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A Study on Formulation of Reconstructive Protocol for Sacral Pressure Sore Defects With Various Types of Flap Cover in a Tertiary Health Care in Odisha.

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I. INTRODUCTION

Pressure sores are defined as soft-tissue injuries resulting from unrelieved pressure over a bony prominence. Pressure sores are an ancient problem, observed even from autopsy of Egyptian mummies and have been reported in the Bible – Lazarus, Joband and Isaiah thought to have had pressure ulcers.

Decubitus ulcers term derived from Latin decumbere, to lie down – occur over areas that have underlying bony prominences when the patient is recumbent, e.g., the sacrum, trochanter, heel, and occiput. Terms such as bedsore or decubitus ulcer should be avoided as they suggest all the sores are a result of supine positioning. Although tissue destruction can occur over areas like the sacrum, scalp, shoulders, calves, and heels when a patient is lying down, the ischial sores occur in wheelchair-bound patients who are sitting, making "pressure sore" the better term.

There are many causative factors for pressure ulcers like shear, friction, denervation, poor nutrition, age, dementia, moisture and smoking ,other than the pressure which is the main causative factor. Previous studies have shown that at the incidence of 3-10 % of hospitalised persons having pressure sores, the incidence rate for the development of a new pressure sore has been demonstrated to be much higher, with range of 7-30 %. They need 50% excess nursing time and also treated in hospital for longer periods and get more hospital charges.

Pressure ulcers occurs in very ill patients and who are kept in prolonged immobilisation. They are quiet frequent in intensive care units and in paraplegic individuals. Due to the complicity of the long losting treatment, the expenses for their care are huge. 96% of pressure ulcers occur below the level of umbilicus.

In 1938, Davis suggested a flap of tissue can be used for replacing the unstable scar of a healed pressure sore. In 1947, Kostrubala and Greeley recommended bony prominence excision and giving padding for the bone exposed raw area with local fascia or muscle- fascia flaps. Conservative management were given to treat shallow and superficial pressure ulcers. Operative management given for deeper wounds with necrosis of deeper tissue, associated with severe infection, this will reduces the hospitalisation period, the need for frequent dressings, preventing enormous scars and the risk of subsequent infection. Early and successful management of Pressure sores ensures early rehabilitation of the patient .

AIM OF THE STUDY

The aim of the study is to know

- The causative and risk factors in development of sacral pressure sore
- The types, planning and techniques of reconstructive methods.
- The merits and demerits of individual reconstructive options
- The Clinical results after a surgical reconstruction of sacral pressure sores.
- The post operative management, risk factors for recurrence and complications.
- To formulate a reconstructive protocol for sacral pressure sore management, based on the outcomes of the study and existing literature, at the same time keeping in mind the resources available.

II. REVIEW OF LITERATURE

SCOPE OF THE PROBLEM

The pressure sores are a common problem associated with much morbidity and cost. The effective surgical treatment is available only from 19th century. The causative factors are pressure, friction, shear, moisture, nutrition, and infection. The pressure sore ulcers are classified into 4 stages. Based on the above factors further treatment is planned. Prevention of pressure sore is very

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essential and is by correcting these causative factors like, using pressure relieving beds for risk patients. Operative intervention is done only after patient is optimized. Less severe cases treated conservatively with wound care alone. when hard tissue is involved ,thorough debridement and stable flap cover is given . Post operative care is important to prevent recurrence.

DEFENITION

Pressure sores are localised areas of tissue necrosis that develop when soft tissue is compressed between a bony prominence and an external surface for prolonged period of time.

ANATOMICAL STRUCTURES IN GLUTEAL REGION

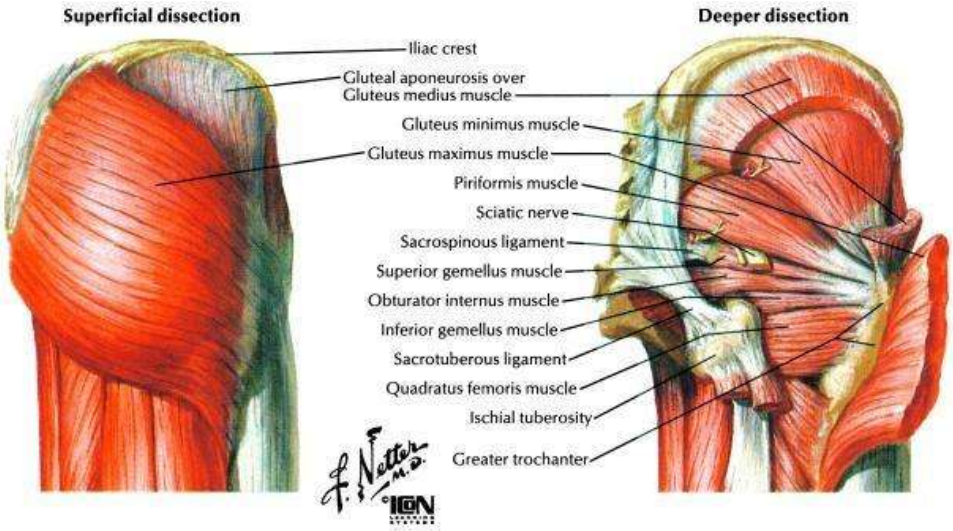

Fig.1

Gluteal region covered superficially with skin and subcutaneous tissue and deeply with Gluteus maximus and minimus muscles .(fig.1)

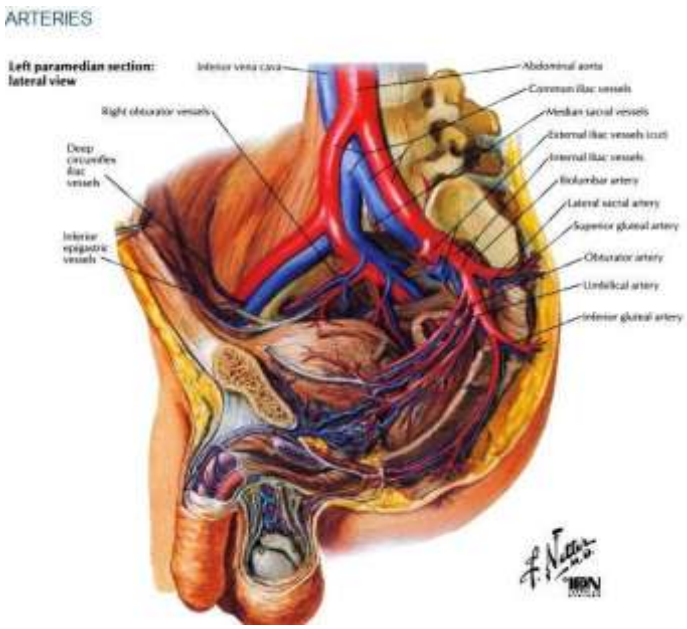

Fig.2

Gluteal region mainly supplied by superior and inferior gluteal arteries which are branches of

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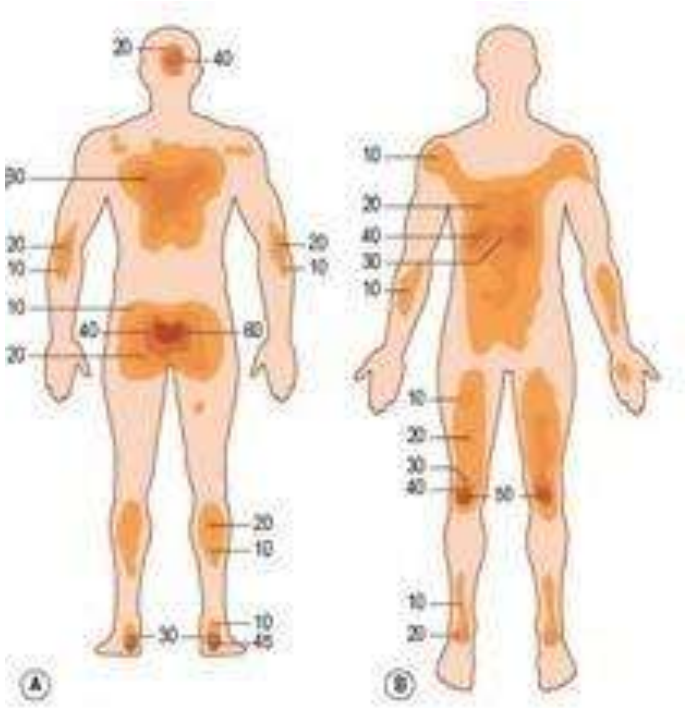
internal iliac artery.(fig.2) Gluteal perforator flaps are designed based on the perforators in the above 2 arteries .

AETIOPATHOGENESIS

The etiology of pressure sores which are resulting from decreased oxygen delivery to the tissues, mostly based on ischemia and hypoxia. In 1879, Charcot suggested the skin necrosis occur due to the injury to CNS trophic centers which decreases tissue tolerance to local pressure. Brown Sequard demonstrated that in animals, both paralysed and nonparalysed pressure ulcers can heal equally well .

The Theory of pressure ischemia states that pressure sores result from continuous pressure for an extended period sufficient to affect local blood flow to soft tissue. This external pressure must be greater than arterial capillary pressure of 32 mmHg to impair inflow and greater than venous capillary closing pressure of 8-12 mm of Hg to impede the return of flow for an extended time.(fig.5). External pressure of 70 mm Hg for 2 hours or more continuously, irreversible changes in tissues occur. Another study demonstrated with pressure release at 5 minute intervals, there will be no histologic changes in tissues.

Lindan et al documented the pressure difference in various anatomic points with particular position. In supine position the following points had the greatest pressure includes are occiput, sacrum, heel of 40 -60 mm Hg. In prone position the following points have the greatest pressure are chest and knees at 50 mm Hg. In sitting position of patient have greatest pressure in ischial tuberosities at 80 mm Hg. For this reason the pressure sore occur in the above sites commonly as these pressures are greater than end capillary pressure. (fig.3 A,B,C,D).



(**Fig.3 A,B)**

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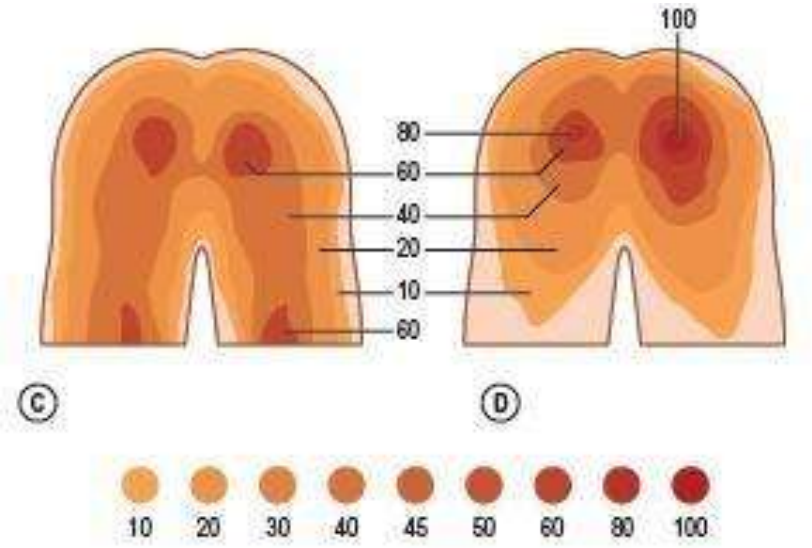

(Fig.3.C,D)

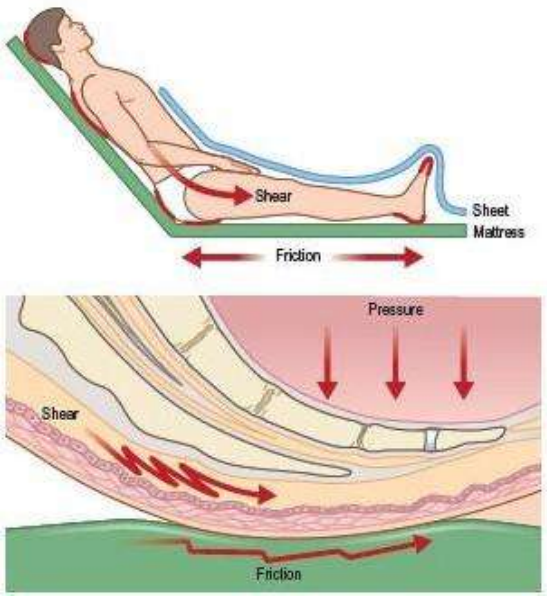

Fig.4

The other forces which contribute to develop pressure sore are shear and friction.(fig.4)

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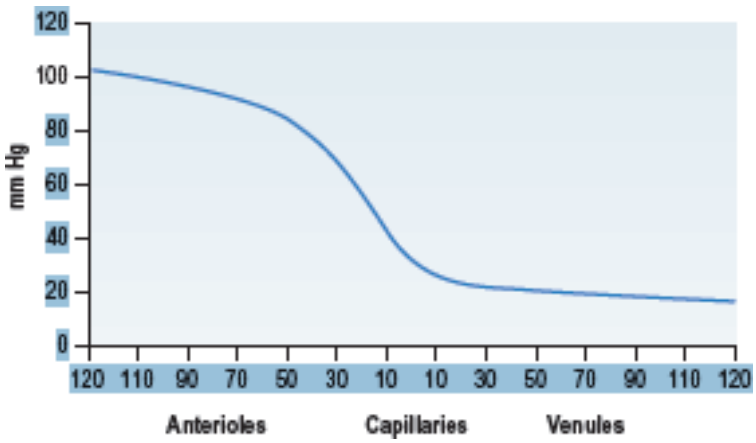

Fig.5

Other, studies have demonstrated that the more severe pathologic changes seen only in the muscles. Skin and subcutaneous layers less affected. These histologic studies revealed that early signs of damage occur in the upper dermis, with dilatation of capillaries and venules and swelling and separation of endothelial cells. In the dermis development of perivascular infiltrates and hemorrhage occurs. Signs of necrosis along with early vascular changes seen in subcutaneous fat. Until late, epidermis shows no signs of necrosis as it is able to withstand in oxygen absence for longer time both in vitro and vivo. The molecular basis for pressure ulcer tells to a imbalance between matrix metalloproteases (MMP) and tissue inhibitors of metalloproteases(TIMP)as a causative factor.

The cone shaped pattern of injury develops in pressure ulcers, the highest pressure and greatest injury is deep, adjacent to bone. The cutaneous wound is only the tip of iceberg.(fig.6)

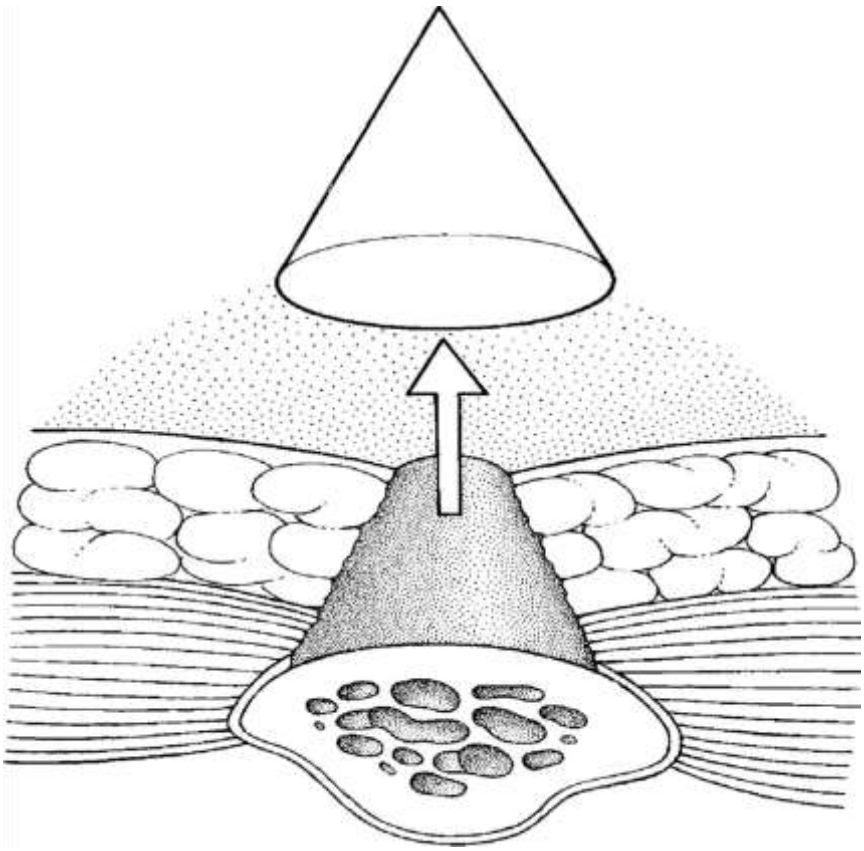

Fig.6

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HISTORY OF THE PATIENT

The pressure sore in a patient usually resulted following with his associated medical problems e.g. paraplegia, quadriplegia, spina bifida, prolonged immobilization in a hospital, multiple sclerosis. Hence history of trauma due to road traffic accident, treatment for spinal cord tumors, tuberculosis spine, encephalitis and fracture pelvis and neck of femur should be elicited from the patient. Other factors in history include onset, duration, ulcers in other parts, prior medical treatment, wound care and prior surgical treatment must be elicited.

The social status also has an impact on treatment. The pressure reducing mattress and appropriate support system to the patient at home to minimise the risk of recurrence is to be ensured. Complete examination of body Systems, includes the history of presence of fever, night sweat, rigor, weight loss, weakness and loss of appetite are essential .The risk factors for development of ulcer include age, gender, impaired sensory perception, moisture, immobility, poor nutrition, friction / shear, smoking, alcohol intake and immune suppressants should be elicited.

LOCAL EXAMINATION

Examination is performed describing the pressure sore location based on the underlying bony prominence eg. sacral, Ischial and trochanteric, for planning and choosing the correct flap for reconstruction. Pressure sores develop around the pelvic girdle with sacrum, ischium, trochanter being the commonest sites which accounts about 75%. Further the site, size, and shape of the ulcer is taken into account to decide for the selection of the flap for reconstruction. The wound base is examined whether it is covered either by granulation tissue or necrotic tissue.

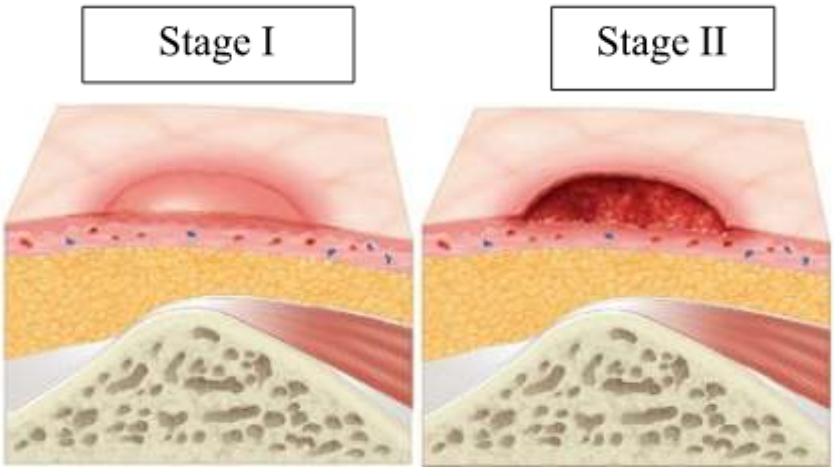
Infection of pressure sore suggested by erythema of wound, pus discharge and foul odour and bone necrosis. Examine tissue injury level ie, to epidermis, dermis, subcutaneous fat, muscle, bone, joint is for planning further management.

STAGING

Many Classification systems are available for pressure sores based on the injury level which are used in planning further treatment.

One commonly used **Classification system by Barczak** it has 4 stages. Stage I Intact skin but erythema for more than 1 hour after relief of pressure. Stage II Blistering in dermis with or without infection.

Stage III Destruction of subcutaneous into muscle with or without infection. Stage IV Bone or joint Involvement of with or without infection.



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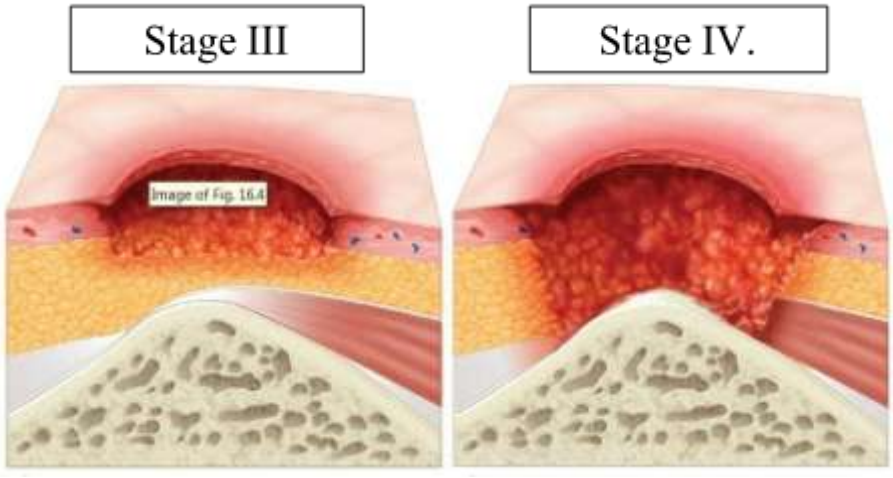

Malignant transformation of ulcer is observed with marjolins ulcers suggested by Verrucous heaps of white tissue within or around the wound. Record the wound size, site, shape, undermining edge, additional pockets. Also record communicating sinus tracts with the hip joint or urethra. Note the presence of the colostomy and cystostomy and existing scars. Also assess the extent of associated contractures and spasm.

INVESTIGATIONS

Blood investigations

- Erythrocyte sedimentation rate (ESR). If it is more than 120 mm/hr and WBC count more than 15000/µL suggests underlying osteomyelitis, should be treated.
- Serum albumin level optimized atleast 3.5 gm/L , which shows the nutritional status of the patient.
- Haemoglobin level should be atleast 10 gms and if it is low , blood transfusion should be given.

Imaging studies

- Plain X -ray film is used to evaluate the underlying osteomyelitis .
- Positive bone scan may also suggest it. Osteomyelitis excluded generally with a negative bone scan finding. False positive bone scan will be seen in patients with open wound like pressure sore.
- MRI will give full details of soft tissue involvement and bone destruction.

Tissue diagnosis

- Tissue Biopsy for quantitative culture done. More than 100000 organisms per gram of tissue must be treated prior to reconstruction.
- Bone biopsy (fig.7) is standard criteria for the diagnosis of osteomylitis within a pressure sore. Those patience having elevated ESR, WBC and abnormal pelvic x ray film findings suggestive of osteomyelitis, should be considered for Bone biopsy.

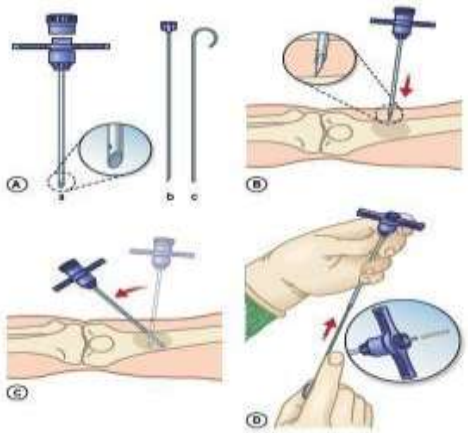

Fig.7

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The Jamshidi bone biopsy needle is used to get tissue from the ulcer for tissue diagnosis. It has needle, cannula and screw on cap. The needle has tapered point and inserted into the cannula and advance into the soft tissue until bone is reached. The stylet is removed and the cannula is used to penetrate the bone to get tissue sample. The cannula is withdrawn and tissue specimen removed from it for sending histopathological examination. The procedure repeated in multiple directions in the wound for getting multiple tissues from various sites.

MANAGEMENT

The decision to reconstruct a pressure ulcer is either conservative or surgical based on several considerations . In general, conservative management methods are adapted to treat stage 1 and stage 2 pressure sore cases, some times stage 3 and stage 4 pressure sore cases because of coexisting severe medical problems, and flap cover management are required to treat stage 3 and stage 4 pressure sore cases .

Non surgical management

In general, conservative management methods are adapted to treat stage 1 and stage 2 pressure sore cases, some times stage 3 and stage 4 pressure sore cases because of coexisting severe medical problems,. The Conservative management of pressure sores includes proper wound care, necrotic tissue debridement, nutritional status optimization, sacral pressure release and muscle spasticity minimisation to provide better opportunity to heal by secondary intention.

Infection in pressure ulcer will affect normal wound healing process. For better wound healing process wound should be bacteriologic balance. Infection in the pressure ulcer suggested by presence of necrotic tissue, wound edges erythema, pus discharge and a foul odour. Proteus mirabilis, Staphylococcus aureus, Pseudomonus, Bacteroides fragilis and Bacteroides asaccharolyticus are the most common organisms found in pressure sores . Before considering wound reconstruction thorough debridement and aggressive wound care is required, when more than 100000 organisms are growing in quantitative cultures taken from the pressure ulcer. Group B streptocooci and Clostridial infections can occur at minimal bacterial counts.

In conservative management the necrotic tissue are removed first, followed by moist to dry dressings with isotonic sodium chloride solution applied, if the necrotic tissue is minimal. Surgical debridement at bedside or in operative room may require in more extensive necrosis. After cleaning the wound silver sulfadiazine is applied to reduce the bacterial load , which helps to fasten the healing of wound. For deeper wounds a negative pressure dressing will help to reduce the bacterial load and healing time.

If the nutritional status of the patient is deficient as determined by low albumin level(< 3.5 gm/L) must be optimized by allowing less calorie intake and protein supplementation by either orally or tube feeding is required. In short term, supplementation can be assessed by serum prealbumin level, which has a shorter half life(2d) than albumin (17d) or urine nitrogen. Patients with gut dysfunction may require total parenteral nutrition.

By turning the patient in bed every 2 hours and by the use of pressure reducing mattress, the pressure on the sacral skin must be reduced. Pressure reducing mattresses include low air loss beds, air fluidized beds (fig.8). And Roho cushion mattress seats for wheel chair. The sitting patients should shift their body weight every 15 minutes.

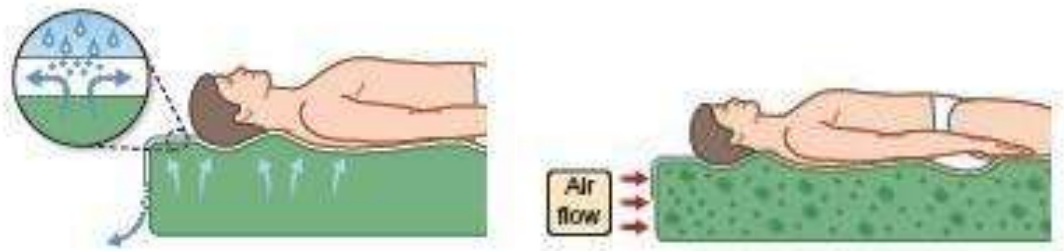

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Fig.8

Skin care principles

Daily cleaning with PH balanced cleanser is essential.. Do not use soap and water to clean the wound, also avoid the scrubbing of the wound. To keep skin moisture use emollients. Reduce the moisture of the patient in sacral region.

Surgical management

Prolonged bed ridden patients are more prone for having pressure sores. Surgical management starts from complete excision of ulcer, conservative ostectomy, followed by reconstruction. In general, flap cover for reconstruction is required for treating Stage 3 and 4 pressure sore cases. Depending on the site, size, shape of the ulcer, the flap is choosed for reconstruction.

Pre operative preparation

Baclofen or diazepam are to be used to control involuntary muscle spasms preoperatively. Pressure reducing mattress is to keep ready for the use in post operative period. If urinalysis and urine culture findings shows nitrites and leukocyte esterase, treat the patient for urinary tract infection. Diverting colostomy for the patients with continuous faecal soiling into the pressure sore should be considered and for those patient with urethral fistula, urinary diversion procedures should be done to them.

Pseudo tumour excision

The wound should be debrided first. Once the decision made for reconstructive procedure, a procedure called pseudo tumour excision (fig.9) i.e a radical bursectomy is performed by keeping sponge moistend with methylene blue in the bursa and sutured at the top and circumferential excision of pressure sore, removing all the unhealthy granulation tissue till its base.

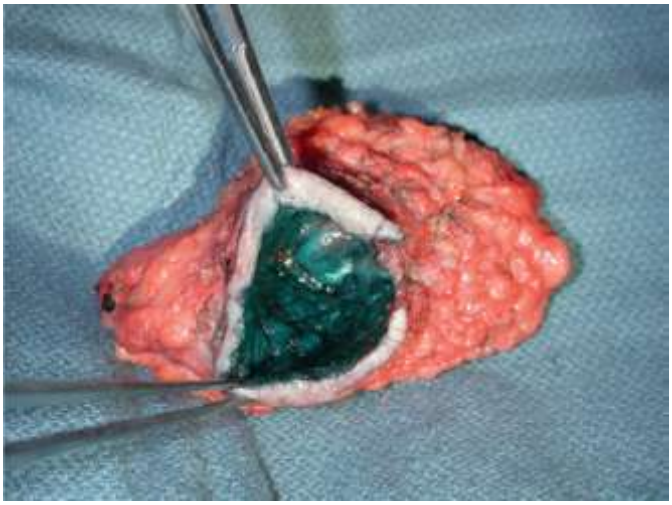

Fig .9

After bursectomy attempt with primary closure of the defect will be always under tension and it will fail. Hence flap cover is essential. Other technical points include in this are, the under lying necrotic bone removal radically, bone stump should be padded, dead space filled with muscle using larger flap, to avoid tension ,flap mobilised adequately and preserve adjacent flap territories for reconstructing the other locations. Depending upon the location of ulcer the flap for reconstruction is choosed.

Flap cover

Small sacral ulcers can be reconstructed with an inferiorly based skin rotation flap with or without the superior gluteus maximus

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myocutaneous flap. The use of random skin rotation flap does not preclude later use of the gluteal muscle. When using a random skin rotation flap, designing a large and wide flap with an axis of rotation that permits tension free closure is essential.

For the superior gluteus maximus myocutaneous flap, a wide rotation flap is elevated with superior portion of the gluteus maximus muscle. The land mark of superior gluteal artery (fig 10) on which the superior gluteus maximus muscle flap is based , include the axis of posterior superior iliac spine(PSIS) and the ischial tuberosity. The superior and inferior gluteal arteries are branches from the internal iliac artery, placed superior and inferior to pyriformis muscle respectively and lies approximately 5 cm away from the medial edge of origin of gluteus maximus muscle, from the sacro coccygeal line (from the PSIS to the coccyx).

The superior gluteal artery is lies more medially. To avoid injury to this artery while elevating the superior portion of gluteus maximus muscle for flap cover procedure, dissection must be from lateral to medial. The insertion of the superior portion of the gluteus maximus muscle is in the ilio tibial tract is erased. The superior gluteus artery pedicle is only of 4 cm long, having limited rotation of the muscle. Hence the gluteus maximus muscle is to be released on both side to allow for easy rotation or turnover into the defect without tension.

Small to medium size ulcer reconstructed well with Limberg flap ,applied when the defect is rhomboid shape.

Larger sacral ulcers needs larger flaps to cover, where bilateral flaps can be used. Best option is bilateral V-Y gluteusmaximus myocutaneous advancement flaps. Depending upon the ulcer size and location of ulcer the V-Y flaps can be planned based superiorly or inferiorly in gluteus muscles. The V should be fashioned wide and long enough to close as Y without tension. The gluteus maximus muscle flap is elevated from its origin and stop elevation at 4cms from midline, because the superior and inferior gluteal arteries enter into the gluteus muscle 5 cm. away from mid-line which is to be protected. For tension free approximation of muscle medially, gluteal muscles released from insertion laterally for medial advancement. For better holding of suture in mid-line, inflamed fibrous tissue along medial muscles edge can be preserved and used.

The other options for sacral ulcer reconstruction are, the Transverse lumbosacral flap based on ipsilateral or contralateral lumbar perforators notably L3, located at the lateral border of paraspinal muscles.

- **Propellar flaps** are recent additions and can be performed for small to medium sized pressure sores. These flaps are designed based on superior and inferior gluteal artery perforators, which are identified using Doppler.

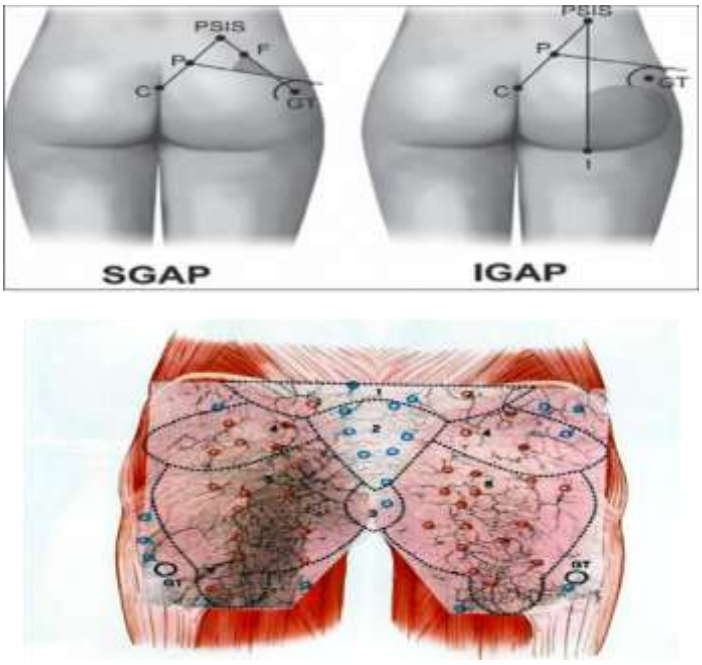

FIG.10

The angiosome concept provided an important early frame for the development of the perforator flaps. Doppler was used initially to identify the perforators. More recently, a combination of vascular injection studies and three dimensional angiography is used to provide a detailed illustration of the vascular integument.

The main advantage of perforator flaps spare the underlying muscle, providing "life boat" for any recurrent problem and because of thick subcutaneous fat layer and with a generous arc of rotation , pedicled perforator flap may be used to fill even the deep wounds. The other advantages of this flap are, preserving of the muscle function and major artery, no tension in donor site closure, design the flap as per defect, minimal donor site morbidity, less chance for recurrence and in case of recurrence local tissue will be available for secondary procedures.

Free tissue transfer either muscle or fascio cutaneous flaps can be considered if no other options of loco regional flaps are available. Tensor fascia latae muscle- skin unit flap, free lateral thigh fascio cutaneous flap based on the first and third direct cutaneous branches of deep femoral vessel are the example for free flaps used in sacral pressure ulcer reconstruction.

Tissue expansion Advantage of this procedure is, it gives sensate skin. The indication of this flap is to cover shallow ulcers with no dead space to fill. Pre expanded tensor fascia latae and lumbosacral fascio cutaneous flaps are used.

Multiple pressure sores can be observed in sacrum and gluteal region in a same patient. Sometimes the use of total thigh flap is needed for the reconstruction of this multiple ulcers. The total thigh flap procedure is time consuming and may need 7 to 10 units of blood transfusions. This flap kept for doing salvage procedure, when other attempts have failed. After doing unilateral total thigh flap, patients can be allowed to sit in a wheel chair.

Single versus multiple stage reconstructionS single stage reconstruction gives considerable cost savings per admission. The disadvantages of single- stage surgical management as longer operative time and higher intraoperative blood loss. The advantages of single-stage pressure sore management include fewer anesthetic episodes, shorter hospital stays, earlier rehabilitation, and lower costs. The multistage procedures reserved for patients who have concurrent pressure sores on the anterior and posterior trunk that are difficult to address in the same sitting.

Post operative management

A effective postoperative care is essential after pressure sore reconstruction to reduce the risk of complications. Precautions to be taken to avoid shearing force and tension across the flap while transferring the patient from the operation table to air fluid bed. Patient are kept in prone position for 4 weeks in a fluid bed, after that semi sitting position can be allowed. After 6 weeks of surgery, sitting is begun, initially for 10 minutes interval. Then evaluate the flap for discolouration and wound edge separation. The sitting periods are increased at further 10 minutes periods over 2 weeks upto 2 hours periods. Then patients are taught to lift their hips to relieve pressure for 10 seconds every 10 minutes.

COMPLICATIONS

Pressure sores are associated with number of adverse outcomes which includes, osteomyelitis, sepsis, pyarthroses, amyloidosis, autonomic dysreflexia anaemia, ulcer recurrence, urethral fistula and malignant transformation.

Osteomyelitis is treated by removal of all non viable bone, following which stable flap cover is used to cover the defect. Following the debridement the flap reconstruction can be done immediately. Then administer intravenous antibiotic for 6 weeks.

Pyoarthrosis of the hip joint can occur with communication of ischial or trochateric pressure ulcers. Often the femur head is affected by osteomyelitis, which mandates its removal. The Girdlestone arthroplasty procedure for this situation where femur head is removed and vastus lateralis muscle flap is used to reconstruct the dead space.

Autonomic dysreflexia is a disordered autonomic response to specific stimuli. It is commonly seen in midthoracic spinal cord lesion patients, shows the following symptoms include head ache, sweating, nasal congestion, flushing, intermittent hypertension, piloerection and bradycardia. Proximal to the level of injury the sweating, and flushing occur. The suggested Patients are first positioned with their head up and watch for changes in heart rate and blood pressure. Following that the precipitating stimulus should be removed.

Bladder distension is the most common precipitating cause, which needs treatment by emptying the bladder with foley catheter insertion or removal the blockage in existing catheter by irrigation. Faecal impaction may be the another cause diagnosed by per rectal examination and has to be treated by evacuation. Nifidepine, topical nitroglycerine, hydralazine can be used to stabilise

the blood pressure. Finally for those who refractory to the above measures spinal anaesthesia may be required to treat autonomic dysreflexia.

Pressure sores recurrence rates can be high because of patients non compliance, hematomas, seromas, wound infections and dehiscence. Intra operative measures that can minimise recurrence risk include aggressive debridement, perfect haemostasis, tension free flap reconstruction and using suction drainage. Pressure reducing mattresses must be used postoperatively to decrease the chance of recurrence. Patients with paraplegia have the highest rate of recurrence about (80%).

Pressure sores can also erode into the urethra lead on to formation of urethral fistula. It is treated by doing urinary diversion procedure. After healing the fistula only, reconstruction of pressure sore should be considered.

Previously it was meant that the marjolins ulcer developed only from chronic scar of a burn wound. At present this term marjolins ulcer are used in the following situation also are ,venous stasis ulcers, pressure sores, osteomyelitis, urethral fistulas, anal fistulas, and other traumatic wounds. This malignant transformation is histologically a well differentiated squamous cell carcinoma. As the pressure sore carcinoma behave very aggressively and is highly lethal, early and effective treatment is needed.

Marjolins ulcer arising from osteomyelitis or burns are treated with wide local excision and lymphnode dissection. Considering the aggressive nature of pressure sore carcinoma more radical treatment is needed (hemicorporectomy and regional node dissection) for better cure. A study shows 3.4 % of 1200 patients with squamous cell carcinoma, the thermal burns of irradiation dermatitis was the cause. It is learnt from literature that only 18 patient had malignant transformation from pressure sores. For better outcome early recognition of malignancy, proper staging and aggressive treatment is necessary. The most common causes of fatality in pressure sore patients are renal failure, septicaemia, pneumonia, and amyloidosis. In general, the mortality rate is high in pressure sore patients, in whom develops a new sore which shows resistance to heal.

OUTCOME AND PROGNOSIS

It is a challenge for Plastic Surgeons to reconstruct the pressure sore defects. Because it has highest complication rates in all available procedures. Even after strictly following the above said guidelines of management, the recurrence rates in pressure sores are high (as low as 3-6% to as high as 33- 100%). The recurrence rate with cutaneous flaps and musculo cutaneous flaps are the same. The ultimate causes of non compliance were individual personalities, an unsteady social situation and inadequate family network. The causes for recurrence are neglect of skin care, drug and alcohol abuse, and neglect of proper sitting practices. Another major determinant of outcome is collaboration between plastic surgeon and physical medicine rehabilitation physician. However multidisciplinary mode of management gives successful outcome.

Before going for pressure sore reconstruction several considerations are to be kept in mind to reduce the risk of adverse outcomes. Preoperatively patient must be prepared well for better wound healing with correcting nutritional deficiency, anaemia, spasms and co existing urinary infection. As the treatment of pressure sore is time consuming and the patient has to keep in bed for long time in hospital, the patient should have adequate social resources like air fluid bed, wheel chair to prevent recurrence of pressure sore. Intraoperatively proper technique to be planned and executed to minimise the risk of complications like infection, haematoma, dehiscence and recurrence. Post operatively precaution to be taken to avoid shearing force and tension across the flap while transferring the patient from operation table to air fluid bed. Then the regimen of transferring the patient from bed to wheel chair to be followed and to make facilitation for early return to daily living condition.

SECONDARY PROCEDURES

It is important that before going for revision of flap surgery, the patient must be fully evaluated. Same risk factors caused the original ulcer should be dealt with accordingly. All the sacral ulcer flap surgeries may go for revision, multiple options should still exist, even in multiple recurrence cases. The simplest option is readvancing a previously performed flap. If tension is excess advancing fasciocutaneous flap over previous musculocutaneous flap, can provide additional length. Severely ill patients with uncontrollable infection amputation or salvage flaps reserved for recalcitrant pressure sores with extensive ulcer.

FUTURE

In recent times it is found that some wound healing factors are having the capacity to promote spontaneous wound closure of the pressure sore. In the inflammatory phase of wound

healing, platelets provide haemostasis and releases growth factors which are known to speed up the wound healing process. Atri et al tried this technique by using Silvadene, but failed. Later Robson et al and Muststoe colleagues had good wound healing result in stage 3 and 4 pressure ulcers management with this technique..

Though the cost of treatment is high at present to use growth factor in treating the pressure sores, in future this non surgical method will be very useful for the patients who are unfit for undergoing surgical procedures affected with co existing morbidities.

III. MATERIAL AND METHODS

Materials

This work includes the study of 50 patients who underwent reconstruction for pressure sores in the Department of Surgery, Hi-Tech medical college & Hospital Bhubaneswar, Odisha.

The patients who were admitted in Orthopaedics, Neurology, Neuro surgery, General Medicine and General Surgery wards and subsequently developed pressure ulcers are referred to Department of Surgery, Hi-Tech medical college & Hospital, Bhubneswar,Odisha were studied between January 2022 – January 2024.

Methods

The methods include obtaining history from patients, thorough clinical examination, necessary investigations and appropriate surgical reconstruction. Intraoperative, postoperative complications were noted and managed accordingly. Patients were advised regarding rehabilitation and referred back to their respective departments and advised regular follow up. The patients were followed up every week for two months, then monthly for a period of 6 months. The maximum follow up was for a period of 6 months. All information are entered in a proforma specially designed for this study.

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.

Basic investigation like urine examination, blood Hb estimation, blood sugar and renal parameters like urea, creatinine 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.

Hypoproteinemia was managed by appropriate nutritional supplementation. Infection was controlled by periodic debridement and antibiotics. Spasm relieved with Diazepam 5 mgs twice daily. Adequate relief of pressure was obtained by change of position every 2 hours, avoidance of moisture and nursing in a water bed provided.

All the patients were informed about the surgical procedures, the intra operative, 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 th e intensive respiratory unit for a couple of days. Patients were advised regarding rehabilitation and referred back to their respective departments and advised regular follow up.

The patients were followed up every week for 2 months, then monthly for a period of 6 months. The maximum follow up was for a period of 6 months.

ANALYSIS

The data obtained was analysed for the following factors

1. Age and Sex of the patient
2. The primary aetiology(High spinal T8 and above), (low spinal-T9 and below)
3. Blood Hb level
4. Serum albumin level
5. Presence of infection
6. Stage of the pressure sore
7. Size of the pressure sore (small<5cm, Medium 5-10 cm, Large >10cm)
8. Site of pressure sore
9. Reconstructive method
10. Complications (Hematoma, Infection Dehiscence, Necrosis, Reccurence)

Factors associated with pressure ulcer development and the outcomes of surgical management were analysed and the results were obtained.

IV. OBSERVATION AND RESULTS

In the fifty patients included in this study, the mean age was 46.36 years, with a range of 17 to 80 years.

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Table I
AGE AND GENDER

Age & Gender	< 20	21-40	41 - 60	61 -80	Total
Male	2	14	16	6	38
Female	2	3	4	3	12
Total	4	17	20	9	50

76 % patients were males and 24 % were females in our study.
Female to male ratio was 1: 3.16

Table II
PRIMARY DIAGNOSIS

Primary Diagnosis	No of cases	%
Traumatic Paraplegia – low spinal level	22	44
Traumatic paraplegia – high spinal level	2	4
Traumatic quadriplegia	5	10
Tuberculosis Paraplegia – low spinal level	2	4
Tuberculosis paraplegia –high spinal level	1	2
Tumour compression – paraplegia low spinal level	2	4
Tumour compression – Paraplegia high spinal level	1	2
Encephalitis	2	4
Head injury.	7	14
Fracture plevis	3	6
Fracture neck of femur	3	6

Traumatic paraplegia low spinal level (T9 and below) was found to be the most common aetiology in 22 patients. Post traumatic paraplegia high spinal level and Post traumatic quadriplegia were present in 2 and 5 patients respectively. Tuberculosis and Tumour compression causing paraplegia were found in 3 patients each. Orthopaedic injuries like fracture neck of femur and fracture pelvis were the causative factors in 3 patients each. Pressure sore development due to alteration of conscious level were found in 9 patients.

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Table III
RISK FACTORS FOR PRESSURE SORE DEVELOPMENT

Risk Factors	No of cases	%
Hb < 10gm %	32	64
Serum albumin < 3gm%	28	56
Presence of Infection	42	84

Infection was present in 84 % of all the pressure sore cases, which required serial debridement, antibiotic therapy and periodic dressings before attempting reconstruction. Anaemia and Hypoalbuminaemia were present in 32 and 28 patients respectively. Anaemia was treated with Iron supplements and blood transfusion wherever necessary. High protein diet was recommended for all patients with low albumin levels.

Table – IV
SIZE OF THE PRESSURE SORE

Size	No of cases	%
Small (< 5 cm)	14	28
Medium (5-10cm)	24	48
Large (>10cm)	12	24

Medium sized pressure sore was noted in 48 % of patients. 14 patients had small pressure sores and remaining 12 had large pressure ulcers.

Table – V
STAGE OF PRESSURE SORE

Stage	No of cases	%
Stage 2	8	16
Stage 3	26	52
Stage4	16	32

The majority of patients, 26 in number, had a Stage 3 pressure sore. Stage 4 sores was found in 32% of patients. Only 8 patients requiring reconstruction had stage 2 ulcers.

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Table VI
METHOD OF RECONSTRUCTION

Reconstruction	No of cases	%
B/L VY Gluteus Maximus Myocutaneous flap	6	12
Gluteus Maximus rotation flap	3	6
B/L VY Skin advancement flap	1	2
Skin rotation flap	8	16
B/L skin rotation flap	3	6
Limberg flap	12	24
Propellar flap	8	16
Double Z Rhomboid flap	2	4
Transverse Lumbosacral back flap	3	6
Secondary suturing	2	4
Split skin graft	2	4

Sacral pressure sore reconstruction was performed with a B/L VY Gluteus maximus myocutaneous flap in 6 patients, B/L skin rotation flap in 3 patients. Limberg flaps were used in 12 patients ,Skin rotation flap done in 8 patients and gluteal artery perforator propellar flap in 8 patients.

Table – VII COMPLICATIONS

Complications	No.of cases	%
haematoma	7	14
infection	6	12
Wound dehiscence	7	14
Flap necrosis	3	6
recurrence	6	12

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Haematoma and wound dehiscence were the commonest complications, encountered in 7 patients. The infection rate was found to be 12% while flap necrosis which were partial were found in 3 patients. In our 6 month follow up recurrence rate was found to be 12%

ROTATION FLAP

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BILATERAL ROTATION FLAP

LIMBERG FLAP

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LUMBO SACRAL FLAP




PROPELLER FLAP


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B/L V-Y ADVANCEMENT FLAP




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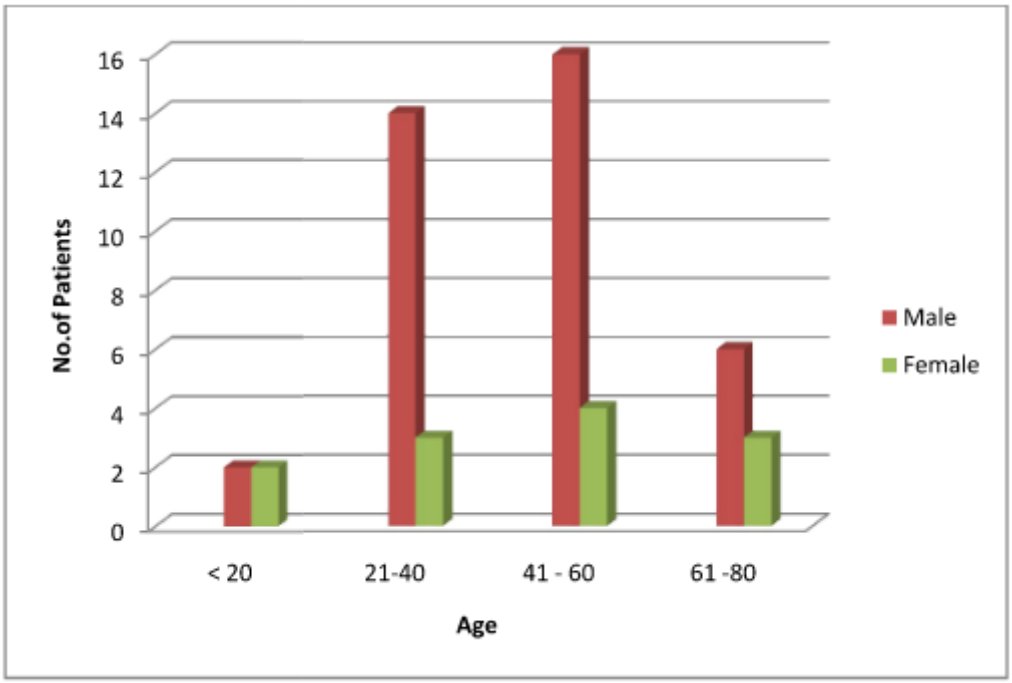
V. DISCUSSION

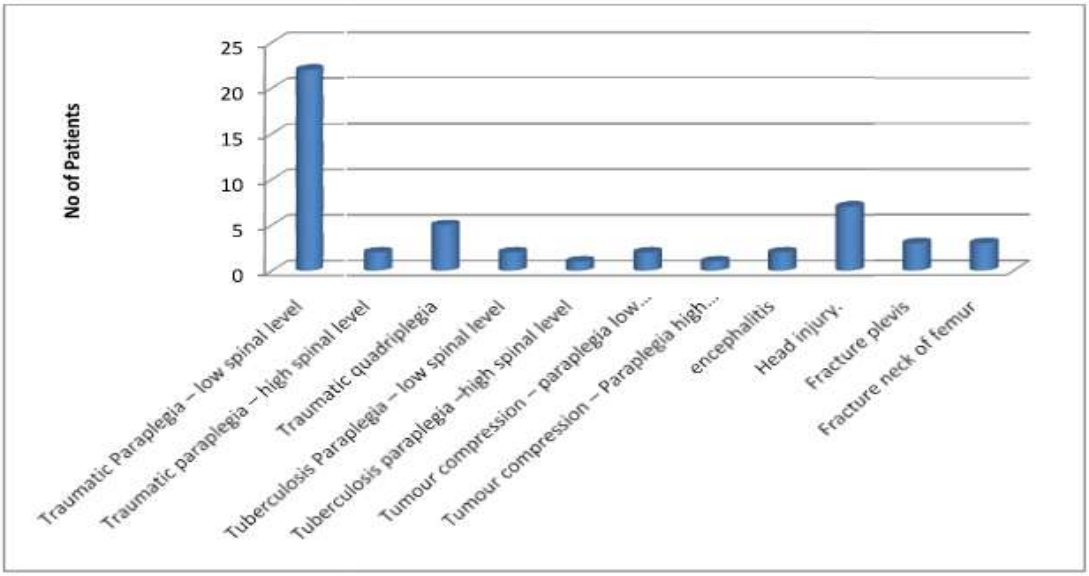
Reconstruction of pressure sore is performed to achieve early healing of ulcer in order to continue the rehabilitation process and treatment of primary illness which resulted in pressure ulcer.

AGE AND GENDER



In our study of 50 patients who requiring reconstruction, the majority of the patients, 37 out of 50 patients were in between 20-60 age group, which is the most productive period of an individual. Men were thrice more commonly involved than females. This may be the fact that more men developed the primary neurological dysfunction resulting in pressure ulcer.

PRIMARY DIAGNOSIS



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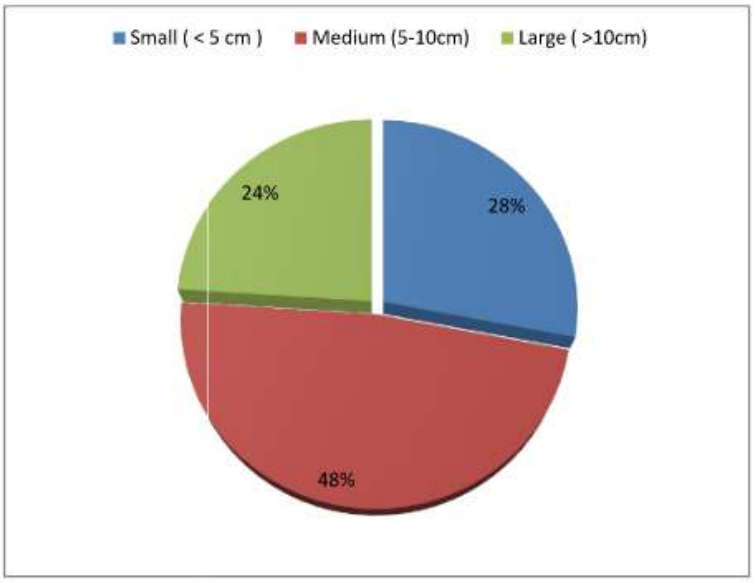
Traumatic aetiology was found to be the cause in more than 80% of patients. Most of the trauma resulted from road traffic accidents. Infectious aetiology namely encephalitis & tuberculosis accounted for only 10% of the patients. Patients developed anaemia (64%) and hypoalbuminemia (56%) either due to the injury or subsequently, which when added to poor nursing care increases the chance of ischemia and subsequent development of pressure ulcers. Once a stage I pressure sore develops, the wound gets infected due to the presence of deep seated devitalised tissue and this becomes responsible for the progression of pressure sore in depth and size.

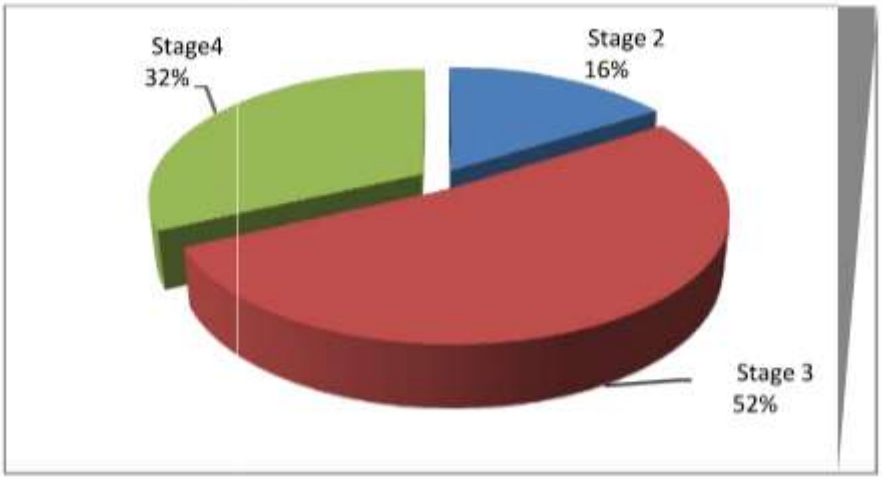
Hence effective control of road traffic accidents plays an important role in primary prevention. Management of anaemia, hypoalbuminaemia with control of infection plays a prime role in secondary prevention of pressure ulcers.

SIZE OF THE PRESSURE SORE



The size of the pressure sore between 5-10cms being the most common to get reconstructed.

STAGE OF THE PRESSURE SORE



Stage I and most of stage II pressure sores where managed conservatively, healed well and did not warrant reconstruction. Around 90% of the reconstruction were done only for stage III and stage IV pressure sores.

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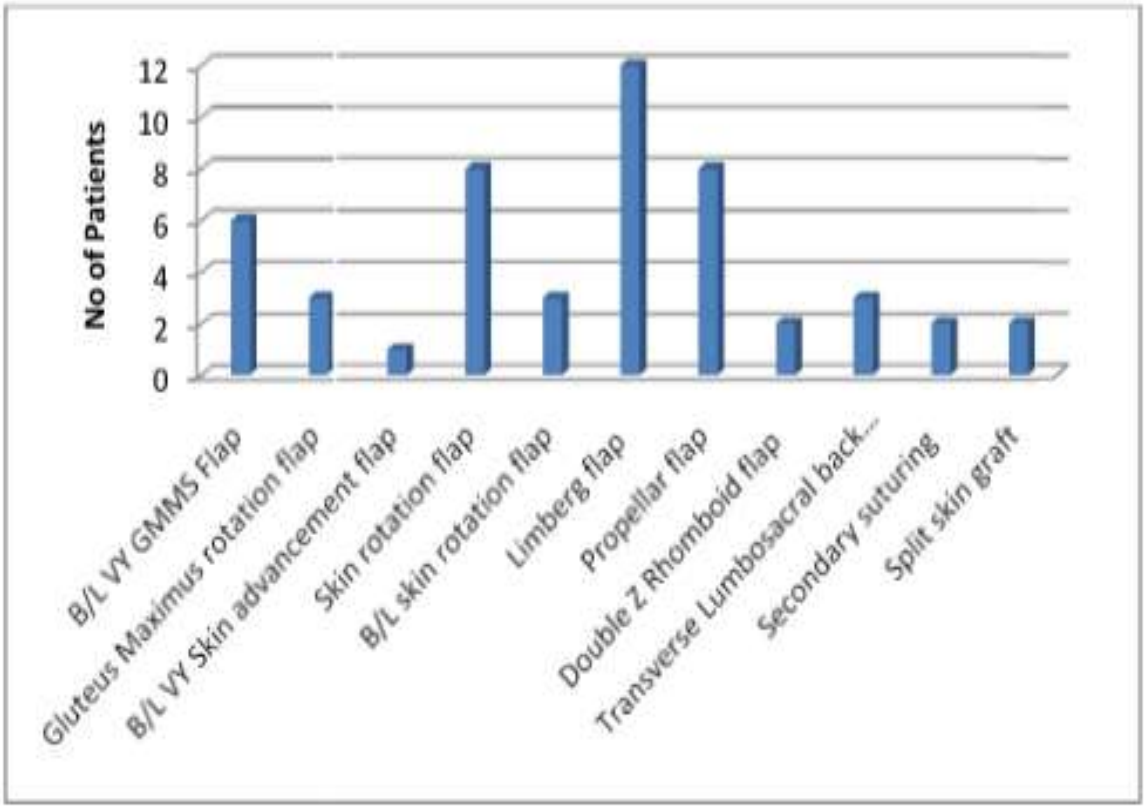
METHOD OF RECONSTRUCTION



A thorough understanding of the principles and options of surgery allows the optimal procedure to be performed. In general all pressure sores needs debridement in the pseudo tumour approach as discussed earlier.

Sacral pressure sore that are stage IV are better managed by a Gluteus maximus myocutaneous flap. It can be a rotation gluteus maximus for a small to medium midline ulcer, unilateral or bilateral V-Y advancement for a medium to large pressure ulcer. Superficial sacral sores can be reconstructed with skin flaps. The commonest flaps used was the limberg flap. It gives good results for a small sacral sore. When the size of ulcer is large, limberg flap application may lead to wound dehiscence. Hence a double Z rhomboid design can be used, which evenly distributes the tension around the raw area. Gluteal artery perforator propeller flaps were used in 8 patients for medium sized superficial ulcers. Rotation skin flaps and Transverse lumbosacral back flaps are also viable options for sacral pressure sore management.

In our study, haemotoma leading on to wound infection and dehiscence was found to be around 12%. This was more common in muscle flaps , where there is more dissection and dead space .a closed suction drain and perfect haemostasis is a must in the reconstruction of pressure sores. Partial flap necrosis was found more with skin flaps, which were salvaged and managed conservatively.

Even with optimal preoperative, efficient intraoperative, good postoperative management and rehabilitation, pressure sores are prone for early or late recurrence. In our study recurrence rate was 12% for a 6month follow up period.

This confirms the time tested fact that for pressure sores, prevention is better than cure.

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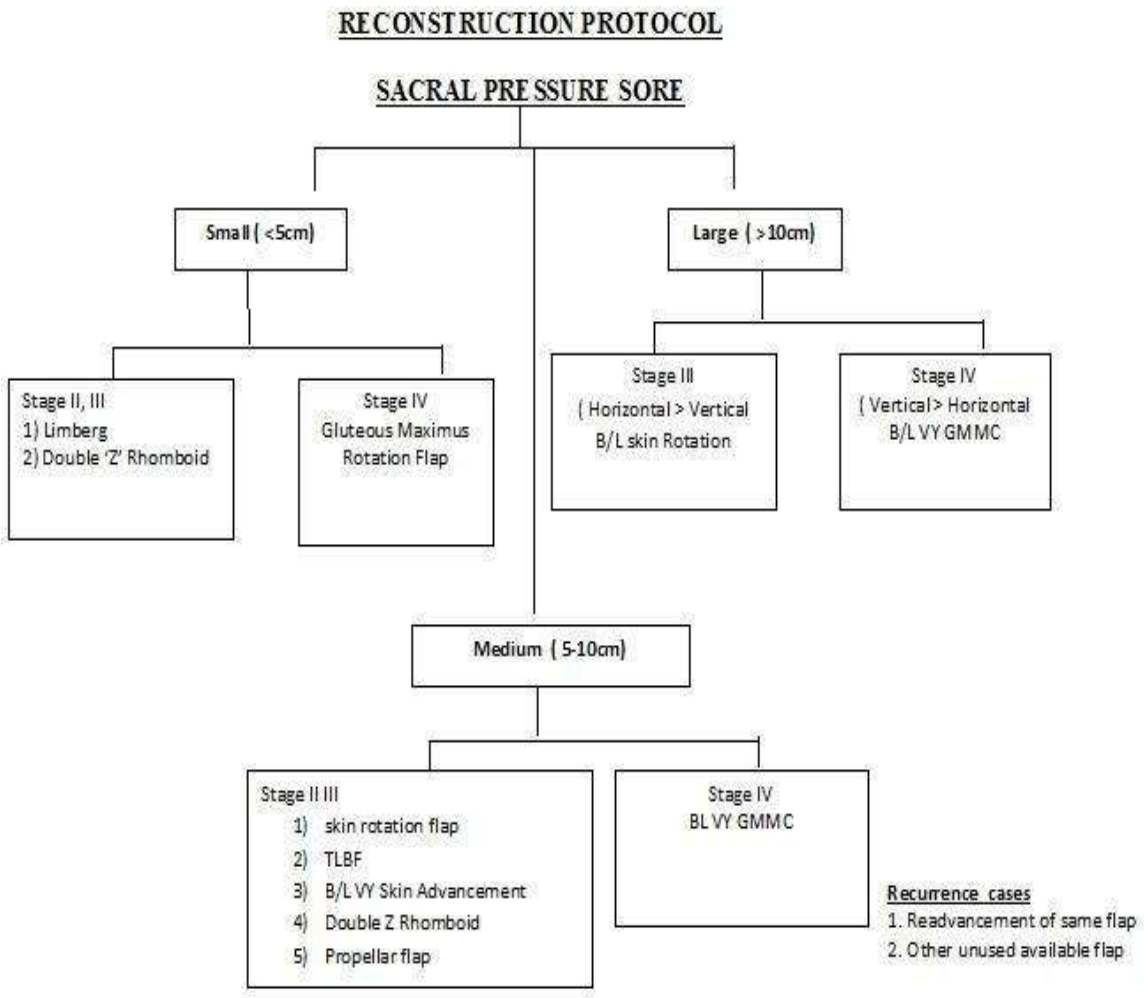

VI. CONCLUSION

1. Sacral pressure sores of stage II and III are best managed with any one of the following flaps, rotation or V-Y advancement skin flap, limberg flap, propeller flap.
2. Sacral pressure sores of stage IV are best managed by one of the variants of gluteus maximus myocutaneous flaps.
3. Effective prevention and management of anaemia and hypoalbuminaemia in addition to good nursing care reduced the incidence of recurrence of pressure sores.
4. Effective control of infection by medical and surgical means in early stages, prevents progression of pressure sores, and promotes early healing.
5. Trauma was the primary causative factor, leading to neurological damage in majority of patients, hence control of road traffic accidents is of prime importance in primary prevention of pressure sores.

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