

Open Unstable Pelvic Ring Fracture and Displaced Acetabular Fracture with Hip Dislocation: A Case Report and Literature Review

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Open fracture; pelvic; Acetabular; Hip dislocation; Internal fixation.

1. Abstract

1.1. Introduction: Open unstable pelvic ring fracture (Tile C3) and displaced acetabular anterior column fracture and posterior hemitransverse fracture (AC-HPTV) with hip dislocation is extremely rare, and its treatment is still a daunting challenge. The purpose of this paper is to report the management of such a case and review the permanent literatures.

1.2. Materials and Methods: A 31-year-old female was suffered from open injury in a severe traffic accident three days ago. Then, she was transferred from local hospital to our trauma center when a successful early resuscitation and pelvic external fixation was performed. She presented with severe soft tissue lesions on right thigh (Faringer zone I, II, III), hip and left leg with stable life sign. Her pelvic was fixed by an external fixator. Radiographs and computed tomography (CT) revealed unstable pelvic ring fracture (Tile C3) and displaced AC-HPTV acetabular fracture with hip dislocation. A diverting colostomy was emergently performed. After several thorough debridement's and vacuum-assisted closures (VAC), posterior pelvic ring disruption was firstly reduced and fixed by lumbopelvic fixations through a posterior-median approach. The sacral fracture was fixed by a reconstruction plate at the same time. Six days later, open reduction and internal fixations (ORIF) were performed for the anterior pelvic ring and acetabulum using the ilioinguinal approach combined with Kocher-Langenbeck approach.

Meanwhile, the open injuries on both low-extremities were closed by vacuum sealing drainage (VSD). A skin-grafting procedure was successfully conducted six days later when she went through the previous surgical procedures.

1.3. Results: At the 36-month follow-up, she was pain-free in her hip and leg. She was satisfied with the result of treatment and went back to her previous work.

1.4. Conclusions: Open pelvic fracture constitute one of the most devastating injuries in musculo-skeletal trauma and must be treated aggressively, incorporating a multidisciplinary approach. If successfully rescued, more attentions should be paid to the management of the associated tissue injuries. Because the clinical results highly depended on the reduction quality of hip, it is never too late that accurate skeletal reconstruction of hip should be the first choice to improve the clinical results even if unstable pelvic ring and displaced acetabular fractures are delayed.

2. Introduction

The management of open pelvic and acetabular fracture is a daunting challenge for orthopaedic trauma surgeons. To our knowledge, it has never been reported in the literature for open unstable pelvic ring fracture (Tile C3) and displaced AC-HPTV acetabular fracture with hip dislocation.

Herein, we report such a case with successful management of asso-

ciated soft tissue injuries and delayed ORIF for unstable pelvic ring and displaced acetabular fracture. We also reviewed the pertinent literature about the therapeutic strategies of open pelvic and acetabular fracture.

3. Case Report

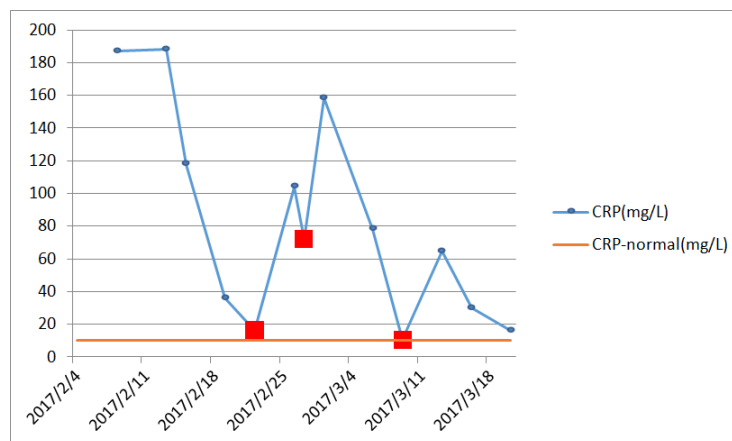
A 31-year-old female suffered an open injury in a severe traffic accident three days ago. Then, she was transferred to our trauma center when a successful early-resuscitation and pelvic external fixation was performed in local hospital. Her body weight was 60kg and she was 160 cm tall. The blood pressure was 105/60cmHg, heart rate was 94/min and blood oxygen saturation was 99%. She presented with severe soft tissue necrosis on her right thigh (about 50*40cm²), which was determined to be Faringer zone I, II, III (perineum, median thigh, groin crease and iliac wing) according to Faringer's injury zone [1] (Figure 1F), and the skin (about 15*20cm²) of her left leg. The de-gloving injury was figured out on her lateral hip (about 8*15cm²). Miraculously, neurovascular assessment of both legs was normal. She suffered a grade II open pelvic fractures, according to Gustilo-Anderson classifications [2].

CT scans (Figure 1A-E) revealed unstable pelvic ring fracture, which was determined to be Tile C3, according to the Tile classification [3], and displaced anterior column fracture and posterior hemitransverse fracture(AC-HPTV) with hip dislocation, according to the Letournel's classification [4]; right No.8-11 and left No.3-4 rib fractures; left scapular fracture. She was healthy before this injury. Complete blood count showed that red blood cell(RBC) was 2.90*10¹²/L and hemoglobin (Hb) was 85g/L; white blood cell(WBC) was 7.0*10⁹/L; Hematocrit (hCT) was 25.5%; Neutrophil (Nc) was 77.1% and Nc number was 5.4*10⁹/L. A colostomy was emergently performed for fecal diversion in the emergency room. Then she was transferred into the intensive care unit(ICU). Her right lower extremity was placed in a skin traction device after surgery.

Three days after initial management, repeated deep debridement and VAC were conducted every three to five days. Complete blood

count and blood chemistries including C reactive protein (CRP) were monitored every three to four days as well. CRP was used as infection index. When it declined close to the normal count, the surgical timing meant coming (Tablet 1). Ten days later, the de-gloving injury on her hip was closed and twenty days later, open wound was clean (Figure 2I). Then, open reduction and lumbopelvic fixation of posterior pelvic ring disruption was firstly performed through a posterior median approach where the skin was intact. Meanwhile the open injuries on both low-extremities were closed by VSD. The sacral fracture was also reduced and fixed in its posterior surface by a reconstruction plate through the same approach at the same time. Six days after the first-stage osteosynthesis for posterior pelvic ring, a secondary procedure of ORIF were performed for the anterior pelvic ring and acetabulum using the ilioinguinal approach combined with Kocher-Langenbeck approach. Direct reduction of the dome impacted fragment was performed through the middle window of ilioinguinal approach. Anatomical reduction was achieved and the fracture was fixed using reconstruction plates. Pubic symphysis and contralateral pubis were reduced and fixed in the meantime. Six days later, a skin-grafting procedure was successfully conducted (Figure 2A-H). Two weeks later, she was allowed back to the local hospital for rehabilitation when 90% skin graft survival was identified (Figure 3). She began to ambulate with the aid of crutches three months postoperatively when the sign of bone healing was observed by radiograph. She began full-weight ambulation in six months postoperatively. (Figure 4) One year later, the lumbopelvic fixation was dislodged. At 2.5-year follow-up, anatomic reduction and bone union were observed by CT scans. (Figure 5) At the three-year follow-up, she was pain free in both of her hips and walk without any aid of devices. The functional outcomes were assessed by the Matta score [5]; the score was 15, indicating that the clinical result was excellent. Radiological outcomes, according to the Matta score [5], was also excellent (Figure5). She was satisfied with treatment and returned to her previous work (Figure 6).

Table1: CRP curve: CRP was used as infection index. When it declined close to the normal, the surgical timing meant coming. The first red low point represented the timing of two-staged osteosynthesis procedures and the second one meant the timing of skin-grafting.



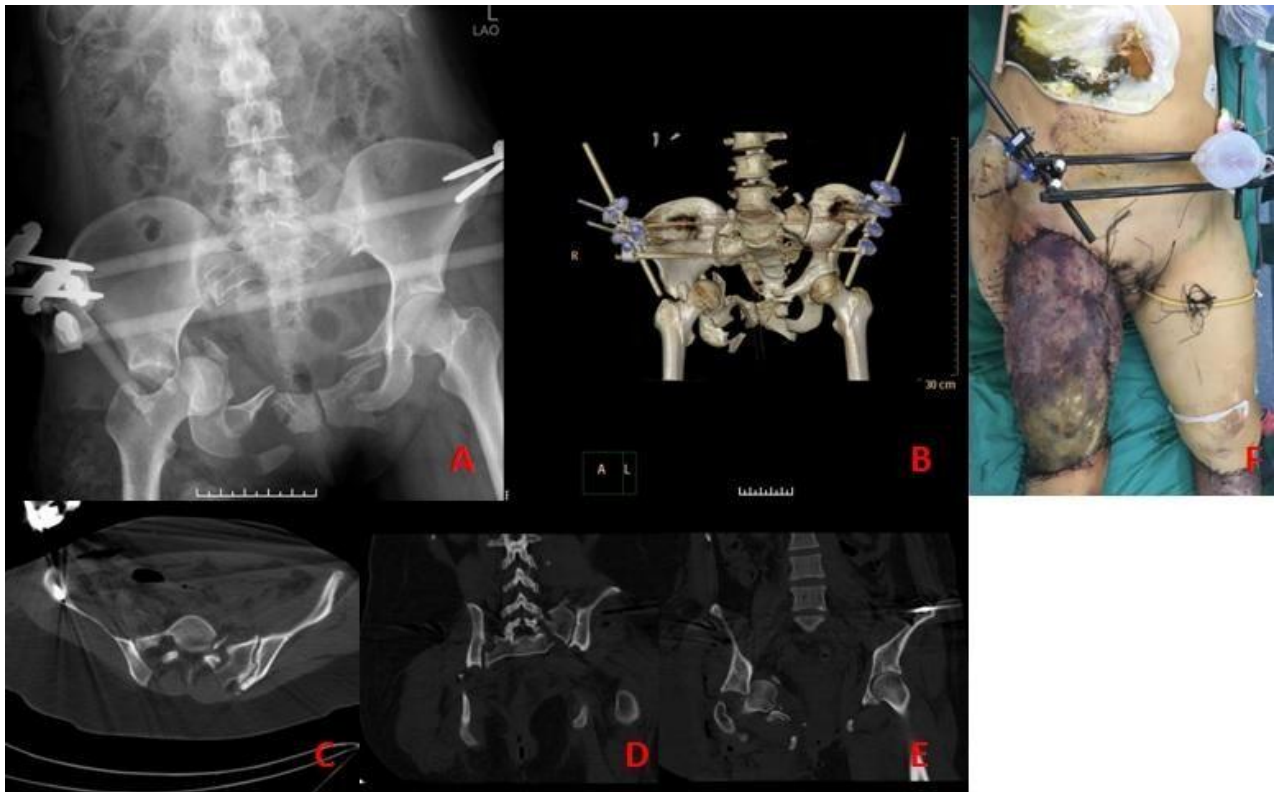


Figure 1: Radiographs(A) and CT (B-E) revealed unstable pelvic ring fracture (Tile C3) and displaced AC-HPTV acetabular fracture with hip dislocation, when this patient was transferred to our center. Her pelvic was fixed by an external fixator. F: When transferred to our hospital, she presented with severe soft tissue necrosis on her right thigh (about 50*40cm²), which was determined to be Faringer zone I, II, III (perineum, median thigh, groin crease and iliac wing) and the skin (about 15*20cm²) of her left leg. The de-gloving injury was found on her lateral hip (about 8*15cm²).

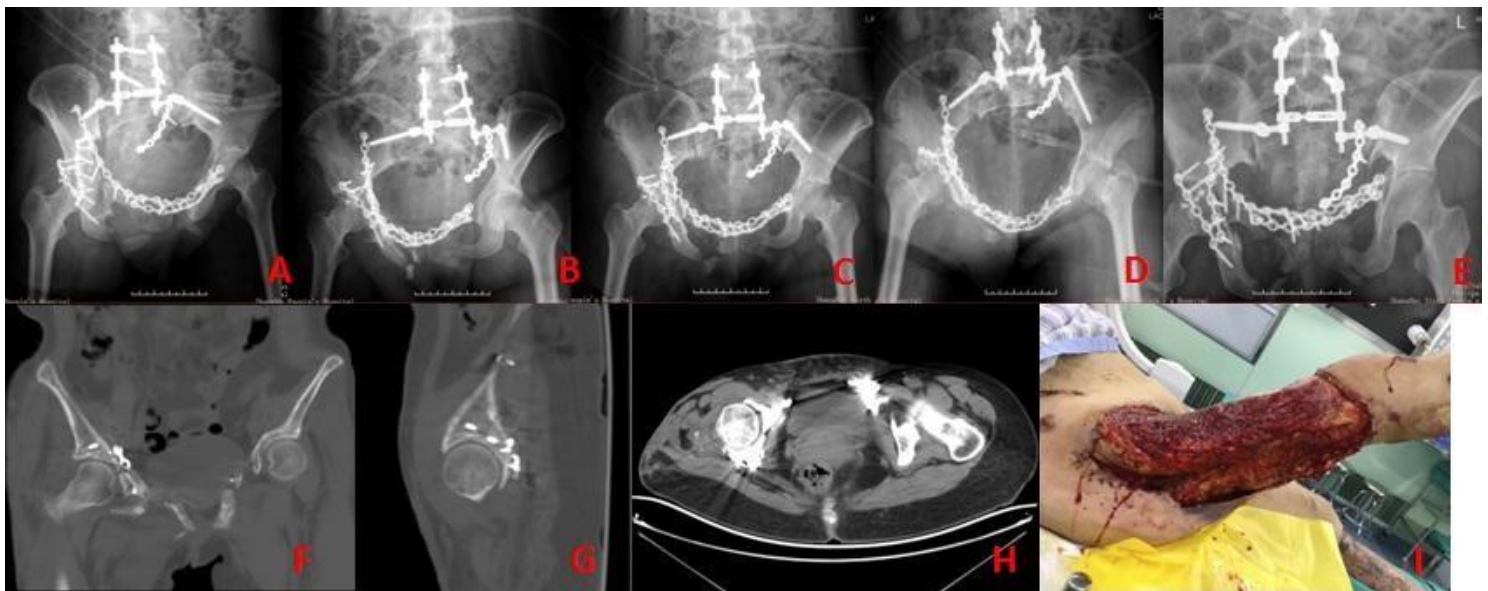


Figure 2: Poster operative radiograph: anteroposterior(A), Judet position (B, C), inlet and outlet position (D, E) presented nearly anatomic reduction and stable fixation for the unstable pelvic and acetabular fracture. Hip dislocation was reduced. CT scans (F-H) revealed the perfect reduction of hip. I: After several repeated debridement's, the soft tissue on her anterior, median and lateral part of right thigh was clean and the de-gloving wound on her lateral hip was closed before the osteosynthesis procedures.



Figure 3: Two weeks after the skin-grafting procedure, the skin graft survival was identified on her right thigh and left leg.

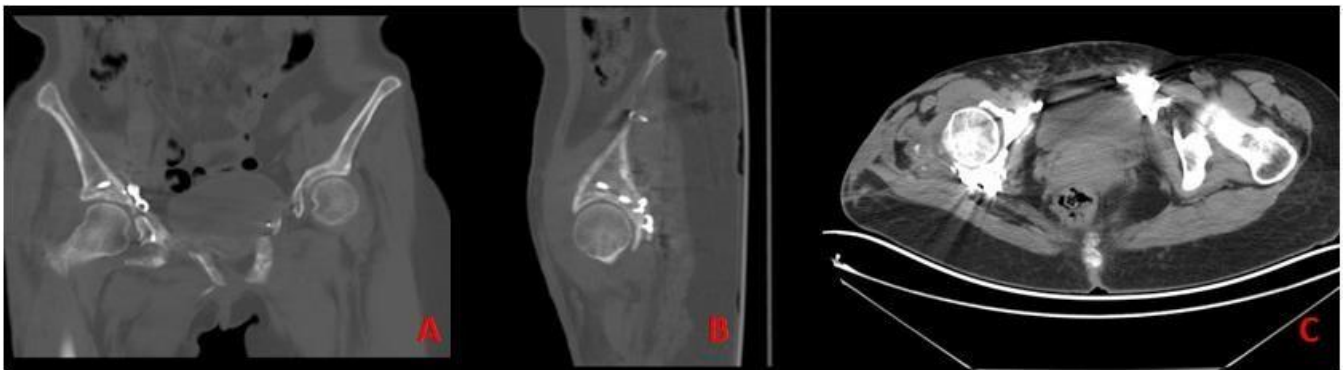


Figure 4: postoperative-6-months images: CT(A-C) scans presented with the anatomic reduction of the fracture and bone healing.

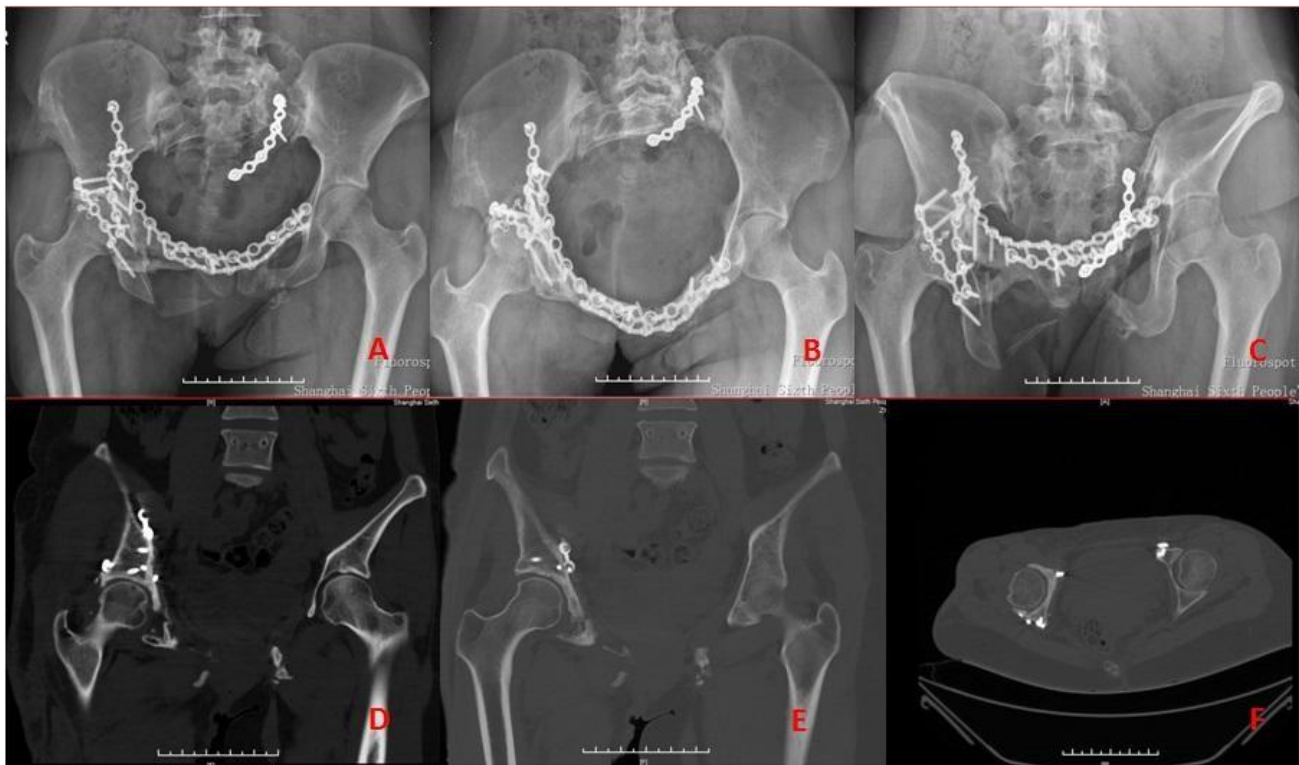


Figure 5: At the 2.5-years follow-up, radiograph of anteroposterior(A) and inlet and outlet position (B, C) presented nearly anatomic reduction and stable fixation for the unstable pelvic and acetabular fracture. Hip dislocation was reduced. CT scans(D-F) revealed the perfect reduction of hip.



Figure 6: At the 3-years follow-up, she was pain free in both of her hips and walk without any aid of devices. Her functional outcomes were excellent.

4. Discussion

Open pelvic fractures are characterized by direct connection between the fracture hematoma and the external environment (through the skin, rectum, or vagina) [1]. They are rare and account for only 2-4% of all pelvic fractures [6]. The mortality was once reported as high as 50% in 1970s and 1980s [7, 8], due to uncontrolled early hemorrhage, or late sepsis and multiple organ failure [9]. Fortunately, the application of multidisciplinary protocols, with early, aggressive damage control and selective fecal diversion, as well as advances in critical care, have led to reduced mortality rates from open pelvic fractures [10,11].

The incidence of pelvic fracture combined with acetabular fracture is difficult to assess, but in case series the rate has been reported to be 5% to 15.7% [12-17]. These combined injuries most often involve lateral compression pelvic ring disruptions and transverse acetabular fractures [18, 19]. Unfortunately, this woman not only sustained bilateral posterior lesions (Tile C3) and displaced AC-HPTV acetabular fracture with hip dislocation, but also combined with massive soft tissue damage, which had never been reported by previous literatures. She had a high risk of deep fecal infection according to the Faringer's injury zone classification [1]. The strategies of treatment were directed towards prevention from asepsis at that time. Therefore, a colostomy was considered as a necessary precaution at the early stage. Due to this specific fracture pattern, hip reduction could not be successfully achieved in the emergency department, as recommended by the previous study [21], without surgical intervention. There was no choice but wait till the infection had been controlled and soft tissue recovered. A skin traction

had to be used as a temporary fixation for her hip.

There is a broad consensus that the optimal timing of ORIF for pelvic fractures should be less than one week given that better reduction qualification required [20]. Calamitously, she had no chance to accept definitive osteosynthesis within a week in the scenario of soft tissue disaster. Total hip arthroplasty should not be taken into account due to the potential risk of infection, defect of skeletal structure and unstable pelvic. CRP had been widely used as an inflammatory marker preventing surgical infections in our medical center for many years. Due to the open wound, it is unrealistic that surgical procedures should not be conducted until her WBC and CRP returned normal. Twenty days after repeated deep debridement when her WBC and CRP declined close to the normal count and no inflammatory secretions were found on her wounds, it strongly indicated that the surgical timing was coming. Moreover, based on our experiences, it was hard to achieve the anatomic reduction of pelvic or acetabular fracture over three weeks. Therefore, staged ORIF procedures were subsequently scheduled under comprehensive considerations. Fortunately, the clinical results proved that our decision was definitely right and practicable.

Fixation techniques in open pelvic fractures are controversial. Traditionally, only external fixation techniques were recommended [22]. Tile stated that no internal fixation should be attempted when there are associated skin, or anorectal lesions [23]. However, Leenen et al. had shown good functional results and low complication rates when internal fixation was used, together with thorough and meticulous soft tissue treatment [24-26] reported that displacement of more than 1 cm posteriorly was associated with increased long-term pain and disability [27, 28] also reported that ORIF of unstable pelvic ring fractures resulted in a high functional success rate. In this case, her pelvic ring was displaced and unstable. Her hip was dislocated as well. Therefore, an OIRF for this patient was strongly recommended.

Ideally, fixation should proceed from posterior to anterior and from lateral (peripheral) to medial (central) based on our experiences, which was also recommended by others [12, 21]. For posterior pelvic disruption, [29] mentioned that exact reduction of pure sacroiliac dislocation was critical for good functional outcome. However, late corrective surgery is more complex and generally associated with worse outcomes. [30] recommended that the lumbopelvic fixation could provide reliable fracture stability and allowed consistent fracture union without loss of alignment. In this case, the lumbopelvic fixation was identified as an effective method for delayed reduction and stabilization of posterior pelvic ring and sacroiliac joint.

Paramount is extensive and meticulous exposure to delayed acetabular fractures according to our experiences and others [4, 5]. For AC-HPTV acetabular fracture, anterior ilioinguinal approach

and posterior Kocher-Langenbeck approach had been reported as an available combination for ORIF [5, 31-33]. Although Stoppa approach was usually introduced as an alternative to ilioinguinal approach for management of anterior fractures of acetabulum in order to reduce complications of the latter [34], it was not available in this case due to the previous colostomy. Fortunately, the distance between the incision to open wound was about 4cm and enough to sterile dressings. The Anatomic reductions were eventually achieved due to this combination approaches which provided sufficient exposure of the anterior and posterior fracture of pelvic and acetabulum.

It has been reported that patients with combined injuries were fare worse than those who sustain isolated acetabular or pelvic ring injuries [31]. [5] demonstrated radiographic reduction of the acetabulum to be a key component in functional outcome. Increased time to surgical management of the acetabulum is also associated with poorer outcomes.

Outcomes certainly are worse when surgery is >3 weeks [32]. However, we believe that patient outcomes primarily depended on acetabular fracture reduction.

In this case, although the ORIF was delayed nearly one months and surgical duration was about 4 hours for the first and 8 hours for the second, which might indicate the poor outcome later, however, the anatomic reduction of acetabular fractures had been eventually achieved and brilliant clinical outcomes were presented at the end of follow-up.

5. Conclusions:

Open pelvic fracture constitutes one of the most devastating injuries in musculo-skeletal trauma and must be treated aggressively, incorporating a multidisciplinary approach. If successfully rescued, more attentions should be paid to the management of associated of tissue injuries. It is never too late that accurate skeletal reconstruction of hip should be the first choice to improve the clinical results even if unstable pelvic ring or displaced acetabular fractures are delayed.

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