

Abdominal Trauma in Children: 10-Year Experience in a Teaching Hospital in Enugu, Nigeria

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To cite this article:

Chukwubuike Kevin Emeka. Abdominal Trauma in Children: 10-Year Experience in a Teaching Hospital in Enugu, Nigeria. *International Journal of Clinical Dermatology*. Vol. 2, No. 2, 2019, pp. 10-14. doi: 10.11648/j.ijcd.20190202.11

Received: November 16, 2019; **Accepted:** December 2, 2019; **Published:** December 7, 2019

Abstract: Background: Abdominal traumas are injuries to the abdomen resulting from transfer of energy from the exterior to the abdomen. It is associated with significant morbidity and mortality especially in developing countries. Methodology: Children who presented with abdominal trauma at Enugu State University Teaching Hospital between January 2007 and December 2016 were evaluated. Diagnosis of abdominal trauma was made based on clinical assessment and imaging investigation. Results: Over the ten year period, there were 42 cases of abdominal trauma with male to female ratio of 3.7:1 and mean age of 9.1 years (4-14). Fall from height, accounting for 42.9% of the cases, was the most common cause of abdominal trauma. This is followed by road traffic accident (35.7%), bicycle handle injury 14.3%, gunshot injury 7.1%. Abdominal ultrasound was the most common imaging modality. The spleen was the most injured organ, followed by liver, kidney, and intestine in descending order. Non-operative treatment was successful in 85.3% of the patients while 14.7% had surgery. The mean duration of hospital stay was 9.8 days (1-14) and the mortality was 7.1%. Conclusion: Abdominal trauma affects children of all age groups. In the current study, fall from height was the most common mechanism of injury and the spleen was the most injured organ. Non-operative treatment was the predominant modality of treatment.

Keywords: Trauma, Injury, Abdominal, Spleen, Children, Experience

1. Introduction

Abdominal trauma refers to physical injury to the abdomen caused by transfer of energy. It is a leading cause of death/disability in children in developed countries and it is estimated to be present in about 25% of children who have major trauma [1, 2]. Abdominal trauma is best categorized by mechanism of injury into blunt abdominal injury and penetrating abdominal injury. Blunt abdominal trauma (BAT) is the most frequent cause of abdominal injury in children and accounts for about 90% of all pediatric injuries [1, 3]. Children are susceptible to abdominal injury for the following reasons: abdominal organs are larger, abdominal muscles are poorly developed, there is less intra-abdominal fat that offer protection against injury, the rib cage is complaint that allows direct transmission of force to the liver and spleen, children have smaller body mass which means greater force applied per unit body surface area [4-6]. Management of abdominal trauma should be multidisciplinary based on the physiology of the patient,

anatomy of the injury and associated injuries [7]. In BAT, the spleen is the most common injured organ and non-operative management is employed in over 95% of the patients [2, 3, 7, 8]. Penetrating abdominal injuries are less common but most times require operative treatment [2]. Initial evaluation of injured children must follow the Advanced Trauma Life Support (ATLS) protocol to ensure that no injury is missed. Serial abdominal examination and serial hematocrit estimation are indispensable [9]. Focused Assessment with Sonography for Trauma (FAST) could be used for the initial assessment of children who have abdominal trauma but computed tomography (CT) scan is the gold standard in the identification of intra-abdominal injury [2]. Resuscitation of injured patients involves the administration of crystalloids, colloids and blood transfusion, if necessary. Hemodynamic instability (despite maximum resuscitation), free intra-peritoneal air, gunshot injury to the abdomen, evisceration of intra-peritoneal contents are absolute indications for emergency laparotomy [2]. This paper reports our experience in the management of children, who sustained abdominal

trauma, at a pediatric surgical unit of a teaching hospital in Enugu, Nigeria.

2. Methodology

This was a retrospective study of pediatric patients who presented with a history of trauma to the abdomen, to the pediatric surgical unit of Enugu State University Teaching Hospital (ESUTH) Enugu, South East Nigeria. Medical records of children (less than 15 years) treated for abdominal traumas over a 10-year period (between January 2007 and December 2016) were analyzed. Patients who have had surgery in a peripheral hospital for abdominal trauma before presenting to us were excluded. Injuries to the urinary bladder and urethra were also excluded.

ESUTH is a tertiary hospital located in Enugu, South East Nigeria. The hospital serves the whole of Enugu State, which according to the 2016 estimates of the National Population Commission and Nigerian National Bureau of Statistics, has a population of about 4 million people and a population density of 616.0/km². The hospital also receives referrals from its neighboring states. Diagnosis of abdominal trauma was made based on the patients' clinical presentation and examination findings by the pediatric surgeon. Necessary investigations such as abdominal ultrasound and computed tomography (CT) scan were done to determine the extent and the organ of injury. Data were extracted from the case notes, operation notes, operation register, and admission-discharge records. The information extracted included the age, gender, mechanism of injury, interval between trauma and presentation to the hospital, condition of the patient on arrival, investigation done, nature/organ of injury, need for blood transfusion, outcome and duration of hospital stay.

Ethical approval was obtained from the ethics and research committee of ESUTH. Statistical Package for Social Science (SPSS) version 23 was used for data entry and analysis. Data were expressed as percentages, range and mean.

3. Result

3.1. Demography

Fifty two cases of pediatric abdominal traumas were seen during the period of the study but only 42 cases had complete case records and formed the basis of this report. A total of 467 cases of pediatric traumas were recorded during the study period, out of which abdominal trauma accounted for 8.9%. There were 33 males (78.6%) and 9 females (21.4%), with a male to female ratio of 3.7:1. The mean age of the patients was 9.1 years (range: 4-14). Seventy six percent of the patients were aged 8 years to 14 years. Thirteen patients (31%) presented to the hospital within 24 hours from the time of the incident, twenty patients (47.6%) within 24 to 72 hours and nine patients (21.4%) after 72 hours of the incident. The mean duration of hospital stay was 9.8 days (range: 1-14), as shown in Table 1.

Table 1. Demographic characteristics of the patients.

Gender	
Male	33 (78.6%)
Female	9 (21.4%)
Mean age	9.1 years (4-14)
Interval from incident to presentation to the hospital	
Less than 24 hours	13 (31%)
24 to 72 hours	20 (47.6%)
More than 72 hours	9 (21.4%)
Mean duration of hospital stay	9.8 days (1-14)

3.2. Clinical State of the Patients at Presentation

As at the time of presentation to the hospital, thirty one patients (73.8%) were in stable clinical state while eleven patients (26.2%) were in shock, evidenced by tachycardia, reduced pulse pressure, reduced urinary output and impaired sensorium (Table 2).

Table 2. Clinical Condition of the patients.

State	Number	Percentage
Stable	31	73.8
Unstable (in shock)	11	26.2

3.3. Mechanism of Injury

Eighteen patients (42.9%) fell from height, fifteen patients (35.7%) were involved in road traffic accident and six patients (14.3%) had bicycle handle injury. The above three mechanisms of injury caused blunt abdominal trauma (92.9%). Three patients (7.1%) had a penetrating abdominal injury due to gunshot wounds (Table 3).

Table 3. Mechanism of injury.

Mechanism of Injury	Number	Percentage
Fall from height	18	42.9
Road traffic accident	15	35.7
Bicycle handle injury	6	14.3
Gunshot injury	3	7.1

3.4. Investigations

Imaging investigations done in our patients included abdominal ultrasound and CT scans. Thirty seven patients (88.1%) did abdominal ultrasound, three patients (7.1%) did CT scan and two patients (4.8%) had no imaging investigation done (Table 4). All the patients had hematological and biochemical tests such as hematocrit and serum electrolyte respectively.

Table 4. Imaging investigations done by the patients.

Investigation	Number	Percentage
Abdominal ultrasound	37	88.1
Computed tomography	3	7.1
None	2	4.8

3.5. Organs Injured

Twenty one patients (50%) had splenic injury; nine

patients (21.4%) had liver injury while seven patients (16.7%) had multiple injuries. Others are as shown in Table 5.

Table 5. *Organs injured.*

Organ injured	Number	Percentage
Spleen	21	50.0
Liver	9	21.4
Multiple organs	7	16.7
Kidney	3	7.1
Intestine	2	4.8

3.6. Treatment Modalities

Thirty six patients (85.7%) were treated non-operatively (conservative treatment) while 6 patients (14.3%) had surgery as shown in Table 6. Patients who had surgery were hemodynamically unstable despite maximal resuscitation.

Table 6. *Treatment offered to the patients.*

Treatment	Number	Percentage
Non operative	36	85.7
Operative	6	14.3

3.7. Blood Transfusion

Twenty nine patients (69%) had blood transfusion. Thirteen patients (31%) were treated with crystalloids and had no blood transfusion.

3.8. Outcome

Thirty eight patients (90.5%) did well and were discharged home. Three patients (7.1%) died while one patient (2.4%) was discharged against medical advice.

4. Discussion

Trauma in children is a global health problem because of the morbidities and mortalities recorded from pediatric trauma every year [10]. With some improvements in the control of infection and malnutrition in developing countries, trauma in children is assuming increasing significance. Pediatric trauma is a major threat to the health and well-being of children [11]. Abdominal trauma is the third most common trauma in children after head and extremity traumas [12].

In the present study, abdominal trauma accounted for 8.9% of all traumas in children. This is similar to the finding of Yang et al and Costa et al [13, 14]. The male predominance observed in the current study is consistently reported in other studies [8, 13, 15, 16, 17]. This gender difference may be explained by the observation that males behave more impulsively and are more likely to be exposed to danger by staying outdoors, driving bicycles or climbing trees. The mean age of our patients is in line with the findings of Ameh et al and Streck et al [15, 18]. However, 7.8 years and 7.2 years were the mean ages recorded by Yang et al and Ndour et al respectively [13, 17]. These differences may be explained by the category of patients recruited into the various studies. For instance, Pariset et al reported 38 months as the mean age of

their patient because the researchers recruited only patients who are below the age of 5 years in their study [19].

There are variations in the age group predominantly affected by abdominal trauma: Our finding of 8 to 14 years is similar to that of Ameh et al, but at variance with the reports of Ndour et al and Djordjevic et al [15, 17, 20]. The reason for these differences is not clear but might be explained by the geographical location. Most of our patients presented late to the hospital. This is in agreement with the report of other authors [8, 21, 22]. It is noteworthy that this delayed presentation is seen in published series emanating from the developing countries. This may be due to poverty and ignorance that is prevalent in developing countries. The mean duration of hospital stay of 9.8 days recorded in our patients seems to be the average of what other researchers reported which ranged from 5.8 days to 18.9 days [8, 15, 17, 18, 20]. The reason for these variations in hospital stay is not exactly known, but may be due to differences in the treatment protocol of the managing units.

One quarter of our patients presented in shock, similar to the report of Ameh et al [23]. However, there are reports as high as 66% and as low as 12% [8, 17]. These variations may be due to differences in time of presentation to the hospital. Osifo et al, in Edo State Nigeria, reported that some of their patients reported after a 2-day lag period [8]. Fall from height was the most common mechanism of injury in the current study. This finding is consistently observed in many other reports too [24, 25, 26]. However, other studies found road traffic accident as the most common etiology of abdominal trauma in children [8, 13, 27, 28]. Kundal et al in their study of 198 paediatric patients in India reported that fall was the most common cause of abdominal trauma. These findings were interesting, but the reasons for these differences are unclear. Majority of our patients had abdominal ultrasound for the evaluation of the injured intra-abdominal organ. This is in agreement with the findings of Ndour et al [17]. Retziaff et al reported that ultrasound combined with clinical assessment provides an effective method for safe diagnosis and appropriate surgical decision making [30]. Although, abdominal computed tomography (CT) scan is the gold standard for grading intra-abdominal organ injury, only a few of our patients did CT scan. This may be due to the high cost, non-availability and risk of radiation exposure of CT scan.

Spleen was the most common injured organ in this series. This is supported by reports of previous workers [2, 20, 28]. In descending order of frequency, spleen, liver, kidney, bowel and pancreas are the commonly injured organs [4, 5]. Majority of our patients (85.7%) were treated non-operatively (conservatively). This may be due to large number of patients with blunt abdominal trauma (92.9%) when compared with penetrating abdominal trauma (7.1%). Other studies also documented non-operative treatment as the predominant modality of treatment of abdominal trauma in children [2, 8, 17]. Minaya-Bravo et al in their study concluded that non-operative management is the gold standard of care when circumstances are favorable [3]. About two-thirds of our patients had blood transfusion which at variance with the report of Yang et al [13]. Late presentation

of our patients may explain the variations in blood transfusion rates in children who have abdominal trauma.

Several studies have reported the mortality of pediatric abdominal trauma in the range of 4.8% to 13.8% [18-22]. Our report of 7.1% mortality seems to lie within the range of other published series. Ndour et al reported a low mortality rate of 1.8% [17]. The reasons for the differences in mortality rates are unclear.

5. Conclusion

Forty two cases of children who had abdominal trauma over a 10-year period were evaluated. Pediatric abdominal trauma accounted for 8.9% of all traumas seen during the study period. Ninety two percent of the abdominal traumas were blunt in nature and fall from height was the most common mechanism of injury. One quarter of the patients presented in clinical state of shock. Abdominal ultrasound was the most common investigation done by the patients. The spleen was the most injured organ and non-operative (conservative) treatment was the predominant modality of treatment. In the current study, the mortality was 7.1%.

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