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Case Report

The Utilization of the Girdlestone Procedure for Treatment of the Sequelae of Non-Operatively Managed Proximal Femur Fractures in Spinal Cord Injury Patients & Repair of Multiple Pressure Ulcers: A Case Report

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Abstract

The risk of lower extremity fractures, particularly femur fractures is high in patients with Spinal Cord Injury (SCI). Historically, surgical treatment of lower extremity fractures has been associated with high complication rates in the SCI population, which has led many to advocate for nonoperative treatment. However, nonoperative treatment is also associated with complications, including nonunion, increased spasticity, infection, and particularly pressure ulcerations. Subsequent heterotopic ossification and pseudoarthrosis can affect mobilization of the joint, altering sitting mechanics and further the cycle of skin breakdown. In addition, the fracture segment itself may penetrate through the skin and contribute to ulceration and infection. In the non-operatively managed patient, or in those whose fractures were neglected, such complications subsequently present a difficult reconstructive challenge.

The Girdlestone procedure has been previously advocated as method to treat severe heterotopic ossification of the hip in SCI patients and a large series showed favorable long-term outcomes. Given the similar pathology, the procedure may represent an approach to challenging or delayed cases of proximal femur fractures. We present the case of a patient with a conservatively-managed proximal femur fracture which leads to heterotopic ossification, pseudarthrosis and multiple pressure ulcers. The patient was treated with a Girdlestone procedure in a combination with multiple flap closures of her pressure ulcers.

Keywords: Girdlestone; Proximal femur fractures; Spinal cord injury

Case Presentation

The patient is a 49-year-old African American female with a past medical history significant for incomplete C6 quadriplegia secondary to a diving accident sustained 13 years prior to current presentation. Other medical history included pre-injury hypertension and hyperlipidemia as well as neurogenic bowel and bladder, severe muscle spasticity with bilateral upper extremity contractures, chronic anemia, scoliosis, anxiety, and sick sinus syndrome requiring placement of a cardiac pacemaker two years prior to presentation [1-12].

The patient was diagnosed with a right proximal femur fracture four months prior to presentation to our clinic, which she believed that she sustained during a transfer. The patient presented in a delayed fashion and was managed non-operatively as acute fixation was no longer an option. The patient went on to develop significant heterotopic ossification at the site and joint ankylosis as well as numerous pressure ulcers over the coccyx, bilateral ischium, and right trochanter. Radiographic evaluation taken at the time of her preoperative visit demonstrated a severely displaced fracture Figure 1 of the proximal femur.

Figure 1: Pre-operative radiograph.

On exam, the patient's hip flexion had been limited to no more than 45 degrees as a result of the injury and she had become unable to sit, which had in turn contributed to the development of her ulcerations. The patient therefore required both durable coverage of the pressure ulcers, as well as correction of the underlying pathology that contributed to them, namely her femur fracture and joint ankylosis. The risks and benefits of a Girdlestone procedure, in combination with multiple flaps for ulcer coverage was discussed with the patient and she elected to proceed with the surgery.

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Operative Technique

Our operative technique largely follows that outlined by Girdlestone with the exception that we resect the proximal femur between 6 cm and 8 cm below the greater trochanter, usually just distal to the lesser trochanter [13]. As described previously, this more extensive femoral resection allows for release the iliopsoas muscle and prevents its role in causing hip contraction and possible subsequent contracture [12]. A muscle flap is also used to fill the acetabular cavity and reduce the risk of pistoning of the distal femur. We have previously described the use of the vastus lateralis [12], but we now advocate the use of the rectus femoris in order to save the vastus lateralis as a future reconstructive option for recurrent pressure ulcerations.

Our patient was first placed in the supine position. Anatomical landmarks were drawn for the rectus femoris which lies between the Anterior Territory of the Tensor Fascia Lata Muscle (ATTFL), represented by a line extending between the Anterior Superior Iliac Spine (ASIS) and the lateral condyle of the femur, and the lateral intermuscular septum. The anticipated pedicle for the rectus is shown approximately 10 cm below the ASIS (Figure 2).

Figure 2: Supine markings for rectus femoris demonstrating expected location of the pedicle.
*Indicates anticipated pedicle.
ASIS: Anterior Superior Iliac Crest; ATTFL: Anterior Territory of Tensor Fascia Lata

Given the patients ulcers, a posterior approach was required and the patient was turned to the prone position. A standard incision for the Girdlestone Figure 3 was made in the midlateral thigh starting from the great trochanter and stopping approximately 5 cm above the femoral condyle. This incision exposes the underlying vastus lateralis muscle, and provides access to the adjacent rectus femoris muscle. The dissection was carried distally along the lateral intermuscular septum, where the vastus lateralis muscle was elevated off the femur to a position just distal to the lesser trochanter. The fracture segments were identified distal to this, where they were found to have formed a fibrous non-union.

The femoral head was then removed. Two Cobb retractors were used to encircle the femur and protect the tissue medial to it (Figure 4). A transverse osteotomy of the femur was made to the shaft of the femur proximal the fracture site first with the oscillating saw, and then completed with the osteotome. The decision was made to leave the remaining fracture segment given the extensive scarring around the fracture site. Dissection was then carried proximally to the joint capsule, where multiple radial incisions were made through the capsule to aid in disarticulation of the femoral head. At this point, the ligamentum teres was divided, and the femoral head was dislocated from the acetabular cavity (Figure 5). The end of the fractured segment of the proximal femur was smoothed with a rasp. Bleeding from the bone marrow and bone surface was controlled by placing a sheath of collagen Avatine (BARD, Murray Hill, NJ) in the femoral shaft cavity and on the bone.

Figure 3: Lateral markings for Girdlestone procedure, demonstrating the planned lateral incision.

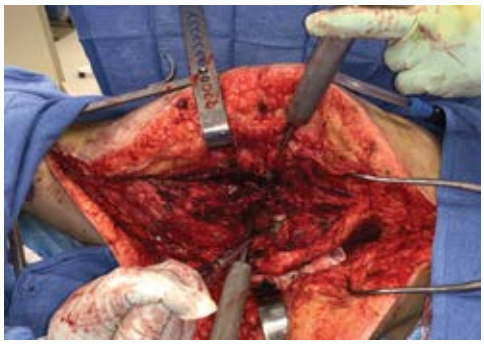

Figure 4: Removal of the femoral head.
*Arrow indicates the femoral head with Cobb retractors encircling the sub-trochanteric region of the femur.

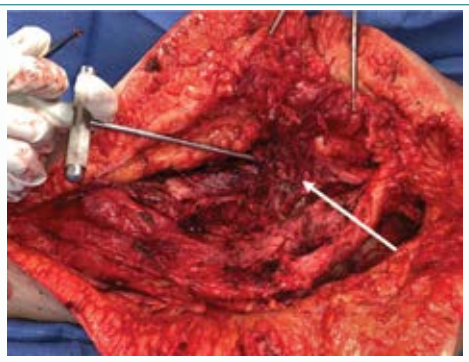

Figure 5: Acetabular defect after femoral head removal.
*Arrow indicates the defect, with hook retracting the remaining proximal fracture segment.

The acetabular cavity was then filled with local vascularized muscle. In the lateral thigh, blunt dissection was used to separate the vastus lateralis from the rectus femoris. The muscle was transected from its distal insertion approximately 4 cm proximal to the patella and elevated until its dominant vascular pedicle from the descending lateral femoral circumflex artery was encountered entering the medial aspect of the muscle approximately 10 cm below to the anterior superior iliac spine. The muscle was then tunneled through a segment of vastus lateralis to fill the defect in the acetabular cavity (Figure 6).

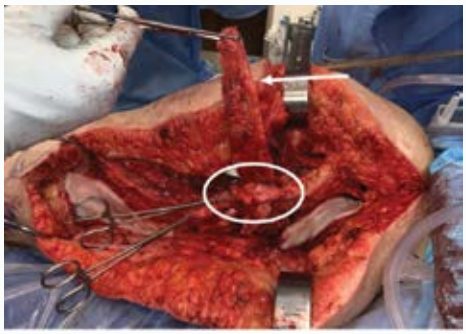

Figure 6: Elevation and inset of the rectus femoris.
*Arrow indicates the elevated rectus femoris muscle with the clamps retracting the vastus lateralis muscle
The circle illustrates the passage of the rectus femoris through the vastus lateralis muscle.

The defect was closed over closed suction drains, with drains above and below the muscle. An intra-operative radiograph was obtained showing complete resection of the femoral head (Figure 7). The leg was also ranged intraoperatively to demonstrate significant improvement in mobility. The lateral thigh was then closed in layers in the standard fashion.

Figure 7: Post-operative radiograph.

The patient's ulcers were next addressed. First coverage for the ulcers was designed with a gluteus maximus rotational flap for the sacral defect and primary closure of the skin planned for the two ischial defects (Figure 8). Each ulcer was excised fully and then the cavity was irrigated with warm saline with bacitracin. The coccyx and left ischium demonstrated involvement of the bone, and so the bone was shaved down using an oscillating saw, followed by an osteotome, and all edges were smoothed with a nasal rasp. The right ischial ulcer had no involved bone, and the soft tissue alone was resected. The gluteal flap was elevated and then rotated into place (Figures 9A, B and C).

Figure 8: Markings for the myo cutaneous gluteus maximus rotational flap.

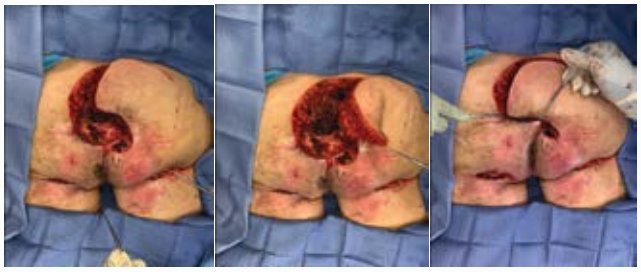

Figure 9: (A) Dissection of the gluteal rotational flap. (B) Elevation of the flap. (C) Inset of the flap.

For the left ischium, the inferior portion of the gluteus maximus muscle was elevated, as was the superior portion of the hamstring muscle, and these were advanced together to cover the bone (Figures 10A and B). The skin was then closed primarily over top. All cavities were closed overtop of a closed suction drain in the standard layered fashion (Figures 11A and B).

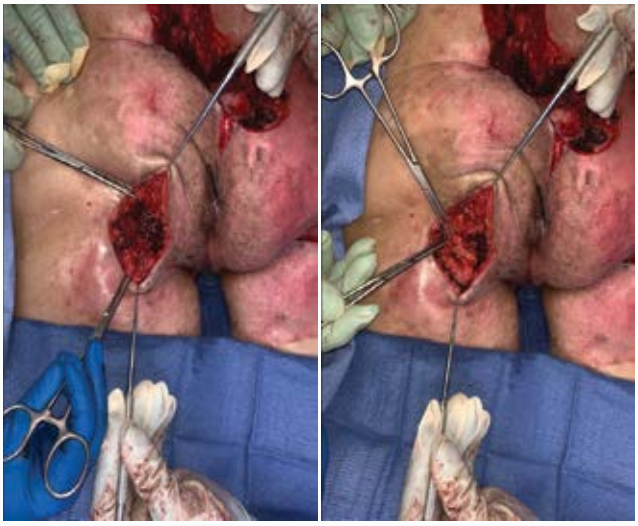

Figure 10: (A) Dissection of the gluteus maximus muscle and hamstring muscle. (B) Inset over the ischial bone.

Figure 11: (A) Final on-table prone view. (B) Final on-table lateral view.

Conclusion

Long-bone fractures of the lower extremity in patients with a preexisting SCI present a unique challenge. The incidence of at least one fracture during a patient's lifetime following SCI is 25% to 34% [14-16]. The unique physiology of SCI patients, including insensate skin, infectious risks, and osteoporosis, contribute not only to the fracture, but also to their altered healing potential and complications

associated with treatment strategies [16]. While the incidence of these complications has been reported in the literature, discussion of effective treatment for them is lacking.

We present a case of the effective use of the Girdlestone procedure to correct the underlying pathology which contributed to the patient's subsequent pressure ulcers. We also demonstrate that it can be used in combination with multiple myo cutaneous flaps for ulcer coverage in a single stage operation to provide comprehensive treatment for these complex cases.

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