Clinics in Surgery

Case Report
Published: 28 Dec, 2018

Combined Bilateral Gluteus Maximus Sliding Island Flap for Closure of a Large Sacro-coccygeal Ulcer and Girdlestone Procedure with Muscle Flap to Treat Femoral Neck Fracture Non-union and Heterotopic Ossification

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Abstract

Pressure sores and heterotopic ossification are both secondary sequela of spinal cord injury that can be a source of significant morbidity and health care cost. The surgical management of these conditions can provide successful treatment of even very large pressure sores, and very extensive heterotopic ossification. We are presenting a case of a patient with a large sacro-coccygeal ulcer as a consequence of staying supine for the non-operative management of a femoral neck fracture, which failed to heal and generated extensive heterotopic ossification. The combined ulcer excision, Girdlestone procedure, and multiple muscle flap reconstruction provided a successful and durable one-stage approach to his pathology.

Keywords: Spinal cord injury; Pressure ulcer; Heterotopic ossification; Girdlestone procedure; Muscle flap closure

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Received Date: *04 Dec 2018*
Accepted Date: *26 Dec 2018*
Published Date: *28 Dec 2018*

Citation:
Rouch JD, Rubayi S. Combined Bilateral Gluteus Maximus Sliding Island Flap for Closure of a Large Sacro-coccygeal Ulcer and Girdlestone Procedure with Muscle Flap to Treat Femoral Neck Fracture Non-union and Heterotopic Ossification. Clin Surg. 2018; 3: 2277.

Introduction

Pressure ulcers remain one of the most common secondary sequelae associated with spinal cord injury [1]. They contribute to significant morbidity of those with neurologic injury, who are insensate. Sacral and coccygeal ulcers occur frequently in bedridden patients who are supine, and account for up to 30% of all documented pressure sores [2]. As with the elderly, spinal cord injury patients also suffer from osteoporosis, and are prone to femur fracture. Much work has been devoted to the morbidity, mortality risk, and health care cost associated with femur fractures in the elderly [3]. Spinal cord injury patients are also at risk of femur fracture due to the combined factors of osteoporosis and disuse [4]. Specifically, femoral neck fractures are very common in the elderly. While debate exists on the best course of management, non-operative management is an accepted treatment modality for debilitated and non-ambulatory patients. Even so, there is a high incidence of fracture non-union when treated non-operatively [5].

Heterotopic Ossification (HO) is also a very common sequela of fracture non-union, and also occurs often without a fracture in patients with spinal cord injury [6]. In the setting of spinal cord injury, H.O. is particularly common. In fact, femoral and pelvic H.O. occurs in 10% to 53% of spinal cord injured patients even without a femur fracture [6]. This is thought to be secondary to multiple factors, including lack of use, infection, pressure, or neurogenic etiology.

We have previously reported our experience with the Girdlestone procedure with muscle flap filling of dead space to alleviate the debilitating sequela of heterotopic ossification in spinal cord injury patients [6,7]. Here we present a case of a very large sacro-coccygeal ulcer occurring in the setting of bed bound recovery following a femoral neck fracture. In addition to the pressure ulcer, the non-operatively managed femoral neck fracture healed with a non-union and extensive heterotopic ossification.

Case Presentation

Clinical history

The patient is a 60 year old male with a large 15 cm × 15 cm × 2 cm Stage IV sacrococcygeal

Figure 1: Pre-operative radiograph showing left femoral neck fracture non-union with extensive heterotopic ossification.

Figure 2: Pre-operative photo showing large 15 cm × 15 cm × 2 cm Stage IV sacrococcygeal ulcers with planned bilateral gluteus maximus sliding island flaps. Note the marked position of the superior gluteal artery pedicles.

Figure 3: Pre-operative lateral view showing planned incisions.

Figure 4: Excised 15 cm × 15 cm × 2 cm Stage IV ulcer with accompanying non-viable soft tissue.

Figure 5: Wound bed after excising the ulcer and shaving the coccyx and sacrum bones.

Figure 6: Bilateral gluteus maximus sliding island flaps coming together without tension in the midline. Note that laterally the fascia has been incised to allow for tension-less advancement.

ulcer and a left hip femoral neck fracture non union with extensive heterotopic ossification. He has a history of L2 incomplete paraplegia from a tree trimming fall in 1988. He is status post spinal stabilization in 1988, but has subsequently had multiple ischial and sacral pressure ulcers. Due to their proximity to the anus, he has had fecal diversion with a colostomy. He had multiple ulcer surgeries in the past: left ischial ulcer closed over a decade ago at our institution as well as a right ischial ulcer closure with left posterior thigh VY advancement. He later underwent recurrent right ischial ulcer closure with gluteus maximus advancement flap. Three months prior, he sustained a fall from his wheelchair onto his left hip, causing a femoral neck fracture. He was treated non-operatively, but developed a fracture non-union with extensive heterotopic ossification (Figure 1). Due to prolonged immobilization and an alteration of his daily routine with increased time supine, he developed a large sacrococcygeal ulcer 15 cm × 15 cm × 2 cm (Figure 2). His other co-morbidities include malnutrition with a pre-albumin of 7, as well as Pseudomonas aeuriginosa and fungus colonized urine. On account of his left hip fracture non-union with heterotopic ossification, along with a large sacro-coccygeal ulcer, there was concern for involvement of the hip joint with his ulcer. As such, we discussed the strategy of removing the proximal femur via a Girdlestone procedure, with concomitant ulcer excision and reconstruction.

Operative procedure

General anesthesia was induced and the patient was intubated on the gurney prior to transfer. All pressure areas on the face, chest and colostomy were then padded Allevyn foam dressing. Once this was completed, he was then flipped to the prone position on the OR table (Figure 2,3). We began the operation by painting the ulcer with methylene blue to aid in excision of all unhealthy and colonized granulation tissue. This helped in our ability to excise the ulcer en bloc, removing all granulation tissue. The excised Stage IV sacro-cocygeal ulcer measured 15 cm × 15 cm × 2 cm (Figure 4). We then used an osteotome to shave the coccyx and sacrum, and used a nasal rasp to smooth the surface. Due to the close proximity of the rectum, we took care to not invade the peri-rectal soft tissue. Finally, we irrigated the entire cavity with bacitracin soaked warm normal saline (Figure 5).

We began the reconstruction by marking out the bilateral gluteus maximus sliding island flaps. As a visual aid, we also marked out the expected position of the superior gluteal artery dominant pedicle on each side. This was done by marking the posterior superior iliac spine, then drawing a line laterally at a 45 degree inferior angle, then marking a point on this line 4 finger-breadths from the PSIS (Figure 2). The skin and subcutaneous tissue was divided until the fascia of the gluteus was encountered circumferentially. In order to gain more length to bring the sliding island flaps to the midline without tension, we incised the fascia of the gluteus 270 degrees, leaving the superio-

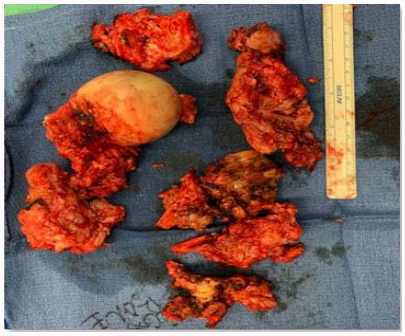

Figure 7: Excised femoral head, proximal femoral shaft, and heterotopic ossification from left hip.

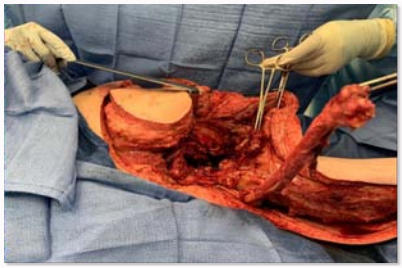

Figure 8: Following Girdlestone proximal femoral excision, this shows the femoral osteotomy and the dead-space of the acetabulum that must be filled with a muscle flap. The rectus femoris muscle has been elevated from its anterior location is shown tethered proximally with its distal attachment transected.

medial fascia intact so as to not disturb the SGA pedicle. This fascial incision greatly enhanced the mobility of the flaps, and allowed them to come together without tension in the midline (Figure 6).

The Girdlestone procedure was begun by marking out the incision over the greater trochanter (Figure 3). We dissected through the fascia lata, which is the iliotibial tract at this location, down to the periosteum of the greater trochanter. We then achieved sharp sub-periosteal dissection on the femur to a point distal to lesser trochanter. We then placed Cobb elevators to protect tissue at the site of our planned osteotomy just distal to the lesser trochanter. Using an oscillating saw ananosteotome, our proximal femoral osteotomy was made. We made sure to divide the iliopsoas to prevent a piston effect of the distal femur. Avitenemicrofibrillar collagen was used as a plug to assist with hemostasis in the medullary canal.

There was significant heterotopic ossification all about the femoral neck, which we excised piecemeal. Due to the vasculature medially and anteriorly, we took care in this area so as to not divide the lateral femoral circumflex artery, profundusfemoris artery or the femoral artery. Our goal was to excise enough of the heterotopic ossification to allow for hip range of motion, but keeping in mind the critical importance of leaving the vascular pedicles to our muscle flaps undisturbed. Due to fracture non-union of neck, proximal femoral shaft was removed en bloc with some heterotopic ossification. In order to liberate the femoral head from the capsule, a capsulotomy was made using multiple radial cuts. The ligamentum teres was sharply divided after elevating the femoral head from the acetabulum, which allowed for complete removal (Figure 7).

In order to fill the dead space of the proximal femur, we planned for our flap reconstruction. Our practice is to typically use the Rectus

Figure 9: The rectus femoris muscle flap has been inset into the acetabulum and the vastus lateralis is shown held with a clamp advanced over the proximal femoral osteotomy. More superiorly, the gluteus sliding island flap can be seen.

Figure 10: Posterior view of the 3 layer wound closure with Shirley sump drains in place.

Femoris flap. We marked our incision distally centered over the lateral thigh from iliac crest to lateral femoral condyle (Figure 3). We made a 3 cm incision distally to find the fascia of the Vastus lateralis. This muscle was found to have large sub-fascial dissecting hematoma from the fracture which had caused necrosis of the muscle, and thus was unusable as a flap. However, the rectus femoris appeared healthy. Once we confirmed the course of this muscle, we connected the distal incision to our proximal Girdlestone incision. The anteriorly positioned Recuts femoris was then dissected free, from distal to proximal (Figure 8). We divided the distal tendinous insertion on the patella, and dissected the muscle up to the pedicle (branch of the LFCA), which comes off 8 cm to 10 cm distal to the Anterior Superior Iliac Spine (ASIS) [8]. Prior to insetting the flap, we irrigated and achieved hemostasis with the aid of Avitenemicrofibrillar collagen.

The rectus femorispedicled muscle flap was then inset into the acetabulum secured with 0 vicry l. Though the distal vastus lateralis was compromised from the extension of the fracture hematoma, the proximal vastus was viable. We thus were able to advance this muscle a few centimeters in order to cover the femoral osteotomy. The Dead-space was then filled by our rectus femoris flap, as well as the vastus lateralis advancement (Figure 9). We were able to further obliterate the dead-space by tightening gluteus inferiorly down to rectus femoris flap, and the vastus superiorly toward the flap. In our standard fashion, we placed two Shirley sump drains in the gluteus maximus sliding flap space as well as Shirley sump drains in the left posterior thigh. We then closed the fascia circumferentially with running 0-Vicryl. Most importantly, the deep aspect of each flap is sutured to the midline to prevent tension. Deep dermis was then closed with 0-Vicryl, and the epidermis closed with a running 2-0 Biosyn followed by a running 0-Prolene. The donor site of each sliding flap was closed in a VY fashion (Figure 10 and 11).

Postoperative protocol

The patient was transferred on to an air fluidized mattress, on which he was left supine for 4 weeks. After 4 weeks, depending on the

Figure 11: Lateral view of wound closure in 3 layers.

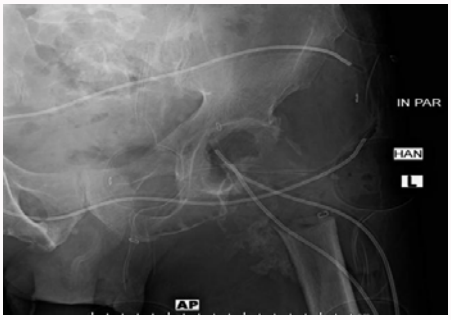

Figure 12: Postoperative radiograph of the left hip showing proximal femoral osteotomy and removal of heterotopic ossification. Note that the rectus femoris muscle flap prevents the left femur from pistoning proximally into the acetabular space.

status of wounds, patients are begun on a supervised sitting protocol. A post-operative radiograph was obtained in the recovery room (Figure 12). The incision lines are dressed with mupirocin ointment, followed by xeroform and gauze. The surgeon performs first dressing change at POD5, followed by daily dressing changes. The drains are kept in place until they reach 20cc/day. In this case, the drains were removed by POD20. For prevention of H.O. recurrence, patients are placed on etidronate and/or indomethacin [9]. As another aid to help prevent a piston effect of the distal femur, we place an abduction pillow between the legs. This is left in place for 4 weeks.

Discussion

Despite vigilant care, pressure sores are a very common manifestation of spinal cord injury. This case demonstrates how mild alterations in the daily routine of a patient can result in significant morbidity. He unfortunately had a fall from his wheelchair, and due to his osteoporosis sustained a proximal femur fracture that healed with a non-union. Due to subsequent alteration in his sitting program, he then developed a very extensive sacrococcygeal ulcer. Ultimately, this case encapsulates much of the pathology and pathophysiology involved in pressure ulceration in spinal cord injury: heterotopic ossification, spasticity and pressure ulceration. We have previously reported on our experience of the single stage surgical management of multiple pressure sores, and highlighted the advantages of a single hospital stay and more stream-lined nursing care [10]. This case highlights the importance of considering options for reconstruction of pressure sores and Girdlestone dead-space, especially when doing so in a single stage. In this case, despite having two areas that required muscle coverage (a large sacrococcygeal ulcer and the proximal femur Girdlestone dead-space) we were able to provide durable coverage without using the vastus lateralis. Subsequent to his femur fracture, the vastus in this case appeared significantly compromised with fracture hematoma tracking down to its distal insertion, precluding its use. It has become our common practice to avoid use of the vastus lateralis until absolutely necessary, as it can be used to reconstruct a wide milieu of large tissue defects associated with pressure ulceration [6]. Because of the high volume of dead space in this case, the vastus may have been a good choice. We have previously reported that our common practice has been to first use the rectus femoris, as this muscle tends to perfectly fill the Girdlestone dead-space while typically preserving the vastus for future use. Furthermore, this case reiterates the dependability of gluteus maximus sliding island advancement for closure of very large sacrococcygeal defects [11].

In spinal cord injured patients, the incidence of heterotopic ossification has been reported to range from 10% to 53% [6]. Often, H.O. is secondary to infection or recurrent ulceration. However, in this case, the H.O. was a response to his femoral neck fracture non-union, which then led to a large sacrococcygeal ulcer. This demonstrates the common pathophysiological pathways that are so common in spinal cord injury related pressure ulceration. A key consideration when excising heterotopic ossification as a part of a Girdlestone procedure is that of the vascular pedicles to the various muscle flaps that can be used to fill dead-space. H.O. can cause altered anatomy, and thus poses a risk to any planned muscle flap if divided. Knowledge of normal vascular anatomy and surgical care is essential when excising H.O. Though performed years prior, the importance of fecal diversion with a colostomy cannot be understated. Not only are sacrococcygeal ulcers often are near the anus superficially, but when shaving the sacrum and coccyx bone the rectum is in close proximity. A colostomy is essential to prevent soiling of the wound, and its absence would be particularly felt in the setting of any unintended rectal injury.

Conclusion

Pressure ulceration, femur fractures, and heterotopic ossification all represent entities associated with secondary morbidity in patients with spinal cord injury. This case highlights these pathophysiological pathways, as well as demonstrates the ability to perform single-staged combined surgical management and reconstruction.

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