PREVALENCE OF UNDESCENDED TESTIS IN CHILDREN AGED 6 MONTHS TO 12 YEARS VISITING THE PAEDIATRIC FILTER CLINIC AT KENYATTA NATIONAL HOSPITAL

A DISSERTATION SUBMITTED IN PART FULFILMENT OF THE DEGREE OF MASTER OF MEDICINE IN PAEDIATRICS AND CHILD HEALTH AT THE UNIVERSITY OF NAIROBI

BY

DECLARATION

This dissertation is my original work and has not been submitted for the award of anycertification, diploma, degree, masters, or doctoral degree in any university to the best of my knowledge.

Sign: .....

Date: ……

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DEDICATION

I dedicate this work to my family for their unwavering support, understanding and encouragement during all these years of study.

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ABBREVIATIONS

CGRP	Calcitonin Gene-Related Peptide
CI	Confidence Interval
DES	Diethylstilbestrol
InsL3	Insulin Like Hormone
KES	Kenya Shillings
MIS	Mullerian Inhibiting Substance
RXFP2	Relaxin Family Peptide 2
SD	Standard Deviation
SGA	Small for Gestational Age
SHBG	Sex Hormone Binding Globulin
SRY	Sex-Determining Region on Y Chromosome
TDS	Testicular Dysgenesis Syndrome
UDT	Undescended Testis
WTI	Wilms Tumor Gene

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ABSTRACT

OBJECTIVE: The purpose of this study wasto determine the prevalence of undescended testis among children between the age of 6 months and 12 years attending the Paediatrics Filter Clinic at Kenyatta National Hospital.

RESEARCH DESIGN: This was a hospital- basedcross-sectional study.

SUBJECTS: **:**The study included 679 male children between the age of 6 months to 12 years attending the Paediatric Filter Clinic between September 2012 and April 2013 and whose parents/guardian gave consent for the study.

METHODS: A structured questionnaire was used for evaluation of sociodemographic data. History was taken from the parent/guardian to look for factors associated with undescended testes. Physical examination was used to ascertain if the testis were descended or undescended as it has been used on other published studies (35, 36, 37). Those testes not found in the scrotum were labelled as undescended.

RESULTS:Six hundred and forty seven male infants and children were included in this study. Of these 35(5.4%) were found to have undescended testis. In 20(57.1%) of the cases, undescended testis was found on the right side,10 of the cases(28.6%)were found on the left side,4 of the cases were found to have bilaterally undescended testis and there was one case of ambiguous genitalia who had been entered as a male infant .

CONCLUSION: A prevalence of undescended testis of 5.4% was found in this population of male infants and children visiting Paediatric Filter Clinic at Kenyatta National Hospital during the period of study. This study detects a similar prevalence to those reported in previous studies from sub-Saharan Africa.

RECOMMENDATIONS: It is recommended midwives, doctors and other health workers should routinely look for undescended testes whenexamining babies and children.

LITERATURE REVIEW

Introduction

The word cryptorchidism is a derivative of a Greek term that means obscure or concealed testis (Hutson, Hasthorpe, & Heyns 1997; Braga, Pemberton, & Cameron 2010). Undescended testis was first reported by Sir John Hunter in 1786 (Hutson & Beasley 1987; Braga, Pemberton, & Cameron 2010).Cryptorchidism is the most common abnormality of male sexual development. In this condition, the testis is not located in the scrotum.

Figure 1: Arrow Showing Undescended Left Testis

Embryology of the Human Testis/Gonadal Differentiation

Normal testicular development has been found to begin at conception (Hutson, Hasthorpe, & Heyns 1997; Braga, Pemberton, & Cameron 2010; Wensing 1988). The testis-determining gene is now identified as the *SRY* gene (sex-determining region on Y chromosome) (Hutson, Hasthorpe, & Heyns 1997; Braga et al. 2008; Hutson 1988). This gene provides an intact downstream, which is a pathway generally resulting in testicular formation (Wensing 1988; Feng, Ferlin, & Truong 2009). At 3-5 weeks' maturation, the indifferent gonad or gonadal ridge develops and at 6 weeks' maturation, primordial germ cell starts to migrate (Braga, Pemberton, & Cameron 2010; Braga & DeMaria 2009). Afterwards, Sertoli cells mature and secretesthe müllerian-inhibiting substance (MIS), which remains significantly high during the course of gestation and causes regression of müllerian ducts (Toppari & Kaleva 1999; Schneck & Bellinger 2007). By 9 weeks' gestation, Leydig cells

develop and start secreting testosterone (Feng et al. 2009; Koivusalo, Kaskinen, & Rintala 1998).Prenatal ultrasonography tests do not show any testicular descent prior to week 28'sdevelopmentapart from transabdominal movement to the internal inguinal ring (Schneck & Bellinger 2007; Davenport 1996). Transinguinal migration isbelieved to be controlled by hormones and it occurs at between week 28's and week 40's gestation (Feng et al. 2009; Braga, Pemberton, & Cameron 2010). This usually results in scrotal testis by the end of full term gestation (Schneck & Bellinger 2007;Feng et al. 2009).

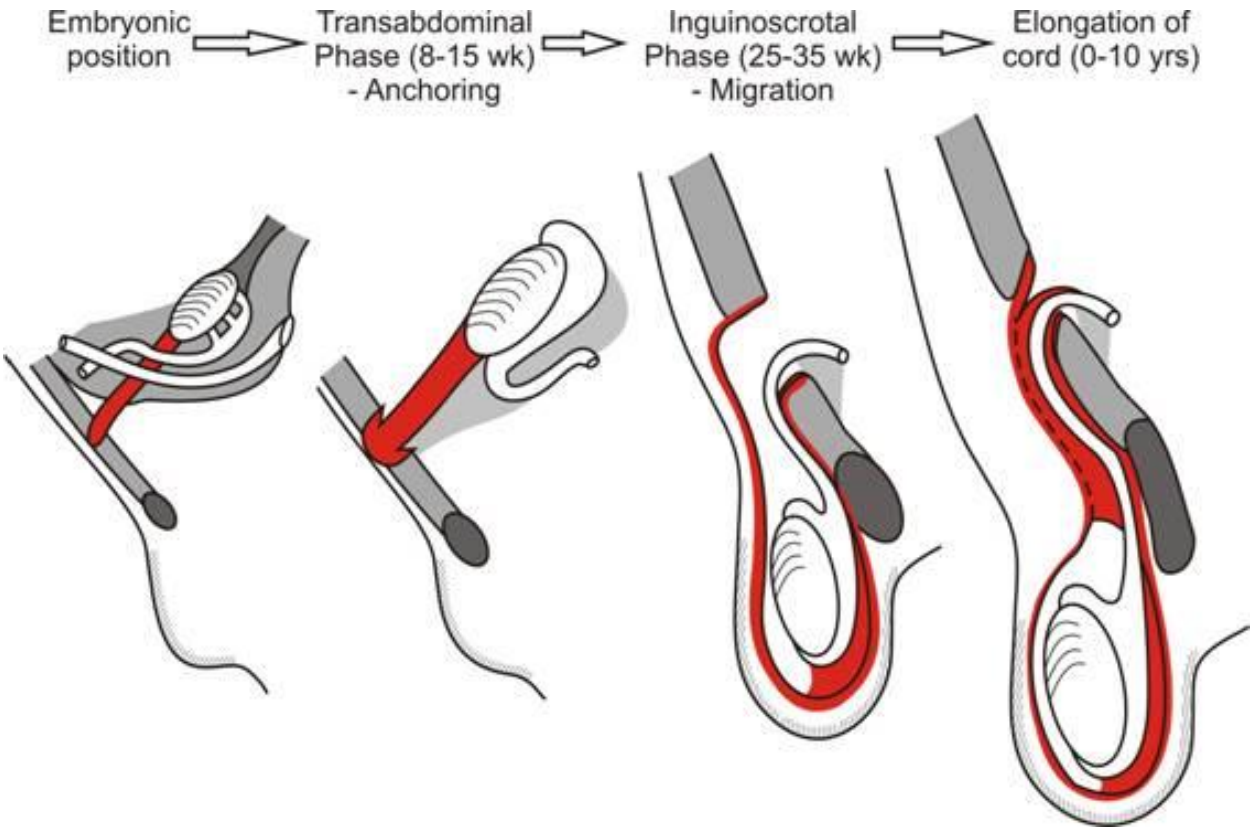

Figure 2: Physiology of normal testicular descent (Source: Martin Rizten et al. 2006)

***Transabdominal** Descent*

The transabdominal descent of the testes takes place between 8 and 15 weeks of gestation under hormonal direction (3). The descending testicles shiftto the inguinal region from the urogenital ridge simultaneously while shortening the gubernaculum, eversion of the cremasteric muscle, and testicular differentiation (5). The Leydig cell produce insulin-like hormone (*Insl3*) termed descendin mediates this transabdominal migration (3-5). Its receptor, relaxin family peptide 2 (*RXFP2 gene*), is expressed on the gubernculum (4).

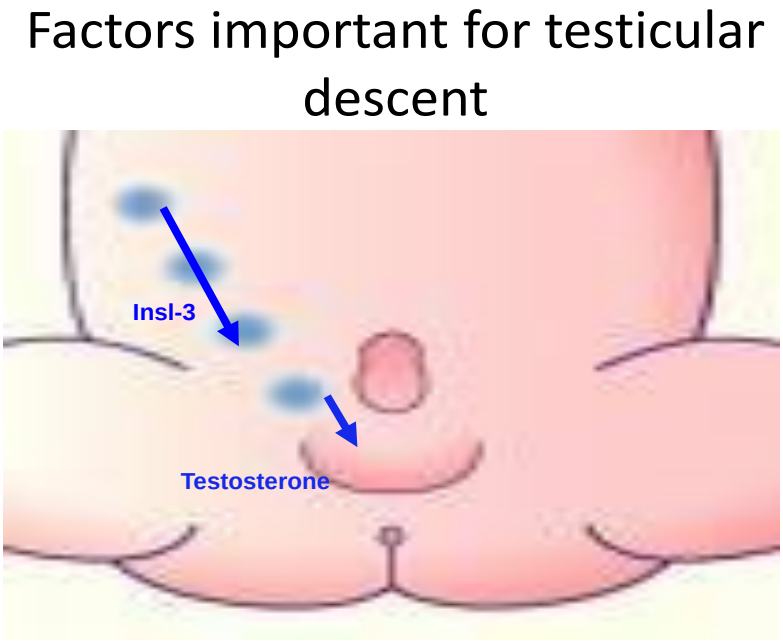

Figure 3: Factors important for testicular descent (Martin Ritzen et al. 2006)

***Inguinoscrotal** Descent*

The inguinoscrotal descent usually occurs between weeks 25 and 35 of the gestation. This process depends on *androgen* and heavily bank on testosterone and androgen receptors to transfer the testis from the inguinal canal to the scrotum (Foresta et al. 2008; Braga, Pemberton, & Cameron 2010; Frye, Peng, & Rajfer 1983). Androgens act on the genitofemoral nerve to induce the release of calcitonin gene-related peptide (CGRP) that is crucial in the promotion of rhythmic contractions of the gubernaculum, which leads to its extension and protrusion into the scrotal sac (Schneck & Bellinger 2007). In the process of protruding towards the scrotum,the *gubernaculum testis*pulls the testis down in the same direction (Hutson 2006). Additionally, the processus vaginalis - an evagination of the parietal peritoneum –tends to elongateas part of the internal inguinal ring encompassing the internal and external oblique muscles and thus creating a pathway for the descending testis to finally reach the scrotum (Feng et al. 2009). Once the process is complete, the inguinal canal is then dilated by the gubernacular bulb and thus allowing the testis to be pushed through the canal by increase in the intra-abdominal pressure (Braga et al. 2008). Premature boys have a higher propensity of having undescended testis at birth, although most of the testiswill have descended to the scrotum within 6 months that correlates to the gestational age(Okeke &

Osegbe 2001; Friedman 1996). If the testis has not reached the scrotum by 6 months of age, then it will not descend instinctively (Friedman 1996).

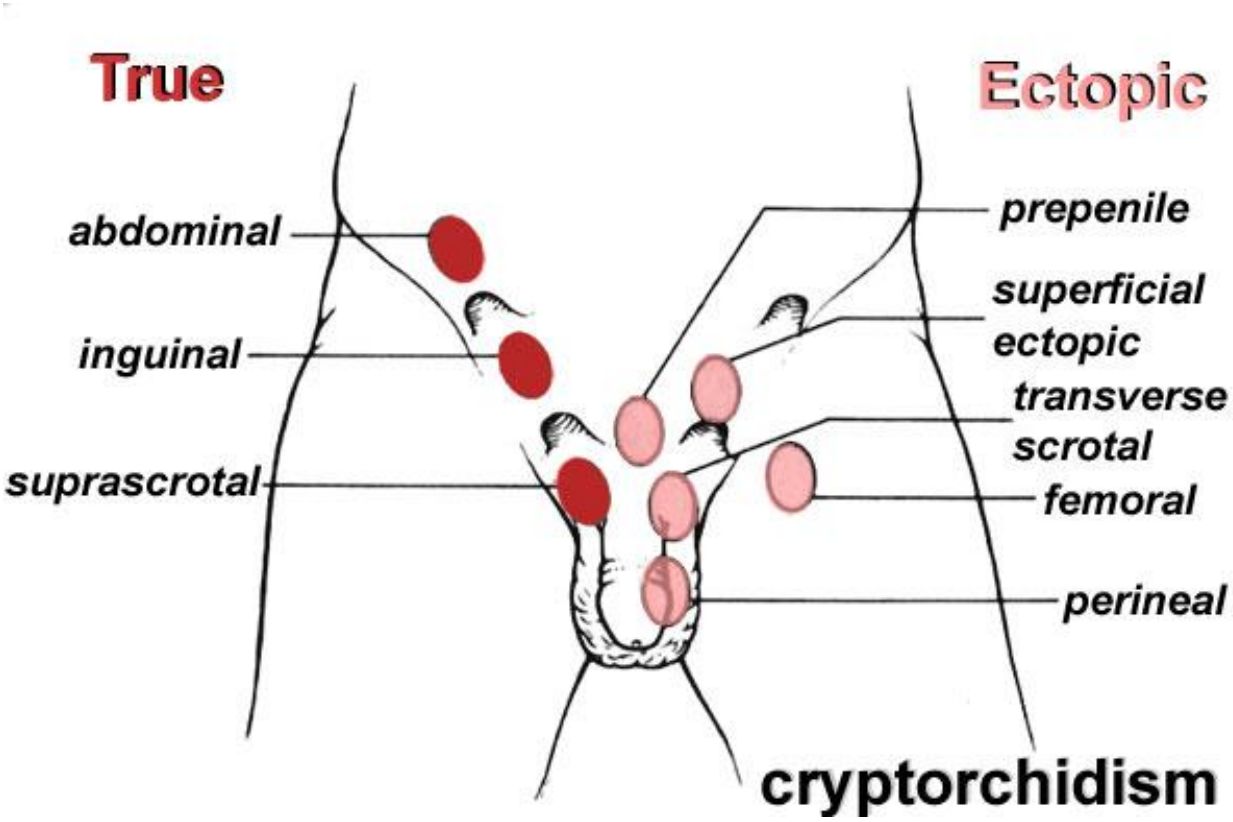

Figure 4: Various possible locations of undescended testis (Source: Martin Ritzen et al. 2006

Prevalence of Undescended Testis

In the United States, prevalence of undescended testis ranges between 3.7% at birth and 1.1% from age 1 year to adulthood. Internationally, prevalence ranges from between 4.3 % and 4.9% at birth to between 1 % and 2.5% at 3 months with the range at 9 months being between 0.8% and 1.5% (Fowler & Stephens 1959; Hutson & Beasley 1987, Hutson 1998; Taghizadeh & Thomas 2008). Cryptorchidism is identified in 1.5-4% of fathers and 6.2% of brothers of patients with cryptorchidism (Kolon, Patel, & Huff 2004; Ogunbiyi et al. 1996). Heritability in first-degree male relatives is estimated to be 0.67 (Kolon, Patel, & Huff 2004). Spontaneous descent into the scrotum usually occurs in the ensuing 3 to 6 postnatal months(Kolon, Patel, & Huff 2004; Osifo & Osaigbovo 2009).

Table 1: Various studies on prevalence of undescended testis

1	Reference first author	Where the study was conducted	Study design	Study population	Method of determination	Prevalence of undescended testis
2a	Boisen at al Lancet 2004(36)	Denmark	Prospective cohort study	Infants	Clinical examination	Birth 9% 3 months – 1.9%
2b		Finland	Prospective cohort study	Infants	Clinical examination	Birth 3.5% 3 months 1.4%
3	Osifo and Osaigbovo(37)	Nigeria	Prospective cohort study	Infants	Clinical examination	Neonates 2.9% 2years 1.8%
4	Sekabira et al(35)	Uganda	Cross – sectional study	Primary school age children	Clinical examination and abdominal ultra sound	5.5% of undescended testis
5a	Thorup and Cortes 1990(13)	Denmark		<20years		1980s 2-3%
5b		England and Wales		< 15years	Orchidoplexy rate	1950s – 1.4% 1970s – 2.9%
6	John Radcliffe Hospital Cryptochidism(25)	USA	Cryptorchidism Study Group	Infants		1.6%

Prospective studies on congenital cryptorchidism

In prospective studies using similar and clearly defined criteria of cryptorchidism the prevalence of cryptorchidism has varied between 1.6 and 9.0% at birth. Preterm boys have been described to have a higher rate of cryptorchidism and when including only boys with birth weight ≥ 2500g, the prevalence has varied between 1.8 and 8.4%. Comparison of the studies performed during the last two decades suggests that there are geographical differences in the prevalence of cryptorchidism.

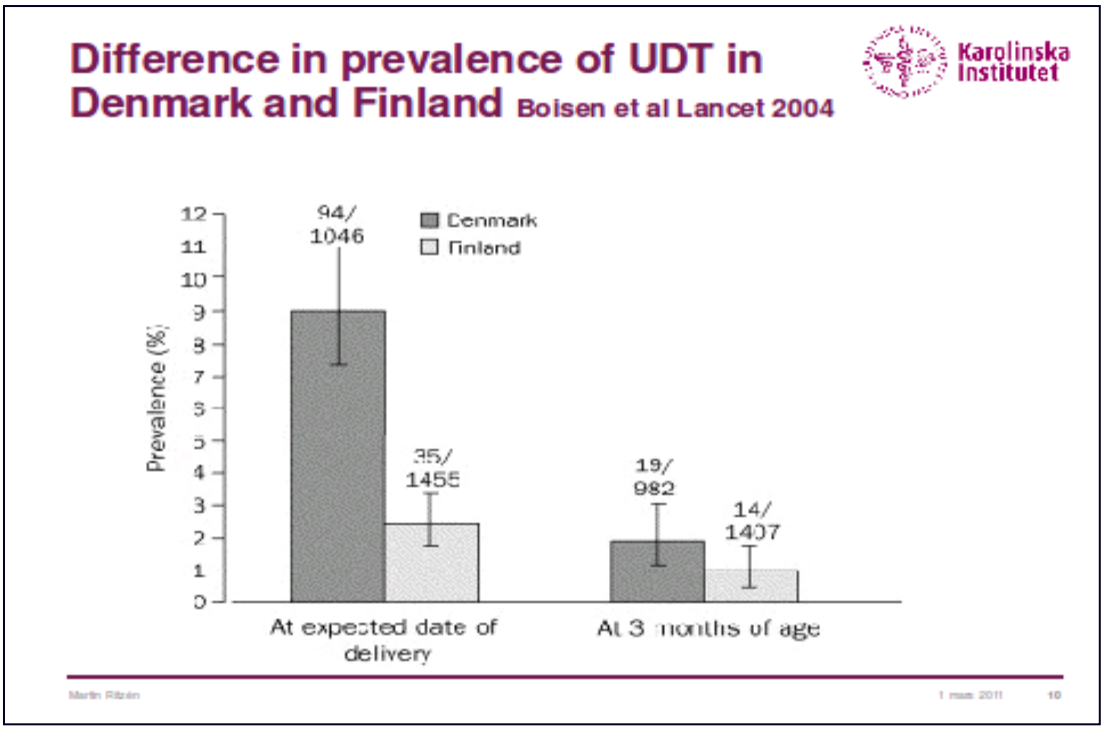

Figure 5: Difference in prevalence of undescended testis between Denmark and Finland

Furthermore, results from countries where repeated studies have been performed suggest an increasing trend in the incidence of congenital cryptorchidism.Congenital cryptorchidism is often followed by spontaneous testicular descent and accordingly lower rates of cryptorchidism that lies between 0.9 and 1.8% have been described at the age of 3 months among boys with birth weight ≥2500 g (Hutson 2006; Schneck & Bellinger 2007).This spontaneous descent occurs usually during the first few months of life. Spontaneous descent has been proposed to be more likely in infants with low birth weight, preterm birth or bilateral cryptorchidism.

In Africa, a prospective study was done on children who underwent neonatal circumcision at the University of Benin Teaching Hospital, Benin City, and Leadeks Medical Centre, both in Edo state, Nigeria, between January 2002 and December 2007 by Osifo and Osaigboyo (2009) and Adeoti et al. (2004). The purpose of these studies was to determine the prevalence, age at postnatal descent, and age at which complications set in. Those diagnosed with undescended testes were recruited into the study and followed up at the surgical outpatient clinic for 2 years (Kollin et al. 2007). Among 6180 children circumcised 186 had undescended testes (Osifo & Osaigboyo 2009).

On follow-up, 65 (34.9% of the subjects) testes mainly among preterm neonates (P = .2450) fully descended within 7 months with no testicular descent recorded afterwards (Osifo & Osaigboyo 2009). Prevalence rates of 2.9% in neonates and 1.8% at 2 years old were recorded. Reduction in epididymoorchitis, testicular volume, and testicular torsion were recorded in 52 (accounting for 28%) undescended testes between 12 and 24 months on follow-up (Osifo & Osaigboyo 2009). this shows why undescended testis should be detected and early correction done.

Prevalence in malformation register-based reports

Reports based on malformation registers proposed an increasing trend in the rate of cryptorchidism, for instance in the 1970s and 1980s the reported rates increased from below 20 per 10 000 total births to over 40 per 10 000 total births in USA and from below 15 per 10 000 total births to almost 30 per 10 000 total births in Canada(Radcliff 1992). A large survey from the John Radcliffe Hospital Cryptorchidism Study Group (1992) suggested that there had been an increase in the incidence of cryptorchidism to 1.6%(Berkowitz et al. 1993).

Prevalence in studies based on orchidopexy figures

In Denmark, the cumulative risk for a person being operated for cryptorchidism before attaining the age of 20 years was 2 to 3% in the 1980s (Cortes, Thorup, & Visfeldt 2001). In England and Wales, data based on orchidopexy rates indicated an increasing trend in the cumulative rate of cryptorchidism in boys below 15 years from 1.4 to 2.9% between the 1950s and the 1970s (Pettersson et al. 2007).

Prevalence in clinical studies on school-aged boys

In studies concerning school-aged children very variable figures on cryptorchidism rates have been described. For instance in a Nigerian studyby Boisen et al. (2004) the rate was 0.82% among 5–13-year old boys, whereas in Denmark a rate of 7.0% was reported in boys aged 6 to 16 years (Paulozzi 1999). In both studies cryptorchidism was defined as a testis that could not be manipulated into the bottom of the scrotum. A cross sectional study was undertaken with the main objective of determining the prevalence and patterns of

undescended testis among 437 primary school pupils from randomly selected primary schools in one Division of Kampala in Uganda (Brown 1999; Sekabira, Kaggwa, & Birabwa-Male 2001).

The study variables included tribe, age, side, scrotal findings, and location of the undescended testis plus associated groin and external genitalia abnormalities. Undescended testis was found in 27 of the 437 children (Sekabira, Kaggwa, & Birabwa-Male 2001; Giwercman et al. 1993). The right side alone was involved in 17 (63%), the left alone in 5 (18.5%) and was bilateral in five cases (18.5%) (Sekabira, Kaggwa, & Birabwa-Male 2001). Sixteen (59%) of undescended testis were palpable in the inguinal region while in 11 (41%) could not be palpated (Sekabira, Kaggwa, & Birabwa-Male 2001). Ultrasonography of the groin area located five of the 11 impalpable testes. This study showed that the prevalence of undescended testis in the study population was 5.5% and occurred more commonly on the right side and the superficial inguinal pouch was the commonest site (Sekabira, Kaggwa, & Birabwa-Male 2001).

Risk factors for cryptorchidism in epidemiological studies

Several risk factors for cryptorchidism have been described in epidemiological studies. Several studies have found some significant level of low birth weight to be correlated to being born with small for gestational age (SGA), and preterm delivery as such risk factors (Thong, Lim, &Fatimah 1998; Hjertkvist, Damber, & Bergh 1989; Foresta & Ferlin 2004). Low birth weight has been identified as a risk factor also in studies where gestational age was taken into account (Thong, Lim, &Fatimah 1998; Jackson & Swerdlow 1986).In addition the risk of cryptorchidism has been described to increase with decreasing gestational age, which is in line with the timing of testicular descent described previously. Moreover, prematurity has been associated with a two-fold risk of being cryptorchid at the age of 1 year, even after adjustment for confounding factors including birth weight as expounded in Thong, Lim, and Fatimah (1998), although register-based studies found no significant association between

cryptorchidism and gestational age after adjustment for birth weight (Jackson & Swerdlow 1986).

Cryptorchidism has also been associated with an increased incidence of other genital abnormalities like hypospadias, in several studies. This observation supports the theory of placental malfunction and subsequently disturbed fetal androgen production as etiological factors in cryptorchidism, which has been proposed in the epidemiological studies (Thong, Lim, & Fatimah 1998; Jackson & Swerdlow 1986). Androgens have been suggested to explain the gender difference in birth weight. Thus, also the description of low birth weight as a risk factor for cryptorchidism is in accordance with the theory of disturbed androgen action having a role in the development of cryptorchidism. Impaired placental function and possibly altered hCG secretion has also been proposed to explain the seasonal variation of cryptorchidism that has been described in some studies(Jackson & Swerdlow 1986).Complications during pregnancy, like in the case of pre-eclampsia and maternal diabetes that have been associated with cryptorchidism in some studies (Jackson & Swerdlow 1986).

The mechanism of the association between cryptorchidism and gestational diabetes is unknown. However, theoretically, gestational diabetes may be associated with an imbalance of estrogen action and fetal androgen (Hosie, et al. 2000).This is because it has been associated with reduced levels of maternal sex hormone binding globulin (SHBG) and fetal hyperinsulinemia that in return tend to reduce fetal SHBG (Hosie et al. 2000).Many of the genes causing some of the intersex conditions associated with androgen deficiency or insensitivity have been identified, and genetic counselling to explain recurrence risk to families is appropriate (Gill et al. 1979; Elert et al. 2003).

Cryptorchidism tends to occur at an increased rate in a wide variety of congenital malformation syndromes (Boisen et al. 2004). Among the more common are Noonan syndrome, Prader-Willi syndrome, and cloacalexstrophy (Hutson & Beasley 1987, Frey, Peng, Rajfer 1983, Tzvetkova & Tzvetkova 1996).Cryptorchidism tends to be common

among patients with gastroschisis and prune belly syndrome, both of which are associated with decreased intra-abdominal pressures (Hutson & Beasley 1987, Frey, Peng, Rajfer 1983, Tzvetkova & Tzvetkova 1996).This leads to increased aromatase activity, Y-chromosome microdeletions, and abnormalities in the Wilms tumor gene (*WT1*) (Huff et al. 2001; Lim, Hughes, & Hawkins 2001).

Environmental factorsrelated to undescended Testis

It has been proposed that hypospadias, cryptorchidism, decreased semen quality,and testicular cancer may often represent testicular dysgenesis syndrome (TDS) of fetal origin (Abratt, Reddi, & Sarembock 1992). In animal studies,exposure to chemicals with anti-androgenic or estrogenic effects has been shown to cause these TDS-linked disorders, except for germ cell cancer (Paulozzi 1999). The same case appliesto humans with a good example being maternal exposure to diethylstilbestrol (DES) during pregnancy being associated with cryptorchidism in male infants. Environmental factors having estrogenic or anti-androgenic effects have therefore been proposed to have a role in the increasing frequency of disorders of male reproductive health (Hosie et al. 2000).

A contributing role of environmental chemicals by endocrine disruptors has the ability to disrupt normal endocrine homeostasis and they include synthetic and natural hormones, xenoestrogens (industrial chemicals), phyto-oestrogens [like in soya], and mycoestrogens among other substances that affect the endocrine signalling (Okeke & Osegbe 2001).These factors contribute to cryptorchidism and its increased incidence in recent years (Tzvetkova & Tzvetkov 1996).

COMPLICATIONS ASSOCIATED WITH UNDESCENDED TESTIS

Infertility

The infertility rate in unilateral cryptorchidism is estimated to be 10% as compared to the reported 6% by the same study for the general population of adult men (Fact Sheets 2009; Hutson 1998; Wood & Elder 2002, 2009).The fertility reduction for bilateral cryptorchidism is more pronounced at approximately 38%, which is 6 times the reported value of the general

population. The universal recommendation for early surgery is based on research showing reduced spermatogonia counts and degeneration of spermatogenic tissue after the second year of life in undescended testes (Akre, Pettersson, & Richiardi 2009;Papparella et al. 2005;Fowler & Stephens 1959).

When should undescended testes be detected and referred? Possible strategies….

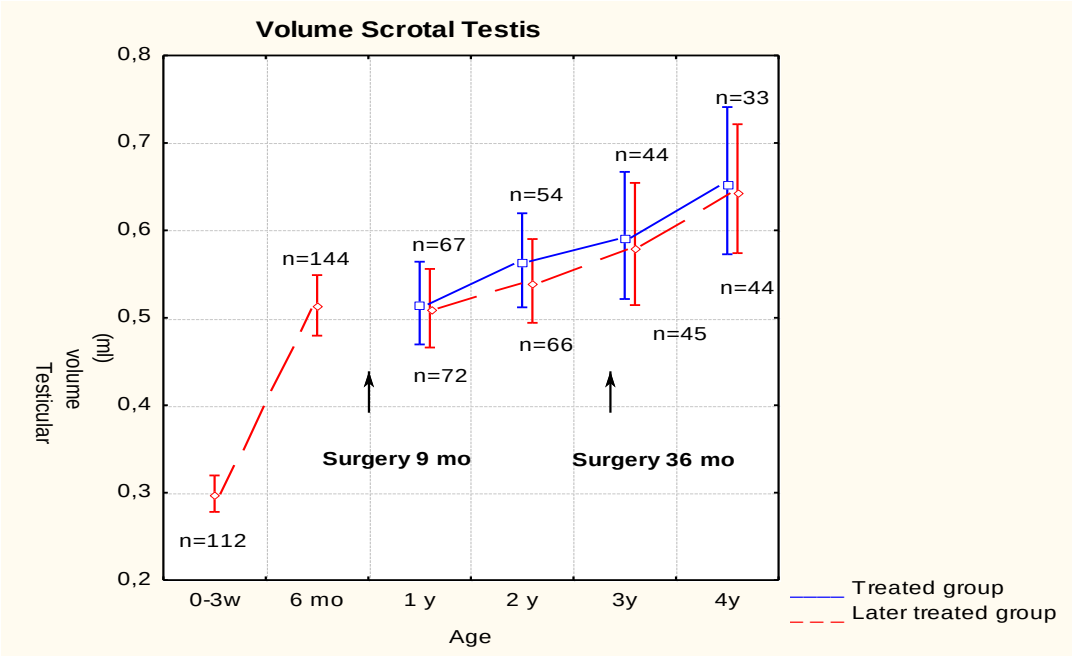

Figure 6: Optimal age of orchidopexy (Source: Martin Ritzen et al. 2006)

Fig. 6 above shows a prospective randomized study on the optimal age of orchidopexy that supported the current trend towards surgerybetween one to one and a half years of age.Studies indicate that testicular growth can be improved by orchidopexy at 9 months but not at 36months of age.Since testicular volume generally reflects spermatogenic activity, early surgery gives hopes for improved spermatogenesis in adulthood.

Pathophysiology of infertility in undescended testis

Temperature is the one contributing mechanism for reduced spermatogenesis in cryptorchid testes (Tzvetkova & Tzvetkov 1996). The temperature of testes in the scrotum is at least a couple of degrees cooler than in the abdomen. Animal experiments in the middle of the 20th century suggested that raising the temperature could damage fertility. Some circumstantial evidence suggests tight underwear and other practices that raise testicular

temperature for prolonged periods can be associated with lower sperm counts (Miller, Coughlin, & Lee 2001). The inhibition of spermatogenesis by ordinary intra-abdominal temperature is so potent to such an extent that continual suspension of normal testes tightly against the inguinal ring at the top of the scrotum using specialized *suspensory briefs* has been researched (Miller, Coughlin, & Lee 2001; Abratt, Reddi, & Sarembock 1992).This was thus used as a method of male contraception and was referred to as "artificial cryptorchidism" by one report (Huff et al. 2001, Lee & Coughlin 2002, Hadziselimovic & Herzog 2001).

An additional factor contributing to infertility is the anomalies of the epididymis in boys with cryptorchidism (Hutson et al. 1994; Lee & Coughlin 2001; Lee et al. 1997). Even after orchiopexy, these may also affect sperm maturation and motility at an older age (Lee et al. 1997; Paulozzi 1999).

Later Cancer Risk

One of the strongest arguments for early orchiopexy is prevention of testicular cancer (Fact Sheets 2009; Wood& Elder 2009; Akre, Pettersson, & Richiardi 2009). About 1 in 500 men born with one or both testes undescended develops testicular cancer, about 4 to 40 fold increased risk (Akre, Pettersson, & Richiardi 2009; Pettersson et al. 2007). The peak incidence occurs in the 3rd and 4^{th} decades of life. The risk is higher for intra-abdominal testes and lowers for inguinal testes (Cortes, Thorup, & Visfeldt 2001; Abratt, Reddi, & Sarembock 1992; Pettersson et al. 2007).The most common type of testicular cancer that occurs in undescended testes is the seminoma.This form of testicular cancer is usually treatable if detected early and thus urologists often recommend that boys who had orchiopexy as infants be taught testicular self-examination to recognize testicular masses and seek early medical care for them. Cancer developing in an intra-abdominal testis would be unlikely to be recognized before considerable growth and spread, and one of the advantages of orchiopexy is that a mass developing in a scrotal testis is easier to recognize than an intra-abdominal mass(Cortes, Thorup, & Visfeldt 2001; Pettersson et al. 2007).

Initial assumptions were that orchidopexy resulted in faster detection of testis cancer, but never lowered the risk of actually developing cancer (Abratt, Reddi, & Sarembock 1992; Hutson et al. 1994; Radcliff 1992). However, recent data has resulted in a paradigm shift. The New England Journal of Medicine published in 2007 that orchidopexy performed before puberty resulted in a significantly reduced risk of testicular cancer than if done after puberty(Petersson et al. 2007).The most common tumor developing in an undescended testis is a seminoma (65%) in contrast, after orchiopexy, seminomas represent only 30% of testis tumors(Cortes, Thorup, & Visfeldt 2001,Pettersson et al. 2007).

Psychological Effects of Undescended Testis

An empty scrotum has psychosocial implications among our children, including low self-esteem, poor school performance, shame and guilt (Cytryn, Cytryn, & Reiger 1967; Friedman 1996; Meyer-Bahlburg et al. 1974). Social isolation and bullying also occur (Friedman 1996). A disturbed self-image forms and especially when the family dynamics are destructive to developing male self-esteem (Elert et al. 2003). However, when the cryptorchism is surgically corrected a healthy masculinity becomes a possibility (Hosie et al. 2000). The basic sexual normality of these boys was confirmed in a small retrospective study that tested adolescent boys several years after their condition was surgically repaired. They had developed into fairly well adjusted teenagers without special sexual or gender problems, and with no distinctive traits of psychopathological relevance (Cytryn, Cytryn, & Reiger 1967, Friedman 1996, Meyer-Bahlburg et al. 1974).

STUDY JUSTIFICATION AND UTILITY

A testis located outside the scrotum is prone to a lot of complications, but early detection and correction often results in good outcome. Undescended testis lead to abnormalities in male fertility and masculinity later. This study will inform the health care professional on the burden and the importance of the genital area examination of male infant and children. The prevalence of undescended testis has been reported to have varying geographical distribution in various studies done elsewhere, but the burden of this disease in

the Kenyan context is not well-known. This study will provide important data on prevalence and associated factors for undescended testis in our community that is lacking in current research works. The results will be useful, not only in improving the management and quality of life of patients with undescended testis, but also in serving as a basis for appropriate further research on possible aetiological factors.

OBJECTIVES

General Objective

- To determine the prevalence of undescended testis in male infants and children between the age of 6 months and 12 years attending the Paediatric Filter clinic at Kenyatta National Hospital.

Specific Objective

- To determine the factors associated with undescended testis including
    - Socio-demographic characteristics,
    - Gestational age at birth,
    - Birth weight,
    - Any known inguinal congenital anomaly affecting the patient, his biological father, or the patient's sibling's and the type of such anomaly

STUDY METHODOLOGY

Study Design

This was a hospital based cross-sectional study.

Study Site

Kenyatta National Hospital at the Paediatric Filter clinic which has about 130 children attending the clinic each day among whom approximately half are male.This is a government and national referral hospital which also serves the population within Nairobi Province. It is also a teaching hospital for the University of Nairobi.

Study Period

The study wasconducted between September 2012 andApril 2013.

Study Population

The study population were male infants and children between the age of 6 months and 12 years presenting at the Kenyatta National Hospital paediatric filter clinic for treatment.

Patient Selection

Inclusion Criteria:

- Male infants and children between the age of 6 months and 12 years presenting to the Paediatric Filter clinic at Kenyatta National Hospital for treatment and whose parents/guardian gave informed and signed consent to participate in the study together with assent from the child if above 7 years (see Appendix 111) .

Exclusion Criteria:

- Parents/guardians who refuse to consent.

Sampling Technique

Consecutive patients who satisfied the inclusion criteria during the study period were recruited into the study.

Sample Size Calculation

Sample size was calculated using Fischer's formula

$$n = \frac{Z^2{}_{\propto/2} \times P(1-P)}{d^2}$$

Where,

n = sample size

$Z^2{}_{\propto/2}$= The corresponding value to the 95% confidence level (1.96)

d = absolute precision (5%)

p = known prevalence from other studies

The international prevalence of undescended testis at 9 months of age ranges from-0.8-2.5%.The prevalence of undescended testis at 9 months of age is 1.7% for studies between January 2002 and December 2007 Osifo and Osaigbovo 2009).

Therefore

$$n = \frac{(1.96)^2 \times 0.017(1 - 0.017)}{(0.01)^2} = 642$$

Screening and recruitment

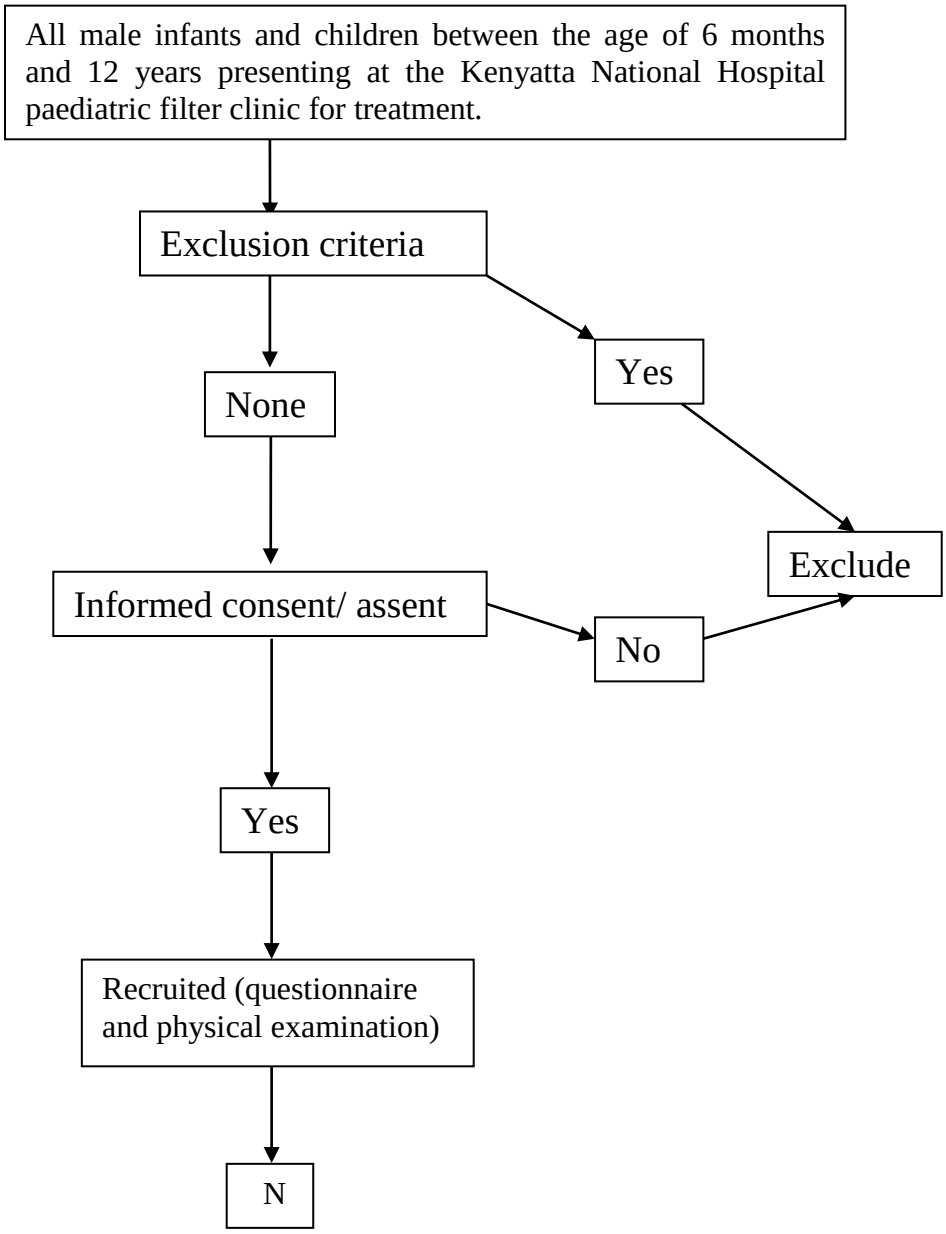

Figure 7: Flow chart of screening and recruitment

STUDY DEFINITIONS

Undescended testis

Any testis not palpated in the scrotum was labelled as undescended testis.

DATA COLLECTION

Clinical methods

A procedure wasused for evaluating social demographic data and other relevant history.Eligible patients were enrolled in the study by entering their names into a register

book and were allocated a code number. Socio-demographic data, specifically relating to age, level of education and monthly income of the parent/guardian and whether in paid employment (see Appendix A).

A complete medical history was obtained and a comprehensive medical examination undertaken. Height was determined to the nearest 5mm with a rigid stadiometer against a vertical wall. Weight was measured without shoes or heavy clothing to the nearest 50g.

Genital physical examination was used to ascertain whether there is undescended testis as it has been used in other published studies (Okeke & Osege 2001, Boisen et al. 2004; Osifo & Osaigbovo 2009).The patient was warm and relaxed for the examination.While lying on a comfortable examination coach, the patient was undressed upto the level of umbillicusand down to the level of the knees and then he was placed in the frog-leg position for examination. This wasparticularly useful in obese children with fatty infiltration of the scrotum and when retractility was a concern. Observation preceded the palpation examination. Milking down palpationwas performed from iliac crest to scrotum Hemiscrotal asymmetry and contralateral testicular hypertrophy was looked for: both are partial indicators of an absent testis.

Figure 8: Hypoplastic Right Hemiscrotum in a Patient with an Undescended Right Testis

Any testis not palpated in the scrotum was labelled as undescended testis. Patients with undescended testis were referred appropriately to endocrinology and paediatric surgery clinic at Kenyatta National Hospital for management at their own costs.

DATA MANAGEMENT AND STATISTICAL ANALYSIS

The data was entered in a statistical program Statistical Product and Service Solutions (SPSS) version 17 for analysis. Chi-square tests were used to compare categorical variables and proportions across groups. Continuous variables were compared using student t-test and Mann-Whitney U test. A p value of less than 0.05 was considered statistically significant.

ETHICAL CONSIDERATIONS

(i) The study was conducted after written approval by the Department of Paediatrics and Child Health, University of Nairobi, and the Kenyatta National Hospital Scientific and Ethical Review Committee.

(ii) The study was carried out on children whose parents/guardians had given informed consent.

(iii) Children found to have undescended tetsis were referred for further care.

(iv) Information gathered was treated with confidentiality.

(v) Laboratory results were availed to the clinician taking care of the patient for patient management.

(vi) There was no added cost to the patient.

RESULTS

Background and other characteristics of the study respondents

A total of 647male infants and children aged 6 months to 12 years were included in thisstudy.The calculated target of 642 was surpassed because a total of 679 participants were selected. Out this group, 32 responses were disqualified on technical grounds, thus leaving 647 participants. Each of the recruited cases was discovered to have missing critical data during analysis.

Socio-demographic and socio-economic characteristics of the study participants:

Table 2 presents selected socio-demographic and socio-economic characteristics of the study participants. Median age of the children was 30 months ranging between 6 and 144 months. Most of the children (40.2%) were aged more than 3 years (36 months) with the lowest number (25.3%) aged less than or equal to 12 months.Median weight of the children was 12.5 kg ranging between 4.5 and 36.0 kg, with majority of the children (65.5%) weighing less than 15 kg. Analysis of level of education for parents of the study children revealed that most of the highest level attained was primary (53.5%) with 2.8% having no formal education and 20.4% attaining tertiary (College/University) level education.

Parent/Guardian's monthly income for most of the children (35.0%) was 10000 - <20000 Kenya shillings.Upon probing whether the respondents received financial assistance, majority of them (65.4%) indicated that they do not receive any financial assistance with 5.7% indicating that they were self-employed.

Table 2: Socio-demographic and socio-economic characteristics among the study population

Variables	n=647	%
Age in months		
<=12 months	164	25.3
13 - 36 months	223	34.5
>36 months	260	40.2
Weight in kg		
<10 kg	186	28.7
10 - <15 kg	238	36.8
15 - <20 kg	120	18.5
20 - <25 kg	55	8.5
25 kg or more	48	7.4
Parents level of education		
No formal education	18	2.8
Primary school	346	53.5
Secondary School	151	23.3
College	125	19.3
University	7	1.1
Parent/Guardian's monthly income		
<10000	43	7.5
10000 - <20000	201	35.0
20000 - <30000	152	26.5
30000 - <40000	115	20.0
40000 or more	63	11.0
Non-response	73	
Financial assistance		
None	423	65.4
Relatives	104	16.1
Employer	83	12.8
Self employed	37	5.7

Medical history among the study children

The various variables on medical history among the study children are presented in Table 3. A significant majority of the children (90.9%) were born at term and (76.0%) were

born at normal birth weight (≥ 2.5kg) only (0.8%) of the children had congenital disease with 0.5% ever having abdominal or inguinal surgery.Upon probing on whether there was known inguinal congenital anomaly affecting the patient, his biological father or siblings, 41.7% of the respondents indicated that indeed there was such history.

Table 3: Medical history among the study children

Variables	n=647	%
Born at term		
Yes	588	90.9
No	59	9.1
Birth weight >=2.5kg		
Yes	492	76.0
No	155	24.0
The child had congenital disease		
Yes	5	0.8
No	642	99.2
History of abdominal or inguinal surgery		
Yes	3	0.5
No	644	99.5
Known inguinal congenital anomaly affecting the patient, his biological father or siblings		
Yes	270	41.7
No	377	58.3

Figure 8 presents the prevalence of undescended testis among the study population.Thirty five (35) children had undescended testis. The prevalence of undescended testis among the study population was 5.4% (95% CI=3.7% to 7.1%).

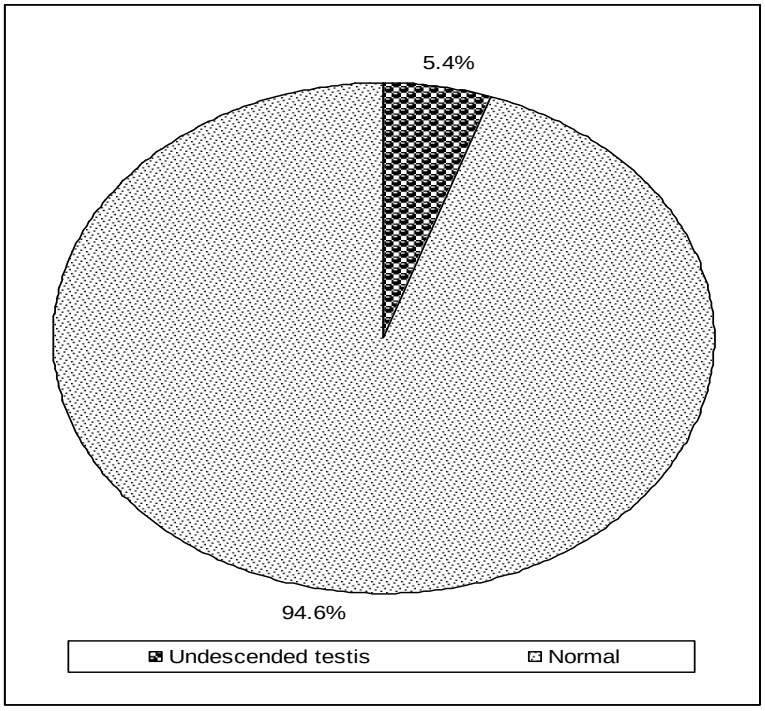

Figure 9: Prevalence of undescended testis among the study children

Distribution of children by affected side among those with undescended testis was done as presented in Figure 10. Most of the children (57.1%) were affected on the right side, with 2.9% having ambiguous genitalia.

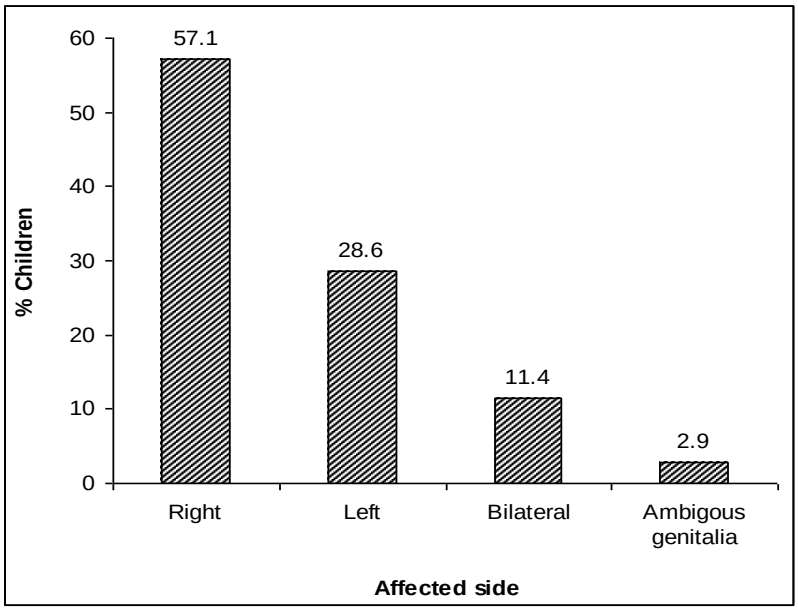

Figure 10: Distribution of children by affected side among those with undescended testis

Among the 35 children with undescended testis in figure 10, 20(57.1%) had a right undescended testis, 10(28.6%) were on the left, 4(11.4%) were bilateral and 1(2.9) were ambiguous genitalia.

Occurrence of other inguinal congenital anomalies among the study children was done as presented in Figure 10. There was a rare occurrence of other inguinal congenital anomalies (1.5%) constituted by inguinal hernia and poorly developed scrotum.Inguinal hernia wasdetected in 2 out of the 4 cases with bilaterally undescended testis, 2 out of 20 cases of right sided UDT compared with 1 case out of 612 cases of normally descended testis.

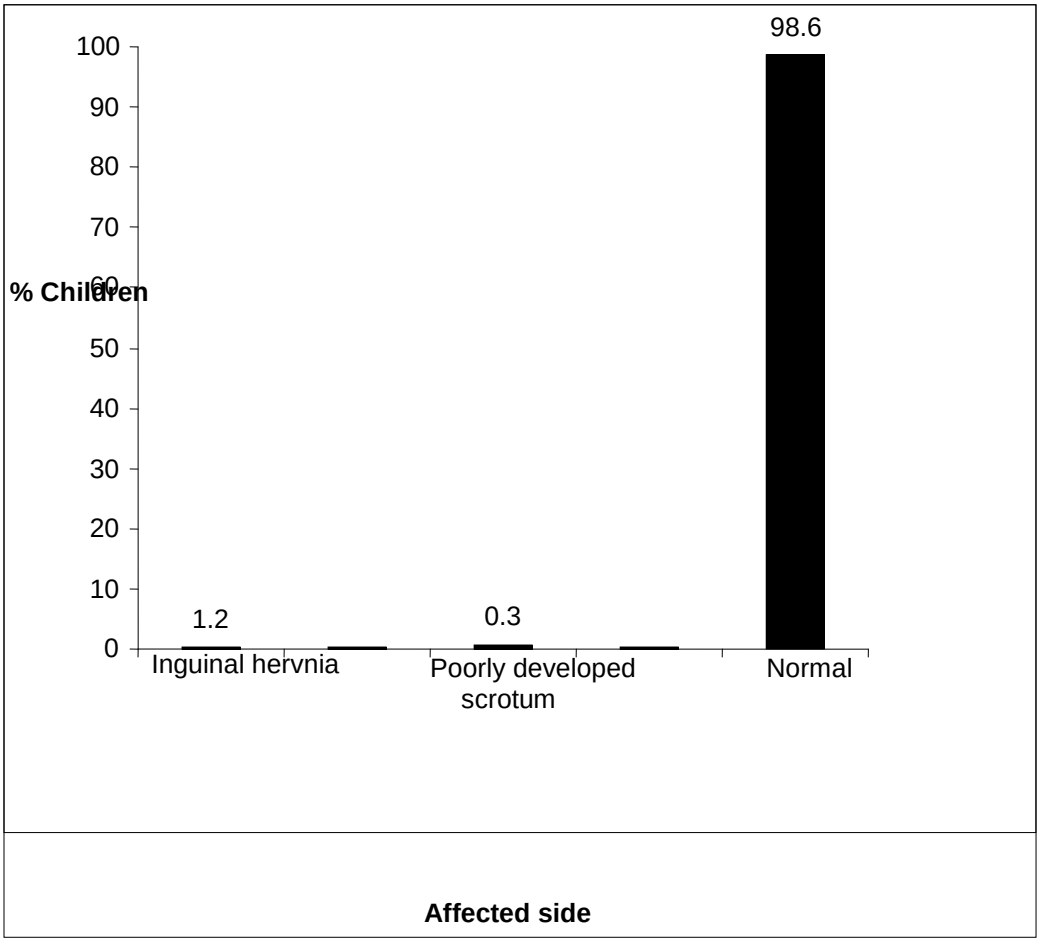

Figure 11: Other inguinal congenital anomalies among the study children

Table 4: Occurrence of Other inguinal congenital anomalies by the affected side

Undescended testis (affected side)/ Other inguinal congenital anomalies	*Inguinal hernia*	*Micropenis*	*hypospandia*	*Poorly developed scrotum*	*Normal*	*Total*
Right	2	0	0	0	18	20
Left	0	0	0	0	10	10
Both	2	0	0	1	1	4
Ambigous genitalia	0	1	1	1	0	1
Normal	1	0	0	0	611	612
Total	5	1	1	1	638	647

Occurrence of undescended testis among the study children in relation to selected socio-demographic and socio-economic characteristics

Table 5 presents occurrence of undescended testis among the study children in relation to selected socio-demographic and socio-economic characteristics. Two factors namely Parent's/Guardian's monthly income were significantly associated with occurrence of undescended testis among the study children.

Parent/Guardian's monthly income <10000 Kenya shillings was significantly associated with increased number of children having undescended testis(14.0%) compared to Parent/Guardian's monthly income of 30000 KSHS or more (1.7%), (OR=9.46; 95% CI: 2.26 – 39.55; p=0.002).

Table 5: Occurrence of undescended testis among the study population in relation to selected socio-demographic and socio-economic characteristics

Variables	Yes (n=35)		No (n=612)		OR	95% CI		p value
	n	%	n	%		Lower	Upper	
Age of child in months								
<=12 months	10	6.1%	154	93.9%	1.47	0.61	3.54	0.391
13 - 36 months	14	6.3%	209	93.7%	1.52	0.67	3.41	0.314
>36 months	11	4.2%	249	95.8%	1.00			
Weight in kg								
<10 kg	12	6.5%	174	93.5%	2.30	0.63	8.34	0.206
10 - <15 kg	17	7.1%	221	92.9%	2.56	0.73	8.95	0.140
15 - <20 kg	3	2.5%	117	97.5%	0.85	0.17	4.33	0.850
20 kg or more	3	2.9%	100	97.1%	1.00			
Parents level of education								
None	2	11.1%	16	88.9%	2.62	0.49	14.12	0.261
Primary school	12	3.5%	334	96.5%	0.75	0.28	2.05	0.581
Secondary School	15	9.9%	136	90.1%	2.32	0.87	6.15	0.092
College/University	6	4.5%	126	95.5%	1.00			
Parent/Guardian's monthly income in Kenya shillings								
<10000 KES	6	14.0%	37	86.0%	9.46	2.26	39.55	**0.002**
10000 - <20000 KES	11	5.5%	190	94.5%	3.38	0.93	12.31	0.065
20000 - <30000 KES	5	3.3%	147	96.7%	1.98	0.47	8.44	0.354
30000 KES or more	3	1.7%	175	98.3%	1.00			
Non response	10		63					
Financial assistance	35		612					
None	21	5.0%	402	95.0%	0.59	0.17	2.09	0.415
Relatives	9	8.7%	95	91.3%	1.07	0.27	4.20	0.919
Employer	2	2.4%	81	97.6%	0.28	0.04	1.75	0.173
Self employed	3	8.1%	34	91.9%	1.00			

Occurrence of undescended testis among the study children in relation to medical history

Table 4.5 presents occurrence of undescended testis among the study children in relation to medical history. One factors namely *presence of congenital disease* was

significantly associated with occurrence of undescended testis among the study children. *Presence of congenital disease* was significantly associated with increased number of children having undescended testis(60.0%) compared to absence (5.3%), (OR=28.59; 95% CI: 4.16 – 177.21; p=0.001).

Table 6: Occurrence of undescended testis among the study population in relation to medical history

Variables	Yes (n=35)		No (n=612)		OR	95% CI		p value
	n	**%**	**N**	**%**		**Lower**	**Upper**	
Born at term								
Yes	33	5.6%	555	94.4%	1.69	0.40	7.25	0.761
No	2	3.4%	57	96.6%	1.00			
Birth weight >=2.5kg								
Yes	29	5.9%	463	94.1%	1.56	0.63	3.82	0.332
No	6	3.9%	149	96.1%	1.00			
Presence of congenital disease in the child								
Yes	3	60.0%	2	40.0%	28.59	4.61	177.21	**0.001**
No	32	5.0%	610	95.0%	1.00			
History of abdominal or inguinal surgery								
Yes	1	33.3%	2	66.7%	8.74	0.81	94.10	0.154
No	34	5.3%	610	94.7%	1.00			
Known inguinal congenital anomaly affecting the patient, his biological father or siblings								
Yes	15	5.6%	255	94.4%	1.03	0.69	1.53	0.890
No	20	5.3%	357	94.7%	1.00			

Factors associated with occurrence of undescended testis among the study children

Multivariate analysis was performed to identify factors associated with occurrence of undescended testis among the study children. Both factors that were associated with occurrence of undescended testis among the study children at p<0.1 during bivariate analysis were considered together in a multivariate analysis. These include; (1) Parents level of education, and (2) Presence of congenital disease in the child. Upon fitting the factors using

Binary logistic regression and specifying 'backward conditional' method with removal at P<0.05, the three factor were retained in the final analysis as shown in Table 4.6.

Adjusting for parent's level of education, presence of congenital disease in a child was significantly associated with having undescended testis among children (AOR=36.40; 95% CI: 5.51 – 240.48; p<0.001). A child with congenital disease was 36.40 times more likely to have undescended testis compared to one without congenital disease.

Table 7: Factors associated with occurrence of undescended testis among the study population

Variables	AOR	95% CI		p value
		Lower	**Upper**	
Presence of congenital disease in the child				
Yes	36.40	5.51	240.48	**<0.001**
No	1.00			
Parents level of education				
None	2.07	0.31	13.76	0.453
Primary	0.85	0.30	2.43	0.760
Secondary	2.86	1.02	8.02	**0.046**
College/University	1.00			

DISCUSSION

From the results presented above, it is apparent that the highest number of children is born with normal birth weight, which is ≥ 2.5 kg. The percentage number of children born with congenial disease was 0.8 % of the population studied. These results appear to correlate with those published in Pettersson et al. (2007). An additional 0.5 % of these children participants undergo abdominal or inguinal surgery. These results also show that 41.7 % of the respondents with congenital anomaly had a family history where the biological father or their close relatives had this problem. The prevalence of undescended testis in this study population is 5.4 %, which is much higher than the research average of 1.7 %.

There appears to be some 3.7 % difference, which may be partly attributed to the fact that research population that came from one location, which is the nation's largest referral hospital and thus a possibility of more congenial anomaly referrals from other hospitals in Kenya. As the nation's largest referral hospital, the facility receives many cases from the 47 counties and thus the recorded high prevalence rate as compared to the industrial average. Nonetheless, it is apparent that these cases are generally rampant and thus the need to have an understanding of contributing factors and intervention mechanisms. However, the prevalence range from an international point of view is between 4.3 % and 4.9 %, which implies that the recorded prevalence of 5.4 % in this study is within range since the difference is 0.5 % (Fawoler & Stephen 1959; Hutson & Beasley 1987; Hutson 1998; Taghizadeh & Thomas 2008).

The distribution of undescended testis appears to be more on the right side of the testis at 57.1 % as compared to 28.6 % on the left side and 11.4 % as bilateral.An additional 2.9 % of the reported undescended testis is ambiguous genitalia. In this study populace, 1.2 % had inguinal hernia with an additional 0.3 % having poorly developed scrotum. These results appear to be consistent with results from Sekabira, Kaggwa, and Birabwa-Male (2001) and Mlay and Sayi (1994), which had 5.5 % prevalence with 63 % occurring on the right side as

compared to 18.5 % on the left side. An additional 18.5 % had bilateral undescended testis (Sekabira, Kaggwa, & Birabwa-Male 2001; Davenport 1996).

Results indicate that there is a strong relationship between medical history, low income, and the presence of congenital disease in children. Results from families earning less than KES.. 10,000 appear to have statistical significance, which may imply poor nutrition and other environmental factors of parents as contributions towards undescended testes. Parents who have a history of undescended testes provide high prevalence levels for their children to inherit these conditions. This implies that genetic transmission of undescended testes is a possibility. However, further investigation of this history of undescended testes among parents needs to be investigated further. The scope of this research does not cover this concept and thus future investigations should focus on this field to develop a holistic intervention mechanism that seeks to address the situation from the root cause.

STUDY LIMITATIONS

This study is limited to investigating undescended testes among children aged between 6 months and 12 years. This implies that results of people beyond 12 years are neglected in this investigation. However, it is crucial that comprehensive investigation through secondary data analysis of recorded cases of undescended testes at Kenyatta National Hospital and other government referral hospitals to be done to find a more accurate figure of the prevalence rate.

The second limitation of this investigation is the facility of study. This study was limited to Kenyatta National Hospital. This health care facility happens to be the national referral hospital and thus the likelihood of having a higher prevalence rate due to high referral levels. Other hospitals may receive relatively less prevalence levels.

Thirdly, this investigation did not consider patient's physical conditions that may influence or affect the accuracy of the tests. For instance, the accuracy level of testing obese patients was in some cases hard and thus testing on grounds of physical palpation alone might have caused some levels of errors. These results can be improved in future research through ultrasonography for accurate readings.

In addition, the sample considered is relatively small as compared to the number of births in a year. Although the sample can be used to represent the general population, similar investigations should be carried out in other locations, especially county Level IV and Level V hospitals for improved statistical results.

CONCLUSIONS

In conclusion, it is apparent that the prevalence rate of the occurrence of undescended testis stands at 5.4 %, which is 0.5 % higher than the global average of between 4.3 % and 4.9 %. However, these results appear to be consistent with multiple research works where the prevalence rates were high. The test subjects in this investigation were children aged between 6 months and 12 years attending the Paediatric Filter Clinic at Kenyatta National Hospital. The prevalence of undescended testes on the right side appears to be higher than on the left side and bilateral scenarios in this investigation. Similar results are observed in other research works. Children whose parents have a history of undescended testis had high prevalence of occurrence of the condition that those with normal parents. Low income parents making less than KES. 10,000 showed statistical relationship with respect to children with undescended testes.

RECOMMENDATIONS

Further investigation of this history of undescended testes among parents needs to be investigated further. The scope of this research does not cover this concept and thus future investigations should focus on this field to develop a holistic intervention mechanism that seeks to address the situation from the root cause. Investigations should focus on between 20 and thirty five years of cohort study focusing only on cases of cryptorchidism throughout all healthcare facilities in Kenya. The gathered data can then be correlated with what has already been done to improve the level of accuracy and intervention strategies based on emerging technologies and intervention approaches.

It is recommended that multiple investigation approaches be adopted in future investigation. This includes utilization of physical palpation coupled with ultrasonography for

improved accuracy. Reliance on physical palpation shows some level of inaccuracy, especially when dealing with obese patients.

Finally, it is recommended that a larger sample size be considered for future investigation. The currently considered population is small, although reliable in representing the general population. However, conducting investigation in multiple healthcare facilities can assist in gathering more patients for investigation, which will improve the accuracy level of the investigation. It is recommended midwives, doctors and other health workers should routinely look for undescended testes whenexamining babies and children. All detected cases should be recorded with as much detail as possible to make it easier for the Ministry of Health and other related bodies to carryout secondary research work using the gathered information.

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APPENDIX

APPENDIX 1: PATIENT QUESTIONNAIRE

STUDY TITLE - The prevalence of undescended testis in male infants and children between the age of 6 months and 12 years attending the paediatric filter clinic at Kenyatta national hospital .

SECTION A

1.0 **Child's details**

Date……

Study No.....

Name:.....

Hospital No.....

Place of work of parent/guardian.....

Contact details: P.O. Box.....

Tel. No.....

Date of birth (dd/mm/yy) □□ □□ □□

Age: □□ Years □□ Months

Weight.....kg (to nearest 50g)

Height.....cm (to nearest 5mm)

SECTION B SOCIODEMOGRAPHIC CHARACTERISTICS

1. Usual residence.....

2. Parents level of education

□ Primary school Number of completed years.....

□ Secondary school Number of completed years.....

□ Tertiary level Number of completed years .....

□ None □ Other (specify).....

5. Parent/guardian's monthly income (Kshs).....

6. Financial assistance □ Relatives □ Employer

□ Non-governmental Organization □ None □ Other (specify).....

SECTION C: MEDICAL HISTORY AND FAMILY SOCIAL HISTORY

7. born at term..... □ yes □ no

8. birth weight = or > 2.5 kg (will request parent/guardian to produce the growth chart)

□ Yes □ No

9. does the child have any known congenital disease □ Yes □ No

10.History of abdominal or inguinal surgery □ Yes □ No

11. Any known inguinal congenital anomally affecting the patient , his biological father or the patient's sibling's and the type of such anomally).

□ father □ Siblings □ others……..

If yes which ones……..

SECTION D: PHYSICAL EXAMINATION

Patient's no.	**Height(cm)**	**Weight(kg)**	**Undescended testis(affected side)**	**Other inguinal congenital anomallies including hypospadia**	**comments**

APPENDIX 11: CONSENT FORM

Study title: PREVALENCE OF UNDESCENDED TESTIS IN CHILDREN AGED 6 MONTHS TO 12 YEARS VISITING THE PAEDIATRIC FILTER CLINIC AT KENYATTA NATIONAL HOSPITAL.

Serial Number:----------

Patient number:----------

Dear Patient/ Parent/ Guardian,

My name is Dr. Kimunya. . I am conducting a research study to find out what proportion of male infants/children between the age of 6 months and 12 years visiting Kenyatta National Hospital have undescended testis. Some of the complications of undescended testis include infertility and testicular carcinoma. Physical examination of male infant/child"s scrotum can help in early detection and management before onset of such complications. I would like to include you/ your child as a participant.

This will require that I administer to you a questionnaire and examine your infant/ child. The physical examination will involve undressing the perineal area and lying in a lithotomy position on a cormfotable and secure examination table. The examiner will then palpate the scrotum after inspection.The examination is in no way harmful to your child.

Participation in this study is voluntary and your decision on whether to participate or not will not prejudice you/ your child's care in any way. Strict confidentiality will be observed at all times.There will be no added costs. If necessary your infant/child will be referred for expert review and management.

I hope that you accept for yourself/ your child to participate in this study, as its outcome will impact on the future management of undescended testis in our country.

Consent

Clinician's consent:

I have understood the purpose and processes involved in this study and hereby accept to participate.

Signed----------Name----------Date----------

Parent/ Guardian consent:

I Mr/Mrs/Miss..... being a person aged 18 years and over, having read/ been explained to the above, and in the knowledge that it is voluntary, do hereby give consent for myself/ my child to participate in this study.

I understand that I/ my child have the right to withdraw from the research at any time, for any reason, without penalty or harm.

Patient/ Parent/ Guardian's signature

Relation to child if not the parent----------

-Date:.....

.....

Child's signature if above 7 years (Assent)

Date:.....

Witness:

Signed----------Name----------Date----------

Tafsiri: Idhini ya Kushiriki kwa Utafiti KIAMBATISHO 11

IDHINI FOMU

Dear Mgonjwa / Mzazi / Mlezi,

Jina langu ni Daktari Kimunya ninafanya uchunguzi juu ya uwepo na idadi ya watoto wa kiume kati ya umri wa miezi 6 na miaka 12 wenye kutembelea Hospitali ya Taifa ya Kenyatta ambao makende yao haiko ndani ya korodani. Kati ya matatizo ya makende kuwa inje ya korodani ni pamoja na utasa na karakani. Kupimwa kwa watoto wachanga wa kiume korodani inaweza kusaidia katika kutambua mapema na usimamizi kabla ya mwanzo wa matatizo hayo.Ningependelea wewe / mtoto wako akuwe mshiriki.

Utahitajika kujibu maswali kadhaa na pia mtoto kufanyiwa uchunguzi wa kimwili. Uchunguzi wa kimwiliutahusishamvuoeneo la korodani kama mtoto amelazwakatika nafasi ya lithotomykwenye kitandamzuri nasalama.Uchunguzihuu hauna madhara yoyote kwamtoto wako. usiriutatunzwa wakati wowote.

Ushirikaji wako kwa utafiti huu ni kwa hiari na uamuzi wako. Una ruhusa kukataa kujibu maswali ama kuniruhusu kufanya utafiti huu. Uamuzi wakokushirikiau kukataa hayataathirihudumaya mtoto wakokatika njia yeyote.Kushiriki kwa mtoto wako kwa utafiti huu hauna ongezeko wa gharama. Utafiti huu utafafanua maarifa juu ya kupima korodani na itatusaidia kuyarekebisha na kuboresha huduma yetu kwa watoto.

Ninaomba idhini yako/ mtoto wako kushiriki.

Ahsante.

Ruhusa ya Mzazi

Mimi ---------- nimeelewa maelezo juu ya huu utafiti na ninakubali mtoto wangu kushiriki.

Sahihi----------Tarehe----------

Ruhusa ya Daktari

Mimi ---------- ------- nimeelewa maelezo juu ya huu utafiti na ninakubali kushiriki.

Sahihi----------Tarehe----------

mshuhudia

Sahihi ya mshuhudia----------jina----------tarehe------

In case of any questions, kindly contact:

[1] Dr Kimunya , Registrar at the Dept. of Paediatric and Child Health.

Telephone number: 0722337938

email address: wanjohikimunya@gmail.com

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[3] Ethics and Research Committee, Kenyatta National Hospital

At the Address, Kenyatta National Hospital,

University of Nairobi,

P.O. Box 20723,

Nairobi.

Telephone number 2726300, Extension 44102.

Fax: 725272

APPENDIX 1II: BUDGET

The estimated cost of conducting this study is summarized in the table below.

	Item	Cost(KES)
1.	Stationery	4,000
2.	Printing and binding costs	18,500
4.	Research assistants (6)	30,000
5.	Statistician	20,000
5.	Contingency	20,000
	Total	**92,500**

The study will cost KES. **92,500**