SONOGRAPHIC FINDINGS IN PATIENTS PRESENTING WITH SCROTAL PAIN REFERRED FOR ULTRASOUND AT MOI TEACHING AND REFERRAL HOSPITAL - ELDORET, KENYA.

NAMDALA CELESTINE EMUKULE

SM/PGR/06/13

A research thesis submitted to Moi University School of Medicine in partial fulfillment of the award of the degree of Master of Medicine in Radiology and Imaging.

DECLARATION

Student's Declaration

I declare that this is my original work and has not been presented in any other university or institution for an award of a degree or any academic credit. No part of this work may be reproduced or transmitted in any form without prior permission from the author or Moi University.

Namdala Celestine Emukule

SM/PGR/06/13

Signature _____ Date_____

Supervisors' Declaration

This research thesis has been submitted for consideration with our approval as university supervisors.

Prof. G.D. Onditi Elias, Associate Professor, Head Department of Radiology and Imaging, School of Medicine, Moi University.

Signature _____ Date_____

Dr. E. C. Kimutai

Consultant Radiologist, Moi Teaching and Referral Hospital, Eldoret.

Signature _____ Date _____

DEDICATION

I would like to dedicate this work to the Almighty for the gift of life. To my parents Joseph and Mary Emukule and all my siblings for their unwavering support. To my lovely wife Judith Mubweka for the good care and understanding during the period of my studies. To my son Jayden Ekirapa Namdala and daughter Talia Namdala from whom I derive the momentum to excel in whatever I do. To all my lecturers and fellow residents for the knowledge, skills and words of encouragement.

To you all, I am truly grateful.

ACKNOWLEDGEMENT

I wish to sincerely thank my supervisors Prof. Onditi Elias and Dr. E.C. Kimutai for their guidance and support during the compilation of this research thesis. I also wish to thank all my lecturers for their contributions.

I acknowledge and appreciate the faculty and all the staff in the Department of Radiology for the knowledge imparted to me during my years of study.

Special thanks to the study participants, sonographers, registrars and all consultants who contributed to the realization of this research thesis.

I would also like to thank Ministry of Health - Kenya for granting me a paid study leave.

Last but not least, my family for providing invaluable support during this demanding period.

TABLE OF CONTENTS

DECLARATION ..... **ii**
DEDICATION ..... **iii**
ACKNOWLEDGEMENT ..... **iv**
LIST OF TABLES ..... **vii**
LIST OF FIGURES ..... **viii**
LIST OF ABBREVIATIONS ..... **ix**
CHAPTER ONE: INTRODUCTION **1**
1.1 Background **1**
1.2 Problem Statement **3**
1.3 Research Questions **4**
1.4 Research Objectives **4**
1.4.1 Main Objective **4**
1.4.2 Specific Objectives **4**
1.5 Justification **4**
CHAPTER TWO: LITERATURE REVIEW **6**
2.1 Epidemiology **6**
2.2 Etiology of scrotal pain **9**
2.2.1 Torsion *10*
2.2.2 Infection *13*
2.2.3 Trauma *14*
2.2.4 Tumour *16*
2.2.5 Varicoceles *17*
2.2.6 Incarcerated inguinal hernia *18*
2.2.7 Hydrocele *18*
2.2.8 Spermatoceles and epididymal cysts. *20*
2.3 The normal scrotal US examination **20**
CHAPTER THREE: METHODOLOGY **22**
3.1 Introduction **22**
3.2 Study design **22**
3.3 Study area **22**
3.4 Study population **23**
3.5 Eligibility criteria **23**
3.5.1 Inclusion Criteria *23*

3.5.2 Exclusion Criteria 23
3.6 Sampling techniques..... 23
3.7 Study procedure 24
3.8 Data collection and management 26
3.8.1 Data Collection 26
3.8.2 Quality control..... 27
3.8.3 Data Analysis and presentation..... 27
3.9 Study Limitations 27
3.10 Ethical considerations 28
CHAPTER FOUR: RESULTS 30
4.1 Demographics of the Participants..... 30
4.2. Sonographic findings..... 32
4.2.1 Size and distribution of lesions..... 38
4.2.2 Echotexture of the Lesion..... 38
4.2.3 Blood flow Pattern..... 38
CHAPTER FIVE: DISCUSSION..... 45
CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS 52
6.1 CONCLUSIONS 52
6.2 RECOMMENDATION..... 52
APPENDICES..... 56
APPENDIX I: CONSENT FORM..... 56
APPENDIX II: DATA COLLECTION FORM 60
APPENDIX III: MTRH APPROVAL TO CONDUCT RESEARCH..... 64
APPENDIX IV: IREC APPROVAL LETTER 65

LIST OF TABLES

Table 1: Clinical Data of 57 Patients 31
Table 2: Different Causes of Scrotal Pain As Diagnosed By USG 32
Table 3: Ultrasound Features of Epididymitis 34
Table 4: Ultrasound Features of Epididymo-Orchitis 35
Table 5: Ultrasound Features in Trauma 36
Table 6: Ultrasound Features of Torsion 37

LIST OF FIGURES

Figure 1: Study Recruitment Schema 29
Figure 2: Distribution of Participants by Age Groups 30
Figure 3: USG showing heterogenous echotexture of epididymal head and testis with increased vascularity on colour Doppler in epididymo-orchitis 40
Figure 4: USG showing diffusely enlarged and heterogenous epididymal head with increased vascularity on colour Doppler with a reactive hydrocele in a case of epididymitis. 40
Figure 5 : Testicular torsion. Transverse US image shows enlarged, heterogenous right testis (RT) with thickened scrotal skin. CDUS shows no vascularity in the right testis 41
Figure 6: Fractured testis in a 17-year-old man presenting with a painful swelling of his right hemiscrotum for 1 day after he experienced trauma in the right scrotum while playing football 42
Figure 7: A case a 64 year old with a epididymal head cyst measuring 11.9 x 11.3mm with a surrounding hydrocele 42
Figure 8: A case of varicocele in a 25yr old. Notice the positive valsalva response in the right image 43
Figure 9: Case of orchitis in a 25 year old who presented with scrotal pain for 1 week. 43
Figure 10: Bilatéral hydrocele in a 30-year-old man with history of progressive painful swelling of bilateral hemiscrotum for 3 weeks. Gray scale images show fluid with low level echoes 44

LIST OF ABBREVIATIONS

CDUS Colour Doppler Ultrasonography

CT Computed Tomography

HRIS Health Records Information System

IREC Institutional Research and Ethics Committee

KNH Kenyatta National Hospital

MHZ Megahertz

MTRH Moi Teaching and Referral Hospital

MRI Magnetic Resonance Imaging

US Ultrasound

USG Ultrasonography

ABSTRACT

Background: The most common causes of scrotal pain include torsion, epididymitis, trauma and testicular cancer. These entities may be clinically indistinguishable because characteristic symptoms and signs for each overlap. High frequency ultrasonography with Colour Doppler has become the imaging modality used to supplement the physical examination of the scrotum and is an accurate, reliable, safe and relatively inexpensive means of evaluating scrotal pain.

Objective: To determine the pattern of sonographic findings in patients presenting with scrotal pain and referred for sonography at Moi Teaching and Referral Hospital, Eldoret.

Methods: This is cross sectional descriptive study done in the Department of Radiology and Imaging, Moi Teaching and Referral Hospital between July 2014 and July 2015. A total of 57 consecutively sampled patients aged 2 to 80yrs with scrotal pain underwent scrotal ultrasonography. A high-frequency (7-12 MHz) linear array transducer of either a Philips HD11 XE machine model 2006 or Aloka Prosound Alpha 7 machine was used. All the images were reviewed by two consultant radiologists. Descriptive statistics were summarized for patient socio-demographics. Frequency tables were generated for categorical variables. Results were presented using tables and charts.

Results: The patients ranged in age from 2 to 80 years (mean 30.96 years). Majority of the patients were in 21-30 years age group comprising 45.6% followed by 31- 40 years comprising 17.5%. Pain with swelling was found to be the most common presenting complaint.Of the 57 patients with scrotal pain 14 had epididymitis, 13 had epididymo-orchitis, 5 had torsion, 4 had hydrocele, 4 had varicocele, 3 had epididymal cyst, 2 had trauma, 2 had hernia, 2 had scrotal mass, 1 had scrotal abscess and 1 had scrotal edema. No abnormality was seen on ultrasound in 5 patients. Epididymitis was the most common cause of scrotal pain in adults while torsion was more common in the younger age group. Epididymal lesions were seen in 52.6% of the patients. Epididymal enlargement was seen in 86% of the cases of acute epididymitis. The majority of the lesions observed were either hypoechoic or heterogenous in echotexture. Hydrocele was present in most cases of epididymitis (64.3%), epididymo-orchitis (53.8%) and in some cases of testicular torsion (20%).

Conclusion: Epididymitis is the most common cause of scrotal pain. Ultrasound provides optimal anatomic detail and when color Doppler imaging is added, testicular perfusion can be assessed. Torsion of the testis remains the most urgent and important entity dependent on ultrasonography for diagnosis.

Recommendation: Scrotal ultrasound evaluation is recommended in all patients presenting with scrotal pain.

CHAPTER ONE: INTRODUCTION

1.1 Background

Scrotal pain is a common urologic problem which often presents a diagnostic dilemma due to its multiple etiologies**.** Scrotal pain may be acute, subacute or chronic depending on its duration. Clinical signs and symptoms are usually nonspecific, variable and often misleading**.** Scrotal abnormalities can be classified into two main complaints, which are scrotal pain and mass/swelling. This study is limited to scrotal pain. Inflammation (epididymitis, epididymo-orchitis, abscess), testicular torsion, testicular trauma, and testicular cancer are some of the causes of scrotal pain (V.S Dogra, Gottlieb, Oka, & Rubens, 2003; Thinyu & Muttarak, 2009). It is important to differentiate these processes for purposes of proper management. High-resolution ultrasonography combined with colour Doppler ultrasonography (CDUS) is the imaging modality of choice for evaluating scrotal diseases (V.S Dogra et al., 2003).

Prompt diagnosis is required to differentiate surgically correctable lesions from abnormalities that can be adequately treated medically. Clinical symptoms and physical examination are often not enough for definite diagnosis due to tenderness and swelling that limit an accurate palpation of the scrotal contents (V. Dogra & Bhatt, 2004; Muttarak & Lojanapiwat, 2005). It is also important to determine whether the mass is intra- or extra-testicular in patients presenting with scrotal pain because the majority of intra-testicular lesions are malignant, while extra-testicular lesions are usually benign (D'Andrea et al., 2013). US examination can detect intrascrotal masses with a sensitivity of almost 100%.

USG is important in the evaluation of scrotal masses because its accuracy is 98% to 100% in distinguishing intratesticular from extratesticular pathology.

CT and MRI which have dominated imaging of other parts of the body have certain limitations in evaluation of scrotal lesions. However CT and MRI still play a major role in staging of testicular cancer and also in evaluation of undescended testes that have not been detected sonographically. While CT delivers radiation to gonads, MRI imaging is costly and not readily available. Scintigraphy on the other hand provides information only in limited conditions of scrotal pathologies especially in assessing perfusion(Chhetri P.K, Tayal, & Deka, 2012).

The speed, portability, accessibility and lack of ionizing radiation make ultrasound the most appropriate imaging modality in the evaluation of scrotal pain. US provides excellent anatomic detail and with color Doppler and power Doppler, testicular perfusion can be assessed (V. Dogra & Resnick, 2002). Miskin M and Bain J performed the first US examination of the scrotum using B mode static scanner in 1974. Two years later, Miskin , Buckspan and Bain presented details of B-mode as well as grey scale images with a high frequency transducer (Murray M, 1997).

This study is aimed at determining sonographically detectable scrotal lesions in patients referred for sonography presenting with scrotal pain at Moi Teaching and Referral Hospital.

1.2 Problem Statement

Scrotal pain can be seen in patients of a wide age range**.** Though the magnitude of scrotal disease in Sub Saharan Africa is largely unknown, there are few studies that have been done on various etiologies of scrotal pain. The findings vary according to geographical location, methods of diagnosis and the age of the patients (Baruga & Guyton Munabi, 2013).

The pattern of sonographic findings in patients with scrotal pain is unknown at MTRH and Kenya as a whole. Inpatient records from MTRH Health Records and Information System show that 54 cases of scrotal disease were admitted in 2013, constituting 0.01% of total admissions. The total number of scrotal US scans done on patients presenting with scrotal pain during this period was 68 (MTRH, 2013). While this might not be the true picture, there is need to have a clear understanding of the sonographic pattern of various scrotal pathologies so as to improve on diagnosis and treatment.

The morbidity associated with scrotal pain leads to reduced productivity coupled with social and economic burden to the patients and their families. Inadequate evaluation and delays in diagnosis and treatment can result in irreversible harm, up to and including testicular loss.

1.3 Research Questions

1. What are the sonographically detectable scrotal lesions in patients presenting with scrotal pain and referred for sonography at Moi Teaching and Referral Hospital?

2. What are sonographic appearances of the scrotal lesions in patients presenting with scrotal pain and referred for sonography at MTRH?

1.4 Research Objectives

1.4.1 Main Objective

To determine the sonographically detectable scrotal lesions and describe their sonographic appearances in patients presenting with scrotal pain and referred for sonography at MTRH during the period July 2014 to July 2015.

1.4.2 Specific Objectives

1. To determine the sonographically detectable scrotal lesions in patients with scrotal pain referred for sonography at MTRH
2. To describe the gray scale and Colour Doppler sonographic appearances of scrotal lesions in patients presenting with scrotal pain at MTRH.

1.5 Justification

There is a paucity of information on the overall prevalence of scrotal disease in sub-Saharan Africa and more so in Kenya. Despite cases of scrotal disease being seen and treated at MTRH, there has been no study to demonstrate the magnitude and the pattern of sonographic findings in these patients.

A wide variety of disease processes involving the scrotum have been shown to have similar clinical manifestation hence posing a diagnostic challenge to the evaluating clinician. This can result in mismanagement of the patient or even unnecessary surgeries with subsequent prolonged hospital stay.(Kawooya M.J, Opio J, Byanyima R.K, & Kiguli-Malwadde, 2008; Thinyu & Muttarak, 2009).

Clear understanding of the patterns of scrotal conditions is therefore important, as it leads to adoption of improved and standardized management options of these conditions.

This study therefore seeks to bridge the existing information gap on the pattern of scrotal diseases at MTRH that are detectable sonographically. This will help both the policy makers and the health care providers to review and streamline the diagnostic workup of scrotal pain. This in turn is expected to contribute in reduction of social and economic burden attributable to its morbidity and cost of treatment.

CHAPTER TWO: LITERATURE REVIEW

2.1 Epidemiology

Globally, it is reported that approximately 0.5% of total emergency department visits are for acute scrotal pain (Blaivas, Sierzenski, & Lambert, 2001).The most common causes of scrotal pain include torsion of the testis, torsion of a testicular appendage, and epididymitis, contributing more than 85% of the causes. The incidence of testicular torsion accounts for 10–40% of the causes of acute scrotum in children, and is more common in the neonatal and adolescent years (Mehran Peyvasteh, Shahnam Askarpour, and, & Bagherya, 2011).Torsion of a testicular appendage occurs at a frequency of 30–45% of causes of acute scrotum and is common in the prepubertal period (Ringdahl & Teague, 2006). Epididymitis accounts for 30–50% of causes of acute scrotum and usually affects post pubertal boys worldwide (Gatti & Patrick Murphy, 2007).

In Italy, D'Andrea et al retrospectively reviewed US results of 164 patients with scrotal symptoms. Of 164 patients enrolled into the study, 125 (76%) presented with scrotal pain, 31 (19%) had painless scrotal mass or swelling and 8 (5%) had trauma. Of the 125 patients with scrotal pain, 72 had infection, 10 had testicular torsion, 8 had testicular trauma, 18 had varicocele, 20 had hydrocele, and 2 had unremarkable results. In the 8 patients who had history of scrotal trauma, US was able to detect testicular rupture in 1 patient and scrotal haematoma in 2 patients (D'Andrea et al., 2013).

In Saudi Arabia, a study by Abdullah et al, in patients with scrotal pain, ultrasound found 7% with testicular torsion , 10% with epididymitis, epididymo-orchitis (13%), abscess (5%)

,encysted hydrocele (8%), varicocele (10%), Spermatocele (5%) , testicular orchitis (4%) and hematoma 8 (8%). Colour Doppler ultrasonography accurately diagnosed all cases of epididymitis or epididymo-orchitis, spermatic cord injury, testicular torsion, varicocele, and hydrocele (Abdullah Hamdan, Yousef, AliOmer, & Abdulla, 2014).

In Nepal, Chhetri et al, scanned 50 patients and the cases followed up and correlated with fine needle aspiration cytology or histopathology reports, surgical findings or response to treatment. The commonest cause for scrotal pain was found to be epididymitis with or without orchitis (40 %), followed by cystic lesions of the epididymis (18 %), varicocele (12 %), trauma (8 %), torsion (4 %) and tumour (2 %). No abnormality was seen on USG in 7 patients (14%). This study concluded that USG is a sensitive and specific examination in patients with scrotal pain (Chhetri, Tayal, & Deka, 2012).

A retrospective study by Lam et al, in Singapore, comparing primary scrotal exploration (294 patients) and initial US examination (332 patients)with exploration for positive US results or a high clinical suspicion of torsion, showed that US obviated the need for exploration in many patients. US was proven to decrease the number of emergency scrotal explorations, length of hospital stay and hence the cost of management of acute scrotum (Lam, Yap, Jacobsen, & Teo, 2005).

In Sub-Saharan Africa only one study has been published on the pattern of scrotal pain. A cross sectional study of 73 patients was conducted at Mulago Hospital, Uganda by Kawooya et al, where sonographic findings of patients with scrotal pain were correlated

with operative findings. Ultrasound accurately diagnosed 38 epididymitis, 12 testicular torsion, and 7 tuberculous epididymo-orchitis. Acute epididymitis was seen in all age-groups and was associated with genitourinary tract anomalies at the extremes of age and sexual activity in young adults. Clinical assessment alone had low accuracy in diagnosis of cause of scrotal pain (Kawooya M.J et al., 2008).

In Kenya, no studies have been done to determine the pattern of scrotal disease as seen on US. There are however studies looking at specific etiologies of scrotal pain. In KNH, Nairobi, Opot and Magoha in a retrospective case study of all histologically confirmed testicular cancer patients over a fifteen year period found that 28.08% of these patients presented with scrotal pain. This was higher than what had been reported in other studies. However no sonographic findings were available in this study.(Opot & Magoha, 2000).

At MTRH, Tenge Kuremu in a case report of bilateral testicular torsion highlighted the implications of misdiagnosis and hence delayed scrotal exploration. He concluded that since diagnostic US is not universally available, there is need to maintain a high index of suspicion and bias towards exploration in acute scrotal pain so as to avoid testicular loss. The study stressed the need for adequate knowledge of the condition by the would be victims to enable them to present early, and by medical health providers to respond appropriately (Kuremu, 2004).

Despite the widespread concurrence on the role of US as an adjuvant tool in diagnosis of scrotal disorders, some studies seem to question its role in guiding management. A study done in USA by Smith et al, found that CDUS demonstrated a relatively poor ability to diagnose epididymitis and did not significantly alter treatment patterns. Data showed that of the 69% of patients with sonographic findings of epididymitis, 95% received antibiotics. In comparison, 96% of patients who did not undergo ultrasound also received antimicrobial therapy. The study therefore concluded that CDUS has a limited role in men where the diagnosis of epididymitis is reasonably obvious. However CDUS can be useful in younger men presenting with acute scrotal pain and torsion has to be ruled out.

The findings from this study, therefore, would seem to indicate there is no role for CDUS when the diagnosis of epididymitis is suspected and testicular torsion or mass can be ruled out by history and physical exam (Smith, Tracy, Kavoussi, Witmer, & Costabile, 2013).

2.2 Etiology of scrotal pain

Scrotal abnormalities can be divided into three groups, which are extra-testicular lesion, intra-testicular lesion and trauma. Causes of scrotal pain include inflammation (epididymitis, epididymo-orchitis, abscess), testicular torsion, testicular trauma, and testicular cancer. Other rare causes of scrotal pain may include idiopathic scrotal edema, incarcerated inguinal hernia, varicoceles, hydroceles, referred pain, post-vasectomy and testicular microlithiasis (V. Dogra & Bhatt, 2004; V.S Dogra et al., 2003; Muttarak & Lojanapiwat, 2005).

2.2.1 Torsion

The most important differential diagnoses for acute scrotum is spermatic cord torsion (Mehran Peyvasteh et al., 2011).Testicular torsion is a medical emergency which requires quick and urgent action. This is due to the fact that torsion leads to testicular death by ischemia within 6 hours (Kapoor, 2008).

The incidence of spermatic cord torsion among patients with acute scrotum varies from 18-45% depending on the age of the patients, the type and locations of the hospital, and the methods of diagnosis. It affects approximately 1 in 4000 young males before the age of 25 years annually (Kapoor, 2008; Ringdahl & Teague, 2006).The peak incidence of torsion of testicular appendage occurs in the prepubertal age group (9–10 years) and that of testicular torsion in the pubertal age group (12–17 years**).** (V. S. Dogra, Rubens, Gottlieb, & Bhatt, 2004; Gunther & Schenk, 2006; Lin, Bhatt, Rubens, & Dogra, 2007).

In Africa testicular torsion remains a common surgical emergency of adolescent males presenting with sudden onset of intense scrotal pain. While the magnitude of testicular torsion is not known it has been identified as a cause of male infertility. Testicular loss in Africa is directly related to delay in surgery and the referral patterns at the point of first contact with health workers. Testicular torsion is more common under the age of 18 years while orchitis is more common after 18 years of age (Baruga & Guyton Munabi, 2013).

Testicular torsion, implies first venous and later arterial flow obstruction. The extent of testicular ischemia will depend on the degree of twisting (180°–720°) and the duration of the torsion. Testicular salvage is more likely in patients treated within 4–6 hours after the onset of torsion.

Two types of testicular torsion are recognized: extra-vaginal and intra-vaginal. Extra-vaginal torsion is seen mainly in newborns and occurs prenatally in most cases. The testis is usually necrotic and the hemiscrotum is swollen and discolored. US findings vary, but complex hydrocele and calcification of the tunica albuginea are common. Intra-vaginal torsion can occur at any age but is more common in adolescents. A predisposing factor is the "bell clapper" deformity, in which the tunica vaginalis joins high on the spermatic cord, leaving the testis free to rotate.

Differentiation between testicular torsion and epididymo-orchitis is clinical challenging, since scrotal pain, swelling, and redness or tenderness are clinical symptoms common to both entities (Kapoor, 2008; Ringdahl & Teague, 2006; Wittenberg, Tobias, Rzeszotarski, & Minotti, 2006). Cremasteric reflex is often preserved in epididymo-orchitis but absent in testicular torsion.

Gray-scale USG along with colour Doppler plays a pivotal role in differentiating testicular torsion from acute epididymo-orchitis and helps in avoiding unnecessary surgery. Both these conditions present with similar clinical features and there is a false positive rate of 50% for the diagnosis of testicular torsion based on clinical findings alone (Patiala, 2009).

In the early phases of torsion (1–3 hours), testicular echogenicity appears normal. With progression, enlargement of the affected testis and increased or heterogeneous echogenicity are common findings. Sonographic evaluation of the spermatic cord is an essential part of the examination. The point of cord twisting can be identified at the external inguinal orifice. The intra-scrotal portion of the edematous cord appears as a round, ovoid, or curled echogenic extra-testicular mass, with the epididymal head wrapped around it. The orientation of the testis, epididymis, and cord may be inverted (V.S Dogra et al., 2003; Kuremu, 2004).

A definitive diagnosis of complete testicular torsion is made when blood flow is visualized on the normal side but is absent on the affected side. Incomplete torsion refers to cord twisting of less than 360°, in which some arterial flow persists in the affected testis. Meticulous comparison of the two testes by using transverse views is mandatory in these cases (Wittenberg et al., 2006).

There are however some pitfalls in the diagnosis of torsion with colour Doppler; for example, smaller degrees of torsion may be missed on color Doppler; also, in torsion–detorsion, the testis may be hyperemic, which may lead to a false diagnosis of inflammation (Patiala, 2009).

The testicular salvage rate is 80% to 100% if surgery is performed within 5 to 6 hours of the onset of pain, 70% if surgery is performed within 6 to 12 hours, and only 20% if

surgery is delayed for more than 12 hours (Cassar, Bhatt, Paltiel, & Dogra, 2008; Muttarak & Lojanapiwat, 2005; Thinyu & Muttarak, 2009).

Reports in the literature have suggested that USG for testicular torsion has a specificity of almost 100%, but the sensitivity varies from 50 to 100% (Baker, Sigman, Mathews, Benson, & Docimo, 2000).

2.2.2 Infection

Infection is the most common cause of acute testicular pain (D'Andrea et al., 2013; Kawooya M.J et al., 2008; Thinyu & Muttarak, 2009) sexually transmitted Chlamydia trachomatis, Neisseria gonorrhea, and Escherichia coli are common pathogens in men younger than 35 years. In men older than 35 years and young children, epididymitis generally results from an underlying urinary tract infection by E coli or Pseudomonas. The finding of epididymitis in a young child should prompt a workup in search of a urinary tract anomaly (Berger et al., 1979; Smith et al., 2013). The infection usually originates in the bladder or prostate gland, spreads through the vas deferens and the lymphatics of the spermatic cord to the epididymis, and finally reaches the testis, causing epididymo-orchitis. Isolated orchitis is very rare (Aso et al., 2005; D'Andrea et al., 2013).

US findings in epididymitis include an enlarged hypoechoic epididymis with hyperemic blood flow on color Doppler imaging. However, scrotal wall thickening and reactive

hydrocele are also commonly seen. In cases of isolated epididymitis, the testis has normal echogenicity, echo texture, and blood flow (Smith et al., 2013; Wittenberg et al., 2006).

Granulomatous epididymo-orchitis can be seen in cases of tuberculosis, brucellosis, sarcoidosis, leprosy, and syphilis. In one study in which 22 patients with granulomatous epididymo-orchitis of tuberculous origin were evaluated, the epididymis was hypoechoic in 13 patients, had mixed echogenicity in seven patients, and was hyperechoic in two patients.

2.2.3 Trauma

Severe testicular trauma results in testicular fracture, rupture, or hematoma. Common causes include motor vehicle accidents, athletic injury, and straddle injuries. Frequently, testicular trauma is associated with pelvic fractures (Buckley & McAninch, 2006a).

Blunt trauma accounts for 85% of testicular injuries, while penetrating injury accounts for 15%. Any foreign bodies should be localized on ultrasound examination. It is important to comment on whether the foreign bodies are intratesticular or extratesticular. 80% of testicular ruptures can be repaired if salvage surgery is conducted within 72 hours following onset of trauma (Deurdulian, Mittelstaedt, Chong, & Fielding, 2007).

Therefore, a prompt and accurate ultrasound diagnosis of testicular rupture is critical. Clinical history is often sufficient for diagnosing scrotal trauma. Since clinical examination is often limited by scrotal edema and pain, USG is used to evaluate the extent of injury

(Buckley & McAninch, 2006a).Trauma can lead to scrotal or testicular edema, hematocele, hydrocele, torsion, hematoma, fracture, or rupture (Deurdulian et al., 2007).

The ultrasound findings in the setting of testicular trauma include a break in the tunica albuginea, testicular contour irregularity, hematoma, poorly defined borders of the testicle, and testicular and scrotal wall thickening (Wittenberg et al., 2006).

Gray-scale examination shows an enlarged testis with a heterogenous echotexture and ill-defined margins. Hydrocele, hematocele, scrotal wall thickening and rupture of the tunica albuginea are the other findings that may be seen. Involvement of capsular vessels and traumatic testicular infarction can be assessed well with color Doppler examination. In cases of trauma, areas of testicular infarction or laceration show absence of vascularity on color Doppler imaging. Hematomas appear hypoechoic or as complex collections, with internal echoes and septae; they are avascular on color Doppler USG (Buckley & McAninch, 2006b; Muttarak & Lojanapiwat, 2005).

In a retrospective study of 24 patients who presented with blunt scrotal trauma to the emergency unit at Suez Canal University Hospital, Egypt, Elkader et al showed that sensitivity and specificity of US were 92% and 50% for testicular rupture, 85% and 75% for hematocele, 80% and 79% for testicular hematoma, and 100% and 96% for testicular avulsion, respectively. US diagnosis however failed to detect 60% epididymal lesions (Elkader, and, & Den, 2010).

2.2.4 Tumour

Although the commonest presenting symptom of testicular neoplasms is a gradual painless enlargement of the testicle, they can present with pain due to associated hemorrhage, infarction or infection within the neoplasm. Pain has been variably reported in between 0.01% and 10% of all testicular neoplasms, though a study by Opot et al in KNH recorded up to 28.8% of patients presenting with scrotal pain (Opot & Magoha, 2000).

Since hematomas, orchitis, and abscesses can mimic malignancy, it is important to correlate the ultrasound findings with the patient's history and symptoms. A follow-up ultrasound examination may be useful to prevent an unnecessary biopsy or orchidectomy. Grayscale ultrasound is nearly 100% accurate for detecting testicular tumors

Testicular malignancy, though the most common solid tumor in young men, is generally rare among Blacks in comparison to Whites (Garner, Turner, Ghadirian, & Krewski, 2005; Opot & Magoha, 2000).The estimated incidence in Black Africans for both testicular and paratesticular neoplasms ranges from 0.7 to 0.8 per 100,000 persons per annum and this includes paediatric and adult cases (Zimmerman & Kung'u, 1978). 95% of primary testicular malignancies are germ cell tumors and, among them seminoma is the most common typically affecting 30-44 year olds.(V.S Dogra et al., 2003; Opot & Magoha, 2000). The other malignant testicular tumors are stromal tumors, mixed germ cell stromal tumors, leukemia, lymphoma and metastases.

On gray-scale USG seminomas appear as a homogenous hypoechoic lesion. Most testicular tumors are hypoechoic in echotexture, though they may sometimes also be hyperechoic. Nonseminomatous germ cell tumors show heterogenous attenuation. Color Doppler assessment provides information about the vascularity of tumor. Large-sized lesions are hypervascular, whereas smaller ones are hypovascular.

Testicular lymphomas show diffuse hypoechogenicity of the testis or present as focal hypoechoic areas. Color Doppler imaging shows increased vascularity (V.S Dogra et al., 2003; Patiala, 2009).Echogenic foci within the substance of the tumors represent areas of hemorrhage, calcification, or fibrosis. They frequently have cystic components, consistent with regions of necrosis. Embryonal cell carcinomas tend to distort the testicle and frequently invade the tunica albuginea (D'Andrea et al., 2013; V.S Dogra et al., 2003).

2.2.5 Varicoceles

These are abnormally dilated (more than 2 mm in diameter) and tortuous veins of the pampiniform plexus. They are generally seen posterior and lateral to the testis within the spermatic cord. Varicoceles are of two types: primary (or idiopathic) and secondary. Idiopathic varicoceles are caused by incompetence of valves of the internal spermatic vein (Mehta & Dogra, 1998). They are more common on the left side because of the longer course of the left testicular vein, which joins the left renal vein at a right angle and, in some cases, because of the compression of the left renal vein by the left testicular artery.

On USG, varicoceles appear as multiple tubular (≥2 mm diameter), hypoechoic serpiginous structures of varying size. CDUS reveals the typical venous flow pattern. Retrograde filling of these varices can be very well demonstrated on color Doppler during Valsalva(Rizvi, Ahmad, Siddiqui, Zaheer, & Ahmad, 2011).

2.2.6 Incarcerated inguinal hernia

Clinical history and physical examination results are often sufficient to make diagnosis of an intrascrotal inguinal hernia. US is however helpful in patients with equivocal physical findings and in those presenting with acute inguinoscrotal swelling and pain. The hernial sac most commonly contains bowel or omentum.

Gray-scale US findings include a fluid or air-filled loop of bowel in the scrotum. The presence of real-time peristalsis is diagnostic for the presence of bowel. An akinetic dilated loop of bowel observed at in the hernial sac is reported to have high 90% sensitivity and 93% specificity for the recognition of bowel strangulation. Hyperemia of scrotal soft tissue and bowel wall are also suggestive of strangulation (V.S Dogra et al., 2003).

2.2.7 Hydrocele

A hydrocele is an abnormally large collection of serous fluid and is the most common cause of painless scrotal swelling. Congenital hydroceles result from a patent processus vaginalis that permits entry of peritoneal fluid into the scrotal sac. In adults, hydrocele may arise due to variety of reasons, including trauma, infection, testicular torsion, or tumor, or it may be

idiopathic. Hydroceles are anechoic fluid collections with good sound transmission; they surround the anterolateral aspects of the testis. Hydroceles may occasionally manifest low-level echoes secondary to high protein or cholesterol content (V.S Dogra et al., 2003).

Adult hydrocele is a very common urological disease in most of the sub-Saharan African countries, with a reported incidence of up to 20–28% in some lymphatic filariasis endemic communities (Simonsen, Meyrowitsch, Makunde, & Magnussen, 1995). It has been suggested that all cases with abnormal findings on physical examination should have a scrotal ultrasound obtained. However, if the history of illness and physical examination is consistent with a simple uncomplicated hydrocele, then the scrotal ultrasound may be omitted provided that a very thorough intraoperative assessment of the testicle and hydrocele sac is performed (Okorie, Pisters, & Liu, 2011).

Scrotal ultrasound is recommended in adult men with hydrocele as part of the diagnostic workup. This recommendation is mainly based on the need to rule out more serious pathologies like testicular/paratesticular cancer and testicular torsion.

However, in Nigeria, Okorie et al, in a study to analyze the necessity of automatic ordering of scrotal ultrasound in cases of longstanding hydrocele in adult Black Africans, concluded that routine preoperative scrotal ultrasound does not seem to be justified in longstanding hydroceles. This is especially important considering the fact that most hydroceles are benign in origin and nature**.** He also cited limited availability of ultrasound machines and radiologists in many rural health facilities across Africa (Okorie et al., 2011)**.**

2.2.8 Spermatoceles and epididymal cysts.

Spermatocele, a common type of extratesticular cyst, represents cystic dilatation of tubules of the efferent ductules in the head of the epididymis. Intratesticular spermatocele is a cystic intraparenchymal lesion attached to the mediastinum in the area of the rete testis. It communicates with the seminiferous tubules, unlike simple ectasia of the rete testis, which does not communicate directly with the seminiferous tubule. These cysts contain spermatozoa and can be septated. Spermatoceles are usually unilocular but can be multilocular and may be associated with a prior vasectomy. At USG, they are well-defined hypoechoic lesions usually measuring 1–2cm and demonstrating posterior acoustic enhancement. They often contain low-level echogenic proteinaceous fluid and spermatozoa. (V.S Dogra et al., 2003).

Epididymal cysts are less common than spermatoceles and are indistinguishable from the latter at US. Epididymal cysts contain clear serous fluid and may arise throughout the epididymis, while spermatoceles almost always arise in the epididymal head. An increased incidence of epididymal cysts has been reported in boys who are exposed in utero to diethylstilbestrol. Although epididymal head cysts cannot be differentiated from spermatoceles, they usually are not clinically relevant.

2.3 The normal scrotal US examination

The testes should be symmetric and ovoid structures, measuring approximately 5×3×2cm. The normal adult testicular volume is 15–20 ml calculated from the formula: length × width × depth × 0.52 = volume. The stage of development of the germ cell elements and tubular

maturation determines the echogenicity of the testicles. Prepubertal testicles are of low to medium echogenicity and post pubertal testicles demonstrate medium echogenicity. The mediastinum testis appears as an echogenic line extending in a craniocaudal fashion. The rete testes is seen in 20% of patients and appears as a hypoechoic area with a striated configuration peripherally or adjacent to the mediastinum testis. The tunica albuginea is an echogenic line around the testes. The space between the two lines of the tunica albuginea contains a small amount of fluid and is seen as an anechoic rim around the testicle. (V. Dogra & Resnick, 2002; Ryan, McNicholas, & Eustace, 2004).

The epididymal head is 5 to 12 mm in length and is best seen in the sagittal plane. It lies atop the testes and is isoechoic to the testes. The body of the epididymis is smaller, measuring 2 to 4 mm (V.S Dogra et al., 2003).The tail of the epididymis is the curved portion that is along the inferior portion of the testes and becomes the proximal portion of the ductus deferens.

Assessing testicular perfusion is an important component of every testicular examination. Even if infection and torsion are not clinically suspected, a sonographic evaluation of testicular blood flow must be routinely included. Color Doppler reliably shows intratesticular flow. Power Doppler ultrasound yields a higher gain and is therefore more sensitive for detecting low flow (V. Dogra & Resnick, 2002; Ryan et al., 2004).

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter details information on the study design, the study area, the target population, the sampling procedure, methods of data collection and analysis, and the ethical considerations for the study.

3.2 Study design

The study employed descriptive cross sectional design whereby all patients who presented with scrotal pain and referred to the department for scrotal ultrasound evaluation and met the inclusion criteria were assessed.

3.3 Study area

The study was conducted at the Radiology and Imaging department of Moi Teaching and Referral Hospital, Eldoret .The Hospital is within Eldoret town, Uasin Gishu County, which is 350 Kilometers North West of the Nairobi. MTRH is a level 6 health facility serving as a teaching hospital for Moi University School of Medicine, Nursing, Public Health and Dentistry. Other institutions that utilize this facility include Kenya Medical Training Center (KMTC) Eldoret and University of Eastern Africa Baraton School of Nursing. MTRH is also a training center for medical, clinical and nursing officer interns. It serves as the main referral hospital for the Western part of Kenya and North rift and has a catchment population of approximately 13 million people. Apart from Radiology and

Imaging, the facility has several other departments including Internal Medicine, Surgery, Pediatrics, Obstetrics and Gynecology, Psychiatry among others.

3.4 Study population

The study population was all male patients who presented with scrotal pain and referred for sonography at Moi Teaching and Referral Hospital. The target population included both inpatients and outpatients of all age groups.

3.5 Eligibility criteria

3.5.1 Inclusion Criteria

1- Patients presenting with scrotal pain and referred for US evaluation.

3.5.2 Exclusion Criteria

1- Fournier's gangrene.

3.6 Sampling techniques

Census study was preferred in this study given the few cases of scrotal pain sent for ultrasound evaluation at MTRH. Data for 2013 showed that 68 patients were sonographically evaluated for scrotal pain. All patients presenting with scrotal pain and referred for sonography during the study period were therefore consecutively sampled into the study. A total of 57 patients were enrolled in the study.

3.7 Study procedure

All patients referred for ultrasound evaluation presenting with scrotal pain and who met the inclusion criteria were scanned. All the examinations were performed by either the principal investigator or by trained research assistant using either Philips HD11 XE 2006 or Aloka's Prosound Alpha 7 machine, with 7-12 MHz linear probe with Doppler capability.

The examinations were performed in supine position, in a warm room that afforded some degree of privacy. A rolled paper towel was placed between the legs to support the scrotum. The penis was displaced superiorly or superolaterally with a paper towel draped over it. Pre-warmed coupling gel was applied to the transducer; a protective sheath (a glove was improvised) was used in cases of scrotal laceration to prevent contamination.

US examination was aimed at localizing the pathologic lesion within the testis, epididymis or paratesticular tissues, characterizing the lesions in terms of echo-texture, definition of outline, determination of the size and extent of the lesion, determination of the state of perfusion of the testis, epididymis and the lesions by Doppler examination as well as detection of complications like formation of hydrocele, abscess or calcification.

Transverse and axial side-by-side images of both testes were obtained and documented for comparison. In cases where the scrotal findings suggested a possible intra-abdominal involvement by the disease, abdominal ultrasound was performed as well (D'Andrea et al., 2013; V.S Dogra et al., 2003).

Data was captured in the form of hard copy sonograms. Images were also saved in the ultrasound machine computer memory and compact disks. Image interpretation were done by the principal investigator and later reviewed by two consultant radiologists. The abnormalities detected were described and a diagnosis made on the basis of characteristic sonographic appearances.

Standard definitions of ultrasound pathology were used. Testicular torsion was defined as absent or markedly decreased blood flow in the affected testicle in comparison with the contralateral testis. Epididymitis was defined as increased blood flow to the epididymis in comparison with the contralateral side. Epididymal enlargement was also sought. Epididymal head enlargement was categorized as 'Normal' up-to 12mm. Orchitis was defined as increased blood flow on color Doppler throughout the affected testis when compared with the contralateral side. Testicular hemorrhage was defined as any abnormalities seen within the testis that could be considered evidence of testicular rupture, especially in the face of scrotal trauma. Ultrasound findings that suggested testicular rupture and hemorrhage included focal areas of heterogenous testicular echogenicity (Blaivas et al., 2001; V.S Dogra et al., 2003).

A varicocele was considered to be present on high frequency USG if 2 or more veins were identified with at least 1 vein having diameter of 2 mm or greater. A varicocele was considered to be present by color Doppler USG if retrograde flow was identified within the pampiniform plexus spontaneously and / or during Valsalva maneuver.

The degree of blood flow within the lesion was also categorized as absent if there are no flow signals detected, reduced compared to the normal, normal if there were a few spotty signals or increased if there was gross hyperemia.

The socio-demographic and sonographic data was entered into a data sheet. The data tools were kept in a secured cabinet during the study period to ensure no access to unauthorized persons.

3.8 Data collection and management

3.8.1 Data Collection

Data was collected between July 2014 and July 2015. Entry was made in the questionnaires and later transferred to a computer database. Double entry was used to ensure accuracy of the data. All patient details were kept confidential and data was only available to the investigator and the supervisors via password access. Patients were provide with a copy of their results and had autonomy over who else can view their scan result(s).Serial numbers were used in order to protect patients' identity. At the end of each day, data collection forms were verified for completeness and coded (assigning numerical meanings).

3.8.2 Quality control

All US scans were done at MTRH US room that had internal quality controls. The scans were done by the Principal Investigator conducting the study plus two other trained assistants based on a standardized evaluation criteria. Images were then reviewed by two consultant radiologists.

3.8.3 Data Analysis and presentation

To facilitate analysis, data collected was converted to numerical codes and de-identified for privacy of the patient. The variables were defined and the coded responses were reflected in the spreadsheet where data was entered. Before analysis the data was cleaned to correct errors made during entry. Data analysis was done using SPSS version 22.0. Continuous variables that assumed Gaussian (bell shaped or normal) distribution were summarized as mean and the corresponding standard deviation (SD) while the continuous variables that (were skewed) violated the assumptions for Gaussian distribution were summarized as the median and the corresponding inter quartile range (IQR). Descriptive statistics were summarized for patient socio-demographics. Frequency tables were generated for categorical variables. Results were presented using tables and charts.

3.9 Study Limitations

1. Selective cohort of patients
2. No physical examination was done prior to ultrasound evaluation

3.10 Ethical considerations

Permits: Ethical approval to conduct the study was sought from the Institutional Research Ethics Committee (IREC) at the Moi Teaching and Referral Hospital/ Moi University School of Medicine on behalf of the National Commission of Science, Technology and Innovations (NACOSTI). Formal approval was granted, FAN: IREC 1220.

Consent: Voluntary and informed consent was obtained from all the study participants. Assent plus proxy consent was obtained for children above 7 years. Only individuals who freely consented were allowed to participate in the study, and no one was coerced to participate. Participants were also informed that they had the right to withdraw at any point of participation in the study.

Confidentiality and Anonymity: The identity and replies of respondents were kept confidential. Participant logs, the only link between identifying information and code numbers, and all data was kept in a locked file cabinet. Only the researcher had access to the files. The code books that link the participant's names with the code were destroyed once they were checked for accuracy.

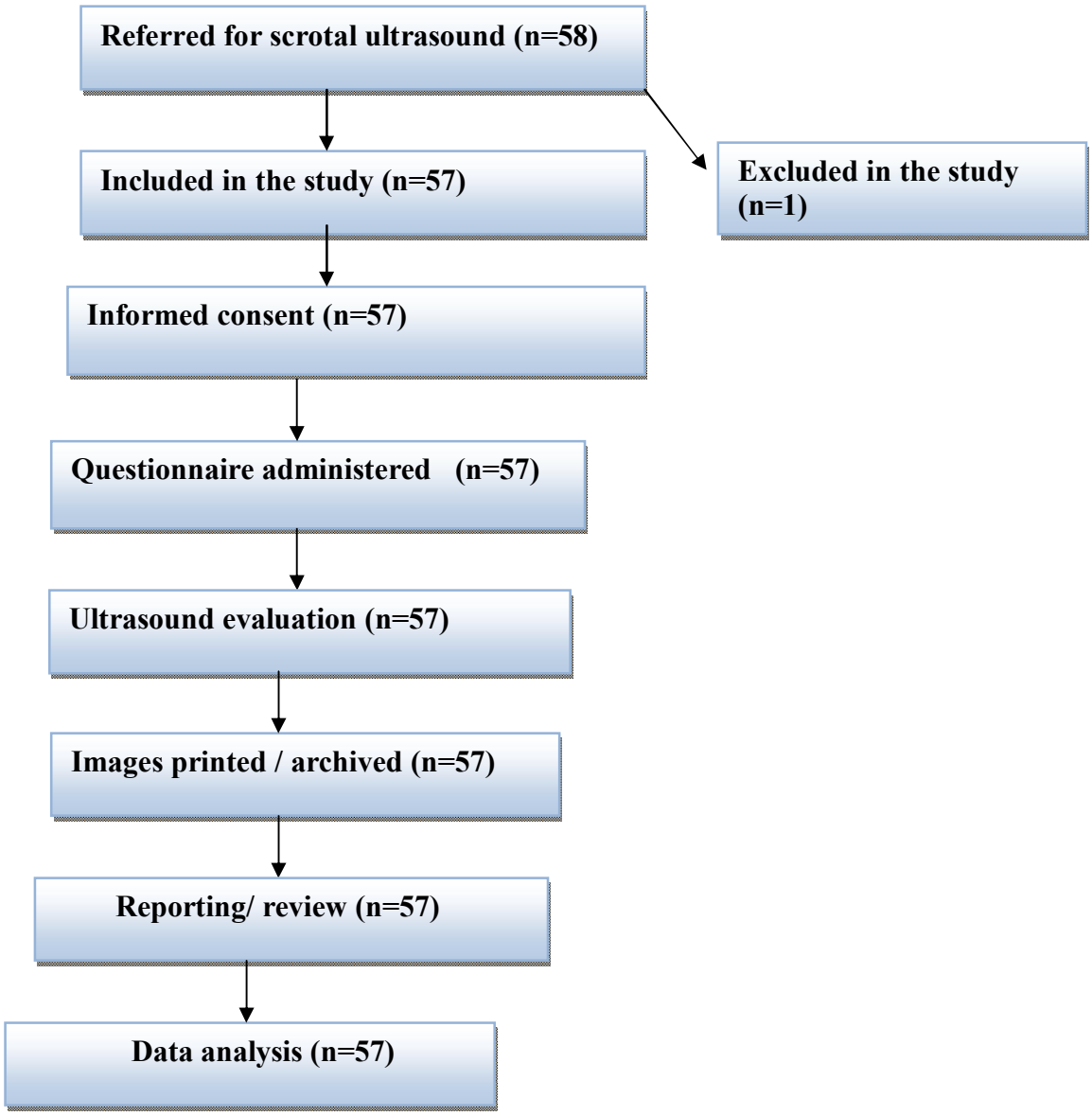

Figure 1: Study Recruitment Schema

CHAPTER FOUR: RESULTS

4.1 Demographics of the Participants

A total of 57 cases were evaluated. The age ranged from 2 to 80 years with a mean age of 30.96 years. Most patients were in range of 21 to 30 years comprising 45.6% followed by 31 to 40 years comprising 17.5 %. Pain with swelling was found to be the most common presenting complaint.

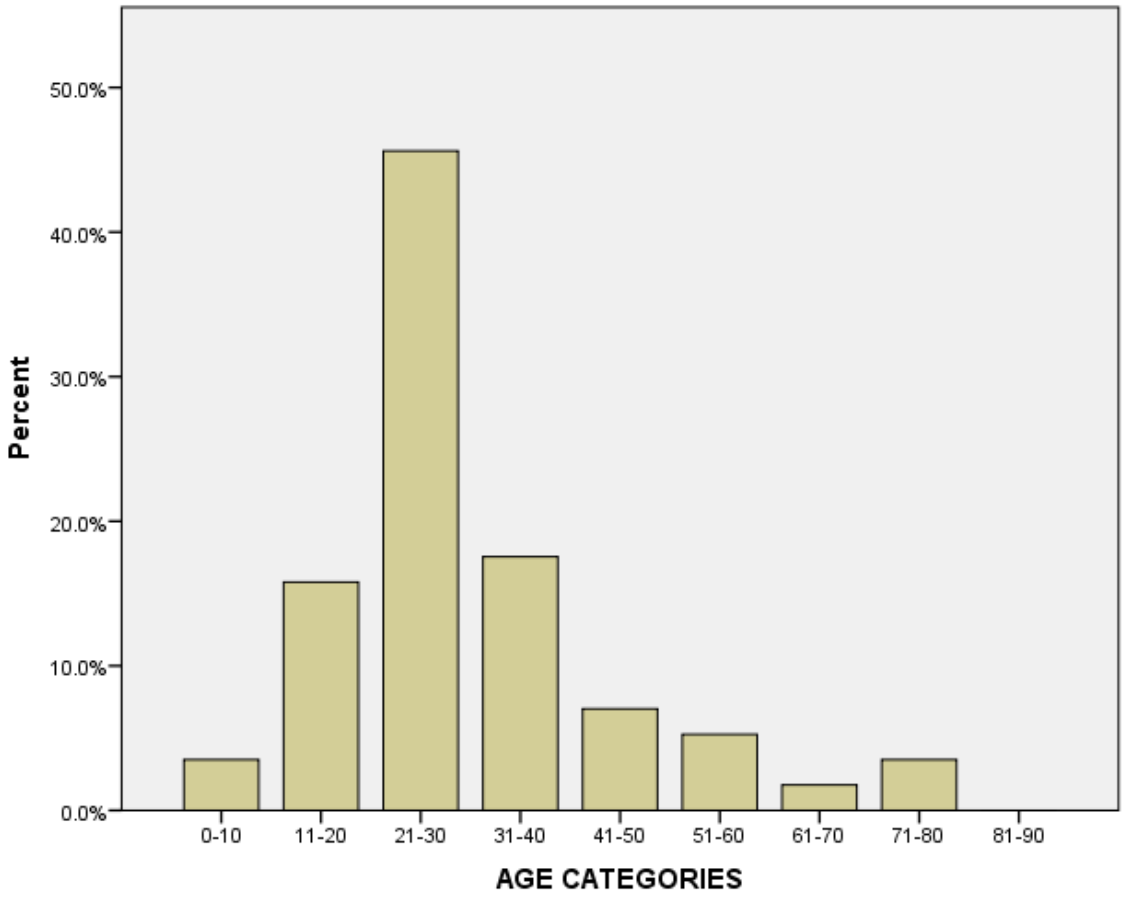

Figure 2: Distribution of Participants by Age Groups

Table 1: Clinical Data of 57 Patients

Clinical presentation	Number of Patients	Final diagnosis	Number of Patients
Pain only	25		
		Epididymal head cyst	2
		Epididymitis	4
		Epididymo-orchitis	6
		Normal	5
		Orchitis	1
		Testicular torsion	4
		Trauma	2
		Varicoceles	1
Pain and swelling	32		
		Epididymal head cyst with hydrocele	1
		Epididymitis with hydrocele	9
		Epididymitis with scrotal wall edema	1
		Epididymo-orchitis with hydrocele	7
		Hydrocele only	4
		Hernia	2
		Intratesticular masses	2
		Scrotal abscess	1
		Scrotal edema	1
		Testicular torsion with hydrocele	1
		Varicoceles	3
Total	**57**		**57**

The average age of patients with epididymitis, epididymo-orchitis and torsion were 29.43 33.08 and 20 years respectively. In the epididymitis group; 14.3% were less than 20 years of age, 57.1% were 20–30 years, and 28.5% were more than 31 years. Sixty percent of the testicular torsion cases were less than 20 years of age.

4.2. Sonographic findings

Table 2: Different Causes of Scrotal Pain As Diagnosed By USG

USG diagnosis	**Number of patients**	**Percentage**	**Mean Age (yrs)**
Epididymitis	14	24.56	29.43
Epididymo-orchitis	13	22.8	33.08
Epididymal head cyst	3	5.26	31.67
Varicoceles	4	7.01	45
Hydrocele	4	7.01	36
Hernia	2	3.5	32
Intratesticular masses	2	3.5	2
Orchitis	1	1.75	29
Scrotal abscess	1	1.75	2
Idiopathic scrotal edema	1	1.75	75
Testicular torsion	5	8.77	20
Trauma	2	3.5	21
Normal	5	8.77	30
Total	**57**	**100**	

Various causes of scrotal pain on ultrasound are depicted in **Table 3**. Epididymitis was the commonest diagnosis for scrotal pain comprising 14 out of total 57 patients (23.6%) followed by epididymo-orchitis comprising 13 out of 57 patients (22.8%)**.** 5 had testicular torsion, 2 had testicular trauma, 4 had varicocele, 4 had hydrocele and 5 had unremarkable results. In the 2 patients who had history of scrotal trauma, US detected testicular fracture in 1 patient and scrotal haematoma in the other.

One patient had features of acute idiopathic scrotal edema, which revealed a normal testis and edema of the scrotal wall. Of the 32 patients who presented with painful scrotum and swelling, 30 had extratesticular lesions and 2 had intratesticular lesions.

Table 3: Ultrasound Features of Epididymitis

Gray scale (Epididymal Size)	**Number**
Normal	2 (14.3%)
Enlarged	12 (75.7%)
Small	0
Gray scale (Echotexture)	**Number**
Normal	1 (7.14%)
Hypoechoic	5 (35.7%)
Hyperechoic	1 (7.14%)
Heterogenous	7 (50%)
Colour Doppler (Blood flow)	**Number**
Normal	0
Reduced	0
Increased	14 (100%)
Absent	0
Gray scale (Hydrocele)	**Number**
Yes	9 (64.3%)
No	5 (35.7%)

Table 4: Ultrasound Features of Epididymo-Orchitis

Feature (Size)	**Number**
Normal	3 (23.1%)
Enlarged	10 (76.9%)
Reduced	0
Feature (Echotexture)	**Number**
Normal	1 (7.7%)
Hypoechoic	5 (38.5%)
Hyperechoic	0
Heterogenous	7 (53.8%)
Feature (Blood flow)	**Number**
Normal	0
Reduced	0
Increased	13 (100%)
Absent	0
Feature (Hydrocele)	**Number**
Yes	7 (53.8%)
No	6 (46.2%)

Table 5: Ultrasound Features in Trauma

Feature (Testicular Size)	**Number**
Normal	0
Enlarged	2 (100%)
Reduced	0
Feature (Echotexture)	**Number**
Normal	0
Hypoechoic	0
Hyperechoic	0
Heterogenous	2 (100%)
Feature (Blood flow)	**Number**
Normal	0
Reduced	1(50%)
Increased	0
Absent	1 (50%)
Feature (Hydrocele)	**Number**
Yes	0
No	2 (100%)

Table 6: Ultrasound Features of Torsion

Feature (Size)	**Number**
Normal	1 (20%)
Enlarged	3 (60%)
Reduced	1 (20%)
Feature (Echotexture)	**Number**
Normal	0
Hypoechoic	2 (40%)
Hyperechoic	0
Heterogenous	3 (60%)
Feature (Blood flow)	**Number**
Normal	0
Reduced	1 (20%)
Increased	0
Absent	4 (80%)
Feature (Hydrocele)	**Number**
Yes	1 (20%)
No	4 (80%)

4.2.1 Size and distribution of lesions

Thirty (52.6%) of the patients were found to have epididymal lesions. 52% of the overall epididymal lesions were observed on the right, 30% on the left and 18% were bilateral. 3 (60%) patients with torsion had epididymal enlargement with normal size seen in 1 case. Reduced epididymal size was seen in the 1 case of missed testicular torsion.

In epididymitis, the lesions were most commonly found involving the head of the epididymis. No cases of isolated lesions of the body of epididymis were seen. The epididymis was enlarged in 86% cases of acute epididymitis. The epididymis was within normal size range in 2(14%) cases of epididymitis and 1 case of torsion. Epididymo-orchitis had enlargement of both the testis and epididymis in 77% of the cases with scrotal wall thickening seen in 36% of the patients.

4.2.2 Echotexture of the Lesion

The majority of the lesions observed were either hypoechoic or heterogenous. Purely hyperechoic lesion was seen in 1 case of epididymitis. Abnormal testicular echotexture was described as heterogeneous in 7 cases (54%) and hypoechoic in 5 cases (39%).

4.2.3 Blood flow Pattern

All cases of infection showed markedly increased vascularity while in the case of torsion there was absent blood flow in 4 cases while one case had reduced vascularity.

4.2.4 Presence of Hydrocele

Hydrocele was present in most cases of epididymitis (n=9), epididymo-orchitis (n=7) and in some cases of testicular torsion (n=1). One of varicoceles had coexisting hydrocele.

SONOGRAPHIC IMAGES

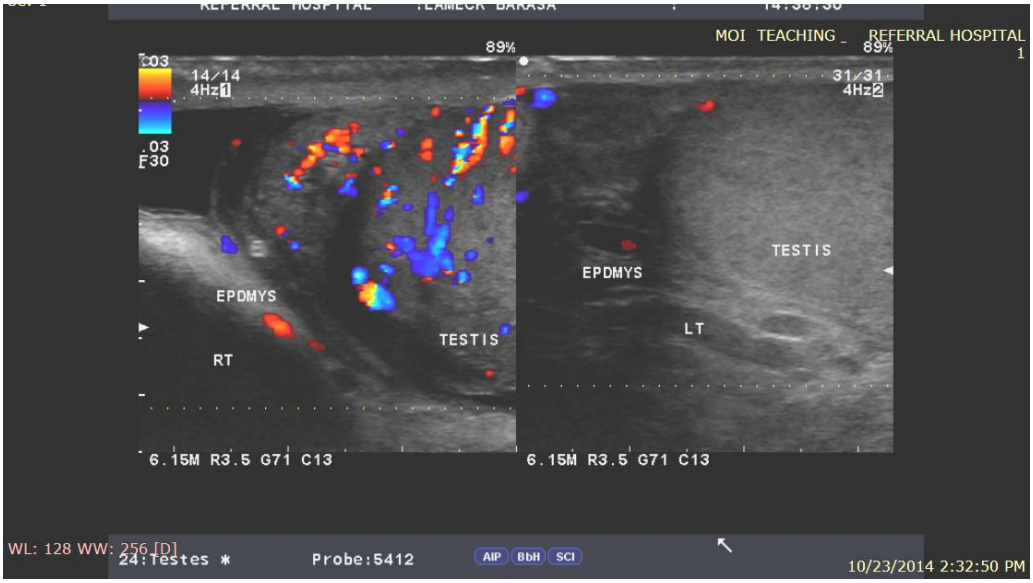

Figure 3: USG showing heterogenous echotexture of epididymal head and testis with increased vascularity on colour Doppler in epididymo-orchitis

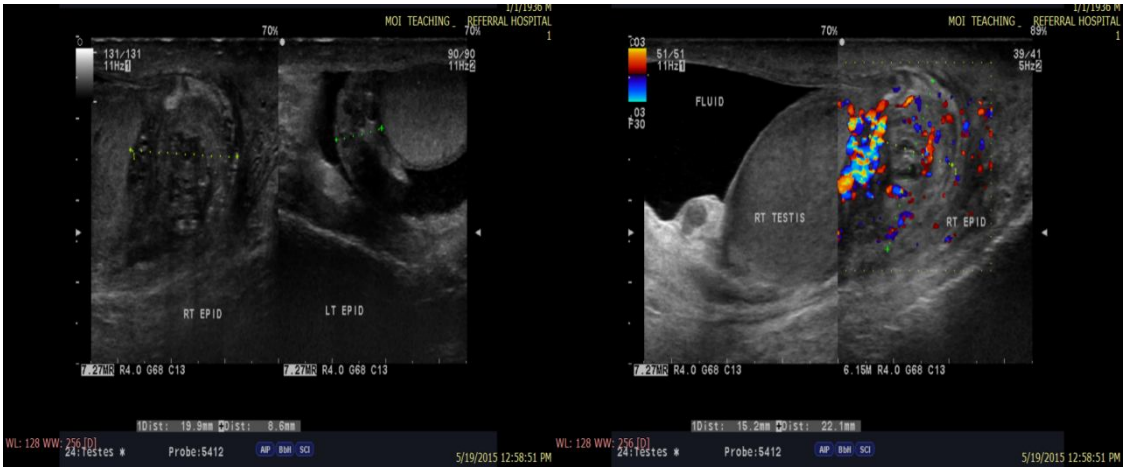

Figure 4: USG showing diffusely enlarged and heterogenous epididymal head with increased vascularity on colour Doppler with a reactive hydrocele in a case of epididymitis.

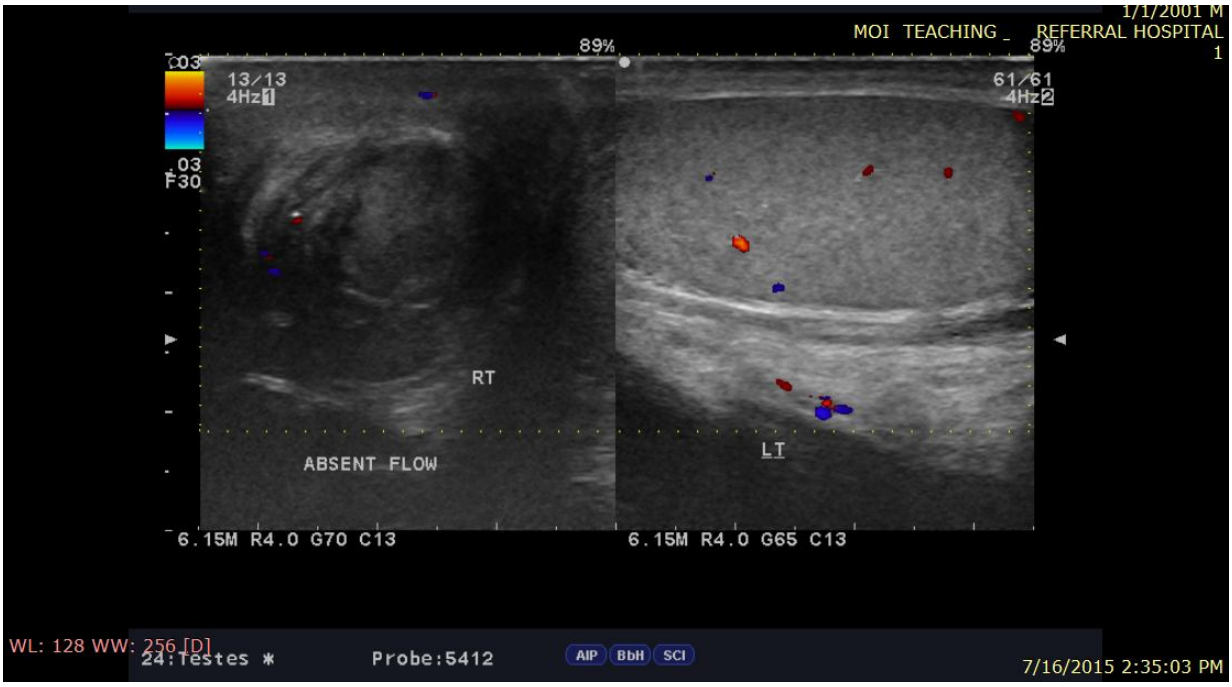

Figure 5 : Testicular torsion. Transverse US image shows enlarged, heterogenous right testis (RT) with thickened scrotal skin. CDUS shows no vascularity in the right testis.

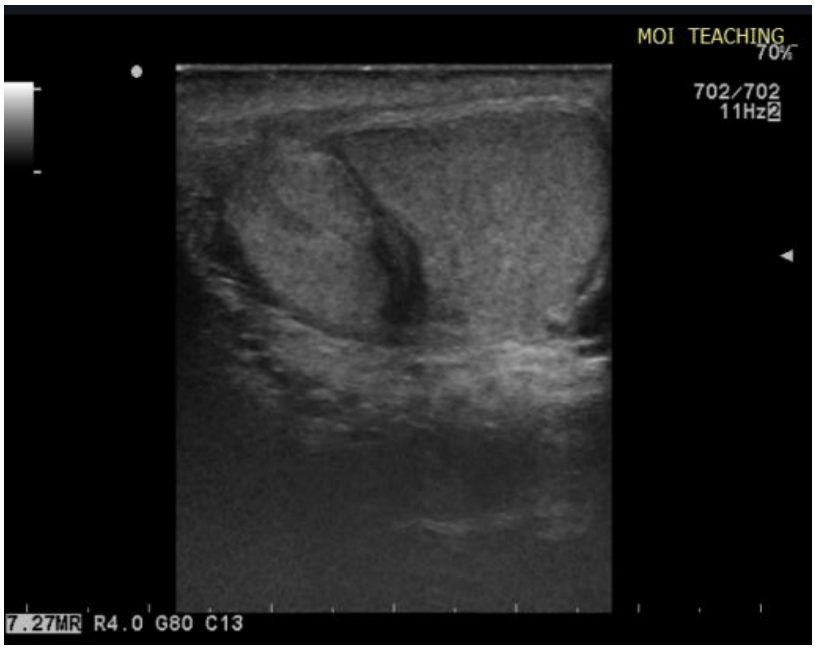

Figure 6: Fractured testis in a 17-year-old man presenting with a painful swelling of his right hemiscrotum for 1 day after he experienced trauma in the right scrotum while playing football

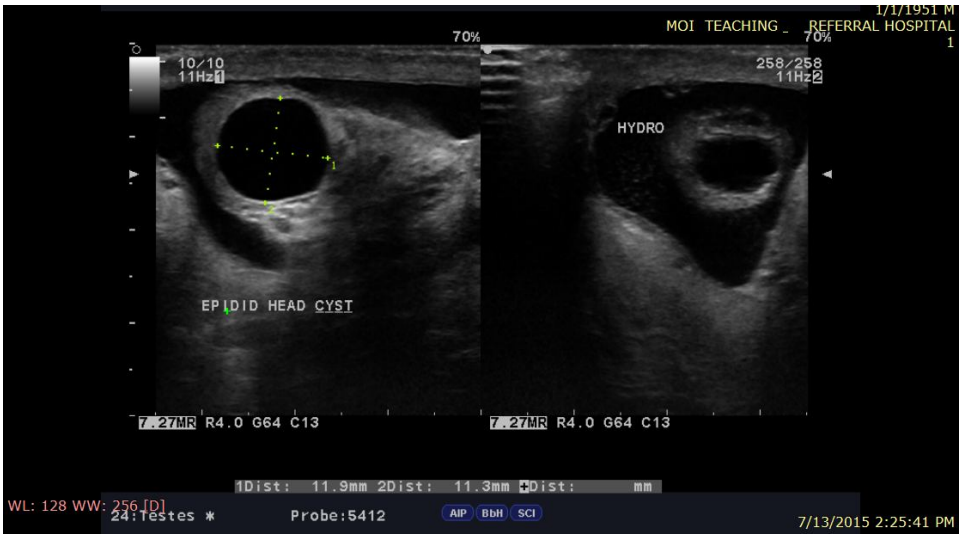

Figure 7: A case a 64 year old with a epididymal head cyst measuring 11.9 x 11.3mm with a surrounding hydrocele

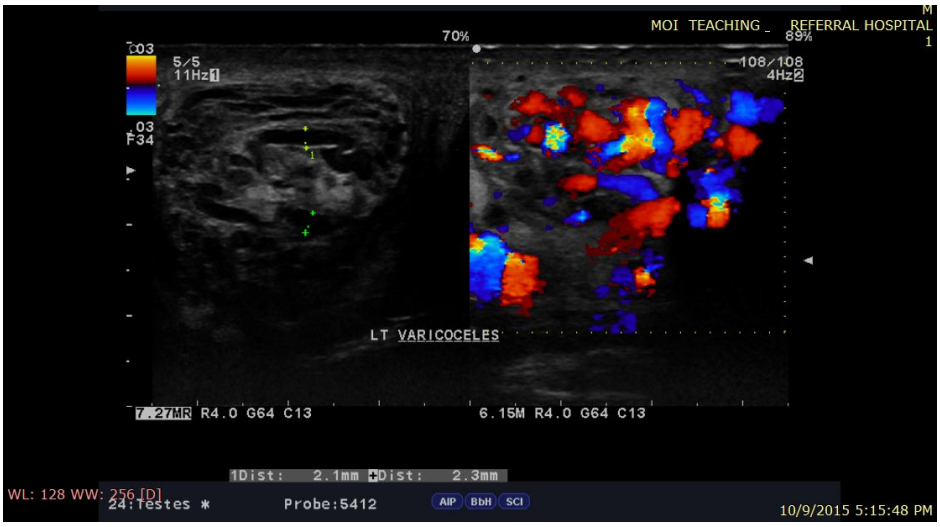

Figure 8: A case of varicocele in a 25yr old. Notice the positive valsalva response in the right image

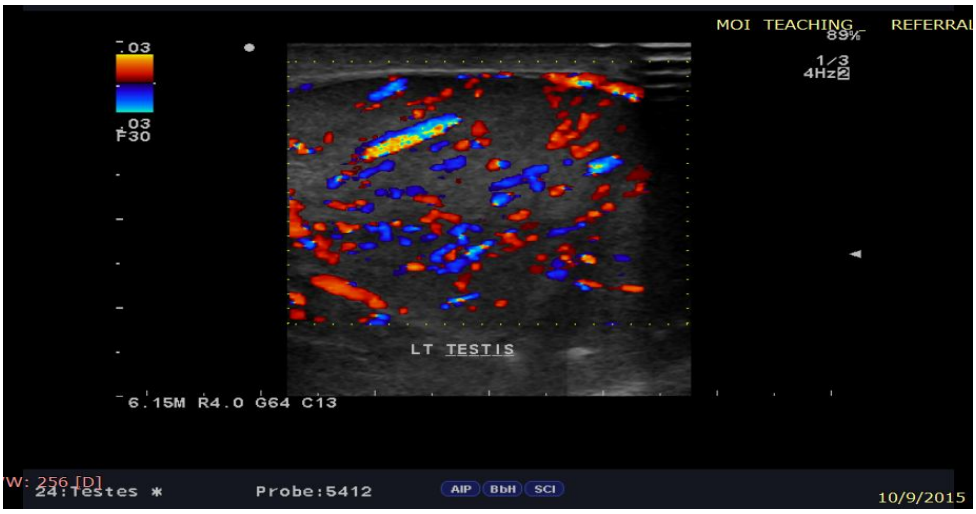

Figure 9: Case of orchitis in a 25 year old who presented with scrotal pain for 1 week. The testis demonstrates heterogenous echotexture with increased blood flow.

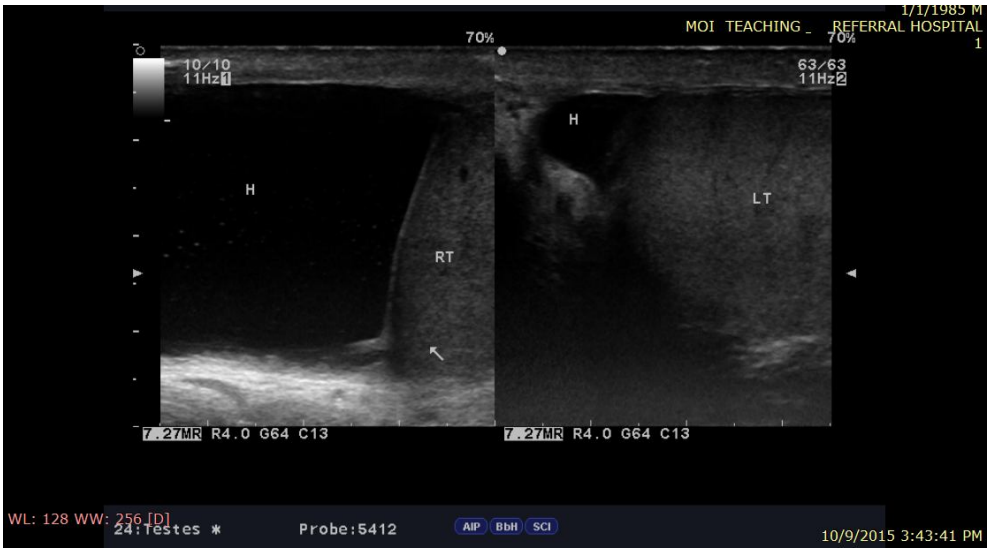

Figure 10: Bilatéral hydrocele in a 30-year-old man with history of progressive painful swelling of bilateral hemiscrotum for 3 weeks. Gray scale images show fluid with low level echoes.

CHAPTER FIVE: DISCUSSION

The majority of the patients were in the age group 21-30 years (45.6 %) followed by 31 to 40 years (17.5%). In Nepal, Subash et al found most patients were in 20 to 30 years age group comprising 41 % followed by 31 to 40 years age group comprising 39% (Subash C. K, Pathak, De, & Sathian, 2015).

Epididymitis was found to be the commonest cause of scrotal pain on ultrasound comprising of 14 cases. Epididymo-orchitis, on the other hand, was documented in 13 of the cases. All these entities which represent inflammation contributed 50.9 % of the respondents. Epididymis was found to be enlarged in 86% of the cases. Hypoechoic echotexture was seen in 5 patients both in epididymitis and epididymo-orchitis. Seven respondents showed heterogenous echotexture. Colour Doppler revealed increased blood flow in all the inflammatory cases. Normal testicular size and echotexture were observed in 5 and 2 of the respondents respectively. The indirect findings included scrotal wall thickening (n=16) and reactive hydrocele (n=18). A study by P K Chettri et al found 40% had inflammatory pathology(Chhetri et al., 2012) while Kawooya et al reported 61.9% to have inflammatory conditions(Kawooya M.J et al., 2008).

Increased blood flow to the epididymis and testis at colour Doppler US examination is a well established criterion for the diagnosis of epididymitis and epididymo-orchitis. The sensitivity of colour Doppler US imaging in detecting scrotal inflammation has been reported to be nearly 100%(Muttarak & Lojanapiwat, 2005). It has been documented that 20% of cases of epididymitis and 40% of cases of orchitis have hyperaemia as the

diagnostic colour Doppler US finding, because gray-scale US findings are normal. This is due to an increased number and concentration of identifiable vessels resulting in a high-flow pattern.(Patiala, 2009)

It is argued that heterogeneous echogenicity does not always indicate orchitis. Important differentials to consider include leukemia and lymphoma of the testis which have a similar appearance and are many a time bilateral, whereas infection, with exception of mumps, is usually unilateral. It is difficult to differentiate focal areas of heterogeneous echogenicity from neoplastic lesions based on gray-scale US findings. It is therefore advisable that whenever the testes show inhomogeneous echogenicity, follow up is recommended to complete resolution and documented with US to rule out tumour, infarction, and metastasis.(V. Dogra & Bhatt, 2004)

Testicular torsion was reported in 5 patients (8.7%) with a mean age of 20 years. The most affected age group was 11-20yrs. Testicular enlargement (n=3), heterogenous echotexture (n=3) and absent intratesticular blood flow (n=4) were the commonest findings. Hydrocele was seen in 1 case. Kawooya et al reported marked enlargement of both epididymidis and testis with heterogeneous echogenicity as characteristic findings (Kawooya M.J et al., 2008). A study by Thinyu et al found 4 cases (4.8%) had testicular torsion with a mean age of 17.2 years (Thinyu & Muttarak, 2009). Heterogeneous echotexture can be due to hemorrhage or infarction. In the acute stage, the testis may only show enlargement with a normal echotexture and so color Doppler and power Doppler examination are important to rule out decreased or absent flow. Reports in literature have suggested that USG for

testicular torsion has a specificity of almost 100%, but the sensitivity varies from 50 to 100% (Baker et al., 2000). The absence of testicular flow at color and power Doppler US is considered diagnostic findings of ischemia, provided that the scanner is optimized for detection of slow flow.

The role of spectral Doppler US analysis is not well established with regard to diagnosis of partial torsion, but the may be useful. As at now, there are no studies available that validate the role of spectral Doppler US in partial torsion; however findings from case reports suggest its usefulness. It is also important to note that the presence of color or power Doppler signal in a patient with the clinical manifestation of torsion does not exclude torsion.(V.S Dogra et al., 2003)

I analysed 2 out of 57 (3.5%) patients with blunt scrotal injuries (mean age 21 years). US detected testicular fracture in 1 patient and scrotal haematoma in the other. D'Andrea et al reported 5% cases of trauma with US accurately detecting testicular rupture in 1 patient and scrotal haematomas in 2 patients. Subash et al found 6% of the cases in his study had scrotal haematoma.

Generally, scrotal trauma can result in contusion, haematoma, fracture or rupture of the testis. Prompt diagnosis of testicular rupture is paramount because the surgical testicular salvage rate drops from approximately 90% to 45% after 72 hours of onset (V. Dogra & Resnick, 2002; Muttarak & Lojanapiwat, 2005).

Colour and power Doppler US are helpful in demonstrating disruption in the normal capsular blood flow of the tunica vasculosa. Heterogeneous intratesticular lesions are usually due to haemorrhage or infarction.(V.S Dogra et al., 2003).

Direct visualization of a fracture line is rare and seen in only 17% of literature cases(Bhatt & Dogra, 2008). The presence of associated hyper- or hypoechoic changes in the testicular parenchyma suggest testicular fracture. It is also important to note that 10%–15% of testicular tumours first manifest after an episode of scrotal trauma; hence, intratesticular abnormalities appearing with trauma should be followed if surgical intervention is not immediate (V. Dogra & Bhatt, 2004).

There were 2 cases (3.5%) of epididymal cysts. Cystic lesions of the epididymis include simple epididymal cyst and often spermatocele. No case of spermatocele was seen in this study. Both cysts involved the head of the epididymis. A study by Subash et al found the prevalence of epididymal cysts to be 9% (Subash C. K et al., 2015) while Chhetri et al recorded a combined prevalence of 18% for both epididymal cysts and spermatoceles.(Chhetri et al., 2012). USG demonstrated anechoic structure with posterior acoustic enhancement as the characteristic finding of a simple cyst.

Differentiating a spermatocele from a simple cyst is considered unimportant and often indistinguishable on USG. A spermatocele is more common than an epididymal cyst and more frequent in the epididymal head (Chhetri et al., 2012). A spermatocele consists of

cystic dilatation of tubules of efferent ductules and often containing low reflective debris representing spermatozoa, lymphocytes, cellular debris fat and proteinaceous fluid.(Rifkin, 1987).

Four cases (7%) of varicoceles with mean age 45 years were documented. Three of the respondents (75%) had left sided varicocele and 1 was bilateral. This finding is similar to study done by Minayoshi et al which showed that the left side was affected in 78-93% and bilateral in 15% cases(Minayoshi K.E., 2001). Thinyu et al documented 6.9% of the cases with mean age of 36.2 years.(Thinyu & Muttarak, 2009). There were no associated significant abdominal findings to suggest secondary varicoceles.

A varicocele is considered to be present on high frequency USG if 2 or more veins could be identified with at least 1 vein having a diameter of 2 mm or greater. On colour Doppler USG retrograde flow is identified within the pampiniform plexus spontaneously or during Valsalva maneuver.

Varicoceles are more common on the left side for the following reasons: a) the left testicular vein is longer; b) the left testicular vein enters the left renal vein at a right angle; (c) the left testicular artery in some men crosses over the left renal vein, thereby compressing it; and (d) the descending colon distended with faecal matter may compress the left testicular vein (V. Dogra & Bhatt, 2004).

Increased pressure on the spermatic vein or its tributaries by lesions such as severe hydronephrosis and abdominal masses causes secondary varicoceles. Neoplasm is the most

likely cause of non-decompressible varicocele in men over 40 years of age. It is commonly caused by a left renal malignancy invading the renal vein. Non-compressible varicoceles on the left or right should therefore prompt evaluation of the retroperitoneum to exclude retroperitoneal mass and of the left renal vein for thrombus or tumour extension(V.S Dogra et al., 2003).

In my analysis, 4 patients had isolated hydrocele as the cause of scrotal pain. The low prevalence can be explained by the fact that most hydroceles present with painless swelling. A total of 18 hydroceles were associated with inflammatory processes, testicular torsion and varicoceles. Unilateral right sided hydrocele was more common with 47.8% compared to left sided and bilateral hydroceles which were 21.7% and 30.4% respectively.

A hydrocele has a variety of causes, including trauma, infection, testicular torsion, or tumor, or it may be idiopathic. Congenital hydroceles result from a patent processus vaginalis that permits entry of peritoneal fluid into the scrotal sac. In adults, hydroceles are usually associated with an intrascrotal pathology, which should be determined and treated.

Hydroceles are anechoic fluid collections with good sound transmission; they surround the anterolateral aspects of the testis. Hydroceles may occasionally manifest low-level echoes secondary to high protein or cholesterol content.(V. Dogra & Resnick, 2002)

Adult hydrocele is a very common urological disease in most of the sub-Saharan African countries, with a reported incidence of up to 20–28% in some lymphatic filariasis endemic communities (Simonsen et al., 1995). Scrotal ultrasound is recommended in adult men with

hydrocele as part of the diagnostic workup so as to rule out more serious pathologies like testicular/paratesticular cancer and testicular torsion.(Okorie et al., 2011).

The other findings in this study include idiopathic scrotal edema, inguino-scrotal hernia, testicular mass and scrotal abscess.

There was no sonographic abnormality documented in 5 respondents. This could be due to the fact that no physical examination was done to objectively assess for pain/tenderness. The possibility of referred pain cannot be ruled out.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

1- Epididymitis is the most common cause of scrotal pain in patients presenting at MTRH

2- The commonest sonographic appearances include epididymal enlargement and abnormal echotexture.

6.2 RECOMMENDATION

1. Ultrasound evaluation is recommended in all patients presenting with scrotal pain.

.

REFERENCES

Abdullah Hamdan, Yousef, M., AliOmer, M. A., & Abdulla, A. (2014). Evaluated of Testicular Tumors using Doppler Sonography. *Journal of Dental and Medical Sciences (IOSR-JDMS), 13*(3), 54-61.

Aso, C., Enriquez, G., Fite, M., Toran, N., Piro, C., Piqueras, J., & Lucaya, J. (2005). Gray-scale and color Doppler sonography of scrotal disorders in children: an update. *Radiographics, 25*(5), 1197-1214. doi: 10.1148/rg.255045109

Baker, L. A., Sigman, D., Mathews, R. I., Benson, J., & Docimo, S. G. (2000). An analysis of clinical outcomes using color doppler testicular ultrasound for testicular torsion. *Pediatrics, 105*(3 Pt 1), 604-607.

Baruga, E., & Guyton Munabi, I. (2013). Case series on testicular torsion: an educational emergency for sub-Saharan Africa. *Panafric African Medical Journal: 14*(18). doi: 10.11604/pamj.2013.14.18.1736

Berger, R. E., Alexander, E. R., Harnisch, J. P., Paulsen, C. A., Monda, G. D., Ansell, J., & Holmes, K. K. (1979). Etiology, manifestations and therapy of acute epididymitis: prospective study of 50 cases. *Journal Urology, 121*(6), 750-754.

Bhatt, S., & Dogra, V. S. (2008). Role of US in testicular and scrotal trauma. *Radiographics, 28*(6), 1617-1629. doi: 10.1148/rg.286085507

Blaivas, M., Sierzenski, P., & Lambert, M. (2001). Emergency evaluation of patients presenting with acute scrotum using bedside ultrasonography. *Academic Emergency Medicine, 8*(1), 90-93.

Buckley, J. C., & McAninch, J. W. (2006a). Diagnosis and management of testicular ruptures. *Urology Clinic North America, 33*(1), 111-116, vii. doi: 10.1016/j.ucl.2005.11.002

Buckley, J. C., & McAninch, J. W. (2006b). Use of ultrasonography for the diagnosis of testicular injuries in blunt scrotal trauma. *Journal Urology, 175*(1), 175-178. doi: 10.1016/S0022-5347(05)00048-0

Cassar, S., Bhatt, S., Paltiel, H. J., & Dogra, V. S. (2008). Role of spectral Doppler sonography in the evaluation of partial testicular torsion. *Journal Ultrasound Medical , 27*(11), 1629-1638.

Chhetri P.K, Tayal, A., & Deka, P. K. (2012). USG evaluation of patients with scrotal pain. *Journal of College of Medical Sciences, Nepal, 8*(1), 18-22.

Chhetri, P. K., Tayal, A., & Deka, P. K. (2012). USG in evaluation of patients with scrotal pain. *Journal of College of Medical Sciences-Nepal, 8*(1), 18-22.

D'Andrea, A., Coppolino, F., Cesarano, E., Russo, A., Cappabianca, S., Genovese, E. A., . . . Macarini, L. (2013). US in the assessment of acute scrotum. *Critical Ultrasound Journal, 5 Suppliment*, S8. doi: 10.1186/2036-7902-5-S1-S8

Deurdulian, C., Mittelstaedt, C. A., Chong, W. K., & Fielding, J. R. (2007). US of acute scrotal trauma: optimal technique, imaging findings, and management. *Radiographics, 27*(2), 357-369. doi: 10.1148/rg.272065117

Dogra, V., & Bhatt, S. (2004). Acute painful scrotum. *Radiology Clinical North America, 42*(2), 349-363. doi: 10.1016/j.rcl.2003.12.002

Dogra, V., & Resnick, M. I. (2002). Ultrasonography of the scrotum. *Journal Ultrasound Medicine, 21*(8), 848.

Dogra, V. S., Gottlieb, R. H., Oka, M., & Rubens, D. J. (2003). Sonography of the scrotum. *Radiology, 227*(1), 18-36. doi: 10.1148/radiol.2271001744

Dogra, V. S., Rubens, D. J., Gottlieb, R. H., & Bhatt, S. (2004). Torsion and beyond: new twists in spectral Doppler evaluation of the scrotum. *Journal Ultrasound Medicine, 23*(8), 1077-1085.

Elkader, and, A. E. N., & Den, K. M. E. (2010). Accuracy of Ultrasound Diagnosis after Blunt Scrotal Trauma (10 Years Experience). *African Journal of Urology, 16*(3), 73-78.

Garner, M. J., Turner, M. C., Ghadirian, P., & Krewski, D. (2005). Epidemiology of testicular cancer: an overview. *Internal Journal Cancer, 116*(3), 331-339. doi: 10.1002/ijc.21032

Gatti, J. M., & Patrick Murphy, J. (2007). Current management of the acute scrotum. *Semin Pediatric Surgery, 16*(1), 58-63. doi: 10.1053/j.sempedsurg.2006.10.008

Gunther, P., & Schenk, J. P. (2006). [Testicular torsion: diagnosis, differential diagnosis, and treatment in children]. *Radiologe, 46*(7), 590-595. doi: 10.1007/s00117-005-1256-4

Kapoor, S. (2008). Testicular torsion: a race against time. *Internal Journal Clinical Practices, 62*(5), 821-827. doi: 10.1111/j.1742-1241.2008.01727.x

Kawooya M.J, Opio J, Byanyima R.K, & Kiguli-Malwadde. (2008). The sonographic pattern of diseases presenting with scrotal pain at Mulago Hospital, Kampala, Uganda. *East and Central African Journal of Surgery, 13*(2), 68-74.

Kuremu, R. T. (2004). Testicular torsion: case report. *East African Medical Journal, 81*(5), 274-276.

Lam, W. W., Yap, T. L., Jacobsen, A. S., & Teo, H. J. (2005). Colour Doppler ultrasonography replacing surgical exploration for acute scrotum: myth or reality? *Pediatric Radiology, 35*(6), 597-600. doi: 10.1007/s00247-005-1411-0

Lin, E. P., Bhatt, S., Rubens, D. J., & Dogra, V. S. (2007). Testicular torsion: twists and turns. *Semin Ultrasound CT MR, 28*(4), 317-328.

Mehran Peyvasteh, Shahnam Askarpour, and, H. J., & Bagherya, Y. (2011). Etiology of acute scrotal pain in children and adolescentpatients admitted in Ahvaz Educational Hospitals. *Annals of Pediatric Surgery, 7*, 148-151.

Mehta, A. L., & Dogra, V. S. (1998). Intratesticular varicocele. *Journal Clinical Ultrasound, 26*(1), 49-51.

Minayoshi K.E., O., Fujisawa M.A., et al. (2001). Hemodynamic evaluation of left testicular varicocele by scrotal scintigraphy. *Europe Urology*(39), 30-35.

MTRH. (2013). Health Records and Information System.

Murray M, M. B. a. J. B. (1997). Ultrasound examination of scrotal masses. *Journal Urology 1*(17), 185-188.

Muttarak, M., & Lojanapiwat, B. (2005). The painful scrotum: an ultrasonographical approach to diagnosis. *Singapore Mediccal Journal , 46*(7), 352-357; quiz 358.

Okorie, C. O., Pisters, L. L., & Liu, P. (2011). Longstanding hydrocele in adult Black Africans: Is preoperative scrotal ultrasound justified? *Niger Medical Journal, 52*(3), 173-176. doi: 10.4103/0300-1652.86130

Opot, E. N., & Magoha, G. A. (2000). Testicular cancer at Kenyatta National Hospital, Nairobi. *East Africa Medical Journal, 77*(2), 80-85.

Patiala, B. (2009). Role of color doppler in scrotal lesions. *Indian Journal Radiology Imaging, 19*(3), 187-190. doi: 10.4103/0971-3026.54874

Rifkin, M. D. (1987). Scrotal ultrasound. *Urology Radiology, 9*(2), 119-126.

Ringdahl, E., & Teague, L. (2006). Testicular torsion. *American Family Physician, 74*(10), 1739-1743.

Rizvi, S. A., Ahmad, I., Siddiqui, M. A., Zaheer, S., & Ahmad, K. (2011). Role of color Doppler ultrasonography in evaluation of scrotal swellings: pattern of disease in 120 patients with review of literature. *Urology Journal, 8*(1), 60-65.

Ryan, S., McNicholas, M., & Eustace, S. (2004). Anatomy for Diagnostic imaging. (2nd ed) London, Elsevier Limited.

Simonsen, P. E., Meyrowitsch, D. W., Makunde, W. H., & Magnussen, P. (1995). Bancroftian filariasis: the pattern of microfilaraemia and clinical manifestations in three endemic communities of Northeastern Tanzania. *Acta Tropical, 60*(3), 179-187.

Smith, R. P., Tracy, C. R., Kavoussi, P. K., Witmer, M. T., & Costabile, R. A. (2013). The impact of color Doppler ultrasound on treatment patterns of epididymitis in a university-based healthcare system. *Indian Journal Urology, 29*(1), 22-26. doi: 10.4103/0970-1591.109979

Subash C. K, Pathak, M., De, A., & Sathian, B. (2015). Ultrasonography in Predicting the Cause of Scrotal Pain: A Study in Nepal. *American Journal of Public Health Research, 3*(5A), 199-202.

Thinyu, S., & Muttarak, M. (2009). Role of ultrasonography in diagnosis of scrotal disorders: a review of 110 cases. *Biomedical Imaging Intervention Journal, 5*(1), e2. doi: 10.2349/biij.5.1.e2

Wittenberg, A. F., Tobias, T., Rzeszotarski, M., & Minotti, A. J. (2006). Sonography of the acute scrotum: the four T's of testicular imaging. *Current Problem Diagnostic Radiology, 35*(1), 12-21. doi: 10.1067/j.cpradiol.2005.10.002

Zimmerman, R. R., & Kung'u, A. (1978). Testicular neoplasms in Kenyan Africans. *Cancer, 41*(6), 2452-2455.

APPENDICES

APPENDIX I: CONSENT FORM

English Version

Investigator: My name is Dr. Namdala Celestine. I am a qualified doctor, registered with the Kenya Medical Practitioners and Dentists Board. I am currently pursuing a Masters degree in Radiology and Imaging at Moi University. I would like to recruit you into my research which is to study the pattern sonographic findings among patients with scrotal pain at Moi teaching and referral hospital. This study has been approved by the Institutional Research and Ethics Committee (IREC) of Moi University/Moi Teaching and Referral Hospital.

Purpose: This study will seek to determine the pattern of sonographic findings among patients presenting with scrotal pain.

Procedure: All patients with scrotal pain referred for ultrasound scanning and for whom consent has been given will undergo US evaluation. Demographic data will be obtained and the patients subjected to a physical examination. Both the clinical and radiologic data will be collected on data collection forms. Data collecting material will be kept in a locked cabinet during the study period.

Benefits: There will be no direct benefits of participating in this study. Study subjects will be accorded same quality of management as non-study subjects

Risks: There are no anticipated risks to the participants attributable to this study.

Confidentiality: All information obtained in this study will be treated with utmost confidentiality and shall not be divulged to any unauthorized person

Rights to Refuse: Participation in this study is voluntary, there is freedom to refuse to take part or withdraw at any time. In the event you do not agree to take part, you shall be evaluated along with other patients but your result/information will not be included in the list of those who consent.

Where a minor declines to take part even in the event the guardian/parents consents, he will not be included in the study.

Sign or make a mark if you agree to take part in the study

I allow the minor to participate

Name……. Relationship: Parent/Guardian: ……

Sign ……..Date: ……

I agree to take part (adults)

Name…….

Sign ……..Date: ……

Investigator Part

Name ……..……

Sign……..Date ……..

Cheti cha Ruhusa

Kiswahili Version

Mpelelezi: jina langu ni Dr Namdala Celestine. Mimi ni daktari aliyehitimu na kusajiliwa na bodi ya Kenya ya Madaktari na Madaktari wa meno. Kwa sasa natafuta shahada ya uzamili katika Radiology na Imaging katika Chuo Kikuu cha Moi. Ningependa kukuajiri katika utafiti wangu ambao ni wa kuangalia baadhi ya magonjwa ambayo yanasababisha maumivu ya korodani kwa kutumia picha ya Ultrasound. Utafiti huu umepitishwa na Utafiti wa Taasisi na Kamati ya Maadili (IREC) ya Chuo Kikuu cha Moi na Hospitali ya Rufaa.

Kusudi: Utafiti huu utajaribu kueleza namna magonjwa mbalimbali ya korodani yataonekana kwenye picha ya Ultrasound.

Utaratibu: Wagonjwa wote ambao wana maumivu ya korodani , watashirikishwa kwenye utafiti huu ikiwa watakubali. Data zitakusanywa kwenye fomu za ukusanyaji data. Hifadhi zitakazo tumika katika ukusanyaji wa data zitawekwa katika kabati iliyofungwa katika chumba cha mpelelezi mkuu kwa kipindi cha utafiti.

Faida: Kutakuwa hakuna faida moja kwa moja ya kushiriki katika utafiti huu.Wanaofanyiwa utafiti watakuwa na haki ya kupewa matibabu sawa na wale ambao hawatahusishwa kwenye utafiti huu.

Hatari: Hakuna hatari ya kutarajia kwa washiriki kutokana na utafiti huu.

Usiri: habari zote zilizopatikana katika utafiti huu wa kutibiwa zitawekwa kwa usiri mkubwa na wala haitatolewa kwa mtu yeyote asiye husika na utafiti.

Haki ya kukataa: Kushiriki katika utafiti huu ni hiari yako, kuna uhuru wa kukataa kushiriki au kujiondoa wakati wowote.

Na iwapo hautakubali kujumuishwa kwenye zoezi hili, bado hutachunguzwa kama wale wengine, kulingana na kanuni za hospitali hii, lakini matokea haitajumuishwa katika utafiti huu. Mgonjwa alieye chini ya miaka kumi na minane, mzazi/ mlezi atamtilia sahii. Iwapo mtotot huyo atakataa, kuhuzishwa basi hatajumuishwa.

Weka sahihi au alama kama umekubali kushiriki katika utafiti.

Mzazi / Mlezi: ..... Mpelelezi: .....

Tarehe: .....

Namruhusu kujumuishwa

Jina …….Uhusiano : Mzazi/mlezi : ……

Sahihi …….Tarehe : ……

Nakubali kujumuishwa

Jina ……..

Sahihi …….Tarehe : ……

APPENDIX II: DATA COLLECTION FORM

SOCIO-Demographics

Date: …… Hospital Number: ……..…… Study No……..

Age…… Referred…….Yes ☐ No ☐

County of residence.....

Level of education None ☐ Primary ☐ secondary ☐ Tertiary ☐

Clinical presentation: Pain only ☐

Pain and swelling ☐

Duration of symptoms ……

Consent …….. Assent……..

ULTRASOUND EXAMINATION

TESTIS			
		RIGHT	**LEFT**
Volume	Normal		
	Reduced		
	Increased		
Echogenicity	Normal		
	Hypoechoic		
	Hyperechoic		
	Heterogenous		
Colour flow	Normal		
	Reduced		
	Increased		

Any other testicular abnormality

……

EPIDIDYMIS			
		RIGHT	**LEFT**
Size	Normal		
	Enlarged		
Echogenicity	Normal		
	Hypoechoic		
	Hyperechoic		
	Heterogenous		
Colour flow	Normal		
	Reduced		
	Increased		
	Absent		

Any other epididymal abnormality

……

……

SPERMATIC CORD			
		RIGHT	**LEFT**
Pampiniform plexus (vein diameter)	2mm		
	> 2mm		
Valsalva manouvre	Positive		
	Negative		

`

Any other spermatic cord abnormality……

SCROTAL WALL/SAC			
		Right	Left
Wall thickness	Normal <8mm		
	Thickened >8mm		
Tunica vaginalis	Fluid collection [volume cc]		

Final diagnosis

1. ……
2. ……

APPENDIX III: MTRH APPROVAL TO CONDUCT RESEARCH

MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4
Fax: 61749
Email: director@mtrh.or.ke

P. O. Box 3
ELDORET

Ref: ELD/MTRH/R.6/VOL.II/2008

20th July, 2014

Dr.Namdala Celestine Emukule,
Moi University,
School of Medicine,
P.O. Box 4606,
ELDORET KENYA.

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:

"The Patterns of Sonographic Findings in Patients in Referred for Sonography Presenting With Scrotal Pain at Moi Teaching and Referral Hospital."

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

DR. WILSON ARUASA
AG. DIRECTOR
MOI TEACHING AND REFERRAL HOSPITAL.

CC - Deputy Director (CS)
- Chief Nurse
- HOD, HRISM

APPENDIX IV: IREC APPROVAL LETTER

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2013/131
Approval Number: 0001220

10th July, 2014

Dr. Namdala Celestine Emukule,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
10 JUL 2014
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Dr. Namdala,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"The Patterns of Sonographic Findings in Patients Referred for Sonography Presenting with Scrotal Pain at Moi Teaching and Referral Hospital".

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1220*** on 10th July, 2014. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 9th July, 2015. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc Director - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD