



ULTRASONOGRAPHIC STUDY OF UNDESCENDED TESTIS AT NRS MEDICAL COLLEGE & HOSPITAL

Anatomy

Dr. Santi Pada Mal Tutor, Department of Anatomy, Rampurhat Government Medical College, Birbhum, India

Dr. Gopal Chandra Mondal* Assistant Professor, Department of Anatomy, N.R.S. Medical College, Kolkata, India
*Corresponding Author

Dr. Abhijit Bhakta Professor, Department of Anatomy, N.R.S. Medical College, Kolkata, India

ABSTRACT

The testes are male reproductive and endocrine organs for sperm production and testosterone secretion and are suspended with 'C' shaped epididymis in the scrotal sac. The left one lies lower than the right one. The undescended testes (UDT) is located in normal descent pathway with normal insertion of the gubernaculum and fails to achieve complete descent into the scrotum. Therefore, a thorough understanding of the proper diagnosis of each of these conditions is required to provide proper management.

This prompted us to carry out the present study, which aimed to observe Precise localization of undescended testes, to measure the dimensions, the echo texture and to note differences of echogenicity of both testes in respect to normal descended testes or normal reference by ultrasonography.

Total 40 male patient in specific age group of six months to twelve years were selected in this study and was conducted according to proforma at NRS Medical College during 2016-17. The mean age of presentation was 4.65 years and most frequent distribution was seen in 3 year to 6 year age group. Position of the undescended testis examined by Ultrasonography were mostly suprascrotal & intracanalicular around 78 percent.

In the present study, We found the age of presentation and location of undescended testes are consistent with most of previous study. Age of presentation as 4.65 year and detect most of UDT on right side (52.5%). Ultrasonography has sensitivity 72.73% and showed the echogenicity of undescended testes, give valuable findings of non-palpable testes and thus help to plan definite surgical procedure.

KEYWORDS

SRY gene on the Y chromosome is the primary driver (4,5) and Leydig cells also secrete insulin like factor -3 and SF1.

INTRODUCTION

The testes are a pair of ovoid glandular organs suspended in the scrotal sac by the scrotal tissues. Testes are reproductive and endocrine organs for sperm production and testosterone secretion.

The left one lies lower than the right one and each placed obliquely, the upper pole anterolaterally and the lower posteromedially within the scrotum. On the posterolateral aspect of testis, C shaped epididymis adjoins and vas deferens ascends from the tail of it.

The term "cryptorchidism" literally means absence of one or both testes inside the scrotum and occurs when one or both testes fails to achieve complete descent into the scrotum⁽¹⁾. John Hunter (1728-1793), the most distinguished Scottish surgeon and anatomist was the first to describe the imperfection of undescended testes⁽²⁾. He speculated that testes should be placed in scrotum. Cryptorchidism is a serious developmental abnormality and still remains one of the most frequent abnormalities of genitourinary tract in male children⁽³⁾. Whereas undescended testes is located in normal descent pathway and shows normal insertion of the gubernaculum.

The undescended testes (UDT) and other forms of cryptorchidism might seem to be simple abnormalities of the testes; it has lots of subtle and complex issues that must be considered separately in each clinical scenario for optimum favourable outcome. Some forms of UDT require no intervention, others are amenable to medical therapy, and some require surgical intervention. Therefore, a thorough understanding of the proper diagnosis of each of these conditions is required to provide proper management.

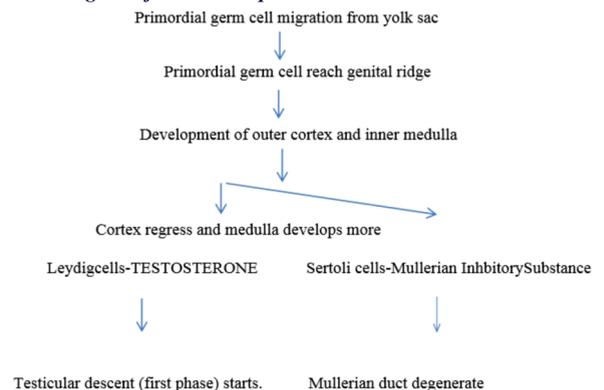
Descent of testes:

Descent is necessary for normal spermatogenesis, requires 2°c-3°c cooler environment found in scrotum⁽⁶⁾. The testes descend in two separate stages^(7,8).

The first stage: Transabdominal migration during the latter part of the first trimester due to differential body growth and traction by the gubernaculum⁽⁹⁾ which is non-androgen dependent and controlled by INSL3 and LGR8⁽¹⁰⁾. **The second stage:** Transinguinal migration at the beginning of the third trimester and predominantly controlled by androgens through CGRP which act on spinal nucleus of Genitofemoral nerve, abdominal pressure and by some genes such as HOX10⁽¹¹⁾.

ANATOMICAL ASPECT:-

Flow diagram of testis development:



Key points: SRY gene on the Y chromosome is the primary driver^(4,5) and Leydig cells also secrete insulin like factor -3 and SF1.

Role of ultrasonography in UDT:

Experience paediatric surgeons can accurately diagnose UDT by repeated and meticulous palpation of scrotal and inguinal region. But we all know that accurate assessment of the position of the UDT and its volume compared with the contralateral, healthy testis gives the surgeon a basic knowledge in cryptorchid boys as testicular volume has always been considered to reflect testicular function. Occasionally, although palpable, testes may not be identified on physical examination in an uncooperative or obese child if the testis is very small. Then further investigation might be done by Ultrasonography, MRI or by invasive method- Laparoscopy. Of these Ultrasonography is the imaging method of choice in children because it is a non-invasive, harmless, radiation free, widely available procedure and relatively cheaper than MRI. Considerable advances had occurred in USG over recent years such as improved transducer technology, 3D image; Doppler technique etc., allows precise monitoring of testicular parameter. Ultrasonography with high resolution linear array transducer offers greatest accuracy in assessment of 100% palpable and 84% non-palpable testes^(12,13). The recent survey data suggest that obtaining an Ultrasound before referral to a specialist is common among surveyed medical practitioners⁽¹⁴⁾.

AIMS AND OBJECTIVES

1. Precise localization of undescended testes by ultrasonography.
2. To measure the dimensions of undescended testes by ultrasonography in respect to normal descended testes or normal reference.
3. To study the echo texture of undescended testes and to note differences of echogenicity of both testes, if any.

REVIEW OF LITERATURES:-

John Hunter (1728-1793) described the earliest account of undescended testes. He stated that during embryonal life testes descend from retroperitoneal area to scrotum; cryptorchid gonad does not descend due to dysgenesis. He was the first to use the term "gubernaculum"⁽²⁾.

In 2000, Riebel et al showed 53% of previously maldescended testes had abnormalities with regard to position, volume, structure and perfusion without any correlation with the patient's age at surgery. Thus the value of even early surgery has to be questioned⁽¹⁵⁾.

Sakamoto and his co-workers (2008) stated that testicular volume has a direct correlation to seminal fluid and sex hormone assay. A total testicular volume of 20 ml and more, as determined by ultrasound, is indicative of normal testicular function⁽¹⁶⁾.

Tasian and Copp performed a systematic review and meta-analysis in 2011 on Diagnostic performance of ultrasound in non-palpable undescended testis. They reported that the sensitivity and specificity of ultrasound in correctly identifying a non-palpable testis was 45% and 78%, respectively. The positive and negative likelihood ratios (LR), which are the increase and decrease in the odds of a test is actually being in the position identified by ultrasound, were 1.48 and 0.79, respectively. When interpreting LR, a positive LR of 1 to 2 or a negative LR of 0.5 to 1, indicate small and clinically insignificant changes to clinical management. So they recommended that the use of ultrasound should be minimized as it would not change the management of nonpalpable testes but would increase health care expenditures⁽⁷⁾.

According to Onkar et al (2012) high frequency ultrasound was able to locate the position of undescended testes in majority of cases. Undescended testes were more commonly found in inguinal canal than abdomen. The ultrasound findings can be useful to determine the time and also the type of surgery⁽¹⁸⁾. Jadhav and Kumar in 2013 performed one prospective study in Maharashtra and concluded that Ultrasonography remains the specific, easily available, non-invasive modality of diagnosis and localisation. In the study they found 100% sensitivity and specificity for localization of undescended testes by Ultrasonography⁽¹⁹⁾.

Agrawal et al (2013) studied, the side on which undescended testis get arrested during its descent. They found that undescended testes more frequently occurred on right side. Among 43 undescended testes, 21 (48.8%) cases were right sided undescended testis, 16 (37.2%) cases were left sided undescended testis and 6 (14%) cases of bilateral undescended testis⁽⁸²⁾.

MATERIALS AND METHOD:-

1. STUDY TYPE: Observational and cross sectional:

2. STUDY AREA: Out Patient Department (O.P.D) in different disciplines and Department of Radio diagnosis at N.R.S Medical College & Hospital, Kolkata-14

3. STUDY POPULATION: The male patient in specific age group of six months to twelve years as per inclusion criteria.

4. STUDY PERIOD: 2016 to 2017

5. SAMPLE SIZE: The target sample was around 40 patient with undescended testes.

6. INCLUSION CRITERIA: Patient coming to N.R.S Medical College in the specified age group (six months to twelve years) with history of absent testes in the scrotum either unilateral or bilateral. Boys whose parent signed the consent form to participate in this study.

7. EXCLUSION CRITERIA: Patient with undescended testes with Age less than six months or above twelve years, Intersex disorder. Patient with retractile testes, inherited/congenital disorder, parents/guardians who refused to consent.

STUDY DESIGN: The study was undertaken after approval of the institutional ethical committee of N.R.S MEDICAL COLLEGE & HOSPITAL. Written consent was taken from parent in each and every case and to get a confirmed diagnosis a proper guideline was followed strictly.

History

History of maternal habit and antenatal history was taken during evaluating a cryptorchid boy. A family history of cryptorchidism or genetic or hormonal disorders is evaluated carefully. Birth weight and maturity of the new-born was taken because it has some important role in cryptorchidism. Any history of prior inguinal surgery was noted carefully with special reference of Orchidopexy.

Physical examination

After detailed history, complete general and systemic examination was carried out. Local examination of genitalia and scrotum was done to confirm the diagnosis.

It was done in a warm room, on relaxed patient, on a comfortable examination couch, the child was undressed up to the level of umbilicus and down to the level of knees and then he was placed in the frog leg position for examination. The child was examined occasionally in sitting or squatting position.

Localization study: All the palpable and non-palpable cases were sent to Radiology Dept. NRS MCH for Ultrasonography to assess the presence or absence of a testis and to localize it. In Ultrasonography morphometric study of the both normal and affected testis was done.

SCANNING TECHNIQUE: The Ultrasonography examination was performed by same radiologist using the aforesaid USG machine and probe.

Room temperature was 22°C to 24°C maintained by AC. The patient skin was lubricated well by sonographic gel for better transducer function.

Ultrasonography was performed in supine position on a soft, well covered examination table. In unilateral undescended testis, the normally descended testis was always examined first. The gain setting was adjusted for optimal demonstration of testicular tissue. The mediastinum of testes was identified first for confident diagnosis. The position, echogenicity and volume measurement of normally descended testis were recorded carefully in a specified format along with any other associated abnormality related to the testis. Then a search for undescended testis was made by scanning the scrotum, scrotal neck and inguinal region in transverse, longitudinal and oblique planes. Testicular volume (incm^3) was taken from the auto measurement of the USG machine. The epididymis was not included in the volume measurement.

The position of undescended testis was documented as intra-abdominal, inguinal, scrotal and not visualized.

Then the cryptorchid patients were referred to Paediatric Surgery Dept. of NRS MCH with ultrasonography report for further evaluation.

TOOLS: Ultrasonography Machine: Philips HD-7 Ultrasonography machine and 2-5 Mhz Turbilinear probe, 3-5 Mhz Linear probe. Guardian information sheet. Vernier Calliper

PARAMETER STUDIED:

Testis position – undescended testis was described as-

On physical examination	On Ultrasonography
Inguinal	Intraabdominal
Suprascrotal	Intracanalicular
Ectopic	Suprascrotal
	Not visualised

If ectopic testis detected it was excluded from study.

Echogenicity: Homogeneous or Heterogeneous echogenicity.

Volume of normal testis and undescended testis-

By Ultrasonography	Both normal and undescended testis	In cm ³
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The testicular length (L), testicular height (H) in the longitudinal plane and the testicular width (W) in the transverse plane were measured and recorded.

Lambert formula- length x height x width x 0.71 was used for volume estimation of testis.

DATA ANALYSIS:

The mean, median and range were calculated using standard methodology. USG guided different data were collected and spread on descriptive table for analysis.

RESULTS

All patients in this study were subjected to physical examination and ultrasonography. Physical examination and ultrasonography were done to identify the location of undescended testis along with its volume and echogenicity assessment.

Table 1: Distribution of study group according to age of presentation:

Age	frequency	percentage
½ - 3 year	15	37.50%
3year -6 year	16	40%
6year-9year	6	15%
9year-12year	3	7.50%
Total	40	100%

Age distribution of UDT

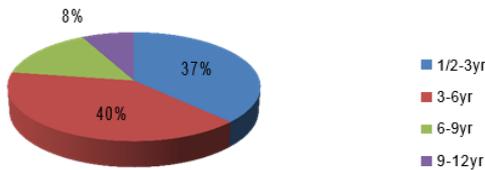


Figure 1

Pie diagram showing age distribution of undescended testis patient Table 1 shows the age distribution of patient of undescended testis. The mean age of presentation was 4.65 years and most frequent distribution was seen in 3year to 6year age group.

Table 2: Laterality of undescended testes on physical examination (n=40)

Side of UDT	Frequency	Percentage
Right	21	52.5%
Left	14	35%
Bilateral	5	12.5%
Total	40	100%

Side of UDT

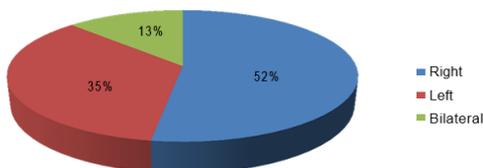


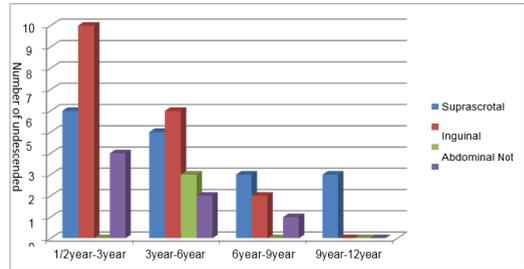
Figure 2

Pie diagram showing laterality of undescended testis

Table 3: Position of testis examined by Ultrasonography (n=45)

Age	Position on USG			
	Suprascrotal	Intracanalicular	Intraabdominal	Not visualised
½ year-3 year	6	10	0	4
3 year- 6 year	5	6	3	2
6 year- 9 year	3	2	0	1
9year- 12 year	3	0	0	0
Total	17(37.78%)	18(40%)	3(6.67%)	7(15.55%)

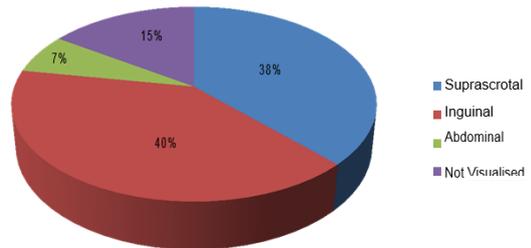
Figure 3



Bar diagram showing frequency of undescended testes in different age group

Figure 3a

Position of undescended testes on USG

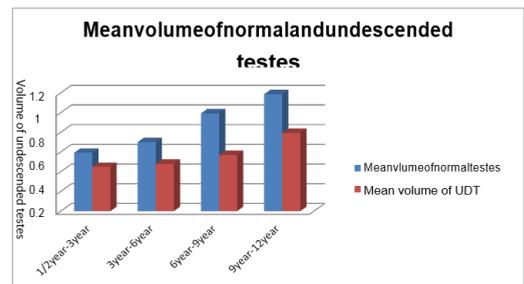


Pie diagram showing percentages of undescended testes in different position

Table 4: Mean volume of normal testes and undescended testes

Mean volume of normal testes(cm3)	Mean volume of undescended testes(cm3)
0.7614	0.5043

Figure 4



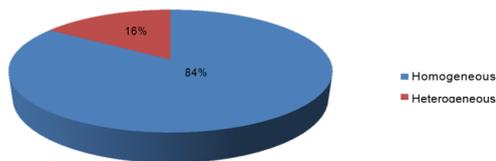
Bar diagram showing mean vol. of normal and undescended testes in different age group

Table 5: Echogenicity of undescended testes on USG

	Frequency	Percentages
Homogeneous echo	32	84.21%
Heterogeneous echo	6	15.78%
Total	38	100%

Figure 5

Echogenicity of undescended testes on



3Pie diagram showing echogenicity of undescended testes on USG

DISCUSSION:-

Undescended testis is one of the anomalies of reproductive system, which has been studied since over hundreds of year. But there is lack of study in the eastern part of India regarding this. In our observational and cross sectional study of 40 cases of undescended testis we tried to highlight different aspects of UDT.

1) Age of presentation:

The study included 40 patients with ages ranged from ½ to 12 yrs. It is found 15 between 1/2to 3 yr(37%), 16 between 3 to 6 yr(40%), 6 between 6 to 9r(15%) and 3 in the age group of 9 to 12 yr(8%). The mean age of presentation was 4.65 yrs and most frequent distribution was seen in the age group of 3year to 6year.

2) Presentation on local examination:

In our study, 35 boys had unilateral UDT (87.5%) and 5 bilateral UDT (12.5%). Total was 45. Among those unilateral cases, 21 right sided UDT (52.5%), and 14 left sided UDT (35%). It is evident from this study that arrest of testicular descend was unilateral and occurred to the right side mainly. In this we also found that 31 palpable testis (69%) and 14 non palpable testes (31%) on physical examination. Many studies reported percentages approximately similar to that of present study. In 2013 according to Agrawal et al⁽⁶⁹⁾, of the 49 undescended testes cases under study 86% were unilateral, among those right sided undescended testis were 48.8% and 37.2% cases had left sided undescended Since palpation of UDT is a subjective measurement then diagnosis mainly depends on examiners experience and ability, non-palpable UDT create problem for precise localisation. Then ultrasonography came forward as the imaging method of choice to give information regarding non palpable UDT.

In our study USG was able to locate 10 out of 14 NPT. 7(50%) of them detected in Intracanalicular position and 3(21.42%) of them were in abdomen. USG could not visualise 4(28.58%) non palpable testes. In a study by Ahmed S Tawfeek⁽²¹⁾ in 2009 reported that 55% NPT were in inguinal canal, 25% were in abdomen and 20% not visualised in USG.

3. Ultrasonography

The role of Ultrasonography was studied in localizing the testis so Ultrasonography was performed in 40 patients out of 40. Total 45 undescended testes were taken for imaging. Ultrasonography precisely located testis in Suprascrotal position 17(37.78%), in Intracanalicular position 18(40%), intraabdominal 3(6.67%) and not visualized 7(15.55%). Agarwal et al⁽²⁰⁾ reported that in Suprascrotal position there were 26.5% testes, 59.2% testes were located at inguinal canal, and in abdomen there were 4.1% testes and not located testes were 10.2%.

Our statistical analysis showed that the mean volume of the cryptorchid testicles was significantly lower than the mean volume of the normal descended testes. This loss of volume of cryptorchid testes was detected in all age group. During surgery we also noticed that undescended testis had smaller size as compared to normally descended contra-lateral testis (by USG). We calculated that mean volume of normal testes was 0.7614 cm³ and mean volume of undescended testes was 0.5013 cm³. According to Lenz et al⁽²³⁾(1993), UDT had smaller testicular volume (median 10.5ml, range 3.9-17.1) in comparison with normally descended testis (median 14.1ml, range 6-31.8). According to Jack S Elder unilateral undescended testis is always smaller than the normally descended testis. Chi-Shin Tseng⁽²⁵⁾ in 2016 reported in their studies that mean volume of 145 undescended testes was 0.238 ml and mean normal volume was 0.418 ml.

6) Echogenicity

In our study we detect 38 UDT by USG; we noticed 32 testes (84.21%) with homogeneous echogenicity and 6 testes (15.78%) with

heterogeneous echogenicity. All the normal descended testes had homogeneous echogenicity. Mean age of patient with heterogeneous echogenicity 6.02 year and among those 4 testes (67%) were inside the inguinal canal, 1 testis was found in abdomen and 1 in suprascrotal position. Most cases (4 testes) of heterogenous tetes were detected in age group 3year to 6year.

According to Grzegorz Jedrzejewski et al⁽²⁴⁾(2016), they found inhomogeneous testes in 38 patients (21.70%) among them 17 were in the age group of 2year-4year, 15 in the age group of 5year-7year and 6 in age group of 8year to 10year.

The actual volume measured by Vernier Caliper was less than USG measured volume of the affected testes. The volume overestimated by USG ranged from 9.08%to 34.97%and the mean was calculated as 21.8%.

Ultrasonography located 8 testes in Intracanalicular, 2 testes in Suprascrotal position and 1 testis was not visualised. During Orchidopexy we found all 11 testes in Intracanalicular position. From this we calculate sensitivity of Ultrasonography for inguinal testes and sensitivity was 72.73%. Similar study by Kaenemoto⁽²⁷⁾ in 2005 stated that sensitivity of Ultrasonography was 76% and Shoukrey M et al⁽²⁵⁾ in 2015 also concluded that sensitivity of Ultrasonography was 85%. High resolution Ultrasonography may be the cause of slight greater sensitivity of the above two study.

SUMMARY AND CONCLUSION

In this study we dealt with one of the most frequent anomaly of genital system- undescended testes. it was known to Anatomist, Surgeon since 18th century but appropriate cause diagnostic test treatment is till debatable to us.

We found the age of presentation and location of undescended testes are consistent with most of previous study. We calculate age of presentation as 4.65 year and detect most of UDT on right side (52.5%).

Ultrasonography may be used as imaging method in our developing country as it is available widely and has sensitivity 72.73% and showed the echogenicity of undescended testes, give valuable findings of non-palpable testes and thus help to plan definite surgical procedure. In our study USG overestimate undescended testes volume of 21.8%, so more careful ultrasonography evaluation was needed.

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