MANAGEMENT OF NON PALPABLE UNDESCENDED TESTIS

A THREE YEAR STUDY ; 2008 – 2011

A Dissertation submitted in partial fulfillment of

M.Ch Branch V (Paediatric Surgery)

examination of Dr. M. G. R. Medical University,

Tamil Nadu, Chennai, to be held in

August 2011.

Certificate

Certified that the dissertation – entitled **"Management of Non Palpable Undescended Testis"** is the Bonafide work undertaken by **Dr. C. VIJAY ANAND**, under my guidance and supervision, in the Department of Paediatric Surgery, Government Rajaji Hospital, Madurai Medical College, Madurai, during the period of his Postgraduate residency in M. Ch. Paediatric Surgery from 2008 to 2011.

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DECLARATION

I, Dr. **C. VIJAY ANAND** solemnly declare that this dissertation "**Management of Non Palpable Undescended Testis**" was prepared by me under the guidance and supervision of Professor and HOD, Department of Paediatric Surgery, Madurai Medical College and Government Rajaji Hospital, Madurai between 2008 and 2011.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of **MASTER OF CHIRURGIE, in PAEDIATRIC SURGERY,** degree Examination to be held in **AUGUST 2011.**

Place : Madurai

Date : **Dr. C. VIJAY ANAND**

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C. Vijay Anand, GRH, Madurai, 2011.

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INTRODUCTION

Undescended testis is a common Paediatric Surgical condition which is conventionally managed surgically by Orchidopexy. It can either be palpable or non-palpable clinically. Inguinal exploration is the standard widely accepted approach for all children with palpable undescended testis.

But the optimal surgical approach for the non-palpable testis is still debated. Laparoscopy and open surgical exploration are the two options, each having its own benefits and draw backs.

Laparoscopy is said to have several advantages, mainly to locate the testis accurately, help in mobilization and remove any atrophic elements, if present. But the problem in subjecting all these children to initial laparoscopy is that in many instances the non-palpable testis may be located at or distal to the deep ring, which just needs a inguinal exploration.

Recently several studies have come up stating that non-palpable testis can be adequately managed by standard inguinal approach, and laparoscopy may only increase the time and cost in majority of the children without actually influencing the results.

AIM OF THE STUDY

This study is aimed at analyzing

- The role of standard primary inguinal exploration in the management of Non- Palpable Undescended testis in children.
- The incidence of scrotal or inguinal testis/ testicular structures in cases with non- palpable undescended testis.
- The incidence of normal viable testis, hypoplastic testis, non-viable testis or vanishing testis in children with non-palpable Undescended Testis.
- The importance of palpable cord structures in assessing the position of the testis and its appropriate management by primary inguinal exploration.
- Forming a new algorithm for Non palpable undescended testis

MATERIALS AND METHODS

All the children with non-palpable undescended testis who were operated in our hospital (n=30), between August 2008 and August 2011, were taken for this study.

Their history and complaints were recorded. Thorough clinical examination performed and attempts made to locate a testis. Attempts were made to locate and palpate the cord structures, if at all present. An ultra-sonogram was done for almost all these cases and the findings documented.

All these cases underwent Diagnostic Laparoscopy followed by Laparoscopic or open Orchidopexy, depending upon the location of the testis. In a very few cases where testis was a nubbin testis, an Orchidectomy was done. The position of the testis, the nature of the testis and the procedure performed were recorded.

These data were analyzed and compared with various reported studies and the choices of surgical procedures for non-palpable Undescended testis.

REVIEW OF LITERATURE

EMBRYOLOGY

Although the sex of the human is determined at the conception by the sex chromosomes, the developing gonad shows no morphological sex differentiation till the seventeenth week. During this period the future ovary or testis is in the indifferent stage and can only be termed a gonad.

Testicular development after the indifferent stage is manifested by continued growth of the sex cords[1]. The cords which are more clearly marked centrally than peripherally become separated from the surface epithelium by smaller cells which will produce Tunica Albugenia by fiber formation. The cords are widely separated by the proliferation of the mesenchyme, and the germ cells get incorporated into the cords. The cord cells themselves will become the Sertoli cells of the seminiferous tubules.

Not all primitive germ cells survive. Only one type appears to survive and the rest degenerate. Although the cord will form the seminiferous tubules, they remain solid until the fifth and sixth months. Coiling as a result of elongation starts late in the third month, and connective tissues appear between tubules. This connective tissue will later join the Tunica Albuginea to form the septum.

Gillman described a remarkable transitory increase in the size and the number of these cells of the mesenchymal component between the third and sixth fetal months[2]. By the eighth month, the volume of the interstitial tissue is reduced by extensive cellular degeneration. The Leydig cells are recognizable by the end of the third month.

Descent of testis:

The testis which is at first parallel to the long axis of the body, becomes nearly transverse by the 50 mm stage. The so called internal descent is the result of the elongation of the lumbar region of the embryo, which carries the mesonephros up, but leaves the testis behind. There is no decrease in the distance between the testis and the site of the internal ring. Growth of the testis is steady up to the fifth month, after which the rate declines, only to recommence at the beginning of the seventh month, just preceding the final descent.

Just prior to the descent during the seventh month, the testis lies at the level of the anterior iliac spine. The epididymis is poster lateral. The gubernaculum is about 1.8 cm long and as large around as the testis and epididymis. The peritoneum dips into the inguinal canal ahead of the testis but less than half way down the gubernaculum. The testis and

gubernaculum lie obliquely, with the testis and the gubernaculums extending into the canal. There appears to be no firm attachment between the end of the gubernaculum and the scrotum.

The Testicular descent was best described by Scorer, who dissected the bodies of 48 fetuses who had died during the seventh to ninth months of gestation. As the testis enters the internal ring, the gubernaculum emerges from the lower ring. As soon as it reaches the bottom of the scrotal sac, it begins to shorten until its lower two thirds have completely disappeared. Descent through the canal is accomplished in a few days. About 4 weeks more is required for the testis to pass from the external ring to the bottom of the scrotum. Descent does not start before the 230 mm stage and it may be complete as early as 240 mm, or it may be still incomplete at birth.

Among the premature births studied by Scorer, testes were undescended in 50% or more of the infants weighing less than 4 lb. and were descended in 50% or more of the larger infants.

The external ring contracts, after the emergence of the testis through it. After the descent is complete, the entire

ProcessusVaginalis closes. Closure is complete by birth in from 50 to 75% of the infants.

Causes for failure of descent:

Since the mechanics of normal testicular descent are obscure, the causes for the failure of descent are largely speculative. The explanations that have been proposed fall under three categories.

1. Insufficient androgen production
2. Anatomic interference
3. Inflammatory adhesions.

Hormones have been demonstrated to produce testicular descent both prematurely and after failure of normal descent. Anterior pituitary extracts, Chorionic gonadotropins and androgens are all very much effective. The maternal chorionic Gonadotropin stimulates the androgen production in the adrenal cortex of the fetus which leads to the normal descent of the testis. The high incidence of UDT in various pseudo hermaphroditism indicates hormones can influence the descent of the testis. Testicular descent by hormonal therapy leaves the ProcessusVaginalis open and that need have to be closed surgically.

Sloan and Walsh described the role of Mullerian Inhibiting hormone, which is a peptide formed in the seminiferous tubules. The MIS may play a key role in keeping the testis retroperitoneally due to persistent Mullerian duct syndrome. In other words, the Mullerian inhibiting substance which is produced by the Sertoli cells is responsible for the regression of Mullerian or paramesonephric duct.

Scott states that a Mullerian inhibiting substance is most likely responsible for the abdominal phase of the Testicular descent.

Anatomical interference with testicular descent has been attributed to

i) Failure of the gubernaculum to shorten during development

ii) Weakness of the Cremaster muscle

iii) Insufficient length of the spermatic artery

iv) Malformation of the internal inguinal ring or the inguinal canal

The theory that shortening of the gubernaculum testis serves to pull the testis into the scrotum has long been abandoned. The scrotal attachment is too week to resist any traction. In addition Lemeh measured the gubernaculum in 19 embryos and concluded that there is no

relative shortening of that structure until 28th week just before the final descent of the testis.

Defects of the Cremaster muscle have been suggested and experimentally confirmed in animal models but yet to be proven that such defects are the primary cause for cryptorchidism in men.

In older patients with undescended testis, the spermatic artery is often too short to permit placement of the testis in the scrotum. This is often the result of UDT rather than the cause for the failure to descend. Had the normal descent occurred the artery could have elongated to serve it at the proper location.

Disproportion between the size of the inguinal canal and the size of the testis, a wide meso orchium which permits excessive freedom of movement of the testis and deformation of the inguinal canal account for some examples of UDT, but they are clearly demonstrable in only extreme cases.

When testis is arrested within the inguinal canal, adhesions of the testis to the surrounding structures are frequently found at surgery. But whether the adhesions prevented descent or formed later is not always clear. Only very occasionally is there a history of inflammation.

The complexity of the normal process of descent suggests that the causative factors are multifactorial. The passive anchoring of the gubernaculum during the intra-abdominal phase is less frequently disrupted, so that the intra-abdominal testis is relatively uncommon, occurring in 5 – 10 % crypt orchid boys.

Abnormalities in the descent may be due to defects in the migratory mechanism itself or failure of Genitofemoral nerve function. Defects in the nerve can be caused by deficiency of androgen secretion during the second and third trimester as a result of deficiency of Gonadotropin production by the pituitary or the placenta.

Undescended testis lying well outside the normal line of descent is very rare and can lie in the perineum or femoral region. The cause of this is unknown. Hutson and associates suggested that this may be because of abnormal location of Genito femoral nerve with consequent abnormal migration of the gubernaculum to the wrong site. Increased gonadal mobility may permit the accidental descent through the contralateral inguinal canal. This can also occur in boys with persistent Mullerian syndrome, where the elongated gubernaculum predisposes to accidental descent to the opposite side.

A number of inherited syndromes are associated with UDT. The underlying cause is not known, although many are associated with microcephaly, suggesting the possibility of pituitary hormone or Gonadotropin deficiency. Some are also associated with neurogenic and mechanical anomalies, like, Arthrogryposis Multiplex Congenita. Intra-abdominal testes are characteristic of Prune – belly syndrome.

The absence of Processus Vaginalis and the location of the testis in the posterior surface of the bladder are consistent with obstructive cause. Ten percent of children with posterior urethral valves can also have cryptorchidism. Cryptorchidism is common with abdominal wall defects, like Gastroschisis, Exomphalos and Exstrophy of the bladder.

Neural tube defects have high incidence of UDT. Where there is a Myelomeningocele affecting the upper lumbar spinal cord, the incidence of UDT is greater than one third. Separation of the body of the epididymis from the testis is frequently observed when undescended. This is more common with intra-abdominal and high inguinal crypt orchid testis. Abnormalities of Vas deferens occur commonly with UDT. The impalpable intracanalicular testis may have a vas deferens forming a loop, which protrudes through the external inguinal ring to the high undescended testis.

Presence of bilateral UDT should raise suspicion of an endocrine disorder or an intersex state that should be evaluated. Cryptorchidism associated with Hypospadias should also raise the possibility of the intersex state and occurs in 30 – 40 % of the patients mainly consisting of defects in the testosterone synthesis pathway.

A thorough history is to be elicited, including prematurity, maternal use / exposure to exogenous hormones, lesions of the Central nervous system and previous inguinal surgery. It is very much essential to document the history of cryptorchidism in the family, history of congenital disorders and consanguinity of marriage between parents.

Fig. 1

Right sided Undescended Testis

Fig. 2

Left sided Undescended Testis

Undescended testis (UDT) is one of the most common congenital abnormalities of the genitourinary system in young boys. Approximately 1- 2 % of the boys at the age of 1 year have a UDT, the disorder being unilateral in about 90% of the cases and bilateral in about 10% , depending on various clinical series.About 20% if UDT's are nonpalpable[3].

In boys with non-palpable testis, approximately 50% are abdominal, 45% are atrophic secondary to in utero spermatic cord torsion and 5% are in the inguinal canal[4]. An undescended testis has impaired spermatogenesis and is prone to malignant degeneration. The goal of management of testis is to identify whether a viable testis is present and, if so, either perform an Orchidopexy, or in selected cases, an orchiectomy. Often diagnostic Laparoscopy is performed to assess whether the testis is intra-abdominal, although some prefer inguinal/abdominal exploration.

Clinical examination:

Detailed clinical examination is indispensable in the management of UDT. Literature would repeatedly reveal that detailed clinical examination is more sensitive than Ultrasonography (USG) or a CT scan. Before labeling a testis as impalpable, careful repeated clinical

examinations have to be done. Palpation has to be repeated once again under Anaesthesia, before surgical procedure. If the testis remains clinically nonpalpable with the patient awake, a further examination under Anaesthesia allows palpation of testis in about 20% of the cases[5].

Methods of palpation:

- To be examined in standingposition and it is ideal to palpate the child when he is calm and comfortable.
- Soap can be applied to the inguinal canal and the abdomen to reduce the friction during examination.
- While squatting the flexion and the abduction of the thigh, relaxes the lower abdominal wall, relaxes the two crura of theexternal rings, increases the intra-abdominal pressure forcing any retained testis outside, making an impalpable testis palpable clinically.
- It is referred to as the “Squatting Position”, or “Base Ball Catching position[1]” .
- During palpation fingers rolled steadily from anterior superior iliac spine to the scrotum - Milking - To mobilise the testis from its

inguinal position to scrotal position thus making an impalpable testis palpable.

- If at any point the testis can be brought to the base of the scrotum and stays there for some time, it becomes retractile testis and makes the diagnosis of Undescended testis, null and void.

Examination under Anaesthesia in many cases may reveal a testis that was initially non-palpable.

A retractile testis is often confused with a UDT. The key to distinguishing a retractile testis from a UDT is demonstration that the testis can be delivered into the scrotum. The retractile testis will stay in the scrotum after the Cremaster muscle has been over stretched. Whereas a low UDT will immediately pop back to its undescended position soon after it is released.

An atrophic or vanishing testis is anywhere along the normal path to the scrotum. The etiology is thought to be due to neonatal vascular ischemia, possibly due to torsion. It is an important sign as it obviates the need for further search of the testis in unorthodox positions.

Fig. 3

Fig. 4

Right UDT and Method of Palpation

Fallacies in palpation[5]:

1. Canalicular testis may be impalpable in up to 30% of the cases

2. A fat child, uncooperative child, small testis, cold weather, crying baby with hyper Cremastericreflux – are some of the reasons for false negative findings. Making the baby cry, making him squat down or putting him in warm bath – can help in localizing the testis which have been missed previously.

3. In children less than 2 years, there is hardly any length of inguinal canal. In them, an impalpable testis is either abdominal, atrophic or absent. It is unlikely for a Canalicular testis to be impalpable in infants.

Imaging studies:

Numerous radiological studies have been used to try to localize the non-palpable testis preoperatively, including retrograde venography, computerized tomography(CT), magnetic resonance imaging(MRI) and Sonography.The concept of retrograde venography is that a viable testis will have a normal venous pattern, whereas an atrophic testis will have diminutive vessels. The test is invasive, requires Anaesthesia and is not very accurate. CT and MRI are much more accurate

in identifying a viable testis. However both require either heavy sedation or general Anaesthesia in infants, and neither can show with 100% certainty that the testis is absent. Consequently irrespective of the outcome of CT or MRI, surgical exploration is necessary.

Role of Ultrasonography[5]:

Abdominal and inguinal Sonography for evaluation of a non-palpable testis is appealing because it is noninvasive, it confers no radiation exposure and it does not require sedation or general Anaesthesia. However reports to date have not demonstrated significant efficacy in localizing the testis, because Sonography rarely will identify a gonad if it is viable and intra-abdominal or if it is atrophic and in the scrotum or inguinal canal.

Fat has the same sonological density of testis, thus making the interpretation of Ultrasound difficult. Differentiation of fat from testis may sometimes be next to impossible. Thus Ultrasound studies may form guidelines but are not fool proof. Many a time, the Ultrasound findings are not reflected during the surgical procedures, but still they are a useful addendum.

Considering that intestinal loops full of gas obstruct Ultrasonography, this examination does not providesurgeons with additional information compared with palpation in a cooperative child. The only indication for Ultrasonography in patients with testis is probably in those who are obese, when body habitus prevents surgeon from palpation of a test is located in the inguinal canal and particularly in uncooperative children. But there are papers arguing in favor of Ultrasonographic examination.

Arguments favoring imaging studies[5]:

1. USG is cheap, freely available, painless, no radiation and no Anaesthesia required.

2. A positive USG supplements clinical examination and avoids an invasive procedure like laparoscopy

3. USG is helpful in looking for associated anomalies.

4. Pick up rate of USG in expert hands is above 95%, with high resolution probe. When in doubt, can switch over to Doppler mode to differentiate testis from lymph node.

Arguments against Imaging studies:

1. USG, though it is less invasive, is more evasive.

2. Irrespective of USG reports, exploration is warranted. If the testis is not found in USG, it becomes very difficult to convince the parents for exploration. On the contrary even a CT/MRI can mislocate a testis and if the testis is not found on exploration/ laparoscopy, then it becomes difficult for the parents to cope up.

3. A negative report may prompt the physician to convince the parents against exploration.

In an article by Jack. S. Elder in his paper, 'USG is unnecessary in evaluating boys with testis' in Paediatrics, 2002, a total of 62 boys with a referral diagnosis of Non palpable testis was taken into study, with the age of the children varying from 4 months to 1 years (mean 4.5 years)[4]. Of which the sonogram could pick up testis in 12 cases and meticulous clinical examination could identify testis/ cord structures in 45 cases. Of these 45 cases diagnosed by clinical examination there was no false positivity (i.e. cases in which a testis was deemed palpable but was found to be absent on surgical exploration).

But out of the 12 testis made out by Sonography, all were made out clinically and approximately half were scrotal or retractile. Among the 54 cases where testis couldnot be localized by Sonography, the testis was palpable in 61% and sonogram is to be considered false negative in these cases. In the remaining 21 cases, in which the testis was not identified by sonogram and was non palpable, abdominal/inguinal exploration was necessary to ascertain if the testis was present.

The only clinical situation in which the testis would alter the management is if the ultrasound demonstrated a testis, whereas the physical examination disclosed a testis. Consequently that review did not identify any such case in which Sonography altered paediatric urological management.

Role of CT and MRI :

Other diagnostic modalities like CT and MRI are too nonspecific and do not preclude operative intervention. MRI is not routinely used to localize as it is not sensitive for Intra-abdominal testis, and requires Anaesthesia in young children.

Yeung and colleagues, however, showed that Gadolinium enhanced MR angiography has a diagnostic sensitivity of 96% and a

specificity of 100% for localizing a UDT. But it is to be reserved and helpful in children who have undergone multiple abdominal surgeries, since intra-abdominal adhesions might make laparoscopic exploration difficult and risky. It can also be useful in pre pubertal children with Non palpable testis and massive obesity, if available. But still the need for sedation in the main limiting factor in the expansion of its routine use for testis.

Role of Laparoscopy in testis[5]:

The laparoscopic technique consists of CO_2 insufflation and the introduction of a micro camera linked to a video monitor. This technique can be advantageous because of the ability to magnify the picture and the zoom potential of the camera, providing a magnified view of the entire abdomen. However it requires general Anaesthesia.

There can be 3 possible findings in laparoscopic examination

1. Intra-abdominal testis (around 40% of the cases)
2. Intra-abdominal Blind ending Vas (15% of the cases)
3. Cord structures entering the internal inguinal ring (45% of the cases)

In the case of normotrophicintra-abdominal testis the surgeon has to choose the best method of doing an Orchidopexy. If the testis is hypo trophic or atrophic, a laparoscopic orchiectomy has to be performed.

In patients with blind ending cord structures (also called Vanishing testis), there is no need for an open inguinal exploration.

When cord structures enter the inguinal ring, it's preferable to perform an inguinal exploration, to look for an ectopic or an atrophic testis, which can be a risk factor for testicular cancer.

A routine inguinal exploration is recommended in patients who are obese, particularly if the cord structures are entering the inguinal canal, because these patients might have a small, normal testis in the inguinal canal.

Treatment:

Hormonal Therapy[2]:

There are two current protocols for hormonal treatment of UDT: the first one is based on Gonadotropin – releasing hormone 1 and the other on human chorionic Gonadotropin. Some use the combination of both. The success rate of these, in various studies, ranges from 6% to 75%. It is also claimed that it was more effective with elderly boys.

Siro Esposito et al in their paper, ‘Management of boys with Nonpalpable Undescended Testis’, claimed that hormone therapy generally has shown poor results with Nonpalpable UDT, although there might be an indication or bilateral testis, where one or both become palpable in about 15% of the cases.

2. Surgical options:

Various surgical techniques were being employed with carrying results for UDT – Standard open Orchidopexy, Fowler-Stephen’s procedure, laparoscopic assisted Orchidopexy, Micro vascular Orchidopexy, Laparoscopic Orchidectomy etc.

Results of Surgery:

Outcomes of Orchidopexy are mainly assessed by testicular position and size. Other factors that should be assessed later in life include fertility and risk of testicular cancer.

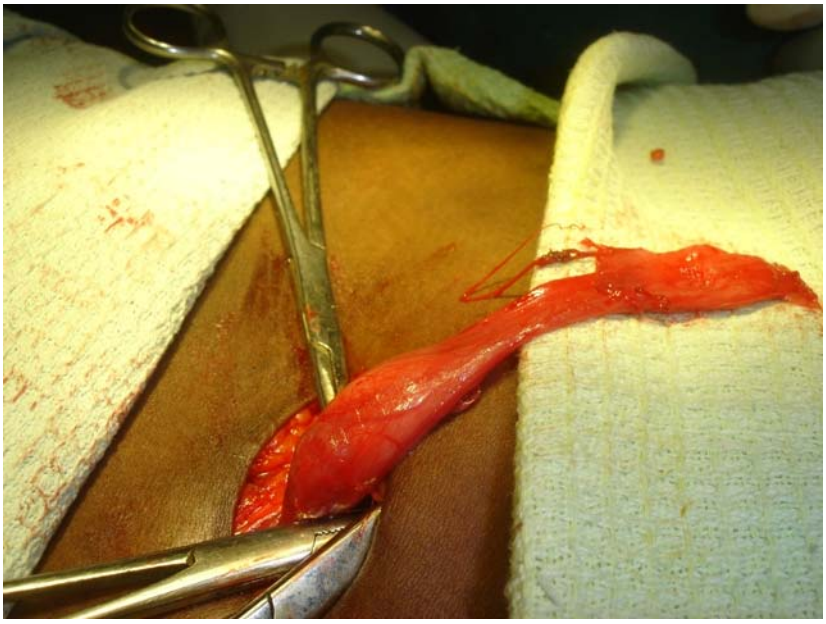


Fig. 5

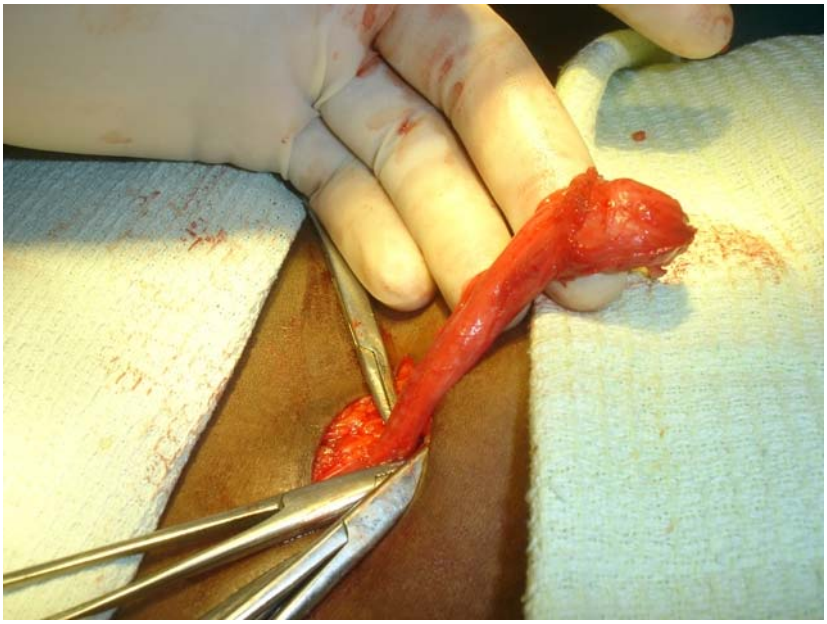


Fig. 6

Inguinal exploration and mobilization of UDT

Fig. 7

Atrophic testis

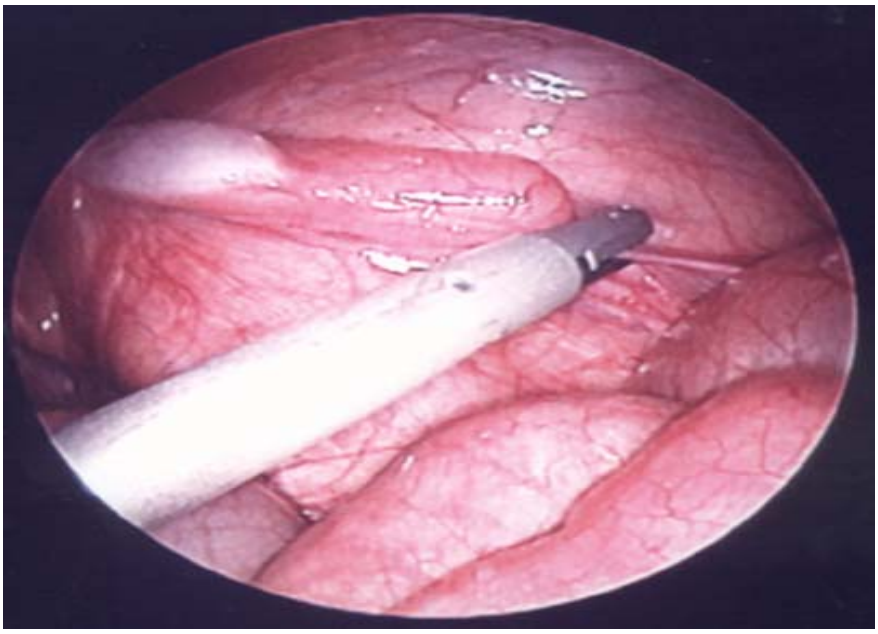


Fig. 8

Laparoscopic Orchidopexy

Testicular atrophy or hypotrophy are the most important complication of Orchidopexy, and occur when testicular vascularity is unable to maintain the testis viability. Ischaemic injury, that leads to testicular atrophy can be secondary to aggressive skeletonization of testicular vessels, post-operative edema, inflammation and undue tension on the spermatic vessels.

It seems that the more proximal the anatomic position of the testis, the lower the success rates in achieving a viable scrotal testis.

The protocol as advised by Jack. S. Elder in his paper, 'USG is unnecessary in evaluating boys with testis' in Paediatrics, 2002.

- In boys diagnosed to have a retractile testis, patients did not undergo a surgical procedure. In boys who were diagnosed to have a palpable undescended testis, inguinal exploration and Orchidopexy was done.In those with testis, diagnostic laparoscopy was performed followed by abdominal Orchidopexy, where the testis was found to be intra-abdominal or just beyond the internal inguinal ring.
- But when the vas and vessels were found to enter the internal inguinal ring, inguinal or scrotal exploration was performed and usually the

testis was found to be in the scrotum secondary to perinatal spermatic cord torsion.

The role of Laparoscopy and primary inguinal exploration for all cases were discussed in detail in an article, ‘undescended testes by Shenoy. V, in the Journal of Indian Association of Pediatric surgery, 2007:

Arguments in favor of Laparoscopy (withoutimaging studies)[2]:

1. If a testis is absent on clinical examination but located on USG, such a testis is likely to be an emergent testis. In such a testis, laparoscopic mobilization is better and results in less tension.

2. In boys less than 2 years, there Is hardly any inguinal canal. In such children, an impalpable testis is either abdominal or atrophic or absent and laparoscopy will be the answer to all these conditions.

3. Laparoscopy helps the surgeon to locate the testis and allows the choice of best approach. It eliminates the chances of any uncertainties and offers a clear cut algorithm in the management of UDT.

4. Cost is not increased significantly.

5. There is no need to correlate the USG finding with the laparoscopy to the parents.

6. Literature reveals that laparoscopy locates the testis which have been missed even on inguinal exploration.

Arguments against Laparoscopy as initial modality[2]:

1. Laparoscopy is an invasive investigation requiring GA and violates a virgin peritoneal cavity

2. There is considerable crushing of the testicular substance during laparoscopy. The way testis and vas are handled with Maryland's are unacceptable.

3. In clinical practice truly intra-abdominal testis that cannot be tracked through inguinal route is rare. So laparoscopy shall be limited to restricted cases where testis is impalpable in two clinical examinations, USG is inconclusive and testis is impalpable under GA, just prior to surgery.

4. Parents should be counseled before sending them for USG.

Arguments in favor of Initial inguinal exploration for all cases of UDT:

1. No study till date has shown USG to be reliable in evaluating impalpable testis, nor can it pick up remnant/nubbin in the inguinal canal.

2. Laparoscopy may unnecessarily be done for impalpable Canalicular testes or for its remnants in the inguinal canal, which may not be palpable even under Anaesthesia. Hence the concept of initial inguinal exploration is gaining popularity in the west.

3. However if the testis is not found on inguinal exploration, the surgeon should be prepared to do a laparoscopy.

In an article 'Scrotal approach to both palpable and impalpable Undescended Testis: should it become our first choice?' – by Piet R. H. Callewaert, Initial single scrotal incision was recommended for Orchidopexy, even in the more difficult cases of impalpable undescended testes. Advantages seem to include shorter operative time, a cosmetically appealing single incision, and possibly less pain. The scrotal incision technique significantly reduces the need for laparoscopy in impalpable testes. Surprisingly, it even allows successful Orchidopexy of abdominal testes, provided an open Processus is present[6].

In their series of 194 cases, a scrotal approach was chosen irrespective of the initial position or presence of open ProcessusVaginalis. Overall

36 off 46 impalpable testes could be diagnosed and treated accordingly, using only a scrotal incision. Conversion to laparoscopy was needed in just 4 cases. In all these cases testis was palpable and remained in the scrotum on follow up.

In another retrospective study by Sharifiaghdas F and Beigi FM in Scand journal of nephrology, 'Impalpable testis: Laparoscopy or Inguinal canal exploration?' the accuracy of intraperitoneal Laparoscopy, inguinal canal exploration and ultrasound in the diagnosis of impalpable testis was evaluated[7].

76 patients with a diagnosis of uni- or bilateral impalpable UDT, were taken for the study and a preoperative USG was done and all patients underwent Intraperitoneal Laparoscopy. An inguinal canal incision and exploration was done in all cases except for patients with high intra-abdominal testes (> 2 cm above the internal ring), for whom laparoscopic dissection, mobilization and Orchidopexy were necessary.

The mean age of these patients were 15.36 years[7]. The UDT was right side in 25% of the cases, left sided in 41% and bilateral in 34%. Intraperitoneal Laparoscopy, inguinal canal exploration and USG detected 70.6%, 78.4% and 12.6% of testis respectively. Overall Laparoscopy changed the management protocol of impalpable UDT in only 21% of the cases. Inguinal canal exploration alone was sufficient in the majority of their cases. Hence they

recommended laparoscopy for those patients with impalpable UDT in whom an initial inguinal canal exploration proves negative.

O'Hali W, Anderson.P and Giacomantonio M in their article 'Management of impalpable testes: Indications for abdominal exploration', has stressed the importance of the presence or absence of hernial sac in the management protocol[8].

In their study, a hernia sac was present in 155 impalpable cases with a testicle present in all the cases. No hernia sac was found in 19 cases, 5 of which had no testicle present. This was confirmed by either open exploration or laparoscopy. In addition to the five absent testicles with no hernia sac, one patient with a hernia sac and no testicle evident benefited from subsequent laparoscopy to identify an intraabdominal testicle[8].

All other patients underwent routine Orchidopexy or Orchidectomy. Nine cases underwent primary laparoscopy and four of those had bilateral impalpable testes. Two abnormal testicles were found and removed. And one Orchidectomy performed with open procedure because of grossly malformed testis. Groin exploration and subsequent Orchidopexy was definitive treatment in all the other cases.

The presence of hernia sac with a impalpable testis was thus very significant. The absence of the sac therefore may reflect and alternate diagnosis. When no sac is found with a testicle in the groin, this may represent an ectopic testis. When no sac is found with no testicle, this may represent a vanishing testis. From this experience the author has suggested that groin exploration should be the initial approach to impalpable testes. The presence of a hernia sac with an absent testicle demands further exploration. The absence of a hernia sac with an absent testicle may be a vanishing testis and need no further exploration.

In a paper, by Rainbow children's hospital, Krishna children's hospital and Hope children's hospital. Hyderabad, the initial approach for testis was debated. That study compares the results of initial laparoscopy and inguinal exploration in the management of unilateral UDT[9].

It suggests that the main advantages of laparoscopy are accurate localization of the testis and the total avoidance of open exploration in some patients. The main criticism against inguinal exploration for a testicle is that it may fail to locate an intra-abdominal testicle. When inguinal exploration was done by them the testis was clearly identified in all the 20 cases(including 12 at or above the deep ring). Many of clinically non palpable testis were either Canalicular or low abdominal, and could be readily managed by the standard inguinal approach.

Kirsch et al reported a large experience with 447 non palpable testis, all of which were treated through a standard inguinal incision. They concluded that the inguinal approach with transperitonel mobilization of vas and vessels is highly successful for the intra-abdominalcrypt orchid testis[10].

Williams et al reported that in 37 of 39 testis, groin exploration was sufficient for deciding and executing treatment[11].

Adam and Allaway reported good results with inguinal exploration followed by pre peritoneal approach for 110 impalpable testes. They concluded that the advantages of laparoscopy could be achieved by this simple surgery, with a favorable cost: benefit ratio[12].

The problem, as suggested by them in subjecting all children for initial laparoscopy is that many testes may be located at or distal to the deep ring. Preoperative radiological tests are not sensitive to locate the testis in the majority of the cases. A significant percentage of these children may have vanishing testis or atrophic testis, and most of these vanishing testes are located distal to the deep ring, mainly in the inguinal canal. A significant percentage of such remnants may have viable germ cells, with a risk of malignant transformation. Hence inguinal or scrotal exploration becomes mandatory in these children to remove these atrophic nubbins.

It iswith this realization that the authors of that paper recommend initial inguinal or scrotal approaches for UDT, laparoscopy being reserved for testes not localized by such exploration. They also admit that no demonstrable specific advantage can be attributed to the initial laparoscopic procedures and that the laparoscopic and inguinal approaches yielded comparable results.

So in general, for children with undescended testis, if the testis is clinically palpable an open Orchidopexy is warranted and that requires no radiological evaluation particularly to locate the testis. And there exists a controversy over management of non-palpable undescended testis.

Here Ultra sonogram and other radiological investigations like CT or MRI are found to be of limited value because of the reasons discussed above and so are not being used routinely. And there are no other investigations that will help us locate the position of the testis or plan the line of management. There has not been a consensus reached yet on streamlining the management protocol for these cases.

The options of surgery for these cases happen to be primary diagnostic laparoscopy, laparoscopic Orchidopexy by identification and

mobilization of the testis, primary inguinal exploration and if needed retroperitoneal dissection and / or open / laparoscopic abdominal exploration.

As we have discussed earlier various points have been discussed in favor of and against each procedure. There are people who advocate primary laparoscopic procedure to be the ideal procedure for thorough evaluation. The others feel as in most of the cases testis is located in the inguinal canal, subjecting all the children for primary laparoscopic evaluation will be a costlier prize paid for nubbin or atrophic testis.

In this scenario, this paper is taken to analyze all the cases of Undescended testis where testis is not clinically palpable and they are subjected to thorough clinical examination followed by diagnostic laparoscopy to locate the position of the testis. All the details were tabulated and analyzed and the following observations were made.

OBSERVATIONS

DEMOGRAPHY OF THE CHILDREN

	Left	Right	Total
0-2	1	2	3
2-5	6	4	10
5-10	7	5	12
10-12	4	1	5
	18	12	30

(Table: 1)

The mean age of the children who presented with non-palpable testis was 6.42 years, with their age varying from one and half years to twelve years.

The condition of non-palpability of the testis was found relatively more common in the left side with 60% of them presenting with left sided UDT. The majority of the cases were of the age group 2 to 10 years, contributing to about 75% of the total cases. Only a very few cases 8 % (total three out of 30) presented in ideal age group for surgery, i.e. before 2 years of age. And around17% of the cases presented very late around 10 -12 years.

POSTION OF THE TESTIS - as per age

	0-2	2-5	5-10	10-12	Total
Abdominal	-	4	1	-	5
Deep Ring	-	4	6	1	11
Inguinal canal	2	2	4	1	9
Superficial Ring	-	-	-	2	2
Absent/Blind ending	1	-	1	1	3

(Table: 2)

POSTION OF THE TESTIS - as per side

	Left	Right	Total
Abdominal	3	2	5
Deep Ring	6	5	11
Inguinal Canal	5	4	9
Superficial ring	2	-	2
Blind ending Vas	2	1	3

(Table: 3)

Among the 30 children who had UDT, 25 of them had their testis at or distal to the deep ring. Only 5 children had their testis intra-abdominally (16%)

Most of the clinically non palpable testes were found to be located at or around the deep ring – 36.6%. Rest were in the canal (30%) and around the superficial ring(6%).

75% of the cases were between 2 and 10 years of age. Only 10 percent of the cases were between 1 and 2 years of age. The various locations of the testis were found to be almost uniformly distributed between right and left sides.

NATURE OF THE TESTIS

	Normal testis	Hypo plastic Testis	Absent/Nubbin
Abdominal	3	2	-
Deep Ring	3	6	2
Inguinal Canal	3	6	-
Superficial Ring	1	1	-
Blind Ending Cord	-	-	3

(Table:4)

	Orchidopexy	Orchiectomy
Abdominal	4	1
Deep Ring	9	2
Inguinal Canal	9	-
Superficial Ring	2	-
Blind Ending Cord/ Absent	-	3

(Table: 5)

Among the testis that were present in the abdomen, 3 were found to be normal and 2 hypo plastic. Among these 4 testis were reinstated in the scrotum and 1 very much hypo plastic testis was subjected to Orhidectomy.

6 of the 11 testis which were present at the level of the deep ring were found to be hypo plastic, whereas 3 were normal and 2 had just a nubbin of tissue. Those with nubbin of tissue was excised and all the rest were positioned back by Orchidopexy.

Among those present in the inguinal canal and at the level of the superficial ring, 7 were hypo plastic and 3 had a blind ending vas. 4 of them were found to be almost normal. Except for those absent testis all other cases underwent Orchidopexy.

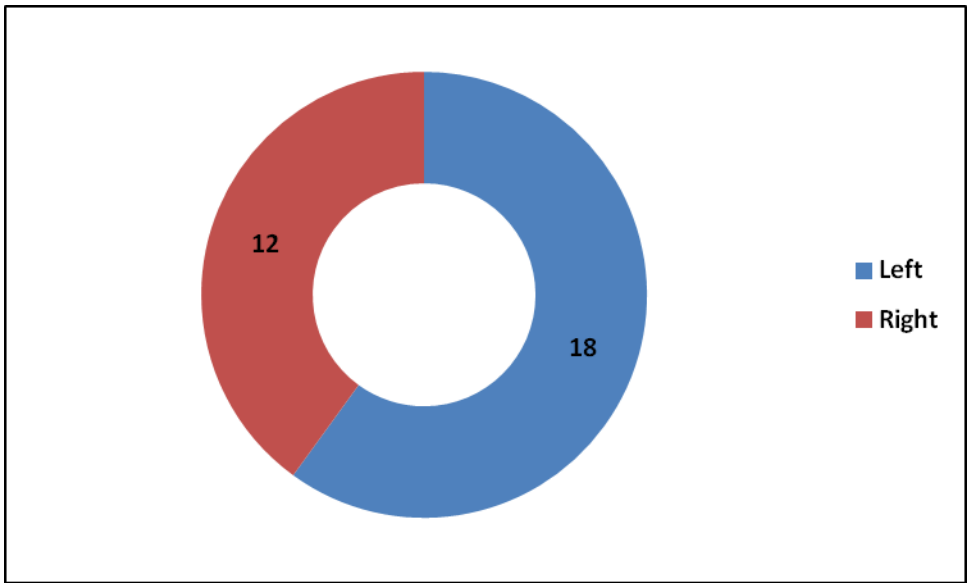
PALPABLE CORD STRUCTURES

	Number of cases	Palpable cord structures
Abdominal	5	-
Deep Ring	11	4
Inguinal Canal	9	7
Superficial Ring	2	2
Blind ending Vas	3	3

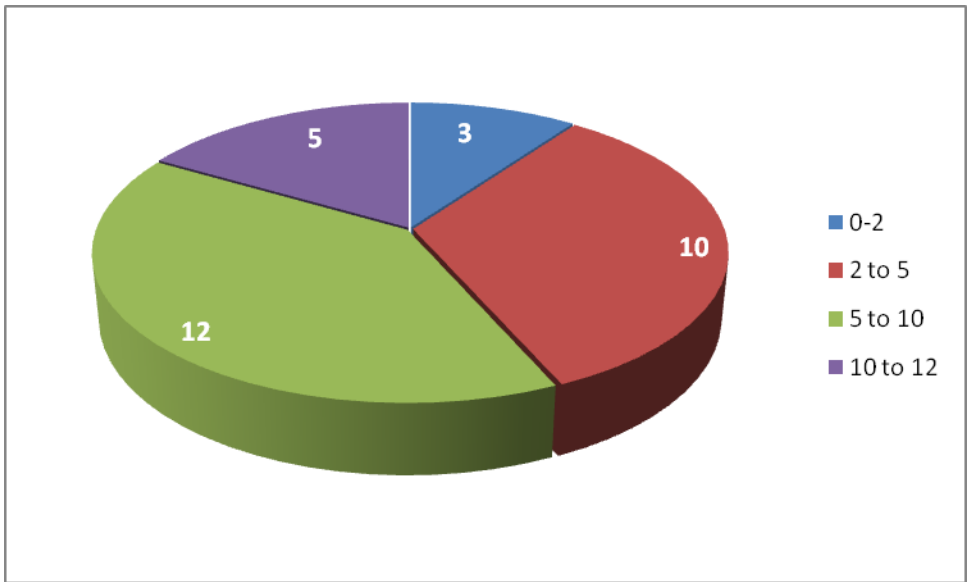
(Table: 6)

Among the 30 children who had testis, the cord structures were clinically palpable in 16 cases.

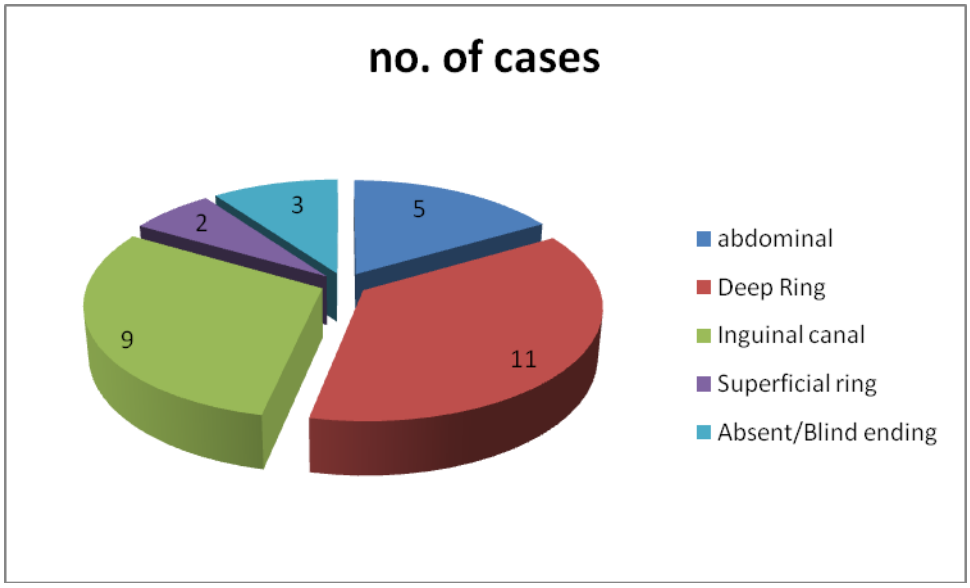
And in all these 16 cases the testis was located somewhere in or around the inguinal canal, deep ring or superficial ring. In 3 cases the children had blind ending vas with no trace of testicular tissue. In none of these was laparoscopy necessary.



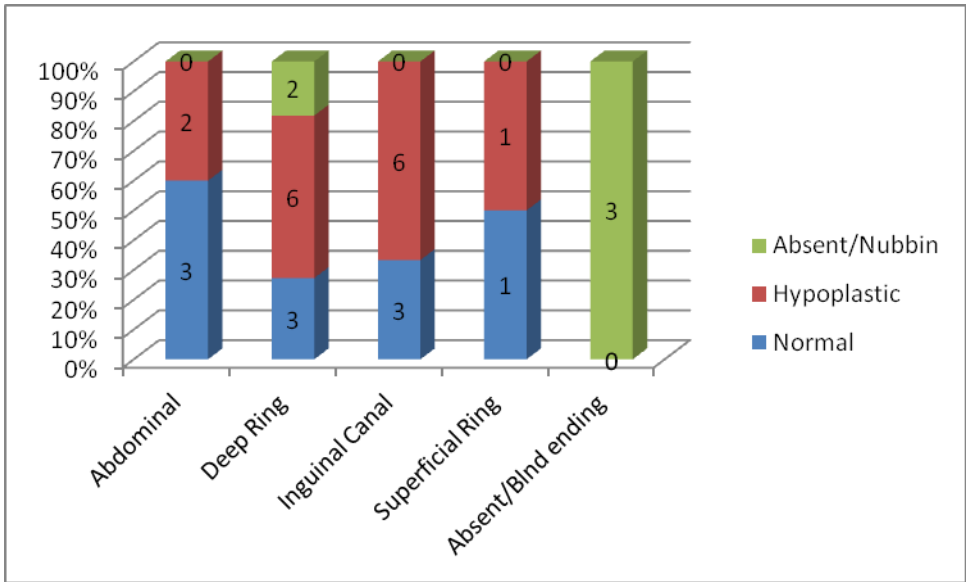
(Left right distribution of the cases)



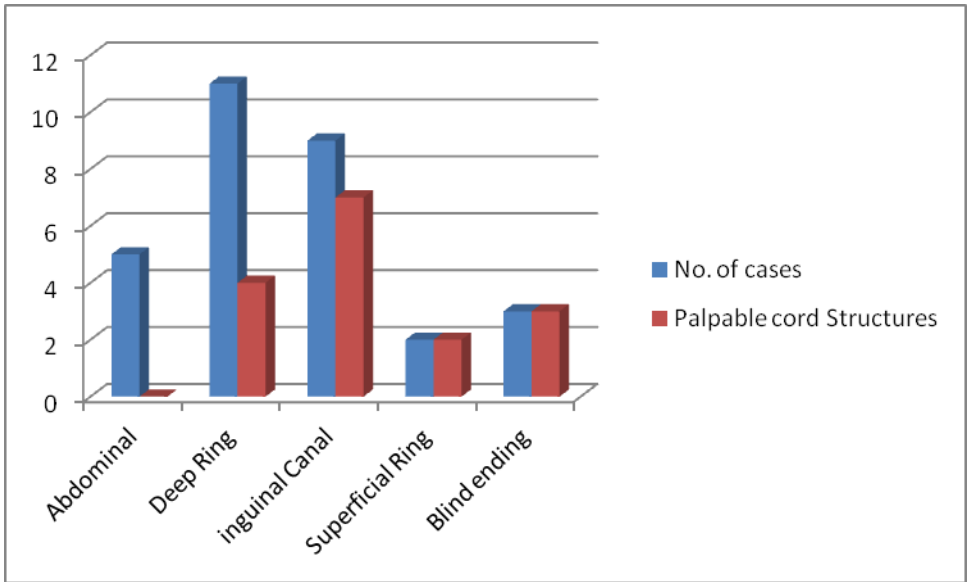
(age distribution of the cases taken for the study)

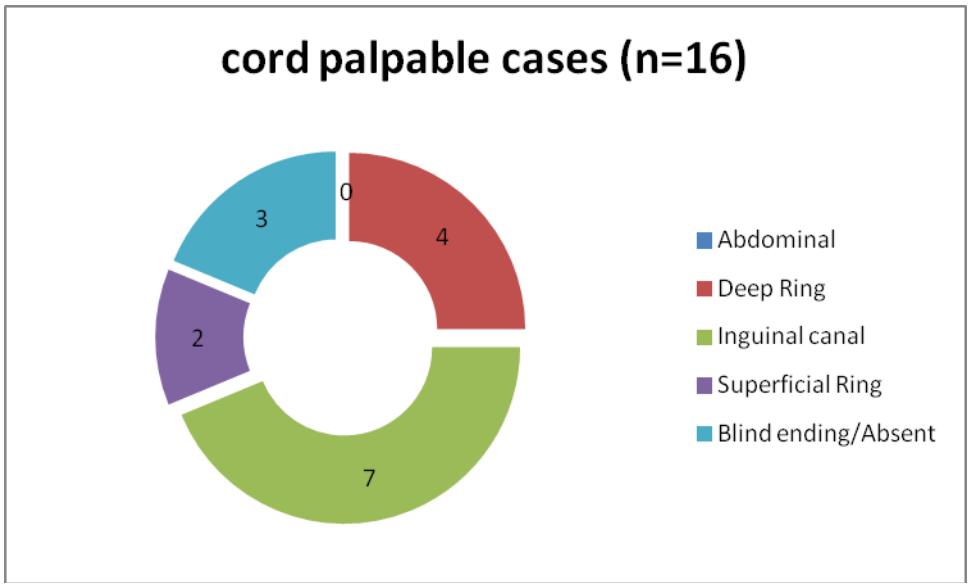


(Location of the testis in the cases taken for the study)

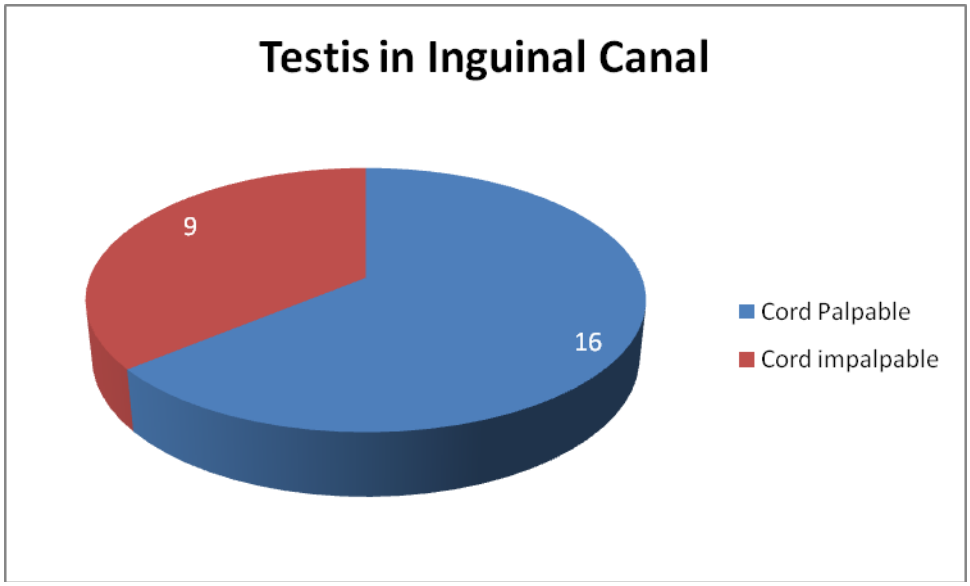


(Nature of the testis with relevance to their position)

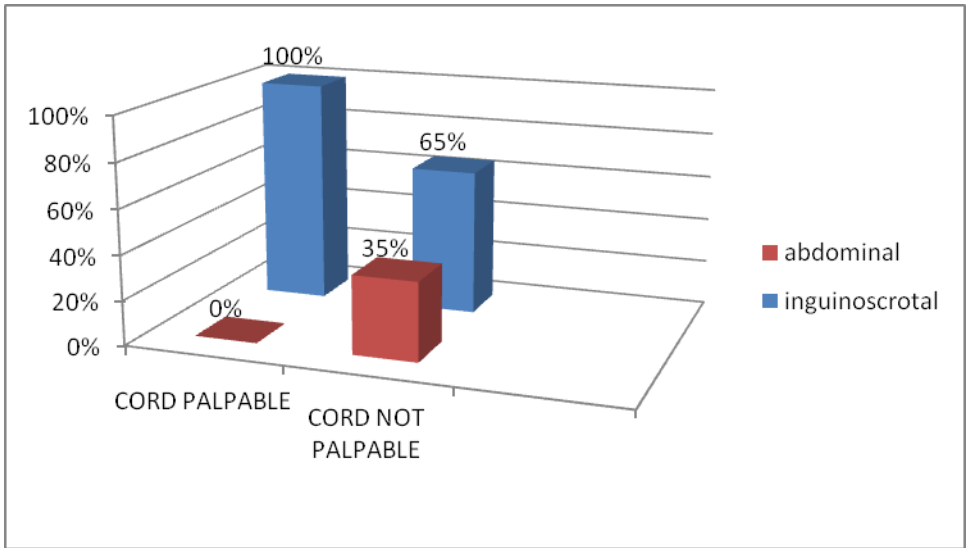




(Location of testis in cases with palpable cord structures)



(Palpability of Cord in inguinal / Scrotal testis)



(Location of testis with cord sign positivity)

DISCUSSION

Comparison of patient details :

	Present study	Emir et al[7]	Piet R.H. Callieveart etal[6]
Mean age of children	6.42 years	4.1 years	6 years
Right sided cases	40%	40%	33%
Left sided cases	60%	60%	66%

(Table: 7)

The mean age group of children presented with Non palpable UDT in our study was 6.42 years as compared to 4.1 and 6 years in studies by Emir et al and Piet R. H. Callieveart et al respectively. But this was much later in age as the ideal age of surgical intervention for cases with UDT to have reasonably good fertility and testicular functioning is around 6 months – 1 year.

The UDT was found to be more common in left side in our study as compared with all other studies.

Testis Location in Non-Palpable Testis

	Present Study	Piet R.H. Callieveart et[6] al	Merry C et al[14]
Abdominal testis	16.7%	22%	10%
Deep Ring / Canalicular testis	83.3%	78%	90%

(Table: 8)

In around 83.3% of our cases the testis was located either in and around the deep ring or in the inguinal canal region. It was similar to the statistics given by most other studies which invoke the debate of primary inguinal exploration for testis over the laparoscopic exploration as in around 80 – 90 % of the cases laparoscopy seems to be unwarranted.

These testis in the inguinal canal cannot be picked up by any investigations including ultra-sonogram.

Nature of the testis in the canal

	Present study	Schleef et al	Rainbow children's Hospital study[9]
Normal/ Viable	33.33%	14%	27%
Hypo plastic	50%	81%	40%
Nubbin/ Absent	16.67%	5%	33%

(Table: 9)

Among the 30 cases that were operated, 33.33 % of the children in our study were found to have almost near normal testis morphologically and around 50 % of the testis was hypo plastic and around 17% of them either atrophic or absent.

In a study done in Rainbow Children's Hospital, the results were almost similar to ours except that their rate of nubbin / atrophic testis was quite high, being stated as around 33%.

Whereas in a study by Schleef et al, the rate of hypo plastic testis was very much high (81%), and only 5 % of the total children were found to have normal or near normal testis.

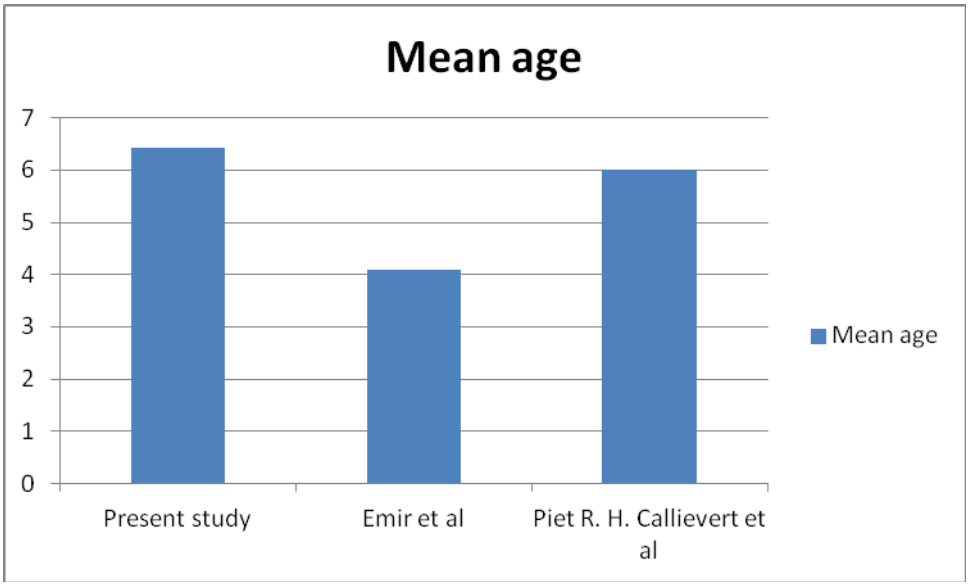
Influence of Laparoscopy

	Present study	Sharifiagdas et al[7]	Merry C et al[14]
Percentage of cases where Lap changed treatment	16.7%	21%	18%
Percentage where lap not influencing management	83.3%	79%	82%

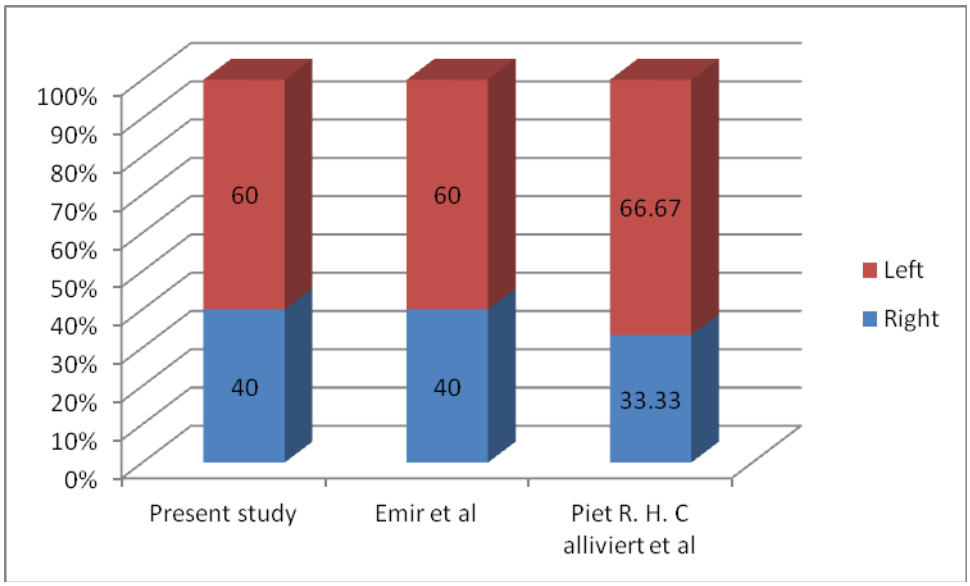
(Table: 10)

The practice of initial Laparoscopic evaluation, in testis has identified a testis in the abdomen in only 16.7% of the cases in our study as against 21 and 18% in the papers by Sharifiagdas et al and Merry C et al, respectively.

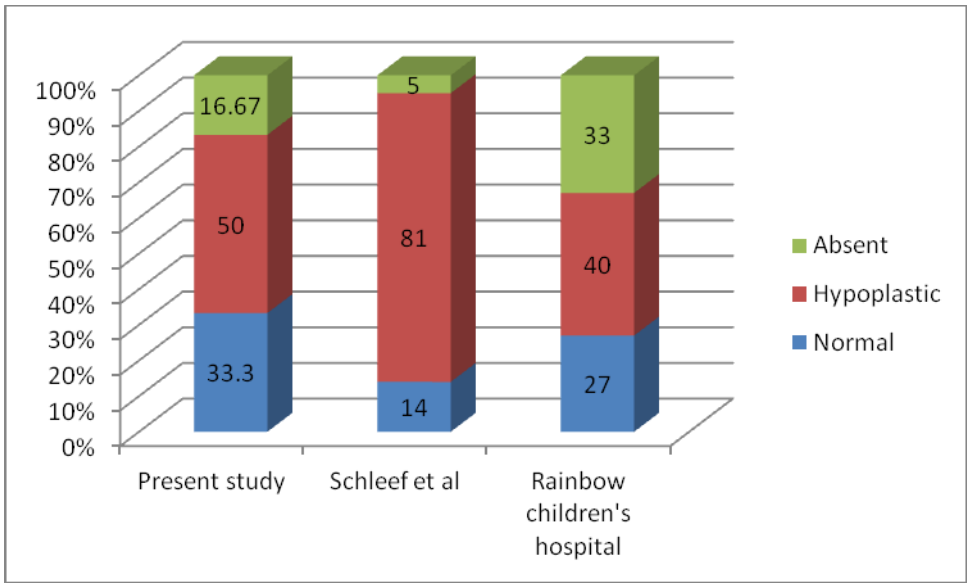
This implicates that around 80 to 85% of these cases if they had been subjected for primary inguinal exploration could have been benefited, in a way that a major procedure like Laparoscopy under GA could have been avoided.



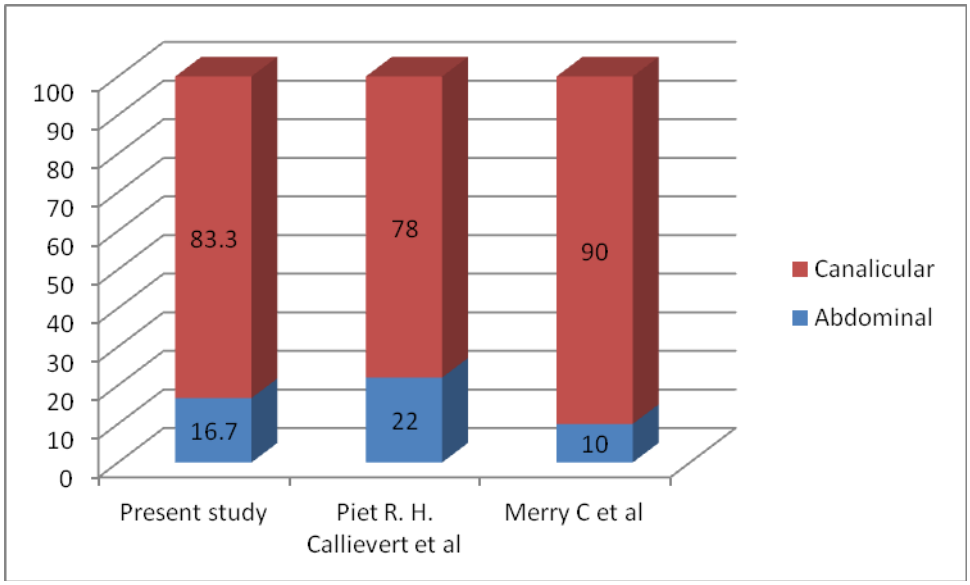
(Comparison of Mean age of the children)



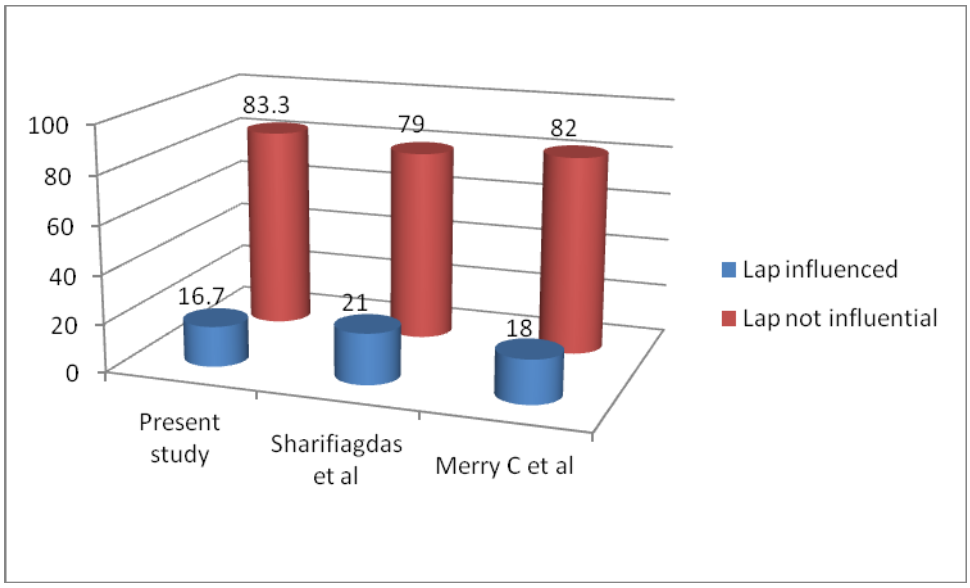
(Left and Right side incidence – Comparison)



(Nature of the Testis – Comparison)



(Location of the Testis – Comparison)



(Influence of laparoscopy – Comparative study)

SUMMARY

- 30 cases of Undescended testis where the testis is non-palpable clinically were taken for the study.

- The mean age of the children presenting with UDT was 6.42 years with their age ranging from one and a half years to Twelve years. The majority of the children were between 2 to 10 years, contributing to about 75% of the cases.

- In our study testis was found to be common in the left side with left to right ratio being 60:40, as is seen in other studies also – Piet R.H. Callevaert al reported 66:34 and Emir et al, a similar 60:40.

- The location of the testis in UDT's in our study was similar to that reported in other studies – distal to deep ring in 84% and intra-abdominal in 16 % in our study as compared to 78% distal to deep ring and 22 % intra-abdominal in a study by Piet R. H. Callevaert et al. In a study by Merry C et al,

- The reported incidence of testis distal to deep ring in cases with non-palpable testis was quite high (i.e. in up to 90% of cases).

- In our study 33% of the cases had near normal testis morphologically, 50 % of the cases had hypo plastic testis and 17% had either atrophic/ absent testis or blind ending vas.

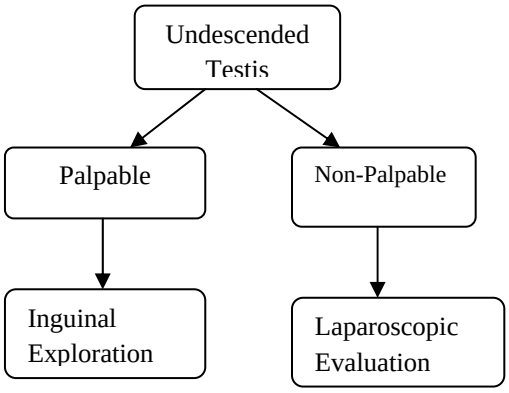
- In our study, Laparoscopic findings has changed the management in only 16% of the cases, as compared to 21% in the study by Sharifiaghdas et al and in 18% in Mery C et AL's study. In the rest of the cases, laparoscopy had no influence at all in the management.

- Any meaningful assessment of Laparoscopy would be possible only after a few years, as the doctrine has just been established. Assessment of spermatogenesis when the child grows up would be the acid test for evaluating these procedures and proof of the pudding would be in the eating.

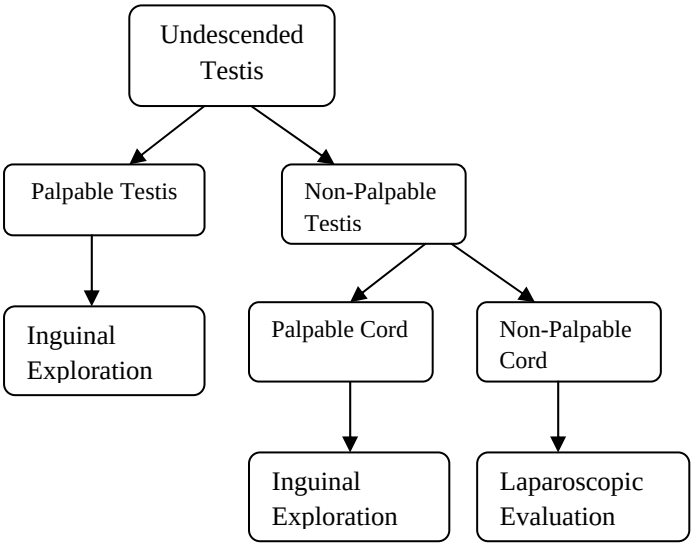
- Of the 25 cases with testis being located at or distal to the deep ring, the cord structures were clinically palpable in 80% of the cases, thereby making it a reliable finding to plan for a primary inguinal exploration rather than to go for a laparoscopic exploration.

CONCLUSION

- ✓ Most of the cases coming to Government institutions are late presentations – 9o% present later than two years. Information and drives to improve public awareness should be done for early reporting and surgical correction of this condition. Referring Doctors should also be imparted knowledge on the timing of Surgery, as many of them do not advice the patients correctly regarding the time of Surgery even when the patient reports to them for this specific complaint.
- ✓ In around 84% of Non-palpable Undescended testis, the testis or testicular structures are found to be present at or beyond the level of the deep ring which could be managed by inguinal exploration. Hence primary inguinal exploration would be sufficient in all these cases avoiding unnecessary laparoscopic abdominal exploration. And Laparoscopic exploration is found to be influential in deciding the procedure in only less than 15% of the cases.
- ✓ Hence we would advocate Inguinal exploration as a primary procedure of choice and relegate laparoscopy to the negative explorations, thus obviating a lot of unnecessary expenditures, risks and cost to the patients.



(Old Algorithm for management of UDT)



(Proposed New Algorithm for management of UDT)

- ✓ Hence, as evidenced from our study, if the cord is clinically palpable, testis will invariably be present in the scrotum or the inguinal region, and this can be dealt in easily with inguinal approach rather than subjecting all the children to primary laparoscopic exploration. This may help in mitigating unnecessary laparoscopic exploration and the study has showed it to be fool proof. (In cases with palpable cord clinically, testis was found to be in the inguinal or scrotal region in 100% of the cases.)

- ✓ So we would like to reinforce this ‘cord sign’ (term coined by our Professor), and it should be brought into the clinical examination of UDT, which will help in avoiding unnecessary Laparoscopic abdominal exploration and is proved to be fool-proof. If the cord is palpable even though the testis is not palpable, the testis is in the Inguinal region, as our studies confirm.

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APPENDIX

PROFORMA

Name	**:**	**Age**	**:**	**Sex**	**:**
Father's Name	**:**			**IP No**	**:**
Address	**:**			**Phone No**	**:**

Age, when first noted : Age, when first consulted :

Any relative with UDT :

Left ***Right***

Clinical examination:

Testis palpable or not :

If palpable, Position of testis :

If not palpable, cord structures :

Scrotum development :

Midline raphe in scrotum :

Penis development :

USG Findings

Testis location

(scrotum /inguinal canal / intra abd /not made out) :

Size of the testis :

Per-op findings

Testis location :

Testis Size :

Final position of Testis

MASTER CHART

S.No	Name	Age	IP no	Side of UDT	Cord palpability	Per op location	Nature of testis	Procedure done
1	Senthil kumar	7	85700	RT	Yes	Deep Ring	Hypoplastic	Orchidopexy
2	Alby	2	86200	LT	Yes	Inguinal Canal	Normal	Orchidopexy
3	Pandi Ganesh	10	91189	LT	No	Deep Ring	Normal	Orchidopexy
4	Siva	4	284	LT	No	Deep Ring	Normal	Orchidopexy
5	Vishal	2.5	5731	LT	No	Deep Ring	nubbin	Orchidectomy
6	Dhanush	5	8876	RT	No	Abdominal	Hypoplastic	Orchidectomy
7	Mohd Pare	9	38858	LT	Yes	Inguinal Canal	Hypoplastic	Orchidopexy
8	Nivas	10	38564	LT	No	Deep ring	Hypoplastic	Orchidopexy
9	Latheeswaran	2.25	39410	RT	No	Inguinal Canal	Hypoplastic	Orchidopexy
10	Ashok	1.5	40779	LT	Yes	Inguinal Canal	Hypoplastic	Orchidopexy
11	Gowri Sankar	6	44312	RT	No	Abdominal	Hypoplastic	Orchidopexy
12	Chellapan	3	85651	RT	No	Deep ring	Nubbin	Orchidectomy
13	Anand	12	102019	LT	Yes	Sup Ring	Normal	Orchidopexy
14	Surya	10	1408	RT	Yes	Deep Ring	Hypoplastic	Orchidopexy
15	Eswaran	3	3321	RT	Yes	Inguinal Canal	Normal	Orchidopexy

S.No	Name	Age	IP No	Side of UDT	Cord Palpability	Per op Location	Nature of Testis	Procedure Done
16	Vasantha Ganesh	7	43219	LT	Yes	Blind Ending	Absent	Orchidectomy
17	Kishore Kumar	7	52222	LT	No	Inguinal Canal	Hypoplastic	Orchidopexy
18	Diwakar	4	55432	LT	No	Abdominal	Normal	Orchidopexy
19	Yousuf	2	67915	RT	Yes	Blind Ending	Absent	Orchidectomy
20	Kishore	6	72741	LT	Yes	Inguinal Canal	Normal	Orchidopexy
21	Natesan	8	81897	RT	Yes	Deep ring	Normal	Orchidopexy
22	Subburaj	12	84310	LT	Yes	Inguinal Canal	Hypoplastic	Orchidopexy
23	Paulraj	11	45310	LT	Yes	Blind Ending	Absent	Orchidectomy
24	Balaji	9	6806	RT	Yes	Inguinal Canal	Hypoplastic	Orchidopexy
25	Ramprasath	12	7287	LT	Yes	Sup Ring	Hypoplastic	Orchidopexy
26	Veeramani	10	43067	RT	No	Deep Ring	Hypoplastic	Orchidopexy
27	Stephen	11	9978	RT	Yes	Deep Ring	Hypoplastic	Orchidopexy
28	Melvin Raj	3	12591	RT	No	Abdominal	Normal	Orchidopexy
29	Gokul	2.25	13692	LT	No	Abdominal	normal	Orchidopexy
30	Dharanidaran	2.5	18163	LT	No	Deep Ring	Hypoplastic	Orchidopexy