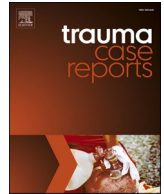




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Case Report

Outcomes of open pelvic fractures: A case series

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ABSTRACT

Introduction: Albeit rare, open pelvic fractures are life threatening injuries associated with significant morbidity and mortality. Due to their rarity, there is paucity of data and literature on best management practices. An open pelvic fracture is one where there is a connection between the fracture site and either the skin, rectum, vagina, or genitourinary system. They commonly affect young individuals involved in high energy injuries. During resuscitation, prompt recognition and control of sepsis and stabilization of unstable fractures should precede definitive management.

Materials and methods: We conducted a retrospective study of prospectively collected data between 2012 and 2022 for patients managed in two teaching hospitals in Kenya. All patients were followed up for at least 6 months. The Faringer classification was used to classify the soft tissue wounds and the Young and Burgess classification was used to classify the pelvic fractures. We investigated their functional outcomes using their ability to ambulate independently and the Merle d' Aubigne-Postel score.

Results: Eight patients with an average age of 31 years were included. All were referrals. Three (37.5 %) developed sepsis but resolved. Four (50 %) needed a diverting stoma, which included 2 of the 3 patients who had developed sepsis. 5(62.5 %) needed an external fixator as part of definitive management. There were no mortalities. All achieved full independent ambulation; and all our patients achieved an average Merle d' Aubigne-Postel score of 17.

Conclusion: Our study demonstrates that early sepsis control, appropriate fracture fixation and a multidisciplinary approach can yield satisfactory functional outcomes.

Introduction

Open pelvic fractures are rare and often because of high-energy trauma and hence associated with high morbidity and mortality rates due to the accompanying lethal injuries [1,2,3]. Their incidence is estimated at 2–4 % of all pelvic fractures [1,3]. Early mortality is due to exsanguinating haemorrhage and late mortality is usually secondary to pelvic sepsis [2]. In the 1970s, the mortality rates were reported to be up to 50 % but has declined over the years due to the improvement of treating protocols to as low as 4 % in the 2000s [3].

This decline has been attributed to improvements in trauma protocols that include a multidisciplinary approach, damage control surgery, faecal diversion, aggressive haemorrhage control and massive transfusion practices [1,2,4]. Mortality and functional outcomes have been shown to be poorer in rural and resource limited settings due to delays in resuscitation and poorly defined fracture fixation strategies [5]. In addition, our setting is lacking in both well-defined prehospital care and literature on the outcomes for patients presenting with open pelvic fractures. Therefore, we conducted this descriptive study to examine and document the outcomes

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of open pelvic fractures managed at 2 tertiary hospitals over a period of 11 years.

The functional outcomes of pelvic ring injuries can be assessed using established scoring tools, for example the Merle d'Aubigne-Postel Score (Postel score) [6,7].

The definition by Bircher [4] of open pelvic fracture was adopted; as one where there is a connection between the fracture site and either the skin, rectum, vagina, or genitourinary system. This allows one to include not only the obvious large perineal lacerations but also the less obvious 'internal open injuries' that occur when bone fragments penetrate the urethra, bladder, rectum, or sigmoid colon.

Materials and methods

A retrospective review was performed on patients with open pelvic fractures treated at two teaching and referral hospitals in Kenya (AIC Kijabe hospital and Nakuru Teaching and Referral hospital), between January 1, 2012, and December 31, 2022. All data was prospectively collected. Each patient was followed up for at least 6 months. We collected data on (Table 1): patient demographics, mechanism of injury, Glasgow coma scale (GCS) on admission, external injury zone according to Faringer classification, pelvic fracture classified according to Young and Burgess classification, concomitant injuries, surgical intervention, faecal diversion, outcome (viz ambulation and Postel score) and complications [7,8,9].

The surgical intervention pathway entailed: initial evaluation as per the ATLS protocol, debridement, and faecal diversion via a colostomy (in selected patients guided by the Faringer wound classification as demonstrated in Fig. 1). As regards the fracture management, all patients had evaluation with plain radiographs and pelvic CT scans. Then the fractures were stabilized using an external fixator and/or internally fixed (percutaneously or open) depending on the fracture pattern, wound location, and level of contamination.

The Postel score contains 3 sections on pain, mobility and ability to walk, with each section having possible scores of worst score which is zero and best score which is 6 [6]. An overall score was obtained by getting an arithmetic sum for the scores from each section.

Ethical review was sought and granted by the Nakuru Level V Hospital institutional review committee under reference number; ERC/NLV5/2021/1-04.

Table 1

This table shows the demographics of the patients, the classification of their injuries, treatment offered as well as their outcomes. (APC- Anteroposterior compression, LC-Lateral compression, S1-first sacral vertebrae, S2-second sacral vertebrae, S-I-Sacro-iliac, Ex-fix- external fixation.)

Gender Age	Young & Burgess class (Fracture type)	Faringer Class (Wound zone)	Diverting Colostomy	Associated Injuries	Outcome (Postel Score)	Outcome (Ambulation)	Definitive management	Complications
1. Male (55 yrs) 15	APC II	Zone I	Yes	Fracture Neck of femur	18	Independent ambulation	Debridement, colostomy, Symphysis plating&S1 Sacroiliac (SI) screw	NIL
2. Male (47 yrs) 15	APCII and LCII	Zone I	Yes	Nil	17	Independent ambulation	Debridement, colostomy, pelvic ex-fix and S1&S2 SI screws	Sepsis
3. Male (38 yrs) 15	APC III	Zone I	No	Nil	17	Independent ambulation	Debridement and S1 SI screw	NIL
4. Female (10 yrs) 15	APC III	Zone I	Yes	Nil	17	Independent ambulation	Debridement, colostomy, pelvic ex-fix, S1 SI screw and perineal flap	Sepsis
5. Female (23 yrs) 15	APCII	Zone I	No	Nil	17	Independent ambulation	Debridement, symphysis plating and S1 SI screw	NIL
6. Male (27 yr) 15	APCIII	Internal open (Bircher)	No	Tibia fracture	16	Independent ambulation	Debridement, pelvic ex- fix and S1&S2 SI screws	NIL
7. Male (20 yr) 15	APCIII	Internal open (Bircher)	No	Femur fracture (diaphyseal)	16	Independent ambulation	Debridement, pelvic ex- fix and S1 & S2 SI screws	Sepsis
8. Male (27 yr) 15	APCIII	Zone I	Yes	Femur fracture (diaphyseal)	18	Independent ambulation	Debridement, colostomy, pelvic ex-fix and S1&S2 SI screws	NIL

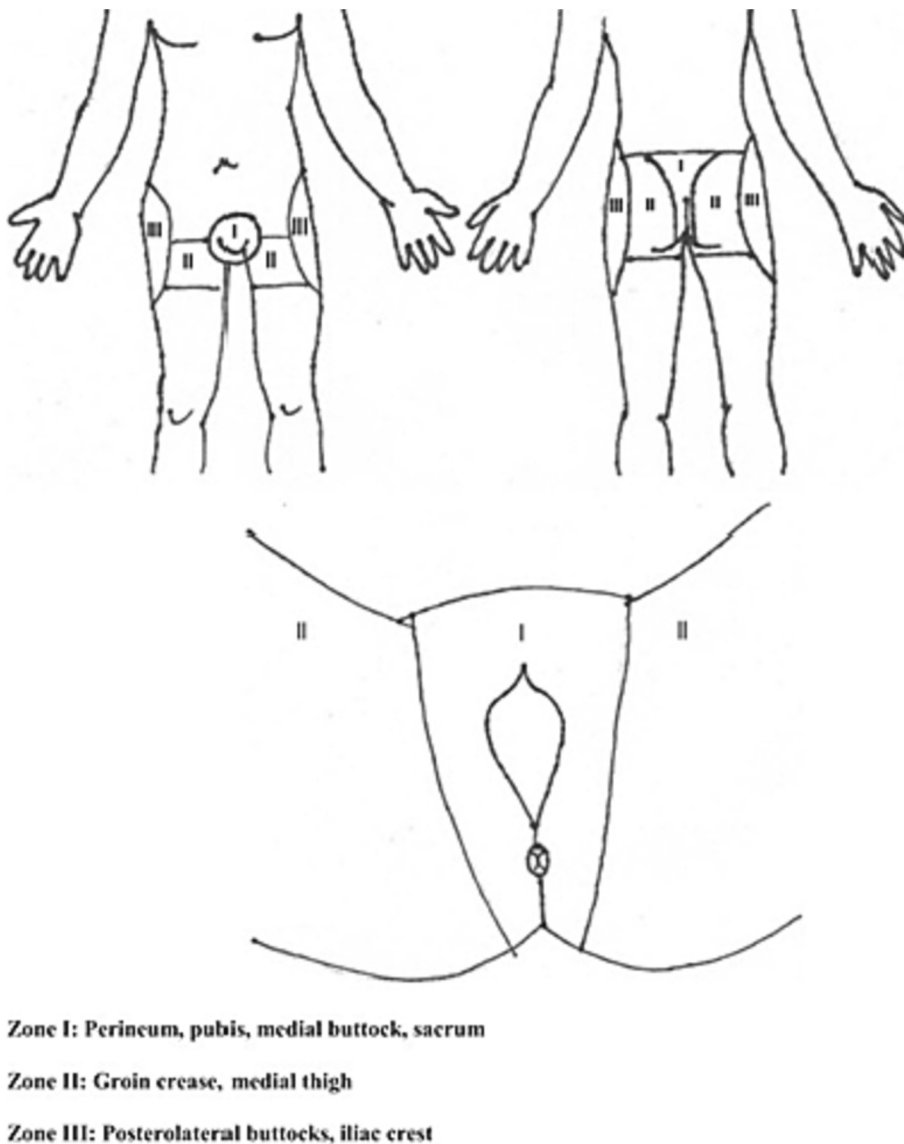


Fig. 1. Faringer classification showing different zones for location of external wounds in open pelvic fractures. (Image source; Hermans, E., Edwards, M.J.R., Goslings, J.C. et al. Open pelvic fracture: the killing fracture? *J Orthop Surg Res* **13**, 83 (2018). Under Creative Commons Attribution 4.0 International License.)

Results

Eight patients were included in the study. They had an average age of 31 years. There were 6 male and 2 female patients. All patients had a GCS of 15 on admission. In addition, all patients had a degree of anteroposterior compression (APC) pelvic fracture (Young and Burgess classification).

Four patients (50 %) were offered a diverting colostomy; 3 of whom had external open pelvic fractures (Table 1). 50 % of all the patients had associated injuries, and that entailed long bone fractures (3 femur and 1 tibia) (Table 1). Five of the 8 (62.5 %) got an external fixator as part of definitive pelvic fixation (Fig. 2). As for the external fixation, the supra-acetabular/sciatic buttress technique was used (Fig. 2).

3 out of the 8 had sepsis that resolved after serial debridement, antibiotics, visceral (bladder) repair and diverting colostomy (Table 1). The diverting colostomy (Fig. 3) was temporary and hence closed once the infection was controlled and wounds healed. There was no ICU admission nor any mortality. All patients progressed to independent ambulation.

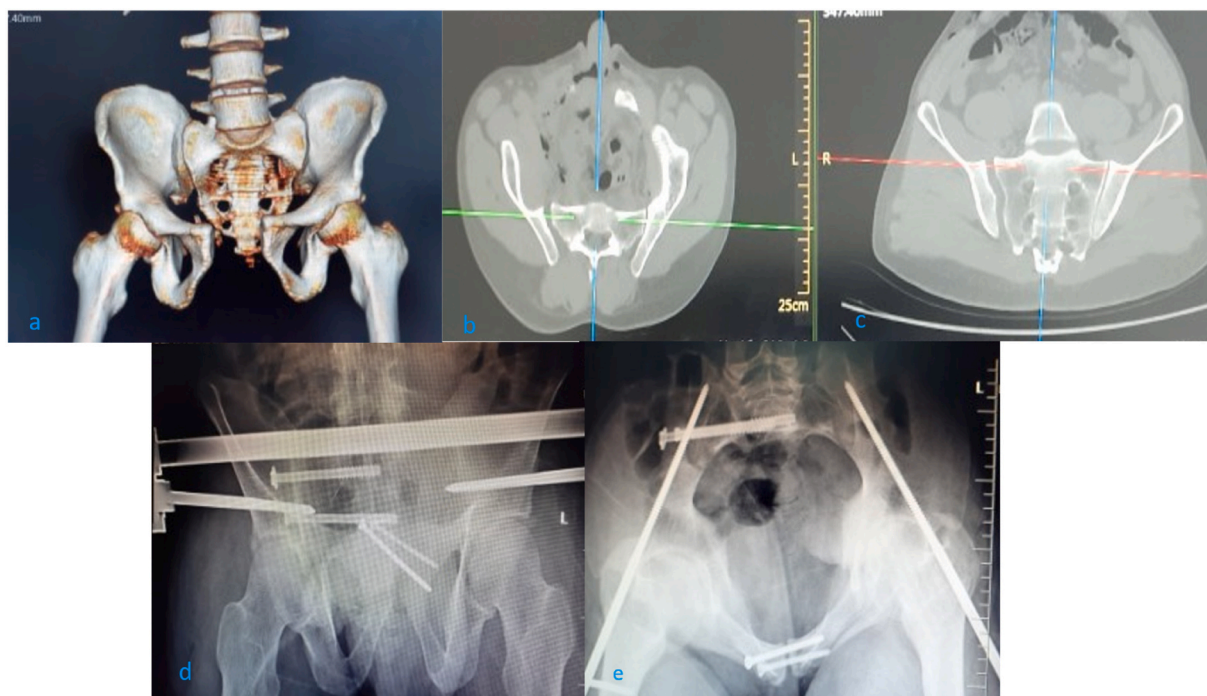


Fig. 2. (a)(b) and (c); CT scans showing an APC III injury with right sacroiliac (S–I) diastasis plus avulsion fracture of the sacrospinous ligament, for one of our patients. (d) Outlet and (e) Inlet view pelvic x-rays showing the right S1 and S2 screws, interfragmentary 3.5 mm symphysis screws and supra-acetabular anterior pelvic external fixator.

Discussion

An open pelvic fracture is a complex injury that profoundly challenges trauma teams and patients alike [4,10]. Open pelvic fractures can be due to blunt injuries or penetrating injuries; with the former being fraught with more severe injuries [2,4]. In addition, open pelvic fractures represent a wide spectrum of injuries, ranging from grazes that expose the iliac crest to massive soft tissue disruptions involving the bowel and genitourinary system. (4)Two patients in our series had internal open fractures. The open nature of a pelvic injury needs to be identified early to trigger the requisite rapid, coordinated, multidisciplinary intervention. This helps avert the significant morbidity and mortality that has plagued these injuries [1,3,4].

The majority of open pelvic fractures are sustained by young individuals often from high energy mechanisms [11]. All our patients were young, with a mean age of 31. They had high energy injuries secondary to road traffic accidents (5 due to motorcycle accidents). Haemorrhage is responsible for most early deaths (first 48 h) and sepsis accounts for majority of the late deaths [10]. Thus, management of open pelvic fractures has focused on addressing four critical elements: 1. haemorrhage control, 2. soft tissue management and infection prevention/treatment of infection, 3. management of associated injuries followed by, 4. definitive management of the pelvic fracture [12].

The design of prehospital care systems affects the ease of accessing timely attention [2]. In addition, depending on the time of presentation, the outcomes are usually different [4]. All our patients were referrals from other institutions and hence the infection was probably already developing in the septic cases treated (50 % of the cases).The septic cases needed serial debridement, external fixation, and prolonged antibiotics coverage (at least 6 weeks). In such circumstances, robust timely wound debridement and external fixation are pivotal in the prevention of progression of pelvic sepsis [13]. Subsequently, internal fixation should be considered at the earliest practical opportunity [8]. Fixation can take various forms, but one has to avoid too much hardware in contaminated zones. Our patients were classified according to Young and Burgess as APC II and above, which necessitated both anterior and posterior fixation (Fig. 2).

Faecal diversion has had mixed reactions in literature regarding the incidence of infection and its associated morbidity and mortality [1,3,10]. We offered a colostomy to half of our patients with regard to their location of injury and presence/absence of sepsis. According to the Faringer classification, 5 patients had zone I injuries, 4 of whom got a diverting colostomy because of the wound proximity to the anal opening/rectal communication [8]. The 1 patient who did not get a diverting colostomy, had labia majora wound that was debrided and repaired immediately. From our experience and those of other authors, we believe that faecal diversion is key in prevention and resolution of sepsis [1]. One should therefore have a low threshold for faecal diversion in patients with injuries that involve the gastrointestinal system or have proximity to the anorectum [3,13,14].

Historically, open pelvic fractures have been associated with long-term morbidity and high mortality rates [4,5,11,15,16]. This has declined over the years due to improvements of trauma protocols [3,17]. In our series, we had no mortality. In addition, all patients



Fig. 3. (Patient in Fig. 2) (a) Examiner's finger showing the zone 1 wound communicating with the space of Retzius through the rectum. (b) The wound after repair. (c) The patient's diverting colostomy and closed midline incision. *(The midline incision was used to fashion the stoma, debride the space of Retzius and reduce and fix the pelvis anteriorly).*

progressed to independent ambulation. Our success can be attributed to several factors: early and thorough debridement, timely faecal diversion, pelvic stabilization, rationalized antibiotic therapy and a multidisciplinary approach. The Postel score is a widely used outcome measurement tool for pelvic ring injuries [6,18]. All our patients achieved an absolute total Postel score of at least 16, suggesting a satisfactory functional result.

Conclusion

Open pelvic fractures are life threatening injuries. They commonly affect young individuals involved in high energy injuries. Our case series demonstrates that, early stomas, early definitive fracture fixation and a multidisciplinary approach can yield satisfactory functional outcomes; even where elaborate prehospital or trauma systems are non-functional or inexistent.

Declaration of competing interest

None of the authors have any conflict of interest.

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