

**PROSPECTIVE STUDY ON SURGICAL MANAGEMENT OF
UNDESCENDED TESTIS IN A TERTIARY HOSPITAL**

Dissertation submitted to

**THE TAMILNADU DR.MGR MEDICAL UNIVERSITY,
CHENNAI**

With fulfillment of the regulations for the award of

M.S DEGREE IN GENERAL SURGERY

BRANCH I



GOVERNMENT VELLORE MEDICAL COLLEGE,

VELLORE

MAY 2020

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled “**PROSPECTIVE STUDY ON SURGICAL MANAGEMENT OF UNDESCENDED TESTIS IN A TERTIARY HOSPITAL**” is a bonafide work of Dr. C.P.PRAVEENKUMAR submitted to The Tamilnadu Dr. M.G.R Medical University in partial fulfilment of requirements for the award of the degree of M.S. BRANCH I (GENERAL SURGERY) examination to be held in MAY, 2020.

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I hereby declare that this dissertation titled “**PROSPECTIVE STUDY ON SURGICAL MANAGEMENT OF UNDESCENDED TESTIS IN A TERTIARY HOSPITAL**”. At Government Vellore Medical College Hospital., is a bonafide and genuine research work carried out by me in the Department of General Surgery, Government Vellore Medical and Hospital, Vellore-11, under the guidance of our Chief Prof. **Dr. R.SRIKANTH., MS.,** Government Vellore Medical College and Hospital.

This dissertation is submitted to THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI in partial fulfillment of the University regulations for the award of M.S degree (General Surgery) Branch I, examination to be held in MAY 2020.

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BONAFIDE CERTIFICATE FROM THE H.O.D

This is to certify that this dissertation entitled “**PROSPECTIVE STUDY ON SURGICAL MANAGEMENT OF UNDESCENDED TESTIS IN A TERTIARY HOSPITAL**” is the bonafide work of Dr. C.P.PRAVEENKUMAR in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, for M.S. General Surgery Branch I examination to be held in May 2020.

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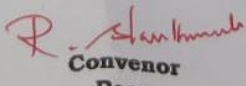
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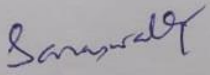
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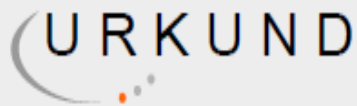
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The Principal Investigator is instructed to submit the status of this project periodically to this College Office.


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<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4272499/>
https://www.researchgate.net/publication/12154992_How_well_does_contralateral_testis_hypertrophy_predict_the_absence_of_the_nonpalpable_testis
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ABBREVIATIONS

UDT – Undescended Testis

USG – Ultra sonogram

TAI - Testicular Atrophic Index

TV - Testicular Volume

INTRODUCTION

Undescended testis is one of the most common surgical problems encountered among paediatric age group. Undescended testis, age of diagnosis plays important role in outcome. In clinical examination of groin and scrotum, palpable testis and non-palpable testis can be categorized. Based on palpable or non-palpable patients management course differs. If retractile testis treatment plan altered, however managed conservatively and monitored periodically. Open Orchiopexy is done for palpable testis and laparoscopic surgeries are done for non-palpable testis. Ultrasound imaging plays a role in locating non-palpable testis and assessing testicular volume. Undescended testis, if left untreated can result in malignancy, infertility, psychological problems, testicular trauma, and torsion testis. Early diagnosis and treatment is of paramount importance. Undescended testis associates with other anomalies such as congenital inguinal hernia, hypospadias and sexual disorders.

This study will present a correlation between presentations, management mainly concentrating on surgical management and outcome of undescended testis patients in Government Vellore Medical college.

AIMS AND OBJECTIVES OF STUDY

1. To study the clinical presentation of undescended testis as regards to age, position, side and symptoms.
2. To study the management on undescended testis.
3. To study laparoscopic management of undescended testis, single staged or double staged
4. To study correlation of preoperative ultrasound imaging, testicular atrophic index and intraoperative findings of undescended testis.

REVIEW OF LITERATURE

Undescended testis (UDT), in which one testis or both testes, fails to descend into scrotum. Cryptorchidism is synonymous with undescended testes. It is one of the most common congenital anomalies found in children. At birth, approximately 95% of infants have the testicle normally positioned in the scrotum. Some undescended testes descends by one year of age. Up to 30% of preterm infants can present with an undescended testis(1) Some undescended testes eventually descend by 1 year of age. In full term infants with 3 % incidence of undescended testis at birth. The incidence decreases to around 1 percent after 1 year of age. It is much more common in premature infants, incidence approaching 100 percent at the gestational age of 32 weeks or less.

Following histologic and morphologic changes occurs in undescended testis

At 6 months- leydig cells atrophy and tubular diameter decreases.

At 2 years of age - impaired spermatogenesis can occur.(2)

A retractile testis is a normally descended testis that retracts into the inguinal canal but can be brought down into the scrotal sac during the examination. It is thought to result from a hyper reflexive cremasteric muscle contraction and does not require operative intervention .Strong contraction of the cremaster muscle pulls the testis from the scrotum into the superficial inguinal pouch. Testicular function and fertility are normal and no need of hormonal therapy(3).The Chair test (Orr) helps



Figure 1 SHOWING RIGHT UNDESCENDED TESTIS

to bring down testes in difficult cases(4) . In this test child is made to sit on chair with keeping both feet on the seat with flexion with extreme flexion of knees towards the chest. Testicular function and fertility are normal.

Nonpalpable testes may include an intra-abdominal, absent, or vanishing testis.

Ectopic testes have had an aberrant path of descent, it occurs during the inguino-scrotal phase of descend, It is a rare condition. Ectopic testes can be found in perineal, femoral canal, and suprapubic regions. An ectopic testis has passed

through the external ring in the normal pathway and deviate in an abnormal location over any among following regions, the rectus abdominis, external oblique muscle, the soft tissue of the medial thigh, behind the scrotum in the perineum.

A congenitally absent testicle results from failure of normal development or an intrauterine accident leading to loss of blood supply to the developing testicle.

HISTORY

The mechanism of descent was unclear until 1786 A.D. Two pioneers in the 18th century, Baron Albrecht von Haller and John Hunter provided the theoretical bases that justify in patients with cryptorchidism. In 1786A.D Hunter dissected the human foetus and found connection of intra-abdominal testis to the inguinal abdominal wall by a ligament called the gubernaculum testis. He also found gubernaculum testis appeared to guide the testis to the scrotum. Hunter confirmed the abdominal position and the neurovascular supply of the fetal testes and the cremaster . In 1866 Thomas B. Curling summarized in his book, *A Practical Treatise on the Diseases of the Testis* regarding abnormal testicular function in undescended testis and proper evolutionary time limits to recovery of retained testicles.(5)

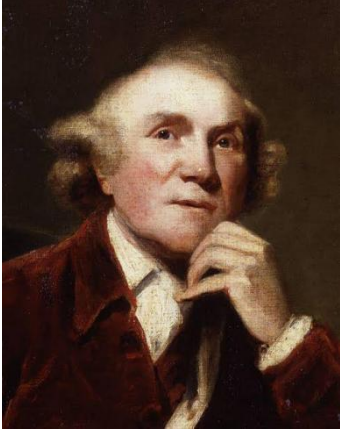


Figure 2 shows scottish surgeon Dr.John Hunter



Figure 3 SHOWING THOMAS B CURLING

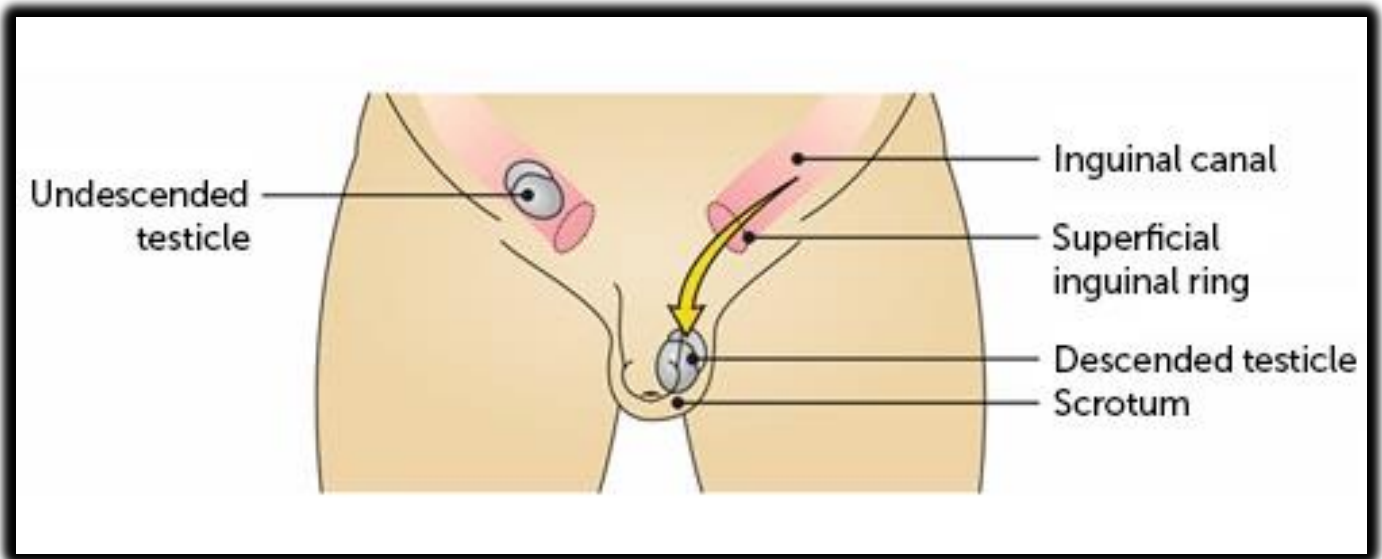



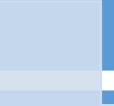
Figure 4 showing UDT , descent pathway

EMBRYOLOGY

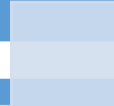
During the 5th to 6th week of gestation, the gubernaculum forms from a band of mesenchyme and extends from the genital ridge through a gap in the abdominal wall musculature to the genital swelling which will develop into the scrotum. Enlargement of the gubernaculum testis is primarily controlled by insulin-like factor 3 (Insl3), which is an analogue of insulin and relaxin produced by Leydig cells



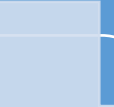
The primordial germ cells from yolk sac migrate along the dorsal mesentery of the hind gut to reach the genital ridge.



During the 7th week, under the influence of H-Y antigen, the indifferent gonads differentiate into fetal testes.



The fetal testis becomes normally active by the 8th week of gestation. The fetal testis secretes testosterone and Mullerian inhibiting substance (M.I.S.). M.I.S. which is secreted by fetal Sertoli cells and stimulated by FSH from pituitary gland. It causes regression of the Mullerian ducts.



During the 10th to 15th week, testosterone produced by Leydig cells stimulates differentiation of Wolffian duct to form the epididymis, vas deferens and seminal vesicles. Leydig cells are stimulated by placental chorionic gonadotropin and pituitary LH. At the seventh month, the gubernaculum increases in size, distending the inguinal canal and scrotum.

The testis then descends through the inguinal canal into scrotum.

Epididymis, attached to gubernaculum, precedes the testis in its descent into the scrotum.



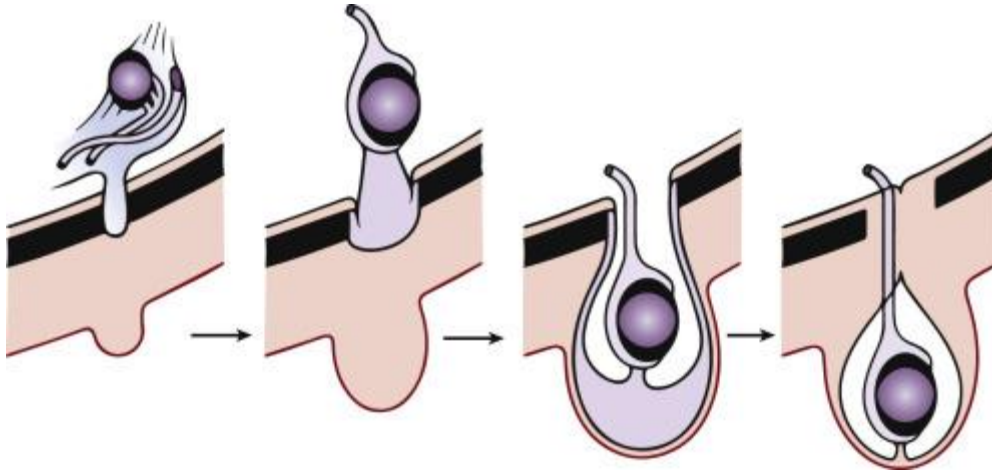
Differentiation of external genitalia depends on the presence of 5- α -reductase, which converts testosterone to dihydrotestosterone. Migration of the testis and gubernaculum from the inguinal region to the scrotum is under androgenic control(6). The cranial ligament regresses under the action of testosterone.

The processus vaginalis forms as a hernial sac through the weakness in the abdominal wall adjacent to the gubernaculum and gradually extends into the scrotum.

Epididymis, attached to gubernaculum, precedes the testis in its descent into the scrotum. Thus the normal descent of testes occurs at about the seventh month of fetal life when the gubernaculum swells and shortens, drawing testis through the inguinal canal into the scrotum. After the descent, gubernaculum persists as a fibrous band, the

gubernacular ligament. The processus vaginalis is completely obliterated prior to birth.(7)

Figure 5 shows testicular descent stages in fetus



Five Major Phases of Testicular Descent in the Human Male

Phase 1: The mesonephros caudal portion contacts the gubernaculum at the internal inguinal ring at 5 weeks.

Phase 2: The genitofemoral nerve becomes associated with the gubernaculum and processus vaginalis. It occurs during 7 weeks. The gubernaculum continues to grow and the processus vaginalis deepens. The cremaster fibers extend into the gubernaculum at 8 to 10 weeks of gestation.

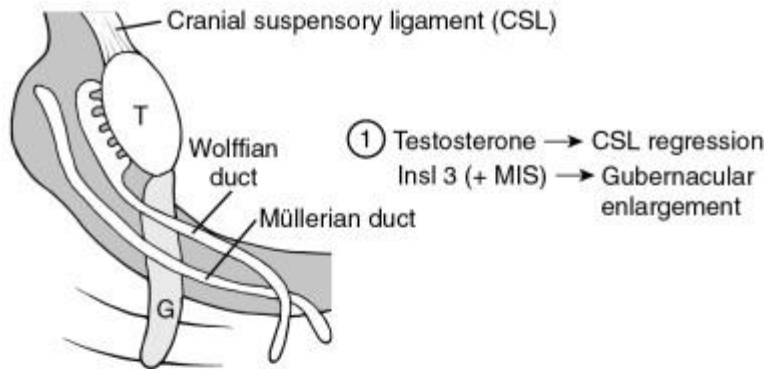
Phase 3: The testis grows while the müllerian ducts and mesonephros regress during 10 to 12 weeks of gestation. The testis contacts the gubernaculum, which begins its swelling phase during 12 to 14 weeks of gestation.

Phase 4: Gubernaculum swelling, cremaster muscle development, and migration of the processus vaginalis widens the inguinal canal, which occurs at 14 to 20 weeks.

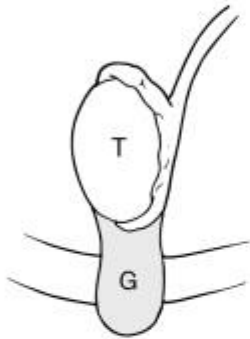
Phase 5: The subcutaneous attachment of the gubernaculum releases,

And the testis begins its passage through the inguinal canal during 20 to 28 weeks.

Until the birth, the gubernaculum continues to regress while the testis descends caudally into the scrotum during 7th month and beyond.



8 - 15 weeks



28 - 35 weeks

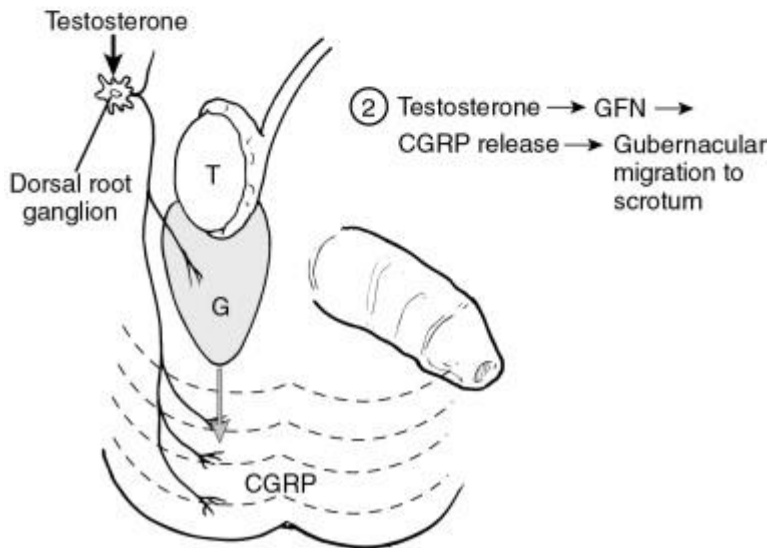


Figure 6 shows gubernaculum development in testicular descent

FACTORS RESPONSIBLE FOR DESCENT OF TESTES

The various factors are proposed to be responsible for testicular descent includes:

1. Traction of testis by the gubernaculum and cremaster .

INSL3 is a circulating peptide, controls the thickening of the gubernaculum, a process crucial for anchoring the testis to the inguinal region.

2. Differential body growth.

3. Increase in intra-abdominal pressure

4. Development and maturation of epididymis.

5. Changes resulting from androgen, mediated through the spinal nucleus of genitofemoral nerve innervating the gubernaculum .Gubernaculum stimulates the release of calcitonin gene-related peptide (CGRP).

6. Role of estrogen and M.I.S. Failure of descent may occur because of the hormonal failure inadequate gonadotropins and testosterone causes inadequate estrogen and M.I.S, thus Failure of descent may occur because of the hormonal failure. Due to hormonal failure dysgenetic testis or an anatomic abnormality such as abnormal or malplaced gubernaculum, obstruction of inguinal canal or scrotum or the shortened vas and/or vessels can occur .(8)

RISK FACTORS

1. Prematurity
2. Small for gestational age
3. Low birth weight (<2.5kg)
4. In Utero exposure to diethylstilbestrol and pesticides
5. Genetic Susceptibility

Genetic studies of cryptorchidism suggest that the disease is heritable But that susceptibility is likely polygenic and multifactorial. Clustering of cryptorchidism has been reported in a number of families affecting multiple individuals in the same generation and variable phenotype

6. Neural tube defects(9)

Sequelae of Undescended testes

1. Infertility.

The higher temperature of extra-scrotal testis causes testicular dysplasia with interstitial fibrosis and thus poor development of seminiferous tubules which impedes spermatogenesis. The testicular position does not affects the testosterone production, thus a male with bilateral undescended testes will develop secondary sexual characters yet may be sterile. The scrotal testis resides in a specialized low-

temperature environment with the pampiniform plexus, scrotal pigmentation, absence of subcutaneous fat, and regulation by temperature-sensitive muscles such as the cremaster and dartos muscle, all ensuring decreased temperature of the epididymis and gonad. The scrotal testis in the human is maintained at 33 degree Celcius compared with 34 degree Celcius to 35 degree Celcius in the inguinal region and 37 degree Celcius intra-abdominally (10). The physiology of the testis is well adapted to this lower temperature (33 degree Celcius); therefore in the undescended testis, ambient temperature is increased, thus causes the testis progressive alteration causes reduced spermatogenesis.

2. Trauma:

The testis in inguinal region is also more prone to direct trauma.

3. Torsion:

The chances for testicular torsion are greatest in the postpubertal period when testis usually increases in size.

4. Neoplasia:

The risk of malignancy in untreated cases raises 10-20 times on the affected side and about 7 times on the contralateral side. This most serious complication is due to the progressive degeneration of germ cells and dysplasia seen in cryptorchid. Early orchidopexy i.e before one year of age may decrease the incidence of malignancy.

5. Hernia due to patent processus vaginalis.

The processus vaginalis normally obliterates after descent of the Testis in the perinatal period. Undescended testes are associated with a higher incidence of patent processus vaginalis and inguinal hernia (11), in many cases leading to early surgical intervention because of the risk of incarcerated hernia (12). A clinically evident hernia present with a cryptorchid testis is an indication for immediate intervention. Mostly perform a hernia repair and simultaneously.

6. Testicular-Epididymal Fusion Abnormality

In cryptorchidism, abnormal connection between the testis and the epididymis is Common. It is greater with testes inside the canal or the abdomen compare with inguinal testes or at the neck of the scrotum. These abnormalities related to underlying androgen deficiency in utero, and interfere with fertility

6. In untreated cases testicular atrophy occurs.

7. Psychologically causes Feeling of incompleteness.

Examination and diagnosis

Testicular examination in infants and young children should always be performed using a two-handed technique. On Groin examination, always look for Hernia, phimosis, hypospadiasis. Any child with unilateral or bilateral UDT associated

with hypospadias, should be investigated for intersexuality. It can be done by performing chromosomal analysis, genitogram, assessment of hormones and tests to detect the presence or absence of Mullerian structures. The position and size of the testis should be noted. During examination if impalpable, ectopic locations should be examined.

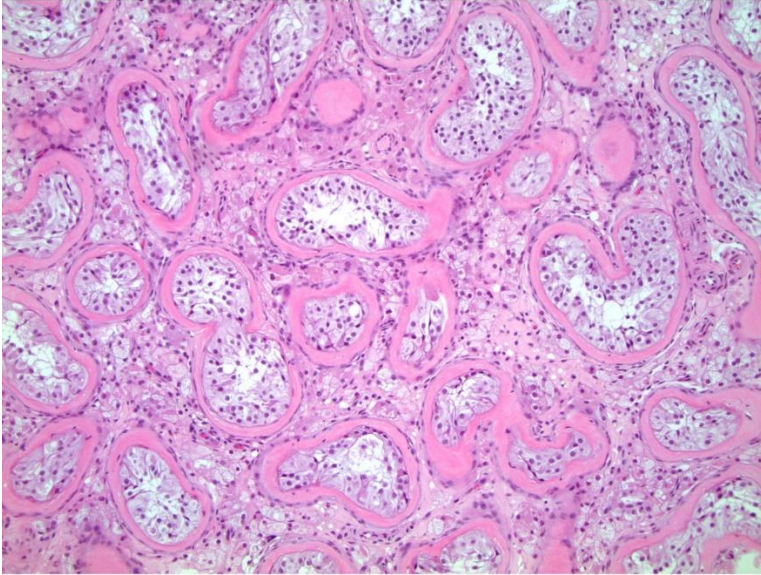
There are many associated anomalies that are quite common with UDT; intersex disorders, prune-belly syndrome, posterior urethral valves, bladder exostrophy and spina bifida .

Histological Changes

Pathological changes in UDT occur as early as 6 months. In 2 to 6 months, impaired Leydig cell development has been shown whereas Sertoli and germ cells appeared normal.

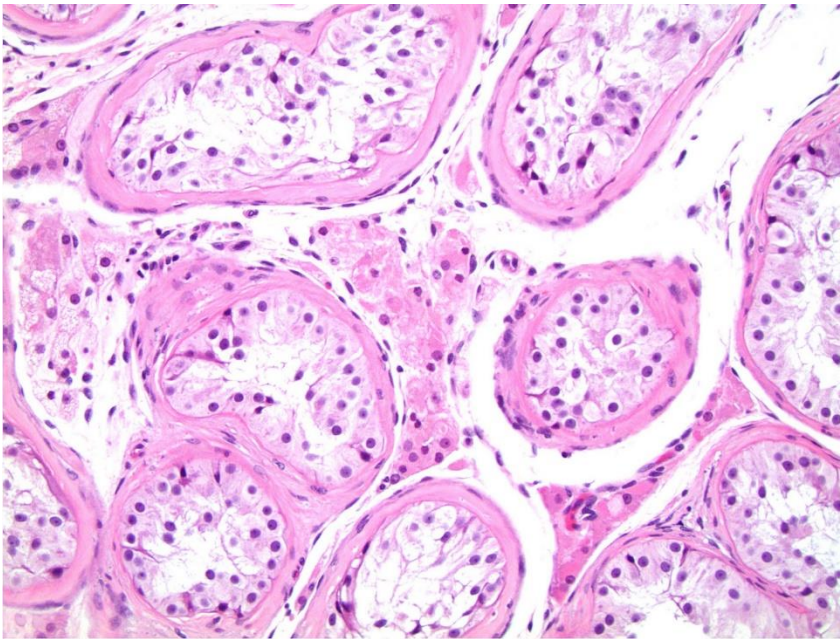
Delayed germ cell maturation, hyalinization of seminiferous tubules and reduced germ cell number are the changes reversible up to 2 years of age.

In cryptorchid testis histologic changes includes loss of ribosomes, degeneration of mitochondria, increase in collagen fibers in the spermatogonia and Sertoli cells.(13)



Seminiferous tubule with Sertoli cells, no spermatogenesis, medium power

Figure 7 SEMNIFEROUS TUBULES WITH NO SPERMATOGENESIS



Retained Leydig cells

Figure 8 SHOWING LEYDIG CELLS RETAINED

CLASSIFICATION OF UNDESCENDED TESTIS

1. Palpable Undescended testis 70%
2. Non-palpable undescended testis - includes
 - a) Intra-abdominal (55%),
 - b) inguinoscrotal 30%
 - c) Vanishing testis 15 %

DIAGNOSIS

Imaging modalities includes Ultrasound abdomen, pelvis and scrotum. Ultrasound has a sensitivity of 45% and a specificity of 78% (14)

In non-palpable testis , according to the American Urological Association Guidelines on Cryptorchidism diagnostic laparoscopy is the gold standard(15).

Advantage of superior diagnostic capabilities, ability to provide therapeutic interventions, laparoscopy can be used in the evaluation and treatment of patients with non-palpable testes.(16)

TESTICULAR ATROPHIC INDEX

Ultrasound studies were performed by using 7.5 and 10 MHz transducers. In the assessment of undescended testicle, the largest measurements in each dimension

were The usefulness of testicular atrophy index .(31) The testicular volume (TV) can be calculated by using the empirical formula of Lambert:

$$TV \text{ (ml)} = 0.71 \times (\text{width} \times \text{length} \times \text{height})/1.000.$$

The testicular atrophy index (TAI) of the affected testicle was calculated as:

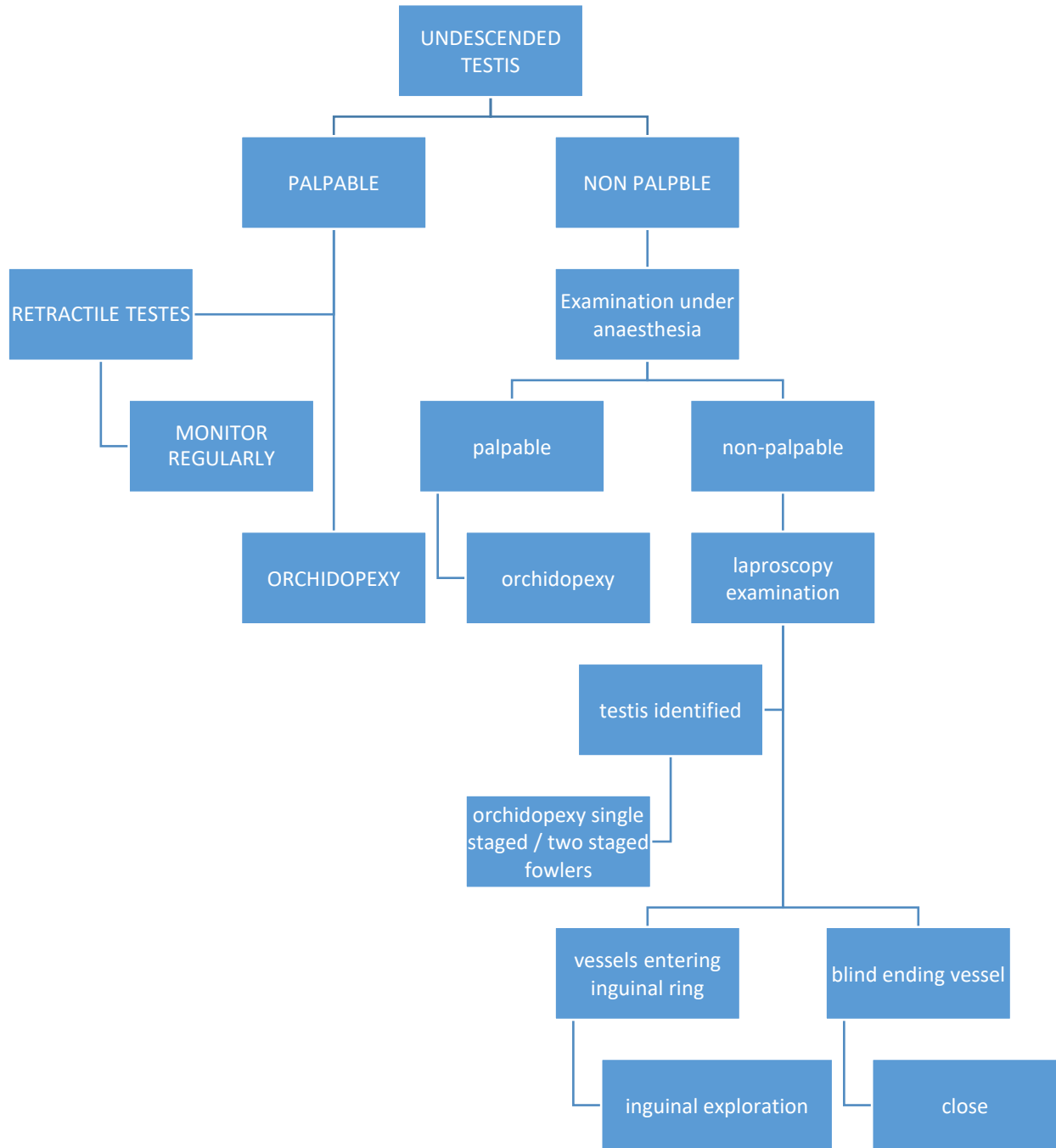
$$TAI = \frac{(\text{contralateral testis volume} - \text{affected testis volume}) \times 100}{\text{Contralateral testis volume}}$$

TAI is expressed as a percent.

Disorder of sex development (DSD)

A newborn boy with bilateral nonpalpable testes must be evaluated for disorder of sexual development and should not be circumcised until after the workup is complete, even if a completely normal phenotypic penis is documented on examination. A 46 XX individual with severe congenital adrenal hyperplasia can be mistaken for a boy with bilateral cryptorchidism. The possibility of DSD, or other syndromes should also be entertained when unilateral or bilateral cryptorchidism is present with phallic anomalies, such as hypospadias or micropenis.

EVALUATION AND TREATMENT OF UNDESCENDED TESTES



VANISHING TESTIS SYNDROME

Vanishing testis syndrome or Testicular regression syndrome (TRS) is defined as the absence or complete atrophy of testis in 46XY patients with normal external genitalia(17).It may be seen in less than 5% of all patients of cryptorchidism. It was present initially but disappeared during development. Etiology is most likely due to spermatic cord torsion or vascular accident occurs after completion of genital masculinization but before fixation of the testis in the scrotum. Diagnosis of a vanishing testis requires documentation of Blind-ending spermatic vessels in the abdomen, inguinal canal, or scrotum. Endocrine evaluation is needed, in cases of suspected bilateral vanishing testis (anorchia). Endocrine evaluations include elevated basal serum gonadotropin levels and no response to hCG stimulation.Histological findings are presence of a fibrovascular nodule with associated hemosiderin-laden macrophages and dystrophic calcification. Residual testicular tubules are found in less than 10% of cases, with prevalence being unrelated to age at surgery. Presence of seminiferous tubules and viable germ cells in testicular remnant tissue has been reported in some series. In long term TRS theoretically carries a potential for malignant degeneration and to eliminate this risk it is a common practice of removal of any remnant.

**Figure 9 INTRAOPERATIVE FINDING OF UNDESCENDED TESTIS
SHOWING UNDESCENDED TESTIS**



Treatment

A child with an undescended testis should be operated at the earliest as the histological changes in the testes occur as early as six months of postnatal life and therefore, operated at the earliest to prevent them. The best time for orchidopexy is about 1 year of age. If, the facilities of surgical expertise and pediatric anesthesia are available, can be performed before 9 months of age. Informed consent for

orchidopexy should include following risks including bleeding, testis atrophy, infection, possibility of a staged procedure,

Revision if the testis does not remain in a scrotal position, and injury to the vas deferens.

Correction of cryptorchidism is indicated to

- a) Optimize testicular function,
- b) Potentially reduce and/or facilitate diagnosis of testicular malignancy,
- c) Provide cosmetic benefits, and
- d) Prevent complications such as clinical hernia or torsion.

Methods of Orchidopexy

1.Extra-dartos pouch—conventional orchidopexy- Inguinal orchidopexy

It is the standard treatment for undescended testes , if testis within or distal to the inguinal canal.

STEPS OF INGUINAL

1. Providing adequate anaesthesia General anesthesia or caudal block depends on patients . Scrotal examination should be performed to confirm the location of both testes.

2. An inguinal incision is made which is transverse incision , made approximately one third the distance between the pubic tubercle and anterior superior iliac spine,

3. Dissection of scarpa's fascia and Blunt dissection is used to

Expose the three key landmarks of the external oblique fascia which is opened sharply and avoiding injury to the ilioinguinal nerve, the shelving edge of the inguinal ligament, and the external ring. Care should be taken to avoid injury of ectopic testes in superficial ring.

4. Within the canal the spermatic cord is identified. Spermatic cord is freed of the cremasteric and spermatic fascial attachments. The spermatic cord is further isolated distally to the testis. The gubernaculum is identified by visualizing an indentation of the Skin of the point of maximal gubernacular fixation. The gubernaculum is transected with electrocautery.

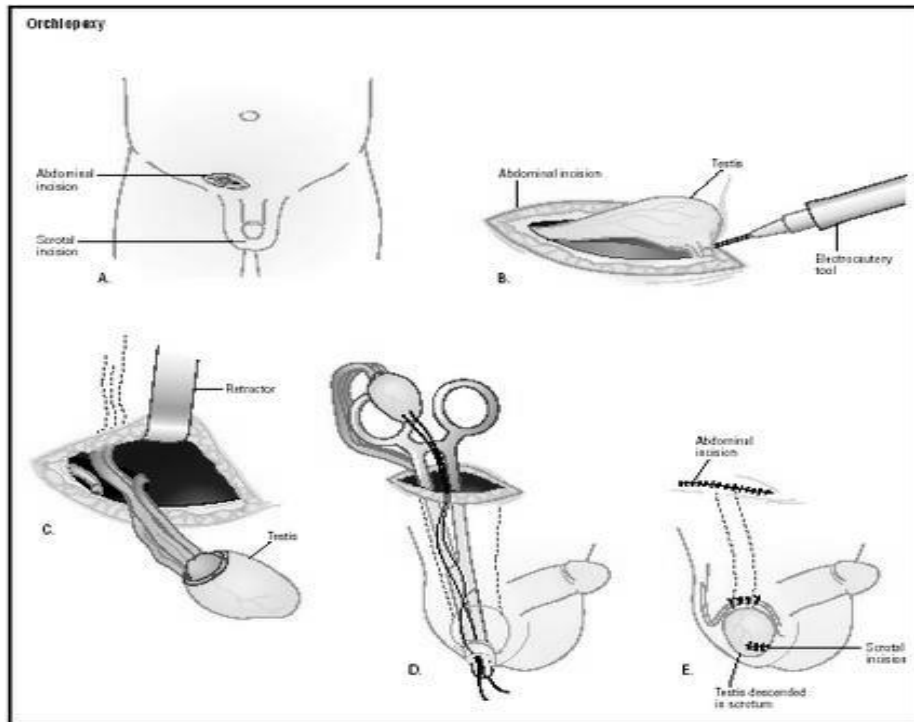
5. Most undescended testes are associated with a patent processus vaginalis, so this hernial sac must be carefully dissected from the spermatic cord and a high ligation of sac is done. The patent processus is divided at this level.

6. Adequate length on the spermatic cord is established by freeing the cord from remaining cremasteric fibers and the lateral spermatic fascia. If the above steps fail to achieve adequate length and additional procedures may be needed.

Retroperitoneal dissection and snipping off of lateral peritoneal bands carefully will give an adequate length to the spermatic cord. If the testis does not reach the scrotum easily then by Prentiss maneuver, the inferior epigastric artery and vein can be ligated and the testis brought directly through the transversalis fascial floor (Prentiss maneuver)(18).

Hutcheson et al. suggested thorough dissection of the internal spermatic fascia from the cord will usually gain necessary length (19). The testicular artery can be ligated for a one- or two-stage Fowler–Stephens procedure if further length is necessary.

Figure 10 open inguinal



7. The testis is placed in an extra-dartos pouch in the scrotum; an adequate dissection should be done to avoid tension on the pedicle while placing the testis in scrotum. Any torsion of pedicle should be avoided.

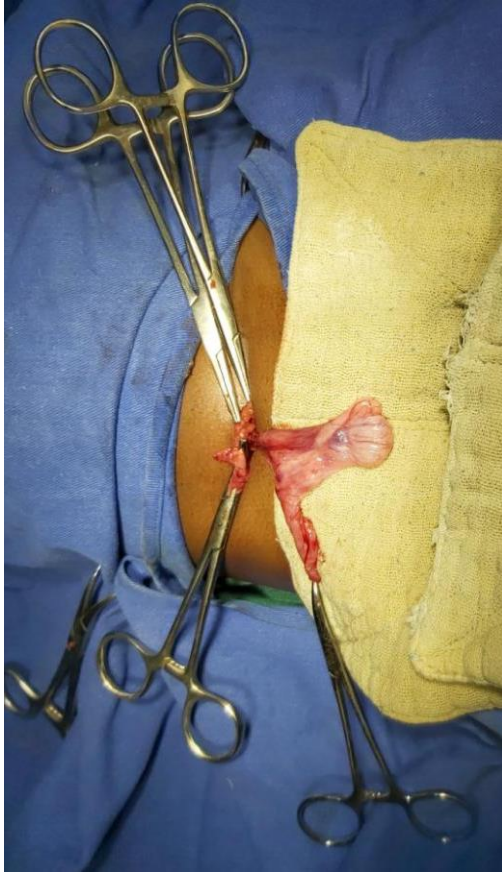


Figure 11 SHOWING INTRAOPERATVE PICTURE OF UNDESCENDED TESTIS



Figure 12 showing scrotal incision for subdartos pouch

Figure 13 showing securing testis in scrotum



2. Transcrotal orchidopexy

It is performed through a skin crease transverse incision in the neck of the scrotum.

It can be done in young infants 9 months of age .High ligation of processus vaginalis, dissection of spermatic cord and placement of testis in an ipsilateral subdartos pouch constructed through the same incision and avoidance of disruption of inguinal canal.(20)

3. Open Transabdominal

An extended inguinal incision or higher incision medial to the pubic tubercle is made, and by pre-peritoneal approach, by longitudinal opening of the internal oblique and peritoneum, Extensive dissection of the vas and vessels is facilitated. A tunnel is created to the scrotum, and the testis is placed as for an inguinal. The success rate reported for this procedure for abdominal testes was 95% (21)

LAPAROSCOPY

Pediatric laparoscopy is an important tool in the search for the undescended testis. Laparoscopy has 95 %sensitivity for locating a testis or proving its absence.

It is a safe and reliable diagnostic and therapeutic for patients with undescended testis.

Intra-abdominal detection allows more testes to be brought down to the scrotum.

Laparoscopy obviates the need for groin exploration in many cases. Technically, a first stage Fowler Stephen's procedure can be performed easily and effectively with the help of a laparoscope

If the testicular vessels are seen to end blindly I means that the testis is absent on that side and that no surgical exploration is necessary. If the vessels are seen to enter the internal inguinal ring, an inguinal exploration or laparoscopic assisted orchidopexy is required.

If the testis is intra abdominal, to perform an extra-abdominal exploration and attempt to place the testis in scrotum or to clip the testicular vessels and perform an orchidopexy at a later date.

Steps in laproscopy procedure

1. Patient anesthetised by General anesthesia .

The anesthetised patient should be fully relaxed, and an orogastric tube to empty the stomach also, the bladder is drained.

2. A small periumbilical incision is made and the camera port is inserted using the Hasson technique or Veress needle. The abdomen is inflated with care to avoid over-inflation.

3. The camera is then inserted and the abdomen inspected for any entry injury. If needed, the patient may be placed in Trendelenburg position to allow the bowel to fall away from the pelvis.

4. First, unaffected side is examined to confirm that both the vas deferens and Testicular vessels pass through a closed internal ring. 3-mm port is placed in each side of the lower abdomen. The affected side is then examined.

5. The spermatic vessels are the key to diagnosis and proof of an absent testis are blind-ending spermatic vessels.

6. If testicular vessels and vas deferens enter the inguinal ring, groin exploration is performed and if a satisfactory testis is found standard orchiopexy is performed.

7. In the case of an intra-abdominal testicular nubbin, removal of testicular nubbin to prevent the risk of malignant transformation.

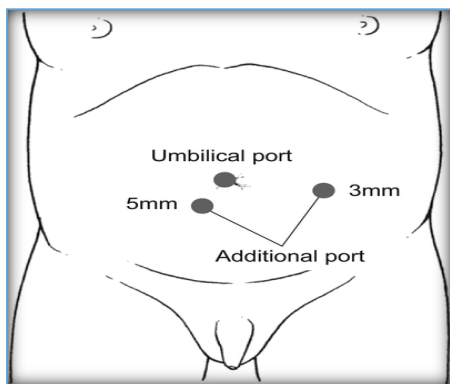


Figure 14 port placement in laparoscopic orchidopexy

Fowler Stephen's technique

It comprises of division of the main testicular vessels and relies on delicate vasal and cremasteric collaterals for testicular survival and growth.

In this technique , the entire length of the vas deferens is identified , gubernaculum is separated, to gain further length the peritoneum may be carefully

Freed from the underlying vessels, the cord and testis are also Released from any attachments dorsally.

The gubernaculum is grasped and the testis brought across the midline to the contralateral external ring and inguinal canal.

If it reaches this far, it will likely reach the ipsilateral scrotum in one step.



Figure 15 showing laparoscopic orchidopexy

Then one stage technique can be preceded. An incision is made in the ipsilateral scrotum and a subcutaneous pouch is developed. (22)

The testis is then grasped by the gubernacular remnant and pulled out of the scrotum .The cord is inspected and the orientation of the testis is also checked to ensure there is no torsion.

The testis is then fixed in the dartos pouch and the scrotal skin closed. After checking for hemostasis, the abdomen is deflated, trocars removed, and fascia and skin closed.

Staged Fowler Stephen's technique

It is a 2-stage procedure.

If the testis does not reach into the scrotum, then 2 stage procedure can be done.

Ligation of the spermatic vessels by using clips to gain length is done as stage I operation by Laparoscopic method to allow the collateral blood supply to develop without mobilizing the testes.

After about 6 months waiting, at second stage the testis can be brought into scrotum by inguinal exploration.

The testicular blood supply is supported by the artery to the vas.(23)

Multistage orchidopexy

The testis is mobilized and brought into the inguinal canal as far as possible. The testis and spermatic cord are wrapped with a silicone sheath to prevent adhesions. After 1 year, at second stage, the testis is brought down to the scrotum.

Microvascular orchidopexy (testicular autotransplantation)

Microvascular transfer of testis is the best procedure to avoid testicular atrophy but it needs greater expertise and equipment. This procedure involves high mobilization of the testicular vascular pedicle and carefully safe-guards vas and vasal collaterals.

Following division of blood supply, the testis is transferred to the scrotum and immediately revascularized by one arterial and one or two venous anastomosis to the inferior epigastric vessels.

Success rate of over 80 to 90 percent is now possible in expert hands.(24)

Refluo technique

It consists of full venous drainage by microvascular anastomosis of the testicular vein to the inferior epigastric vein, but it relies on the arterial input from the vasal collaterals.(25)

Ombredanne's procedure the testis is placed into the contralateral scrotal sac

Through the scrotal septum.(26)

KetleyTorek

This procedure is now not used as with high rate of testicular atrophy. It is involved in fixation of testis to the thigh with a thread and repeated pulling of thread. (27)

COMPLICATION OF SURGERY

1. Bleeding or scrotal hematoma,
2. Hydrocele,
3. Vas and vessel injury. Division of the vas deferens can be managed with immediate microsurgical repair or delayed repair performed after puberty,
4. Local wound infection,
5. Testicular ascent .It is managed by re-operative.
6. Testicular atrophy
7. Failed orchidopexy.
8. Recurrence of non-descent due to inappropriate choice of surgical technique.

OUTCOMES

The successful outcome defined as a normal sized testis in the dependant scrotal position.It varies by initial location of the testes and the Performed procedure.

Table 1 Procedures and success rates (15)

S.No	Procedure	Success rates
1	Inguinal orchiopexy	89% to 99%
2	one-stage Fowler– Stephens orchiopexy	63% to 67%
3	two-stage Fowler–Stephens orchiopexy	67% to 89%

Role of Hormones

Hormones such as human chorionic gonadotrophins (hCG) and gonadotropin releasing hormones (GnRH) therapy play multiple roles.

Hormones, mainly the hCG, have been used for the detection of anorchia in case of impalpable testis.

In case of bilateral UDT, an hCG test (1,000 IU on alternate days for

3 injections) is performed to look change in the level of testosterone. (28)

A less than 20-fold rise is indicative of anorchism and surgery is not indicated in these patients. These days, laparoscopy is a much better modality than the hCG stimulation test.

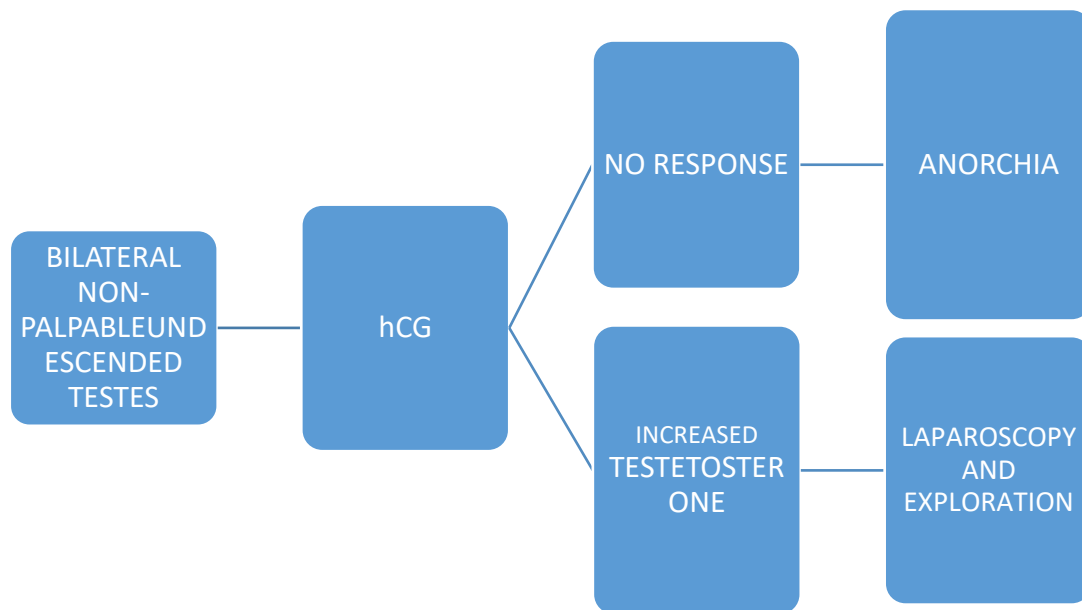


Figure 16 ALGORITHM FOR BILATERAL NON-PALPABLE UNDESCENDED TESTIS

hCG is also used to achieve descent of undescended testis partially or completely and the secondary benefits for redo cases, i.e. for the testicular volume enlargement, the vessels and the scrotum. Under the hCG effect, the spermatic vessels become more pliable and the length of the cord is also increased. The scrotum becomes more spacious. The results following hormonal therapy are known to be better if at least for 3-4 weeks after hCG therapy and the testis is low-lying (inguinal or high scrotal), retractile, unilateral, good in volume and in boys above 8 years of age. Since the therapy is effective in only 20 to 30 percent cases,

it is not widely-used. All these beneficial effects have been regularly well-utilized to bring the difficult testes down to scrotum, within 1 to 2 week of therapy till the effects of hCG persist.(29)

Indications for Orchidectomy

1. Malignancy.
2. Testicular atrophy.
3. High intra-abdominal testis which cannot be brought down.

Prosthesis

Prosthesis can be used if orchidectomy has been done.

Prosthetic placement should be performed for psychological reasons, at first in childhood as it allows the growth of scrotum. Later on puberty, the prosthesis can be replaced by an appropriate-sized. This is only for psychological satisfaction.(30)

Due precautions need to be observed for proper placement in scrotum and to prevent infection.

Prognosis

1. Recurrence – 2 %
2. Incidence of atrophy -2 to 5%,

3. Fertility after unilateral orchidopexy -70 to 80 % and

4. Fertility after bilateral orchidopexy-40 %.

Higher the testis, higher are the chances of malignancy and poorer the outcome for fertility. The lower the testis, the higher the success

MATERIALS AND METHODS

MATERIALS AND METHOD

SOURCE OF DATA

It includes the patients admitted for undescended testis and related surgically in Government Vellore medical college hospital, in Department of General Surgery.

Study population

50 POSITIVE FINDING CASES OF UNDESENDED TESTIS

Inclusion criteria

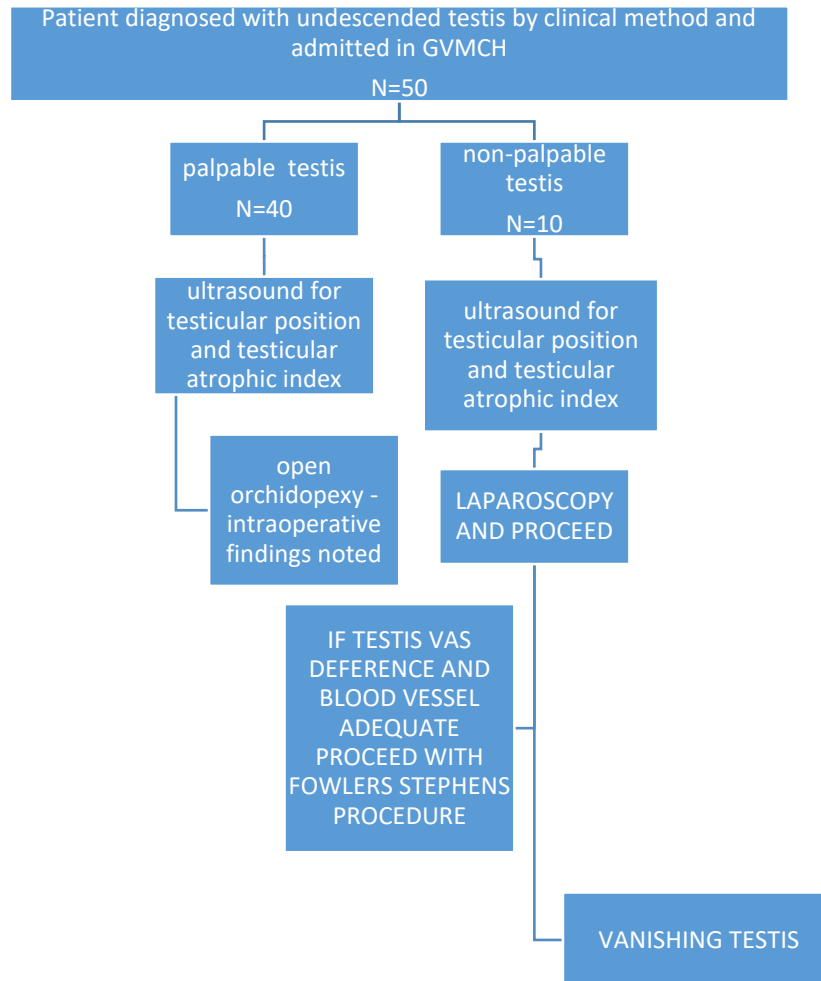
1. Patients diagnosed with undescendent testes
2. Patients willing for surgery
3. upper age limit Is upto 16 years of age

Exclusion criteria

1. Patients with retractile and ectopic testis
2. Patients not willing/ unfit for surgery
3. Patients with bilateral non-palpable undescended testis
4. Age more than 15 years of age.

METHODOLOGY

Figure 17 ALGORITHM OF METHADODOLOGY OF THE STUDY



In this study, patient brought by their parents for Undescended testis divided into two groups

group A - palpable undescendend testis for open

group B- non-palpable undescendent testis , opting for laparoscopic management in which undergoes single and double staged treatment

It includes, collecting details of patients regarding,

- 1: Age wise distribution.
2. Clinical presentation associated anomalies
3. Sides of presentation
4. Palpable or non-palpable
5. Preoperative Ultrasound findings Relation between the position and palpability of testis.
6. Types of operative procedures
7. Intraoperative findings - Relation between the position and palpability of testis
8. Postoperative complications
9. Duration of hospital stay

For the management of unilateral palpable testis, Laparoscopy should be reserved for patients with non-palpable undescended testes.

for non-palpable undescended testes if age less than 4 years single staged laparoscopic procedure and if age more than 4 years double staged laparoscopic procedure

In laparoscopy method to opt single and two staged procedure INTRA OP

DISTANCE BETWEEN TESTIS AND DEEP RING, mobility of the testis to the

contralateral ring noted, compiling treatment procedures for patients and following up postoperatively during hospital stay.

Testicular atrophy index is a valuable and objective tool for assessment of the state of development of the testis at every stage of UDT treatment.

In this study preoperative Testicular atrophic Index is used to predict outcome of vanishing testis.

Ethical Considerations

The following ethical guidelines were put into place for the research period:

October 2018 to September 2019

- The dignity and wellbeing of students was protected at all times.
- The research data remained confidential throughout the study and the

Researcher obtained the patients' permission to use their real names in the research report.

Research protocol was presented in Institutional Ethical review Board and due permission was obtained to undertake the study

Conflict of Interest

Study is self-sponsored with support from institution. There is no commercial or conflict of interest

OBSERVATION AND RESULTS

The following study was conducted at Government VELLORE MEDICAL COLLEGE AND HOSPITAL hospital which is the hospital attached to GOVERNMENT VELLORE Medical College. A total of 50 patients participated in this study. All the patients were selected randomly .The study was conducted for the period of 12 months from October 2018 to September 2019. For all patients clinical study was done through questionnaires and clinical examination.

AGE OF PRESENTATION

Out of 50 patients, 6 patients, presented at the age between 0 to one year, 22 patients presented at the age between one year to 5 years, 12 patients presented at the age between 5 years to 10 years , 10 patients presented at the age between 10 to 15 years .

Table 2 AGE OF PRESENTATION

S.NO	AGE OF PRESENTATION	PALPABLE	NON PALBABLE	No.OF PATIENTS
1	O - 1 YEAR	5	0	6

2	1 YEAR TO 5 YEARS	11	0	22
3	5 YEARS TO 10YEARS	15	7	12
4	10 - 15 YEARS	9	3	10
TOTAL		40	10	50

Figure 18 SHOWING CHART OF AGE OF PRESENTATION

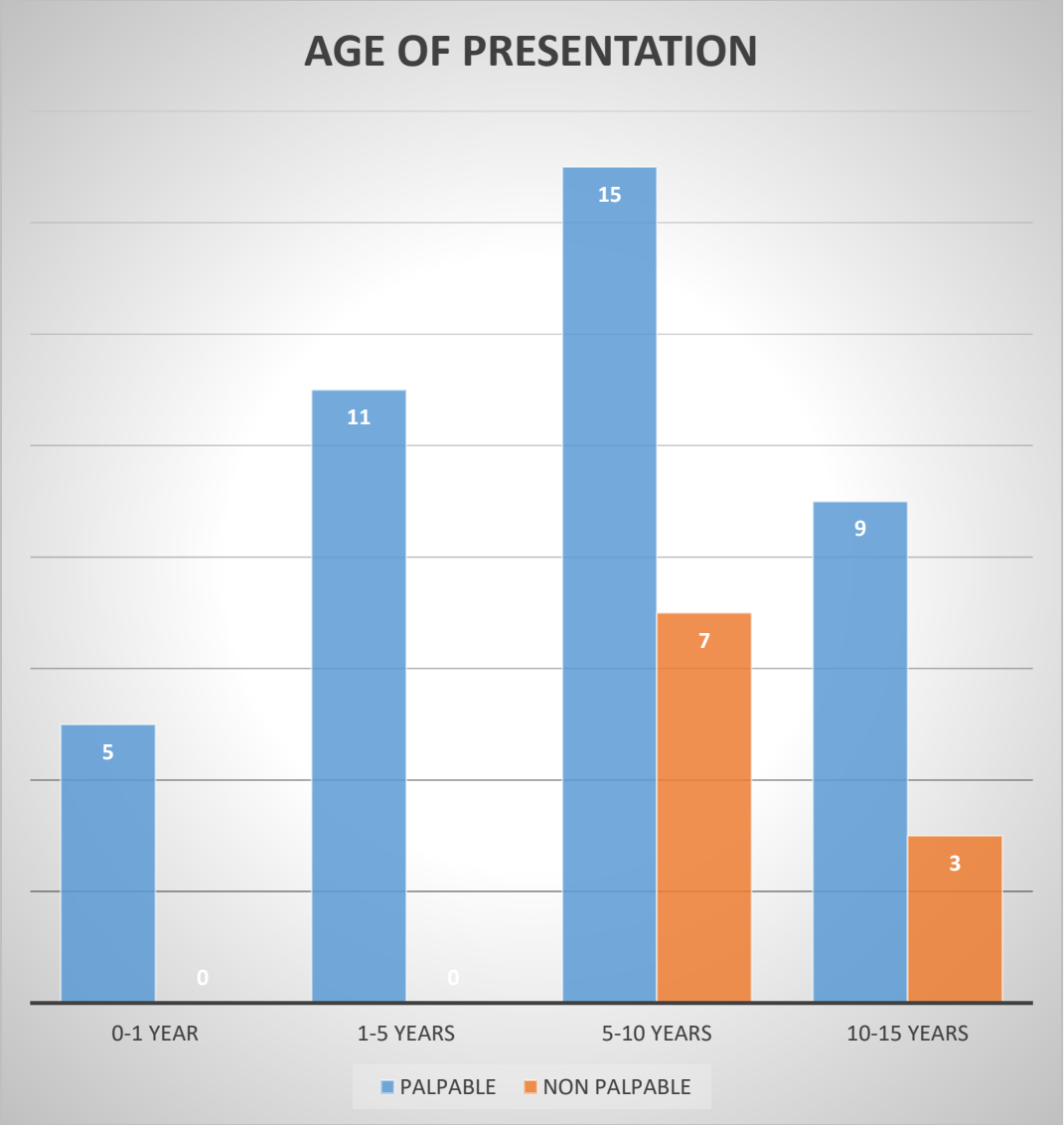


Figure 19 showing Graphical presentation of Age of Presentation

2.Mode of presentation

Out of 50 cases , 14 patients presented as swelling in inguinal region , 35 patients presented with complaints of empty scrotum , in those patients on examination 26 patients with palpable testis in groin region and remaining 9 patients with non-

palpable testis , 1 patient admitted for phimosis and on clinical examination found to be empty scrotum in right side and non palpabe undescended testis .

Table 3 modes of presentation

S.No	Modes of presentation	Palpable	Non-palpable	Total No.of patients
1	swelling in inguinal region associated with inguinal hernia In contralateral side	1	0	14
2	complaints of empty scrotum	38	9	35
3	admitted for phimosis, on examination detected	0	1	1
4	Associated with hypospadiasis	1	0	1
	Total	40	10	50

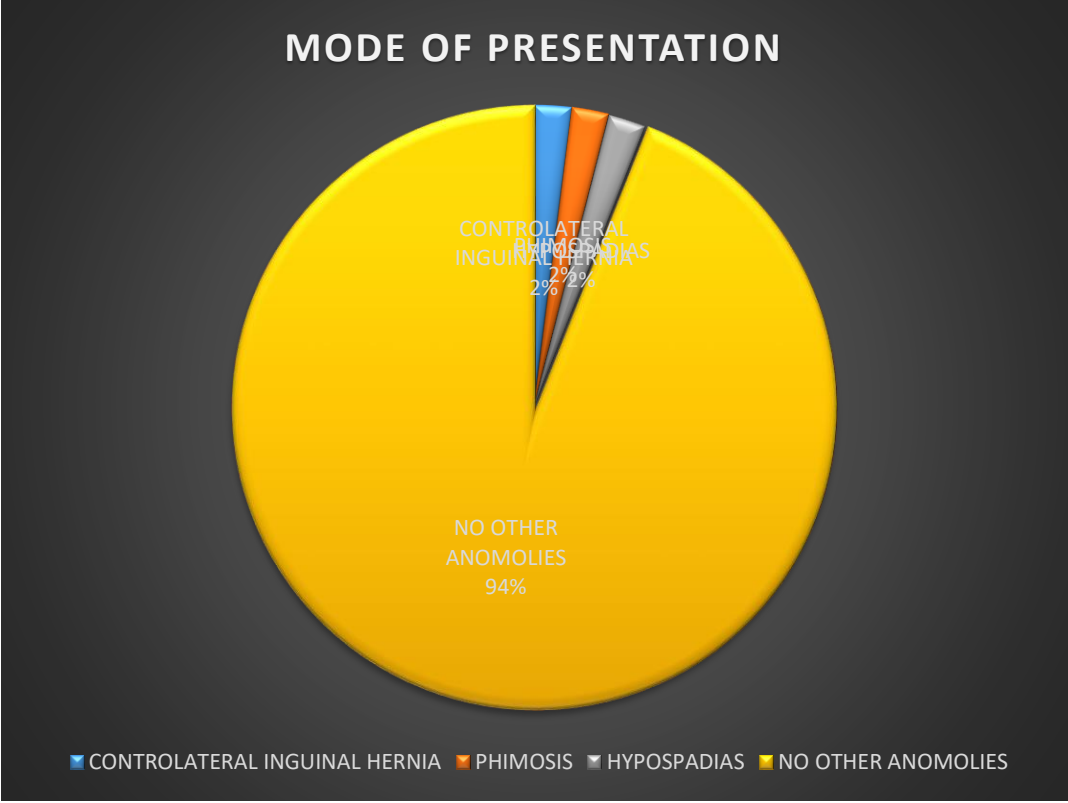


Figure 20 showing Pie chart of Mode Of Presentation

2. PALPABLE AND NON-PALPABLE

In our study, out of 50 patients , 10 patients presented as non-palpable and 40 patients presented as palpable undescended testis

Table 4 palpable and non-palpable

PALPABLE	NON-PALPABLE	TOTAL
40	10	50

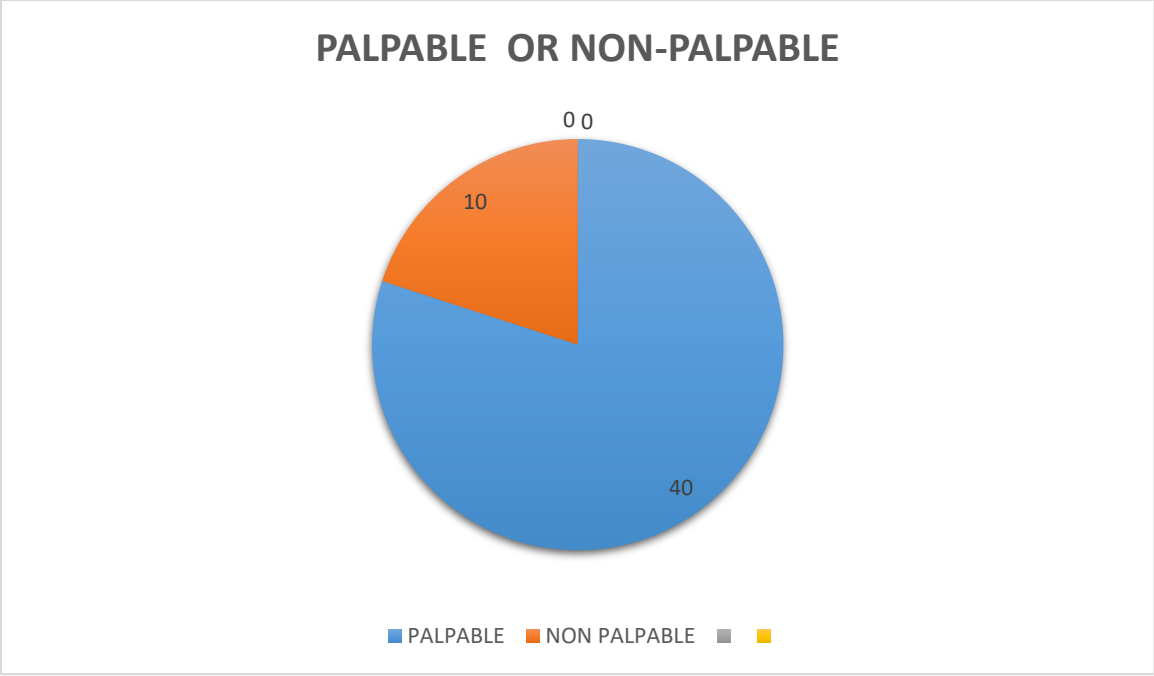


Figure 21 PIE HART OF PALPABLE AND NON-PALPABLE CHART

4. SIDE OF UNDESCENDED TESTIS

In our study, out of 50 cases, 24 cases of right side, 20 cases of left side and 6 cases of bilateral side. Thus, most common affected side is Right side

Table 5 side of UDT

SIDE	NO.OF CASES	PERCENTAGE
RIGHT	24	48 %

LEFT	20	40 %
BILATERAL	6	12%

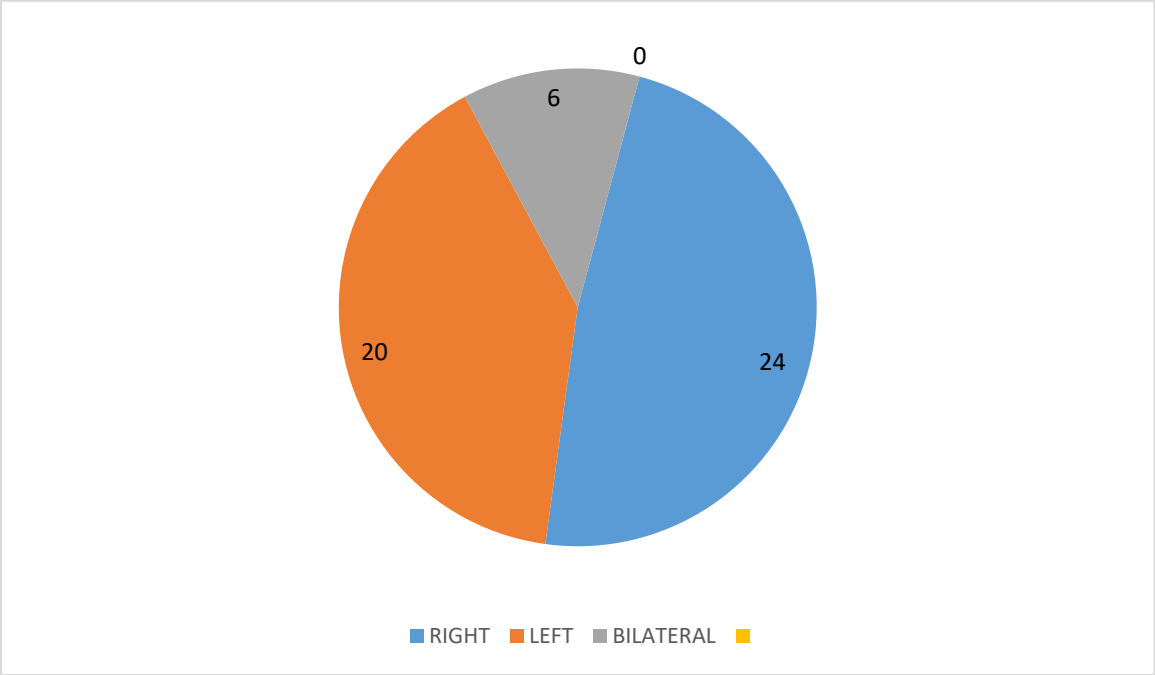


Figure 22 PIE CHART OF SIDES OF PRESENTATION

SIDE	PALPABLE	NON-PALPABLE
RIGHT	21	3

LEFT	13	7
BILATERAL	6	0

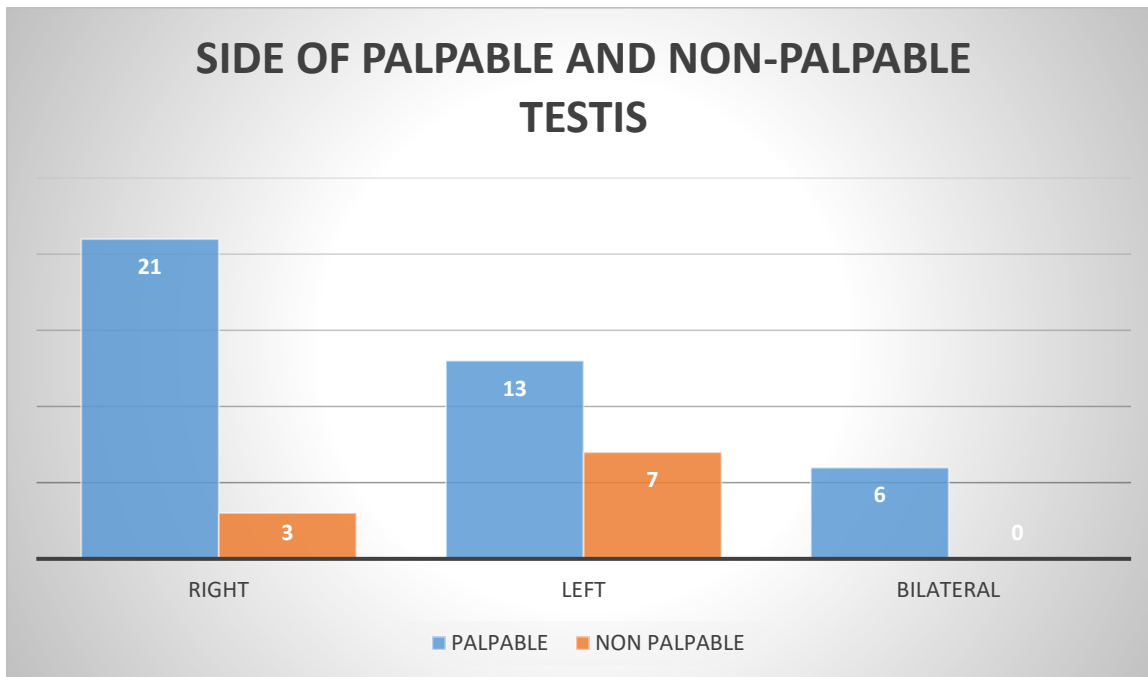


Figure 23 GRAPH SHOWING SIDES OF PRESENTATION

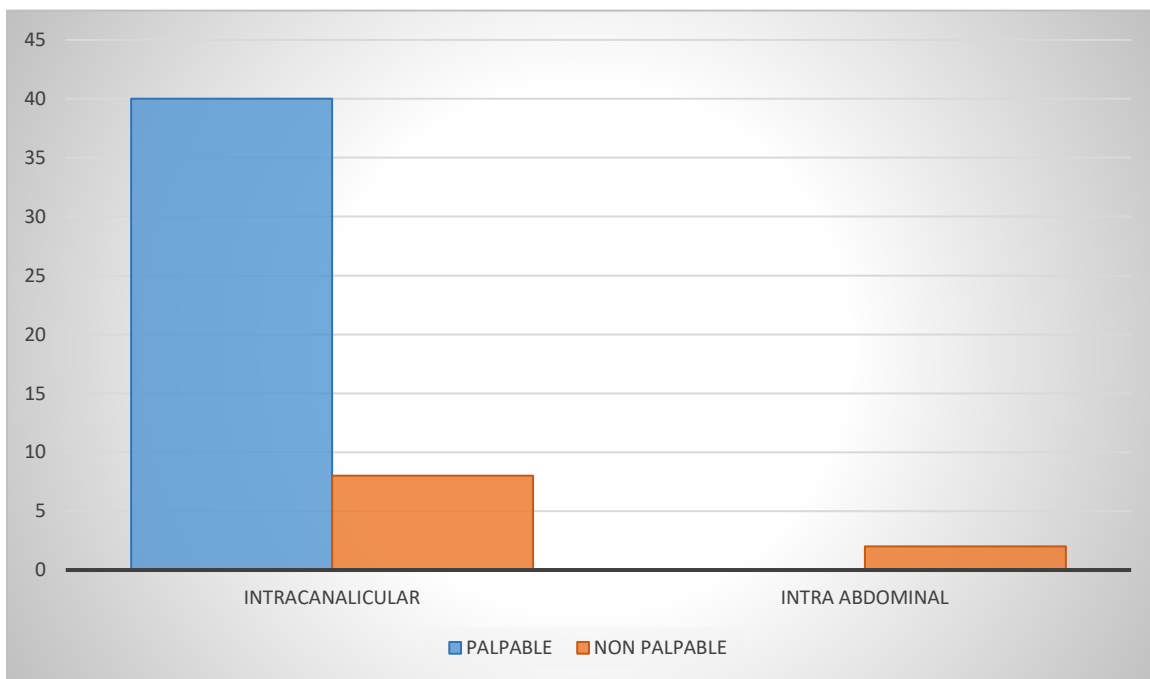
5. Relation between the position and palpability of testis.

Out of 50 patients, 40 Patients with palpable and 10 patients with non-palpable testis . In 40 patients of palpable testis , 40 patients with intra canalicular position ,10 patients with non-palpable testis , among 10 patients , 2 cases with intra-abdominal position and 8 patients with intra canalicular position.

Table 6 RELATION BETWEEN PALPABILITY AND TESTICULAR POSTION

	PALPABLE	NON-PALPABLE
INTRA CANALICULAR	40	8
INTRA ABDOMINAL	0	2
TOTAL	40	10

Relation between the position and palpability of testis



6.complications

Out of 50 students,

7.preop Ultrasound findings

Out of 50 patients , among 40 patients of palpable undescended testes ,40 patients undergone preoperative ultrasound , in which all patients with intracanalicular position .10 patients of non-palpable undescended testis , 10 patients undergone preoperative ultrasound imaging , in which , 4 patients inconclusive /testis not visible, 1 patient with intra abdominal and 5 patients with intracanalicular position .

Table 7 PREOP ULTRASOUND FINDINGS

POSITION	PALPABLE	NON-PALPABLE
INTRA CANALICULAR	40	5
INTRA ABDOMINAL	-	1

NOT VISUALISED TESTIS	-	4
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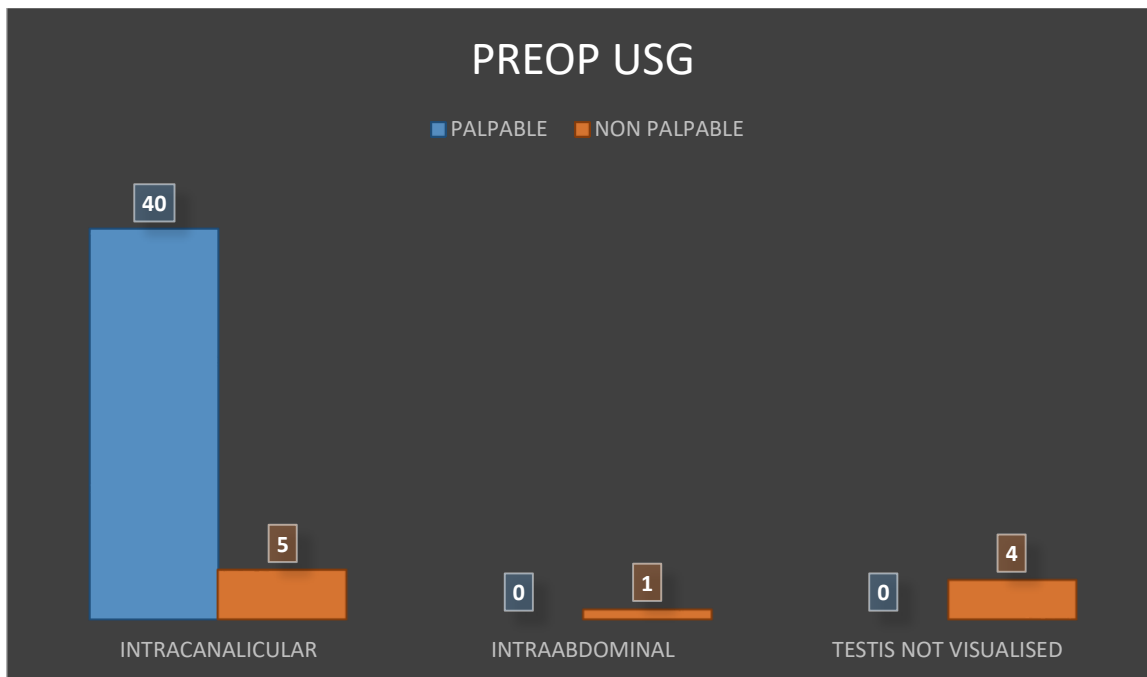


Figure 24 SHOWING PREOPERATIVE USG FINDING

Intraoperative findings

8. Types of operative procedures

Out of 50 patients , 40 patients of palpable testis patients undergone open , and 10 patients undergone Diagnostic laproscopy and in which 4 patients of Vanishing testis syndrome , and 6 patients undergone Fowlers staged procedure .In

6 patients , 4 patients undergone Fowlers single staged procedure , 2 patients undergone double staged procedure .

Table 8 TYPES OF OPERATIVE PROCEDURES

PROCEDURE	PALPABLE	NON-PALPABLE	Percentage
OPEN	40	-	80 %
FOWLERS PROCEDURE	-	6	12%
VANISHING TESTIS	-	4	8%

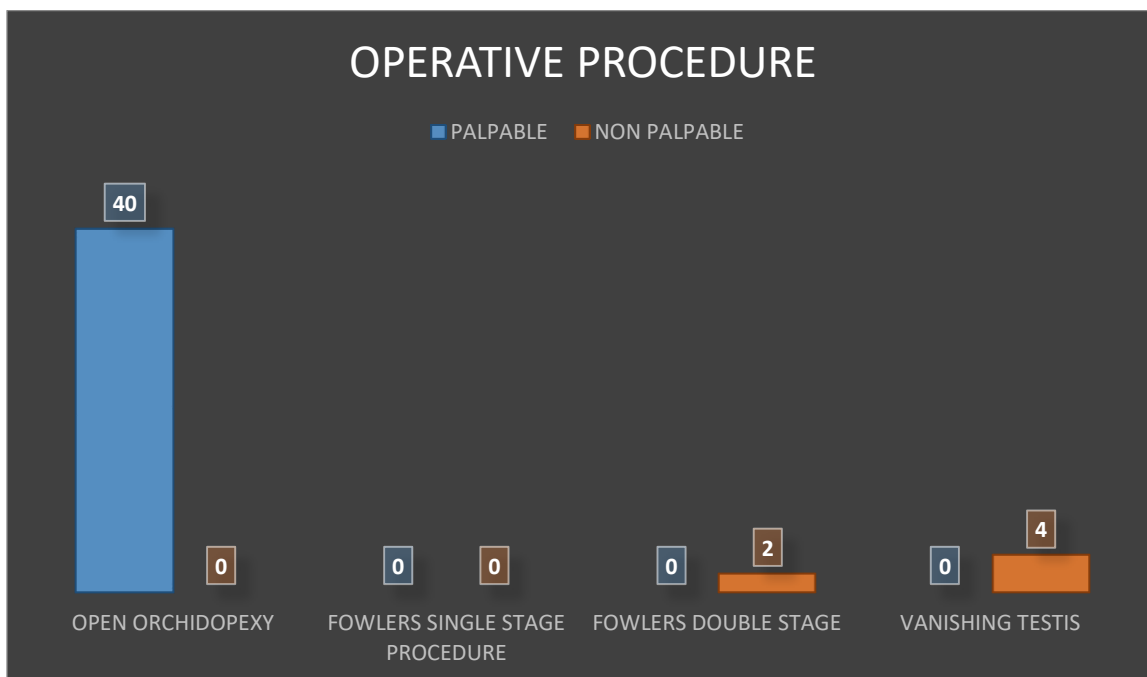
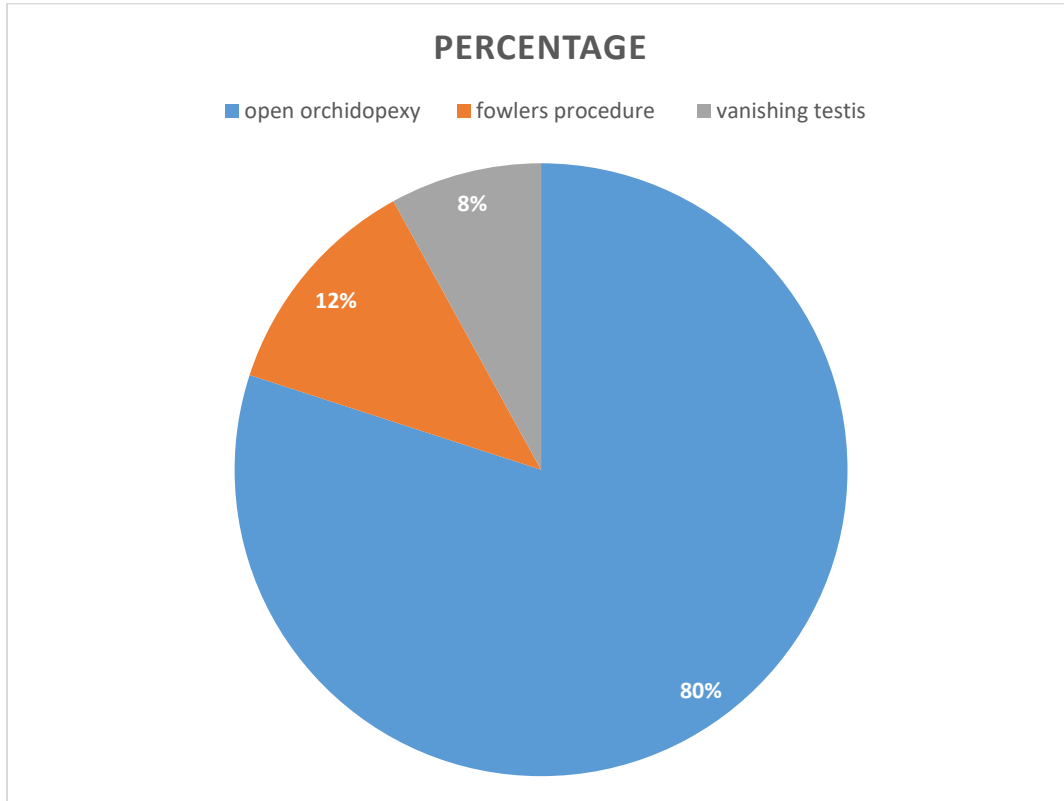


Figure 25 OPERATIVE PROCEDURE GRAPH REPRESENTATION



9. Postoperative complications

Out of 50 patients, followed up for postoperative complication

Wound hematoma in one palpable patient, postoperative infection on one patient.

	Palpable	Non-palpable testis

Wound hematoma	1	0
infection	1	0
Retractile testis	0	0

Table 9 SHOWING OPERATIVE FINDING

10. Duration of hospital stay

Duration of hospital stay	palpable	Non-palpable
Less than 2 days	37	0
2 to 4 days	1	10
>4 days	2	0

Table 10 duration of hospital stay

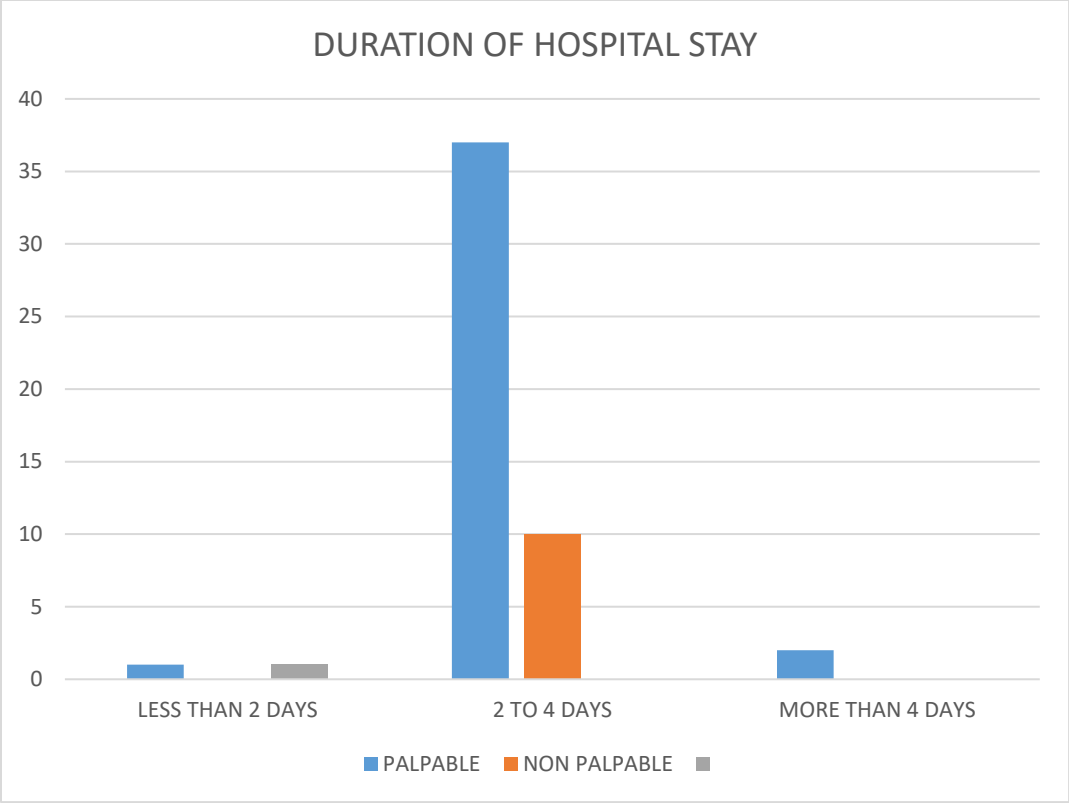


Figure 26 showing duration of hospital stay graphic representation

Testicular atrophic Index

Out of 50 patients ,testicular atrophic index measured for 34 patients , ultrasound abdomen plays important role in measuring testicular volume . here listed mean TAI for palpable and non-palpable undescended testis , with procedures done For 34 patients done ultrasound abdomen , among 34 patients 10 patients with non-palpable testis , among them 4 patients vanishing testis syndrome , with mean TAI of 60 % ,

For remaining 6 patients eith mean TAI of 13 % , for remaining 24 patients with mean TAI of 11 % are palpable testis.

	Mean TAI
PALPABLE UNDESCENDED TESTES UNDERGONE OPEN	12 %
LAPROSCOPIC WITH VIABLE TESTES	13%
VANISHING TESTIS	60 %

SO TAI with more value suggests or implies vanishing testis syndrome.

Discussions

In our hospital, admitted out of 50 patients, 40 patients (80 %) with palpable undescended testis, 10 patients with non-palpable testis (10%). Among 40 patients of palpable undescended testis patients, 52 % (n= 21/40) of palpable testis patients with right sided presentation, 33% (n=13/40) of patients with left sided presentation ,15 % (n=6/40) of patients with bilateral presentation .

In 10 patients of Non-palpable testis, 30 % (n=3/10) of non-palpable testis patients with right sided presentation , 70 % (n= 7/10) of palpable testis patients with left sided presentation .

In palpable undescended testis , mean age of presentation is 8 years , among undescended testis , mean age of presentation is 7 years , smallest among them is 10 month child , largest is 15 years of age.in non-palpable testis , mean age of presentation is 10 years .

Table 11 correlation between TAI and palpable /non-palpable testis p value =0.000 (<0.05)

TAI *									
WHETHER			Std						
PALPABLE	Obs	Mean	Dev	Min	25%	Median	75%	Max	Mode
NON-		38.166	25.388						
PALPABLE	6	7	3	14	15	38.5	61	62	61
		11.672							
PALPABLE	40	5	0.3537	11	11.4	11.6	12	12.5	12

Table 12 age in relation with presentation

	NON-	PALPABLE	Total
	PALPABLE		
EARLY AGE <8 years	2	23	25
LATE AGE >8 years	8	17	25
Total	10	40	50

Earlier age presentation in palpable undescended testes, comparatively late age presentation in non-palpable UDT .Odds ratio with Confidence Interval 95 %, p value =0.000 (<0.05)

Table 13 SHOWING TESTICULAR ATROPHIC INDEX IN RELATION TO VANISHING TESTIS with p value = 0.00 (< 0.5)

	VANISHING TESTES	NORMAL TESTES	Total
Low TAI < 20%	0	43	43
High TAI >20 %	3	0	3
Total	3	43	46

p value = 0.00 (<0.05) , $\chi^2 = 46.0$, 2 tailed p = 0.00 CI – 95 %

Testicular atrophic index (preoperative USG) for both palpable and non-palpable testis patients compared with intraoperative findings of normal testes and vanishing testes, TAI value less than 20 % taken as low and more than 20% as high , thus with high testicular index for three patients with vanishing testes syndrome . TAI with high index can predict vanishing testis syndrome with p value 0.00 (<0.05).

CONCLUSION

Undescended testis, one of the most common congenital disease , In this study right side as most common side of presentation , with earlier age presentation in palpable undescended testis and In non-palpable undescended testis with late age presentation . Among palpable and non-palpable Undescended testis, palpable is more common than non-palpable undescended testis. Vanishing testis in non-palpable testis of about 8% incidence with preoperative Ultrasound predicts vanishing testis by Testicular atrophic index if more than 60 % . Associated congenital anomalies in this study was phimosis, hypospadias and congenital inguinal hernia was studied. Approximately 10 percentage of tumor occurs in testes with maldescended testis. However testicular malignancy and in fertility could not be studied in this study as needed long duration for follow up.

BIBLIOGRAPHY

1. Sabiston Textbook of Surgery - 20th Edition [Internet]. [cited 2019 Oct 18]. Available from: <https://www.elsevier.com/books/sabiston-textbook-of-surgery/townsend/978-0-323-29987-9>
2. Verkauskas G, Malcius D, Eidukaite A, Vilimas J, Dasevicius D, Bilius V, et al. Prospective study of histological and endocrine parameters of gonadal function in boys with cryptorchidism. *J Pediatr Urol*. 2016 Aug;12(4):238.e1-6.
3. La Scala GC, Ein SH. Retractable testes: an outcome analysis on 150 patients. *J Pediatr Surg*. 2004 Jul;39(7):1014–7.
4. Van Essen W. The retractile testis. *Postgrad Med J*. 1966 Apr 1;42(486):270–2.
5. Park K, Choi H. An Evolution of Orchiopexy: Historical Aspect. *Korean J Urol*. 2010 Mar;51(3):155–60.
6. Testis Descent - an overview | ScienceDirect Topics [Internet]. [cited 2019 Oct 18]. Available from: <https://www.sciencedirect.com/topics/medicine-and-dentistry/testis-descent>

7. Barteczko KJ, Jacob MI. The testicular descent in human. Origin, development and fate of the gubernaculum Hunteri, processus vaginalis peritonei, and gonadal ligaments. *Adv Anat Embryol Cell Biol.* 2000;156:III–X, 1–98.
8. Hughes IA, Acerini CL. Factors controlling testis descent. *Eur J Endocrinol.* 2008 Dec 1;159(suppl_1):S75–82.
9. Gurney JK, McGlynn KA, Stanley J, Merriman T, Signal V, Shaw C, et al. Risk factors for cryptorchidism. *Nat Rev Urol.* 2017 Sep;14(9):534–48.
10. Steinberger A. Effects of Temperature on the Biochemistry of the Testis. In: Zorngiotti AW, editor. *Temperature and Environmental Effects on the Testis* [Internet]. Boston, MA: Springer US; 1991 [cited 2019 Oct 18]. p. 33–47. (Advances in Experimental Medicine and Biology). Available from: https://doi.org/10.1007/978-1-4684-5913-5_4
11. Favorito LA, Riberio Julio-Junior H, Sampaio FJ. Relationship between Undescended Testis Position and Prevalence of Testicular Appendices, Epididymal Anomalies, and Patency of Processus Vaginalis. *BioMed Res Int* [Internet]. 2017 [cited 2019 Oct 18];2017. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5763057/>

12. Inguinal hernias and hydroceles in infancy and childhood: A consensus statement of the Canadian Association of Paediatric Surgeons. *Paediatr Child Health*. 2000;5(8):461–2.
13. Pathology Outlines - Cryptorchidism [Internet]. [cited 2019 Oct 18]. Available from: <http://www.pathologyoutlines.com/topic/testiscryptorchidism.html>
14. Tasian GE, Copp HL. Diagnostic performance of ultrasound in nonpalpable cryptorchidism: a systematic review and meta-analysis. *Pediatrics*. 2011 Jan;127(1):119–28.
15. Evaluation and Treatment of Cryptorchidism (2014) - American Urological Association [Internet]. [cited 2019 Oct 19]. Available from: <https://www.auanet.org/guidelines/cryptorchidism-guideline>
16. Laparoscopic evaluation of the nonpalpable testis: A prospective assessment of accuracy - *Journal of Pediatric Surgery* [Internet]. [cited 2019 Oct 18]. Available from: [https://www.jpedsurg.org/article/0022-3468\(95\)90656-8/fulltext](https://www.jpedsurg.org/article/0022-3468(95)90656-8/fulltext)
17. Pirgon Ö, Dündar BN. Vanishing Testes: A Literature Review. *J Clin Res Pediatr Endocrinol*. 2012 Sep;4(3):116–20.
18. Ayub K, Williams MP. A simple alternative technique of orchiopexy for high undescended testis. *Ann R Coll Surg Engl*. 1998 Jan;80(1):69–71.

19. Graham SD, Keane TE, Glenn JF. Glenn's Urologic Surgery. Lippincott Williams & Wilkins; 2010. 992 p.
20. Khirallah MG, Elafifi MA, Elbatarny AM, Elsharaby AM. Orchiopexy through a single high transverse scrotal incision. Afr J Paediatr Surg AJPS. 2015;12(1):61–5.
21. Campbell-Walsh Urology - Alan J. Wein, Louis R. Kavoussi, Andrew C. Novick, Alan W. Partin, Craig A. Peters - Google Books [Internet]. [cited 2019 Oct 19]. Available from:
https://books.google.co.in/books?id=W1aeyJD46kIC&pg=PA3570&lpg=PA3570&dq=Open+Transabdominal+Orchidopexy&source=bl&ots=Puj374PjQc&sig=ACfU3U338semZqrzdl5XxhA2_d6Qn72-6w&hl=en&sa=X&ved=2ahUKEwijaK26ajlAhXOXSSsKHSGWALQQ6AEwDnoECAkQAQ#v=onepage&q=Open%20Transabdominal%20Orchidopexy&f=false
22. Holcomb GW. Laparoscopic evaluation of the nonpalpable testis: A prospective assessment of accuracy: R.G. Moore, C.A. Peters, S.B. Bauer, et al. J Urol 151: 728–731, (March), 1994. J Pediatr Surg. 1995 Jan 1;30(1):135.
23. Bakr AAM, Kotb M. Laparoscopic Orchidopexy: The Treatment of Choice for the Impalpable Undescended Testis. JSLS. 1998;2(3):259–62.

24. Garibyan H, Hazebroek FW, Schulkes JA, Molenaar JC, Dabhoiwala NF. Microvascular surgical orchiopexy in the treatment of high-lying undescended testes. *Br J Urol*. 1984 Jun;56(3):326–9.
25. Dòmini R, Lima M, Dòmini M. Microvascular autotransplantation of the testis: the “refluo” technique. *Eur J Pediatr Surg Off J Austrian Assoc Pediatr Surg Al Z Kinderchir*. 1997 Oct;7(5):288–91.
26. Schutt JP. Ombredanne operation for undescended testicle (cryptorchidism). *Northwest Med*. 1945 Nov;44:349–51.
27. Saha M. Modi ed dartos pouch technique by trans xing the testis to a nylon button for undescended testes with short spermatic cord. :3.
28. Rohatgi M, Gupta DK, Menon PS, Subarao P, Verma IC, Rajalakshmy M. Hormonal therapy in undescended testes. *Indian J Pediatr*. 1991 Feb;58(1):79–83.
29. Nation TR, Balic A, Southwell BR, Newgreen DF, Hutson JM. The hormonal control of testicular descent. *Pediatr Endocrinol Rev PER*. 2009 Sep;7(1):22–31.
30. Ferro F, Caterino S, Lais A. Testicular prosthesis in children: a simplified insertion technique. *Eur Urol*. 1991;19(3):230–2.

31. 21-Niedzielski.pdf [Internet]. [cited 2019 Oct 19]. Available from:
http://www.advms.pl/roczniki_2003/volumes/vol48_03/21/21-Niedzielski.pdf

DATA SHEET

NAME -

AGE -

IP.NO -

PRESENTATION-

SIDE OF UDT -

EXAMINATION FINDING – PALPABLE /NON PALPABLE

OTHER ASSOCIATED ANOMOLY -

ULTRASOUND FINDING-

PROCEDURE –

INTRAOP FINDING –

POST OP PERIOD -

MASTER CHART

NAME	AGE	SIDE	WHETHER PALPABLE	TAI	HOSP STAY	VIABILITY	USG	POSITION OF TESTES	ASSOCIATED	PROG
NAVEEN	8	BILATERAL	PALPABLE	11.3	1	V	C	C	N	O
SURYA	13	BILATERAL	PALPABLE	11.6	1	V	C	C	N	O
UDHAYASHANKAR	7	BILATERAL	PALPABLE	11.6	1	V	C	C	N	O
GOKUL	5	BILATERAL	PALPABLE	12	1	V	C	C	N	O
RAM PRASANTH	3	BILATERAL	PALPABLE	12	1	V	C	C	N	O
AFROS	7	RIGHT	PALPABLE	11.5	1	V	C	C	N	O
VIJAY	6	BILATERAL	PALPABLE	11.4	1	V	C	C	N	O
NAGHUL	8	LEFT	PALPABLE	11	1	V	C	C	N	O
PRITHVIRAJ	8	LEFT	NON PALPABLE		2	V	N	C	N	L
LOKESH	14	LEFT	NON PALPABLE		2	V	N	C	N	L
SAI SARATH	9	LEFT	NON PALPABLE		2	NV	N	C	N	L
HAREESHWARAN	3	LEFT	NON PALPABLE	62	2	NV	C	C	N	L
VENKATESH	10	LEFT	NON PALPABLE	15	2	V	C	C	N	L
ASWIN	12	LEFT	NON PALPABLE	61	2	NV	C	C	N	L
RAJESH	15	LEFT	NON PALPABLE		3	V	N	C	N	L
SABARINATHAN	9	LEFT	PALPABLE	11.2	1	V	C	C	N	O
SURENDRAN	12	LEFT	PALPABLE	11	5	V	C	C	N	O
ASHWIN	1	LEFT	PALPABLE	12	1	V	C	C	P	O
DINESH	12	LEFT	PALPABLE	11.2	1	V	C	C	N	O
DHARSHAN	3	LEFT	PALPABLE	12	1	V	C	C	N	O
VINOTH	1	LEFT	PALPABLE	11.8	1	V	C	C	N	O
POORNESH	3	LEFT	PALPABLE	11.6	1	V	C	C	N	O
YOGA KATHIR	3	LEFT	PALPABLE	11.6	1	V	C	C	N	O

PRATHAP	4	LEFT	PALPABLE	11.8	1	V	C	C	N	O
KISHORE KUMAR	10	LEFT	PALPABLE	12	1	V	C	C	N	O
GOWTHAM	7	LEFT	PALPABLE	12.5	1	V	C	C	N	O
HARIHARASUDHAN	11	LEFT	PALPABLE	11.5	1	V	C	C	N	O
KALAIYARASAN	7	RIGHT	NON PALPABLE	16	2	V	C	C	N	L
RAJU	10	RIGHT	NON PALPABLE	61	2	NV	C	C	N	L
SEETHARAM	9	RIGHT	NON PALPABLE	14	2	V	A	A	N	FS2
RITHIN	7	RIGHT	PALPABLE	11.3	1	V	C	C	N	O
UDHAYAN	1	RIGHT	PALPABLE	12	1	V	C	C	N	O
HEMACHANDRAN	11	RIGHT	PALPABLE	12.1	5	V	C	C	N	O
RAMESH	7	RIGHT	PALPABLE	12	1	V	C	C	N	O
MOORTHI	3	RIGHT	PALPABLE	12	1	V	C	C	N	O
DEEPAK	6	RIGHT	PALPABLE	12.4	1	V	C	C	N	O
ABISHEK	8	RIGHT	PALPABLE	11.6	1	V	C	C	N	O
RAGUL	2	RIGHT	PALPABLE	12	1	V	C	C	N	O
UDHAYA	14	RIGHT	PALPABLE	12	1	V	C	C	N	O
MADHAN	11	RIGHT	PALPABLE	11.6	1	V	C	C	N	O
BHUVANESH	1	RIGHT	PALPABLE	11.6	1	V	C	C	H	O
KISHORE	2	RIGHT	PALPABLE	11.4	1	V	C	C	N	O
MOHAN	11	RIGHT	PALPABLE	11.7	1	V	C	C	N	O
SABARINATH	9	RIGHT	PALPABLE	11.4	1	V	C	C	N	O
MANGALAM	7	RIGHT	PALPABLE	11.6	1	V	C	C	N	O
LOKESH	7	RIGHT	PALPABLE	11.5	1	V	C	C	N	O
YOGESH	12	RIGHT	PALPABLE	11.4	1	V	C	C	N	O
NAVEEN	7	RIGHT	PALPABLE	12	1	V	C	C	N	O
ARJUNAN	14	RIGHT	PALPABLE	11.3	1	V	C	C	N	O
SUKRAN	11	RIGHT	PALPABLE	11.4	1	V	C	C	N	O

CONSENT FORM

NAME OF THE PATIENT –

GUARDIAN /PARENTS NAME -

I give consent for including my son's particulars regarding disease, investigations and treatment details for thesis and dissertation purposes. I knew that involvement in this thesis does not make changes or contribute outcome of my son health condition.

எனது மகனின் நோய் விவரங்கள் மற்றும் சிகிச்சை விவரங்கள் மற்றும் ஆய்வறிக்கை நோக்கங்களுக்காக சேர்ப்பதற்கு நான் ஒப்புதல் அளிக்கிறேன். இந்த ஆய்வறிக்கையில் ஈடுபடுவது எனது மகனின் உடல்நிலையின் மாற்றங்களை ஏற்படுத்தாது அல்லது பங்களிப்பதில்லை என்பதை நான் அறிவேன்

இப்படிக்கு