

Surgical Reconstruction of Pressure Ulcers in Patients with Spinal Cord Disease: A Prospective Study

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Abstract

Objective: To study efficacy of surgery in the management of pressure ulcers in spinal cord disease.

Design: Prospective, follow up study.

Setting: Neurological rehabilitation unit of a tertiary centre.

Sample: Patients of spinal cord diseases with grade III/IV pressure ulcers, underwent surgical reconstruction and rehabilitation in year 2005 with a minimum follow up duration of one year.

Outcome measures: Ulcer healing rate, postoperative complications, ulcers recurrence rate.
Statistical analysis: Frequency analysis on SPSS 13.0 for windows.

Results: Surgical intervention was carried out in 25 subjects (M-19, F-6), having total 39 ulcers (stage III -16, IV - 23). Surgeries performed were: debridement - 3, split skin grafting -13 and flap mobilization and closure - 23. Only four subjects (16.6%) had initial complications: wound dehiscence - 2 and delayed graft healing -2. Follow up rate was 92.0% (23/25 patients), duration of 12-21 months (mean 15.4+/- 7.45m) and only four subjects (17.3%) had ulcer recurrence.

Discussion: All outcome variables showed significant improvement at follow up with good ulcer healing rate (87.0%), low initial complication (16.6%) and recurrence rate (17.3%).

Conclusion: Timely surgical interventions are necessary for pressure ulcers. Reconstructive procedures are simple & highly effective and should be an integral part of rehabilitation program.

Key words: debridement, pressure ulcer, flap mobilization, primary closure, recovery, rehabilitation, spinal cord disease, surgery, skin grafting

Introduction

Pressure ulcers have a human affliction since antiquity. Overall, 85% of subjects with spinal cord disorders develop a pressure ulcer during their lifetime, and around 8% die from them¹. Pressure ulcer result in the loss of therapy time, increase the duration of hospital stay,

escalate the cost of treatment, aggravate spasticity, delay neurological recovery, and impair quality of life. Various physical, pharmacologic, and surgical methods have been tried in the treatment of pressure ulcers. Sir John Staige Davies is credited with being the first to attempt surgical cure of pressure sores². Now, several decades later, several options are available for surgical management of pressure ulcers, including direct closure, skin grafting, skin flaps, and musculo-cutaneous flaps³. Immediate post-operative complications and ulcer recurrence rates at follow up have been remarkably high, particularly in

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patients with spinal cord injury^{4,5,6}. These high incidences can be brought down by comprehensive care provided by the rehabilitation team⁵.

The aim of our study was to determine efficacy of surgical interventions in the management of pressure ulcers in patients with spinal cord diseases.

Methods

This prospective study was conducted in the department of Psychiatric & Neurological rehabilitation, National Institute of Mental Health & Neurosciences (NIMHANS), Bangalore, India. Patients with spinal cord disorders admitted in the neurological rehabilitation ward with pressure ulcers within one year period of January to December 2005 having grade III/IV pressure ulcers were included in the study. Pressure ulcers were divided into four stages as per National Pressure Ulcer Advisory Panel (NPUAP 1989)⁷. Subjects with ulcers due to other causes, primary site of pathology other than spinal cord, grade I/II and poor general condition to undergo a surgical procedure were excluded from the study.

Socio-demographic and clinical information was obtained in a pre-designed format. The socio-demographic information included was age, sex, primary illness, and Braden pressure ulcer risk assessment scale⁸. The clinical examination was done according to the guidelines of the International Standards for Neurological Examination and Functional Classification of Spinal Cord Injury (ASIA Grade)⁹. The data collected for pressure ulcer were number, site, duration and staging of each ulcer. Photographs of all ulcers were taken preoperatively, postoperatively, after suture removal and repeated at follow up.

The principle of management was to treat the patient with the spinal cord disease as a whole and not the ulcer only. The intervention was divided into three continuous stages of preoperative, operative and post operative management. The preoperative management consisted of proper nursing care, bedside debridement and dressing and education regarding ulcer care. Operative interventions were decided on the basis of ulcer stage and presence /absence of eschar: grade III / IV necrotic wounds - debridement, grade III clean and granulating – skin grafting, and grade IV clean and granulating – local flap mobilization and primary closure. Post operative management consisted of continuous negative pressure by suction drain for 48-72 hr and appropriate wound hygiene. Sutures were removed on postoperative day 10, followed by gradual mobilization and weight bearing on the affected part.

Postoperative complications recorded were wound dehiscence, graft failure and bleeding etc. At follow up, ulcer recurrence and neurological examination were

recorded. All recordings were done by single evaluator. Outcome measures were initial complications after surgery, ulcer healing and recurrence rate. Frequency analysis was done for the outcome variables on SPSS13.0 for windows.

Results

Of 180 persons admitted in the neurological rehabilitation ward during the study period, 45 had pressure ulcers at the time of admission. Twenty five subjects (19 men, 6 women and 22 paraplegics, 3 tetraplegics) satisfied the inclusion criteria for the study. Age ranged from 13-45 years (mean 27.6 ± 7.45 y). The etiology of spinal cord lesions were: Transverse myelitis – 7, spinal tuberculosis - 6, spinal cord trauma – 5, spinal tumors - 3, ossified posterior longitudinal ligament – 2, lumbar meningomyelocele - 2. Neurological evaluation revealed most of the subjects in ASIA Grade A- 20 (80%), Grade B- 3 (12%), Grade C- 2 (8%), Grade D- 0 and Grade E- 0. Pressure ulcer risk assessment on Braden scale showed that 22 (88.0%) subjects were in high risk category (score <16), while remaining 3 (12%) had low risk (score >16).

Total twenty five subjects (39 ulcers) were included in the study: sixteen subjects (64.0%) had a single pressure ulcer; where as 9 (36.0%) had multiple ulcers. 5 (20.0%) subjects had two ulcers, 3 (12.0%) had three ulcers and 1 (4.0%) subject had four ulcers. The number of ulcers by stage at beginning of the study was: Stage III – 13 (33.3%), Stage IV- 26 (66.6%). The number and location of these ulcers were: Sacrum 13 (33.3%), gluteal region - 9 (23.0%), greater trochanter - 8 (20.5%), ischial tuberosity - 4 (10.2%), heel - 2 (5.1%), sole of feet - 2 (5.1%) and dorsum of ankle – 1 (2.5%). Most ulcers, 20 (51.2%) evolved in the acute care facility, 15 (38.4%) at home and 4 (10.2%) in the rehabilitation ward.

Surgical procedures carried out were: debridement, 3 (7.6%); skin grafting, 13 (33.3%); and flap mobilization and closure, 23 (58.9%). Single stage debridement was done in three subjects under monitored anesthetic care due to large size of sacral ulcers with significant necrotic tissue (Figure 1). Two of these subjects were referred to a general medical facility for management of the



Figure 1: Debridement – Pre and post debridement



Figure 2: Split skin grafting (Sequence of events)



Figure 4: Local flap mobilization and primary closure (Sequence of events)

associated co-morbidities, and their ulcers were not healed at the time of referral. Split skin grafting was done for 13 ulcers: sacral -5, gluteal - 3, heel -2, sole -2, and ankle - 1 (Figure 2). Two grafts had postoperative complication, Methicillin Resistant Staphylococcus Aureus (MRSA) infection, which was managed by meticulous care and appropriate antibiotics. Both of these grafts were ultimately taken up but took a longer time. Local flap mobilization and primary closure was done in 23 ulcers: trochantric - 8, gluteal - 6, sacral -5, and ischial -4 (Figure 3). Two flap procedures had a suture line dehiscence as a result of the haematoma formation and excessive tension on the suture line. One of them required repeat closure while the other healed with conservative management. Therefore, postoperative complication occurred in 4 (10.2%) ulcers and consequently healing time was more in these four ulcers. Among rest 33 ulcers, average healing time for grafting procedures was 35.5 days where as, for flap mobilization and closure was 20.5 days. Thirty seven ulcers (94.8%) were healed at the time of discharge from the rehabilitation unit. The average time for starting sitting after surgery was 28 days, more for those who underwent grafting procedures than those with flap surgery.

All subjects were prospectively followed, but two subjects (who were referred to medical facility for the management of co-morbidities) were lost in follow up.

Follow up duration ranged from 12 to 21 months (mean 15.4 +/- 7.45). As compared to preoperative neurological status, 13 out of 23 (56.5%) patients had significant neurological recovery. Neurological evaluation at follow up revealed: ASIA Grade A - 5 (21.7%), Grade B - 1 (4.3%), Grade C - 2 (8.6%), Grade D - 15, and Grade E - 0 (Figure 4).

At follow up, ulcer recurrence was seen in 4 (17.3%) subjects: 3 (13.0%) had recurrence at the same site (all three were spinal cord injury and had a skin graft), where as, 1 (4.3%) had a new ulcer at different site (ischial). Ulcer healing rate was 87%; 20 out of 23 subjects had no local recurrence at the same site. Ulcer free rate was 82.7%; 19 out of 23 subjects had no new ulcer at follow up.

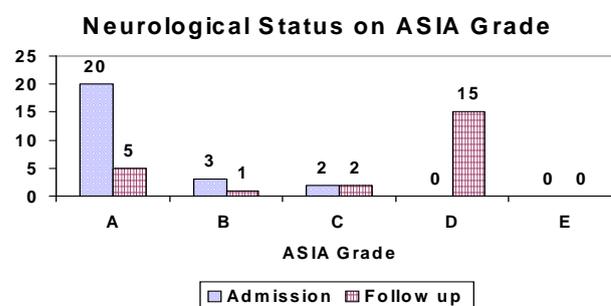


Figure 4: Neurological recovery on ASIA Grade at follow up as compared to admission

Discussion

Surgical management of pressure ulcer can provide skin and soft tissue coverage, physiological barrier to infection, eliminate dead space of the wound, and improve vascularity which enhances local oxygen tension, provides extended soft tissue penetration of antibiotics, and improves total lymphocyte function. In choosing the appropriate treatment strategy, consideration should be given to the stage of the wound and the purpose of the treatment. Wound care can be divided into non-operative and operative methods. Stage I/II pressure ulcers can be managed by non-operative means but stage III/IV requires surgical intervention¹⁰.

The surgical approach and management techniques have changed over the years. Some of these changes include reduction in the length of in hospital stay, wound cleansing and debridement methods, types of surgical procedures, and the reduction in postoperative immobilization. In our study, 6 (24%) subjects were admitted a week before surgery, while in the other 19 (76%) patients the admission to operative interval was long due to co-morbidities. Preoperative planning is mandatory. The decision to use a particular flap or type depends on the surgeon's expertise and preferences³. The position of the ulcer may suggest the most appropriate method. The local flap mobilization with primary closure method done in our study is a modification of double opposing semicircular flap for closing circular defects as advocated by Keyser et al¹¹. Diligent post operative care is important in avoiding the skin breakdown. Schryvers et al¹² in a study of 65 pressure ulcers managed by primary closure reported average healing time of 65.3 days which is much higher than our study of 25.91 days.

Suture line dehiscence and graft failure are most common complications after pressure ulcer surgery. In a 17 year review of surgical treatment of 280 pelvic area pressure ulcers in mostly spinal cord injured population, Foster et al¹³ found an overall 28% initial complication rate and 17% re-operation rate. Similarly, high complication rate of 36% and 42% have been reported by Disa et al⁶ and Schryvers et al¹² respectively. In our study, wound dehiscence and graft failure was noted in two cases each, all but one healed by conservative means, for which re-operation and closure was required leading to initial complication rate of 10.2% and re-operation rate of 2.6% respectively. Aggarwal et al¹⁴ in a study of 34 spinal cord injured subjects also reported lower (11.4%) incidence complications.

Postoperative ulcer recurrence is still seen with regularity, and success remains variable. Relander and Palmer⁴ reported a 48% recurrence rate for 66 surgically treated ulcers with follow-up ranging from 2 to 12 years

postoperatively. Similarly, Disa et al⁶ described a 61% recurrence rate at an average of just 9.3 months following reconstruction of 66 pressure ulcers. In fact, these dramatic statistics prompted the authors to question the validity of such reconstructions for both young post-traumatic patients and elderly patients with evidence of cerebral compromise. This work underscores that recurrence rates tend to vary not only according to anatomic wound location and closure method but also to pressure sore predisposing risk factors. Kirney et al⁸ in their 12-years review of 158 subjects with 268 pressure ulcers found an ulcer recurrence rate at same site of 19% which is comparable with our study of 17.3%. Similarly, low ulcer recurrence rates of 11.3% and 22% were also reported by Aggarwal et al¹⁴ and Bilkay et al¹⁵. In our study, recurrence rate was high among subset of subjects who underwent skin grafting procedures. In the treatment of pelvic area pressure ulcers, grafting has a useful but limited value because graft does not tolerate pressure well¹². As noted by Kirney et al⁵ active participation of the rehabilitation team in peri-operative care is important. The whole patient, not just the ulcer, needs treatment because there are many physical and psychosocial factors that require attention to optimize healing and prevent recurrence.

The higher success rate of surgical reconstruction in our study population can be due to supervised care and training provided by the combined and coordinated efforts of the rehabilitation team. But this emphasizes the need for involvement of rehabilitation team in the planning and management of patients with spinal cord disorders. Even if, patients with spinal cord disorders are admitted in other units for any procedures, timely referral to rehabilitation team will definitely improve the ultimate outcome.

However, there were few limitations in the study. The study has limited sample size and follow up duration was short. Large sample size and longer follow up duration may give better understanding of ulcer recurrence in patients with spinal cord diseases. Selection bias was there in the study in terms of age at onset, level of lesion and pattern of paralysis. As most of the patients were young adult paraplegics, had better participation in the rehabilitation program and became independent in ambulation leading to better ulcer healing rate at follow up.

Conclusion

Surgical interventions play an important role in the management of pressure ulcer in patients with spinal cord diseases. Wound dehiscence is a common complication, due to various reasons. Ulcer recurrence is more following skin grafting, if weight bearing is not prevented and there is no neurological or functional recovery. Timely surgical

interventions are necessary for grade III-IV pressure ulcers. Reconstructive procedures are simple and highly effective and should be an integral part of a rehabilitation program.

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