Open Pelvic Ring Fracture and Multiple Fractures of the Lower Extremities : A Case Report

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Open Pelvic Ring Fracture and Multiple Fractures of the Lower Extremities : A Case Report

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Abstract

A 73-year-old female was hit by a car, and transferred to our hospital. On examination, her consciousness was alert, but her vital signs were unstable. There are three 10-cm open wounds on her right buttock. X-rays showed an unstable pelvic ring fracture, a right femoral shaft, a right proximal tibia and a right tibial plafond fractures. One hour after the injury, transarterial embolization (TAE) followed by external fixation (EF), and retroperitoneal pelvic packing (RPP) was performed. Two days and five days after the injury, thorough debridement of the open wounds was performed. The skin defect on the right buttock and the lower abdomen had enlarged to 40 x 35 cm, therefore, negative pressure wound therapy was applied. On the same day, right femur was fixed using a retrograde intramedullary nailing. 12 days after the injury, the proximal tibial fracture was fixed using a plate, and the tibial plafond fracture was fixed using screws and external fixators. 28 days after the injury, the split-thickness skin graft was performed on the right buttock and the lower abdomen. Seven months after the injury, the open wounds were completely healed without infection. She was able to walk smoothly with a T-cane.

For the management of open pelvic ring fractures, it is essential to perform TAE, EF and RPP as soon as possible. Providing aggressive management, including thorough debridement, is mandatory to prevent severe infection and sepsis. We achieved a good clinical outcome by using a combination of TAE, EF, RPP and staged surgery, including thorough debridement.

Key words : Open pelvic ring fractures・Transarterial embolization・External fixation・Retroperitoneal pelvic packing

Introduction

Open pelvic ring fractures are one of the most challenging and life-threatening traumas[1)~6)]. In open pelvic ring fractures, the pelvic floor is disrupted, therefore it leads to loss of tamponade and greater difficulty controlling hemorrhage. Therefore, the mortality of open pelvic fractures remains very high due to massive hemorrhage and sepsis. Reported mortality rates range from 25% to as high as 45%[1)~6)]. We experienced an unstable open pelvic ring fracture and multiple fractures of lower extremity. Informed consent has been obtained from the patient for publication, including any necessary photographs.

Case report

Case : A 73-year-old female was hit by a car, and sustained her pelvis and right lower extremity. On arrival, her consciousness was alert, but her vital signs were unstable (BP 51/31mmHg, HR 63 bpm). She had a history of diabetes mellitus

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and right patella fracture surgery.

On examination, her right pelvis and right thigh was found to be swollen and deformed. There are three 10-cm open wounds and degloving injury on her right buttock (Fig. 1), and a 10-cm open wound on the right knee and right leg. Chest X-ray was normal and Focused Assessment with Sonography for Trauma (FAST) was negative. X-rays and CT showed an unstable pelvic ring fracture including an injury of the left sacroiliac joint (AO : 61-B2. 2) (Fig. 2a). CT also showed extravasations and air signs in the pelvis (Fig. 2b). We diagnosed an open pelvic ring fracture due to the presence of air signs. The location of soft-tissue injury was Zone Ⅲ according to the system described by Faringer[4]. The injury was a grade Ⅲ A open pelvic ring fracture according to the classification of Gustilo and Anderson[7], and a class 2 open pelvic ring fracture according to the Jones-Powell's classification[6]. The additional injuries were a right femoral shaft (AO : 32-A2. 3), a right proximal tibia (AO : 41-B3. 2) and a right tibial plafond fracture (AO : 43-C2. 3). There was no rectal or bladder injury. Injury severity score (ISS) was 26, and revised trauma score (RTS) was 6.38.

One hour after the injury, transarterial embolization (TAE) was performed. Arterial bleeding was embolized with gelatin. Her blood pressure was improved (115/81 mmHg). Then, EF was performed in the operation theater. Before surgery, her blood pressure was getting worse (78/55 mmHg), and even after performing EF, her blood pressure continued to be unstable. Therefore, retroperitoneal pelvic packing (RPP) was performed. Surgical laparotomy pads were placed on each side of the bladder, deep within the preperitoneal space (Fig. 3). Her blood pressure was improved (113/59 mmHg). Right femoral and tibial fractures were also fixed temporally using external fixators. She received 40 units packed red blood cells, 35 units fresh frozen plasma, and 30 units platelet transfusion in the first 24 hours.

Two days after the injury, a second-look surgery was performed. The surgical laparotomy pads in the pelvis were removed, and thorough

Fig. 1 There were three 10-cm open wounds and degloving injury on her right buttock.

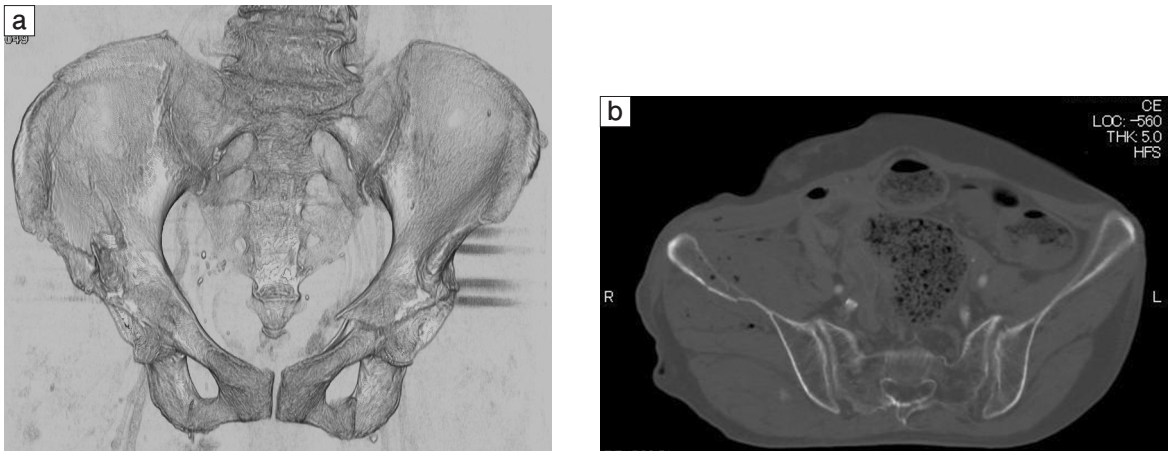

Fig. 2 a : A 3D-CT image of the pelvis on the day of admission. The CT showed pubis and ischium fractures and a right iliac fracture.
b : A CT image of the pelvis on the day of admission. The axial CT showed an injury of the left sacroiliac joint and air signs around the right ilium.

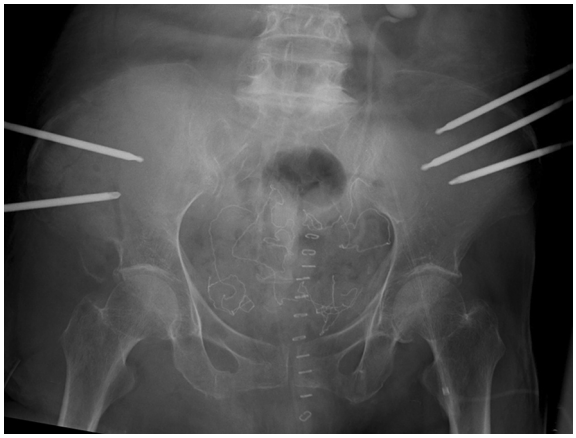

Fig. 3 An X-ray photogragh of the pelvis just after surgery on the day of admission. The pelvic ring fracture was fixed using external fixators. Surgical laparotomy pads were placed on each side of the bladder, deep within the preperitoneal space.

Fig. 4 The open wound on the right buttock before surgery five days after the injury. The condition of the open wound was getting worse and infectious. The size of the open wound was 15 x 15 cm.

Fig. 5 The open wound on the right buttock just after surgery five days after the injury. Thorough debridement was performed. The skin defect has enlarged to 40 x 35 cm.

Fig. 6 The split-thickness skin graft was performed on the right buttock 28 days after the injury.

debridement of the open wounds on the buttock was performed. The skin defect on the right buttock has enlarged to 15 x 15 cm. However, five days after the injury, the condition of the open wound was getting worse and infectious (Fig. 4). Therefore, thorough debridement was performed. The skin defect has enlarged to 40 x 35 cm (Fig. 5). On the same day, the right femur was fixed using a retrograde intramedullary nail (Stryker, Kalamazoo, Michigan, USA). Then, negative pressure wound therapy (NPWT) was performed using the V.A.C. ATS® system (KCI, San Antonio, Texas, USA) on the right buttock. Two days after the second-look surgery, there was no sign of infection or necrosis on the buttock and lower abdomen. Therefore, artificial dermis was applied, and the polyurethane foam of the NPWT was changed every 48-72 hours.

12 days after the injury, the soft tissues on the right leg has become necrotic partially, therefore, debridement of the necrotic soft tissues was performed. On the same day, the proximal tibial fracture was fixed using a LCP Medial Proximal Tibial Plate 3.5 (Synthes GmbH, Oberdorf, Switzerland), and the tibial plafond fracture was fixed using screws and external fixators.

28 days after the injury, the split-thickness skin graft was performed on the right buttock and the lower abdomen (Fig. 6). For the distal tibial fracture, skin graft was applied, and a Taylor

Spatial Frame (Smith & Nephew plc, London, UK) was applied as a definitive fixation. Seven months after the injury, the open wounds were completely healed without infection. Bone unions were obtained in all fractures and the left sacroiliac joint was reduced almost anatomically. The patient was able to walk smoothly with a T-cane.

Discussion

Open pelvic ring fractures are one of the most challenging and life-threatening traumas[1)~6)]. Providing immediate management and an optimal treatment strategy in patients with open pelvic ring fractures is essential in order to achieve a good clinical outcome. Massive hemorrhage is reported to be the primary cause of death within 24 hours. Pelvic sepsis has also been reported to be the primary cause of late death[1)3)]. Risk factors for mortality in patients with open pelvic ring fractures include RTS, ISS, the admission Glasgow coma scale score, Faringer zone Ⅰ or Ⅱ soft tissue injury, Gustilo grade Ⅲ soft tissue injury, vertical shear bony injury and the presence of associated intra-abdominal injury[3)].

According to the guidelines established by the Japan Advanced Trauma Evaluation and Care (JATEC™) [8)], two liters of Ringer's lactate is usually administered to trauma patients as an initial fluid resuscitation. A responder is defined as a patient who responds rapidly and thereafter remains hemodynamically normal (systolic blood pressure ≧ 90mmHg) after fluid resuscitation. A transient responder is defined as a patient who responds temporarily to the initial fluid bolus, but thereafter begins to deteriorate. A non-responder is a patient who does not respond even after the initial fluid resuscitation (systolic blood pressure < 90mmHg).

The standard management for controlling hemorrhage involves TAE, EF and RPP[9)~18)]. Suzuki reported the importance of combining TAE, EF and RPP in patients with unstable pelvic ring fractures[17)]. Our treatment strategy for hemodynamically and osteoligamentous unstable pelvic fractures is as follows. When the patient is a non-responder, we first perform EF and RPP, followed by TAE. When the patient is a transient responder, we select the treatment that can be performed most rapidly. If both EF and TAE can be readily performed at the same time, we perform EF first. RPP is then carried out if the patient's blood pressure continues to be unstable. Finally, TAE is performed. The current patient was a transient responder, and both EF and TAE were readily available at the same time. However, the use of multiple EF and debridement procedures may have wasted time, therefore, TAE was performed first.

The management of sepsis involves infection control, including debridement of soft tissue. In the current case, thorough debridement was performed to prevent severe infection and sepsis. Moreover, the application of NPWT improved the granulation of soft tissue until skin grafting could be performed. In patients with open pelvic ring fractures, providing aggressive management is mandatory to prevent severe infection and sepsis. We achieved a good clinical outcome by using a combination of TAE, EF, RPP and staged surgery, including thorough debridement.

In conclusion, for the management of open pelvic ring fractures, it is essential to perform TAE, EF and RPP as soon as possible. Providing aggressive management, including thorough debridement, is mandatory to prevent severe infection and sepsis.

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（和文抄録）

骨盤輪開放骨折を伴った多発骨折の一例

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我々は，骨盤輪開放骨折を伴った多発骨折の一例を経験したので報告する．

症例：73 歳女性．歩行中に乗用車にはねられ受傷した．初診時，意識清明であったが，ショック状態を認めた（血圧：51/31 mmHg，脈拍：63 回/分）．骨盤と右下肢に腫脹・変形と，右殿部に約 10cm の開放創を 3ヶ所認めた．単純 X 線撮影・CT にて，不安定型骨盤輪開放骨折（AO 分類：61-B2.2，Gustilo 分類：grade Ⅲ A），右大腿骨骨幹部骨折（AO 分類：32-A2.3），右脛骨近位端骨折（AO 分類：41-B3.2），右脛骨天蓋開放骨折（AO 分類：43-C2.3）と診断した．搬送 1 時間後に経カテーテル的動脈塞栓術（TAE）を施行し，続いて骨盤創外固定術と後腹膜ガーゼパッキングを施行した．血圧は 113/59 mmHg と改善した．さらに，右大腿骨・脛骨骨折に対して創外固定術を行った．受傷 2 日目に右殿部開放創のデブリドメント・局所陰圧吸引処置を開始した．受傷 5 日目に開放創の皮膚壊死を認めたため，デブリドメントを追加した．皮膚欠損は 40 x 35cm となった．同日大腿骨骨幹部骨折に対して逆行性髄内釘固定術を施行した．受傷 12 日目に，右脛骨近位端骨折に対して plate 固定術を，右脛骨天蓋開放骨折に対して screw 固定と創外固定術を施行した．受傷 28 日目に，右殿部・下腹部の開放創に対して分層植皮術を施行した．受傷 7ヶ月後，開放創は感染を合併せず治癒し，杖歩行可能となった．

骨盤輪開放骨折は大量出血や感染・敗血症を合併することが多く，死亡率の高い外傷の一つである．大量出血に対しては，TAE・創外固定術・後腹膜ガーゼパッキングを可及的早期に行うことが必須である．また，開放創の積極的なデブリドメントが感染・敗血症の予防として重要である．本症例では，TAE・創外固定術・後腹膜ガーゼパッキングと段階的な手術により良好な治療結果を得ることができた．