Annals of Plastic and Reconstructive Surgery

Case Report
Published: 12 Jul, 2018

Complex Reconstructive Surgery Following Excision of Multiple Stage IV Pressure Ulcers, and Hip Joint Heterotopic Ossification in the Spinal Cord Injury Patient

*Farias-Eisner G[1] and Rubayi S[2]**

[1]Department of Plastic and Reconstructive Surgery, University of California Los Angeles, USA

[2]Department of Plastic Surgery, University of Southern California, USA

Abstract

The effects of gunshot wound injuries often extend far beyond the immediate trauma resulting in lifelong physical, emotional, and social consequences. Gunshot wounds are the third leading cause of Spinal Cord Injury (SCI) in the United States. This patient population is at high risk for the development of pressure ulcers due to lack of sensation, loss of motor function, and bowel and/or bladder dysfunction. The surgical treatment of pressure ulcers in patients with spinal cord injuries is an extremely complicated and challenging problem. These patients may suffer from Heterotopic Ossification (HO) of the hip, which further exacerbates the pressure ulcer resulting in pelvic obliquity. When a pressure ulcer has recurred, and a patient has already undergone multiple reconstructive flap procedures, options for wound coverage become limited. We describe a case of a single patient with multiple end-stage pressure ulcers who suffers from severe Heterotopic Ossification (HO) of the bilateral hips, in which excision of heterotopic ossification is treated with proximal femoral osteotomy and flap reconstruction.

Keywords: Spinal cord injury; Heterotopic ossification; Ulcers

OPEN ACCESS

Correspondence:
Salah Rubayi, Department of Plastic Surgery, University of Southern California, Ranch Los Amigos National Rehabilitation Center, 7601 East Imperial Highway, Downey, CA 90242, USA,
E-mail: srubayi@dhs.lacounty.gov

Received Date: *12 Feb 2018*
Accepted Date: *10 Jul 2018*
Published Date: *12 Jul 2018*

Citation:
Farias-Eisner G, Rubayi S. Complex Reconstructive Surgery Following Excision of Multiple Stage IV Pressure Ulcers, and Hip Joint Heterotopic Ossification in the Spinal Cord Injury Patient. Ann Plast Reconstr Surg. 2018; 2(3): 1018.

Introduction

According to the national spinal cord injury database, gunshot wounds are the third leading cause of Spinal Cord Injury (SCI) in the United States after motor vehicle accidents and falls [1]. The effects of this violence often extend far beyond the immediate trauma resulting in lifelong physical, emotional, and social consequences. The victims of violently acquired SCI tend to be younger and often unmarried, unemployed, and from racial/ethnic minorities when compared to SCI resulting from other causes [2]. This unique patient population has limited access to long term caretakers, health insurance, and financial and educational resources that place them at risk for morbidities, such as pressure ulcers that are associated with SCI [3].

Pressure ulcers are the most common secondary medical complication associated with SCI. Due to loss of motor, sensory, and autonomic control associated with SCI, up to 95% of adults will develop pressure ulcers in their lifetime, resulting in decreased quality of life, depression, hospitalizations, and in 7% to 8% of patients, complications that can result in death [3].

Of those with SCI, 27% to 40% will develop a pressure ulcer during their initial hospitalization and/or rehabilitation. Furthermore, the rates of re-hospitalization for pressure ulcer disease are 17.7% within the first year and 37.4% by 20 years post-injury [4]. The cost of treating pressure ulcers in SCI patients has been reported as high as $1.2 billion per year in the United States and is expected to rise as high as $7.5 billion by 2020 [5].

When pressure ulcers have recurred and a patient has already undergone multiple reconstructive flap procedures, options for wound coverage become extremely limited. These patients may suffer from severe muscle spasms of the hip flexors and hamstrings, resulting in hip subluxation, hip dislocation, knee flexion contracture, and joint ankylosis. These patients may suffer from Heterotopic Ossification (HO) of the hip, which further exacerbates the pressure ulcer [6]. These contractures prevent individuals from sitting or lying in a functional position. Pressure is abnormally distributed, consequently predisposing patients to further ulceration over these boney prominences [7]. Thus, treatment of pressure ulcers in the end-stage patient should address all of the contributing problems.

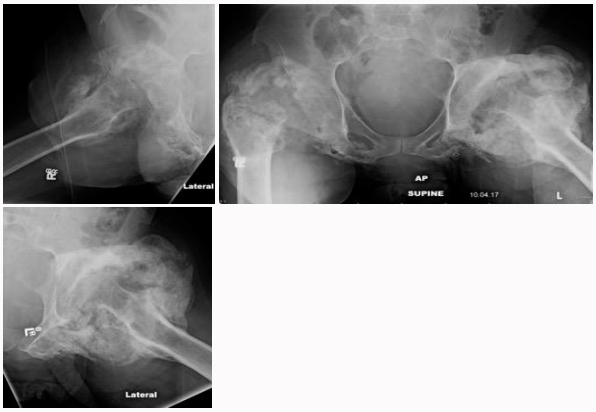

Figure 1: AP and lateral radiographs of the patient's pelvis demonstrate severe circumferential areas of heterotopic bone overlying the right and left hip with partial resorption of the left femoral head and inferior pubic rami as well as heterotopic bone of the inferior rami bilaterally.

Figure 2: Preoperative photograph depicting stage IV right ischio-post-trochanteric pressure ulcer extending to the right ischial bone and stage III left ischio-gluteal ulcer located approximately 3 cm from the anus. Previous surgical flap history evidenced by extensive scarring of the right lateral and left posterior thighs.

Here, we present a case of multiple end-stage pressure ulcers in a patient with severe muscle spasticity and severe heterotopic ossification of the bilateral hips in which excision of right heterotopic ossification is treated with right proximal femoral osteotomy and flap reconstruction (Girdlestone procedure). We outline important principles in treating patients with end-stage pressure ulcers in the setting of HO as developed by the senior author.

Case Presentation

Clinical history

The patient is a 44-year-old African American male with a history of T4 complete paraplegia spinal cord injury secondary to a gunshot wound in 1991. His history is complicated by bilateral hip heterotopic ossification with ankylosis (Figure 2) and he developed a chronic stage III left ischiogluteal pressure ulcer and extensive stage IV right ischio-post-trochanteric-gluteal-pressure ulcer secondary to prolonged wheelchair sitting.

The patient's medical history is significant for neurogenic bowel and bladder and severe muscle spasm. His surgical history includes multiple recurrences of complicated pressure ulcers reconstructed by multiple flap surgeries performed at outside facilities.

The patient presented to our clinic with a stage IV right ischio-posttrochanteric-gluteal pressure ulcer and stage III left ischiogluteal ulcer that had been present for several years. The stage IV right ischio-posttrochanteric-gluteal pressure ulcer measured 15 cm × 6 cm × 5 cm extending to the right ischial bone. The stage III left ischiogluteal ulcer measured 9 cm × 6 cm × 3 cm and was located approximately 3 cm from the anus. The wounds were clean with pink granulation tissue and no evidence of active infection (Figure 1).

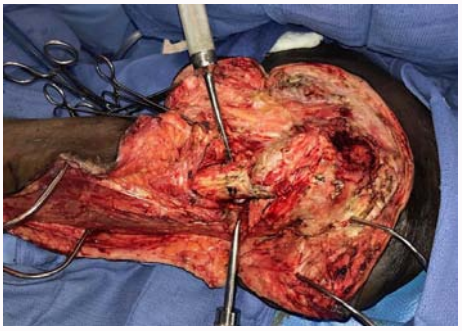

Figure 3: Operative photograph demonstrating post excision of the bursa with exposure of the shaved ischium and reflection of the vastus lateralis from its origin to expose the proximal femur. A Cobb elevator instrument is inserted underneath the femur in preparation for transverse femoral osteotomy by oscillating saw.

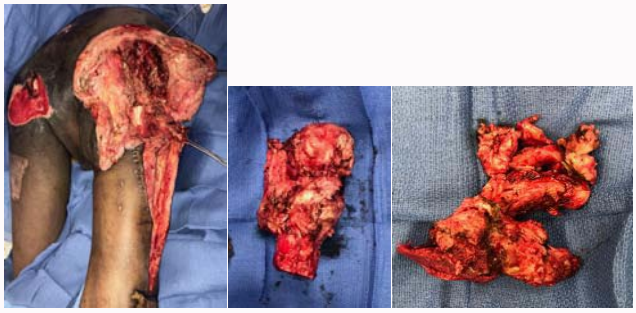

Figure 4: Operative photograph demonstrating the remaining acetabular cavity (indicated by guide wire), proximal femur, and the cavity resulting from removing the femoral component and heterotopic ossification.

Operative procedure

Given the proximity of the ulcers to the anal verge (<5cm), the decision was made for the patient to undergo diverting colostomy prior to surgery.

Several days following this procedure, the patient underwent excision of bilateral ulcers, excision of the entire right hip heterotopic ossification, right proximal femoral osteotomy with mobilization of right vastus lateralis muscle with utilization of the previous gluteal flap to cover the vastus lateralis muscle and ulcer defect, as well as split thickness skin graft from the right leg to the left ulcer defect.

The decision was made to stage the left side. The left hip demonstrated severe and very extensive HO that would need to be addressed in order to correct pelvic obliquity (Figure 2). However, it was felt that the risk of blood loss and of prolonged length of surgery was too high to be performed in a single operation.

The surgical procedure described is a technique developed and routinely utilized by the senior author with high rates of success.

The patient was positioned prone on the operating room table. A 1 cm rim of healthy-appearing tissue around the right ulcer was marked and a small area on the left ulcer was marked for excision. It is our practice to paint the ulcer with methylene blue to identify the entire bursa. All tissue that had a blue hue of methylene blue was

Figure 5: Operative photograph demonstrating elevation and inset of the vastus lateralis into the acetabular cavity, in order to fill the dead space and provide vascularized coverage of the ischium. The vastus lateralis flap is supplied by the lateral circumflex femoral artery identified by the pointer in the figure on the far left.

Figure 6: Operative photograph demonstrating re-rotation of the previous gluteal flap.

excised such that the entire bursa was removed en bloc. We then proceeded to rasp the edges of the ischium bone with care to rasp down any sharp edges.

After excising the bursa en bloc, we began the reconstructive portion of our surgery. The intermuscular septum was again palpated. The incision was curved anteriorly, as well as laterally along the inferior edge of the gluteus maximus. The tensor fascia lata fascia was incised revealing the vastus lateralis below and dissection was carried superiorly further defining the vastus lateralis. We proceeded to identify the lateral intermuscular septum laterally and dissect the lateral edge of the vastus lateralis from the lateral intermuscular septum. Superiorly, we detached the vastus lateralis from its origin at the greater trochanter by making a transverse incision over the muscle and identifying the proximal femur (Figure 3).

The proximal femur was freed of soft tissue circumferentially in preparation for our transverse osteotomy (Figure 3). Two Cobb elevators were positioned at the level below the lesser trochanter, the location of the transverse osteotomy. This is our standard practice to prevent injury to the soft tissue. The oscillating bone saw was then used to perform a transverse osteotomy. We then made multiple transverse and longitudinal osteotomies along the segment of bone in order to facilitate dislocation of the femoral head. The head of the femur was dislocated from the acetabular cavity and the ligamentum teres and capsule were transected. Residual HO was removed from

Figure 7: Operative photograph demonstrating the gluteus maximus flap sutured in place and the inset of a split thickness skin graft harvested from the patient's right posterior calf.

Figure 8: AP radiograph of the patient's pelvis status post Girdlestone procedure of the right hip.

the cavity using a straight osteotome (Figure 4).

The vastus lateralis muscle was transected at its most distal end at the musculotendinous junction of the quadriceps and our dissection proceeded from lateral to medial directly on the femur with care to preserve periosteum. A plane was identified between the vastus lateralis and the rectus femoris medially. We identified the plane between the vastus lateralis and the vastus medialis continuing our dissection from distal to proximal with great care to preserve the vascular pedicle, which can be found approximately 10 cm from below the anterior superior iliac spine (Figure 5).

The vastus lateralis was used to fill the dead space of the acetabular cavity and cover the proximal femur. We took great care to ensure there was enough of a rotational arc to allow for the inset of the flap without tension or kinking (Figure 5). The vastus lateralis flap was inset to the gluteus maximus and surrounding muscle closing the dead space (Figure 5).

The gluteus maximus was rotated utilizing the previous flap for closure (Figure 6). The muscle was then reapproximated, the tensor fascia lata fascia was repaired and skin was closed (Figure 7).

We then prepared the right posterior proximal calf for skin graft harvesting. Given that a small amount of the sacral bone was exposed, we re-rotated the previous fasciocutaneous gluteal flap over the bone. We then inset the skin graft using staples (Figure 7). A bolster dressing was sutured in place. Having completed the surgery, we dressed the wounds. The patient was placed in a foam abduction pillow to maintain stability of the surgical site until healing was achieved four weeks postoperatively.

Our standard postoperative protocol was implemented (Figure

8). In the senior author's vast experience this protocol has proven to be most effective in preventing wound dehiscence, flap ischemia and complications. Initially patients are put on bed rest on an air-fluidized bed (Clinitron; Hill-Rom, Batesville, IN) to reduce pressure on the flaps and surgical site for four weeks. A foam abduction pillow is used to immobilize the lower extremities and antispasmodic medications are administered to reduce the movement caused by muscle spasms. Patients who undergo excision of heterotopic ossification are given Didronel (Warner-Chilcott, Rockaway, NJ) to prevent heterotopic ossification recurrence in the acute stage and/or Indomethacin/ Nonsteroidal anti-inflammatory drug (Iroko Pharmaceuticals, Philadelphia, Pa).

The first dressing change was performed on postoperative day 5 and twice weekly for all subsequent dressing changes. The patient's insurance limited him from remaining an inpatient. Thus, the patient was discharged to a skilled nursing facility for several weeks until he can return for the contralateral surgical procedure.

Discussion

The above case represents a common clinical problem in spinal cord injury patients. Multiple stage IV ulcers are defined as clinical manifestation of more than two pressure ulcers. Patients with spinal cord injuries suffer from three major risk factors contributing to the formation of a pressure ulcer: 1) They do not sense discomfort or pain when their tissues become ischemic from long-standing pressure due to prolonged wheelchair sitting or horizontal positioning in bed, 2) They are unable to move their bodies to relieve this pressure and 3) They lose alpha adrenergic nerve fibers that control vascular tone, increasing the likelihood of vascular occlusion [8]. This combination creates the perfect storm for multiple, chronic, recurring ulcers.

Not only do these patients suffer from soft tissue destruction incurring multiple pressure ulcers, but also the paralyzed individual incurs bony pathology that must be addressed. The reported incidence of heterotopic ossification varies greatly in the SCI population, ranging from 10% to 53% [9,10].

Heterotopic Ossification (HO) is the formation of bony tissue outside the normal skeleton. This pathologic process was first described by Dejerine and Ceillier in 1918, in post-World War I veterans. In this ground-breaking publication, the authors observed that HO in SCI patients occurs only in patients with complete cord injury, in those that exhibit spasticity and below the level of the neurological injury [11].

Various clinical factors have been associated with neurogenic HO. However, a causal relationship between these factors and the development of HO post SCI has yet to be determined [12]. In a recent study by Yang et al. [13], the etiology of HO occurrence was attributed to a neurogenic process that occurs early after injury. This process is usually bilateral, interestingly, involving uninjured hip joints. Pressure ulcers result due to poor joint mobility and subsequent development of pressure points. Another hypothesis as described by Yang et al. [13] is that HO is an infection-driven process, in which HO is associated with either pressure sores or septic hip joints [14].

HO can be an extremely debilitating problem. Limitation of hip flexion range (0 to 20 degrees) can be so severe that the patient is unable to reach the sitting position, further predisposing the patient to development of pressure ulcers secondary to fixed pressure points from the HO on the skin [12].

The plastic surgeon in this field faces challenges in his or her approach to repairing multiple pressure ulcers in a patient with HO. The surgeon must decide if he or she will close all the ulcers in a one-stage or multi-staged procedure. Heterotopic ossification must be addressed in order to eliminate pelvic obliquity and tissue and muscle must be preserved for the inevitable recurrence [13]. Thus, the Girdlestone procedure as described by the senior author should be considered an excellent option in the treatment of severe heterotopic ossification in the setting of multiple pressure ulcers.

The Girdlestone procedure was first described in 1943 by Gathorne Robert Girdlestone, a British orthopedic surgeon. This procedure was first introduced as a treatment for polyarthritis and tuberculosis of the hip joint [9]. Overtime, this procedure has evolved. In 1991, the senior author presented the modified Girdlestone procedure utilizing the vastus lateralis muscle flap and customized postoperative management [12].

The goal of this procedure, as performed by the senior author includes: Filling the dead space secondary to bony resection to prevent proximal migration of the femur, a larger resection of the femur and a single-stage technique. [6]. Utilizing local muscle flaps to fill the cavity allows for vascularized tissue to effectively mitigate wound healing [6]. Fasciocutaneous, perforator based, and musculocutaneous flaps have all been shown to be effective treatment options for pressure ulcers with equivalent complication and recurrence rates [15]. The senior author recommends utilizing the pedicled muscle flap for sufficient elimination of dead space. The rectus femoris is especially useful in the non-ambulatory patient so that the vastus lateralis may be preserved for later use upon recurrence [7].

The senior author's standard protocol is to prevent recurrence of HO in the post-resection phase using anti-inflammatory drugs, such as indomethacin and etidronate [16]. Indomethacin is given when the surgical drainage decreases to a small volume. In a recent systematic review evaluating therapeutic interventions for HO following SCI, the authors highlight Level 1 evidence demonstrating that Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), Rofecoxib and Indomethacin, reduce the incidence of HO when administered early (3 weeks) after SCI [12]. The senior author starts etidronate 400 mg, three times per day, on post-operative day one [7]. In the same review, the authors found Level 2 evidence that etidronate can halt the progression of HO once the diagnosis is made if initiated early (3 to 6 weeks) and Level 4 evidence that bisphosphonates effectively halt secondary HO progression post-surgical resection of HO [12].

Conclusion

The patient presented here with multiple prior surgeries, multiple recurring stage IV ulcers in the setting of debilitating heterotopic ossification of the bilateral hips demonstrates the complex reconstructive nature of pressure ulcer management in the spinal cord patient. Our recommendation for the care of these patients includes multidisciplinary care, complete surgical excision of HO with modified Girdlestone procedure with complete soft tissue coverage and attention to post-operative care that emphasizes the prevention of HO.

References

1. National spinal cord injury statistical center. Spinal cord injury (SCI) facts and figures at a glance. 2016.

2. Kroll T. Rehabilitative needs of individuals with spinal cord injury

resulting from gun violence: The perspective of nursing and rehabilitation professionals. Appl Nurs Res. 2008;21(1):45-9.

3. Marin J, Nixon J, Gorecki C. A systematic review of risk factors for the development and recurrence of pressure ulcers in people with spinal cord injuries. Spinal Cord. 2013;51(7):522-7.
4. Goah SL, Schalden M, Pineada CG, Hsieh CH. Prevention of pressure ulcers among people with spinal cord injury: A systemic review. PM&R. 2015;7(6):613-36.
5. Byrne DW, Salzberg CA. Major risk factors for pressure ulcers in the spinal cord disabled: A literature review. Spinal Cord. 1996;34(5):255-63.
6. Rubayi S, Gabbay J, Kruger E, Ruhge K. The modified girdlestone procedure with muscle flap for management of pressure ulcers and heterotopic ossification of the hip region in spinal injury patients: A 15 year review with long-term follow-up. Ann Plast Surg. 2016;77(6):645-52.
7. Rubayi, Salah. Reconstructive plastic surgery of pressure ulcers. New York: Springer; 2015.
8. Christain D, Leland H, Rubayi S. Major repair for end stage pressure ulcer in a spinal cord injury patieint by disarticulation and total thigh flap a case report. J Dermatol Plast Surg. 2016;1:1005.
9. Van Kuijk AA, Geurts AC, van Kuppevelt HJ. Neurogenic heterotopic ossification in spinal cord injury. Spinal Cord. 2002;40(7):313-26.
10. Banovac K, Williams JM, Patrick LD, Haniff YM. Prevention of heterotopic ossification after spinal cord injury with indomethacin. Spinal Cord. 2001;39(7):370-4.
11. Dejerine A, Ceillier A. Paraosteoarthropathies of paraplegic patients by spinal cord lesion. Clin Orthop Relat Res. 1991;263:3-12.
12. Rubayi S, Pompan D, Garland D. Proximal femoral resection and myocuntaeous flap for treatment of pressure ulcers in spinal injury patients. Ann Plast Surg. 1991;27(2):132-8.
13. Yang K, Graf A, Sanger J. Pressure ulcer reconstruction in patients with heterotopic ossification after spinal cord injury: A case series and review of literature. J Plast Reconstr Surg. 2017;70(4):518-28.
14. Teasell R, Mehta S, Aubut J, Ashe M, Sequeira K, Macaluso S, et al. A systematic review of therapeutic interventions for heterotopic ossification following spinal cord injury. Spinal Cord. 2010;48(7):512-21.
15. Sameem M, Au M, Wood T, Farrokhyar F, Mahoney J. A systematic review of complication and recurrence rates of musculocuntaneous, fasciocutaneous, and perforator-based flaps for treatment of pressure sores. Plast Reconstr Surg. 2012;130(1):67e-77e.
16. Yao C, Perrault D, Rubayi S. Complex reconstructive plastic surgery for end stage pressure ulcers in spinal cord injury patients. Clin Surg. 2017;2:1325.