

Complex Reconstructive Plastic Surgery for Bilateral Stage IV Pressure Injury Involving The Hip Joint in The Spinal Cord Injury Patient

Pien I¹ and Rubayi S^{2*}

¹Department of Plastic Surgery, University of California, USA

²Division of Plastic Surgery, Department of Surgery, University of California - Los Angeles (UCLA)

Volume 1 Issue 5- 2018

Received Date: 18 July 2018

Accepted Date: 15 Aug 2018

Published Date: 18 Aug 2018

1. Abstract

Pressure ulcers represent an often complex problem for patients and health care providers and ancillary services. Patients who develop a pressure ulcer are at high risk for recurrence, and often can present with multiple wounds that require careful surgical planning to completely excise the diseased area, address concomitant precipitating or exacerbating factors, and provide coverage with adequate well-perfused soft tissue from the local region to allow for healing. In this case report, we present a patient with large, multiple stage IV pressure ulcers necessitating complex flap reconstruction in addition to the Girdle stone procedure for hip osteomyelitis and heterotopic ossification.

2. Introduction

Pressure ulcer care costs the US \$9.1-\$11.6 billion per year according to the Agency for Healthcare Research and Quality of the United States Department of Health and Human Services [1]. Care for patients with pressure ulcers is complex, requiring the coordination between multiple medical and surgical teams in addition to ancillary support teams. Pressure ulcers present unique challenges to the surgeon, with success of the operation tied not only to the choice of reconstruction but also the post-operative care, in both the immediate and long term setting.

Although specific independent risk factors for developing pressure ulcers in an adult patient population have not been able to be statistically proven, there are three major global aspects of all patients with this problem: 1. Restriction in mobility or activity, 2. Impaired perfusion, and 3. Pre-existing skin status [2].

Because pressure ulcers can often occur in patients with spinal cord injuries who fulfill the “restriction in mobility or activity” global aspect, other considerations, such as severe muscle spasticity, joint ankylosis, joint subluxation or dislocation, and heterotopic ossification are also factors contributing to the complexity of this problem in this patient population. The hip joint can be a

significant problem in patients with spinal cord injuries, resulting in contractures, subluxation, or dislocations that create abnormal bony contours and pressure points which precipitate ulcer development [3]. The Girdle stone procedure, which was initially described in 1943 as a treatment for pyogenic arthritis, has been adapted by the senior author as the procedure of choice to address severe joint ankylosis, joint or bursal infection in patients with pressure ulcers in the setting of spinal cord injury [4,5]. This procedure, which carries significant morbidity in patients with previous independent function, in fact addresses multiple problems which are faced by this patient population. It removes and alters pressure points that cause mechanical wound problems and breakdown, eliminates the restrictive hip joint stiffness and/or ankylosis associated with prolonged disuse with or without heterotopic ossification, and frees up space to allow better coverage with soft tissue.

Within the subpopulation of patients with spinal cord injuries, the patients who are most at risk for developing pressure ulcers are those with limited access to long-term caretakers, insurance, social support, and other resources for prevention. And, pressure ulcers beget pressure ulcers [6]. Thus, the care of these patients can become a herculean effort. Performing the surgical recon-

*Corresponding Author (s): Division of Plastic Surgery, Department of Surgery, University of California - Los Angeles (UCLA) E-mail: srubayi@dhs.lacounty.gov

struction not only requires the technical aspects of surgery, but successful outcomes can only be achieved with careful nurturing of the patient and the wound for weeks to months after the operation itself. Comprehensive care of the pressure ulcer patient includes a dedicated surgical team, medical and specialty consultants, pharmacist, nursing staff, case manager/social worker, and physical/occupational therapist.

The surgical management of pressure ulcers has evolved over the years to encompass a single stage procedure where the ulcer is excised and the defect immediately closed with a combination of local tissue myocutaneous, muscular, or fasciocutaneous flaps [7]. The Girdle stone procedure has been previously described to be successful performed in a single stage, and this approach has been incorporated into the broader surgical management of single-stage pressure ulcer reconstruction [5] Here, we present a case of multiple stage IV pressure ulcers in a paraplegic patient necessitating complex flap reconstruction in addition to the Girdle stone procedure.

3. Case Presentation

3.1. Clinical History

The patient is a 56 year old homeless Hispanic male with a history of T11 incomplete paraplegia spinal cord injury secondary to a stab wound in 2017. As a result of the spinal cord injury, he suffered from neurogenic bowel for which he underwent creation of a diverting colostomy and neurogenic bladder managed with indwelling Foley catheter. He was hospitalized for several weeks after being found in the streets covered with feces from his colostomy which was missing the bag. He was initially stabilized in the intensive care unit for sepsis secondary to infected pressure ulcer and diffuse osteomyelitis of the sacrum, bilateral iliac bones, bilateral ischial tuberosities, left femur, and bilateral calcanei demonstrated on MRI. The patient received 6 weeks of targeted antibiotic therapy.

At the time of evaluation by the pressure ulcer management team, the patient had several stage IV pressure ulcers involving the left ischium, trochanter, and sacrum which were all in continuity to the left hip joint; in addition, there were stage IV pressure ulcers of the right ischium and trochanter. The wounds were dressed with half-strength Dakin's solution moist gauze three times per day to create clean ulcer bases prior to surgery.

4. Operative Procedure

4.1. Preoperative Protocol

Pre-operatively, the patient's nutrition and medical co morbidi-

ties are optimized to allow for wound healing and minimize complications. All patients undergoing pressure ulcer excision and coverage have their wounds swabbed and sent for culture so as to determine the pre-operative prophylactic antibiotic of choice, since many pressure ulcer patients have had histories of prolonged hospitalization and multi drug resistant bacterial colonization. Occult UTI can also be identified in patients who frequently have concomitant neurogenic bladder, so this is also treated prior to operative intervention. For ulcers in proximity (less than 5cm) to the anal verge, patients are evaluated for diverting colostomy to prevent wound or dressing contamination during surgery and also during the weeks-long healing period **Figure 1**.

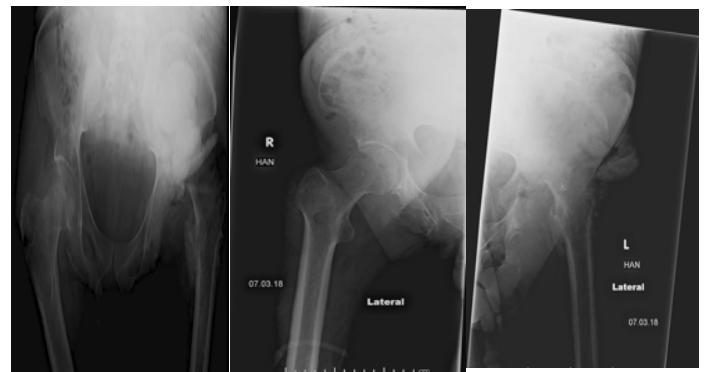


Figure 1: AP and lateral radiographs of the patient's pelvis demonstrating extensive erosion of the pelvic bone with dislocation and near fusion of the left femur to the left iliac bone with heterotopic ossification.

Standard pre-operative imaging includes plain films of the pelvis in order to identify dislocation, fracture, heterotopic ossification, or other abnormalities. More advanced imaging, including CT or MRI, is obtained only if clinically indicated in cases concerning for osteomyelitis or deep space infection. The patient's pre-operative pelvic XR is shown in **FIGURE 1**. Consultation to Physical Medicine & Rehab is common to manage the spasticity which afflicts spinal cord injury patients, and pre-operative muscle relaxants or botulinum toxin injections are often indicated.

5. Operative Procedure

The patient was brought to the operating room to undergo excision of all ulcers, excision of left hip/proximal femoral heterotopic ossification (Girdle stone procedure), coverage with left vastus lateralis muscle flap, left rectus femoris muscle flap, left tensor fascia latafasciocutaneous flap, bilateral gluteus maximus musculocutaneous flaps, and split thickness skin grafts. Pre-operative photographs of the ulcers are shown in **Figure 2**.

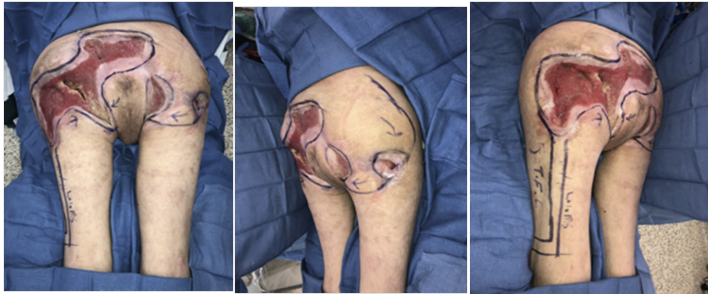


Figure 2: Pre-operative markings depicting extensive stage IV ulceration of of the left ischium, trochanter, and sacrum, in addition to stage IV ulceration of the right ischium and trochanter with proposed excision margins. On the left, the lateral intermuscular septum and tensor fascia latafasciocutaneous flap is marked. Arrows delineate the proposed rotation/advancement of the fasciocutaneous and mucu-locutaneous flaps.

Excision of all ulcers is accomplished with a combination of sharp dissection and electrocautery. A 1cm rim of grossly normal tissue around each ulcer in included in the resection. For ulcers with tracts or significant undermining, methylene blue on a cotton swab is used to paint the extent of ulceration to accurately identify the entire bursa. **Figure 3** demonstrates the final surgical defect after excision of all ulcers.



Figure 3: Final defect following excision of left stage IV ischial, trochanter, sacral ulcer, and right stage IV ischial and trochanter ulcer.

The left proximal femoral head and neck were exposed posteriorly in order to prepare for the Girdle stone procedure. As seen on pre-operative radiographs, the patient had significant destruction of normal anatomy of the left hip joint with severe heterotopic ossification. The femoral head and proximal femoral neck, including the lesser trochanter and all associated heterotopic ossification was excised with an oscillating bone saw. The intra-op view and subsequent resected specimen is shown in **Figure 4**. The final surgical defect of the left ischial, sacral and trochanteric ulcer with removal of the proximal femoral head and neck measured 32cm x 17cm x 4cm. The right ischial defect measured 9cm x 10cm x 3cm; the right trochanteric defect measured 7.5cm x 7cm x 2.75cm.

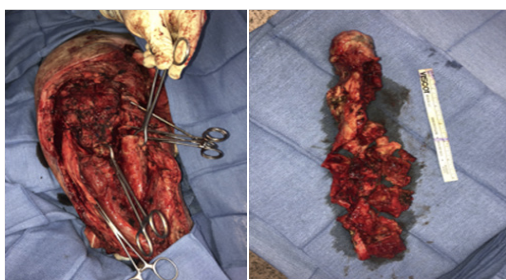


Figure 4: Left Girdlestone procedure specimen. Note the femoral head and resection of the proximal femur to include the lesser trochanter.

The extent of resection and soft tissue defect on the left side necessitated multiple flaps to fill in dead space and provide resurfacing. For resurfacing, the left tensor fascia latafasciocutaneous flap was utilized as a rotation flap, and a left gluteus maximus musculocutaneous flap was also required to partially advance over the ischial defect. The rectus femoris and vastus lateralis muscles were exposed and elevated via a mid-thigh incision between the lateral intermuscular septum and anterior border of the tensor fascia lata with transection at their distal insertion near the patella in order to fill in the dead space. The rectus femoris was turned over to cover the proximal exposed femoral shaft and left ischial defect; the vastus lateralis was reflected to cover the sacral defect. The flaps and their inset are shown in **Figure 5**.

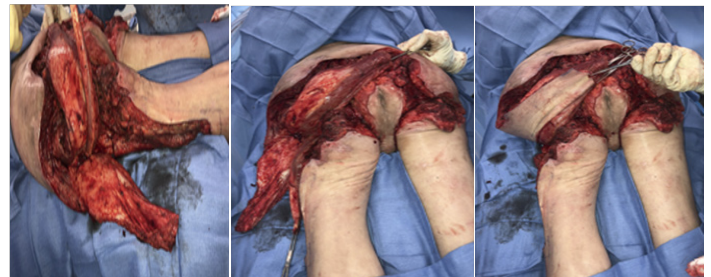


Figure 5: (left) Left tensor fascia latafasciocutaneous flap, left vastus lateralis and rectus femoris elevated in preparation for transposition/turnover to cover dead space after Girdlestone procedure and ulcer excision. (center) Vastus lateralis turnover into sacral defect. (right) Tensor fascia lata flap inset to partially cover the transposed vastus lateralis requiring mobilization of left gluteus maximus musculocutaneous advancement to allow for primary closure.

On the right, the ischial ulcer defect was able to be closed primarily, as the patient had sufficient tissue laxity. The trochanteric defect was closed with mobilization of a large right gluteus maximus musculocutaneous rotation advancement flap with the plane of dissection between the gluteus maximus and gluteus medius. **Figure 6** shows the flap elevation and proposed inset.



Figure 6: Right gluteus maximus musculocutaneous rotation advancement flap to cover the right trochanteric ulcer excision defect.

The majority of the wounds were able to be closed primarily; however, a 6cm x 16cm area of the vastus lateralis turnover flap remained exposed. Thus, a split thickness skin graft was harvested from the right posterior thigh and bolstered in place, shown in **Figure 7**.

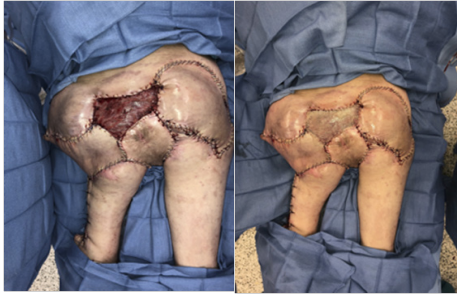


Figure 7: (left) Remaining exposed area of the vastus lateralis turnover flap. (right) Final closure after application of split thickness skin graft.

6. Post-operative Protocol

A post-operative pelvic radiograph in the recovery unit is performed and is shown in **Figure 8**. Bilateral lower extremity abduction pillows are placed to help prevent spasms from causing shear, friction, or unnecessary mechanical factors to cause dehiscence or wound breakdown. A standardized protocol has been developed by the senior author to minimize wound dehiscence, flap ischemia, and complications. Patients are restricted to bed rest on an air-fluidized bed for 4-6 weeks post-operatively with the first dressing changes performed 1 week post-operatively. Drains are removed once daily output is less than 30cc per day, which typically occurs within the first 1-2 weeks. To prevent heterotopic ossification, patients are started on etidronate and/or nonsteroidal anti-inflammatory drug as tolerated. Dressings involve antibiotic ointment (mupirocin), xeroform gauze, 4x4 gauze, and abdominal pads secured into place with non-woven or silk tape changed on a daily to twice-weekly basis. Local wound care and bedside debridement for any areas of epidermolysis, dehiscence/wound breakdown, or full thickness necrosis and eschar formation is continued until healed. Patient received double protein and double calorie meals with vitamin supplementation. Local electrical stimulation can also be administered as an ancillary measure to aid in wound healing. This patient did develop some very small areas of necrosis at the distal tip of the left tensor fascia latafasciocutaneous flap which was managed with local wound care at the two-week mark, shown in **Figure 9**.



Figure 8: AP radiographic demonstrating post-operative appearance of resected proximal left femur and heterotopic ossification.

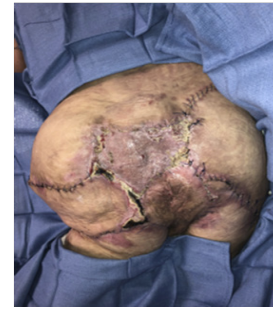


Figure 9: Post-operative appearance at two weeks with very minor full thickness necrosis of the distal tip of the tensor fascia latafasciocutaneous flap. The skin graft had excellent take over the turnover vastus lateralis muscle flap.

7. Discussion

Pressure ulcer management encompasses multiple specialties and requires understanding of the underlying causes of ulcer development. Preventative measures cannot be overstated, as surgical reconstruction can become quite complex and require significant investments from all involved in the care of patients with these wounds. Irreversible pressure injury can occur with as little as 70mmHg over 2 hours [8]. Patients with spinal cord injuries represent a unique population where their pathology truly optimizes pressure ulcer formation – they often have lost protective sensation to alert impending pressure injury; they may not be capable of independent movement to shift while in prolonged positions, as in a wheelchair or facility bed; loss of adrenergic innervation to the vasculature results in increased probability of occlusion; joint contractures and bony changes can result in abnormal bony prominences that put increased pressure on the overlying soft tissue. It has been reported that up to 40% of spinal cord injury patients will develop pressure ulcers within their lifetime [9].

Once a pressure ulcer develops, it can progress quickly through the four stages of ulceration. Surgical management is typically indicated for stage three and four ulcers, and often these injuries exhibit a “tip of the iceberg” phenomenon where the externally visualized ulcer tracks more deeply or more extensively than what can be seen on initial examination. Patients who develop one ulcer can rapidly develop multiple, and recurrence rates have been described as ranging as high as 20%. [10] The key to treating these wounds is to address as many risk factors as possible with an interdisciplinary approach.

The effects of certain mechanical causes for pressure ulcer development can be mitigated. For example, muscle spasticity as a result of loss of normal afferent and efferent nerve pathways can contribute to joint ankylosis and also apply deleterious mechanical forces onto any flap used in reconstruction. Muscle relaxants, botulinum toxic injections, and even surgical tenotomies are the mainstays of treatment and should be optimized prior to undergoing surgical excision and flap coverage of any pressure ulcer. Neurogenic heterotopic ossification, or the formation of

abnormal bony elements in spinal cord injury patients resulting in contracture or joint ankylosis, must be addressed. In the hip, it can be treated with a combination of prevention with aggressive physical therapy to preserve range of motion and surgical resection of the femoral head and proximal neck (Girdle stone procedure).

The importance of psychosocial support cannot be understated in helping patients find and become situated in environments that will prevent pressure ulcer recurrence. Nursing care is critical in the peri- and post-operative period, which can last up to several months, with daily to three times per day dressing changes. Patients must be compliant and adhere to strict bed rest on an air-fluidized, slow air loss mattress to prevent shear or pressure forces from negatively affecting flap healing. Education and training by occupational and physical therapists help patients with strategies to offload pressure strategically once they are discharged from the hospital to prevent recurrence. Psychologist and psychiatrists can help patients cope with concomitant stress, anxiety, or behavioral disorders that could contribute to patient noncompliance or. ***Pressure ulcer care truly requires a team effort from all healthcare providers.

8. Conclusion

Patients who develop pressure ulcers represent a unique and challenging population with a combination of social, psychological, medical and mechanical issues that require significant effort and thoughtful optimization for successful post-operative outcomes. The principles of pressure ulcer care can be applied to even complex or extensive ulcers to yield good results. Here, we present a case of multiple stage IV pressure ulcers in a paraplegic patient necessitating complex flap reconstruction in addition to the Girdle stone procedure.

References

1. Are we ready for this change?. Content last reviewed October 2014. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/professionals/systems/hospital/pressulreulcertoolkit/putool1.html>
2. Coleman S, Gorecki C, Nelson EA, Closs SJ, Defloor T, Halfens R, Nelson EA. Patient risk factors for pressure ulcer development: systematic review. *Int J Nurs Stud*. 2013; 50(7): 974-1003.
3. Dejerine A, Ceillier A. Paraosteopathies of paraplegic patients by spinal cord lesion: clinical and roentgenographic study. *ClinOrthopRelat Res*. 1991; (263): 3-12.
4. Girdlestone GR. Acute pyogenic arthritis of the hip: an operation giving free access and effective drainage. *Lancet*. 1943; (241): 419-421.
5. 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): 645-652.
6. DeJong G, Hsieh CH, Brown P, et al. Factors associated with pressure ulcer risk in spinal cord injury rehabilitation. *Am J Phys Med Rehabil*. 2014 Nov; 93(11): 971-986.
7. Rubayi S, Burnett CC. The efficacy of single-stage surgical management of multiple pressure sores in spinal cord-injured patients. *Ann Plast Surg*. 1999; 42(5): 533-539.
8. Brooks B, Duncan GW. Effects of pressure on tissues. *Clin Orthop Relat Res*; (113): 15-26.
9. Brienza D, Krishnan S, Karg P, Sowa G, Allegretti AL. Predictors of pressure ulcer incidence following traumatic spinal cord injury: a secondary analysis of prospective longitudinal study. *Spinal Cord*. 2018; 56(1): 28-34.
10. Sameem M, Au M, Wood T, Farrokhhyar F, Mahoney J. A systematic review of complication and recurrence rates of musculocutaneous, fasciocutaneous, and perforator-based flaps for treatment of pressure sores. *PlastReconstr Surg*. 2012; 130(1): 67e-77e.