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Objectives: To study mechanisms of injury, presentation, management and outcome of paediatric blunt abdominal trauma in KTH.

Patients and methods: This is a prospective observational descriptive study involving children aged less than 15 years presenting to KTH with blunt abdominal trauma. The study conducted in the period from March 2012 to August 2013.

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Children Blunt Abdominal Trauma at Khartoum Teaching Hospital

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Results: There were 50 patients. The mean age was 7 years. Male to female ratio was 2:1. There was a wide spectrum of causative trauma. The most frequent cause was RTA 40%. Solid organ injuries were (70%), intestinal injuries (12%), diaphragmatic hernia (2%), abdominal wall haematoma (2%), NOM for solid organs injuries was successful in 94%. There were 3 deaths (6%). Two of them associated with head injuries and one was delayed intestinal perforation.

Conclusion: The majority of children with blunt abdominal solid organs injuries can be treated successfully without surgery, associated head injuries and delayed intestinal perforation were main causes of mortality.

Keywords: abdominal trauma, abdominal injury, children, paediatrics, blunt.

I. INTRODUCTION

Despite increased awareness and prevention efforts, trauma remains number one cause of childhood death and disability in the developed countries ^[1]. In under developed countries it is beginning to assume importance as infections and malnutrition are controlled ^[2]. Childhood trauma will be number one disease globally in 2020 as expected by the World Health Organization (WHO), who published their third World Report on Child Injury Prevention in December 2008 ^[3]. The abdomen is the third most commonly injured anatomic region in children following head and extremities ^[4]. But it is the most common site of initially unrecognized fatal injury in traumatized children.

Despite its importance being the most common cause of traumatic abdominal injury, paediatric blunt

abdominal trauma in Sudan is not studied before and this motivate me to address this issue in Khartoum teaching hospital which is the main referral hospital for paediatrics surgical emergencies.

II. OBJECTIVES

a) The General objective

To study mode of trauma, presentation, management and its outcome in paediatric patients with blunt abdominal trauma presented to Khartoum teaching hospital.

b) Specific objectives:

- To specify mechanism of injury in paediatric blunt abdominal trauma.
- To determine types of intra-abdominal injuries in paediatric blunt abdominal trauma in KTH.
- To determine incidence of solid organ injury in paediatric blunt abdominal trauma in KTH.
- To identify modalities of treatment of intra abdominal injuries.
- To determine outcome of paediatric blunt abdominal trauma in KTH.

III. PATIENTS AND METHODS

Study design: This is a prospective observational descriptive study.

Study area: Department of paediatrics surgery Khartoum teaching hospital.

Study duration: The study was conducted in the period from March 2012 to August 2013.

Patient selection:

Inclusion criteria: All children with blunt abdominal trauma aged less than 15 years regardless of the mechanism of injury.

Exclusion criteria: Children with blunt abdominal trauma with associated penetrating injury.

Sample size: Number of paediatric patients with blunt abdominal trauma admitted to KTH during the above mentioned period.

Data collection tool: Structured pre-designed questionnaire including demographic data, date and mode of trauma, presenting complaints, examination on presentation, resuscitation done, investigations requested, management and outcome.

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presentation, resuscitation done, investigations requested, management and outcome.

Data analysis: Data was analyzed using SPSS version 20 and a P value was considered significant if it is $\leq 0,05$.

Consent and ethical clearance: all patients were informed and consented about their inclusion in this study and no one was forced or included against his /her or their family interest.

IV. RESULTS

a) Demography

A total number of 50 patients with paediatrics blunt abdominal trauma were included in the study.

Mean age was 7 (SD \pm 3.5), it ranged from 2 to 13. Boys were 34 (68%) and girls 16 (32%), with a male to female ratio of 2:1.

b) Mode of trauma

There was a wide spectrum of causative trauma. The most frequent causes were RTA representing 40%, falling from height 26%, animal related accidents 18% and other causes with varying prevalence (Figure1).

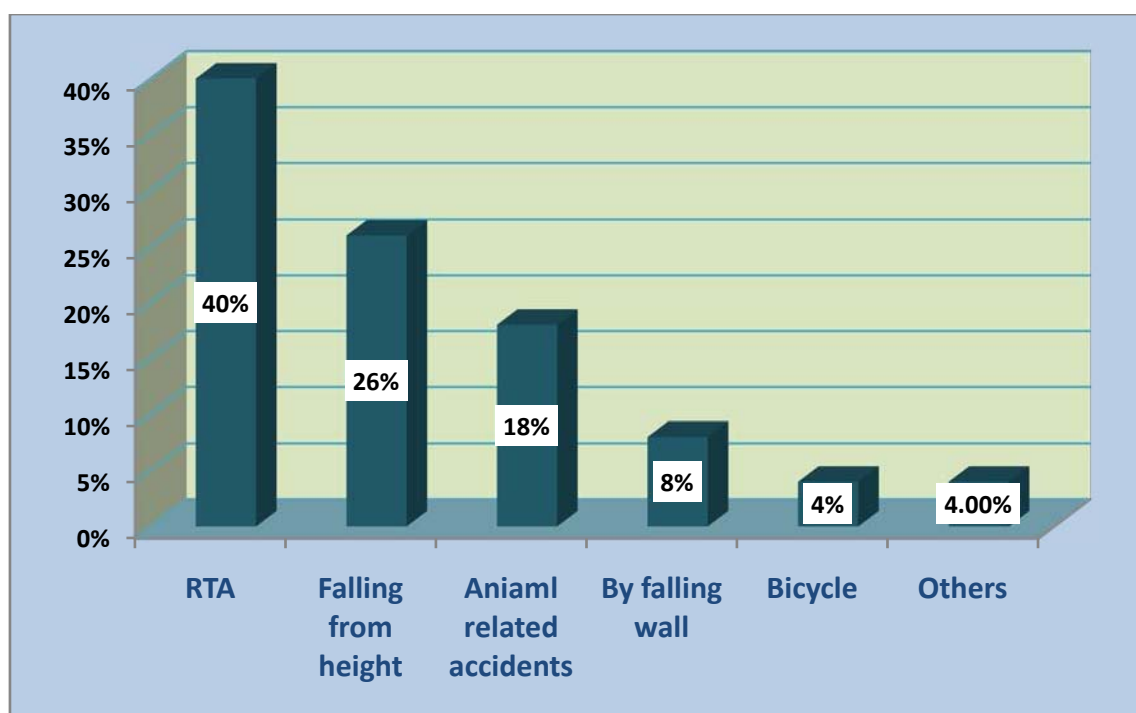


Figure1 : Mode of trauma in paediatric blunt abdominal trauma.

c) Clinical presentation

The main symptom on presentation was abdominal pain; it was the only symptom in 60%, abdominal pain associated with vomiting was noticed in 22%, abdominal pain with associated vomiting and distension in 16%. Vomiting was the only presenting symptom in 2%.

Abdominal tenderness was found in 48 patients (96%). Only two cases were negative for abdomen tenderness (one has splenic injury and the other with liver injury), however there were six patients with abdominal tenderness but no evidence of intra abdominal injury. Abdominal rigidity was detected in 22 patients (44%) and negative in 28 patients (56%). Most patients have normal GCS (15), three patients (6%) with GCS of 13 one of them with associated pelvic fracture, two patients (4%) with GCS of 10 both have associated head injury.

d) Investigations

Mean haemoglobin was 9.38 (SD \pm 2.01), it was low (less than 10 gram/dl) in 52%, Urinalysis was normal in 84%; it showed gross haematuria in four patients (8%) and microscopic haematuria in a similar number. Renal injuries were proved in three out of the four patients with gross haematuria, but only in one patient of those with microscopic haematuria. Two patients were found to have renal injury and normal urinalysis.

Renal function test was normal in 43 patients (86%), and abnormal in seven patients (14%). Liver function test was done for 22 patients (44%) and was abnormal in 8 patients (16%).

Abdominal ultrasound (US) was made for 47 patients out 50 (94%), it showed 32 solid organ injuries in 26 patients (52%); splenic 18, liver 9, renal 4 and one pancreatic injury. It showed haemoperitoneum with no solid or hollow organ injuries in 17 patients (34%) of

whom four patients were later diagnosed as intestinal injuries, and was normal in four patients 8%.

Abdominal computed tomography scan (CT scan) was done for 29 patients (58%); it showed 30 solid organ injuries of these 17 were splenic injuries, seven liver injuries, five renal injuries, one pancreatic injury and two haemoperitoneum. It detected eight solid organ injuries that were not seen in abdominal sonography.

Table 1 : Intra- abdominal injuries in children with blunt abdominal trauma

Type of injury	Number of patients	Frequency
Solid organ injury	35	70%
Hollow viscus injury	6	12%
Haemoperitoneum only	6	12%
Diaphragmatic hernia	1	2%
Abdominal wall haematoma	1	2%

f) Associated extra-abdominal injuries

Associated injuries were seen in 11 patients (22%), head injuries in five patients (10%) followed by chest injuries in four patients (8%). There was one patient with pelvic fracture and one with lower limb fracture- dislocation.

g) Management of paediatric blunt abdominal trauma

On presentation 36 patients (72%) were haemodynamically stable and 14 patients (18%) were unstable of these 11 patients responded to resuscitation. Three patients did not respond to crystalloid and blood transfusions and were taken to the theatre. Conservative treatment was done for 32 patients

e) Intra-abdominal injuries

There were 43 solid organ injuries found in 35 patients (70%), The most frequently injured solid organ was spleen 22 patients (44%) followed by the liver 14 patients (28%). There were six small bowel injuries ,the most commonly injured small bowel was jejunum four patients (8%), followed by duodenum one patient (2%) and ileum one patient (2%) (Table1).

out of 35 patients with solid organ injuries it was successful in 30 patients (94%) and failed in two patients 6%. one patient developed liver abscess after successful conservative treatment and was drained operatively.

Nine patients (18%) required operative treatment; six small bowel injuries and three solid organ injuries. One patient was presented three months after the operation with adhesive intestinal obstruction for which he was re-operated.

There were three mortalities (6%); one died post-operatively and two patients were died during conservative management (Table 2).

Table 2 : Mortalities in paediatrics blunt abdominal trauma.

No.	Age	Sex	Mode of trauma	Intra-abdominal injury	Associated injury	Treatment
1-	11years	Male	RTA	Splenic injury	Head injury	Conservative
2-	4 years	Male	By falling wall	Haemoperitoneum	Head injury	Conservative
3-	6 years	Male	Kicked by donkey	Jejunal injury	No	Operative

h) Hospital stays

Mean hospital stay was 7.9 days (SD± 4.64), ranging from 1-21 days. The majority of patients (80%) were discharged after 12 days.

V. DISCUSSION

Abdominal trauma accounts for 8-10% of all trauma admissions to paediatric hospitals. Penetrating injuries are less common in children and account for 8-12% of paediatric abdominal trauma admissions. Abdominal trauma can be associated with significant morbidity and may have a mortality rate as high as 8.5%.^[1]

In this study mean age is 7 years (SD ±3.26) ranging from 2 -13 years. Boys were 34 (68%) and girls were 16 (32%), male to female ratio was 2:1. Most

literatures cited mean age around seven years and male predominance^[2, 5, 6].

The majority of our patients sustained their injuries as RTA (40%) or falls (26%) which is similar to other studies^[2,7,8]. Several studies showed that abdomen to handle collision are associated with high risk of small bowel injury^[9]; in our study the most common cause of small bowel injuries was domestic animal related accident (66%).

In current study abdominal tenderness was found in the vast majority of patients vies 48 patients (96%). Only two cases were negative for abdomen tenderness. However, there were six patients (12%) with abdominal tenderness but no evidence of intra abdominal injury.

Liver enzymes; alanine aminotransferase (ALT) and aspartate aminotransferase (AST) are markers for liver or other solid organ injury. Liver function test was done for 22 patients (44%) ALT and AST were high in eight patients (16%).

Abdominal CT scan is the investigation of choice in haemodynamically stable patients ^[4], in our study it was made for 29 patients (58%) and was indicated by positive findings in abdominal US. It detected eight solid organ injuries that were missed by abdominal US. CT scan should not affect the decision to operate or conserve as this is a clinical judge. However, some study reported negative laparotomy rate of 51% for paediatrics blunt abdominal trauma and they explain it by lack of advanced imaging modalities ^[5].

There is controversy in literature regarding the most commonly injured intra- abdominal organ, classically spleen was the most commonly injured organ, and however, recent studies cited that the liver is the most commonly injured intra-abdominal organ followed by spleen ^[1, 7, 10]. In our study spleen is the most commonly injured organ 22 patients (44%) followed by liver 14 patients (28%); and this is the same in regional studies in Egypt and Nigeria ^[2,5].

Non-operative management has become the standard of care for managing solid organ injuries, and is successful in more than 95% in appropriately selected patients ^[11]. The failure rate of non-operative management is 5%. In our study conservative treatment which include; proper resuscitation, serial abdominal examination, imaging facility and close monitoring of the haemodynamic status was successful in 30 patients (94%) out of 32 patients with solid organ injuries treated conservatively and was failed in two patients (6%).

Regarding splenic injuries it is estimated that 15 % of children with blunt abdominal trauma still undergo splenectomy ^[12]. Non –operative management in our study was successful in 86.3% out of the total patients with splenic injuries, it failed in two splenic injuries (9%), operative management was carried for three patients (13%) of splenic injuries. two were ended with splenectomy and one was underwent splenorraphy, our splenectomy rate was 9% of the total splenic injuries Although liver injuries account for 15-20% of abdominal injuries they are responsible for more than 50% of death resulting from blunt abdominal trauma ^[8]

In our study liver injuries were found in 14 patients (28%), thirteen patients were successfully treated conservatively one of them developed liver abscess and was drained operatively. One unstable patient was treated operatively, and was presented three months after the operation with adhesive intestinal obstruction for which he was re-operated.

Renal injury occurs in 10% of paediatric blunt abdominal trauma ^[13]. In the current study we had six patients (12%) of renal injuries, sixty six percent of renal injures we had were associated with haematuria. Over

the last twenty years, the management of paediatric renal trauma has shifted towards a primarily non-operative approach that is now well established for children up to 18 years old. In the current study we have six patients (12%) of renal injuries all of them were treated conservatively.

Blunt trauma to pancreas is rare and clinical features are often non-specific and unreliable leading to possible delays in diagnosis and therefore increased morbidity ^[14]. In our study there was only one pancreatic injury (2%), he developed pancreatic pseudocyst and was resolved on conservative treatment.

Traumatic diaphragmatic hernia is uncommon, it should be suspected in all blunt abdominal traumas; because delayed diagnosis is usually associated with high morbidity ^[15]. We have one patient (2%) of diaphragmatic hernia and was associated with chest and jejunal injuries. The diagnosis was clinical supported by chest x-ray and the patient was operated on immediately without further investigation.

Hollow viscus injuries are uncommon and occur in approximately 3% of abdominal injury, small bowel was the most frequently involved hollow viscus ^[16]. In this study hollow viscus injuries were found in six patients (12%) all were treated operatively by simple repair. One patient was died postoperatively and was due to delayed presentation (after three days).

We had three deaths (6%) all were males and two of them were associated with head injuries. It was found that fatal paediatric trauma occurs most frequently in boys, and associated with severe head injuries ^[17]. In western countries mortality of paediatric blunt abdominal trauma is up 8.5%, regionally in Egypt and Nigeria mortality rate of 17% and 13% was reported respectively ^[2,5]. for blunt spleen/liver injury in children the American Paediatric Surgical Association recommends a number of bed rest days equal to the grade of injury+1 ^[4]. In the current study mean hospital stay was 7.9 days (SD 4.64), ranging from 1-21 days. The majority of patients (80%) were discharged after 12 days.

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