

**PATTERN OF GENITOURINARY TRACT INJURIES IN PATIENTS WITH
MULTIPLE TRAUMA AT THE KENYATTA NATIONAL HOSPITAL**

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H58/87740/2016

**A RESEARCH UNDERTAKEN IN PART FULFILLMENT FOR THE AWARD OF
MASTER OF MEDICINE IN UROLOGY OF THE UNIVERSITY OF NAIROBI.**

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DECLARATION BY SUPERVISORS

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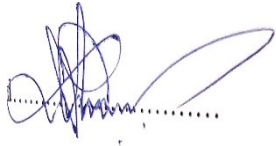
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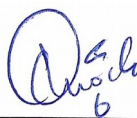
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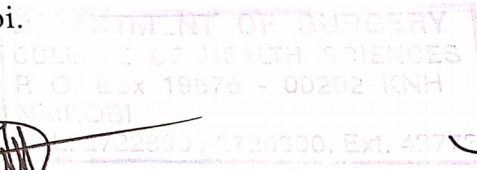
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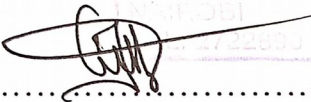
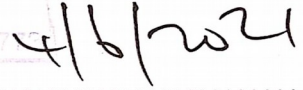
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DEPARTMENTAL APPROVAL

This research was presented at the general surgery departmental meeting of the University of Nairobi on 14th May 2020 and is hereby approved.

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DEDICATION

This research work is dedicated to all my teachers in surgery, colleagues, and patients for making this study possible. I also wish to dedicate it to my beloved family and friends who have supported me in one way or another towards the accomplishment of this great noble of my research proposal.

ACKNOWLEDGEMENT

My utmost gratitude goes to the almighty God who has granted me this opportunity to develop this proposal. Special thanks go to my supervisors; Dr. Francis Abiga Owilla and Dr. Daniel Ojuka for their assistance, guidance, and their expert opinions throughout this period of proposal development. Their patience in reading and providing criticism has been greatly appreciated.

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LIST OF ABBREVIATIONS

A&E	Accident and Emergency
ERC	Ethics and Research Committee
GSW	Gun Shot Wound
GU	Genitourinary
KNH	Kenyatta National Hospital
MVCs	Motor Vehicle Collisions
UoN	University of Nairobi
CT-Urogram	Contrast-enhanced computer tomography scan of the kidneys, ureters and urinary bladder

OPERATIONAL DEFINITIONS

Multiple trauma: Refers to patients who are severely injured having two or more traumatic injuries that are significant, and an injury severity score total of above 15, or an injury scale that is abbreviated and greater than 2 in at least two regions of injury severity score.

Genitourinary trauma: Injuries to the kidneys, ureters, urinary bladder, urethra, penis, scrota and/or testes.

ABSTRACT

Background: Genitourinary tract injury is common in multiple injured patients after both penetrating and blunt trauma. Current published data, mostly from developed countries, indicate variations in pattern of genitourinary injuries in terms of overall prevalence in multiple trauma patients, frequency of individual genitourinary organ involvement, mechanisms of injury, clinical presentation, and associated injuries. Locally, we do not have data for comparison and to guide clinical practice.

Study objective: To determine the pattern and clinical presentation of genitourinary tract injuries among multiple trauma patients at the Kenyatta National Hospital (KNH).

Study design and Sites: This was a cross sectional study undertaken in the Accident and Emergency Department (A&E), Surgical Wards, and Intensive Care Unit of the Kenyatta National Hospital.

Participants and Methodology: A total of 384 patients with multiple trauma in KNH were enrolled in the study after signing a written consent form. An interviewer guided questionnaire was administered to the eligible participants and data collected from patient and their files on the demographic characteristics, genitourinary organ injured, clinical presentation, mechanism of injury and associated injuries using a pretested data collection tool.

Data management: The collected data was entered into SPSS version 23.0 and analyzed for means, frequencies and proportions. The results are presented in tables.

Results: Three hundred and eighty-four participants (384) with multiple traumata were enrolled in the study between the period of November 2020 and April 2021. The age of the participants ranged between 19 and 59 years, with a mean age of 29.7 (SD 11.0) years. Genitourinary injuries were recorded in 52 patients representing 13.5%. The majority were males (37, 71.2%), while females were (15, 28.8%). The most commonly injured genitourinary organ was the urethra (27, 51.9%). Blunt trauma was recorded in 76.9% while penetrating trauma in 23.1%. All genitourinary injuries were associated with non-genitourinary injuries with pelvic fractures being the most common at 52.0%.

Conclusion: Epidemiology of trauma is varied hence there is need for every region to establish its own updated database. Genitourinary injuries mostly result from blunt trauma

due to road traffic accidents with urethral injuries being the most common in our setting; and mostly seen in the youth.

CHAPTER ONE: INTRODUCTION

Genitourinary (GU) trauma involves injuries to the kidneys, ureters, urinary bladder, urethra, penis, scrotum and/or testes. They affect health and -related life quality and contribute to disease burden related to trauma in both developing and developed countries (1) and frequently occur in the background of multiple trauma and may easily be overlooked (2).

Multiple trauma refers to patients who are severely injured having two or more traumatic injuries that are significant, and an injury severity score total of above 15, or an injury scale that is abbreviated and greater than 2 in at least two regions of injury severity score (3). The injuries are either blunt or penetrating according to the basic mechanism of injury with majority being of blunt nature. Penetrating injuries are defined by break on the skin (4). However, variations exist in the absolute numbers across geographic regions from Iran (5), Scotland (6) and United States (4, 7). The clinical presentation of GU trauma is also wide-ranging. The most common indicators of GU injuries are lumbar vertebral or fractures of lower rib or pelvic, hematoma or flank pain, abnormal prostate (high riding nonpalpable or free-floating) on rectal examination, presence of blood at the urethral meatus, hematuria, perineal wounds, inability to void and distended bladder (8).

The prevalence of GU trauma across different populations vary too. In Scotland, Bariol and colleagues reported a 1.5% incidence of GU trauma (6). Babak Javanmard and colleagues in a 2019 publication reported a 2% prevalence of GU injuries among multiple trauma patients. They looked at 13598 trauma patients admitted in Shohada-e-Tajrish Hospital, Tehran, Iran, between 2008-2017 and found only 267 cases with GU injuries (5). Sanjay Shewakramani et al. found that genitourinary tract trauma accounts for approximately 10% of trauma admissions in the United States (4). In the year 2000, E Nordberg after reviewing literature for 13 years reported that injuries are on the rise in developing countries, including sub-Saharan Africa (9).

These variations in any given set up will help clinicians to have heightened index of suspicion if they are caring for multiple injured patient as to presence of GU trauma and in the same vane help in the development of protocols that include the care of GU trauma. This

study therefore seeks to determine the pattern of genitourinary tract injuries in patients with multiple trauma in our set up.

CHAPTER TWO: LITERATURE REVIEW

2.1: Introduction

Geographic variations exist and greatly influence the patterns of GU traumatic injuries. In Scotland, Bariol and colleagues reported a 1.5% incidence of GU trauma (6). Babak Javanmard and colleagues in a 2019 publication reported a 2% prevalence of GU injuries among trauma patients. They looked at 13598 patients admitted in Shohada-e-Tajrish Hospital, Tehran, Iran, between 2008-2017 and found only 267 cases with GU trauma (5). Sanjay Shewakramani et al.(2011) found that genitourinary tract trauma accounts for approximately 10% of trauma admissions in the United States (4). Najibi et al (2010) working at Henry Ford Hospital, Michigan also reported a similar incidence as Shewakramani at 10.5% (7).

2.2: Diagnosis

GU trauma is diagnosed on clinical history, physical examination, laboratory investigations, and radiological imaging. Diagnosis of patients who are haemo-dynamically unstable and cannot undergo radiological evaluation is made on surgical exploration.

Imaging plays a critical role in the evaluation of the GU tract in a patient who has sustained either penetrating or blunt trauma. Contrast-enhanced computer tomography scan of the kidneys, ureters and urinary bladder (CT-Urogram) is the principal imaging of choice used to evaluate the kidneys and the ureters following trauma. Cystography is useful in the evaluation and diagnosis of trauma to the urinary bladder while retrograde urethrography is used for imaging the urethra. Penile, testicular and scrotal injuries are diagnosed through clinical examination with ultrasonography used in equivocal cases (10).

2.3.0 Kidneys

2.3.1 Prevalence

Krieger et al (1984) looked at 184 GU trauma causes in Pacific Northwest and found 84% of them to have kidney injuries (11) while Ali et al (2018) reported renal trauma prevalence

among GU injuries at 49.7% in Pakistan (12). In Nigeria, Salako and associates in the year 2010 found renal injuries to be responsible for 15.5% of the total GU trauma cases (13).

2.3.2 Mechanism

Blunt trauma accounts for 82–95% of renal injuries as per multiple series (14-16). Rapid decelerations, like it is seen in motor vehicle collisions (MVCs) may lead to injuries by shearing to the vasculature and renal pedicle as the kidney hilum is fixed. Thoracic wall, abdominal wall, and the spine hit the kidney in blunt trauma (17-19). Baverstock R et al (2001) reported 93.4% of renal injuries to be secondary to blunt causes and 6.6% due to penetrating injuries (14).

Penetrating injuries are common in developing countries and areas prone to civil wars. Such injuries are likely due to gunshot or stab wounds. Gunshot injuries present with concomitant injury of adjacent organs such as spleen, liver, pancreas, and intestine. Ersay A et al.(1999) conducted a retrospective study for 4 years in a hospital in Turkey in a region with frequent gun warfare and found gunshot wounds (GSW) in 59% of renal injuries (20). In a Durban hospital, 75% of kidney trauma were caused by penetrating injuries, with 50% secondary to GSW. MVCs accounts for nearly 70% of blunt renal injuries (21). Pucher and Dijkstra in a mode-by-mode fatality review, bicycling was found to be 12 times more likely to result in mortality than riding in a car per kilometer traveled (22, 23).

2.3.3 Presentation

Patients present with a history of abdominal trauma, abdominal/flank pain, haematuria and physical signs of bruising or hematoma of abdomen/flank, abdominal tenderness, rib fracture or hemodynamic instability (Systolic Blood Pressure \leq 90 mmHg). Injuries to other organs are present in up to 90% of cases (19, 24, 25). Krieger et al. (1984) reported associated injuries with 83% of blunt renal trauma and in 90% of penetrating injuries (11).

2.4 Ureters

2.4.1 Prevalence

Ureters being retroperitoneal and flexible, are well protected and rarely prone to injury from external source. Recent retrospective analysis reports ureteral trauma to be responsible for 2.5% of GU trauma. Siram and colleagues found ureteric injuries in only 582 patients out of a

total of 22706 with GU trauma while Liaqat Ali and colleagues working in a tertiary hospital in Pakistan reported ureteric injuries in 5% out of the 183 GU trauma cases (12, 26). In Iran, Javanmard et al (2019) reported ureteric injuries in 1.1% of GU trauma patients (5).

2.4.2 Mechanism

Most injuries of ureter (80% to 95%) are as a result of penetrating trauma, and majorly as a result of gunshot wounds (related cases estimated for 88% to 95% of penetrating wounds), followed by stabbing wounds (27-30). Blunt ureteral injuries are infrequent and happen in the background of deceleration or acceleration trauma like in MVCs where hyperextension of the trunk leading to ureteric shearing away from the renal pelvis at the pelvic ureteric junction (31).

2.4.2.1 Concurrent Injuries

Ureteral injuries seldom occur in isolation, 50% to 100% of patients presents with co-existing injuries of abdomen (31, 32). Pereira BM et al. (2010) found associated injuries in 90.4% of patients with trauma and having ureteral injury (32). The association is mostly because of the ureter's proximity to many retroperitoneal and abdominal organs. Siram et. Al discovered that the small intestine and the colon to be the most commonly associated injuries in 51% and 49%, respectively. They also reported vascular injuries in 38% of ureteric injuries (26).

2.4.3 Presentation

No specific presentation is diagnostic. A high index of suspicion is warranted. Symptoms to look out for in the acute phase are haematuria and flank pain. Symptoms and signs that are of delayed missed injury or urinary leak are; high output from drains, prolonged ileus, sepsis, abdominal pain or persistent flank mass or elevated creatinine, and blood urea nitrogen (33).

2.5.0 Bladder Injuries

2.5.1 Prevalence

A recent publication in 2018 by Liaqat Ali and colleagues reported urinary bladder injuries to account for 7% of GU trauma cases (12). Earlier, Bariol et al. (2005) reported bladder injuries to account for 18% of GU injuries in Scotland (6). Javanmard and associates, however, reported a prevalence of 12.7% in Iran while in Nigeria and Pakistan, a prevalence of 25.6%

and 15.8% respectively were reported (12, 13). Literature reviews have found that extraperitoneal bladder ruptures account for 55–78%, with the rest consisting of intraperitoneal at 17–39% and combined intra- and extraperitoneal injuries at 5–8% (34, 35).

2.5.2 Mechanism

Blunt trauma is responsible for 51–86% of bladder injuries with MVCs being the most common cause of such injuries in 50.5% of cases followed by pedestrians vs. automobile in 29.1% and falling from a height in 14.5% (36). Deibert et al. (2011) found pelvic fractures to be present in 70% of the time there is a bladder rupture, demonstrating the strong association between these conditions (37). Bladder ruptures without an associated pelvic fracture ensue after a blow to the abdomen in a person with a full urinary bladder. Locally, unpublished data of a 11 years' retrospective study (1988-1999) by Dr. Charles Ondego Ochieng (2000) reported blunt trauma as responsible for 90% of bladder injuries.

Penetrating causes of bladder injury varies from 14–49% in a number of large series, with GSWs consisting 88% (36, 37). Gomez RG and colleagues in a wide review reported bladder injuries in 3.6% of penetrating abdominal gunshot wounds, 13% of penetrating rectal injuries and 20% of penetrating gluteal injuries (34).

2.5.3 Presentation

Urinary bladder injury is likely to present with suprapubic pain, bruising at the site of injury, haematuria, painful urination or inability to urinate and urinary bladder distension (38).

2.6.0 Urethra

2.6.1 Prevalence

Liaqat Ali and associates recently reported 33.8% (41 patients out of 183) to have urethral trauma (12). In Scotland, Bariol et al. (2005) reported a prevalence of 4% (6). Javanmard et al. (2019) found a prevalence of 5.6% in Iran (5). Salako et al. (2010) found a 58.9% prevalence in Nigeria (13).

2.6.2 Mechanism

Posterior urethral injuries are nearly constantly the result of blunt trauma like MVC or accidents by bicycle, pedestrian injuries or fall and are commonly noticed relating to fractures

of pelvic (39). Injuries to the posterior urethra follow shearing forces across the prostatomembranous junction as pubo-prostatic ligaments fix the prostatic urethra in position; fracture of the pelvic bones can cause stretching of the membranous portion of the urethra. Chapple et al. (2004) found that all ruptures of membranous urethra are in conjunction with pelvic fracture injuries (35). Dreitlein and associates reported that the posterior urethral disruption happens concurrently in 10% to 25% of fracture of pelvic rings and in up to 35% of injuries of urinary bladder (40).

Injuries to the anterior urethra generally occur in isolation and usually caused by blunt traumatic perineal force causing an effect of crushing on the urethral tissues against the pubic symphysis (40). Najibi et al. (2010) found urethral injuries in 2.9% of civilian GSW in a retrospective review of 309 patients sustaining GSW patients in the Henry Ford Medical Center Trauma Registry (7).

2.6.3 Presentation

Hematuria, inability to void, blood at urethral meatus, presence of a high-riding prostate gland on digital rectal examination are indicative of urethral injury (41).

2.7.0 External Genitalia

2.7.1 Prevalence

Traumatic injuries to the external genitalia are seen in 7.0 to 68.1% of all patients with trauma having injury to the GU tract in accordance to many published series (4, 6, 12, 13). Penile trauma involve 10–16% of injuries of genitourinary per a number of series (42).

2.7.2 Mechanism

McAninch et al. (1984) reported blunt trauma to account for up to 85% of injuries of scrotal and testicular (43). Phonsombt and McAninch found that 40%–60% of injuries of penetrating GU comprised the external genitalia with GSW accounting for 55% of penetrating scrotal trauma, and stab wounds (42%) (44).

2.7.3 Presentation

Scrotal injury results in a range of results; varying from local hematoma to ruptured or dislocated testicle. Patients could also present with genital skin laceration/bruising, penile swelling or amputation (44).

2.8: Conceptual Framework

2.8.1 Narrative

Trauma to the GU tract is an important public health challenge globally and is responsible for most emergency urological admissions and surgeries. Trauma to the GU organs can be as a result of motor vehicle collisions, bicycle injuries, bullet wound injuries, blunt object trauma or trauma from sharp objects such as knives and spears.

Patients presenting in the accident and emergency department with multiple traumatic injuries undergo clinical examination whose findings guide laboratory and imaging investigations with subsequent management either surgically or non-surgically depending on the extend of the trauma and the type of injury.

2.8.2 Figurative Presentation

Figure 1; Conceptual Framework

2.9: Study Justification

Trauma is an important public health challenge globally and is responsible for 10% of deaths (1). Genitourinary injuries contribute to the global figure. Beyond the impact on health and general well-being, traumatic injuries also influence both social and economic development of the affected individuals (9). The pattern of these injuries in our setting is currently unknown. The available studies which are mostly from developed countries are non-reflective of our situation as pattern of trauma varies greatly across populations. No local study has been undertaken to investigate the pattern of trauma in the entire genitourinary tract.

The findings of this study will be helpful in rationalization of resource allocation and hopefully influence focused clinical trainings by medical schools. The knowledge of local pattern of genitourinary trauma will also benefit individual clinicians in raising their index of suspicion while evaluating trauma patients thus timely diagnosis, management, and better patient outcome.

2.10: Research Question

What is the pattern and clinical presentation of genitourinary tract injuries in patients with multiple trauma at the Kenyatta National Hospital?

2.11: Study Objectives

2.11.1 Broad Objective

To determine the pattern and clinical presentation of genitourinary tract injuries in patients with multiple trauma at the Kenyatta National Hospital

2.11.2: Specific Objectives

1. To establish the proportion of GU injuries in multiple trauma patients
2. To establish the spectrum of clinical presentations of GU tract trauma
3. Determine mechanism of GU tract injuries
4. To determine associated injuries in genitourinary tract trauma

CHAPTER THREE: METHODOLOGY

3.1 Study Design

Descriptive Cross-Sectional study. Since the study aims to establish prevalence, mechanism of trauma, demographic patterns and frequently encountered associated injuries, a cross sectional design that seeks to describe the presence of disease at a time is suitable.

3.2 Study Area

The study was carried out at the A&E department, Surgical Wards, and Intensive Care Unit of KNH. KNH is a tertiary health institution located at the Kenyan capital of Nairobi. It has a bed capacity of 1800 and staff of about 5000. It serves as a national referral hospital for Kenya and the larger East African region. The clinical staff in these departments are dedicated nurses, medical officers, postgraduate students, and consultants with keen interest and adequate training in emergency medicine including trauma care.

3.3 Study Population

Multiple injured trauma patients between ages of 13 to 99 years.

3.3.1 Inclusion Criteria

- i. Multiple injured patients diagnosed on clinical history, physical examination, laboratory investigations, radiological imaging, and intra-operative findings.
- ii. Patients who gave consent, assent or who by virtue of age or clinical state, their caregivers gave consent on their behalf.

3.3.2 Exclusion Criteria

- i. Patients without comprehensive investigations (laboratory and imaging) for genitourinary trauma
- ii. Patients with isolated genitourinary tract injuries

3.4 Sample Size Determination

The sample size for this study was estimated using the Cochran's formula

$$n = \frac{Z^2 p(1 - p)}{d^2}$$

Substituting this in the sample size formula and with taking the standard assumptions as shown below where:

Where **n** is the calculated sample size assuming finite population of genitourinary injuries in multiple trauma patients.

Z is the statistic representing 95% confidence level of confidence = 1.96

P is the prevalence of genitourinary trauma among multiple trauma patients, put at 50% as local data is not known

d is the desired level of precision

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$
$$n = 384$$

Where **n** is the minimum sample size.

Therefore, 384 participants will be enrolled.

3.5 Sampling Procedure

Total number of 384 patients were recruited by convenient sampling technique. If the selected patient was not eligible or declined consent to participate in the study, the next most eligible patient was approached for possible enrollment. This was repeated until the sample size of 384 was attained.

3.5.1 Study Flow

The study was conducted as indicated in the study flow diagram:

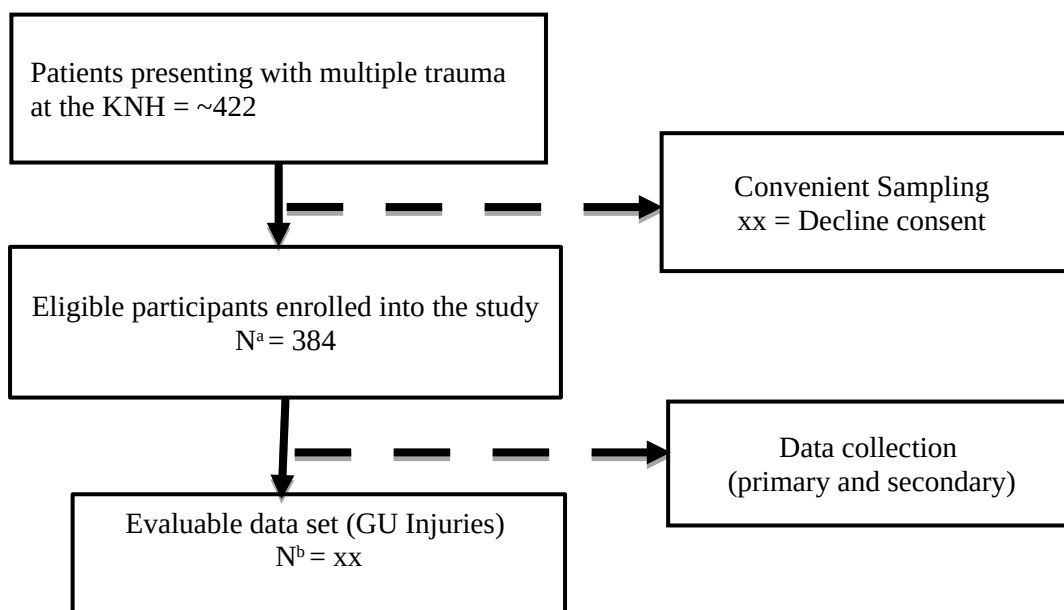


Figure 2: Study Flow Diagram

3.6 Study Variables

Table 1: Study Variables

Variable type	Definition
Independent	Road traffic accidents, bullet wounds etc.
Intermediate	Time from injury to presentation at the hospital Investigations (Hemogram, UECs, LFTs, Urinalysis) Imaging (Ultrasound, X ray, Retrograde Urethrogram, CT-Urogram)
Dependent	Surgical and Non-Surgical Management

3.7 Training and Data Quality Procedures

The questionnaire was pre- tested and analyzed before a final draft was administered to the study participants. The research assistants, who were two postgraduate students and the statistician were trained on the research methodology, appropriate interview techniques, data collection and cleaning procedures.

The study questionnaire was pre tested in a similar population before and appropriately adjusted before administration to the study participants. Recording of clinical findings was entered after thorough scrutiny. Unique identifiers were assigned to all the study participants. If double entries were discovered, one of the questionnaires was withdrawn, discarded and serialization rectified. Information filled on the questionnaires was checked for any errors and corrected.

3.8 Study Enrollment Procedures

In this study, patients diagnosed with GU trauma in the context of a multiple trauma at KNH were the target population. The objectives and purpose of the study was explained by the principal researcher. Patients who were eligible for enrollment in the study were taken to a secluded place for consenting. Patients/guardians who agree to participate in the study signed the informed consent (Annex Ib/Id). An interviewer guided questionnaire (Annex II) was administered to the participants' by either the Principal Investigator (PI) or the Research Assistant. The clinical information on the questionnaire was obtained from the patient records. The information collected included age, sex, presenting symptoms, findings on physical examination, mechanism of injury, GU organ injury sustained, associated non-genitourinary injuries, findings of laboratory and radiological investigations.

3.9 Data Collection and Management

The data collection tool was in two parts. The first part captured demographic data. The second part captured clinical, laboratory, imaging, and disease-specific characteristics. Data was collected using the study questionnaire and uploaded to a password protected excel sheet for cleaning and coding.

3.10 Statistical Analysis

The cleaned data was analysed using the Statistical Package for Social Sciences (SPSS) version 23.0 for mean, frequencies and proportions in line with the objectives of the study.

3.11 Ethical Considerations

The study was carried out after approval by the KNH/UON Ethics and Research Committee. Informed consent was obtained from the patient if they were above 18 years old or from the caregiver if they were less than 18 years old explaining to them the objective and methodology of the study. The principal investigator (PI) undertook the discussion on informed consent and ensured that the participants and caregivers understood the decisions that they were making. All patients' information was held in confidentiality and used only for the purpose for which this study is intended for. This study did not include any invasive processes. There was no extra cost encountered by the patient. Unique identifiers were used for each of the participants to maintain confidentiality.

Appropriate personal protective equipment was worn by both the research team and the patient during the interview process in order to curb the spread of COVID-19 and any other infectious disease.

3.12 Study Closure Plan and Results Dissemination

The findings of the study shall be disseminated to the KNH, presented in medical conferences, and published in medical journals and public media where necessary for the benefit of the medical profession and the lay public. A soft copy of the dissertation will be available at the UoN e-repository on the UoN website

CHAPTER FOUR: RESULTS

4.1 Baseline Characteristics of Participants

Three hundred and eighty-four participants (384) with multiple trauma were enrolled in the study between the period of November 2020 and April 2021. The age of the participants

ranged between 19 and 59 years, with a mean age of 29.7 (SD 11.0) years. *Table 2* below demonstrates further details.

Genitourinary injuries were recorded in 52 patients representing 13.5%. The majority were males (37, 71.2%), while females were (15, 28.8%).

Table 2: Age Distribution of Patients

Age	Frequency (n=52)	Proportion (%)
<20	4	7.7
20 – 29	29	55.8
30 – 39	11	21.2
40 – 49	4	7.7
50 – 59	4	7.7

4.2: Genitourinary Organ Injuries

Among the genitourinary organs, the most commonly injured was the urethra (27, 51.9%). The rest were the kidneys (11, 21.2%), scrotum (8, 15.4%), urinary bladder (4, 7.7%), ureter (1, 1.9%) and penis (1, 1.9%) (*Table 3*).

Table 3: Type of Genitourinary Tract Injuries

Organ	Frequency (n=52)	Proportion (%)
Kidney	11	21.2
Ureteric	1	1.9
Urinary Bladder	4	7.7
Urethral	27	51.9
Scrotal	8	15.4
Penile	1	1.9

4.3: Clinical Presentation

Diagnosis was established based on clinical presentation of symptoms and signs, imaging and intraoperative findings. Abdominal/flank pain and tenderness was the most common presentation occurring in all the 52 patients who sustained genitourinary injuries. The other presentations were abdominal/flank skin bruising (36, 69.2%), haematuria (28, 53.8%), blood at the urethral meatus (16, 30.8%), inability to void (15, 28.8%), distended bladder (12, 23.1%), and perineal wound or hematoma (9, 17.3%) (*Table 4*).

Table 4: Presenting Symptoms and Signs

Presentation	Frequency (n=52)	Proportion (%)
Haematuria	28	53.8
Abdominal/flank pain or tenderness	52	100.0
Abdominal/flank skin bruising	36	69.2
Blood at the urethral meatus	16	30.8
Inability to void	15	28.8
Distended bladder	12	23.1
Perineal wound or hematoma	9	17.3

4.4: Mechanisms of Injury

The mechanisms of injury were blunt trauma in 40 cases representing 76.9% and penetrating trauma (12, 23.1%). The common causes of the blunt injuries were motor vehicle accidents (19, 47.5%) and motor cycle accidents (9, 22.5%). The rest of the patients sustained blunt injuries through fall from height, blow to abdomen, and bicycle accident injuries each occurring in 4 patients representing 10% respectively. Stab wounds (7, 58.3%) and gunshot injuries (5, 41.7%) were the causes of penetrating injuries (Table 5).

Table 5: Mechanisms of Injury

Aetiology	Frequency(n=52)	Proportion (%)
Blunt injury	40	76.9
Penetrating injury	12	23.1
Blunt injury	Frequency(n=40)	Proportion (%)
Motor Vehicle Accident	19	47.5
Motor Bike Accident	9	22.5
Bicycle Accident	4	10.0
Blow to Abdomen	4	10.0
Fall from height	4	10.0
Penetrating injury	Frequency(n=12)	Proportion (%)
Stab wound	7	58.3

Gunshot	5	41.7
---------	---	------

4.6: Associated Injuries

Associated injuries involving non-genitourinary organs occurred in all patients who sustained genitourinary injuries. They included pelvic fractures in (27, 51.9%) patients, chest injuries (23, 44.2%), bowel injuries (21, 40.4%), head injuries 19 (36.5), splenic injuries (11, 21.2%), and liver injuries (7, 13.5%) patients, as shown in *Table65* below.

Table 6: Associated Injuries

Organ	Frequency (n=52)	Proportion (%)
Chest injury	23	44.2
Splenic injury	11	21.2
Liver injury	7	13.5
Bowel injury	21	40.4
Pelvic fracture	27	51.9
Head injury	19	36.5

CHAPTER FIVE: DISCUSSION

Genitourinary injuries were documented in 52 of the 384 patients with multiple trauma at a rate of 13.5 per 100 multiple trauma admissions. This prevalence is remarkably higher than the findings in Scotland and Iran (5, 6) and close to the reports from the United states of America (4, 7). The variation is likely due to differences in patterns of trauma in different regions and the possibility of genitourinary trauma being overlooked in most emergency settings (2).

Males were 2.5 times more prone to trauma than females (71.2 vs 28.8%), and mainly prevalent in the 2nd decade of life. This may owe to men working in riskier jobs, being more involved in violent behavior and also number of male drivers being more than females (1).

The diagnosis of genitourinary injuries was established through clinical history, physical examination, radiological imaging, and intraoperative findings which is similar to the practice reported in literature (4-8, 10-14, 16, 19, 22).

The majority of genitourinary injuries in this study involved the male urethra (27, 51.9%). No injury involving the female urethra was documented. The rest of the genitourinary injuries were the kidneys (11, 21.2%), scrotum (8, 15.4%), urinary bladder (4, 7.7%), ureter (1, 1.9%) and penis (1, 1.9%). The male urethra was the commonest site of injury probably because of the high rates of concomitant pelvic fractures (27, 51.9%). The female urethra is known to be short and is rarely involved in traumatic injuries (39).

At the Kenyatta National Hospital, the logistics of performing retrograde urethrogram in the emergency circumstances limited its routine use in suspected urethral injuries. Therefore, the urethral injuries were diagnosed exclusively on the basis of symptoms and signs. Similar challenge was encountered by other workers from developing countries (13). However, the absence of retrograde urethrography does not seem to have significantly impaired the clinical diagnosis.

Krieger et al and Ali et al working from Pacific Northwest and Pakistan respectively reported renal injuries as the most common genitourinary organ injured. They, however, reported significantly higher cases of gunshot injuries as opposed to road traffic accidents in their region (11, 12). The finding of the urethra as the most commonly injured genitourinary organ is similar to reports from Nigeria where road traffic accidents are the prevalent mechanism of trauma (13).

In this study, blunt trauma was seen in 40 cases representing 76.9% and penetrating trauma (12, 23.1%). The common causes of the blunt injuries were motor vehicle accidents (19, 47.5%) and motor cycle accidents (9, 22.5%). The rest of the patients sustained blunt injuries through fall from height, blow to abdomen, and bicycle accident injuries each occurring in 4 patients representing 10% respectively. Stab wounds (7, 58.3%) and gunshot injuries (5, 41.7%) were the causes of penetrating injuries. Other studies have too reported similar patterns of injury (4-6, 8, 11, 12).

Presentations of injured patients were similar to those in the literature (4-6, 8, 11, 12) with all the 52 patients presenting with abdominal/flank pain and tenderness.

All the genitourinary trauma patients had multiple injuries and required multi-disciplinary approach. The most common associated injury was the pelvic fractures in (27, 51.9%) patients, chest injuries (23, 44.2%), bowel injuries (21, 40.4%), head injuries 19 (36.5), splenic injuries (11, 21.2%), and liver injuries (7, 13.5%) patients.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSION

6.1: Recommendations

- i. Establishment of integrated multidisciplinary trauma center for management of multiple trauma patients.
- ii. Introduction of Retrograde Urethrography in the emergency department.
- iii. Public interventions toward reduction of Road Traffic Accidents.

6.2 Conclusion

Epidemiology of trauma is varied hence each region need to establish its own updated database. Genitourinary injuries mostly result from blunt trauma due to road traffic accidents with urethral injuries being the most common in our setting; and mostly seen in the youth.

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STUDY TIMELINES

	Aug 2020	Sept 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	March 2021	April 2021	May 2021	June 2021
Proposal development											
Ethical approval											
Data collection											
Data analysis											
Results presentation, dissemination and close out											

BUDGET

Item	Total Cost (Kshs.)
Printing Services	10000
Flash Disk	2000
Stationery	1000
Airtime	2000
Statistician Fee	30000
Research Assistants(2)	70000
Ethics And Research Fee	3000
Total Cost	113000

ANNEXES

Annex I (a): General Information Sheet

Participant study number:

Study title: **PATTERN OF GENITOURINARY TRACT INJURIES IN PATIENTS WITH MULTIPLE TRAUMA AT THE KENYATTA NATIONAL HOSPITAL.**

Principal Investigator: Dr. Chrispine Onyango Oluoch (postgraduate student in Urology, University of Nairobi)

Supervisors: Dr. Francis Abiga Owilla
 Dr. Daniel Ojuka

Introduction

Genitourinary trauma is injury to the kidneys, ureters, urinary bladder, urethra, testes, and scrotum. The injuries are an important cause of mortality and morbidity in the developing world. When unrecognized, it can impact negatively on one's quality of life. Life-threatening complications may also occur.

We request for your involvement in this study as we seek to establish what proportion of patients with multiple trauma have injuries to the genitourinary tract and their pattern of presentation.

We request that you go through this form and ask any question that you may have before agreeing to participate in this study.

Purpose of the study

The aim of this study is to determine the pattern of genitourinary tract injuries in patients with multiple trauma. The outcome of this study will help in informed policy making and improved patient care.

Description of the Study

Once you have accepted to take part in this study, you will be allowed to enquire further regarding the study and raise any concerns you may have. Once you are satisfied with the answers you have received you will be required to sign a consent form. The principal investigator or his assistants will give you a questionnaire to fill that will capture your demographic data and clinical history.

Risks involved

This study will not affect you negatively in any way and there are no hidden charges in your participation. Treatment shall not be withdrawn if you do not participate.

Benefits

The information will create a data pool from which important policy and planning decisions can be drawn.

Confidentiality

Your name will not appear in any of the documents and only a code number will be used as an identification marker.

Use of data collected

All information you give will only be shared when authorized by KNH-UON Ethics Committee. Like all scientific information, we seek to share our findings with other people doing similar studies. Therefore, the findings will be presented in scientific meetings and published in scientific journals.

Voluntariness of participation

You can voluntarily decline to participate in this study without any penalty.

Annex I (b): Certificate of Consent

I.....freely give consent to take part in the study conducted by Dr. Chrispine Onyango Oluoch, the nature of which has been explained to me. I have been informed and have understood that my participation is entirely at my own will. I comprehend that if I so wish I can freely withdraw from the study

and this will not in any way alter the care being given to me. The results of the study may directly be of benefit to me, my kin and other patients.

Signature/ left thumb-print (self).....

Date.....

Next of Kin/Parent/Guardian (where applicable)

Name.....Signature.....Date.....

Witness: Name:

Investigators Declaration

I as the principal investigator declare that no financial payments were received or made either to the supervisors or Kenyatta National Hospital nor received from any pharmaceutical companies or any other quarter to finance this study.

Please feel free to seek additional information through the contacts given below:

Principal investigator:

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Signature:

Annex I (c): Faharasa/Dibaji

Utangulizi

Majiraha katika figo, mishipa na mfuko ya makojoo and sehemu nyeti ni shida kubwa katika mataifa yanayoendelea. Majiraha haya yasipogunduliwa mapema huenda yakadhuru maisha ya mhudhuriwa.

Tunakuomba ushiriki katika utafiti huu wa kufumbua kiwango cha majiraha haya.

Tunakuomba usome fomu hii na uulize maswali yoyote ambayo unaweza kuwa nayo kabla ya kukubali kushiriki katika utafiti huu.

Sababu za utafiti

Kusudi la utafiti huu ni kutambua jinsi majiraha katika njia ya makojoo na sehemu nyeti hujitokeza. Matokeo ya utafiti huu yatatumika kutengeneza dimbwi la data litakalo tumiwa kwa uundaji wa sera.

Maelezo ya Utafiti

Baada ya kukubali kushiriki katika utafiti huu, utaruhusiwa kuuliza maswali yoyote. Utakapo ridhika na majibu uliyopokea utatia saina fomu ya idhini. Mtafiti mkuu atakupa dodoso litakalochukua historia ya majiraha.

Hatari zinazohusika

Utafiti huu hautakuathiri vibaya kwa namna yoyote na hakuna mashtaka yaliyofichika katika ushiriki wako. Matibabu hayaondolewi ikiwa hushiriki.

Faida

Taarifa tunayopata itatusaidia kuongeza maarifa kuhusa majiraha pamoja na kutengeneza dimbwi la data litakalo tumika kwa uundaji wa sera.

Siri

Jina lako halitaonekana kwenye nyaraka yoyote na namba ya usajili tu itatumika kama alama ya kutambua.

Matumizi ya Data

Kama habari zote za kisayansi tunatafuta kushiriki matokeo yetu na wasomi wengine wanaofanya masomo kama hayo. Kwa hiyo, matokeo yatatolewa katika mikutano ya kisayansi na kuchapishwa katika majarida ya kisayansi.

Uhuru wa kuhusika

Unaweza kujiondoa kwa hiari wakati wowote bila adhabu yoyote.

Annex I (d): Cheti cha Idhini

Nimeelezwa utafiti huu kwa kina. Nimekubali kushiriki utafiti huu kwa hiari yangu. Nimepata wakati wa kuuliza maswali na nimeelewa kuwa ninapo maswali zaidi, ninaweza kumuuliza mtafiti mkuu au watafiti waliotajwa hapo awali.

Jina la Mshiriki.....

Sahihi ya Mshiriki.....

Tarehe.....

Tamko la Mtaalamu

Mimi kama mchunguzi mkuu natangaza kuwa hakuna malipo ya kifedha niliopokea wala wasimamizi au hospitali ya Taifa la Kenyatta, kutoka kwa kampuni yoyote ya dawa au robo nyingine yoyote ili kufanya utafiti huu.

Tafadhali jisikie huru kutafuta maelezo ya ziada kupitia anwani zilizo hapa chini;

Mtafiti Mkuu:

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M.Med Urology, Idara ya Upasuaji

Shule ya Matibabu, UoN

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Wasimamizi:

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Mshauri wa Urology, Mhadhiri mkuu

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Annex II: DATA COLLECTION TOOL

Study Title: **PATTERN OF GENITOURINARY TRACT INJURIES IN PATIENTS WITH MULTIPLE TRAUMA AT THE KENYATTA NATIONAL HOSPITAL**

Date:.....

Time:.....

Study number:.....

Part I: Demographic Information

Age in years.....

Residence.....

Sex:

Male	<input type="checkbox"/>
Female	<input type="checkbox"/>

Part II: Clinical Data

1. Mechanism of Injury

(a) Blunt Injury

YES

NO

- i. Motor Vehicle Accident () ()
- ii. Motor Cycle Accident () ()
- iii. Bicycle Accident () ()
- iv. Blow to Abdomen () ()
- v. Fall from height () ()
- vi. Others, please specify.....

(b) Penetrating Injury

YES

NO

- i. Stab Wound () ()
- ii. Gunshot () ()
- iii. Others, please specify.....

2. Presenting Signs and Symptoms

YES

NO

- i. Haematuria () ()
- ii. Abdominal/flank pain or tenderness () ()
- iii. Abdominal/flank skin bruising () ()
- iv. Blood at the urethral meatus () ()
- v. Inability to void () ()
- vi. Distended bladder () ()

- vii. Perineal wound or hematoma () ()
- viii. Others, please specify.....

3. Investigations Giving Positive Findings	<u>YES</u>	<u>NO</u>
i. CT Scan	()	()
ii. Ultrasound	()	()
iii. Urethrogram	()	()
iv. Cystogram	()	()
v. X-Ray	()	()
vi. Urinalysis	()	()
vii. Laparotomy	()	()

4. Genitourinary Diagnosis	<u>YES</u>	<u>NO</u>
i. Kidney injury	()	()
ii. Ureteric injury	()	()
iii. Urinary Bladder injury	()	()
iv. Urethral injury	()	()
v. Scrotal injury	()	()
vi. Penile injury	()	()

5. Non-Genitourinary Diagnosis	<u>YES</u>	<u>NO</u>
i. Chest injury	()	()
ii. Splenic injury	()	()
iii. Liver injury	()	()
iv. Bowel injury	()	()
v. Pelvic fracture	()	()
vi. Head injury	()	()
vii. Others, please specify.....		

Annex III: KNH/UON-ERC Letter of Approval



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Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC



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Ref: KNH-ERC/A/358

15th October 2020

Dr. Chrispine Onyango Oluoch
Reg. No.H58/87740/2016
Dept. of Surgery
School of Medicine
College of Health Sciences
University of Nairobi

Dear Dr. Oluoch

RESEARCH PROPOSAL – PATTERN OF GENITOURINARY TRACT INJURIES IN PATIENTS WITH MULTIPLE TRAUMA AT THE KENYATTA NATIONAL HOSPITAL (Descriptive cross-sectional study design) (P304/06/2020)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 15th October 2020 – 14th October 2021.

This approval is subject to compliance with the following requirements:

- a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
- c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
- d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
- e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
- f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

Protect to discover

For more details consult the KNH- UoN ERC website <http://www.erc.uonbi.ac.ke>

Yours sincerely,



PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

- c.c. The Principal, College of Health Sciences, UoN
 The Senior Director, CS, KNH
 The Chairperson, KNH- UoN ERC
 The Assistant Director, Health Information, KNH
 The Dean, School of Medicine, UoN
 The Chair, Dept. of Surgery, UoN
 Supervisors: Dr. Francis Abiga Owilla, Dept.of Surgery, UoN
 Dr. Daniel Ojuka, Dept.of Surgery, UoN

Annex IV: Plagiarism Certificate

99% Confirmed  Kiboniu

PATTERN OF GENITOURINARY TRACT INJURIES IN PATIENTS WITH MULTIPLE TRAUMA AT THE KENYATTA NATIONAL HOSPITAL

ORIGINALITY REPORT

9%	5%	5%	4%
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3	James B. McGeedy, Benjamin N. Breyer. "Current Epidemiology of Genitourinary Trauma", Urologic Clinics of North America, 2013 <small>Publication</small>	1%
4	Submitted to Kenyatta University <small>Student Paper</small>	1%

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