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Original article

Definitive Treatment of Open Pelvic Fractures with External Fixator

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Abstract

Background: Unstable and open pelvic fractures are often associated with significant morbidity and mortality, especially in patients with multiple injuries. Early pelvic fixation provides stability and should diminish ongoing hemorrhage. ***Materials and Methods:*** We undertook a retrospective and descriptive study of all cases of unstable open pelvic fractures treated with external fixators in the orthopedic and trauma surgery department of the Army Training Hospital Principal in Dakar over 4 years ranging from 1 January 2018 to 31 December 2022. ***Results:*** 12 patients were included in this study. The mean age of the patients was 39 years with extremes of 21 and 56 years. The series consisted of 10 men (83.3%) and 2 women (16.7%), representing a sex ratio of 5. The etiology of the open fractures was road traffic accidents (61%), followed by public road accidents (33%), and finally falls from a high place (6%). The injury mechanisms were direct impact in 9 cases and 3 cases of indirect impact by shearing. Bone injuries were Tile B in 75% and Tile C in 25%. Soft tissue lesions were located in the perineum in 7 patients, in the inguinal area in 2 patients, and the buttock in 1 patient. Pelvic exofixation was performed in all patients with an average delay of 12 hours, with extremes of 4 and 24 hours. One case of infection was observed in the medium-term outcome. Three deaths were recorded. Radiographically, the reduction was satisfactory in 75% of cases (N=9) (**Figs. 6 and 7**), tolerable in 16.7% (N=2), and poor in 8.3% (N=1). Two patients had a residual disjunction of more than 5mm. ***Conclusion:*** The external fixator in unstable open fractures of the pelvis appears to be a good alternative that finds its place within the limits of emergency internal osteosynthesis (hemodynamic instability, hemorrhagic and infectious risk). The limits of its use in isolation are related to its inefficiency in the reduction and correct stabilization of lesions of the posterior arch.

Keywords: ***unstable open fractures, external fixator, definitive***

Introduction

By definition, an open pelvic fracture is a fracture that communicates with the external environment either directly or through an orifice (rectum or vagina). These injuries are generally uncommon [1,2] and serious because of their hemorrhagic and infectious risk. The management of these unstable and open pelvic fractures remains difficult and the therapeutic management is not well codified. The stabilization of the pelvic ring is one of the first objectives to reduce bleeding. The initial management of these injuries is based on applying orthopedic damage control through an external fixator as a temporary device. And once the patient is hemodynamically stable, the choice of definitive treatment for the pelvic fracture will be planned according to possible associated injuries by internal fixation. In addition, internal fixation can't be performed on some local soft tissue injuries. In these patients, definitive external pelvic fixation is recommended to ensure rapid stabilization of the pelvic ring [3].

We report the results of a series of external fixator osteosynthesis used as a permanent treatment for unstable and open fractures of the pelvis. We aimed to evaluate the reliability of this therapeutic approach by assessing the clinical and radiological results of our trauma patients and to define the place of the external fixator as a permanent therapeutic approach in unstable pelvic fractures (Type B, Type C).

Materials and Methods

Study design

We undertook a retrospective and descriptive study of all cases of unstable open pelvic fractures treated with external fixators in the orthopedic and trauma surgery department of the Hôpital Principal de Dakar over 4 years ranging from 1 January 2018 to 31 December 2022.

Study population

We included all unstable pelvic fractures associated with an opening to the external environment either directly or via an orifice. Data collected on each patient included: age, sex, type of pelvic fracture, mechanism of injury, location of soft tissue injury, immediate and secondary outcome after exofixation, and complications.

Surgical technique

Radiological planning was used to assess the fracture lines and displacements (instability) in the horizontal, vertical, and anteroposterior planes. The exofixation was performed on an ordinary table under a C-arm control. Two types of fixators were used in our study. These were the Geneva External Fixation (GEXFIX) (**Fig. 1A**) and the Military Health System External Fixator (FESSA) (**Fig. 1B**)

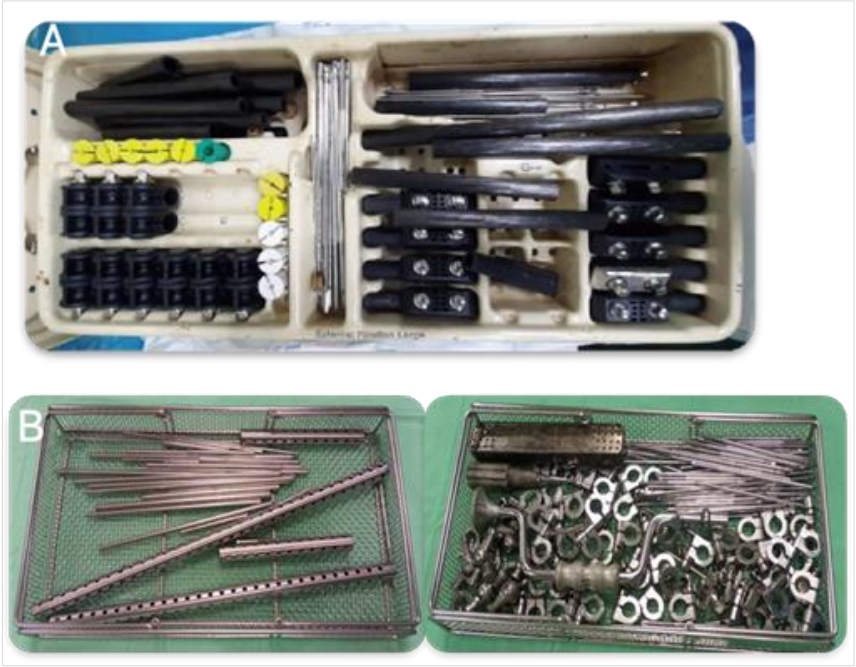

Figure 1: A: GEXFIX (Geneva External Fixation); B: FESSA (Military Health System External Fixator)

The pelvic fixation site used in this emergency setting was the iliac crest. Placement of the screws in both iliac crests is not always easy through the percutaneous route. The iliac crest is approached 2.5 cm posterior to the anterior superior iliac spine, and 2 wires are placed through the soft ends, one of which shaves the medial table and the other the lateral table of the iliac wing. The pins are inserted into the thickness of the ridge parallel to the pins. This guarantees that they will hold well. The size of the screws depends mainly on the thickness of the patient's bone. The screws can be used to obtain a better reduction, especially in the closure of the pelvis. The reduction was done by external maneuver under the fluoroscopic control (face, outlet, inlet). Traction was applied to correct ascension and compression was applied to reduce diastasis. It is relatively easy to maintain closure of an open pelvis; however, it is more difficult to reduce vertical displacement. The fixation of the wing screws is done with the rigid rods of a conventional fixator.

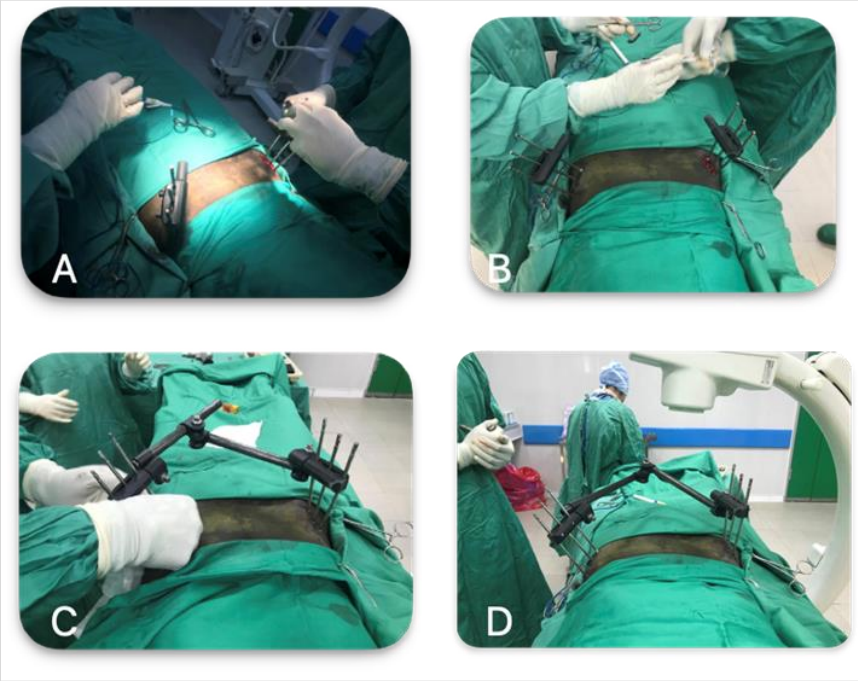

Figure 2: Technique for placing GEXFIX fixator

Post-operative care

A sitting position was allowed right after surgery. Walking was forbidden for 6 weeks. Dressing of the plug holes was performed every 2 days. A clinical and radiographic check-up (pelvis face, outlet, inlet) was performed every month until consolidation. Support was progressive from the 8th week. The external fixator was removed at 3 months.

Results

12 patients were included in this study. The mean age of the patients was 39 years with extremes of 21 and 56 years. The series consisted of 10 men (83.3%) and 2 women (16.7%), representing a sex ratio of 5. The etiology of the open fractures was road traffic accidents (61%), followed by public road accidents (33%), and finally falls from a high place (6%). The injury mechanisms were direct impact in 9 cases by anteroposterior compression (6 cases) or lateral compression (1 case) and 3 cases of indirect impact by shearing. Bone injuries were Tile B in 75% (**Fig. 3A**) and Tile C in 25% (**Fig. 3B**).

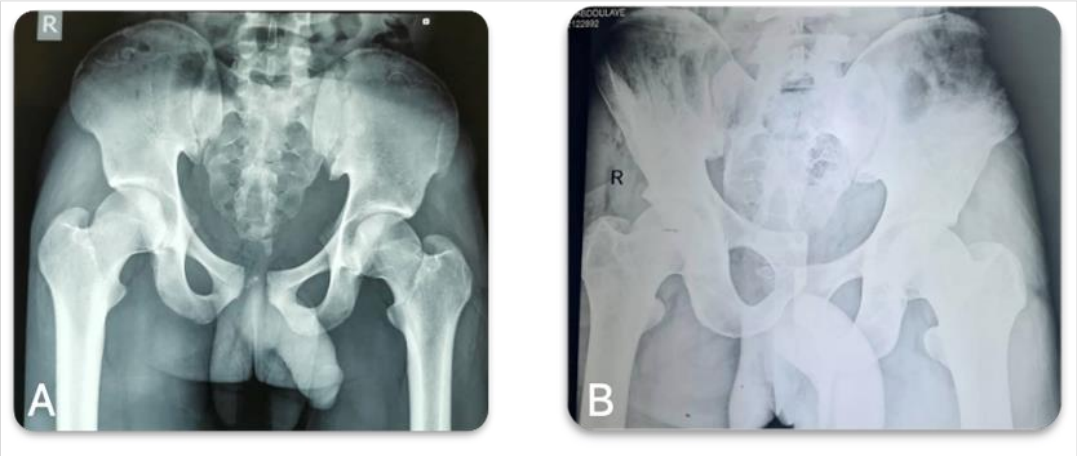

Figure 3: Bone lesions; A: type B according to Tile classification; B: type C according to Tile classification

Soft tissue lesions were located in the perineum in 7 patients (**Fig. 4A**), in the inguinal area in 2 patients (**Fig. 4B**), and the buttock in 1 patient. The opening was also rectal in 1 patient and vaginal in 1 patient.

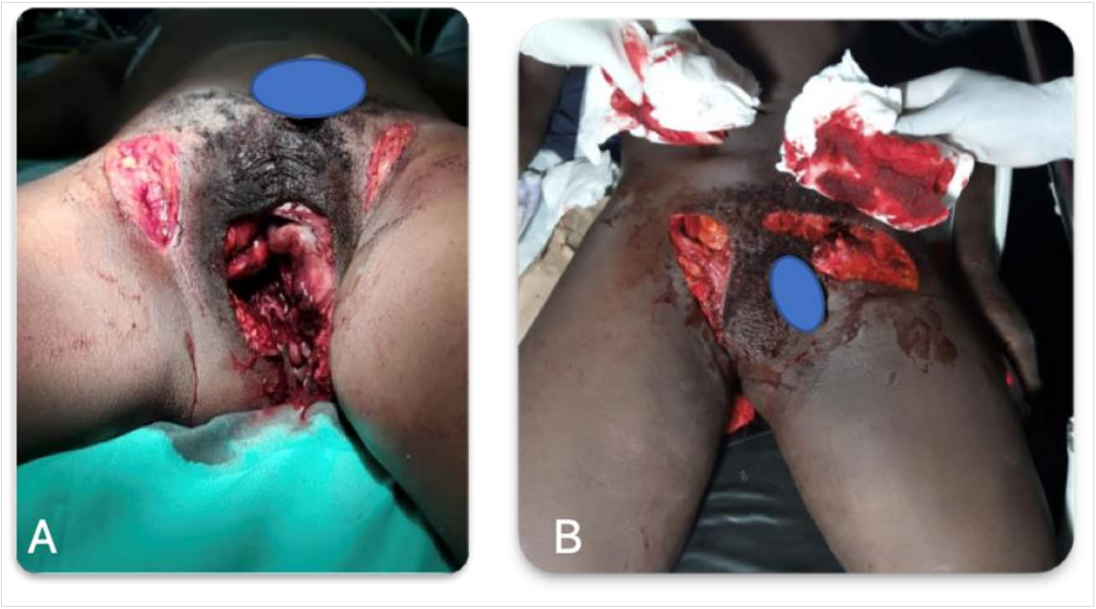

Figure 4: Soft tissue lesion; A: perineum opening; B: inguinal opening

The associated lesions were a urethral rupture in 8 patients, a bladder rupture in 1 patient, and a vascular lesion in 1 patient.

Pelvic exofixation was performed in all patients with an average delay of 12 hours, with extremes of 4 and 24 hours.

The GEXFIX fixator was used in 9 patients (**Fig. 5A**) and the FESSA in 3 patients (**Fig. 5B**).

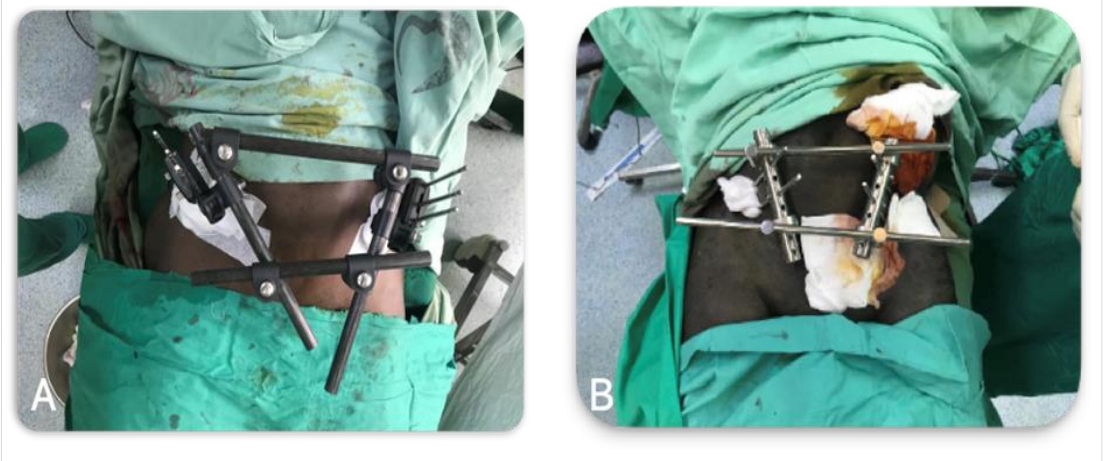

Figure 5: type of used external fixator: A: GEXFIX; B: FESSA

Short-term outcome after external fixation was mainly an improvement in the risk of bleeding in all patients and stabilization of hemodynamic parameters in 90% of cases. Pain relief was also observed in all patients after fixation.

One case of infection was observed in the medium-term outcome. Three deaths were recorded.

Radiographically, the reduction was satisfactory in 75% of cases (N=9) (**Figs. 6 and 7**), tolerable in 16.7% (N=2), and poor in 8.3% (N=1). Two patients had a residual disjunction of more than 5mm.

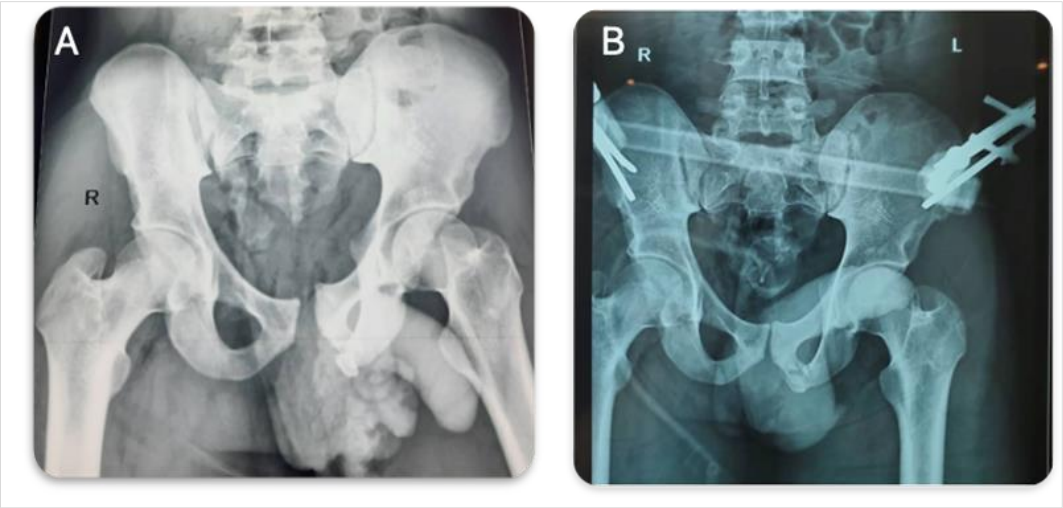

Figure 6: External fixator reduction of a compound pelvic fracture in a 50-year-old patient. A: Preoperative pelvic X-Rays; B: Postoperative pelvic X-Rays

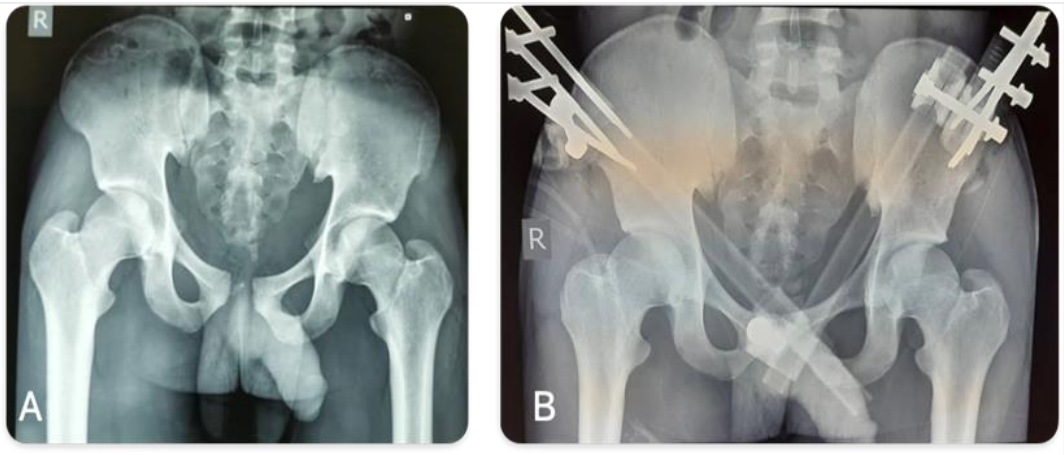

Figure 7: External fixator reduction of a compound pelvic fracture in a 24-year-old patient. A: Preoperative radiograph of the pelvis; B: Postoperative radiograph of the pelvis

After a 3-month follow-up, a vicious callus was observed in 2 patients with pelvic asymmetry. A lower limb length inequality (LLIE) of about 1cm was also observed in these patients.

Good and excellent results were observed with fractures of type B of the Tile classification.

Discussion

Pelvic fractures are estimated to account for 3% of all fractures, with an associated mortality rate of 10% to 16% [1,2,4,5]. However, compound pelvic fractures stand for only 2-4% of all pelvic fractures [1,6-10]. They are generally associated with a high mortality rate. The overall mortality reported in the literature is 30-45% [7; 11].

In addition to increased mortality, compound pelvic fractures result in increased blood transfusion requirements in the first 24 hours [7;11]. Angiography is effective in controlling pelvic fracture hemorrhage [12]. However, it is generally not rapid or available at all hours in our hospital. Therefore, the alternative to fracture-induced blood loss is pelvic ring stabilization. Ganz [13] has developed a temporary pelvic clamp for emergency compression of pelvic ring ruptures in patients in hemodynamic distress. Currently, a compass-shaped pelvic stabilizer with the same action as the Ganz clamp is also available and is very easy to use. But the oldest and most widely used "classical" external fixator is the treatment of choice for unstable and open pelvic injuries. It can be used as a transient or permanent treatment approach.

External fixation allows the stabilization of lesions with a short-time intervention. It facilitates nursing and can be used in hemodynamically unstable patients. It often results in anatomical reduction of the lesions but partial reduction was the most common [14]. The effectiveness of the fixator is greater on the anterior arch of the pelvis. The external fixator alone is insufficient to reduce sacroiliac shear, but it does have a buffering effect, reducing bleeding and helping to stabilize the hemodynamic status.

Several fixations have been described. The single-plane external fixator is the most widely used but is considered ineffective for the stabilization of posterior pelvic arch fractures [15-17] and is prone to late complications (pseudarthrosis and ILMI). The advent of the modular multi-stem fixator has overcome its shortcomings. Ratsimandresey et al [18] report satisfactory results using the external fixator as the permanent treatment method.

External fixator placement is conducted in the operating room. It is recommended that the plugs be placed open, Nordin [14] making a small approach to the iliac crest. The infection rate in the series is in agreement with the literature as it is a minimally invasive approach in contrast to open osteosynthesis which is prone to potential complications [19,20]. Percutaneous osteosynthesis also reduces the risk of infection, but this technique exposes the patient to iatrogenic neurological damage [21,22]. In our study, no nerve complications were observed.

Infectious complications of the plugs and a mechanical complication can be observed. Lindhal [23] presented a consecutive

study of 70 horizontal and 40 vertical displacement lesions, all treated with external fixators. He found 57% loss of initial reduction, 58% callus, 5% pseudarthrosis, and 24% plug infection. He emphasized the ease of implantation of external fixators in an emergency setting, but this was countered by poor stability, resulting in a high rate of recurrence of the initial displacement in both horizontal and vertical displacements. Type B lesions are better reduced and maintained by FE than type C lesions. To reduce and maintain a Type C lesion with an external fixator, homolateral traction can be combined with shear as recommended by Tile. Finally, posterior internal fixation can be combined with anterior external fixation.

Conclusions

Despite this short series and given our radiographic and functional results, the use of the external fixator in unstable open fractures of the pelvis appears to be a good alternative that finds its place within the limits of emergency internal osteosynthesis (hemodynamic instability, hemorrhagic and infectious risk). The limits of its use in isolation are related to its inefficiency in the reduction and correct stabilization of lesions of the posterior arch, whether incomplete (type B) or complete (type C), as shown by the defects observed in our series.

Ethics approval and consent to participate

Informed consent was obtained from all patients included in the study. Access to the data has been authorized by the hospital's ethics committee, which is responsible for protecting patient information.

Data Availability

The data are kept with the main author. It was available upon request from the corresponding author.

Conflicts of Interest

Authors report no conflicts of interest related to this study.

Funding Statement

The authors declare that they have not received any funding for the realization of this work

Authors' contributions

All authors contributed to the conduct of this research work. They read and approved the final version of the manuscript.

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