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• Case Report •

Concise Bedside Surgical Management of Profound Reperfusion Injury after Vascular Reconstruction in Severe Trauma Patient: Case Report

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For an orthopaedic surgeon, the critical decisions to either amputate or salvage a limb with severe crushing injury with progressive ischemic change due to arterial rupture or occlusion can become a clinical dilemma at the Emergency Department (ED). And reperfusion injury is one of the fetal complications after vascular reconstruction. The authors present a case which was able to save patient's life by rapid vessel ligation at bedside to prevent severe reperfusion injury. A 43-year-old male patient with no pre-existing medical conditions was transported by helicopter to Level I trauma center from incident scene. Initial result of extended focused assessment with sonography for trauma (eFAST) was negative. The trauma series X-rays at the trauma bay of ED showed a multiple contiguous rib fractures with hemothorax and his pelvic radiograph revealed a complex pelvic trauma of an Anterior Posterior Compression (APC) Type II. Lower extremity computed tomography showed a discontinuity in common femoral artery at the fracture site and no distal run off. Surgical finding revealed a complete rupture of common femoral artery and vein around the fracture site. But due to the age aspect of the patient, the operating team decided a vascular repair rather than amputation even if the anticipated reperfusion time was 7 hours from the onset of trauma. Only two hours after the reperfusion, the patient was in a state of shock when his arterial blood gas analysis (ABGA) showed a drop of pH from 7.32 to 7.18. An imminent bedside procedure of aseptic opening the surgical site and clamping the anastomosis site was taken place rather than undergoing a surgery of amputation because of ultimately unstable vital sign. The authors would like to emphasize the importance of rapid decision making and prompt vessel ligation which supply blood flow to the ischemic limb to increase the survival rate in case of profound reperfusion injury. [J Trauma Inj 2016; 29: 204-208]

Key Words: Reperfusion injury, Closed injury, Femoral artery, Vascular reconstruction, Hip disarticulation

I. Introduction

For an orthopaedic surgeon, the critical decisions to either amputate or salvage a limb with severe crushing injury with progressive ischemic change due to arterial rupture or occlusion can become a clinical dilemma at the Emergency Department (ED). Because a life-threatening reperfusion injury is one of the fatal complications after vascular reconstruction in the condition of profound limb ischemic injury. Hereby, the authors present a case which was able to save patient's life by rapid vessel ligation at bedside to prevent severe reperfusion injury.

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II. Case Report

A 43-year-dd male patient with no pre-existing medical conditions was transported by helicopter to Level I trauma center from incident scene. He was presented to our Emergency Department with drowsiness, chest wall pain, and pelvic pain accompanied by a painful swelling of his left leg. The accident happened when the counter jib ballast of the tower crane fell on the patient while he was working at the loading and unloading zone on a truck.

He arrived at the ED four hours from the onset of trauma and he had a Glasgow Coma Scale (GCS) score of 13. Initial vital sign assessment showed a systolic and diastolic blood pressure of 127/62 mm Hg, a heart rate of 98 beats per minute, a respiratory rate of 22

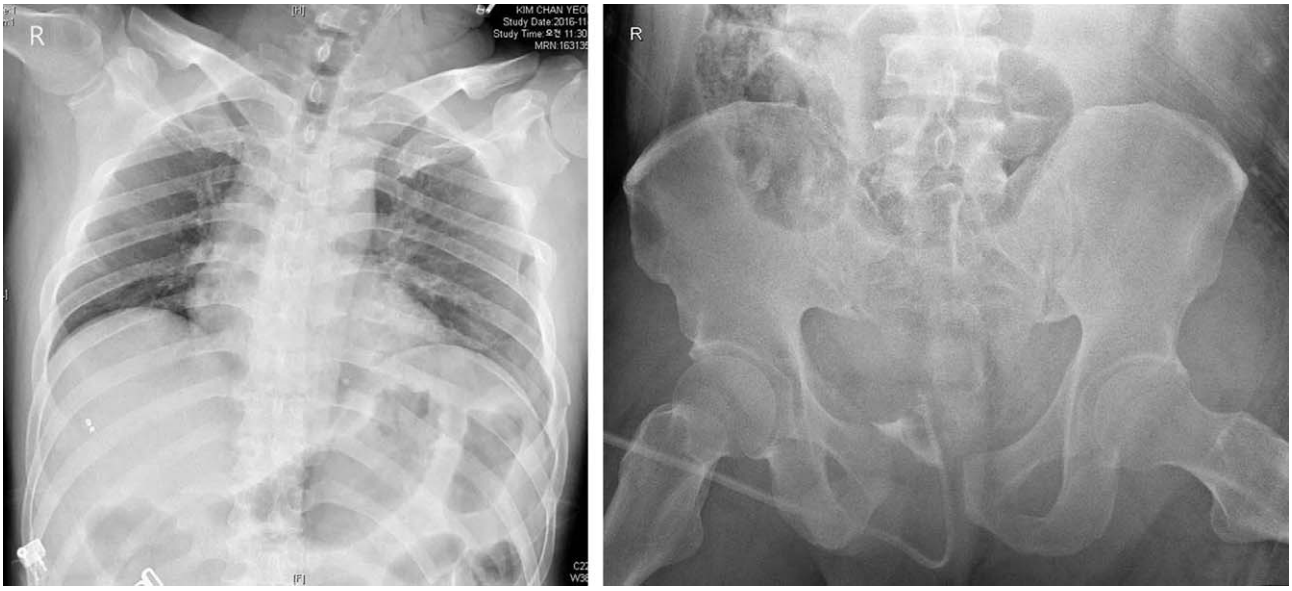

Fig. 1. Multiple contiguous rib fractures with hemothorax was seen on left chest and APC type II injury was seen on Pelvis AP view.

Fig. 2. Proximal femur fracture was seen on femur AP and Lateral view.

Fig. 3. Lower extremity computed tomography showed a discontinuity in common femoral artery at the fracture site and no distal run off.

Fig. 4. Complete rupture of common femoral artery and vein around the fracture site.

per minute, and a body temperature of 36.5 degrees Celsius. Initial result of extended focused assessment with sonography for trauma (eFAST) was negative. The trauma series X-rays at the trauma bay of ED showed a multiple contiguous rib fractures from the 3rd to the 10th ribs of his left chest with hemothorax. His pelvic radiograph revealed a complex pelvic trauma of an Anterior Posterior Compression (APC) Type II and Type B1.2 pelvic ring injuries (Fig. 1).

As soon as an appropriate pelvic binder was applied, additional imaging studies were carried out. A proximal femoral fracture with open wound of 1 centimeters in length was discovered (Fig. 2). The physical examination showed no arterial pulsation on common femoral and dorsalis pedis artery. Lower extremity computed tomography showed a discontinuity in common femoral artery at the fracture site and no distal run off (Fig. 3).

Surgical finding revealed a complete rupture of common femoral artery and vein around the fracture site accompanied by mangled thigh muscles (Fig. 4). Due to the age aspect of the patient, the operating team decided a vascular repair rather than amputation even if the anticipated reperfusion time was 7 hours from the onset of trauma. In time flow, an accident occurred at 10:30 AM and the patient arrived at the emergency room at about 2:00 PM. Then, operation started at 4:45 PM and revascularization was performed at 5:40 PM. The polytetrafluoroethylene

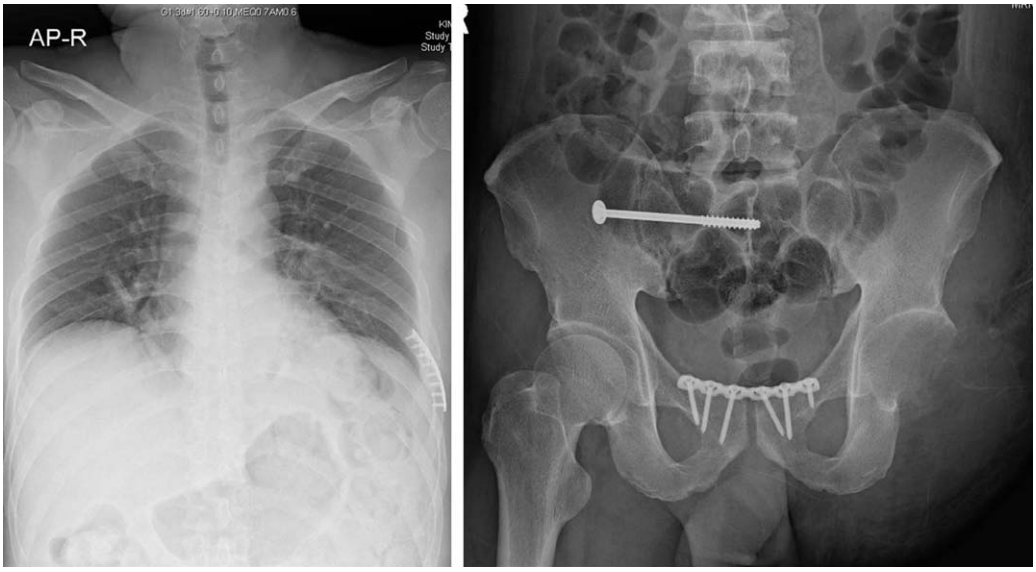

Fig. 5. Postoperative x-rays of chest and pelvis AP.

interposition graft replacement at common femoral artery injury site and end-to-end anastomosis of femoral vein were performed. Perfusion was checked with Doppler ultrasonography and positive sign was seen. An external fixator device was applied for the proximal femur fracture and the post-operative management was carried out in the intensive care unit with deep sedations status (ICU).

Only two hours after the reperfusion, the patient was in a state of shock when his arterial blood gas analysis (ABGA) showed a drop of pH from 7.32 to 7.18, and a reperfusion injury with cardiac suppression was suspected to be progressed. Blood pressure was changed from 94/55 mmHg to 75/38 mmHg and potassium was elevated from 3.9 mmol/L to 6.0 mmol/L. An imminent bedside procedure of aseptic opening the surgical site and clamping the anastomosis site was taken place rather than undergoing a surgery of amputation because of ultimately unstable vital sign. Immediately after clamping the anastomosis site to block blood flow to the ischemic limb, vital sign of the patient was rapidly stabilized. The ABGA and other laboratory findings of the patient were recovered to normal values as well. Also, sinus tachycardia rhythm on elctrocardiogram was transformed normal sinus tachycardia rhythm.

It was inevitable that the patient had to undergo another operation of hip disarticulation on the post-operative day 1. On the post-operative day 7, the definitive surgery including open reduction and internal fixation of pelvic ring injury and multiple rib fractures were performed after the patient state was stabilized (Fig. 5).

III. Discussion

It is never an easy clear-cut decision when an orthopaedic surgeon encounters a patient with a large vessel injury and has to decide to salvage or amputate an injured limb. The decision is based on many factors such as time from the onset of ischemia, the location of the injury, and the degree of damage. We report a rare case of closed injury of a lower extremity involving large vessel damage. According to the studies of Dou et al.,(1) the rate of limb amputation is 0.91% in overall trauma patients, while the rate of amputation in closed injury is only 5.68% of the overall amputation cases mainly due to a vessel injury. In our case, it was not obvious to suspect a vessel injury initially where the open injury was not severe at all (Gustilo and Anderson type I). The external outlook of the injury can mask the severity of the injury and the golden time for emergency operation can be lost in some cases.

Lange and colleagues(2) mentioned the surgical indications of immediate amputation as follows: (a) complete tibial nerve disruption; and/or (b) crushing injury with warm ischemia sustaining more than six hours

duration. In our case, the patient's warm ischemic time was over six hours and degree of muscle injury was severe due. In such a situation, one could usually consider an immediate amputation. However, the age factor was not negligible that the salvage procedure was decided initially.

It is well known that a prolonged ischemia would disrupt the cell membrane potential and ion distribution. Consequently, this change would increase the level of hypoxanthine and decrease the level of adenosine 5'-triphosphate (ATP), phosphocreatine, and glutathione resulting in cellular acidosis.(3) Clinical symptoms and signs can vary whilst a reperfusion injury is suspected due to no flow phenomenon, reperfusion arrhythmia, circulatory shock, and multi-organ dysfunction syndrome.(3,4) The cellular dysfunction of skeletal muscle is another factor to bear in mind when the extremity ischemia is progressed. Within three to four hours of ischemia, thrombosis of microcirculation in skeletal muscle would occur and cause leukocyte infiltration leading to anaerobic metabolism, cell necrosis, and the release of toxic inflammatory mediators(5-7).

The authors experienced a profound reperfusion injury immediately after the vascular reconstruction of major vessel. The immediate action of vessel clamping seemed to have lowered the mortality risk of the patient even though the hip articulation was unavoidable in the end. Nonetheless, the authors would like to emphasize the importance of rapid decision making and prompt vessel ligation which supply blood flow to the ischemic limb to increase the survival rate in case of profound reperfusion injury.

IV. Conflict of Interest

All of the authors, their immediate family, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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