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Case Report

Case series of two successful pelvic ring reconstructions using a pedicled anterolateral thigh flap ☆

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ABSTRACT

Open pelvic ring fractures can have devastating functional consequences including prolonged disability, chronic pain, infection, and even death. These injuries are uncommon but often involve soft tissue defects. Without early and appropriate coverage, patients are likely to sustain infection, which can be fatal. Here, we present the successful use of a pedicled ALT flap in two patients with soft tissue defects due to open pelvic ring injury. The pedicled ALT flap can be harvested as a composite flap comprising a portion of the skin, fascia, and muscle depending on the defect. Although the ALT flap has often been employed for abdominal wall and abdominoperineal reconstruction, this is the first case series to report the use of the ALT flap in a subacute traumatic setting for pelvic ring reconstruction.

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Introduction

Open pelvic ring fractures account for 2–4% of pelvic fractures but present with high mortality rates ranging from 4 to 50% due to hemorrhage and sepsis.[1,2] Soft tissue defects increase the risk of infection due to enteral content exposure.[3,4] Anterolateral thigh (ALT) flaps may provide soft tissue coverage to mitigate these complications.

ALT flaps have been previously described in procedures such as abdominal wall reconstruction.[5] Benefits of ALT flaps include minimal donor-site morbidity, large vessel diameter, flexibility due to its long pedicle length, and simultaneous work at donor and recipient sites. ALT flaps have been successfully used to cover defects throughout the body, including the lower extremities, trunk, and perineum.[6] ALT flaps pose advantages over other flaps for pelvic reconstruction, such as vertical rectus abdominis myocutaneous (VRAM) flaps, due to intact abdominal muscles reducing bulge and hernia formation.[5] Furthermore, flaps based on the rectus muscle are associated with a lower risk of injury compared with pelvic approaches. Therefore, due to decreased risk of infection, shorter hospitalizations, faster recovery, and reduction in hardware complications, ALT flaps are promising options for pelvic ring reconstruction.

In this case series, we present for the first time ALT flap reconstruction of pelvic ring fractures in two patients with immediate outcomes.

Patient 1

The first patient, a 32-year-old male pedestrian struck by a vehicle, was admitted to the emergency department as Category 1 trauma with complex pelvic ring injury including pubic symphysis disruption, left sacroiliac joint dislocation, and right-sided acetabular fracture. After immediate placement of a pelvic binder, the patient was taken to the operating room.

Due to continued hemorrhage from persistent pelvic ring instability, a resuscitation iliosacral screw was placed on the left side to maintain the pelvic ring volume and allow for inspection of the perineum. The patient then underwent left lower quadrant colostomy. After wound exploration with irrigation and debridement, the patient underwent limited open reduction and internal fixation (ORIF) of the symphysis due to instability compromising soft tissue. However, the patient developed pelvic hardware infection, suspected to be *Candida*, due to perineal and rectus breakdown despite multiple debridements and an implant exchange. External fixation did not provide adequate pelvic ring stability. In addition, the patient showed compromised soft tissue coverage, with partially devitalized right rectus, bladder exposure under skin, and induration of right peri–rectal area and buttocks with communication with the pelvic cavity (Fig. 1). Therefore, an ALT flap and right gracilis flap were indicated for coverage of pelvic hardware and the perineal wound, respectively.

Immediate reconstruction was performed at the time of hardware exchange by orthopedic surgeons. Part of the vastus lateralis extending from the mid portion distally was kept in the flap to obliterate dead space (Fig. 2). For flap delivery, a subcutaneous tunnel was first attempted, but it was unsuccessful due to body habitus. Flap placement within the defect provided muscle coverage of the plate with the fascial defect repaired by the fasciocutaneous portion of the flap (Fig. 3). The donor site was closed with a lateral keystone flap.

Postoperatively, the patient was initially prescribed micafungin, then fluconazole (200 mg daily) and ertapenem. At one year follow-up, the patient is functioning well with no signs of infection and no requirement for further operative intervention.

Patient 2

The second patient was a 29-year-old male pedestrian who sustained a crush injury to the pelvis after being pinned between two vehicles. The patient was admitted with “open book” pelvic fracture with pelvic hematoma, intraperitoneal bladder rupture, sacral fracture, multiple lumbar spine transverse process fractures, and bilateral femur fractures. After colon resection and bladder repair, the patient underwent anterior pelvic ring external fixation, closed reduction percutaneous pinning of the

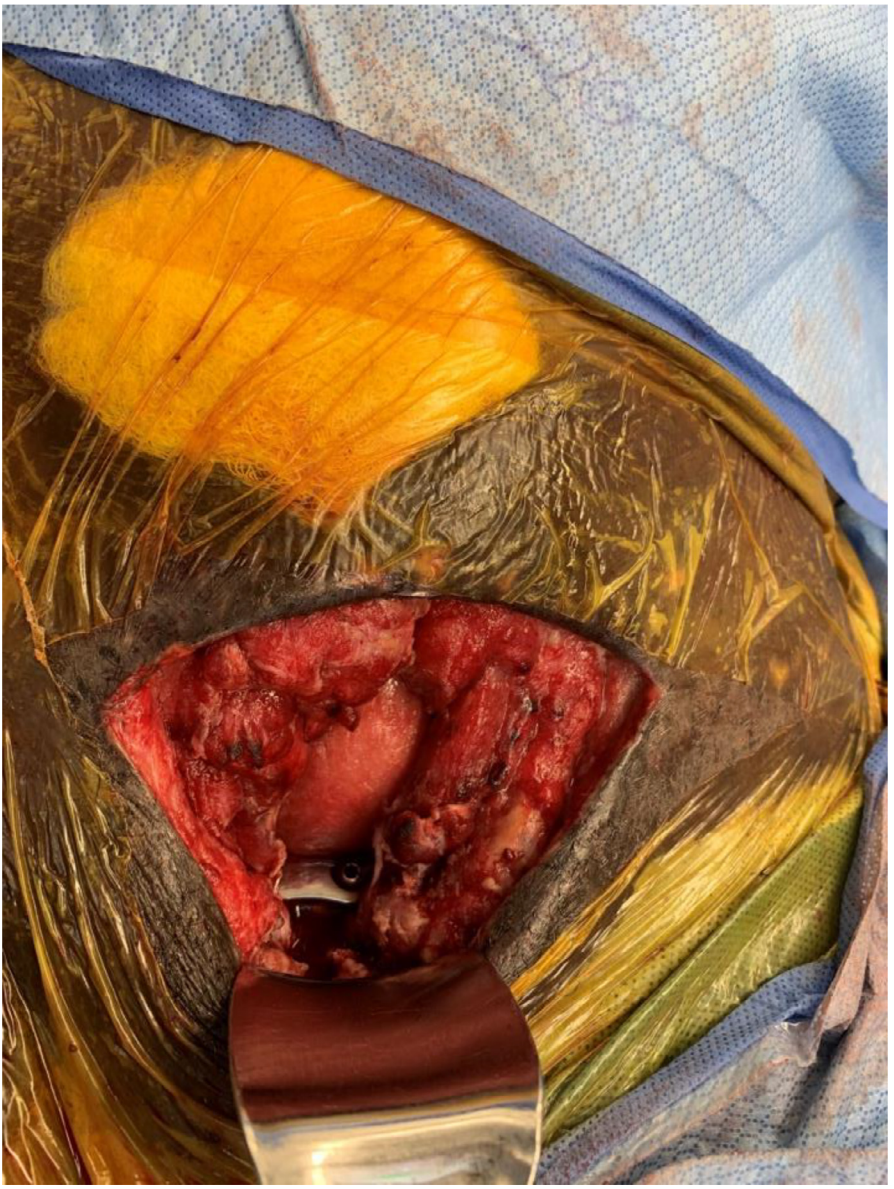

Fig. 1. Exposure of the soft tissue of the perineum in Patient 1 prior to ALT flap reconstruction led to infection and eventual replacement of the orthopedic hardware.

posterior pelvic ring, through-knee guillotine amputation of the left lower extremity, and ORIF of the bilateral acetabular fractures within one week after admission.

After anterior fixation of the pelvic fracture, an ALT flap was performed bilaterally for abdominal wall loss including portions of the rectus muscle and anterior fascia. The distal portion of the flap contained musculocutaneous perforators to obliterate the portions of dead space. A subcutaneous tunnel to open exposed hardware for flap placement was made but placed excessive tension on the perforator. A subsequent dissection underneath the rectus muscle tunnel failed to relieve flap ten-

Fig. 2. The ALT flap was procured from the myocutaenous portion of the right lower limb of Patient 1.

Fig. 3. Placement of the ALT flap provided protection of the perineal opening of Patient 1.

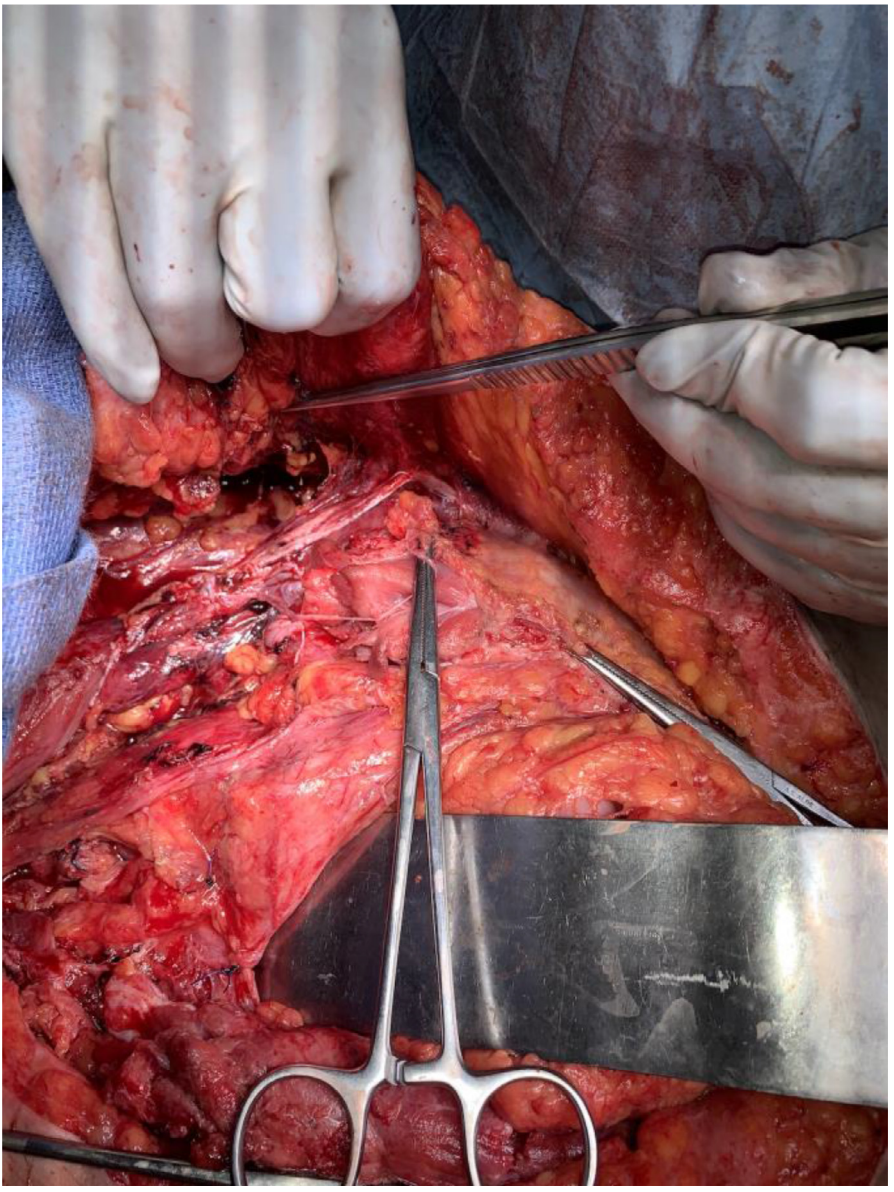

Fig. 4. Placement of an ALT flap underneath the sartorius in Patient 2.

sion. Therefore, the sartorius muscle was divided, and the superficial femoral artery branches were ligated to allow flap delivery underneath the sartorius (Fig. 4). After repositioning, the flap was de-epithelialized for repair within the pelvis. A keystone flap of size 11 × 11 cm^2 was used to cover the harvest site.

Three days after ALT flap placement and anterior fixation, the patient displayed increased bilateral lower extremity swelling, and the left above-knee amputation (AKA) site displayed dark drainage, with CT showing air in the wound. Gram stains revealed *Pseudomonas* growth, with myonecrosis at the left AKA site. Consequently, serial debridement was performed and antibiotics were started with

incisional VAC placed at the amputation site, and the ALT flap wound was opened two days later. Left hip disarticulation was performed with excisional debridement of the thigh to the buttocks. Despite these setbacks, the patient was off antibiotics without signs of infection a month later and remains infection free at one year with no further procedures required.

Discussion

ALT flaps have gained widespread recognition for wound coverage due to their versatility, coverage, and blood supply. Flap composition can vary, from being fasciocutaneous to being myocutaneous or adipocutaenous, depending on the desired wound coverage. Furthermore, these flaps can be intentionally harvested with their different components to address the deficit.

Recent years have witnessed the increasing use of ALT flaps in treating other pelvic injuries. For instance, Kamitomo et al. reported on the successful application of ALT flaps for traumatic bilateral hemipelvectomies.[7] Multiple studies have also reported on the use of ALT flaps in unilateral hemipelvectomies.[8,9]

Although orthopedic hardware provides support for pelvic ring fractures, soft tissue coverage is necessary to prevent complications. This case series documents the successful applications of ALT flaps in two patients with open pelvic ring fractures. For example, the first patient developed a fungal infection, causing removal of orthopedic hardware; following hardware replacement and ALT flap coverage, infection did not reoccur at the pelvic ring. For the second patient, there was *Pseudomonas* infection at the AKA site with extensive myonecrosis following ALT flap and ORIF. However, this infection did not spread to the hardware site, potentially due to soft tissue coverage from the ALT flap.

The versatility of ALT flaps is demonstrated by different presentations in the two patients. The first patient had a skin deficit, requiring cutaneous coverage from the flap. The second patient, however, did not have a skin deficit; as a result, the flap was de-epithelialized, and the resulting myofascia served to obliterate dead space.

The importance of early coverage has been established in other traumatic injuries. For example, Wood et al. have stressed on the importance of prompt coverage in open fractures.[10] In both of our cases, ALT flap reconstruction was performed 17 days and nine days after trauma, respectively. This prompt treatment may have prevented infection surrounding the pelvic ring, although delayed ALT reconstructions are not yet available for comparison.

Conclusion

In this case series, we described two patients who underwent ALT flap reconstruction for open pelvic ring fractures with soft tissue defects. The benefits of this procedure include the coverage of exposed tissue and hardware as an integral part of defense against infection. Prompt intervention by the plastic surgery team is recommended for optimal outcomes.

Financial disclosure

None of the authors have a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

Ethical approval

N/A.

Declaration of Competing Interest

The authors report no conflicts of interest relevant to this work.

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