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Formation of reconstruction protocol for sacral pressure sore defects

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Abstract
The aim of this study is to formulate a protocol for reconstruction of sacral pressure sores by analyzing the data. A total of 50 patients with age ranging from 18 to 84 years were diagnosed with sacral pressure sore. Traumatic paraplegia, post traumatic quadriplegia, encephalitis, tumor compression causing paraplegia, fracture pelvis, fracture of neck of femur and head injury were the primary diagnosis. The pressure sores were managed by various reconstructive methods. Defects of <5cm and 5- 10cm are best managed by the following flaps – VY advancement, Skin rotation, Limberg flaps. Pressure sores of >10cm are best managed by bilateral skin rotation and transverse lumbosacral flaps. Effective control of infection by medical and surgical means prevents progression of pressure sores and promotes early wound healing. All bedridden patients need to be properly educated regarding prevention of pressure sores and routine self-examination for development of new pressure sores.

Keywords: sacral pressure sore, pressure sore management, pressure ulcers, pressure ulcer reconstruction, surgical management of pressure sore

1. Introduction
The pressure ulcers have been considered as a disease entity since ages even before the development of modern medicine. Pressure ulcers were also found in Egyptian mummies, which were more than 5,000 years old [1]. Pressure sore, is localized soft tissue injury resulting from unrelieved pressure, usually over a bony prominence. Since the area of pressure depends on patient position, the term “pressure sore” is preferred rather than bedsore or decubitus ulcer [2]. The delayed healing, high rate of recurrence and over added stress of the primary medical condition in patients makes the treatment of pressure ulcers a challenge for health care professionals [3].
Pressure sores have been described as one of the most costly and physically debilitating complications in the 20th century. They are the third most expensive disorder after cancer and cardiovascular diseases. The exact incidence of pressure sores is unclear but it is different in each clinical setting. There have been reports of incidence rates of 0.4% to 38% in inpatient care while prevalence was reported as 3.5% to 69%. In long term care, the incidence is between 2.2% to 23.9% while in home care, it varies from 0 to 17% [1].
Pressure ulcers occur in very ill patients who are kept in prolonged immobilization for nursing. In the early acute phase after spinal cord injury, the sacral area tends to be the most common site of pressure sores as patients are stabilized and treated for concomitant injuries in the supine position. In the sub-acute and chronic phases after spinal cord injury, the ischial area becomes the predominant site of pressure sores as the patient begins to sit up in a wheelchair during rehabilitation [4].
The reconstruction of sacral defects can be challenging for a plastic surgeon. Replacing the old unstable scar of pressure ulcer by a flap was suggested by John in 1938. Lamon described the first closure of open pressure sores in 1945, and by the end of the decade most of there was further advancement in surgical manipulations of pressure sores. Kostrubala and Greeley recommended excision of the bony prominence and padding the exposed bone with local fascia or muscled fascia flaps in 1947 [4].
Local flap options include muscle, fasciocutaneous and skin flaps from the gluteal region, such as gluteus maximus musculocutaneous flap, gluteal fasciocutaneous flap and gluteal rotation flaps. Wound care has become ever more complex and numerous technical refinements have been developed, but the basic concepts of patient optimization, complete debridement, and tension-free soft-tissue coverage remain constant. Early and successful management of pressure sores ensures early rehabilitation of the patient.
In an era where pressure ulcers are seen as a preventable disease, priority must be given to prevention. The education of health care professionals and patient care takers for detecting early signs is necessary. Management of a pressure ulcer is a challenge both to the patient as well as the health care system. Prevention and detection of pressure ulcers in bedridden patients is important to provide a good quality of life and longer life expectancy.

2. Materials and methods
2.1 Materials
The study includes patients who underwent reconstruction for sacral pressure sores in the Department of Plastic Surgery, SRM Medical College Hospital and Research Center, Chennai. The patients diagnosed with sacral pressure ulcer were also referred from Neurosurgery, General Surgery, General Medicine and Orthopedics department’s fifty patients of sacral pressure sore who underwent reconstruction procedures from November 2015 to January 2018 were included in the study. Patient demography, presentation,

diagnostic modalities, reconstruction procedures, outcomes and complications were analyzed. All patients were evaluated for their primary diagnosis as well. The patients were staged according to the size and depth of the ulcer. All the patients underwent surgical reconstruction.

2.2 Methods

The patients after admission were evaluated by obtaining history, thorough clinical examination and necessary investigations and formed a management plan. The sacral wounds were taken for surgery. They were debrided and freshening of margins of the wound was done in cases of superficial ulcers. Deep ulcers were debrided by pseudo tumour excision. The reconstruction of the sacral ulcers was decided depending on the size of the defects.

The various methods used were

1. Limberg flap
2. Unilateral gluteal skin rotation flap
3. Bilateral gluteal skin rotation flap
4. VY advancement flap
5. Bilateral VY advancement flap
6. Transverse lumbosacral flap
7. Double Z rhomboid flap
8. Secondary suturing
9. Split skin grafting

The patients were managed during their intraoperative and postoperative period. Any complications that developed were noted and managed accordingly. Once stabilized, the patients were discharged or referred back to their respective departments. The patients were followed up every week for the next month and once monthly for 6 months. All information was documented in a proforma developed for the study.

2.3 Methodology

The patients name age, sex, history of presenting illness and its duration were obtained. Past history of chronic medical and surgical illness noted. Personal history like smoking, alcohol consumption and diet pattern were obtained. Detailed physical examination of the pressure sore was made and tissue diagnosis was recorded and reconstruction planned accordingly. Neurological examination regarding sensory, motor impairment, bladder, bowel control, presence of contractures and spasms were noted. General investigation like urine examination, Hemogram, blood sugar and renal parameters were done. Serum protein levels were assessed. Wound swabs for culture and sensitivity were taken. X ray chest, X- ray of local part and ECG were taken.

Hypo-proteinemia was managed by appropriate nutritional supplementation. Infection was controlled by periodic wound debridement and antibiotics. Spasm relieved with Baclofen 100 mg twice daily. Adequate relief of pressure was obtained by application of air bed (alpha bed) and change of position every 2 hours, avoidance of moisture and nursing.

All the patients were informed about the surgical procedures, the intraoperative, post-operative complication and rehabilitation. A detailed informed consent regarding the procedure and its complications was obtained. Patients were operated under general anesthesia and in prone position. Postoperatively all the patients were managed until suture removal. Blood transfusion was given in indicated patients. If necessary, patients were observed in the surgical intensive care unit for a couple of days. Patients were educated regarding rehabilitation. The patients, once stabilized, were discharged or referred back to their respective departments and advised regular review. The patients were reviewed once every week for the next month, then monthly for a period of 6 months. The maximum follow up was for a period of 6 months.

3. Results & discussion

Pressure ulcers are a poorly understood complication seen in bed ridden individuals. The presence of pressure ulcers indicates inadequate nursing care as well as the degrading general health of the individual. Prolonged presence of untreated pressure ulcer can lead to development of a malignant neoplasm.

The incidences of pressure ulcers are variable as the patient population studied are from acute care settings, nursing homes, and in paraplegic population. Studies have shown that pressure ulcers develop in 9% of all hospitalized patients. [5] In acute and long term care facilities the overall reported incidences are 3.5% and 29.5%.[6] Pressure ulcers, if not managed in a timely manner, can lead to multiorgan failure and consequently death.

According to the recent definitions issued by the National Pressure Ulcer Advisory Panel (NPUAP), the term ‘pressure ulcer’ was replaced by the term ‘pressure injury’ in the National Pressure Ulcer Advisory Panel Pressure Injury Staging System. According to the NPUAP, the change in terminology was done as it accurately describes pressure injuries to both intact and ulcerated skin.

According to NPUAP, pressure injury is defined as the localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. This injury can present as intact skin or as an open ulcer and may or may not be painful. The injury occurs as a result of intense and prolonged pressure or pressure in combination with shear. The tolerance of soft tissue for pressure and shear may also be affected by microclimate, nutrition, perfusion, co-morbidities and condition of the soft tissue [7].

Recent advances in science and technology have provided various methods of managing a pressure but high recurrence rates have led to requirement for a reconstruction procedure. The goal of pressure ulcer reconstruction is to provide soft tissue coverage over the ulcer. Though a pressure sore may be closed by primarily, the recurrence rates are high as there is actual tissue deficiency and closed under greater tension. Transposition of local flaps is considered as the mainstay of treatment. Musculocutaneous and fasciocutaneous flaps have been successful as it provides adequate tissue bulk and enhanced perfusion and tissue coaptation in the depths for pressure sore coverage. Microvascular tissue transplantation for pressure sore reconstruction is reserved for cases where local flaps are not available. Nahai *et al.* [8] and Hill *et al.* [9] have described free tissue transfer in the reconstruction of pressure sores, with and without preservation of sensation.

Though free flap reconstruction is becoming more popular, the usage of these flaps in pressure sore reconstruction is yet to become popular.

Tissue expanders are tolerated very well in spinal cord injury patients. Esposito et al concluded that the main advantage of tissue expansion is the advancement of sensitive skin which helps in pressure awareness and future ulcer prevention. This is also useful in the event of an unstable wound secondary to previous skin graft or secondary healing [10].

3.1 Sample Size

Pao *et al.* [11] considered 36 patients, Hyun Ho Han *et al.* [12] also in their study of reconstruction of sacral pressure sores considered 13 patients. Y C Chen *et al.* considered 63 patients in his study [13]. Ahmad Al Fadhli *et al.* also considered 50 patients for his study [14].

3.2 Age Group

Our study included all patients who required surgical reconstruction for pressure ulcers. The maximum patients considered for the study were from 21-30years. In their study series Pao *et al.* [11] included patients of age 24 to 89 years (average 59.3 years; men 54.5 years; women 65.5 years). Hyun Ho Han *et al.* considered males of the age 26 to 89 years and females from 13years to 64 years [12].

3.3 Sex

Our study population was a group of patients who underwent surgical reconstruction for sacral pressure ulcer defect. There were 39 (78%) males and 11 (22%) females for the study. Studies by Pao *et al.* and Sever C *et al.* had 23 males and 13 females and 13 males respectively [11, 15].

3.4 Primary Diagnosis

In our study, patients were already diagnosed with encephalitis, fracture of neck of femur, fracture pelvis, head injury, traumatic paraplegia, traumatic quadriplegia, tuberculosis and tumor compression. The maximum number of patients having pressure ulcer were traumatic paraplegics, 18 cases (36%) while 9 (18%) patients were diagnosed with quadriplegia following trauma. The incidence of patients with encephalitis were 6 (12%), fracture of neck of femur 4(8%), fracture of pelvis 2(4%), head injury 7(14%), tuberculosis 2(4%) and tumor compression 2 (4%). Hyuck Jae Lee *et al.* [15] in their study of sacral pressure ulcers also had maximum of paraplegics. They also considered patients with encephalitis, quadriplegics and multiple sclerosis. All the patients in the study were bed ridden during their initial period of management for their primary disease. These are the patients who develop pressure ulcers. They were not educated for the need of preventive measures for pressure ulcers. Hence due to lack of proper care, these patients develop pressure ulcers. By the time these patients present to the hospital with non healing wound, the pressure ulcer usually progress to stage III ulcer.

3.5 Size of the Ulcer

In our study, the pressure ulcers were divided according to the size of the ulcer. The ulcers were designated as small for ulcers <5cm, medium for ulcers of size 5cm -10cm and large for ulcers >10cm. 35 (70%) patients were having medium sized ulcers while large and small sized ulcer were seen in 8 (16%) and 7 (14%) patients respectively. Korambayil, *et al.* in their study also considered patients with medium and large sized ulcers [17].

3.6 Risk Factors

In our study, risk factors like anemia, hypoalbuminemia and local wound infection. Out of the 50 patients considered for the study, 38 (76%) patients were diagnosed to be anemic. These patients were given blood transfusions and anemia corrected and taken up for surgical reconstruction. Hypoalbuminemia was identified in 42 (84%) patients and wound infection was seen in 45 (90%) patients. In their study, S. Bhattacharya and Mishra define the risk factors for developing pressure ulcers. The risk factors include direct causes, which are pressure, shear, friction, immobility, loss of sensation. The indirect risk factors are poor nutrition, co-morbidities, incontinence [18].

3.7 Surgical Reconstruction Method

In our study sacral pressure ulcer were reconstructed with fasciocutaneous flaps like bilateral skin rotation flap, bilateral VY advancement flap , double opposing z rhomboid flap, Limberg flap, unilateral skin rotation flap, transverse lumbar back flap, unilateral VY advancement flap. Limberg flaps were done for 15 (30%) cases, bilateral skin rotation flap for 10 (20%) patients, bilateral VY advancement flap 4 (8%), double opposing rhomboid flap 2 (4%), unilateral skin rotation flap 8 (16%), transverse lumbar back flap 3 (6%), unilateral VY advancement flap 3 (6%). Secondary suturing and primary closure was done for 3 (6%) patients and skin grafting was done for 2 (4%) patients.

3.8 Postoperative Complications

In our study we encountered complications like wound dehiscence, partial flap necrosis, infection and recurrence.

Partial flap necrosis was seen in 2 (4%) patients. This may be attributed to the fact that these patients had stage III pressure ulcer and had 2 or more associated risk factors for developing the complication. It was also seen that the positioning of the patients during the post operative period was not adequate and there was direct pressure over the flap due to failure of the alpha bed. These cases required more time for healing but healed primarily once proper care was given.

Wound dehiscence was seen in 4 (8%) of the patients. These patients had all 3 risk factors contributing to the development of pressure ulcers and is also associated with poor wound healing. The development of the complication was also attributed to the spasms of the lower limbs in these patients. 2 cases required bedside secondary suturing while the other 2 healed spontaneously once the spasm was relieved. In their study Abdou *et al.* [31] also have encountered post operative complications like seroma, wound infection which was managed conservatively same as in our study.

Out of the 50 patients, 3(6%) patients developed infection over the flap site. One case had a hematoma which got infected; it was managed conservatively with regular dressing and antibiotics. The other 2 cases had minimal signs of inflammation over the flap inset margins which settled with

antibiotics.

Recurrence was seen in 2(4%) patients during their follow up period in which it developed into stage II ulcer but the ulcers healed primarily once the patient care givers were properly educated regarding nursing care.

4. Figures and charts

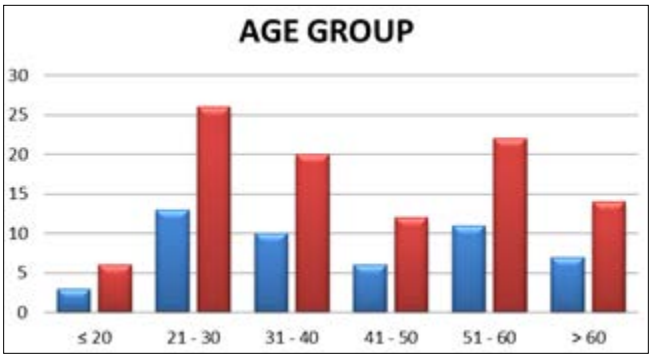

Fig 1: Age Wise Distribution

In the study, total of 50 patients were studied, the maximum number of patients were between the age group 21-30 years. The minimum age considered for the study is 15years.

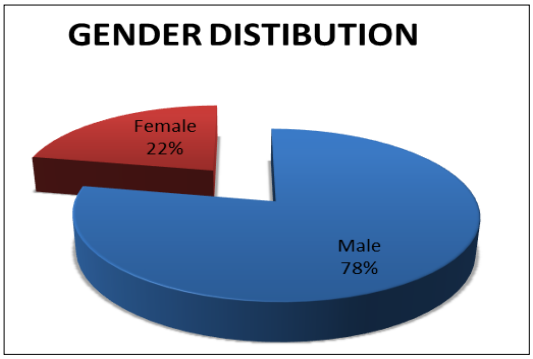

Fig 2: Gender Wise Distribution

In the above chart representing the distribution of patients according to the gender, 39 (78%) were males and 11 (22%) were females.

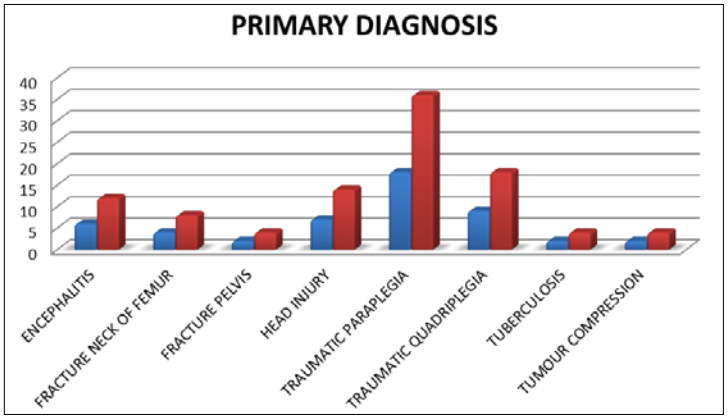

Fig 3: Distribution of Patients with respect to the Primary Diagnosis

In the above table representing the distribution of patients according to their primary diagnosis, the maximum patients were suffering from traumatic paraplegia while the least number was seen in tuberculosis, tumor compression and fracture pelvis.

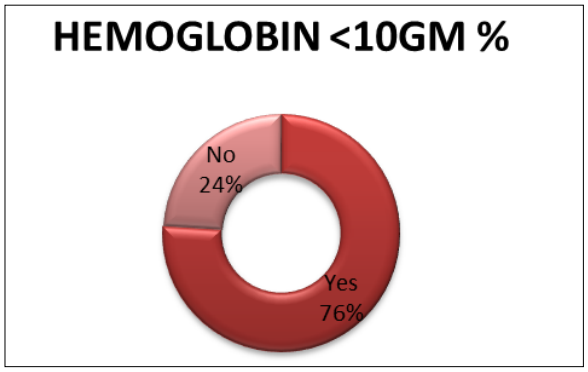

Fig 4: Distribution of Patients with respect to their Hemoglobin Values

In the above table representing the distribution of patients according to the risk factors for developing pressure sores, hemoglobin was less than 10 gm % in 38 patients.

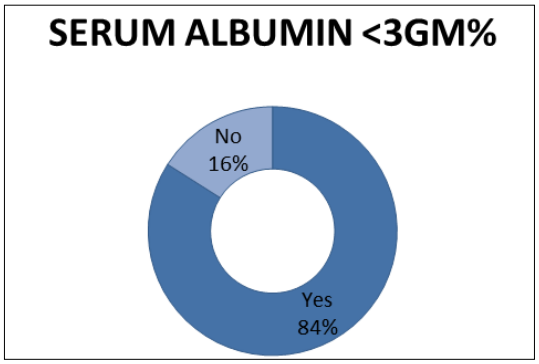

Fig 5: Distribution of Patients With Respect To Hypoalbuminemia

In the above table representing the distribution of patients according to the risk factors for developing pressure sores, the serum albumin was less than 3 gm % in 42 patients.

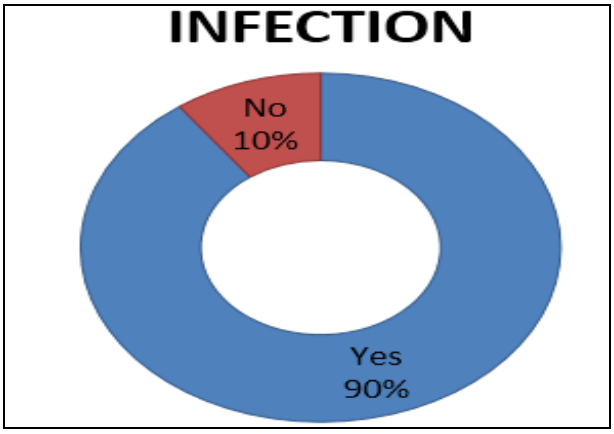

Fig 6: Distribution of patients with respect to the presence of infection

In the above table representing the distribution of patients according to the risk factors for developing pressure sores, 45 patients had infected pressure ulcers.

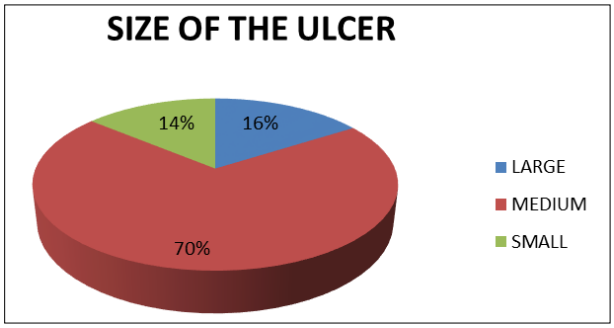

Fig 7: Distribution of patients with respect to the size of pressure ulcer

The above table shows the distribution of patients with respect to the size of the ulcer. The maximum numbers of cases were having medium sized ulcers.

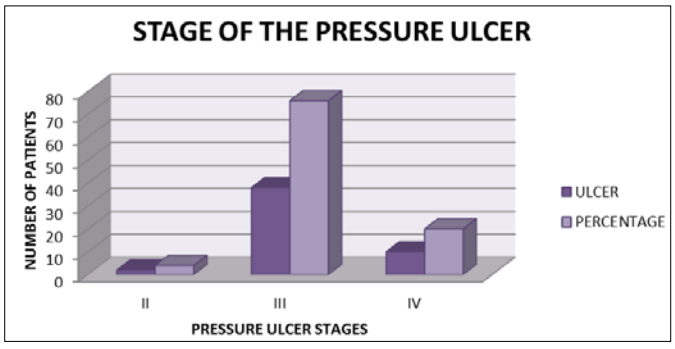

Fig 8: Distribution of patients with respect to stage of pressure sore

In the above table representing the distribution of patients with respect to the stage of the pressure sore, 38 cases (76%) were stage III and 10 cases (20%) were stage IV pressure sore

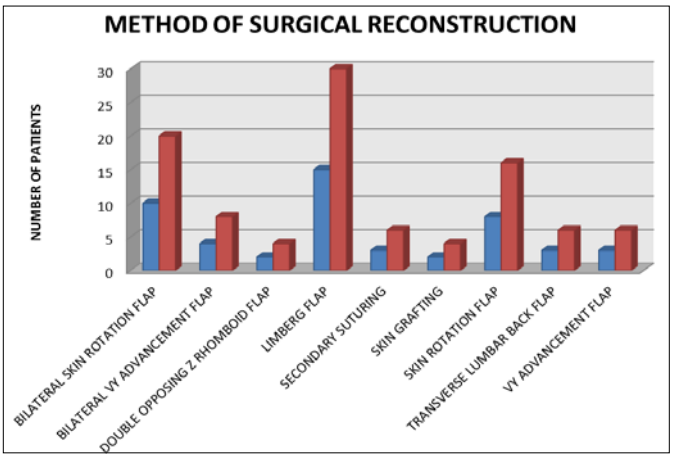

Fig 9: Distribution of patients with respect to the method of surgical reconstruction for the pressure sore

The above table shows the distribution of different reconstruction procedures done for all cases. In the study most of the pressure sore reconstruction was done by using the Limberg flap in which 15 (30%) cases were operated. 10 (20%) cases were reconstructed by the bilateral skin rotation flap method and 8 (16%) cases were operated using the unilateral skin rotation flap

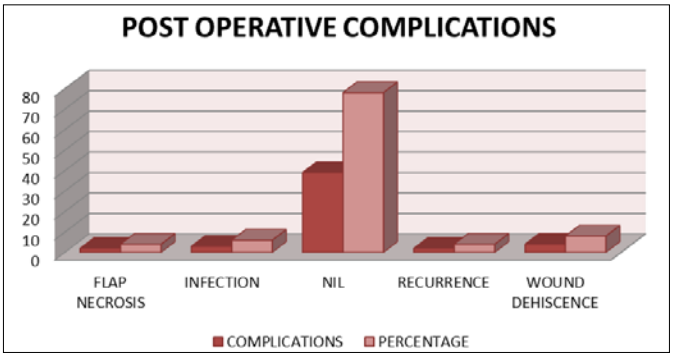

Fig 10: Post-Operative Complications

In the above table representing the distribution of patients who developed post operative complications, 4 (8%) patients developed wound dehiscence, while 3 (6%) patients developed local infection and partial flap necrosis and recurrence were seen in 2 (4%) patients each.

Fig 11: Limberg Flap

Fig 12: Unilateral gluteal rotation skin flap

Fig 13: Bilateral gluteal rotation skin flap

Fig 14: VY Advancement Flap

Fig: 15: Transverse lumbosacral back flap

Fig 16: Double opposing rhomboid flap

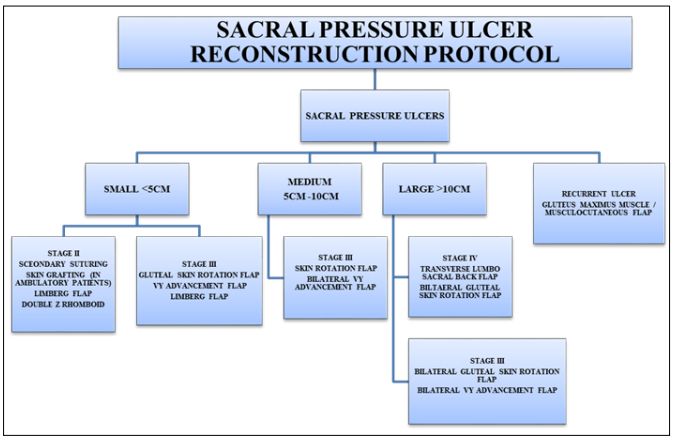

Fig 17: Protocol for sacral pressure sore reconstruction

5. CONCLUSION

Sacral pressure ulcer reconstruction is required to facilitate early healing of the ulcer and thereby continue the rehabilitation process of the primary illness which resulted in development of the ulcer.

In our study the majority of the patients 40 out of 50 were from the 20-60 age groups. This is the most productive period of an individual.

Traumatic injury to the spine was found to be the common cause in more than 80% cases. These patients due to poor nursing care develop stage 1 pressure sore which get infected and results in further progression of the ulcer. The pressure ulcer commonly reconstructed in our study was between 5-10cm sizes.

Sacral pressure ulcers reconstruction requires adequate knowledge of the development of pressure ulcers. Optimal understanding of the principles and options of surgery helps in reconstruction. The stage I ulcers were managed conservatively.

In our study 90% of the reconstruction was done for stage III and stage IV pressure sores. Sacral pressure of <5cm and 5-10cm are best managed by one of the following flaps – VY advancement, skin rotation, Limberg flaps. Pressure sores of >10cm are best managed by bilateral skin rotation and transverse lumbosacral flaps. Effective control of infection by medical and surgical means prevents progression of pressure sores and promotes early wound healing. All bedridden patients and their care takers need to be properly educated regarding prevention of pressure sores and routine examination for development of new pressure ulcers.

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