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Abdominal trauma experience over a two-year period at a tertiary hospital in north-western Tanzania: a prospective review of 396 cases

PHILLIPO L. CHALYA* and JOSEPH B. MABULA
Department of Surgery, Catholic University of Health and Allied Sciences- Bugando, Mwanza, Tanzania

Abstract: Abdominal trauma continues to be a major cause of trauma admissions all over the world and contributes significantly to high morbidity and mortality. A descriptive prospective study was conducted at Bugando Medical Centre in north-western Tanzania to describe our experience on the management of abdominal trauma outlining the causes, injury characteristics and treatment outcome of these patients. Statistical data analysis was done using SPSS programme. A total of 396 patients were studied. Male to female ratio was 3.2: 1. The median age was 28 years. More than three quarter of patients sustained blunt abdominal injuries. Road traffic accidents (RTAs) were the most common cause of injury accounting for 64.9% of cases. None of our patients received any pre-hospital care. The spleen was the most common injured organ in blunt abdominal trauma occurring in 176 (75.9%) patients, while in penetrating injury; gastrointestinal tract was the most common in 24(10.3%) patients. One hundred twenty-four (31.3%) patients had associated extra-abdominal injuries of which the head/ neck region (46.8%) was commonly affected. A total of 232 (58.6%) patients were treated surgically with a negative laparotomy rate of 7.8%. Complication and mortality rates were 20.7% and 17.9% respectively. The age of patients, presence of associated extra-abdominal injuries, severity of injury (Kampala Trauma Score II ≤ 6), admission Systolic Blood Pressure < 90mmHg, injury-arrival time > 24 hours and presence of postoperative complications mainly surgical site infections significantly predicted mortality ($p < 0.001$). The overall median length of hospital stay was 12 days. Patients who had severe trauma (KTS II ≤6) and those with associated injuries stayed longer in the hospital ($p < 0.001$). Abdominal trauma resulting from RTAs is still rampant in our environment and remains a major source of morbidity and mortality. Preventive strategies should be focused on reduction of road traffic accidents, violent crimes and social conflicts.

Keywords: abdominal trauma, aetiology, injury patterns, treatment, outcome, Tanzania

Introduction

Trauma continues to be a major public health problem worldwide and it is associated with high morbidity and mortality in every country, regardless of the level of socioeconomic development (Norberg, 2000; Aldemir *et al,* 2004). Trauma is reported to be the leading cause of death, hospitalization, and long-term disabilities in the first four decades of life (Norberg, 2000; Isenhour & Marx, 2007). Globally, approximately one third of trauma patients have abdominal trauma and it accounts for a large fraction of tragic loss of life and unrecognized abdominal injury remains a distressing frequent cause of preventable death (Hemmila &Wahl, 2008). The abdomen is vulnerable to injury since there is minimal bony protection for underlying organs (Alastair & Pierre, 1999). In developing countries including Tanzania, trauma in general and abdominal trauma in particular is increasing at a fast rate due to increase in urbanization, motorization, civil violence, wars and criminal activities (Museru *et al.,* 1998; Mutasingwa & Aaro, 2001; Museru & Leshabari, 2002; Moshiro *et al*., 2005). In Bugando Medical Centre, abdominal trauma is the single most common cause of trauma admissions and contributes significantly to high morbidity and mortality (Chalya *et al*, 2010; Chalya *et al*., 2012; Chalya & Gilyoma, 2012).

* Correspondence: Dr. Phillipo L. Chalya; E-mail: drphillipoleo@yahoo.com

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The etiological spectrum and mechanism of injury of abdominal trauma which have been reported in literature vary from one part of the world to another partly because of variations in infrastructure, civil violence, wars and crime (Adesanya *et al,* 1998). Abdominal trauma is traditionally classified as either blunt or penetrating (Aldemir *et al.,* 2004). Blunt abdominal trauma predominates in rural areas, while penetrating ones are more frequent in urban settings (Hemmila &Wahl, 2008). Road traffic accidents are the commonest cause of blunt abdominal trauma in civilian practice (Muckart *et al.,* 1995; Al-Qahtani, 2004; Khan *et al.,* 2006). With increasing criminal activities, civil violence and use of firearms, arrows and spears the incidence of penetrating abdominal trauma has been increased in civil society (Khan, 1999).

Abdominal trauma poses a diagnostic challenge to trauma and general surgeons practicing in resource-limited countries like Tanzania where advanced diagnostic tools such as Focused Assessment Sonography for Trauma (FAST) and CT scan are not available (Museru & Leshabari, 2002; Moshiro *et al*., 2005; Chalya *et al.*, 2010; Chalya *et al.*, 2012; Chalya & Gilyoma, 2012). Whereas penetrating abdominal trauma can usually be diagnosed easily and reliably, the diagnosis of blunt abdominal trauma is a real challenge even for experienced trauma surgeons. The clinical findings are usually not reliable. Many injuries such as fractures of lower chest ribs, contusion and abrasions of the abdominal wall, presence of fractured lumbar vertebrae with retroperitoneal hematoma, and reduced level of consciousness may not manifest during the initial assessment and treatment period. Mechanisms of injury often result in other associated injuries that may divert the physician's attention from potentially life-threatening intra-abdominal pathology (Abbas & Upadhyay, 2004).

The management of patients with abdominal trauma has several important elements: adequate pre-hospital care, rapid transport to a specialized centre, complex in-hospital care and rehabilitation. The pre-hospital phase of management is the most important interval in determining the ultimate outcome of these patients. Lack of advanced pre-hospital care in our environment coupled with ineffective ambulance system for transportation of patients to hospitals are major challenges in providing care for trauma patients and have contributed significantly to poor outcome of these patients due to delay in definitive management.

In recent years many abdominal injuries especially those involving solid organs are managed non-operatively. This has been made possible by the invention of imaging techniques like ultrasonography, computerized tomography (CT) scan and magnetic resonance imaging (MRI) which shows the site and extent of injury. The injured organ can then be observed over time as it heals (Abu-Zidan *et al.*, 1996; Shapiro *et al.,* 2001, Dittrich & Abu-Zidan, 2004; Radwan & Abu-Zidan, 2006). However, in resource-limited countries like ours, these modern diagnostic facilities are lacking making non-operative treatment a major challenge.

Most of abdominal injuries are preventable. Establishment of preventive strategies as well as treatment guidelines requires a clearer understanding of the causes, injury characteristics and treatment outcome of these patients. However, such data are lacking in our environment as there is no local study which has been done on this subject despite increase in the number of abdominal trauma admission to our centre. It is on this background that this study, seeks to describe our own experience on the management of this condition outlining the causes, injury characteristics and treatment outcome as seen in our institution and to have a baseline data for future comparison.

Materials and Methods

Study design and setting

This was a two-year descriptive prospective study of abdominal trauma patients who resented to the Accident and Emergency (A & E) department of Bugando Medical Centre (BMC) between May 2011

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and April 2013. Bugando Medical Centre is a tertiary care and teaching hospital for the Catholic University of Health and Allied Sciences-Bugando (CUHAS-Bugando) and other paramedics and it is located in Mwanza city in the north-western part of the United Republic of Tanzania. It is situated along the shore of Lake Victoria and has 1000 beds. BMC is one of the four largest referral hospitals in the country and serves as a referral centre for tertiary specialist care for a catchment population of approximately 13 million people from neighbouring regions. There is no trauma centre or established advanced pre-hospital care in Mwanza city as a result all trauma patients including abdominal trauma are referred to Bugando Medical Centre for expertise management.

Study population

The study population included all patients who presented to the Accident and Emergency (A&E) Department with a clinical diagnosis of abdominal trauma during the study period. Patients who failed to give proper information about the injury and those who had no relative to consent for the study were excluded from the study. Recruitment of patients to participate in the study was done at the A & E department. Patients were screened for inclusion criteria and those who met the inclusion criteria were, after informed consent to participate in the study, consecutively enrolled into the study. Patients with severe injuries were first resuscitated in the A&E department according to Advanced Trauma Life Support (ATLS). From the A & E department, patients were taken into the surgical wards or the intensive care unit (ICU) from where necessary investigations were completed and further treatment was instituted.

Patients with penetrating abdominal trauma and those with evidence of intra-abdominal visceral injuries were taken to theatre for surgical intervention. Patients with associated extra-abdominal injuries requiring operation were also taken to theatre for surgery. The severity of injury was determined using the Kampala trauma score II (KTS II) (Mutooro *et al.*, 2010). Severe injury consisted of a KTS II ≤ 6, moderate injury 7-8, and mild injury 9-10. Patients with head injuries were classified according to Glasgow Coma Scale (GCS) into: severe (GCS 3-8), moderate (GCS 9-12) and mild (GCS 13-15). An initial systolic blood pressure (SBP) from each patient was also recorded on admission. Routine investigations including haematological (haemoglobin, blood grouping & cross-matching), biochemical (serum creatinine and serum electrolytes) and imaging (x-rays of the chest & abdomen, abdominal ultrasound and CT scan) were performed on admission.

Depending on the type of injury, patients were treated either conservatively or surgically All patients were followed up till discharged or death. This information was collected using a pre-tested questionnaire. Included in the questionnaire were socio-demographic data (age, sex, education and occupation), mechanism of injury, pre-hospital care, injury-arrival interval, admission hemodynamic parameters (e.g. systolic blood pressure and pulse rate), type and pattern of injury, trauma scores, body region injured, treatment offered, complications of treatment. Outcome variables were length of hospital stay, mortality and disability.

Data analysis

Statistical data analysis was done using SPSS software version 17.0 (SPSS, Inc, Chicago, IL). Data was summarized in form of proportions and frequent tables for categorical variables. Continuous variables were summarized using ranges, median and inter-quartile ranges (IQR). P-values were computed for categorical variables using Chi-square (X^2) test and Fisher's exact test depending on the size of the data set. Independent student t-test was used for continuous variables. Multivariate logistic regression analysis was used to determine predictor variables that are associated with outcome. A p-value of less than 0.05 was considered to constitute a statistically significant difference.

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Ethical considerations

Ethical approval to conduct the study was obtained from the CUHAS-Bugando/BMC joint institutional ethic review committee before the commencement of the study. Informed consent was sought from each patient before being enrolled into the study.

Results

Patient's characteristics

During the period of study a total of 2804 trauma patients were admitted to our centre. Of these, 396 (14.1%) patients had abdominal trauma, and these made the study population. There were 302 (76.3%) males and 94(23.7%) females with a male to female ratio of 3.2: 1. The age of patients at presentation ranged from 9 to 74 years with a median age of 28 years. The peak age incidence was 21- 30 years accounting for 46.5% of cases. Two hundred and twelve (53.5%) patients were aged 30 years and below. The vast majority of patients, 315 (79.5%) were unemployed and most of them (254, 64.1%) came from the low-income areas (high density areas) of Mwanza city. In this study, only 24 (6.1%) patients had definable source of private or governmental health care insurance at the time of their injury.

Circumstances of the injury

The majority of patients, 308 (77.8%) sustained blunt abdominal injuries and the remaining 88 (22.2%) had penetrating abdominal injuries. The blunt to penetrating abdominal injuries ratio was 3.5: 1. Road traffic accident (RTA) was the most common cause of injury accounting for 257 (64.9%) patients. One hundred eighty-six (72.4%) of injuries were related to motorcycle RTAs. Other causes included fall, assaults and sport injuries in 68 (17.2%), 20 (5.1%) and 5 (1.3%) respectively. Penetrating abdominal injuries such as stabbing or gunshot were recorded in 30 (7.6%) and 16 (4.0%) patients respectively. Most of injuries, 328 (82.8%) occurred during the day. The vast majority of patients 286 (72.2%) reported to the A & E department within 24 hours after injury. The median injury-arrival time was 16 hours (range: 1-186 hours). None of the patients received any pre-hospital care and majority of them, 299 (75.5%) were brought in by relatives, friends or Good Samaritan or by police. Only five (1.5%) patients were brought in by ambulance. According to multivariate logistic regression analysis, the injury-arrival time significantly influenced the outcome in terms of both length of hospital stay (p = 0.015) and mortality (p = 0.003). The median waiting time (i.e. time interval taken from reception at the A& E department and reception of definitive treatment) was 4 hours (range 1- 10 hours). The majority of patients, 262 (66.2%) were attended to within six hours of arrival to the A & E department.

Injury characteristics

Isolated abdominal injuries occurred in two hundred seventy-two (68.7%) patients while 124 (31.3%) patients had associated extra-abdominal injuries. Blunt abdominal trauma (96.8% i.e. 120/124) in the present study was strongly associated with other associated extra-abdominal injuries, whereas penetration trauma was less strongly associated with such injuries (3.2% i.e. 4/124). This difference was statistically significant (p = 0.011). The head/neck region was commonly affected in 46.8% of cases (Figure 1). In this study, missed injuries were reported in 28 out of 124 (22.6%) patients with blunt abdominal injuries.

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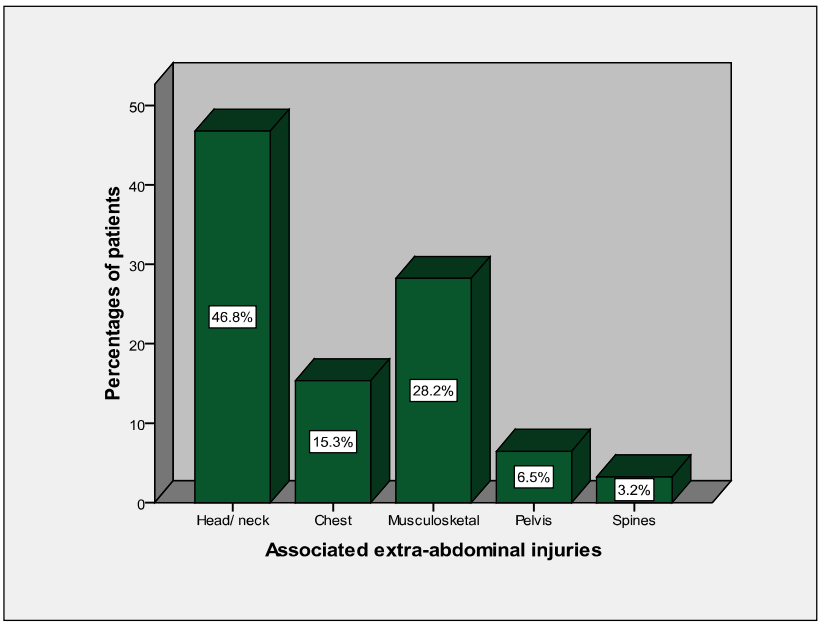

Figure 1: Distribution of patients according to associated extra-abdominal injuries

In this study, missed injuries were reported in 28 (7.1%) patients. According to Kampala Trauma Score II (KTS II), mild (KTS II = 9-10), moderate (KTS II = 7-8) and severe (KTS II ≤ 6) injuries were recorded in 56 (14.1%), 228 (57.6%) and 112(28.3%) patients respectively. The Glasgow coma scale in patients with head injuries indicated that most of them, 102 (55.1%) had moderate to severe injuries. The majority of patients, 292 (73.7%) had systolic blood pressure (SBP) > 90 mmHg on admission and the remaining 104(26.3%) patients had SBP of 90 mmHg and below. The mean haemoglobin level on admission was 10.6 g/dl (range 5.2-14.8 g/dl). The haemoglobin level was less than 10 g/dl in 262 (66.2%) patients.

Table 1: Distribution of patients according to visceral (organ) injuries (N = 232)

Organ injured	No. (%) of blunt abdominal injuries	No. (%) of penetrating abdominal injuries	Total No. (%)
Spleen	126(54.3)	50(21.6)	176 (75.9)
Bowel	7(3.0)	6(2.6)	13 (5.6)
Stomach	2(0.8)	9 (3.9)	11 (4.7)
Liver	1 (0.4)	9 (3.9)	10 (4.3)
Diaphragm	3 (1.3)	0	3 (1.3)
Urinary bladder	1 (0.4	0	1 (0.4)
Kidney	1(0.4)	0	1 (0.4)
No visceral injury	11(4.7)	7(3.1)	18 (7.8)
Total	151 (65.1)	81(34.9)	232 (100)

Treatment modalities

Out of 396 patients, 232 (58.6%) were treated surgically and the remaining 164 (41.6%) were treated conservatively. Surgical intervention was far more common for penetration cases (92.0% i.e. 81/88) than for blunt cases (49.0% i.e. 151/308). The spleen (75.9%) was the most commonly injured organ among the patients that had exploratory laparotomy while the urinary bladder (0.4%) and the kidney (0.4%) were the least injured (Table 1). Negative laparotomy was recorded in 18 (7.8%) patients. Of

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these, 11 (61.1%) were due to blunt abdominal trauma and the remaining 7(38.9%) were due to penetrating abdominal trauma.

Table 2: Distribution of patients according to intra-operative findings (N= 232)

Intra-operative findings	Frequency	Percentage
Haemoperitonium	214	92.2
Splenic laceration	176	75.9
Perforated bowel	13	5.6
Perforated stomach	11	4.7
Lacerated liver	10	4.3
Retroperitoneal hematoma	8	3.4
Ruptured diaphragm	3	1.3
Perforated urinary bladder	1	0.4
Lacerated kidney	1	0.4
Normal finding	18	7.8

The intra-operative findings are as depicted in Table 2. Splenectomy was the most frequently intra-abdominal surgical procedure performed in 74.1% of cases (Table 3). Surgery for associated extra-abdominal injuries was performed in 16.4% of cases (Table 4). Out of 308 patients with blunt trauma, 157 (51.0%) were treated conservatively. Of the total 88 patients who had penetrating trauma, 7(8.0%) were selectively treated conservatively with good results, except one patient who died of associated extra-abdominal injuries during observation period.

Table 3: Distribution of patients according to the type of surgical procedure performed (N= 232)

Type of surgical procedure	Frequency	Percentages
Splenectomy	172	74.1
Bowel repair /resection and anastomosis	13	5.6
Stomach repair	11	4.7
Repair lacerated liver	10	4.3
Splenorrhaphy	4	1.7
Diaphragm repair	3	1.3
Urinary bladder repair	1	0.4
Nephrectomy	1	0.4
Negative laparotomy	18	7.8
Surgery for associated extra-abdominal injuries	38	16.4

Treatment outcome

Postoperative complications were recorded in forty-eight (20.7%) patients, the commonest being surgical site infections in 27.1% of patients (**Table 5**). A total of seven patients required re-laparotomy for postoperative complications as follows; four patients for intra-abdominal abscess, two patients for wound dehiscence /peritonitis and one patient for intra-abdominal bleeding.

The overall length of hospital stay (LOS) ranged from 1 day to 56 days with a median of 16 days. The LOS for non-survivors ranged from 1 day to 14 days (median 4 days). According to multivariate logistic regression analysis, patients who had severe trauma
(Kampala Trauma Score II ≤ 6) and those with associated injuries stayed longer in the hospital and this was significant ($P < 0.001$).

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Table 4: Distribution of patients according to surgical procedures performed for associated extra-abdominal injuries (N= 38)

Surgical procedures performed	Frequency	Percentages
Surgical debridement	32	84.2
Treatment of fractures	23	60.5
Craniotomy/burr holes	18	47.4
Limb amputation	5	13.2
Underwater seal drainage	4	10.5
Scrotoplasty	2	5.3
Supra pubic cystostomy (SPC)	2	5.3

Of the 396 patients, three hundred twenty-five (80.5%) were alive and the remaining seventy-one (17.9%) patients died. Age of patients (> 40years) [OR = 3.5, 95% CI (2.1- 6.9), p = 0.012], presence of associated extra-abdominal injuries [OR = 2.9, 95%CI (1.1-8.3), p= 0.002], severity of injury (KTS II < 6) [OR=8.3, 95%CI (3.4-9.9), p= 0.000], admission SBP < 90mmHg [OR = 4.9, 95% CI (1.8- 10.7), injury-arrival time > 24 hours [OR = 0.1, 95% CI(0.2-0.9), p= 0.003] and presence of postoperative complications mainly surgical site infections [OR= 8.3, 95% CI (3.5-11.2), p= 0.001] were the main predictors of mortality.

Table 5: Distribution of patients according to postoperative complications (N = 48)

Postoperative complications	Frequency	Percentages
Surgical site infection	13	27.1
Hypovolaemic shock	11	22.9
Enterocutaneous fistula	5	10.4
Intra-abdominal abscess	5	10.4
Paralytic ileus	5	10,4
Wound dehiscence	3	6.3
Urinary tract infection	2	4,3
Disseminated intravascular coagulopathy	2	4.3
Peritonitis	1	2.1
Intra-abdominal bleeding	1	2.1

Discussion

Abdominal trauma continues to be a major cause of trauma admission all over the world and contributes significantly to high morbidity and mortality (Abbas & Upadhyay, 2004). In this review, abdominal trauma accounted for 14.1% of all trauma admissions seen during the study period in our setting. This concurs with a figure of 14.2% reported by Ruhinda *et al* (2008) in Uganda, but at variant with other studies (Chalya *et al,* 2010; Chalya *et al*, 2012) that reported high figures of abdominal trauma. These differences in the rate of abdominal trauma reflect differences in risk factors for abdominal trauma between the study settings. The rate of abdominal trauma in our study may be underestimated due to unreported patients, patients who died at scene or who did not reach our hospital because of treatment of minor injuries in private hospitals. A better picture of the magnitude of abdominal trauma in our setting requires comprehensive data including police records, hospital admissions, and mortuary records.

In agreement with other studies (Edino, 2003; Alli, 2005; Chalya *et al*, 2010; Chalya *et al*, 2012; Chalya & Gilyoma, 2012), the majority of abdominal trauma patients in the present study were found

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to be young in their third decade of life and tended to affect more males than females. This group represents the economically active age and the reason for the high incidence of abdominal trauma in this age group reflects their high activity levels and participation in high-risk activities. The fact that the economically productive age-group was mostly involved demands an urgent public policy response. Male predominance in the current study is due to their increased participation in high-risk activities. Males are the bread earners in most households, and are probably more involved in activities that predispose them to injury in the process of trying to earn a living. Identification of risk taking behaviour among trauma patients has potential significance for the prevention of injuries. Trauma in general and abdominal trauma in particular has been reported to be more prevalent in people with low socio-economic status (Lone *et al.,* 2001). This observation is reflected in our study where most of patients were unemployed and majority of them came from the low-income areas (high density areas) of Mwanza city.

As reported by other authors (Udoejop & Iwatt, 1991; Haan *et al,* 2003; Chalya *et al*, 2012; Chalya & Gilyoma, 2012), more than three-quarter of patients in our study sustained blunt abdominal injuries. This observation is at variant with other studies (Ismail *et al,* 1991; Edino, 2003; Musau *et al*, 2006) which reported penetrating abdominal trauma as the most common mechanism of abdominal trauma. The high incidence of blunt abdominal trauma in this study can be explained by the fact that those patients who had blunt injuries were mostly involved in road traffic accidents; another common feature of increased motorization in this environment. Blunt abdominal trauma is more likely to be missed because clinical signs are less obvious (Jansen & Yule, 2008). This observation is reflected in our study as more than one-fifth of blunt abdominal injuries were missed during primary and secondary surveys.

Road traffic accidents remain a leading cause of trauma and admissions to the A&E departments of most hospitals in Tanzania and contributing significantly to high morbidity and mortality (Chalya *et al*, 2010; Chalya *et al*, 2012). In this study, road traffic accidents were the most common cause of abdominal trauma and the majority of patients were due to motorcycle accidents (Chalya *et al*, 2010; Chalya *et al*, 2012). Findings from this study calls for urgent interventions targeting at reducing the occurrence of road traffic accidents and subsequently reduce the incidence of these injuries in this region. In addition, the finding that most of injuries in the present study occurred during the day-time agrees with that of other studies (Kobusingye *et al*, 2002; Naddumba, E2004; Chalya *et al*, 2010). Increased rate of injuries during the day-time can be explained by increased traffic jams as well as increased human activities in the city during the day time. Knowing the time of injury in trauma patient is important for prevention strategies.

In the present study, none of the patients had pre-hospital care; as a result the majority of them were brought in by relatives, Good Samaritan and police who are not trained on how to take care of these patients during transportation and only a few patients were brought in by ambulance. Similar observations have been reported by other authors in developing countries (Odero *et al.*, 1997; Museru *et al.,* 1998; Kobusingye *et al.*, 2002; Alicoglu *et al.*, 2008). The pre-hospital care of trauma patient has been reported to be the most important factor in determining the ultimate outcome after the injury (Chalya *et al.*, 2010). Lack of advanced pre-hospital care and ineffective ambulance system for transportation of patients to hospitals are a major challenges in providing care for trauma patients including abdominal trauma in our environment and have contributed significantly to poor outcome of these patients. Previous studies have shown that prolonged injury-arrival time contributes significantly to high morbidity and mortality among trauma patients (Tan *et al.,* 2010; Chalya *et al.*, 2012). This observation is in agreement with our review in which patients who presented late to the hospital had significantly high mortality rate and prolonged hospital stay. Early presentation to hospitals and definitive treatment of these injuries has been reported to reduce

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mortality and morbidity associated with the disease (Al-Qahtani, 2004, Khan *et al.,* 2006; Tan *et al.*, 2010; Chalya *et al.*, 2012). The delay in presentation to hospital, and the mode by which patients arrive in our centre, shows gaps in the referral system and is clear testimony that pre-hospital care is lacking.

Abdominal injuries are commonly associated with other injuries and these may complicate the management and affect the outcome (Musau *et al.*, 2006). In this study the head/neck and musculoskeletal were the most frequently injured regions which is in agreement with findings from other studies done elsewhere (Chin, 2009; Chalya *et al.*, 2012). In the present study, the presence of associated injuries was found to be significantly associated with both mortality and length of hospital stay (morbidity). Early recognition and treatment of associated injuries is important in order to reduce mortality and morbidity associated with abdominal injuries.

As reported by other studies (Musau *et al*, 2006; Nyongole *et al*, 2013), the spleen was the most commonly injured organ among the patients who had exploratory laparotomy. Despite being protected under the bony ribcage, the spleen remains amongst the most vulnerable organs sustaining injury from amongst the abdominal trauma cases in all age groups. In this study, the spleen was found to be the most commonly injured intra-abdominal organ in blunt abdominal injuries, whereas gastrointestinal tract was injured most in penetrating abdominal injuries. The findings in this study conform to previous studies elsewhere that confirmed that the gastrointestinal tract is injured most in penetrating than blunt injuries (Suthar & Mewada, 2012). Injury to the gut in blunt abdominal injury is uncommon but not a rarity (Suthar & Mewada, 2012). Splenectomy was the commonest means of treatment of splenic injuries. This agrees with the previous study by Chalya *et al.* (2012) in which the majority of patients with splenic injuries were treated operatively with most of them subjected to splenectomy. This is in contrast with other centres in the world where the success of conservative strategies on the injured spleen has been complemented with CT scan and angiographic embolization for splenic injury to control haemorrhage (Skattum *et al,* 2012). Currently non operative treatment is attempted in 60 – 90% of patients with splenic injuries (Skattum *et al,* 2012). The tendency of treating splenic injuries by splenectomy can be attributed to limited access to CT scan expertise as well as lack of treatment guidelines in imaging such injuries.

The operative rate in the current study was 58.6%, a figure which is comparable with that of 59% reported by Suthar & Mewada (2012) in Ahmedabad, but low than that of 70% reported by Musau *et al* (2006) in Kenya. In our study, surgical intervention was far more common for penetration cases (92.0%) than for blunt cases (49.0%). The surgical management of penetrating injuries poses a great challenge in surgeons practicing in developing countries such as Tanzania. Some surgeons had advocated routine exploration of all potentially penetrating abdominal injuries irrespective of the clinical signs (Leppaniemi *et al*, 1999; Haan *et al*, 2003). The reason for this is that most patients sustain multiple visceral injuries; the other reason is that the initial examination may not be reliable (Haan *et al*, 2003). Others use some form of selective conservative management to minimize the incidence of negative laparotomy without increasing morbidity due to missed or delayed reorganization of serious wounds (Emst *et al,* 1999; William, 2001; Conrad *et al,* 2003). In our series, six out of seven patients with penetrating abdominal injuries were treated by selective conservative management with good results. However, in a situation like ours where there is shortage of manpower and appropriate facilities for proper monitoring of such patients, selective conservative management may not be advisable to follow.

The rate of negative laparotomy in patients with abdominal trauma has been reported in trauma literature to range between 7% and 40% (McFarlan, 1995; Leppaniemi *et al,* 1995; Musau *et al,* 2006). The overall negative laparotomy rate in this study was 7.8%, a figure which is significantly low compared with other studies (Musau *et al,* 2006; Siddig & Ahmed, 2008; Suthar & Mewada, 2012).

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Low figures of negative laparotomy rate were also reported by others (Miller *et al* 1989; Emst *et al,* 1999; Bautz, 2000; Conrad *et al,* 2003). These differences reflects differences in improvement on patient selection and when to operate on patients with abdominal injuries and also differences in availability of staff and appropriate facilities (e.g. CT scan and FAST) for proper monitoring of such patients. The rate of negative laparotomy in our study is impressive not only because of the varied approaches to management in the admitting surgical firms but also because of its being an indication of progress in better management compared to previous studies done elsewhere.

The presence of complications has an impact on the final outcome of patients presenting with abdominal trauma as supported by the present study. Our complication rate of 20.7% was found to be significantly high compared with other studies done elsewhere (Ayoade *et al,* 2006; Siddig & Ahmed, 2008; Suthar & Mewada, 2012). In keeping with other studies (Ayoade *et al,* 2006; Suthar & Mewada, 2012; Nyongole *et al*, 2013), surgical site was the most frequent postoperative complication attributing this to the fact that some of the patient had bowel injuries with heavy contamination of the peritoneum and consequently the wounds.

The overall median duration of hospital stay in the present study was 16 days which is higher than that reported by Nyongole *et al.* (2013) in Dar es Salaam, Tanzania. In this study patients with severe and associated extra-abdominal injuries and those who developed postoperative complications stayed longer in the hospital. However, due to the poor socio-economic conditions in Tanzania, the duration of inpatient stay for our patients may be longer than expected. Prolonged hospitalization is associated with an unacceptable burden on resources for health and undermines the productive potential of the population through time lost during hospitalization.

The overall mortality rate in this study was 17.9% and it was significantly associated with age of patients, presence of associated extra-abdominal injuries, severity of injury, admission SBP < 90mmHg, injury-arrival time > 24 hours and presence of postoperative complications mainly surgical site infections. Addressing factors responsible for high mortality in our patients is mandatory so as to be able to reduce mortality associated with this disease.

Delayed presentation, lack of Focused Assessment using Sonography in Trauma (FAST) and irregular availability of CT scan (due to breakdown or inability of patients to afford) and unavailability of interventional radiology were the major limitations of this study. However, despite these limitations, the study has provided local data that can be utilized by health care providers to plan for preventive strategies as well as establishment of management guidelines for patients with abdominal trauma. The challenges identified in the management of patients with abdominal injuries in our setting need to be addressed, in order to deliver optimal trauma care for these patients. In conclusion, abdominal trauma resulting from RTAs is still rampant in our environment and constitutes significantly to high morbidity and mortality. Early recognition of the diagnosis, aggressive resuscitation and early institution of surgical management is of paramount importance if morbidity and mortality associated with abdominal trauma are to be minimized. Urgent preventive measures targeting at reducing the occurrence of RTAs is necessary to reduce the incidence of these injuries in this region.

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References

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Abbas, S.M., Upadhyay, V. (2007) Hollow viscus injury in children: Starship Hospital experience. *World Journal of Emergency Surgery* 1186, 1749-7922.

Abu-Zidan, F.M,, Al-Zayat, I., Sheikh, M., Mousa, I., Behbehani, A. (1996) Role of ultrasonography in blunt abdominal trauma, a prospective study. *European Journal of Surgery* 162, 361–365.

Adesanya, A.A., Afolabi, I.R., da Rocha- Afodu, J.T. (1998) Civilian abdominal gunshot wounds in Lagos. *Journal of Royal College of Surgeons of Edinburg* 43, 230

Alastair, C.J., Pierre, J.G. (1999) Abdominal trauma. In: John M, Graeme D, Kevin OM, editors. Surgical Emergencies, 1st edition. Italy: Blackwell Science Ltd. 224-236.

Aldemir, M., Tacyildiz, I., Girgin, S. (2004) Predicting factors for mortality in the penetrating abdominal trauma. *Acta Chirurgica Belgica* 104, 429–34

Alicoglu, B., Yalniz, E., Eskin, D., Yilmaz, B. (2008) Injuries associated with motorcycle accidents. *Acta Orthopaedica et Traumatologica Turcica* 42, 106-111.

Alli, N. (2005) Management of blunt abdominal trauma in Maiduguri: a retrospective study. *Nigerian Journal of Medicine* 14, 17-22.

Al-Qahtani, M.S. (2004) The pattern and management outcomes of splenic injuries in the Assir region of Saudi Arabia. *West African Journal of Medicine* 23, 1-6.

Ayoade, B.A., Salami, B.A., Tade, A.O., Musa, A. A., Olawoye O.A. (2006) Abdominal Injuries in Olabisi Onabanjo University Teaching Hospital Sagamu, Nigeria. *Nigerian Journal of Orthopaedics and Trauma* 5, 45 – 49.

Chalya, P.L., Mabula, J.B., Giiti, G., Chandika, B.A., Dass, R.M., Mchembe, M.D., Gilyoma, J.M. (2012) Splenic injury at Bugando Medical Center in northwestern Tanzania: A tertiary hospital experience. *BMC Research notes* 5, 59.

Chalya, P,L., Mabula, J.B., Dass, R,M., Mbelenge, N., Ngayomela, I.H., Chandika, A.B., Gilyoma, J.M. (2012) Injury characteristics and outcome of road traffic crash victims at Bugando Medical Centre in Northwestern Tanzania. *Journal of Trauma Management & Outcomes* 6, 1.

Chalya, P.L., Mabula, J.B, Ngayomela, I.H., Kanumba, E.S., Chandika, A.B., Giiti, G., Mawala, B., Balumuka, D.D. (2010) Motorcycle injuries as an emerging public health problem in Mwanza City, north-western Tanzania. *Tanzania Journal of Health Research* 12, 214-221.

Conrad, M.F., Patton, J.H. & Parikshak, M. (2003) Selective management of penetrating truncal injuries: is emergency department discharge a reasonable goal. *American Journal of Surgery* 69, 266-272.

Dittrich, K. & Abu-Zidan, F.M. (2004) Role of Ultrasound in Mass-Casualty Situations. *International Journal of Disaster Medicine* 2, 18–23.

Dogo, D., Yawe., T., Hassan, W. & Tahir, B. (2000) Pattern of Abdominal Trauma in North Eastern Nigeria. *Nigerian Journal of Surgical Research* 2, 48-51.

Edino, S.T. (2003) Pattern of abdominal injuries in Aminu Kano Teaching Hospital, Kano. *Nigerian Postgraduate Medical Journal* 10, 56-59.

Emst, P.H., Bart, P.J., Peter, P.L. & Jan, S.K. (1999) The efficacy of serial physical examination in penetrating abdominal trauma. *Injury* 30, 599-604.

Haan, J., Kole, K. & Brunetti, A. (2003) Nontherapeutic laparotomies revisited. *American Journal Surgery* 69, 562-565.

Isenhour, J.L. & Marx, J. (2007) Advances in abdominal trauma. *Emergency Medicine Clinics of North America* 25, 713–733.

Ismail, A.E., Suleiman, H.S. & Ahmed, M.E. (1991) Abdominal trauma in Khartoum. *Sudan Medical Journal* 9, 75-77.

Jansen, J.O. & Yule, S.R. (2008) Investigation of blunt abdominal trauma. *British Medical Journal* 336, 938–942.

Doi: http://dx.doi.org/10.4314/thrb.v15i4.x

Kang, E.G., Sharma, G.K. & Lozano, R. (2000) The global burden of injuries. *American Journal Public Health* 90, 523-526.

Khan, J.S., Iqbal, N. & Gardezi, J.R. (2006) Pattern of visceral injuries following blunt abdominal trauma in motor vehicular accidents. *Journal of the College of Physicians and Surgeons--Pakistan* 16, 645-647.

Khan, A. (1999) Stab wounds abdomen: an experience with 105 laparotomies. *Journal of Ayub Medical College Abbottabad* 11, 6-8.

Kobusingye, O.C., Guwatudde, D., Owor, G. & Lett, RR. (2002) Citywide trauma experience in Kampala, Uganda: a call for intervention. *Injury Prevention* 8,133-136.

Leppaniemi, A.K., Voutilainen, P.E. & Haapiainen, R.K. (1999) Indications for early mandatory laparotomy in abdominal stab wounds. *British Journal of Surgery* 86, 76-80.

Lone, G.N., Peer, G.Q., Warn, A.K., Bhat, A.M. & Warn, N.A. (2001) An experience with abdominal trauma in adults in Kashmir. *JK Practitioner* 8, 225–230.

McFarlane, M. (1995) Management of penetrating abdominal injuries. *West Indian Medical Journal* 44, 140-142

Miller, F.B., Cryer, H.M. & Chilikuri, S. (1989) Negative findings on laparotomy for trauma. *Southern Medical Journal* 82, 1231-4

Muckart, D.J., Meumann, C. & Botha, J.B. (1995) The changing pattern of penetrating torso trauma in Kwazulu/Natal: a clinical and pathological review. *South African Medical Journal* 85, 1172-1174.

Museru, L.M, Leshabari, MT., Grob, U. & Lisokotola, L.N.M. (1998) The pattern of injuries seen in patients in the orthopedic/trauma wards of Muhimbili Medical Centre. *East and Central African Journal of Surgery* 4, 15-21.

Musau, P., Jani, P.G. & Owillah, F.A. (2006) Pattern and outcome of abdominal injuries at Kenyatta National Hospital, Nairobi. *East African Medical Journal* 83, 37-43.

Mutooro, S.M., Mutakooha, E. & Kyamanywa, P. (2010) A comparison of Kampala trauma score II with the new injury severity score in Mbarara University Teaching Hospital in Uganda. *East and Central African Journal of Surgery* 15, 62-70.

Naddumba, E.K. (2004) A cross sectional retrospective study of boda boda injuries at Mulago Hospital in Kampala. Uganda. *East and Central African Journal of Surgery* 9, 44-47.

Nyongole, O.V., Akoko, L.O., Njile, I.E., Mwanga, A.H. & Lema, L.E. (2013) Overview of the Pattern of Abdominal Trauma as seen at Muhimbili National Hospital Dar es Salaam, Tanzania. *East and Central African Journal of Surgery* 18, 41-48.

Odero, W., Garner, P. & Zwi, A. (1997) Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine and International Health* 2, 445-460.

Radwan, M.M. & Abu-Zidan MI. (2006) Focused assessment sonographic for trauma (FAST) and CT scan in Blunt trauma. Surgeon's perspective. *Africa Health Sciences* 6, 187-190.

Ruhinda, G., Kyamanywa, P., Kitya, D. & Banjunirwe, F. (2008) Abdominal Injury at Mbarara Regional Referral Hospital, Uganda. *East and Central African Journal of Surgery*, 13, 29-36.

Siddig, H.D., Ahmed, M.E. (2008) Management of abdominal trauma in Khartoum Teaching hospital. *Khartoum Medical Journal* 1, 112 - 115

Skattum, J., Naess, P.A. & Gaarder, C. (2012) Non operative management and immune function after splenic injury. *British Journal of Surgery* 99, 59-65.

Smith, J., Caldwell, E., D'Amours, S., Jalaludin, B. & Sugrue, M. (2005) Abdominal trauma: A disease in evolution. *ANZ Journal of Surgery* 75, 790–794.

Suthar, K.D. & Mewada B.N. (2012) Abdominal injuries: an experience of 87 cases. *Journal of International Medical Research* 1, 1-8.

Doi: http://dx.doi.org/10.4314/thrb.v15i4.x

Tan, K.K., Chiu, M.T. & Vijayan, A. (2010) Management of isolated splenic injuries after Blunt Trauma: an institution's experience over 6 years. *Medical Journal* of *Malaysia* 65, 306-308.

Udoejop, U.W. & Iwatt, A.R. (1991) Abdominal trauma in South-Eastern Nigeria. *Central African Journal of Medicine* 37, 409-415.

William, C. (2001) Selection of nonoperative management candidates. *World Journal of Surgery* 29, 1389-1392.