SURGICAL RECONSTRUCTION IN PRESSURE ULCERS- A RETROSPECTIVE STUDY OF THE WORKHORSE FLAP OPTIONS

Sheeja Rajan T. M[1], Ranjith Satyan[2], Sreelesh L. S[3]

[1]Associate Professor, Department of Plastic Surgery, Government Medical College, Kozhikode, Kerala.
[2]Professor and HOD, Department of Plastic Surgery, Government Medical College, Kozhikode, Kerala.
[3]Assistant Professor, Department of Plastic Surgery, Government Medical College, Kozhikode, Kerala.

ABSTRACT

BACKGROUND

Pressure ulcers can significantly contribute to morbidity and mortality by chronic infections. Radical debridement of all devitalised and infected tissues followed by a reconstructive algorithm for soft tissue padding over bony prominences to prevent recurrent breakdown are the mainstay of surgical management of pressure ulcers. Choice of the soft tissue flap for reconstruction is influenced by the dimensions of ulcers, local tissue availability and surgeon's preferences.

MATERIALS AND METHODS

This retrospective study includes 140 patients with spinal injuries having pressure ulcers of NPUAP grade III and IV treated surgically over a period of four years. The demographics of pressure ulcers, the workhorse flap options as well as the outcome were analysed.

RESULTS

The pressure ulcers were seen predominantly in males (93.6%) of 40-49 years' age group (42.8%). Ischial pressure ulcers (n=104) constituted 74.2% followed by sacral pressure ulcers (n=24) that is 17.1% and trochanteric pressure ulcers (n=12) in 8.6%. Debridement and direct closure of wound were possible only in 10 cases. Majority (92.8%) of patients needed additional tissues for wound coverage. Our workhorse fasciocutaneous flaps were rotation flaps from the gluteal region or posterior thigh with medial or lateral based designs (34.2%). Local muscle tissue was used in 64 cases (46%) either as gluteal, tensor fascia lata and biceps femoris myocutaneous flaps or gluteus maximus, hamstring or gracilis muscle fillers in myoplasty.

CONCLUSIONS

Rotation flap along with myoplasty were our workhorse flap options in majority of the pressure ulcers. But, our future perspective is to spare muscle and use more fasciocutaneous perforator flaps for reconstruction according to evidence-based clinical practice.

KEYWORDS

Ischial Sores, Pressure Ulcers, Pressure Sore Management, Plegic Patients, Reconstructive Surgery, Sacral Sores, Spinal Cord Injury, Trochanteric Sores.

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BACKGROUND

Pressure ulcers, pressure sores and decubitus ulcers are terms synonymously used to refer to tissue ulceration seen over pressure points in debilitated patients. They have been recognised as a disease entity since prehistoric times. Evidence of pressure ulcers can be found in Egyptian mummies who were treated with honey according to their ancient scriptures.[1] Hippocrates (460-370 BC) is known to have associated pressure ulcers with paraplegics having bladder and bowel dysfunction.[1]

Pressure ulcers are a serious complication in elderly, debilitated and immobile patients and can significantly contribute to mortality in them. Chauhan et al reported the prevalence of pressure ulcers in India as 4.94%.[2] With conscientious efforts at nursing care and guidelines from advisory panels in USA and European countries, the prevalence of high-grade pressure ulcers has come down to 3.4% in elderly in nursing care institutions. However, they still continue to be a significant complication in younger patients with spinal cord injury having a significant impact on the overall quality of life. Furthermore, the longstanding cases of pressure ulcers pose a heavy burden on the health care economy of a country.

Pressure ulcers after spine injury are most frequently located in the ischial, sacral and trochanteric regions contributing to 62% of the total ulcers.[3] General condition of these patients are often poor due to anaemia and hypoproteinaemia as well as due to local and systemic infections, all of which are detrimental to proper wound healing. These factors need rigorous management before undertaking any surgical procedure for pressure ulcers. Radical debridement of all devitalised and infected tissues followed by a logical sequence of reconstructive procedures are the mainstay of surgical management of pressure ulcers.

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Corresponding Author:
Dr. Sheeja Rajan T. M,
Shrirang, Opp. Chevayur Telephone Exchange,
P.O. Chevayur, Kozhikode - 673017, Kerala.
E-mail: sheejarajantm@gmail.com
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Reconstructive algorithm followed in pressure ulcers is governed by the singular aim of giving adequate soft tissue padding for support and protection over bony prominences, which is crucial in prevention of recurrent breakdown. Choice of the flap for reconstruction is influenced by the dimensions and location of pressure ulcers, availability of local tissues and their vascularity as well as by the surgeon's preference.

The current study reviews the various surgical interventions performed in patients with longstanding pressure ulcers over a 4 year period in a tertiary care hospital in the public sector.

MATERIALS AND METHODS

This is a retrospective study, which includes 140 patients with pressure ulcers of long duration (2-18 months) treated surgically over a period of four years from January 2011 to December 2014. The patients had either paraplegia or quadriplegia predisposing to the development of pressure ulcers. Pressure ulcers of National Pressure Ulcer Advisory Panel (NPUAP) grade III or IV involving sacral, ischial and trochanteric areas were included in this study. Management of the pressure ulcers including the protocol for preoperative preparation, the method of surgical interventions, postoperative care, the average hospital stays and rehabilitation was analysed. All the procedures were performed by the surgical team from plastic and reconstructive surgery. The data was collected and analysed from the archives of a single tertiary care teaching hospital in the public sector.

RESULTS

In this study, the pressure ulcers were predominantly males (n=131; 93.6%), as compared to females (n=9; 6.4%). The incidence of pressure ulcers were highest in the 40-49 years age group (n=60; 42.8%), followed by 30-39 years age group (n=58; 41.4%) [Table 1]. Four patients in our series had quadriplegia, whereas 136 had paraplegia as predisposing factors for developing pressure ulcers. Except for patients with congenital meningomyelocele, all the others (n=136) had orthopaedic trauma of the spine causing paralysis. Among the traumatic paralysis group, 6 patients had sustained fracture to cervical spine and 130 patients had injured their thoracic spine. All the patients with cervical spine trauma and 112 patients with thoracic spine injury had undergone skeletal fixation of the spine fracture.

Distribution of patients presenting in the 4 years were the highest in 2011 (n=41) and 2012 (n=40) followed by 2013 (n=35) and 2014 (n=24). In terms of body localisation of pressure sores, ischial pressure ulcers (n=104) constituted 74.2% followed by sacral pressure ulcers (n=24) that is 17.1% and trochanteric pressure ulcers (n=12) in 8.6%. 12 patients had pressure ulcers involving multiple locations and 25 patients had bilateral pressure ulcers over either ischium as trochanter of varying severity. In our study, the location of the pressure sore that underwent surgical reconstruction alone was considered (Table 2).

After adequate preoperative preparation, surgical interventions were undertaken in the patients. The standard protocol followed in our center was to do pseudotumour excision technique for bursectomy in ischial and trochanteric pressure ulcers followed by judicious ostectomy. The resultant dead space was filled with myoplasty in ischial ulcers and appropriate flap options for wound closure in the other locations. In sacral pressure sores, the ulcer was resected followed by excision of osteomyelitic parts of sacrum and coccyx followed by a supple flap cover. Both myocutaneous and fasciocutaneous flaps were used. Bilateral ulcers were operated in a single sitting if the general condition of patient permitted. Otherwise, staged procedures were used.

The various reconstruction options used for wound closure in pressure ulcers were as follows (Chart 1). Direct closure of wound was possible only in 10 cases. Majority (92.8%) of patients needed additional tissues for wound coverage. Rotation flaps from thigh in ischial pressure ulcers and gluteal rotation flaps in sacral pressure ulcers were most frequently used (n=48). V-Y design of flaps from gluteal, posterior thigh regions (n=28) or Tensor Fascia Lata (TFL) flaps (n=12) were also used frequently. Posterior thigh transposition flap was used in 15 cases. Limberg flaps were used in smaller dimensions of sacral ulcers or grade III ischial pressure ulcer (n=4). In select cases, additional procedures like scrotal skin advancement for perineal ulcer (n=1) and haemorrhoidectomy were also performed. Myoplasty (n=64; 45%) of local muscle was done for obliteration of dead space after bursa excision using inferior part of gluteus maximus muscle (n=36) or biceps femoris muscle (n=12) or gracilis muscle (n=16) in deep ischial pressure ulcers (Chart 2). Skin grafting was used in a large sacral sore with recovering spine injury.

Most frequent complications encountered were suture dehiscence (n=11; 7.9%), which necessitated secondary suturing. Haematoma evacuations were needed in three cases and packing and late closure due to bleeding in five. Six cases had marginal flap necrosis and infection. Five cases required multiple debridement before definitive wound cover. In two cases of recalcitrant infection, debridement with Negative Pressure Wound Therapy (NPWT) was employed with late closure of wound. Sutures were removed at three weeks. Patients were allowed to exert gradual pressure on flap by six weeks. Average duration of hospitalisation was four weeks.

Gender	No. (n=140)	%
Male	131	93.6
Female	9	6.4

Table 1. General Characteristics of Patients with Pressure Ulcers

Age Group (Years)	No. (n=140)
0-9	3
10-19	1
20-29	8
30-39	58
40-49	60
50-59	9
60-69	1

Anatomic Location	2011	2012	2013	2014	Total
Ischial	35	33	20	17	105
Sacral	4	6	10	4	24
Trochanteric	2	1	5	3	11
Total	**41**	**40**	**35**	**24**	**140**

Table 2. Anatomical Distribution of Pressure Ulcers Presenting Over 2011-2014 Period

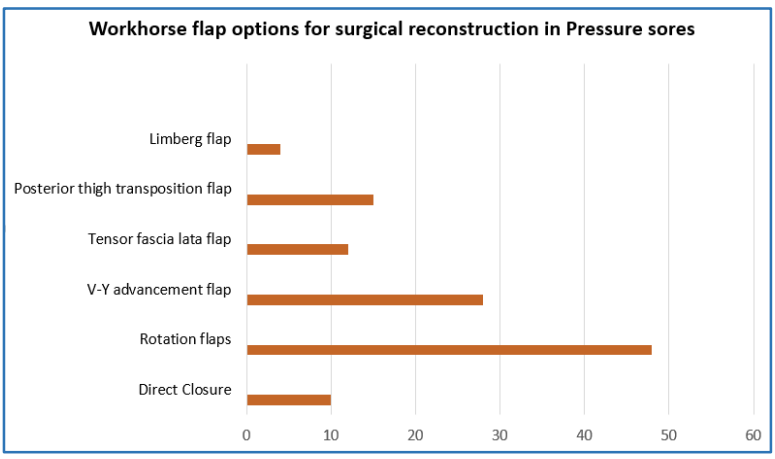

Chart 1

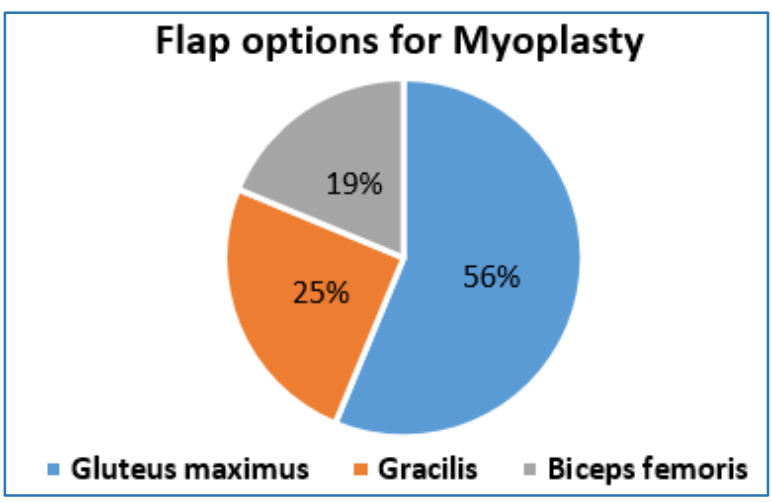

Chart 2

Figure 1a and 1b- Sacral Pressure Sore with Gluteal V-Y Flap Reconstruction

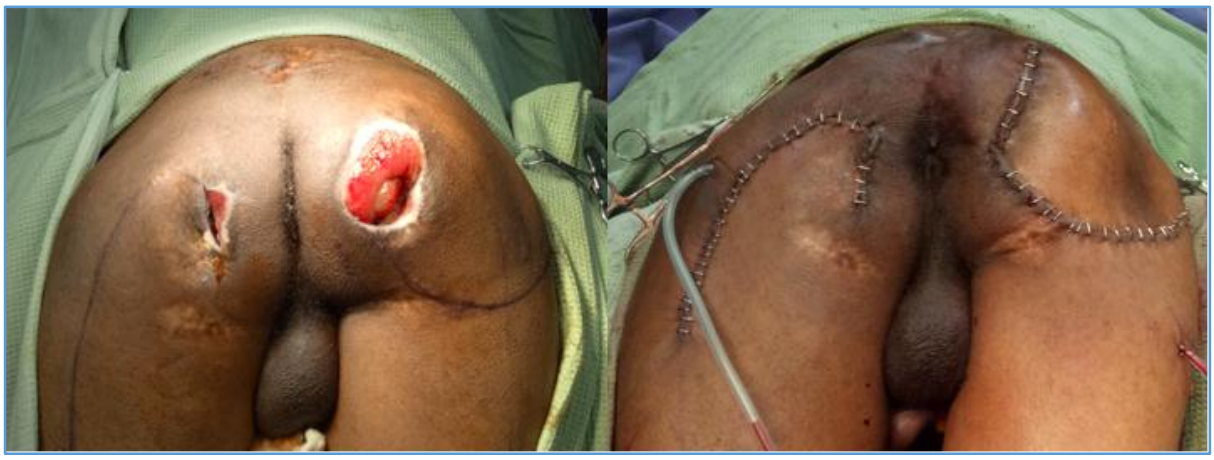

Figure 2a and 2b- Bilateral Ischial Pressure Sores Reconstructed with Medially Based Posterior Thigh Rotation Flap on the Left Side and Superiorly Based Gluteal Rotation Flap on the Right Side

DISCUSSION

The term "pressure ulcer" was popularised by the Agency for Healthcare Research and Quality.[1] Agarwal et al defines pressure ulcer as an area of localised soft tissue ischaemic necrosis caused by prolonged pressure higher than the capillary pressure with or without shear related to posture and usually occurring over a bony prominence.[1] This is a modification for the definitions proposed by the Pressure Ulcer Advisory Panels in USA and Europe, namely, NPUAP established in 1987 and EPUAP in 1996. NPUAP classifies pressure ulcers into four grades of increasing severity.[4] Only grade III and IV require surgical intervention with the other two being managed conservatively with adequate pressure relieving mechanisms, topical and systemic antibiotics as well as nutritional support.

Pressure ulcer starts as non-blanching erythema and progressively deepens into an ulcer. Uninterrupted pressure causes muscle necrosis that is out of proportion to the smaller sized skin ulcer leading to the subsequent fibrosis and formation of an inverted cone-shaped pseudobursa with the base overlying a bony prominence. Persistent inflammation involves the underlying bone leading to chronic osteomyelitis. Resection of the osteomyelitic bone can reduce recurrence rate of pressure ulcers after surgery.[5,6] Removal of excessive bone leads to shift of pressure to the opposite or adjacent bony prominences increasing the propensity for further pressure ulceration, and therefore, judicious ostectomy is followed. Ueda et al[7] reported 22% mortality over 20 years and Kuwahara et al[8] as high as 68.8% due to secondary systemic complications even after surgical intervention.

Hence, surgical management of pressure ulcers is a challenge requiring time, patience and adequate resources. Surgery is aimed at achieving complete wound healing, adequate pressure sore free period and ultimately improve quality of life of the patient and help them pursue a vocation. This is especially significant for many of our patients who had been the sole breadwinner of their family were young males (93.6%) in the third and fourth decades of life. Our findings are comparable to the study by Duci et al[9] where the average age of patients in 34.8 years. The most common predisposing factor in our series of patients was traumatic paraplegia involving the thoracic spine (92.8%). They were attempting rehabilitation and accustomed to sitting in wheelchairs with inadequate support. The pressure-friction-shear trio resulting from the bottoming out of the wheelchair seats along with the moisture from incontinent bladder and bowel were all contributing to the aetiopathogenesis of the ulcers and posing serious risks for recurrence of ulcers in the postoperative period.

Needless to say, the body localisation of pressure ulcers in our patients was most frequently over the ischial tuberosities (74.2%) followed by sacral (17%) and trochanteric pressure sores (8.6%). Pressure ulcers in multiple locations with bilateral involvement were also posing serious problems in surgical management and rehabilitation. The patients required multidisciplinary team approach to attain adequate nutritional status with control of comorbidities and infective foci prior to surgery. We ensured that the patient and caregivers were adequately educated and motivated to ensure their cooperation in preventing recurrences in the postoperative period.

The preparation of wound was achieved in a single debridement in all except in 5 cases who required multiple debridements for control of inflammation before wound coverage. Surgery was staged in 5 patients due to excessive bleeding after ostectomy. We ensured that adequate blood and inotropic support is arranged preoperatively due to propensity of blood loss and autonomic dysreflexia in these patients leading to shock.

Various methods are described in literature for closure of wounds after pressure ulcer excision.[10-14] The mainstay of wound cover is to use a well-padded myocutaneous or fasciocutaneous flap. The choice of the flap depends on the surgeon's preference and expertise. Thiessen et al[15] stated that fasciocutaneous flaps have good blood supply, tolerance to infection and coverage capabilities similar to myocutaneous flaps and are sufficient to cover average sized lesions and that the use of muscle is justifiable only in extremely large defects.

In our series, direct closure was performed only in 10 cases of ischial pressure ulcers with very small dimension in NPUAP grade III category. Direct closure and subsequent scarring are associated with higher recurrence rate as in

Larson et al[16] series. Our workhorse fasciocutaneous flaps were rotation flaps from the gluteal region or posterior thigh with medial or lateral based designs for ischial pressure ulcers (34.2%).

Gluteal rotation flaps or gluteal V-Y advancement flaps were used in sacral pressure ulcers. Other fasciocutaneous flaps used were post thigh flap transpositions or in V-Y design for ischial pressure ulcer. TFL was used in transposition and V-Y designs in trochanteric pre sores. Smaller defects of ischium and sacrum could be covered with Limberg flap and its Dufourmental modification.

Muscles were used for wound coverage either as myocutaneous flaps or as myoplasty to fill dead space under fasciocutaneous flaps. Gluteal myocutaneous flap for sacral pressure ulcer and biceps femoris myocutaneous flap for ischial ulcers were the commonly employed flaps. Inferior gluteus maximus, hamstring or gracilis muscles were used as fillers in myoplasty. Thiessen et al[15] have pointed out that using muscle in pressure ulcer coverage can be detrimental to the ambulation of recovering paraplegic patients and also that they diminish future reconstructive possibilities with flaps. We have used muscle in 64 cases (46%). But, our future perspective is to spare muscle and use more fasciocutaneous perforator flaps for reconstruction according to evidence-based clinical practice.[17-19]

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