after birth through infancy and childhood with some remaining patent even in adulthood but mostly occurs before 2 years of age. Studies suggest that 80–100% of infants are born with a patent processus, and additionally, a short inguinal canal that has not developed in an oblique direction along with direct superimposition of the external and internal rings favors the development of hernias and hydrocele. The incidence of inguinal hernias is 0.8–4.4% or 10–20/1000 live births. The risk factors include prematurity, low birth weight, family history, hydrops, meconium peritonitis, chylous ascites, liver disease with ascites, abdominal wall defects, ambiguous genitalia, hypospadias or epispadias, bladder extrophy, cryptorchidism, cystic fibrosis, and connective tissue disorders such as Ehlers–Danlos syndrome. The predisposing conditions include 4 prematurity, low birth weight, family history, hydrops, meconium peritonitis, chylous ascites, liver disease with ascites, abdominal wall defects, ambiguous genitalia, hypospadias or epispadias, bladder extrophy, cryptorchidism, cystic fibrosis, connective tissue disorders like Ehlers Danlos syndrome, Ventriculoperitoneal shunts, continues ambulatory peritoneal dialysis and mucopolysacchridosis. The indirect inguinal hernias occur as bubonocoe (hernia limited to the inguinal canal), funicular (hernias extends into the scrotum and up to the upper pole of the testis), and complete (where hernia completely surrounds the testis) [Figures 1].

The presentation typically can be groin swellings which appear with increased intra-abdominal pressure such as crying or straining and may disappear spontaneously or with gentle manual pressure. The other features include groin pain during exercise which can be vague chronic sharp fleeting type. Abdominal distention, vomiting, and absence of stool/flatus would suggest intestinal obstruction, perforation, and peritonitis. With strangulation, occasional

bleeding per rectum may be seen. On the other hand, hydrocele presents as a translucent smooth non-tender swelling. The other differentials include inguinal lymph nodes, encysted hydrocele of cord, varicocele, lymph varix, funiculitis, ectopic or retractile testis, testicular malignancy, aneurysm of external iliac artery, cryptorchidism, abscess in inguinal region, and lipoma of the cord and femoral hernia.

The diagnosis is based on clinical history and examination and laparoscopic surgery with or without contralateral exploration. The complications include wound infection at 1–2% recurrences at 1% and uncommonly vas injury and testicular atrophy which commonly occurs after emergency surgery.

Aim

To study the different types of inguino-scrotal swellings and their management in the tertiary care referral centre.

Objectives

Primary objective

1. To study the differential diagnosis of inguino-scrotal swelling in children [Figures 2-7].

Secondary objectives

The secondary objectives are as follows:

1. To study the age, sex and sidewise distribution of inguinoscrotal swellings in children.
2. To study the various management options for various types of inguinoscrotal swelling open as well as minimal excessive surgery.
3. To study the associated anomalies like undescended testis, hypospadias and patency of processus vaginalis.
4. To study the postoperative complications such as wound infection, haematoma, recurrence etc.
5. To study complications like incarceration, strangulation and gonadal infarction.

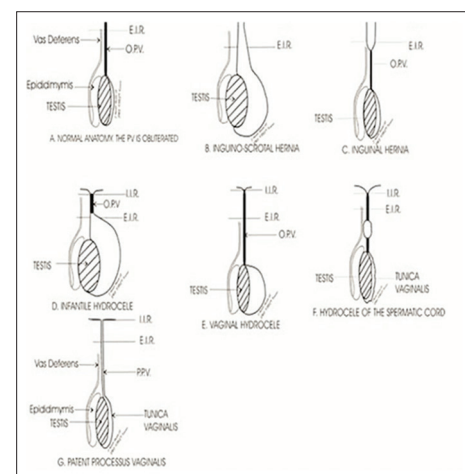


Figure 1: Diagrammatic representation of different types of inguinal hernias and hydrocele in boys[9]



Figure 2: Right inguinal swelling

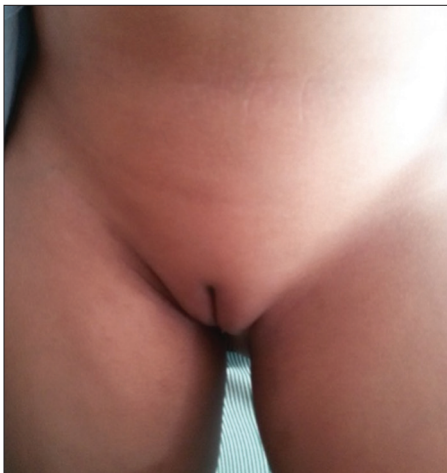


Figure 3: Left inguinal swelling



Figure 4: Left scrotal swelling

EMBRYOLOGY

Pediatric hernias and hydrocele are fundamentally the result of incomplete or abnormal obliteration of the patent processus vaginalis. During the fifth week of gestation, the gonadal ridge develop from an outgrowth of the coelomic epithelium overlying the medial aspect of the mesonephros. Primordial germ cells migrate from the endothelial lining of yolk sac to gonadal ridge during sixth week, forming



Figure 5: Right congenital hydrocele



Figure 6: Right undescended testis



Figure 7: Open herniotomy position

the indifferent gonad. The gonad, is identifiably a testis by the eighth week. As testicular development proceeds, mullerian duct regression begins under the influence of

mullerian inhibiting substance, and wolffian duct begins under the influence of fetal testosterone.^[4]

The gubernaculum develops as a condensation of mesenchyme, extending from the caudal end of the testicle to the future site of inguinal canal and scrotum. The processus vaginalis, a diverticulum of the peritoneal cavity, can first be identified during the third month of fetal life. The round and ovarian ligaments in the female are analogous to the male gubernaculum and are distinguishable by the eleventh week, once mullerian duct fusion has occurred. The gubernaculum undergoes a period of rapid growth after week 15, filling and dilating inguinal canal. This development probably due to stimulation from testosterone but may also involve mullerian inhibiting substance. During week 27 to 28, the testicle, gubernaculum, and processus vaginalis descend through the inguinal canal in to scrotum. This transinguinal passage is probably a rapid process, because testicles are rarely found within the inguinal canal in fetal autopsy studies.

Prior to the descent of the testis and the ovary from their site of origin, a peritoneal diverticulum called the processus vaginalis is formed. The processus vaginalis passes through the layers of the lower part of the anterior abdominal wall. It traverses the fascia transversalis at the deep inguinal ring and acquires a tubular covering, the internal spermatic fascia, through the lower part of the internal oblique muscle, which form the cremasteric muscle. Muscle fibers are embedded in fascia and thus the second tubular sheath called cremasteric fascia. On reaching the aponeurosis of the external oblique it evaginates this to form the superficial inguinal ring and acquires a third tubular fascial coat, the external spermatic fascia. It is in this manner that the inguinal canal is formed.^[5]

The processus vaginalis accompanies the testicle on its journey in to the scrotum. Normal fusion of the processus occurs spontaneously after the testicle is in place. Precisely when, why, and how it occurs is not known. It is clear that the closure of the processus continues after birth through infancy and childhood with some remaining patent in to adulthood. Most closure of the processus appear to occur before the age of 2 years. Patency of the processus is necessary for the development of pediatric hernias and hydroceles. Why many patent processus remain asymptomatic can only be speculated.

Incomplete obliteration of the processus vaginalis results in the formation of various types of inguinal hernias and hydroceles in infancy and childhood, and accounts for the classification of these hernias and hydroceles as congenital anomalies, even though they may not be clinically present

at birth. Obliteration of the distal processus with proximal patency leads to the formation of a shorter inguinal hernia sac. Complete failure of obliteration of the processus leaves a sac extending all the way from the internal ring to the testicles, resulting in an inguino-scrotal hernia, the tunica vaginalis being contiguous with the hernia sac and the peritoneum. Narrowing of the processus vaginalis at the level of the internal ring results in the formation of a communication between the tunica vaginalis and the peritoneal cavity, leading to the establishment of a communicating hydrocele. Conversely, obliteration of the proximal portion of the processus with distal patency results in the formation of a non-communicating hydrocele or hydrocele of the tunica vaginalis. Finally, if complete obliteration of the processus occurs with patency of the mid portion, a hydrocele of the cord (or canal of nuck in the females) occurs. This presents as a mass in the inguinal canal, and frequently has a small connection to the peritoneal cavity at the inguinal ring. The exact timing of closure is uncertain. Studies have suggested that as many as 80% to 100% of infants are born with a patent processus vaginalis and the closure, if it occurs, is most likely within the first 6 months of life.^[6]

In the female, the descent of the gonads is similar to that in the male, except that there is no external phase of descent; the uterus is interposed between the ovarian ligament and the round ligament, which by the 3rd month of gestation appears as a thick mesenchymal band extending from the region of the uterus to the labia majora. A peritoneal pocket associated with the round ligament and known as the diverticulum of nuck correspond to the vaginal processus in the male and predisposes to the formation of inguinal hernias in the female.

ANATOMY

The foundation of the inguinal anatomy is the bony pelvis. The inguinal ligament a reflection of the aponeurosis of the external oblique muscle, rest on this foundation, stretching from the anterior superior iliac spine to the pubic tubercle. The inguinal canal allows passage of the spermatic cord from the abdomen into the scrotum. The spermatic cord contains the vas deferens; three arteries (testicular, cremasteric and deferential); three veins (pampiniform/testicular, cremasteric and deferential); and three nerves (ilioinguinal, genital branch of the genitofemoral, and sympathetic nerves). The spermatic cord passes through the deep inguinal ring or arch, which is composed of the transverse abdominis and internal oblique muscles. The cord structures then continue through the inguinal canal. Anteriorly the canal is formed by aponeurosis of the external oblique muscle. The posterior wall or floor of the canal is formed by the transverses abdominis muscles

and the transversalis fascia. Roof is formed by conjoint tendon and the floor by the reflected part of inguinal ligament. Hesselbach's triangle is a region of the posterior wall at risk for direct herniation. Its boundaries consist of inferior epigastric artery on lateral, rectus muscle on medial and base formed by inguinal ligament. The cord then exist the external inguinal ring, which is formed by external oblique muscle just superior and lateral to pubic tubercle. The spermatic cord passes down to scrotum and covered with external spermatic fascia, which are derived from the fascia of external oblique muscle and transversalis fascia respectively.

The basic anatomy of inguinal canal is same as in the adult. However, it is important to emphasize that in infancy till 2 years of age, the inguinal canal is extremely short and has not developed an oblique direction, the external ring being situated almost directly over the internal ring. Scarpa's fascia is more prominent in children can be easily mistaken for external oblique aponeurosis. The internal ring is superior and lateral to the external ring, providing a protective mechanism so that when there is an increase in intra-abdominal pressure, the posterior wall of the canal is forced against the anterior wall, thus obliterating the space.

EPIDEMIOLOGY AND RISK FACTORS

The origin of inguinal hernia is unclear, although it is a common condition of infancy and childhood. Inguinal hernia occurs in 0.8–4.4% of children, and are unilateral in 75–90%.^[7,8] Incidence is higher in premature infants (13% of those <32wks gestation) and low birth weight infants (30% in infants <1000g). The inguinal hernia occurs in 0.8% - 4.4% of children, which roughly translates as 10 to 20 per 1000 live births.^[7,8] The incidence rises in premature infants (13% of those <32 weeks gestation) and low birth weight infants (30% in infants <1000g).^[8] The incidence is highest during the first year of life with peak during the first month. It has been documented that approximately one third of children with inguinal hernias are less than 6 months of age. Boys are affected approximately 6 times more often than girls. The higher incidence of inguinal hernia on the right side is related to the fact that the right testis descends at a later than the left and, therefore the right processus vaginalis obliterates later than the on the left processus. Consequently, patients who present with left sided inguinal hernia have a higher incidence of occult right sided inguinal hernia. The association of undescended testis and inguinal hernia is common. It has been reported that in both boys and girls, approximately 60%-70% of inguinal hernias occur on the right, 25%-30% on the left, and 5%-10% occur bilaterally.^[9]

Extrophy of the bladder, Ehlers-Danlos syndrome and

Prune belly syndrome are associated with an increased incidence of inguinal hernia and patients who have ventriculo-peritoneal shunts are prone to the development of inguinal hernia, secondary to the increase in intra-abdominal pressure.

Conditions that predispose to hernia development include^[4] Prematurity, Low birth weight, Family history, Hydrops, Meconium peritonitis, Chylous ascites, Liver disease with ascites, Abdominal wall defects, Ambiguous genitalia, Hypospadias, Epispadias and Extrophy of the bladder, Cryptorchid testis, Cystic fibrosis, Connective tissue disease, Ventriculoperitoneal shunts, Continuous ambulatory peritoneal dialysis & Mucopolysaccharidosis

PRESENTATION AND EVALUATION

Most inguinal hernias are accidental findings, either by parents or during a well-baby or preschool check. There is usually a history of an intermittent bulge appearing in the groin, scrotum, or labia, especially noted at times of increased intra-abdominal pressure, such as crying or straining. Its presentation may be present at birth or may not appear until weeks, months, or even years later. Nevertheless, they are thought to be present at birth, and not related to crying or straining with bowel movements, or other activities of daily living. Hernias are usually asymptomatic. Parents are frequently concerned that hernia may cause the infant to be irritable or have a loss of appetite. In most cases the only complaint is the appearance of groin swelling, which disappear when the patient relaxes, either spontaneously or with gentle manual pressure. Older children may complain of groin or inguinal pain during exercise. This pain may be vague or chronic, sharp and fleeting.^[3]

If a loop of bowel becomes entrapped in a hernia, the patient becomes extremely irritable and develops intense pain, followed by signs of intestinal obstruction (abdominal distention, vomiting, absence of flatus/stool). Vomiting is common in incarceration, and is usually secondary to visceral distention. If bile-stained vomitus is seen, then intestinal obstruction must be suspected. If the hernia is not reduced, the blood supply may be compromised leading to perforation and peritonitis. This process can occur within 2 hours, so the urgency to reduce a suspected incarcerated hernia is of the highest priority. If strangulation occurs, blood may occasionally be seen per rectum. Incarceration occurs more frequently with in the first 6 months of life. It becomes less common after 2nd year, and after 5 years of age is relatively rare. Occasionally patient presents with symptoms of intestinal obstruction without a history of an inguinal hernia. Infancy is the most common time for this to occur. All pediatric patients with intestinal obstruction, regardless of age, should be examined for an incarcerated

hernia. A small groin hernia in an overweight baby may be overlooked easily.

With the child in supine position and undressed, the examiner observes for inguinal asymmetry or an obvious mass. If no visible mass is seen, the older child should be allowed to cry or strain, frequently despite increasing intra-abdominal pressure, a mass may not be demonstrated. In this situation, the cord is palpated to determine the thickening – the silk glove sign. This sign, although suggestive of a hernia, is unreliable. An exaggerated cremasteric reflex will produce a groin swelling that may be mistaken for a hernia. It is, therefore important that both testicles are examined and are demonstrated to be within the scrotum when the groin swelling is demonstrated.

In females, the incidence of incarceration is higher, but the incidence of strangulation is lower. This is owing to the fact that in females it is the ovary, not the intestine that incarcerates most frequently. The ovary, unlike the air filled intestines, is a solid organ that swells when it becomes incarcerated. Although this swelling of a solid organ makes the ovary more difficult to reduce, the blood supply to the ovary is not usually compromised. An incarcerated ovary which is not tender or mobile is an urgent but not emergent problem.

If incarceration has occurred, the child may be dehydrated if repeated vomiting has occurred, and an elongated mass can be felt along the inguinal canal. This mass is exquisitely tender and may be associated with edema of the surrounding tissue. If intestinal obstruction has occurred, although rare, abdominal distension/hyperactive bowel sounds may be noticed. If bowel strangulation has occurred the child will become toxic; if peritonitis is present, there will be abdominal tenderness with involuntary guarding.

Different types of indirect inguinal hernias are:

- a) Bubonocoele - Where hernia is limited to the inguinal canal.
- b) Funicular - hernia extends into the scrotum and upto the upper pole of the testis.
- c) Complete - where hernia completely surrounds the testis.

DIFFERENTIAL DIAGNOSIS

A hydrocele is differentiated from a hernia by the ability to palpate above the mass and not feel continuity between the scrotal hydrocele and the inguinal canal at the level of the internal ring. An incarcerated hernia may be mistaken for a tense hydrocele especially in the neonate. However, if the diagnosis is that of a hydrocele, there will be no history of reducibility and no associated symptoms. The swelling is translucent, smooth and usually non-tender. Occasionally

an acute hydrocele of the cord cannot be differentiated clinically from an incarcerated inguinal hernia, and surgery is required. A transilluminated mass does not rule out an incarcerated hernia.^[3]

Torsion of the testis may also be misdiagnosed as an inguinal hernia. This may occur without any previous history of groin swelling, or may associate with a history of undescended testis. In case of torsion of testis, there is acute, severe pain with vomiting and the tender mass in the inguinoscrotal region does not extend through the internal ring in to the inguinal canal. Torsion of appendix testis usually present with acute scrotal pain. On examination, there will be no evidence of an inguinal hernia in the inguinal canal or scrotum, and the testis itself may not be tender; a tender, blue nodule will be present at the upper pole of the testis.

Inguinal lymph nodes, although lateral and inferior to the inguinal canal, may often be mistaken for an incarcerated hernia. This is especially true in the female, since a lymph node's size and consistency are similar to that of an ovary. There is usually evidence of recent infection in the area of lymphatic drainage, and the nodes are tender and fixed.

In children, femoral hernia, although rare, and direct inguinal hernias, even rarer, must also be looked for. These hernias tend to be large and do not descend in to the scrotum. Although very infrequently demonstrated, direct hernias are associated with Extrophy of the bladder and other anomalies. They tend not to incarcerate.

RADIOLOGICAL INVESTIGATION

The diagnosis of an inguinal hernia can be usually be made on the basis of the clinical history and examination. However, there are a few patients who have histories suggestive of a hernia, but do not have a convincing physical examinations. In these situations, several surgeons have recommended herniography, although this remains controversial. Water soluble radiopaque contrast media is injected in to the peritoneal cavity via an infraumbilical injection. Radiographs of the inguinal regions, taken at 5, 10 and 45 minutes apart will demonstrate contrast in the hernia sac or hydrocele if present. However, it is of no value for detecting an incarcerated hernia, since the neck of the sac is plugged with a loop of bowel, preventing contrast from entering the sac. Complications include intramural intestinal hematoma, intestinal perforation, and adverse reaction to the contrast media. It should not be used routinely to simply rule out the presence of a hernia or determine the presence of contralateral hernia. As such, the decision to order a herniogram should be left to the pediatric surgeon.^[5]

HYDROCELE

Hydrocele is an abnormal collection of serous fluid in the layers of the tunica vaginalis, the persistently patent processus vaginalis surrounding the testis.^[10] About 5 percent of inguinal hernias are associated with a vaginal hydrocele on the same side.

Hydrocele are common in infants. Most infant hydroceles (perhaps 90%) will spontaneously subside owing to ongoing changes in the processus. Although hernias and hydroceles co-exist, only a confident diagnosis of hernia requires early surgical intervention. Some hydroceles persist beyond infancy and some occur for the first time later in childhood, these hydroceles do requires an operative procedure.

Different types of hydrocele are:

- a) Communicating (congenital)
 - A patent processus vaginalis flow of peritoneal fluid in to the scrotum.
 - Indirect inguinal hernias are associated with this type.
- b) Non communicating
 - There is a patent processus vaginalis but no peritoneal cavity communication.
- c) Hydrocele of the cord
 - The closure of tunica vaginalis is defective. Distal end of the processus vaginalis closes correctly, but the mid portion remains patent. Proximal end may be open or closed.

On examination, a nontender, cystic swelling of the scrotum, which surrounds the testicle and is able to be transilluminated, is evident. A word of caution: simple Transillumination does not exclude the diagnosis of an incarcerated hernia. It is usually possible to palpate the spermatic cord above the hydrocele. However, this may be difficult in the case of a hydrocele of the cord, which may extend from the scrotum or in the inguinal canal.

In the majority of infants, there is no indication for surgery within the first 12 to 24 months of age, as hydroceles not associated with inguinal hernias tend to resolve spontaneously during this time; the parents should be reassured and advised to observe the child over the ensuing months. A hydrocele that persist beyond 2 years of age, those that do not become apparent until the child is several years old, or those associated with an inguinal hernia require operations. The operation performed is high ligation of the patent processus vaginalis, the same procedure as that performed for inguinal hernia repair. Under no circumstances should a hydrocele be aspirated.

OTHER CAUSES OF INGUINO-SCROTAL SWELLINGS

Encysted hydrocele of the cord, Varicocoele, Lymph varix, Funiculitis, Diffuse lipoma of the cord, Inflammatory thickening of the cord extending upwards from the testis and epididymis, Testicular malignancy, Ectopic testis, Undescended testis, Torsion of the testis, Retractable testis, Enlarged lymph nodes, Abscess in inguinal region, Aneurysm of external iliac artery

MANAGEMENT

Inguinal hernia are not known to resolve spontaneously and must therefore is repaired surgically shortly after diagnosis on an elective basis; the definitive treatment for inguinal hernia is early operation, a herniotomy. That can be open or laparoscopic. This will reduce the risk of incarceration with its attendant complication, such as obstruction and strangulation. While congenital hydrocele is known to resolve spontaneously, one can wait till one year of age. If hydrocele persist beyond 1 year or if it is very large and rapidly increasing in size then herniotomy is done.

OPERATIVE TECHNIQUE

The patient is placed in the supine position, and the skin is prepared with an iodophor solution from umbilicus to mid-thigh. Care is taken not to soak the underlying sheet, because thermoregulation is of special importance in small infants and children, who are placed on warming blanket.

OPEN HERNIOTOMY

The procedure involves a herniotomy through a transverse or oblique incision made in the lowest inguinal skin crease.

1. The incision is deepened through the camper's fascia, subcutaneous fat, and scarpa's fascia (in the process, one will encounter the superficial epigastric and the external pudendal vessels, which may be retracted aside, coagulated, or tied with suture) until the aponeurosis of the external oblique abdominal muscle is reached. After cleaning it of overlying fat, the external inguinal ring is identified.

In neonates and infants, the external inguinal ring almost overlies the internal inguinal ring, so there may not be the need to open the aponeurosis of the external oblique muscle to get to the hernia. In large hernias, it is advisable to incise the aponeurosis of the external oblique to open in to the inguinal canal before looking for the hernia sac. Here, too, one may decide to open the external oblique aponeurosis to include the external inguinal ring or not to include it in the incision.

2. The sac is normally found on the anteromedial aspect of the elements of the spermatic cord after bluntly

spreading the fibres of the cremasteric muscle; it is picked up with hemostats and dissected free of the cord, using both blunt and sharp dissection.

3. Once the sac is dissected up to the internal inguinal ring, it is opened and its content(s) replaced into the peritoneal cavity to make sure it is empty.

Where the sac is big and extends into the scrotum, no attempt should be made to dissect it completely into the scrotum. This will lead to unnecessary bleeding and hematoma formation postoperatively. Using sharp dissection and several hemostats (a minimum of 6), a large hernia sac can be circumferentially dissected, clamped, and amputated distally without having to follow it into scrotum.

4. The dissection is then continued proximally towards the internal inguinal ring until the pre peritoneal fat is visualized.
5. The sac is then twisted several times on itself to make sure the reduced content(s) stay in the peritoneal cavity out of harm's way and neck is then transfixed and ligated high up in the internal ring with Vicryl 3/0 and excess sac excised.

High ligation of the hernia sac is all that required. Sometimes, an enlarged internal inguinal ring is narrowed at the medial margin by placing one or two sutures through the transversalis fascia.

6. Hemostasis is secured and, where the aponeurosis was opened, it is approximated with Vicryl and the skin is closed with a suitable suture material. Usually one Vicryl 2/0 or 3/0 suture of 90cm in length is adequate enough to suture- ligate the sac, and close the aponeurosis and the skin. Especially if one uses the subcuticular method of closure.^[9]

LAPAROSCOPIC HERNIA SURGERY

Laparoscopic hernia surgery is performed with the patient under general anesthesia in supine position and a nasogastric tube and Foley or straight catheter in place.

A 5mm trocar is placed infraumbilical, and a pneumoperitoneum is established. A laparoscopic inspection is then performed. Bilateral or unusual hernias, such as femoral or direct hernias, are easily identified. Two 3-mm stab incision are made in the right and left lower quadrant s, respectively, allowing the trocarless introduction of 3-mm instruments. Placing the ports in this way allows both side to be addressed easily. A purse-string stitch is placed at the neck of the sac using a laparoscopic 3-mm needle driver. The cord structures are readily identified and excluded from the purse-string stitch. Once the stitch is placed, it is tied intracorporeally. The 3-mm ports do not require suture closure, and the umbilical port is closed with absorbable suture.

CONTRALATERAL EXPLORATION

Controversy continues among surgeons over the treatment of the contralateral processus vaginalis in the infant and child with a unilateral hernia. In an attempt to address this controversy, both the risk of contralateral inguinal exploration versus no exploration must be examined. The advantages of contralateral exploration include the avoidance of second anesthetic, early repair of an asymptomatic hernia, and avoidance of later incarceration or strangulation with risk to testis or intestine. The disadvantage of exploration include unnecessary surgery when negative and the potential risk of infection and injury to the testis and vas deferens. To minimize these risks a selective approach to contralateral inguinal exploration based on age, sex, sided presentation, incidence of patent processus vaginalis, the risk of incarceration is needed.

COMPLICATIONS

The complication rate for repair of inguinal hernias and hydrocele in children ranges from 1.7 to 8%. The wound infection rate is 1% to 2% and recurrence rate is less than 1%. Most recurrences are associated with comorbid condition and occur within 2 years of the original operation. Other factors predisposing to inguinal hernia recurrence include failure to ligate the sac high enough at the internal ring, Failure to repair the internal ring or canal floor injured at initial surgery, infection, incarceration requiring emergency surgery, and deferred Orchidopexy in infants with a concomitantly undescended testis.

Testicular complications associated with hernia and hydrocele repair may be more common than previously expected. Vas injury is recognized as a cause of subsequent infertility in the adult who underwent inguinal surgery as an infant or child. Testicular atrophy following hernia repair ranges from 0% to 19% and is much more common after emergency surgery for incarcerated hernia repair.^[4]

Inguinal hernia and hydrocele in pediatric age group has been studied worldwide. The present study has been contemplated to find out the age, sex, side wise distribution of inguinal hernia and hydrocele in children and also to document the patency of processus vaginalis, associated congenital anomalies and postoperative complications.

MATERIALS AND METHODS

Study Site

The patient was selected from those attending the Pediatric Surgery O.P.D. or admitted in the wards of K. J. Somaiya Hospital and Research Center, Sion, Mumbai (tertiary

care center).

Study Population

All consecutive male and female below 12 years of age with inguinoscrotal swellings satisfying the pro forma were selected.

Study Design

This study would be the prospective observational study.

Sample Size

The patient for the study was selected by simple random sampling with computer-generated random number in the below mentioned time period, including both males and females below the age of 12 years.

Using open EPI software with following information, the estimated sample size is 597 at 95% confidence level and 1.5% absolute precision 1%.

1. Population size - Number of children in the age group of 0–12 years eligible for the enrolment in study attending pediatric surgery O.P.D. during study duration approximately 1000.
2. Proportion of children having inguinoscrotal swelling attending O.P.D = 4%.^[3]
3. Absolute precision = 1%.

Study Period

This study was carried out from October 2014 to April 2016.

Inclusion criteria

Patients below 12 years of age including both males and females attending surgery O.P.D with swelling in inguinoscrotal region associated with symptoms as well as found accidentally on examination were included in the study.

Exclusion criteria

Patients with multiple congenital anomalies were excluded from the study.

Methodology

The study was conducted in the Department of Surgery, K.J. Somaiya Hospital and Research Center. The patients for the study were selected by simple random sampling with computer-generated random number from October 2014 to April 2016. All the selected patients were below 12 years including both males and females. It includes patients who attended pediatric surgery O.P.D and fitted in pro forma. All the registered patients were examined clinically thoroughly after taking a detailed history. Routine investigations such as CBC, PT, aPTT, routine urine examination, and chest X-ray were carried out for the fitness for operation. All the operations were carried out under general anesthesia.

Injection Amoxicillin + clavulanate (30–40 mg/kg) was given just before the incision. The operating field, i.e. from the level of umbilicus to mid-thigh was painted with 10% povidone-iodine solution. This was followed by sterile skin draping. Incision was made in the lowest skin crease in the groin approximately one finger above pubic tubercle on the same side of a hernia. The subcutaneous tissues were bluntly separated to expose the Scarpa's fascia, which was grasped and incised with scissors exposing oblique aponeurosis. After safeguarding the ilioinguinal nerve, the cremasteric muscle was separated on the anteromedial surface, thereby exposing the hernia sac, which was usually presented as a white and glistening membrane. The spermatic vessels and vas deference were bluntly teased off from the hernias sac. Hernial sac cut opened between two hemostats. The distal portion of hernia sac dissected up to the deep inguinal ring and completed when the neck of the sac was reached as indicated by the presence of pre-peritoneal fat. High ligation of the sac was done by twisting and transfixing the sac at the level of internal ring with 3–0 vicryl. The rest of the distal portion of the sac is excised. The proximal portion of the sac is cut open on the anterior aspect by safeguarding vas and vessels. Hemostasis checked. The testis was always replaced in the normal location.

In female patient, the hernia sac separated from the round ligament, cut open between two hemostats, dissected and transfixed at its neck. The hernia sac was always widely opened and inspected before twisting and ligating as the fimbriated end of fallopian tube was apt to be adherent to the neck of the sac.

In cases where the internal ring was wide enough, repair of the fascia transversalis was done with non-absorbable suture to narrow the deep ring.

In case of undescended testis, testis was brought down and placed in the scrotum by making a sub dartos pouch after separating the hernia sac, dissecting and lengthening vas and vessels.

In case of encysted hydrocele of the cord, above-mentioned herniotomy was done with excision of the cyst.

For congenital hydrocele, high ligation of patent processus vaginalis (PPV) at the deep ring was done, and the distal portion was kept slit open to prevent the collection of fluid.

The external oblique aponeurosis was sutured with 3–0 Vicryl and skin closed subcuticularly with 3–0 vicryl.

In case of laparoscopic herniotomy, a 5-mm trocar was placed infraumbilically, and a pneumoperitoneum was established. After then, laparoscopic inspection was

performed both deep inguinal rings, and the patency of processus vaginalis was identified. Two 3-mm stab incision was made in the right and left lower quadrants, respectively, allowing the trocarless introduction of 3-mm instruments. A purse-string stitch was placed at the neck of the sac using a laparoscopic 3-mm needle driver. The cord structures and testicular vessels were readily identified and excluded from the purse-string stitch. Once the stitch was placed, it was tied intracorporeally [Figure 12]. The 3-mm ports did not require suture closure, and the umbilical port was closed with port closure vicryl.

The patient was usually discharged from the hospital from the same day or 2nd day.

Post-operative follow-up of the cases was done after 1 week, 1 month, and 6 months from the date of operation.

Management

Inguinal hernia is not known to resolve spontaneously and must, therefore, be repaired surgically shortly after the diagnosis on an elective basis; the definitive treatment for inguinal hernia is early operation, a herniotomy, that can be open or laparoscopic. This will reduce the risk of incarceration with its attendant complication, such as obstruction and strangulation. While congenital hydrocele is known to resolve spontaneously, one can wait until 1 year of age. If hydrocele persists beyond 1 year or if it is very large and rapidly increasing in size, then herniotomy is done.

Operative Technique

The patient is placed in the supine position [Figure 8], and the skin is prepared with an iodophor solution from umbilicus to mid-thigh. Care is taken not to soak the underlying sheet because thermoregulation is of special importance in small infants and children, who are placed on warming blanket.

Open Herniotomy

The procedure involves a herniotomy through a transverse or oblique incision made in the lowest inguinal skin crease [Figure 9].

1. The incision is deepened through the Camper's fascia, subcutaneous fat, and Scarpa's fascia (in the process, one will encounter the superficial epigastric and the external pudendal vessels, which may be retracted aside, coagulated, or tied with suture) until the aponeurosis of the external oblique abdominal muscle is reached. After cleaning it of overlying fat, the external inguinal ring (EIR) is identified.

In neonates and infants, the EIR almost overlies the internal inguinal ring (IIR), so there may not be the need to open the aponeurosis of the external oblique muscle to

get to the hernia. In large hernias, it is advisable to incise the aponeurosis of the external oblique to open into the inguinal canal before looking for the hernia sac. Here, too, one may decide to open the external oblique aponeurosis to include the EIR or not to include it in the incision.

2. The sac is normally found on the anteromedial aspect of the elements of the spermatic cord after bluntly spreading the fibers of the cremasteric muscle; it is picked up with hemostats and dissected free of the cord, using both blunt and sharp dissection [Figure 10].
3. Once the sac is dissected up to the IIR, it is opened and its content(s) replaced into the peritoneal cavity to make sure it is empty.

Where the sac is big and extends into the scrotum, no attempt should be made to dissect completely into the scrotum. This will lead to unnecessary bleeding and hematoma formation postoperatively. Using sharp dissection and several hemostats (a minimum of 6), a large hernia sac can be circumferentially dissected, clamped, and amputated distally without having to follow it into the scrotum.

4. The dissection is then continued proximally toward the IIR until the preperitoneal fat is visualized.
5. The sac is then twisted several times on itself to make sure the reduced content(s) stay in the peritoneal cavity out of harm's way, and neck is then transfixed and ligated high up in the internal ring with vicryl 3/0 and excess sac excised.

High ligation of the hernia sac is all that is required. Sometimes, an enlarged IIR is narrowed at the medial margin by placing one or two sutures through the transversalis fascia.

6. Hemostasis is secured and, where the aponeurosis was opened, it is approximated with Vicryl and the skin is closed with a suitable suture material. Usually one Vicryl 2/0 or 3/0 suture of 90cm in length is adequate enough to suture- ligate the sac, and close the aponeurosis and the skin. Especially if one uses the subcuticular method of closure.^[9]

Laparoscopic Hernia Surgery

Laparoscopic hernia surgery is performed with the patient under general anesthesia in the supine position and a nasogastric tube and Foley or straight catheter in place [Figure 9].

A 5-mm trocar is placed infraumbilical, and a pneumoperitoneum is established. A laparoscopic inspection is then performed [Figure 11]. Bilateral or unusual hernias, such as femoral or

direct hernias, are easily identified. Two 3-mm stab incision is made in the right and left lower quadrants, respectively, allowing the trocarless introduction of 3-mm instruments. Placing the ports in this way allows both sides to be addressed easily. A purse-string stitch is placed at the neck of the sac using a laparoscopic 3-mm needle driver. The cord structures are



Figure 8: Skin crease incision



Figure 9: Dissection of sac

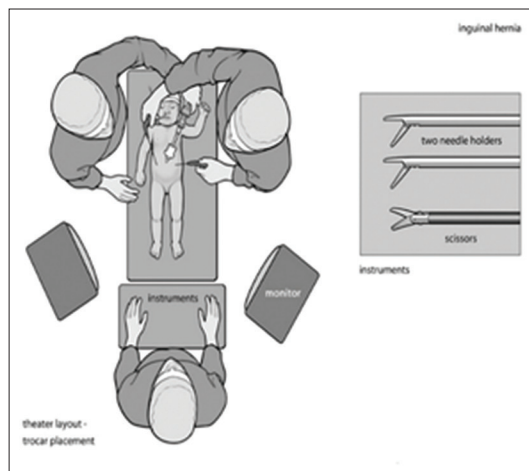


Figure 10: Laparoscopic herniotomy repair

readily identified and excluded from the purse-string stitch. Once the stitch is placed, it is tied intracorporeally [Figure 12]. The 3-mm ports do not require suture closure, and the umbilical port is closed with absorbable suture.

Contralateral Exploration

Controversy continues among surgeons over the treatment of the contralateral processus vaginalis in the infant and child with a unilateral hernia. In an attempt to address this controversy, both the risk of contralateral inguinal exploration and no exploration must be examined. The advantages of contralateral exploration include the avoidance of second anesthetic, early repair of an asymptomatic hernia, and avoidance of later incarceration or strangulation with risk to the testis or intestine. The disadvantage of exploration includes unnecessary surgery when negative and the potential risk of infection and injury to the testis and vas deferens. To minimize these risks of a selective approach to contralateral inguinal exploration based on age, sex, sided presentation, and incidence of PPV, the risk of incarceration is needed.

Complications

The complication rate for the repair of inguinal hernias and hydrocele in children ranges from 1.7% to 8%. The wound infection rate is 1–2% and the recurrence rate is <1%. Most recurrences are associated with comorbid condition

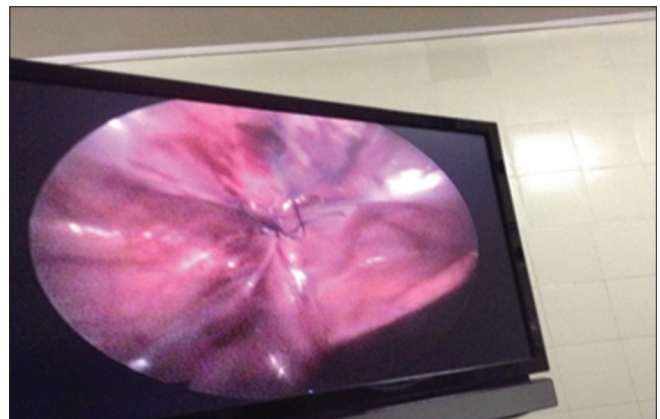


Figure 11: Intracorporeal sac ligation

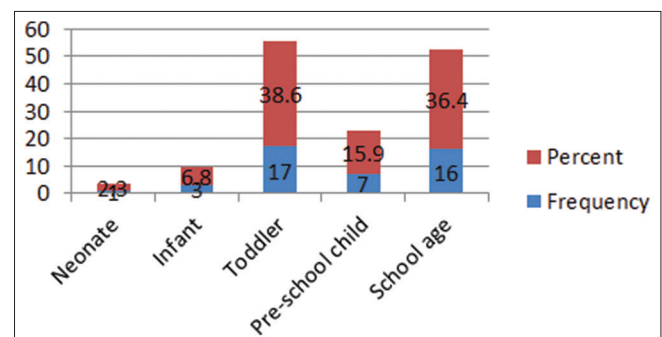


Figure 12: Age

and occur within 2 years of the original operation. Other factors predisposing to inguinal hernia recurrence include failure to ligate the sac high enough at the internal ring. Failure to repair the internal ring or canal floor injured at initial surgery, infection, incarceration requiring emergency surgery, and deferred orchidopexy in infants with a concomitantly undescended testis.

Testicular complications associated with a hernia and hydrocele repair may be more common than previously expected. Vas injury is recognized as a cause of subsequent infertility in the adult who underwent inguinal surgery as an infant or child. Testicular atrophy following hernia repair ranges from 0% to 19% and is much more common after emergency surgery for incarcerated hernia repair.^[4]

Inguinal hernia and hydrocele in the pediatric age group have been studied worldwide. The present study has been contemplated to find the age, sex, and sidewise distribution of inguinal hernia and hydrocele in children and also to document the patency of processus vaginalis, associated congenital anomalies, and post-operative complications.

RESULTS AND OBSERVATION

The present study was carried out in 44 children who were operated for an inguinal hernia and hydrocele at the Department of Surgery, K. J. Somaiya Hospital and Research Center, Mumbai, from October 2014 to April 2016. The initial diagnosis was made from history and clinical examination. The cases were followed up for a period of 12–52 weeks. All the operations were performed under general anesthesia. The operating time ranged from 25 min to 35 min for unilateral hernia, 40–45 min for bilateral hernia, and 45–50 min for laparoscopic herniotomy. The post-operative stay was 1–2 days.

Age Distribution

The age of the patient ranges from 0 to 12 years. They were divided into five groups. The maximum number of cases was in the toddler age group (38.6%) and the minimum number was in the age group of neonate (2.3%) [Figure 13 and Table 1].

Sex Distribution

In this study, 39 (88.6%) were males and 5 (11.4) were females, the ratio being 7.8:1 [Figure 14 and Table 2].

Birth History

In this study, 35 were term children and 9 were pre-term children [Figure 15 and Table 3].

Side Distribution

Among these cases, 26 cases were on the right side, 13 cases

were on the left side, and 5 cases were bilateral [Figure 16,17 and Table 4].

Swelling

Of all these cases, 34 cases presented with inguinal swelling, 6 were presented with scrotal swelling, and 4 were presented with inguinoscrotal swelling [Figure 18 and Table 5].

Diagnosis

In this study, 32 children diagnosed as inguinal hernia, 5 children as congenital hydrocele, 3 children as encysted hydrocele of cord, and 4 children as undescended testis [Figure 19 and Table 6].

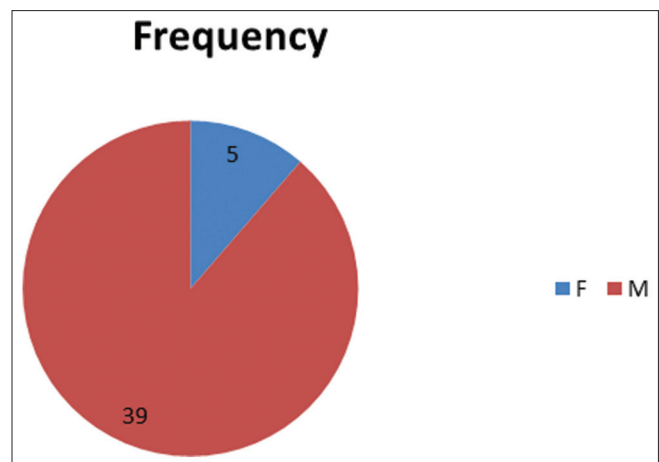


Figure 13: Sex distribution

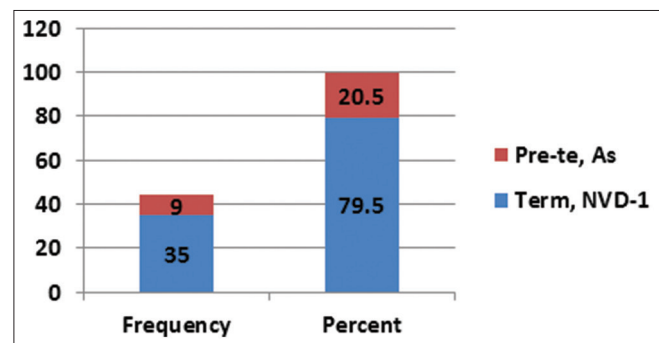


Figure 14: Birth history

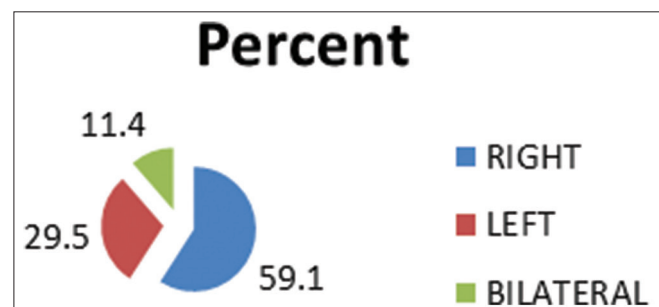


Figure 15: Side (%)

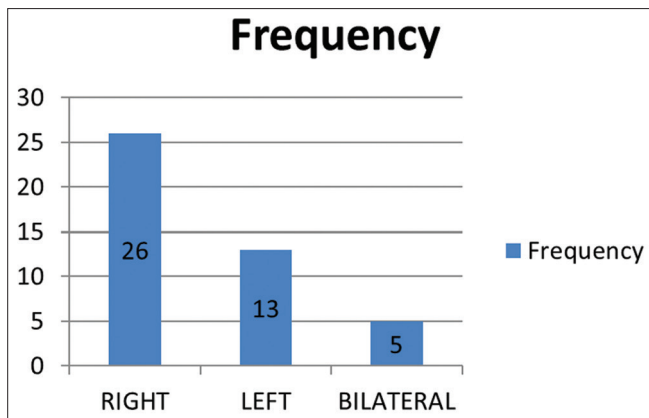


Figure 16: Side (frequency)

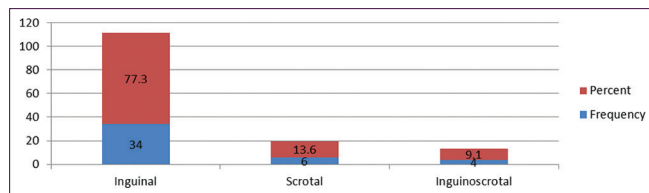


Figure 17: Swelling

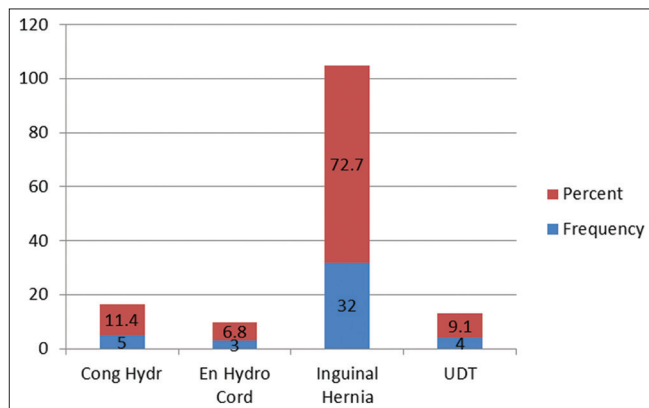


Figure 18: Diagnosis

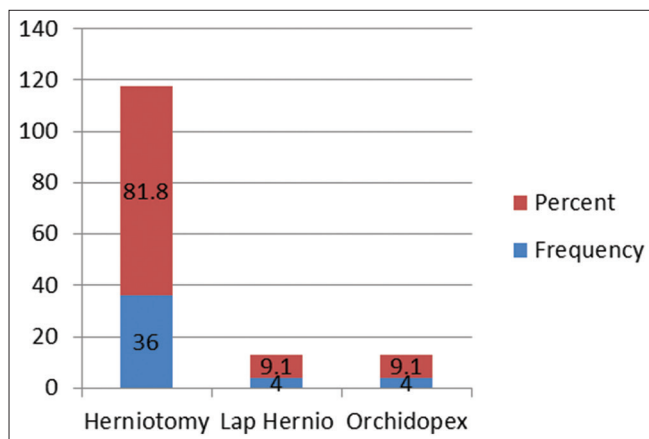


Figure 19: Procedure

Table 1: Age

Age	Frequency (%)
Neonate	1 (2.3)
Infant	3 (6.8)
Toddler	17 (38.6)
Pre-school child	7 (15.9)
School age	16 (36.4)
Total	44 (100.0)

Table 2: Sex

Sex	Frequency (%)
Female	5 (11.4)
Male	39 (88.6)
Total	44 (100.0)

Table 3: Birth history

Birth history	Frequency (%)
Term, NVD-1	35 (79.5)
Pre-test	9 (20.5)
Total	44 (100.0)

Table 4: Side

Side	Frequency (%)
Right	26 (59.1)
Left	13 (29.5)
Bilateral	5 (11.4)
Total	44 (100.0)

Table 5: Swelling

Swelling	Frequency (%)
Inguinal	34 (77.3)
Scrotal	6 (13.6)
Inguinoscrotal	4 (9.1)
Total	44 (100.0)

Table 6: Diagnosis

Diagnosis	Frequency (%)
Congenital hydrocoele	5 (11.4)
Encysted hydrocoele of the cord	3 (6.8)
Inguinal hernia	32 (72.7)
UDT	4 (9.1)
Total	44 (100.0)

UDT: Undescended testis

Operation Performed

Among these patients with inguinoscrotal swellings, 36 were undergone herniotomy, 4 were undergone laparoscopic herniotomy, and 4 were undergone orchiopexy [Table 7].

Table 7: Procedure

Procedure	Frequency (%)
Herniotomy	36 (81.8)
Lap hernio	4 (9.1)
Orchidopexy	4 (9.1)
Total	44 (100.0)

DISCUSSION

Today, inguinal hernia and hydrocele in children remain one of the most common congenital anomalies observed by pediatricians and surgeons requiring surgical intervention. In the general population, the incidence of inguinal hernia is not precisely known; however, in controlled population based studies, there are between 10 and 20 inguinal hernias per 1000 live births.^[5]

Age Distribution

Adesunkanmi AR^[35] *et al.* reported 71% of the inguinal hernia in a study of 208 children in the age group of 5 years and below and Charles M.R. *et al.*^[37] reported 71.6% of the inguinal hernia in a study of 133 children in the age group of below 6 years. Jadhav *et al.*^[64] found in their study of 50 children that 46% of cases were between 2 and 7 years. In the present study, the youngest patient was 20 days and oldest was 12 years old. The maximum number of patients was in the age group of between 0 and 5 years comprising >50% of the cases, and these findings show similar trend in the incidence of inguinal hernia when compared to the above-mentioned studies. Peak incidence of hernia in this study was in toddlers with 38.6%. Chang S.J. *et al.*^[63] reported that the peak incidence of inguinal hernia was at 0 years of age for males and 5 years of age for females. Jadhav *et al.*^[64] found in their study of 50 children that the maximum number of cases was in the age group of 2–3 years. On comparison of the findings of the foreign authors (Chang) with the present study, it was observed that >1/3rd of the cases were diagnosed to have inguinal hernia in the age of 1–3 years, but this age is slightly more with respect to the age of the patients in the above studies by a year. The reason for this could be better health care facilities, awareness among the parents to seek opinion early, and better reporting and documentation of the data. However, when these findings were compared to a study done in our country, it shows almost the same findings suggesting some geographical, above-mentioned factors, or yet unidentified factor contributing to this delay in the diagnosis probably increasing the risk of complications.

Sex Distribution

In all the studies of inguinal hernia in children, there is male preponderance. Rowe and Clatworthy^[19] reviewed 2764 children treated for inguinal hernia and found 87%

of the children to be boys, giving male-to-female ratio of 7:1. Powell T.G.^[25] in our study of 44 children with inguinal hernia and hydrocele, there were 39 males and 5 female female in the ratio of 9.2:1. Dinesh L. Jadhav *et al.*^[64], in a study of 50 children found male to female ratio of 11.5:1. In our study of 44 children with inguinal hernia and hydrocele, there were 39 males and 5 female.. The ratio being 7.8:1, William B Kiesewetter and Kook Sand^[21] studied 400 paediatric patient for inguinal hernia and hydrocele over a period of 2 years. In their study, 85% were male and 15% female. Adesunkanmi A.R.^[35] *et al.*, in a study of 208 children for inguinal hernia and hydrocele found that 197 (19.7%) of the cases to be male and only 11 (5.3%) to be female. In present study 88.6% were males and 11.8% were females. The findings of the above mentioned studies that inguino-scrotal swellings are found more commonly in male then female but the percentage varies according to study duration and geographical areas.

Side Distribution

Childhood inguinal hernias are generally more predominant on the right side, and this has been attributed to the delay in descent of the right testis. Hernias occurred bilaterally in 10–15% of the cases and in as many as 40–45% affect premature infants compared to 8–10% of the full term infants. Larsen and Tenn^[13] in a study of 111 cases of inguinal hernia in children found 60 cases on the right side, 39 cases on the left and 12 cases as bilateral. Muhammad T. Salaymeh^[17] studied 240 inguinal hernia in infants and children. He encountered 60% of the cases to be on the right side, 30% on the left and 10% bilateral. Rowe M. I. *et al.*^[18] documented the higher incidence of inguinal hernia on the right side. In their study of 2764 cases, 60% of the cases were on the right, 30% on the left and 10% were bilateral. William B. Kiesewetter and Kook Sang^[21] in a study of 400 paediatric patient for inguinal hernia over a period of 2 year found 64% to be on the right side, 26% on the left and 10% bilateral. Charles M.R. *et al.*^[37] found 61.6% on right side, 36.8% on left side and 1.5% bilateral. Dinesh L.J. *et al.*^[64] documented in a study of 50 children with inguinal hernia, 64% on right side, 28% on left side and 8% bilateral. In this study of 1 inguinal hernia in children up to 12 years of age, 26 cases were on right side, 13 cases were on the left and 5 cases were bilateral. On the basis of collected data the figure in the present study correlates well with other studies mentioned.

Associated Congenital Anomalies Included

Undescended testis

During the course of this study, four cases of undescended testis were detected. Two were on the right side and two were bilateral. All of them were situated in the superficial inguinal pouch. These patients underwent herniotomy at the time of orchidopexy, and the testis was placed in the subdartos pouch.

Encysted hydrocele of cord

There were three cases of encysted hydrocele of the cord, 1 on the right side and 2 were on the left side. All patient had undergone herniotomy.

Congenital hydrocele

There were five cases of congenital hydrocele, of which all were on the right side. All of them had high ligation at the deep ring while the distal portions were kept slit open. Willis J. Potts^[14] in a study of inguinal hernia in 600 children found hydrocele to be associated in 9% of the cases. Venugopal S.^[13] while treating 271 cases of inguinoscrotal hernias and hydrocele at the university hospital of West Indies found that 12.5% of the cases were hydroceles. Unlike the hernias, 20 of the 34 cases of hydrocele were on the left side..

Hypospadias

In this study, association of hypospadias was not observed.

In this study, 9 cases of inguinal hernia were found to be associated with prematurity and all of them were males. Boocock G.R.^[23] found 23 boys and 3 girls were below 36 weeks of gestation among 61 children who were operated for hernia at Liverpool Hospital in 1981. Davis N. *et al.*^[27] reviewed 85 cases of irreducible inguinal hernia in children below 2 years of age and found that 30 children had preterm delivery.

First Person to Notice the Swelling

In the present study of 44 cases, 36 swellings were noticed by parents, 5 by grandmother, and 3 by doctor. Parents are usually the first person to notice the swelling. Usually parents and grandmother notice the swelling while bathing the child or changing clothes. This could be because of the closeness of parents and grandmother to the child. In this series, three cases were detected while checking for immunization.

In this series, infants and children required general anesthesia for operative repair of inguinoscrotal swellings. Open herniotomy was done for 36 cases and laparoscopic herniotomy done was done for 4 cases.

Laparoscopic techniques

To improve the results and outcome of treatment, there have been a various modifications in the technique of laparoscopic inguinal hernia repair in children. This modification has done in the methods of ligation of the PPV at the IIR.

Various techniques**Extracorporeal suturing and knotting technique**

This technique employs two-port and non-absorbable suture material. The trend is shifting toward this technique

because it is simple, safe, feasible, and reproducible. This method has low recurrence rates (0–2.0%), and more importantly, knotting does not require any special skill because it is done externally in the subcutaneous tissue in the conventional manner. The limitation of this technique is that special needles and introducers are required.

Intracorporeal suturing and knotting technique

The technique employs three ports and uses non-absorbable suture materials. Intraperitoneal knotting is performed to close the IIR in this technique. The closure is achieved by applying a suturing in purse-string fashion and knotting tight the IIR.

Inversion and ligation technique

This method of laparoscopic inguinal repair is widely used in female children. This is a modification of the intracorporeal technique, using three ports and non-absorbable sutures. In the inversion and ligation technique, the sac is isolated, inverted, and ligated laparoscopically.

Resection and ligation technique

This is another modification of the intracorporeal technique, with three ports and non-absorbable sutures employed. In this technique, the hernia sac is resected and closed with a purse-string suture at the level of the IIR.

Resection and no ligation technique

Here, the hernia sac is resected at the level of the internal inguinal and allowed to close spontaneously.

Flip-flap technique

In this procedure, a flip-flap is raised in the IIR and used to close the defect. This is a three-port technique that uses absorbable sutures.

Three-port or single-port technique

The pioneer procedures for inguinal hernia repair in children by laparoscopy used the three-port method. Recently, with refinements in technology, the single procedure is currently attracting attention.

Use of tissue adhesives

Today, tissue adhesive is being employed in a host of pediatric endoscopic surgeries, including inguinal hernia repair

In the present study, as per hospital setup, open herniotomy was most convenient. Yang *et al.*^[65] observed in his study that there was no significant difference between LH and OH in patients' age, sex, affected side, operative time for unilateral hernias, duration of hospital stay, time to resume full activity, recurrence, and complication. LH is superior to OH in the repair of bilateral inguinal hernia and low rate of metachronous contralateral hernia. The current trend

shows the preference for extracorporeal technique because it is simple, safe, reproducible and has low recurrent rates.^[47] The other trend is toward the single-port technique because it results in virtually scarless abdomen as the surgical incision is hidden within the umbilicus.^[66,67]

For congenital hydrocele, the procedure followed was high ligation of the PPV at the deep ring and keeping the distal portion slit open.

After unilateral herniotomy, the appearance of a hernia on the opposite side (metachronous presentation) occurred in two cases, and both were males and both were presented with left inguinal hernia. The time interval between initial herniotomy and appearance of the opposite hernia was 3 months in one case and 7 months in the other. Routine exploration of contralateral hernia is not preferred these days because the literature suggests that laparoscopically identified CPP is a poor indicator of future contralateral hernia. Almost a third of patients will have a CPP, while less than one in 10 will develop MCH when managed expectantly. Performing contralateral hernia repair in patients with CPP results in overtreatment in roughly 2 of 3 patients.^[64]

Zamakhshary M *et al.*^[48] found in his study of 1065 infants and children that a wait time for surgery of more than 14 days was associated with a doubling of the risk of hernia incarceration among infants and young children with inguinal hernia. But Chang S.J. *et al.*^[63] found in his study that incarceration was not associated with prematurity or waiting time for surgery. In this present study there was not even single case of incarceration or strangulation.

The postoperative complications comprised 1 case of wound haematoma, 1 case of wound infection. All of them responded to conservative treatment. Dinesh L. Jadhav *et al.*^[64] found 2 cases of wound infection and 2 cases of hypoglycemia in his study of 50 children. Lawrence R. Moss and Edwin I. Hatch^[28] in a study of 384 patients who underwent inguinal hernia repair during a 5 years period found 9 minor postoperative complications

Recurrent inguinal hernias are relatively uncommon. In general, the reported recurrence rate for uncomplicated hernia repair is 0–0.8%; this rises to about 15% for premature infants and about 20% after operation for incarcerated hernias.^[6] Factors associated with the recurrence are increased abdominal pressure, prematurity, malnutrition, anemia, and connective tissue disorder. Other causes of recurrence include a missed sac and injury to the floor of the inguinal canal resulting in a direct hernia. There was no recurrence during the period of one and half year study and follow-up for 12 weeks. Mestel *et al.*^[16]

stated that the repair of child's hernia is not a parlor piece, but a master's work should be performed or supervised by a skilled surgeon. Certainly, if recurrence is >1%, the surgeon should perhaps give up children's surgery or at the very least review.

Summary

This study was carried out in 44 children with inguinoscrotal swellings who were operated at the K. J. Somaiya Hospital And Research Center from October 2014 to April 2016. All the patients in the study were subjected to minimum investigation such as CBC, PT, aPTT, urine routine, and chest X-ray. The age of the patients varied from 0 to 12 years. The maximum number of cases was in toddler group (38.6%) and the minimum number of case was in the age group of neonate (2.3%). There were 39 males and 5 females, thereby giving ratio of 7.8:1. Of the 44 cases, 26 cases were on the right side, 13 cases were on the left side, and 5 cases were bilateral; prematurity was associated in 9 cases who were all males. 36 swellings were first noticed by parents, 5 were noticed by grandmother, and 3 cases were detected by doctors at routine checkup during immunization. Congenital anomalies such as undescended testis were associated with inguinal hernias in four cases. The two undescended testes were on the right side and two were bilateral. Orchidopexy done and the testis was kept in the subdartos pouch. Of 3 encysted hydrocele of the cord, two on the left side and one was on the right side. In the case of 5 hydroceles, all were on the right side. High ligation at the level of deep ring was done in all the cases. In this study, no case of associated hypospadias was encountered. Open herniotomy done for 36 cases and laparoscopic herniotomy done for 4 cases. For female patients, the hernia sac was always widely opened and inspected for the entrapment of ovary or other structures before twisting and ligating at its neck. The distal portion of the sac was cut open after incising the wall to prevent the collection of fluid. All 44 cases were operated as elective. None had incarceration, obstruction, or strangulation. The operating time ranged from 25 min to 35 min for unilateral hernia, 40 to 45 min for bilateral hernia, and 45 to 50 min for laparoscopic herniotomy. The period of post-operative stay ranged from 1 day to 2 days. The cases were followed up to 12–52 weeks. There were two minor post-operative complications which include one case of wound hematoma and one case of wound infection, all of them responded to conservative treatment. In this study of 44 cases during the period of 1½ years with follow-up of 12–52 weeks, there was no case of recurrence.

CONCLUSION

Inguinal hernia and hydrocele in children remain one

of the most common congenital anomalies observed by surgeons. The threat to loss of testis, ovary or a portion of bowel due to incarceration or strangulation remains. Prompt diagnosis and early treatment of the inguinal hernia continue to be the mainstay if these complications are to be avoided. As many hydrocele of the tunica vaginalis may involute spontaneously, hydroceles that do not change over time should be observed at least up to 1 year of age before considering repair. The childhood inguinal hernias are generally more predominant on the right side, and this has been attributed to the delay in descent of the right testis. Regarding the sex prevalence, males are more commonly affected. Congenital anomalies such as undescended testis and hypospadias can be associated with inguinal hernia and hydrocele. In the case of undescended testis, herniotomy is done at the time of orchidopexy. Parents are usually the first person to notice the swelling or bulge in the inguinal region when changing a diaper or bathing or while the child is crying or straining. An inguinal hernia will not resolve spontaneously and should be repaired as soon as possible after the diagnosis because of the risk of incarceration, obstruction, or strangulation. In general, infants and children require general anesthesia for the operative repair of inguinal hernia and hydrocele. Post-operative complications are usually rare following elective operation, whereas minor complication does occur after emergency operation. Recurrence is usually rare if operated by experienced surgeon. Inguinal herniotomy in children is safe and effective operation whether open or laparoscopic.

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