UNDERSGENDED TESTIS: PATTERN OF PRESENTATION AND OUTCOME OF SURGICAL MANAGEMENT

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Dedication

To my father

Wishing him speedy recovery & to continue on that cheerful, nice smile and high morale despite the long and unpleasant sufferings.
Acknowledgment

I am really indebted to my supervisor without whom this
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<th>Full Form</th>
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<td>ECT</td>
<td>Ectopic testis</td>
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<tr>
<td>F.H</td>
<td>Family history</td>
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<td>G.I.T</td>
<td>Gastrointestinal tract</td>
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<tr>
<td>MS</td>
<td>Multiple stage</td>
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<td>Pt.</td>
<td>Patient</td>
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<td>SS</td>
<td>Single stage</td>
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<td>S.U.H</td>
<td>Soba University Hospital</td>
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<tr>
<td>U.D.T</td>
<td>Undescended Testicles</td>
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<td>U/S</td>
<td>Ultrasound</td>
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<td>CT</td>
<td>Computerized tomography</td>
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<td>hCG</td>
<td>Human chorionic gondotrophine</td>
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<td>KTH</td>
<td>Khartoum Teaching Hospital</td>
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ABSTRACT

Introduction: UDT is failure of the testis to descend from retroperitoneum during development to its normal position in the scrotum.

Objectives: To evaluate patients with UDT, their presentation, diagnosis and treatment.

Methods: Prospective study performed in 89 patients with UDT at Soba University Hospital and Police Teaching Hospital, from November 2003 to November 2004. Data tabulated included personal data; presentation, family history, examination, investigations, treatment and outcome.

Results: Empty scrotum is the main presenting symptom discovered by parents, doctors or patient himself in 100%. Orchidopexy is the treatment done to eighty seven (89.6%) patients as one stage, 10.1% as two stages. Orchidectomy was done to 2 patients because of marked atrophy.

Conclusion: early detection of UDT and treatment is associated with improvement of testicular growth and spermatognisis and hence high fertility rate and to avoid complications.(1)
ملخص الأطروحة

مقدمة:
الخصية المعقلة ببربخ لقصور في هجرة أول نزول الخصية من البطن إلى قاع كيس الصفن.

هدف الدراسة:
معرفة أعراض وعلامات والفحوصات التشخيصية ونتائج العلاج.

الطريقة:
هذه دراسة مستقبلية، اجريت على 89 مريض بالخصية المعقلة بمستشفى سوبا ومستشفى الشرطة في الفترة من نوفمبر 2003م إلى نوفمبر 2004م. تم جمع المعلومات عن المرضى باستخدام استبيان عن المرض، تشخيصه، فحوصاته، علاجه ومحصلة العلاج.

النتائج:
تم إنزال الخصية في المرحلة الأولى لعدد 78 مريض (87.6%) والمرحلة الثانية لعدد 9 مرضى (15.1%).

تم إزالة الخصية لعدد 2 مريض (2.2%) نسبة للضمور الشديد.

خلاصة:
التشخيص المبكر وإجراء عملية في موعد أقصاه سنتين تحسن نمو الخصية وينتاج الحيوانات المنوية وذلك لتساعد في زيادة الخصوبة للرجل عند البلوغ وأيضًا إنزال الخصية في الوقت المبكر يقلل من نسبة المضاعفات من التهابات، التواء، ضمور وارتفاع نسبة الإصابة بالسرطان مستقبلا.
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APPENDIX (questionnaire)
INTRODUCTION

Undescended testis implies an arrest of descent somewhere along the normal pathway.\(^{(1)}\)

Arrest of descent occurs at any level in the normal pathway. Many complications result when the testis is not in its normal position.

Early management prevents some of the complications to occur.\(^{(1)}\)

The management of UDT is surgical.

In Sudan, Soba University Hospital and Police Hospital are the hospitals concerned with this problem, this makes SUH, Khartoum Teaching Hospital, Police Hospital and Wad Madani Hospital are suitable places to undertake the study on UDT.

According to my personal communications and literature research no previous local study of the subject was done.
This was a good reason for undertaking this study hoping to find an answer for some of abnormalities with regard to position, volume and structure.

**LITERATURE REVIEW**

**Historical background:**

The term cryptorchidism from Greek cryptos (Hidden) used for a testis that is not palpable on examination usually intra-abdominal.\(^{(2)}\)

The classical description of orchidopexy is that of Bevan (1899) his basic principles are that the testis should be mobilized fully to be brought down into the scrotum without tension. Only minimal fixation is needed.

Ectopic testis should be mobilized fully if is to be brought down without tension.\(^{(2)}\)

Hasteld and Schrardt (1965) reported that the incidence of malignancy is maximal when the testis is in an abnormal position.\(^{(3)}\)

Ludwig and Potempa (1975) orchidopexy has shown to improve testicular growth and spermatogenesis.\(^{(4)}\)
Mangel et al (1981) spermatogenesis only occurs if the testis lies in scrotal environment.\(^\text{(4)}\)

**Development of the testis:**

The testes develop from the genital fold medial to the mesonephros (Wolffian body); in early foetal life, they lie in the retroperitoneum below the developing kidneys. The primitive testis is attached to the posterior abdominal wall by the mesorchium, a neurovascular pedicle derived from the lowermost thoracic segments.

The Wolffian duct becomes the epididymis and the vas deferens, the gubernaculum develops as a fold of peritoneum, which can be traced from its attachment between the vas and the epididymis to the region of the developing phallus.

The fully developed gubernaculum contains muscle fibres, but there is still no certainty as to the part that it plays in testicular descent.

Maternal chorionic gonadotrophin stimulates growth of the testis and may stimulate its migration. Imperfectly developed testes tend to descend incompletely.\(^\text{(5,6)}\)

**Anatomy:**
**Inguinal canal:**

- Is an oblique intermuscular slit above the medial half of the inguinal ligament.\(^{(5)}\)
- Commences at deep ring end at superficial ring.
- The deep ring and superficial ring overlying each other in children.

**Transmit:**

- Spermatic cord.
- Iloingunal nerve in male and round ligament in female.\(^{(5)}\)

**Anterior wall**

Formed by the external oblique aponeurosis and laterally by portion of the internal oblique muscle.

**Floor:**

Is in rolled lower edge of inguinal ligament reinforced medially by lacunar ligament.

**Roof:**

By lower edge of internal oblique and transverses muscles, which joint to form conjoined tendon inserted into pubic crest and pectinial line.

**Posterior wall**
Strong conjoined tendon medially and weak transversals fascia laterally.

**Deep ring:**

Above mid inguinal point is an opening in transversals fascia bounded laterally by the angle between transversus muscle fibres and ingunal ligament.

Structures passing through the internal ring are: vas deferent and its artery from superior or inferior vesical artery testicular artery, and veins usually double at this level, remains of the processes vaginalis. Autonomic nerves and lymphatics.

**Layers of spermatic cord:**

Internal spermatic fascia, cremasteric muscles and external spermatic fascia.

Cremasteric muscle and coverings are supplied by cremastric artery from inferior epigastric artery, venous return by cremastric vein to inferior epigastric vein.
Lymphatics of the coverings drain to external iliac nodes the cord passes vertically down word over pubic tubercle and enters the scrotum.

In the scrotum testicular veins form rich pampini form plexus.

Anastomosis occur in region of the epididymis between testicular artery, the cremastic artery and artery to the vas, but these are smaller vessels may not be adequate to nourish the testes if testicular artery is divided.\(^{(5)}\)

**Scrotum:**

Is a pouch of skin containing testis and spermatic cord. The subcutaneous tissue has no fat but contains dartos muscle the rugosity of the skin is due to contractions of this muscle, which is a smooth muscle supplied by sympathetic fibres from genital branch of the genofemoral nerve, deep to dartos muscle layer of Colles' fascia (superficial).\(^{(5)}\)

**Blood supply:**

From superficial and deep external pedendal artery venous drainage by superficial and deep external pedendal to greater saphenus vein.\(^{(5,7)}\)
Lymphatic:

To medial groups of superficial inguinal node.

Nerve supply:

By ilio-inguinal nerve L₁ and perineal nerve S₃ and S₂.(5)

Development of scrotum:

From labioscrotal swelling lateral to urogenital folds on either side of the urogenital membrane.(5,8)

Testis:

Oval organ possessing a thick covering of fibrous tissue (Tunica albuginea to its posterolateral surface epididymis is attached. The vas is a direct continuation of the epididymis medial to it. Front and lateral surfaces of the testis are covered by Tunica vaginalis.

Testis and epididymis are covered by prolongation of the spermatic cord covering.(5)

Histology:

Dense fibrous tissue (Tunica albugenia) send septa divide the testis into loculi. Seminiferous tubules convoluted within the loculi. Each tubule shows several layers of cells
outer most consists of spermatogonia, which is divided to produce primary spermatocytes, which divide by meiosis to give secondary spermatocytes, then divides to give spermatid, which will mature to spermatozoa.\(^{(5,9,10)}\)

Spermatogenesis takes 64 - 70 days. Transformation of spermatids to spermatozoa is called spermiogenesis.

Sorteli cells provide physical support and nutritive substances.

Testis form negligible contribution to seminal fluid. Leydig cells secrete testosterone.\(^{(5)}\)

**Blood supply:**

Testicular artery from the aorta. Veins form the pampini form plexus in the scrotum. In ingunal canal becomes four veins, which join to form 2 veins leaving the deep ring to inferior vena cava in the right and to the left renal vein in the left.\(^{(5)}\)

**Lymphatic drainage:**

To common iliac and para aortic nodes at level of L2.\(^{(5)}\)

**Nerve supply:**
Sympathetic nerve T10 segment of the cord in greater or lesser splanchnic to caeliac ganglia. Post ganglionic pass to the testis through testicular artery. Sensory through sympathetic pathways. No para sympathetic supply to the testis.\(^{(5)}\)

**Pathophysiology:**

During the 7\(^{th}\) week after conception the testis start to develop sertoli cells, and then leydig cells with maternal HCG. Leydig cells produce testosterone for male differentiation and tubular development, at 7\(^{th}\) month the testis is in the inguinal canal and at 8\(^{th}\) month on descends to the scrotum. Incompletely descended testes are often normal until the age of 6 years, at puberty the testis is flabby and poorly developed compared with intrascrotal counterpart. Epithelial element are grossly immature and by the age of 16 years irreversible destructive changes have occurred, which halts spermatogenesis and limit the production of androgens to around half of the normal output.\(^{(11,12,13)}\)

**Theories of descent:**
1- A hypothesis is proposed that the abnormal development of the diaphragmatic ligaments of the testes may lead to lack of their involution with consequent cryptorchidism. In the case of splenogonadal fusion the abnormal ligaments are colonized by splenic cells, possibly because of an abnormal proximity to the splenic angle with the resulting abnormal ligament persisting as the splenic cord and thus resulting in cryptocordism. The basic abnormality may be inconnections of the diaphragmatic ligament caused by abnormal midline development in the 3rd to 4th week of gestation.\(^{(14)}\)

2- At the 10th weeks of the intrauterine life Gubernaculum develop as a fold of peritoneum between the vas and the epididymis to the region of the developing phallus. Fully develop Gubernaculum contain smooth muscle may place part in testicular descent with aids of maternal chorionc gonadotrophic hormone.\(^{(15,16)}\)

**Clinical features:**

Unilateral on the right in 50% and on the left in 30%. Arrested descent of both testes occurs in 20%. Secondary
sexual characteristics are normal, but other abnormalities of the genitourinary tract may be present.

The testis may be:

1- Intra-abdominal.

2- In the inguinal canal.

In some boys the least stimulation of the skin of his scrotum or thigh will result in the testis ascending to the superficial ring or into the inguinal canal (Cremasteric reflex) and this causes the retractile testis.

**Ectopic testis:**

- The testis may be in superficial inguinal pouch.
- Root of the penis.
- Anterior thigh.
- Perineum.

**Associated diseases and syndromes:**

- Omphalocele and Brain malformation (Omphalocels-Cryptochordism-Brain Syndrome), Klinefelter syndrome, Down's syndrome and Cleft-syndrome. Persisting processes vaginals in 50%. Epididymal pathology 30%, hypo or
epispadias 8%, malformation of lower urinary tract (ectopia visica 3% and upper urinary tract 1%).(15)

**Diagnosis:**

Empty scrotum is usually underdeveloped. Associated hernia may be obvious. Cremasteric reflex help in detecting retractile testis.(17)

**Investigations:**

- Ultrasound (U/S): has limited role in detecting undescended inguinal testis in obese boys. In intra-abdominal testis, furthermore, intestinal gases, retroperitoneal fat, lymph nodes and already small testis (less than 1 cm). Make localization infeasible U/S can measure testicular volume pre-and postoperative for the follow up of testicular volume using the following equation:(18)

  \[
  \text{Volume} = (0.523 \times \text{height}) \times \text{anteroposterior diameter} \times \text{transfer diameter}
  \]

- MRI: using fat-suppressed image.(7)

- CT: can play a role in detecting intra-abdominal and inguinal testes.
- Laparoscopy: has diagnostic and therapeutic role, is an effective method in managing intra-abdominal testis.\textsuperscript{(10)}

- Hormonal assessment: in children with bilateral impalpable testis need a search for mullerian structures, endocrine tests to identify functioning testicular tissue by using I.M HCG which causes rise in serum testosterone.\textsuperscript{(7,15)}

**Size of the testis:**

Testicular size is important in assessing testicular function because 98\% of the testicular volume is composed of seminifrous tubules. The size is a reflect of this tissue mass.

\[
\text{Volume} = \left( \frac{\pi}{6} \right) \times L \times D^2
\]

Testis can be measured by:

- Ultrasound.
- Prader-orchidometer.
- Takihara- punched-ring orchidometer.
- Seager orchidometer.

In our study we used a tape to measure the length and width (fixed the testis by finger and measured in centimeter).
\[ V = \left(\frac{\pi}{6}\right) \times L \times D^2 \text{ in ml} \]

The 3 orhdidometer correlated well with ultrasound ±2 ml. The size increased with age range from 2 ml at birth to 25 ml in adolescent and 35 ml in adult.\(^{(8)}\)

**Hazards of incomplete descent are:**

- Sterility in bilateral cases.\(^{(19)}\)
- Trauma.
- An associated indirect inguinal hernia is often present and, in older patients is frequently the hernia, which causes symptoms and complications.
- Torsion.
- Atrophy.
- Increased liability to malignant disease. All types of malignant testicular tumour are more common in incompletely descended testes even if they have been brought down surgically. It has been estimated that the chance of a tumour is about 35 times than in a normally positioned testis. Testicular tumours are rare and there is no reliable statistic as whether orchidopexy diminished the
liability but it does improve the prospect of early diagnosis by self examination and doctor.\(^{(20,21,22)}\)

**Treatment:**

1- Surgical correction (orchidopexy) is usually recommended between 9 months and two years of age. The reasoning is based on the fact that the testis functions and grows better (normal spermatogenesis) at a temperature (33.2°C), which is lower than normal body temperature of 37°C. Higher temperatures cause progressive and often irreversible changes to the sperm producing cells. Testis is flabby poorly develop and histologically immature lead to sterility in bilateral cases.\(^{(15,23,24,25)}\)

2- The psychological aspect of empty scrotum is eliminated.

3- Early diagnosis of testicular tumour. An increased incidence of testicular cancer in the cryptorchid testis, when it is not brought down. The risk is 35 time greater in this group than in normal population.\(^{(26)}\)

Masses are much easier to detect, obviously, if the testis is brought down and is easy to detect. Postoperatively,
the testis should be examined yearly by a surgeon until the boy learns daily self-examination.

Other reasons for orchidopexy include the risk of testicular torsion, as the undescended testis is poorly or not attached.

Hormone therapy of cryptorchidism is controversial, there are advantages such as increased vascularity.

Disadvantages includes painful administration (shots), low success rate, and high relapse rate. Premature closure of epiphysis resulting in short stature.

Orchidectomy is usually implemented in unilateral intra-abdominal testis which can not be corrected by orchidopexy for risk of malignancy.\(^{(15)}\)

Very high intra-abdominal testes can be brought to an accessible position. Microvascular staged orchidopexy is an option to preserve the testis in bilateral intra-abdominal testis, when the testicular vessels are short using either Fowler Steeven's technique open or laparoscopically.

**Operations:**

**Orchidopexy:**
Orchidopexy consists firstly of mobilisation of the testis and spermatic cord and secondly, retaining the testis in the scrotum and fixed.\textsuperscript{(15)} Orchidectomy should be considered if the undescended testis is markedly atrophied and the other testis is normal.\textsuperscript{(27)}

**Inguinal approach:**

An oblique incision is made over the inguinal canal and deepened to expose the external oblique aponeurosis. The external oblique aponeurosis is divided upwards and laterally from the ring. The cremaster muscle is incised longitudinally and the spermatic cord and the testis are delivered into the wound. The hernial sac identified ligated and divided. The cord lengthening is achieved by proper dissection. If the testis still could not be brought into scrotum can be fixed by suture at its lowest position and then explored 6 months later when remobilization is often successful in obtaining enough cord length (obsolete), tendency to maximum mobilization in the first session with extensive retroperitoneal dissection.

**Fixation of the testis in the scrotum:**
A subcutaneous pouch is formed by scissors dissection and the testis is drawn in the pouch and fixed by nonabsorbable suture.

**Fowler-Stephens technique:**

Fowler and Stephens (1959) confirmed that the vasal vessels alone can often adequately vascularize the testis so that division of the testicular vessels may be safely carried out when they are too short to let the testis come to the scrotum.\(^4\)

**The high intra-abdominal testis:**

The classic example of this form of cryptorchidism is encountered bilaterally in boys with the prune belly syndrome. Each testis is suspended within the peritoneal cavity in a mesentery at the postero-lateral aspect of the pelvic brim. The testicular vessels are very short but the vas and its accompanying vessels are correspondingly long. The peritoneal cavity is opened through an oblique, muscle-cutting incision in the iliac fossa and the testis in its mesentery is delivered into the wound. The testicular vessels superiorly, the gubernaculum inferiorly and the vas with its accompanying
vessels centrally are recognized. Vascular clamps are applied to the testicular vessels above the communications with the vasal vessels and to the gubernaculum and the effect on the testis is observed, doubt concerning testicular vascularity can be resolved by division of one of the subtunical vessels. If the testis remains well vascularized the testicular vessels and the gubernaculum are divided between ligatures at the levels of clamping. To bring the testis to the scrotum, an artery forceps is passed through a scrotal incision and guided obliquely through the abdominal parietes in the inguinal region. The testis is drawn down. In a study described a two staged modification of the above technique. At the first stage, ligation of the testicular vessels is performed. Some months later, following the establishment of an assured collateral testicular circulation through the vasal vessels, the second stage is carried out as described.

**Impossible orchidopxy:**

Boys with bilateral cryptochordism in whom neither testis can be made to reach the scrotum. Orchidectomy during
childhood, followed by hormonal replacement at age of puberty is appropriate to decrease the risk of malignancy. Preservation of one testis in subcutaneous position in the groin for hormonal function and early detection of malignant changes is another option.\textsuperscript{(28)}

**Acquired undescended testis in boys (Testicular ascent):**

Is the testis that previously residing in the scrotum that no longer be manipulated into stable position in the scrotum, due to improper technique or progressive shortening of cord structures with respect to other tissue and growth of the scrotal base moves further inferiorly, the testis remain immobile seemingly ascends. Treatment with HCG will result in full descent of the testis.\textsuperscript{(12)} HCG stimulates leydig cell to produce high local level of testosterone. Spontaneous descent before adolescence is common, orchidopexy should be for those who fail to descend at puberty. Testicular volume is appropriate for age.\textsuperscript{(29,30)}

**Similar studies:**

1- Study aimed to determine the size and position of the fetal testis during gestation in 48 testis from 24 human fetuses
aged 14 – 40 weeks. The results, in 22 tested, age 14 – 37 weeks were in abdominal cavity, no testis had descended to the scrotum in any fetus until 27 weeks. The conclusion that all testis had descent to the scrotum by 33 weeks, but there was considerable variation in position from 27 week.\(^{(31)}\)

2- One stage orchidopexy for high undescended testis using low testicular vascular ligation: an alternative Fower-Steveen’s techniques, 33 patients with 37 high undescended testis located intraabnominal or near the internal ring. Through skin-crease inguinal incision. By ligating the testicular vessels adjacent to testis and dividing the peritoneum between the testis and vas. One year follow up showed a viable testis by palpation and/or Doppler flow study in 91%. The conclusion was high ligation is not necessary for the testis viability; vascular anatomy support low ligation; low ligation may enhance testicular viability by reducing tension and improve collateral; inguinal incision can be use in all cases.\(^{(32,33)}\)

3- The study aims to report confirmed cases of spontaneous testicular ascent in patients with cryptorchid testis which
had been previously in the scrotum in 36 patients treated surgically and verified to be in the scrotum by pediatrician or pediatric surgeon. The results, the mean time between the last normal explorations until the testis ascended was 4.5 years during surgery, an open processus vaginalis was found in 18 testes. The conclusion was the study confirmed that previously descended testes can ascend spontaneously. The clinical and anatomical pathology characteristic of this testis were similar to those of the cryptorchid testis.\(^{(34)}\)

**OBJECTIVES**

The objectives of this study are to describe:

1- The pattern of presentation and methods of diagnosis of undescended testicles in Sudanese children.
2- The result of operative treatment associated hernial sac and the size of the testis at surgery.

PATIENTS AND METHODS

Study design:
This is descriptive prospective study supported by follow-up of patient during hospital stay and in referred clinic in-patients and out patients.

**Study population:**

The study population consisted of non-selected series of patients with undescended up to 13 years of age seen as out patient, admitted and offered surgical treatment.

**Area and period of the study:**

This study was conducted in Department of Paediatric Surgery at Soba University Hospital and Police Teaching Hospital, in the period from November 2003 - November 2004.

**Data sources:**

1- Patients in the time period specified.

2- Informations obtained by the investigator through examining patients and interviewing patients at the wards and outpatients.

**Data collection:**
Data was collected by a self-administered questionnaire. This was constructed in sections to address the different aspects of the study as follow:

Section A- Personal data.

B- Presentation.

C- Family history.

D- Examination findings.

E- Investigation.

F- Surgical management and outcome.

**Patient assessment:**

This was done in the normal manner by history examination and investigations.

History of personal data, presenting symptoms and family history.

Examination concentrate mainly in scrotal examination, perineum and abdominal examination. Looking for:

- Empty scrotum
- Ectopic testis.
- Associated anomalies.
**Investigations:**

- Scrotal and abdominal U/S for selected cases.
- Chromosomal study for selected cases.

**Operative management:**

Results of the patients underwent inguinal explorations and orchidopexy as first stage. Some of bilateral cases (intersex) underwent abdominal exploration for biopsy (present or absent of testicular tissue) and then orchidopexy later done to two patients.

**Postoperative assessment:**

Immediate postoperative assessment for: postoperative pain, fever, abdominal distension, urine retention, chest infection and wound complications.

Follow up: one week after operation and then six months to assess the wound, position of the testis and its size.

**Review of the literature:**

This started before collecting data of this study. Review sources included journals and textbook to cover the various aspects.
Data analysis:

All the collected data was entered into a master sheet and then analyzed by using Statistical Package of Social Sciences (SPSS), the result expressed in numbers and percentage.
RESULTS

From November 2003 to November 2004 a total of 89 patients were admitted and treated at SUH and Police teaching Hospital with the diagnosis of undescended testes.

Eighty-six patients were males (96.6%) and 3 patients (3.4%) were inter-sex, later converted to be males after biopsy and chromosomal study.

The age of patients at presentation range from 3 month - 12 years with means ± 6.723 years [Fig.1].

- All patients are resident in different regions in Sudan [Table 1].
- Positive family history of undescended testis in 9 patients [10.1%] [Fig 2].
- All patients are full term at delivery [100%].
- Sixty-two point nine percent of patients presented at birth, 91% of them presented below 5 years [Table 2].
- In 81 (91%) of UDT were discovered by parents (mother) [Fig 3].
• Sixty nine point seven percent of parents were educated, 
30.3% non educated [in health Education and Child Care] 
[Fig.4].

Presenting finding:

• Eighty-nine patients [100%] presented with empty scrotum 
[Fig. 5].

• Eighty three point one percent with underdeveloped scrotum 
15 (16.9%) patients with normal scrotum              [Table 3].

• Three patients with ambiguous genitalia.

• In 69 (77.5%) patients the testis impalpable on examination 
20 (22.5%) patients the testis were palpable at inguinal region [Fig. 6].

• Thirty-six (40.4%) patients left sided, 32(36%) patients right side, while 21 patient [23.6%] Bilateral [Fig 7].

Investigations:

U/S: Twenty-eight (31.5%) patients did U/S [Table 4].

- In five (5.6%) patients intra-abdominal, intra-operative go 
  with U/S report.
In seventeen patients (19.1%) in whom the testis were located in the inguinal canal, intra-operatively go with U/S findings.

- Two (2.2%) patients superficial inguinal pouch -intra-operatively is found to be in the inguinal canal did not go with U/S findings.

- Four (4.5%) patients not seen by U/S, intra-operatively is found to be in the inguinal canal.\(^{(35)}\)

**Chromosomal study:**

- Three (3.4%) patients did chromosomal study [inter sex], all were XY.

**Laparotomy:**

- Laparatomy done for three patients (intersex), and biopsy confirmed that they are males.

**Surgical treatment:**

**Orchidopexy:**

Seventy-eight patients (89.65%) did one stage orchidopexy, nine patients [10.1%] two stage orchidopexy [Fig 8].

**Time of orchidopexy:**
Fifteen (17.24%) patients underwent orchidopexy below the age of 2 years, 21 (1.13%) patients underwent orchidopexy between 3-5 years of age and 36 (41.37%) patients surgery done beyond 5 years. Most of operations were done between 6-10 years in 35 patients [40.22%] [Table 5].

**Orchidectomy:**

In two (2.2%) patients orchidectomy was done due to marked atrophy, both were as the age of 12 years.

**Result of orchidopexy:**

Table 6 shows results of orchidopexy, 89.9% testis were brought intrascrotal at the time surgery (one stage). Six [6.7%] patients at the neck of the scrotum. One [1.14%] at superficial inguinal pouch.

**Hernia sac:** was found in all patients (100%), according to pre-operative clinical obvious hernia were found, 64 (71.9%), which were ligated and divided (Table 7).

**Size of the testis during surgery [Table 8]:**

Normal size in relation to age, compared with normally descended testes in 41 (46.1%). Small size, compared with
normal descended testes in 17[19.3%], moderate in 29[32.6%], two are atrophied and removed.

**Site of the testes at surgery:**

Eighty five point four of testis were found in inguinal conal at the time of surgery, 14.6% were intra-abdominal.

**Orchidopexy done by:**

Sixty-seven point four percent of orchidopexies were done by a paediatric surgeon and 12.4% by registrar under supervision of a pediatric surgeon.

**Morbidity:** Complications in short term were:

- Urine retention (2.44%).
- Chest infection (4.49%).
- Wound infection (0.0%).
- Urinary tract infection (0.0%).
- Retraction of the testes (0.0%).

**Follow-up:**

All patients were followed during the first postoperative week (100%). Eighty four patients (69.5%) came to follow up at six month.

Site: Intrascrotum (80 patients; 91%).
At the neck of scrotum 4 patients by palpation.

Size: Moderate: 6 testis.

Same size at the time of the first stage surgery:

78 patients.

Atrophied: zero.

Mortality: zero.

Table 1: Distribution of the study group according to residence

<table>
<thead>
<tr>
<th>Region</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khartoum</td>
<td>52</td>
<td>58.4%</td>
</tr>
<tr>
<td>Central</td>
<td>23</td>
<td>25.8%</td>
</tr>
<tr>
<td>North</td>
<td>06</td>
<td>6.7%</td>
</tr>
<tr>
<td>East</td>
<td>02</td>
<td>2.24%</td>
</tr>
<tr>
<td>West</td>
<td>06</td>
<td>6.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table 2: Distribution of the study group according to time of presentation

<table>
<thead>
<tr>
<th>Time (years)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>15</td>
<td>16.9%</td>
</tr>
<tr>
<td>3 - 5</td>
<td>21</td>
<td>23.6%</td>
</tr>
<tr>
<td>6 - 10</td>
<td>35</td>
<td>39.32%</td>
</tr>
<tr>
<td>11 - 13</td>
<td>18</td>
<td>20.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table 3: Status of the scrotum

<table>
<thead>
<tr>
<th>Status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under developed</td>
<td>74</td>
<td>83.1%</td>
</tr>
<tr>
<td>Developed</td>
<td>15</td>
<td>16.9%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table 4: Investigation by ultrasound

<table>
<thead>
<tr>
<th></th>
<th>Intraoperative</th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inguinal</td>
<td></td>
<td>Intra-abdominal</td>
</tr>
<tr>
<td>Done</td>
<td>21 (75%)</td>
<td></td>
<td>7 (25%) 28 (100%)</td>
</tr>
<tr>
<td>Not done</td>
<td>55 (90.2%)</td>
<td></td>
<td>6 (9.8%) 61 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76 (85.4%)</strong></td>
<td></td>
<td><strong>13 (14.6%) 89 (100%)</strong></td>
</tr>
</tbody>
</table>
Table 5: Distribution of the study group according to time of orchidopexy (n = 87)

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>15</td>
<td>17.24%</td>
</tr>
<tr>
<td>Result after surgery (Site)</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>3 - 5</td>
<td>21</td>
<td>24.14%</td>
</tr>
<tr>
<td>6 - 10</td>
<td>36</td>
<td>41.38%</td>
</tr>
<tr>
<td>11 - 13</td>
<td>15</td>
<td>17.24%</td>
</tr>
</tbody>
</table>

Table 6: Distribution of the study group according to outcome following surgery (n =89)
<table>
<thead>
<tr>
<th>Location</th>
<th>Registrar</th>
<th>General surgeon</th>
<th>Paediatric surgeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-scrotal</td>
<td>8 (8.98%)</td>
<td>18 (20.22%)</td>
<td>54 (60.67%)</td>
</tr>
<tr>
<td>At the neck of the scrotum</td>
<td>3 (3.37%)</td>
<td>0 (0.0%)</td>
<td>3 (3.37%)</td>
</tr>
<tr>
<td>Superficial inguinal pouch</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>1 (1.12%)</td>
</tr>
<tr>
<td>Orchidectomy</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>2 (2.2%)</td>
</tr>
</tbody>
</table>

Table 7: Preoperative clinically detected
### Associated Hernal Sac

<table>
<thead>
<tr>
<th>Hernal sac</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>64</td>
<td>71.9%</td>
</tr>
<tr>
<td>Absent</td>
<td>25</td>
<td>28.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table 8: Distribution of the study group according to size of the testis (n = 89)

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Normal</th>
<th>Moderate</th>
<th>Small</th>
<th>Atrophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>14 (15.73%)</td>
<td>0 (0.0%)</td>
<td>1 (1.12%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>3 - 5</td>
<td>17 (19.1%)</td>
<td>3 (3.37%)</td>
<td>1 (1.12%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>6 - 10</td>
<td>8 (8.98%)</td>
<td>19 (21.34%)</td>
<td>8 (8.98%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>11 - 13</td>
<td>2 (2.24%)</td>
<td>7 (7.86%)</td>
<td>7 (7.89%)</td>
<td>2 (2.24%)</td>
</tr>
</tbody>
</table>

Parameters:

Testicular volume = $L \times D^2$ (length × diameter) in ml

Standar according to Prader orchifometer.

2 ml at birth, 25 ml at adolescent and 35 in adult.
This is a prospective study, conducted at S.U.H and Police Teaching Hospital.

Eighty-nine patients with UDT were treated surgically. The residence of 18 patients (20.22%) of our series from states lacking specialized hospitals, 6.77% coming from the North, 6.7% coming from the West and 2.2% from the East, from the South is none. Other patients (84.26%) from the center and the capital where services are better [Tale 1].

The mean age of presentation was ranging from 3 months to 12.5 years, all were full term at birth

- Up to 2 years 16.85%
- 3-5 years 23.595%
- 6-10 years 39.325%
- 11-13 years 20.224%

Most of them were late in presentation, early presentation is recommended.(17)

The late presentation in our study group can be explained by far residence, lack of health education among educated parent [Fig. 8].
In our study 67.7% are educated at secondary school parent and 30.3% not educated. UDT more common in children with less educated parent.\textsuperscript{36,37} For those educated most consult medical-officer who explained to them orchidopexy can be done between 9-12 years.\textsuperscript{38,39}

In our study 10.1% familial predisposition, so this high familial index can be explained by the high incidence of consanguinity in our society, paralleled with the literature.\textsuperscript{40}

Associated anomalies in 3 patients (3.4%) were intersex confirmed after XY karyotype and positive biopsy of testicular tissue following abdominal exploration. An infant with ambiguous genitalia is a problem of diagnosis and management.\textsuperscript{40}

Hypospasias as an associated anomaly (3.4%) was reported in our study.

Empty scrotum was the main presentation (100%). Scrotum is under developed in 74 patients 83.1% [Fig 3], this means that early examination of the new born child by doctors or midwives or parents [91%] can assist in early diagnosis and management, 14.6% intra-abdominal, 2.2% atrophied and
83.2% in inguinal region. Proper examination can aid in location of the testis.\(^{(40)}\)

Site of the testes on the right (36%) on the left (40.4%) and bilateral (23.6%). The right and left not in accordance with reported literature.\(^{(41)}\)

U/S was done to 28 patients (31.5%). No correlation between site of the testes preoperative and interoperative.

No correlation in our study, this explain by U/S is less useful in locating intra-abdominal testes because, the presence of gas in colon, fat and when the testis is less than 1 cm in diameters, and differentiation between testis and lymph node is difficult and needs an experienced sonologist.\(^{(42,43,44)}\)

Chromosome study done to 3 patients with inter-sex is 100% sensitive to confirm the sex aided by histopathology.

Laparatomy was done to all (3 patients) for incisional biopsy which increase the morbidity of the patient. No U/S or CT guided biopsy available.

**Hormonal study therapy:**
Are not used as a method of studying and therapy in patients with UDT in Sudan.

**Distribution of age and time of orchidopexy** (P. 0.000):

There is correlation between the patient's age and the outcome. Whenever the orchidopexy done early up to 2 years there is less chance of complications and good outcome [Table 5].

Most of our patients (39.2%) did orchidopexy between 6 - 10 years. This explains the late presentation and lack of health education.

Early correction of cryptorchidism before 2 years of age is recommended. The optimum age is 6 - 12 months.

Cryptorchidism is a known risk factor for testicular cancer and infertility.

Unilateral orchidectomy performed to small number to 2.2% due to marked atrophy. There is correlation between distribution of age and orchidectomy (P = 0.045), which is significant (Table 5). When ever the patient is late in presentation and older in age, there is high chance of orchidectomy.
Size of the testes is normal in 46.1%, moderate in 32.6%, small in 20.22%, atrophied in 2.2% (compared with the size of normally descended testis and measured clinically by tape. There is correlation between the size of the testes and the age (P= 0.000), which is significant. Older patients has a high chance of the testes to be small in size and atrophied.

Orchidometers and U/S\(^{(22)}\) are not used in measuring the size of the testes in our study.

Associated hernial sac was found in 100% during orchidopexy.

In literature more than 90\%(\textsuperscript{6}) during orchidopexy, the ratio in our series is lower but went parallel with the literature.

No retrectile testis was reported in our study and also ectopic testes.

There is significant relation between the result of orchidopexy and experience (\textbf{Table 6}) (P = 0.035), the place where this kind of surgery performed at S.U.H is main the tertiary referral hospital, where good facilities are available and well experienced paediatric surgeons are supervising.
Post operative complications: two patients (2.2%) develop acute urine retention treated conservatively and 4 patients (4.44%) has chest infection.

Follow up: 89 (100%) patients came for follow up after one week of surgery. No infection, testis in place, no retraction.

Six month follow up after surgery, 84 (86.5%) came to follow at 6 months of surgery.
CONCLUSION

• Undescended testis present late, with more than two-third of patients presenting between 3-10 years of age.

• The main presentation is an empty scrotum with associated hernial sac.

• Undescended testis is usually discovered by parents.

• In this study undescended testis with mainly a unilateral disease with the right and left sides having equal chances.

• Orchidopexy is carried out extremely late.
RECOMMENDATIONS

In the view of the data we obtained from the study and also from literature we draw the following recommendations:

1. Awareness of the disease and early referral to specialized centres.

2. Early age of surgery is better.

3. Training programm to junior specialists for early age orchidopexy.

4. Introduction of laproscopic technology as diagnostic and therapeutic procedure.

5. Postoperative follow up at 6 month interval in first year and then annually with good facility with patients contact.
REFERENCES


Fig. 1: Distribution of the study group according to age (in years)

Fig. 2: Distribution of the study group according to members of the family affected by the UDT
Fig. 3: Distribution of the study group according to member who discovered the disease (UDT)

- Parent: 81 (91%)
- Doctor: 4 (4.5%)
- Patient himself: 4 (4.5%)
Fig. 4: Status of parent's education

- Not educated: 27 (30.3%)
- Educated: 62 (67.7%)
Fig. 5: Distribution of the study group according to the status of presentation
Fig. 6: Distribution of the study group according to groin examination

- Impalpable: 69 (77.5%)
- Palpable: 20 (22.5%)
Fig. 8: Outcome of orchidopexy in the study group

One stage
78 (89.658%)

Two stage
9 (10.1%)