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Pedicled rectus femoris flap for coverage of complex open pelvic fractures

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Summary Complex open pelvic fractures are highly morbid injuries. Distant soft tissue transfer is often necessary for reconstruction. We report two cases of traumatic open pelvic fractures in which a pedicled rectus femoris flap was used for soft tissue coverage.

Two patients presented with complex open pelvic fractures resulting from blunt trauma. In both patients a pedicled rectus femoris flap was used to reconstruct the full thickness soft tissue defect.

Both patients had complete soft tissue coverage of the anterior pelvic defect allowing definitive pelvic fracture fixation. No significant donor site morbidity was associated with either patient post operatively.

The well described pedicled rectus femoris flap's reliable anatomy, ease of harvest, and versatility as well as acceptable donor site morbidity makes this flap ideal for the reconstruction of complex open anterior pelvic fractures with full thickness soft tissue defects when other local flaps or free tissue transfer is not an option.

Open anterior pelvic ring fractures pose a significant challenge to both patients and reconstructive surgeons. These fractures often occur in the setting of high-energy trauma resulting in multisystem injuries. Stabilization of these patients' acute injuries is of primary concern in the initial stages of treatment and often requires a multidisciplinary approach. After stabilization of the acute injuries, fixation and soft tissue coverage of the open anterior pelvic fracture is imperative for a successful long-term outcome.[1–4] Due to the locally destructive nature of these types of injuries, soft tissue coverage is a challenging problem. The externally applied forces of both crush and shear associated with these high-energy traumas can severely compromise the soft tissue envelope of the pelvis.[5]

As a general rule, the treatment of open fractures, especially those with exposed hardware, requires well-vascularized soft tissue coverage. Without adequate coverage these fractures are at risk for hardware failure resulting from infection. This hardware failure will ultimately lead to a boney non-union.[1–5] Local tissue flaps are the

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obvious first choice for coverage of open fractures, however local tissue is often either not available or compromised secondary to trauma. In this situation, distant tissue, either in the form of a pedicled flap or free tissue transfer, may be required to reconstruct the associated soft tissue defect.

Soft tissue coverage of traumatic injuries to the abdominal wall, posterior pelvis, or groin has been previously described utilizing various pedicled and free flaps. One such described pedicled flap is the rectus femoris flap.[6–10] However, it's utility for coverage of open anterior midline pelvic fractures with an overlying soft tissue defect has not been well described. Because these wounds occur in the setting of significant soft tissue injury, local muscle flaps such as the rectus abdominis are often within the zone of injury. Ultimately, soft tissue coverage requires the use of distant tissue outside of the zone of injury. The rectus femoris flap provides a valuable option for reconstruction of these complex traumatic wounds when local tissue is absent or compromised.

Multiple reports have demonstrated the utility of the rectus femoris for reconstruction of soft tissue defects both local and distant.[6–10] Despite the literature documenting its utility, the use of the rectus femoris flap has often been avoided secondary to its suspected functional and donor site morbidity.[11–13] We report two cases of traumatic open anterior pelvic fractures associated with a significant anterior soft tissue defect in which a pedicled rectus femoris flap was used for coverage.

Technique

The rectus femoris is a versatile flap that can be used as a pedicled muscle- or musculo-cutaneous flap as well as a free-tissue flap. Classified by Mathes and Nahai[14] as a type I flap, it is based on the lateral femoral circumflex artery, which enters the muscle on its deep surface. Typically in an adult, the flap dimensions are 35 cm long by 7 cm wide and 5 cm thick.[15] The rectus femoris muscle originates from the anterior inferior iliac spine and the superior portion of the acetabulum and inserts into the superior border of the patella. Grouped as a component of the quadriceps femoris, the rectus femoris participates in leg extension at the knee and hip flexion.[14,16] When marking the flap intra-operatively, a vertical line is drawn from the anterior superior iliac spine to the center of the patella. The location of the vascular pedicle is identified by the intersection of the aforementioned longitudinal line and a horizontal line that is drawn from the pubic tubercle laterally across the thigh. (Figures 1 and 3) A skin paddle up to 30 cm long by 11 cm wide can be drawn along the vertical axis.[18] Dissection begins laterally, releasing the rectus femoris muscle from the vastus lateralis and iliotibial tract, continues medially, separating it from the vastus medialis, and deeply from the vastus intermedius in a distal to proximal fashion. The proximal extent of the dissection can be taken up to the bifurcation of the lateral circumflex femoral from the deep femoral artery. After rotation and inset of the flap, the donor site can be primarily closed or skin grafted if a larger skin paddle was needed in the reconstruction. Care must be taken to plicate the remaining distal extensor mechanism after flap harvest in order to reduce knee extension lag that may occur with this procedure.

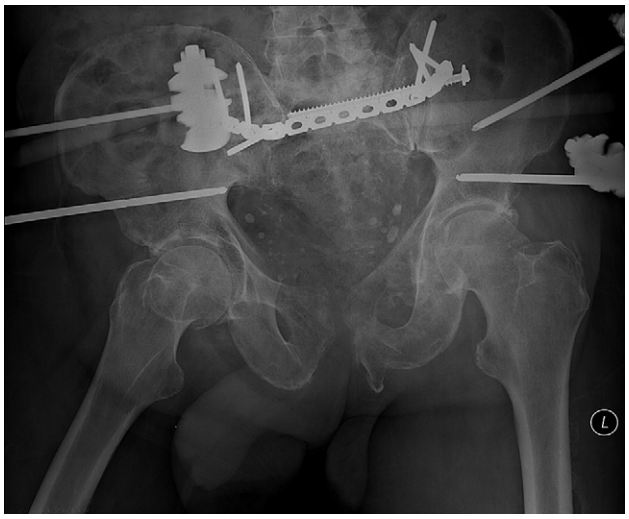

Figure 1 JT post fixation X-ray.

Patients

Patient 1: JT

JT is a 74-year-old male farmer who sustained an open fracture of his pelvis secondary to a crush injury after a tractor rolled on top of him. Injuries were primarily localized to his pelvis and included a urethral disruption, a left sided sacral fracture, widening of the anterior pelvis, and left sided pubic rami comminuted fractures. The described pelvis fracture was classified as an APC type III open fracture.[17] Due to hemodynamic instability on presentation, the patient was taken immediately to the operating room. He underwent pre-peritoneal packing of the pelvis via a lower midline incision, placement of a supra-pubic catheter and application of an anterior pelvis external fixator. Multiple subsequent surgeries were required to re-establish bony continuity of his pelvis including: ORIF of the anterior and posterior pelvic ring as well as subsequent washouts and soft tissue debridements over a one-month period. Unfortunately the anteriorly placed pelvic hardware failed due to infection requiring removal and external fixator placement. (Figure 1) The hardware removal and multiple debridements that were required to excise the devitalized or infected tissue resulted in a large pelvic dead space and a significant soft tissue defect. (Figure 2)

Plastic surgery was consulted to provide anterior soft tissue coverage and to fill the large pelvic defect created by multiple debridements. Upon intra-operative examination, the patient was found to have a 15 × 8 cm anterior, midline soft tissue defect with exposed pubic rami and bladder. Of note, both inferior epigastric arteries had been ligated during the course of the previous surgeries. Bilaterally, the rectus abdominis had been dis-insterted from the pelvis, and debrided proximally to a level just below the umbilicus.

Because of the extensive tissue injury, we were unable to reliably utilize a locally based flap that would provide tissue sufficient for both anterior soft tissue coverage and the volume required to fill the acquired defect. Therefore, a pedicled rectus femoris muscle flap from right lower