

Patterns of pelvic and acetabular injury among Sudanese patients.

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Abstract:

Background: Most of major pelvic fractures result from very high energy trauma and require urgent hospital treatment. However more minor, stable fractures may only require a period of rest and analgesia followed by gradual mobilization. Extended civil development and increased means of transportation in Sudan during the last two decades led to an increase in the number of highly potentiated traumatic accidents including isolated or combined pelvic and acetabular injuries. For this reason a unit for pelvic surgery has been established in Khartoum north teaching hospital in 2006.

Objectives: A prospective study designed to evaluate the various patterns of pelvic and acetabular injuries in Khartoum North Teaching Hospital.

Material and Methods: Patients with pelvic ring and acetabular injuries treated in Khartoum North Teaching Hospital, Khartoum, Sudan, between August 2006 and September 2009 were enrolled in the study. The collected data had been managed statistically using the appropriate SPSS computer package.

Results: Hundred ten patients were included in the study. There were eighty one males. The mean age (\pm SEM) was 36.6 ± 1.61 years. The cause of injury was a road traffic accident in 89 patients, a fall from height in ten patients, a fall at home in three patients and in eight patients due to miscellaneous cause. Forty four (40%) patients presented directly to our hospital, whereas, 66 (60%) patients referred from other various hospitals from different region of Sudan. The average hospital stay (\pm SEM) was 16.12 ± 1.09 days. Regarding pattern of fractures; pelvis only was 59.1%, acetabulum only was 25.5%, and combined pelvic and acetabular fracture was 15.5%. According to Tile's classification of pelvic and acetabular injuries there were 25 (22.7%) patients with type C1 pelvis, 18 (16.4%) with type A2 pelvis, 15 (13.6%) with type A1 acetabulum, three 2.7% with type A2 pelvis and A1 acetabulum, and three 2.7% with type C1 pelvis & A3 acetabulum injuries. Thirty seven patients had associated skeletal fractures and 12 patients had extra-skeletal injuries.

Conclusion:

Pelvic and acetabular injuries remain relatively uncommon in Sudan when compared with other musculoskeletal injuries. But our study showed that there is a continuous increase in the number of pelvic and acetabular injuries. So, many pelvic surgery units are needed to be established to cover many areas in Sudan to overcome the delay factor which may affect management outcome.

Keywords: Pelvic fracture; Acetabular fracture; Tile's classification; AO group classification.

Pelvic ring and acetabular fractures are associated with a high incidence of mortality and remain the third most common cause of death in motor vehicle accidents¹.

When injury is found, a number of classification systems to describe pelvic fractures are available. Classification systems have been developed to assist in understanding the anatomy of the injury, help in identifying associated injuries, correlates with the degree of injury, predicting prognosis, and is useful in preparing for definitive orthopaedic repair²⁻⁵.

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Two of the most prominent pelvic fracture classifications are the Tile classification^{2,6} and the Young and Burgess classification³, which are based on the direction of the injury, pelvic stability, and forces involved. The Young-Burgess classification system focuses on the degree of injury⁷. The Tile classification system focuses on pelvic stability².

Concerning acetabular fracture classification the most popular two classification systems are, Letournel-Judet classification system, who classified acetabular fractures according to the fracture morphology as elementary fracture patterns, and later on AO group proposed their classification system modifying the concepts of the Letournel-Judet⁸⁻¹⁰.

Pelvic ring and acetabular fractures occur as the result of high-energy blunt trauma, as may result from motor vehicle collisions and falls. These injuries are associated with significant morbidity and mortality, both from the complications of pelvic ring or acetabular fractures and from commonly associated injuries. Recognition of the pattern of injury to the bony pelvis directs the search for associated soft tissue injuries and allows

implementation of the appropriate therapy^{11,12}.

Patients and methods:

This prospective study was carried out at Khartoum North Teaching Hospital, department of orthopaedic surgery, Sudan, in a period of 37 months between August 2006 and September 2009, after approval was obtained from the institutional review at the hospital. Study was conducted to find out the epidemiology and pattern of pelvic and acetabular fractures (incidence, age and sex distribution, external cause, fracture classification, associated injuries, and hospitalization). All patients were admitted to the authors' unit because of pelvic or acetabular injuries during the study period were included in this study. The images for the study were plain radiographs and computed tomography (CT) scans of the pelvis.

The patients' with pelvic ring disruptions or acetabular fracture had been classified with the Tile's classification (Table1) and AO group classification systems (Table 2) respectively.

Table 1: Tile Classification of Pelvic Fracture¹³

- Type A-stable (posterior arch intact)
 - A1: Avulsion injury
 - A2: Iliac wing or anterior arch fracture caused by direct blow
 - A3: Transverse sacrococcygeal fracture
- Type B-Partially stable (incomplete disruption of posterior arch)
 - B1: Open book injury (external rotation)
 - B2: Lateral compression injury (internal rotation)
 - B2-1: Ipsilateral anterior and posterior injuries
 - B2-2: Contralateral (bucket handle) injuries
 - B3: Bilateral
- Type C- Unstable (complete disruption of posterior arch)
 - C1: Unilateral
 - C1-1: Iliac fractures
 - C1-2: Sacroiliac fracture-dislocation
 - C1-3: Sacral fracture
 - C2: Bilateral, with one side type B, one side type C
 - C3: Associated with an acetabular fracture

Table 2: AO group classification of acetabular fracture¹⁴

- Type A: fracture involves only one of two columns of acetabulum;
 - Type A1: posterior wall fracture and variations.
 - Type A2: posterior column fracture and variations.
 - Type A3: anterior wall and anterior column fracture.

- Type B: transverse fractures, portion of roof remains attached to intact ilium.
 - Type B1: transverse fracture and transverse plus posterior wall fracture.
 - Type B2: T-shaped fracture and variations.
 - Type B3: anterior wall or column plus posterior hemitransverse fracture.

- Type C: fractures of anterior and posterior columns, no portion of roof remains attached to intact ilium;
 - Type C1: anterior column fracture extending to iliac crest.
 - Type C2: anterior column fracture extending to anterior border of ilium.
 - Type C3: fractures enter sacroiliac joint.

The fracture was categorised into pelvis fractures only, acetabulum only, and combined pelvic and acetabular fractures. Treatment was based on the attending surgeon's (authors) preference according to the stability of the fracture. Using SPSS computer package, data were expressed as mean \pm SEM and compared using the Student's *t* test where appropriate. Categorical data were presented as numbers with percentages and compared using χ^2 analysis.

Results:

Over a period of three years, 110 patients (81 males, 29 females) were admitted to our orthopaedics surgical ward and diagnosed as having different pelvic or acetabular fractures. Out of them 65 patients had pelvic fractures, 28 had acetabular fractures and 17 had combined pelvis and acetabulum fractures. All these patients were included in our study.

The incidence of pelvic and acetabular fractures in males was 73.6 % (81 patients) and in the females 26.4 % (29 patients) with male to female ratio of 2.8: 1. The age ranged between 5-80 years, the mean age \pm SEM was 36.6 \pm 1.61 years. There was remarkable annual increase in the incidence of admitted patients with such fractures (Fig.1 and table 3).

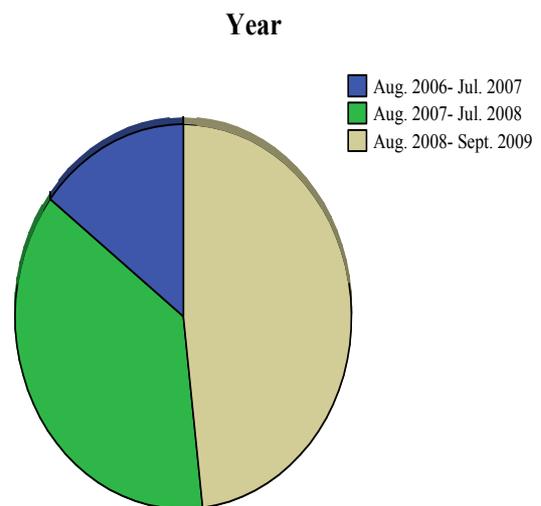


Fig. 1: Annual admission of patients with fracture pelvis and acetabulum.

Table 3: Annual admission of patients with fracture pelvis and acetabulum.

Year	Frequency	Percent
Aug. 2006- Jul. 2007	16	14.5
Aug. 2007- Jul. 2008	41	37.3
Aug. 2008- Sept. 2009	53	48.2
Total	110	100.0

These fractures have a rather narrow spectrum of causes. Of those with high energy trauma, the most frequent cause of injury was a road traffic accident seen in 88 patients (80 %), 10 patients (9.1 %) due to fall from height, and one patient (0.9%) due to an accident sustained during a fall from a mobile vehicle. The proportion of those sustained pelvic and acetabular fractures due to road traffic accidents was higher in men than in women (58.2 % vs. 21.8 %, respectively). Moreover,

the proportion of other causes was also higher in men (15.4%) than in women (4.5%).

There was a tendency towards higher incidence of high energy trauma in the younger age group as compared to the older ones (P = 0.04).

In the older persons, the women had a higher incidence of fractures (P < 0.05). Both sexes showed an increased incidence of fractures between two age groups: viz., from 50-64 years of age and 65-80 years of age (P = 0.03 and 0.04. respectively) (Table 4).

Table 4: Mechanism of injury according to Age groups of patient

Age group	Mechanism of injury					Total
	RTA	Fall from height	Fall from moving vehicle	Fall at home	Others	
5-19	10	0	0	0	3	13
20-34	34	5	0	0	5	44
35-49	21	2	1	1	0	25
50-64	16	1	0	1	0	18
65-80	7	2	0	1	0	10
Total	88	10	1	3	8	110

Forty four patients (40%) presented directly to the authors' unit, whereas, 66 (60%) patients were referred from other various hospitals from different region of the Sudan (Fig.2, 3 and table 5).

Table 5: Residence of the patients.

	Frequency	Percent
Khartoum	66	60.0
Aljazeera	12	10.9
White Nile	9	8.2
Blue Nile	3	2.7
Northern of Sudan	6	5.5
Western of Sudan	12	10.9
Eastern of Sudan	2	1.8
Total	110	100.0

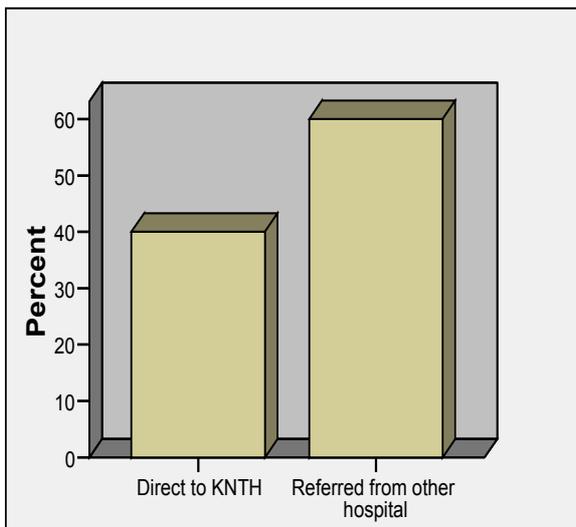


Fig.2: Presentation to Khartoum north teaching hospital

The overall incidence in the patients with fractures requiring surgical operation was 77.3% (85 patients) (Table 6). The average hospital stay (Mean ± SEM) was 16.12 ± 1.09 days. Regarding pattern of fractures; pelvis fractures were observed in 65 (59.1%) patients, while acetabular fractures were found in 28 patients (25.5%), and combined ones were seen in 17 (15.5%) (Fig.4).

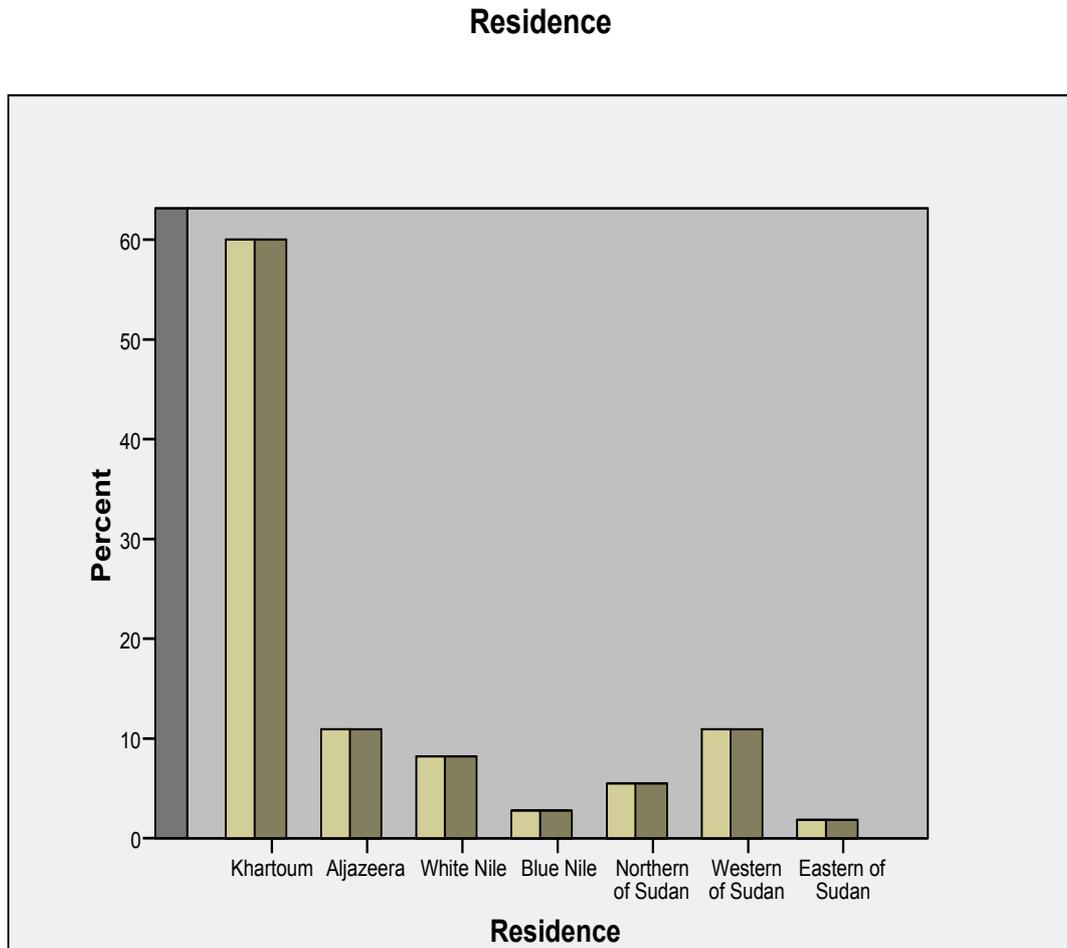


Fig. 3: Residence of the patients.

Table6: Definitive treatment

	Frequency	%
Non-surgical treatment	25	22.7
Surgical treatment	85	77.3
Total	110	100.0

Using Tile’s classification for pelvic fractures and AO group classification for acetabular fractures, a classification of the fractures was possible in all patients.

Accordingly there were 25 patients (22.7%) with type C1 pelvic, 18 (16.4%) with type A2 pelvic, 15 (13.6%) with type A1 acetabular, 3 (2.7%) with type A2 pelvic & A1 acetabular (C3 Tile), and (3 2.7%) with type C1 pelvic & A3 acetabular injuries (C3 Tile), table 7 and

figure 5 shows the various pattern of fractures.

Thirty seven patients had associated other skeletal fractures and 12 patients had extra-skeletal injuries (Table 8).

When looking for the associated injuries there is statistically significant difference ($P < 0.05$) between the group with low energy trauma and that with severe trauma where only two out of 11 (18.2 %) patients were seen in the former and 47 out of 99 (47.5 %) were found in the latter. The patients with high energy trauma often had more than one associated injury. Patients with associated injuries had a longer hospitalization than those without associated injuries $P < 0.01$.

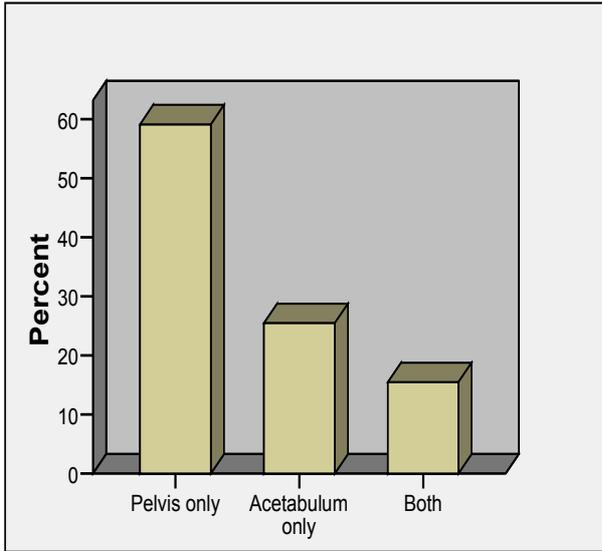


Fig.4: Anatomical site.

Discussion:

Although several series of pelvic fractures have been published overseas, there has not been much work done to examine the pattern of these fractures in our local Sudanese population. The aim of our study was to analyze the patients with pelvic or acetabular fractures treated in authors' unit in Khartoum North Teaching Hospital.

Study showed that the total incidence of all hospitalized patients to our unit with pelvic and acetabular fractures was 10.85%, with male predominance (73.6%).

This is nearly comparable to the studies done by others where the incidence of pelvic and acetabular fracture constituted approximately 1-9.3% of all skeletal injuries and 60% occurred in men¹⁵⁻¹⁷.

Table 7: Classification of fracture according to Tile's and AO classification systems.

Classification	Frequency	Percent
A2 pelvis	18	16.4
A3 pelvis	5	4.5
B1 pelvis	5	4.5
B2 pelvis	5	4.5
B3 pelvis	2	1.8
C1 pelvis	25	22.7
C2 pelvis	2	1.8
C3 pelvis	1	0.9
A1 acetabulum	15	13.6
A2 acetabulum	5	4.5
A3 acetabulum	5	4.5
B2 acetabulum	2	1.8
C1 acetabulum	1	0.9
C2 acetabulum	2	1.8
C1 pelvis & A1 acetabulum	2	1.8
C1 pelvis & C1 acetabulum	2	1.8
A2 pelvis & A1 acetabulum	3	2.7
C1 pelvis & B2 acetabulum	1	0.9
C1 pelvis & A3 acetabulum	3	2.7
A2 pelvis & B3 acetabulum	1	0.9
C1 pelvis & C3 acetabulum	1	0.9
A3 pelvis & C3 acetabulum	1	0.9
A2 pelvis & B2 acetabulum	1	0.9
B2 pelvis & A3 acetabulum	1	0.9
A2 pelvis & C2 acetabulum	1	0.9
Total	110	100.0

Tile's
 C3

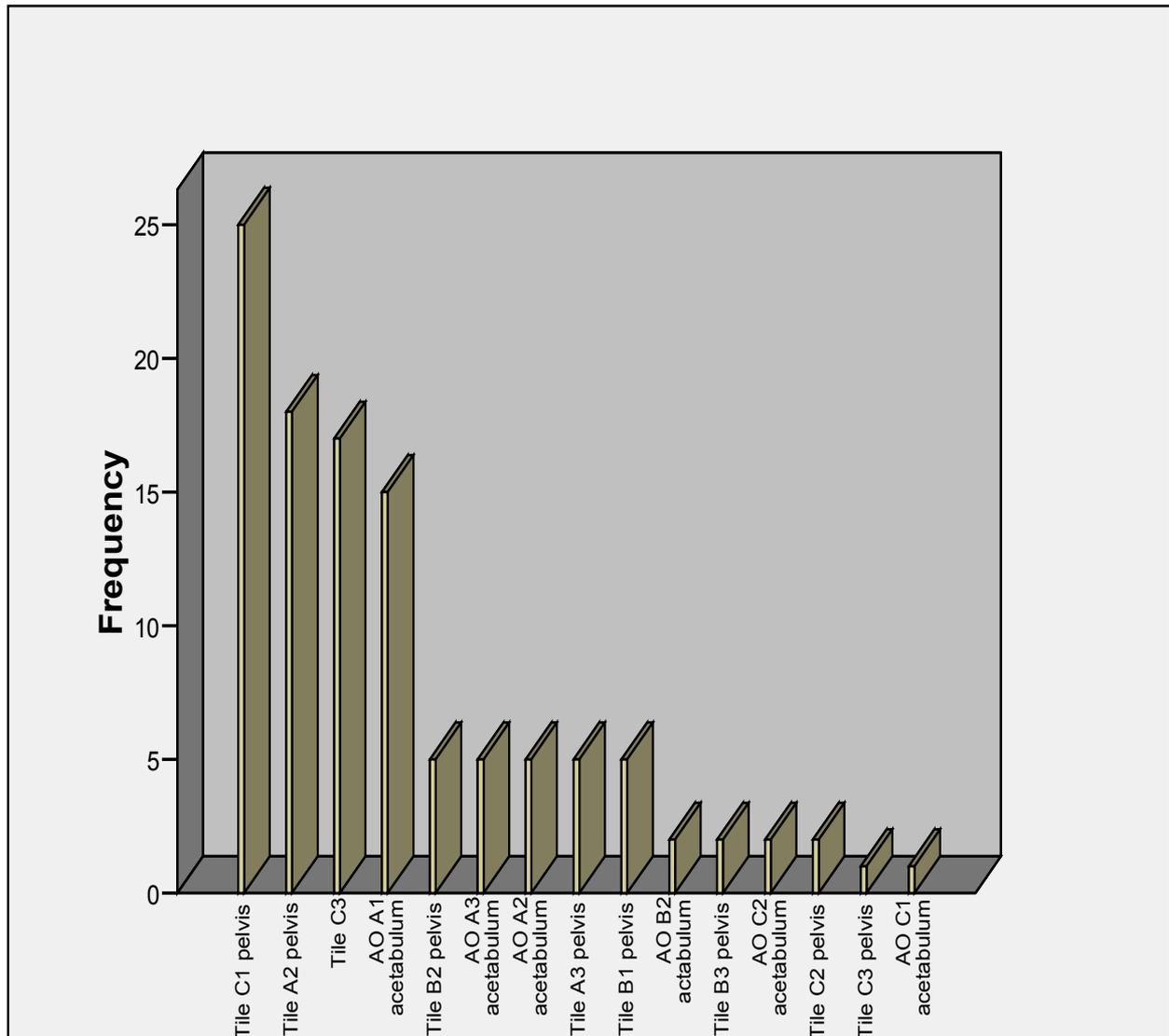


Fig. 5: Different pattern of pelvic and acetabular fractures.

Table 8: Associated traumatic injuries

	Prevalence	Percent
Chest injury	1	0.9
Abdominal injury	5	4.5
Head injury	3	2.7
Urethral injury	4	3.6
Upper limb injury	7	6.4
Lower limb injury	15	13.6
Both Upper and Lower limb injuries	9	8.2
Chest & Lower limb injuries	2	1.8
Head & Lower limb injuries	2	1.8
Other injuries	1	0.9
Total	49	100.0

The study showed that there is increased incidence among young adults; most pronounced in males. Melton et al. in their study showed the same result¹⁸. But others found increasing incidence rates associated with increased age, but no difference between the sexes¹⁹. Ninety eight (89.1%) patients were from urban population. This might be due to extended civil development and increased means of transportation. The most frequent (90%) cause of injury was a high energy trauma, out of them road traffic accident constituted 80 %, and fall from height constituted 9.1 %.

This is in agreement with the result by Bruce and Reckling in their study, as they found that road traffic accidents constituted about two third of causes²⁰.

From our data the majority of pelvic fractures among the elderly were caused by low energy trauma; which was much higher in females than in males. The increased prevalence of osteoporosis and resultant bone fragility as women aged, could account for older females pelvic fractures in this study. The same result was also obtained by elsewhere²¹.

Although the frequency of pelvic and acetabular fractures in relation to other skeletal fractures cannot be ascertained in this study, some indicators of the importance of this fractures can be noted when the annual frequency is compared during the study period. This study showed increasing annual frequency admission of patients with fracture pelvis and acetabulum during the study period.

The study also showed that 60% of cases were referred from varying hospitals of different regions in our country, this reflect the lack of expertise and trained orthodox practitioners in pelvic and acetabular surgery in other parts of Sudan.

In this study cumulatively the incidence (40.9%) of unstable fractures was higher than stable fractures (20.9%). Similar results were presented by others²².

We found that the incidence of fractures treated by non-surgical means was 22.7%.

This high rate of tendency to non-surgical treatment is explained by refusal of some patients the surgical intervention.

In our study, the average length of an in-patient hospital stay for pelvic and acetabular fractures was 16.12 ± 1.09 days, this result was found to be less than that in previous reports conducted in different period in Sweden and Oxford (22 and 28 days respectively)^{19,21}. This might reflect the way of early mobilization applied in the authors' experience.

Bruce and Reckling²⁰ in their series found associated injuries in 60% of the patients in contrast to 44.5% in our study (75.5% skeletal fractures and 24.5% extra- skeletal injuries).

Conclusions and recommendations:

Pelvic and acetabular injuries remain relatively uncommon in Sudan when compared with other musculoskeletal injuries. But our observation showed that there is a continuous increase in the number of pelvic and acetabular injuries. So, many pelvic surgery units need to be established in order to cover many areas in Sudan to overcome the delay factor which may affect management outcome and good result. We recommend the implementation of training program for orthopaedic practitioners aiming to cover the vast need for this speciality.

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