



**ORIGINAL RESEARCH PAPER**

**Orthopaedics**

**ROLE OF VARIOUS FLAP PROCEDURES USED IN ORTHOPAEDIC SURGERY**

**KEY WORDS:** Flap

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**ABSTRACT**

In this study 38 flap procedures have been done in 27 patients to cover various skin defects caused by trauma, pressure sores and non-healing ulcers. It was observed that maximum number of defects were caused by open fractures. Fasciocutaneous flaps were commonly used in this study. Most of the flaps healed within 4 weeks. It is concluded that various flap procedures are essential for better biological environment for future surgery and to cover defects which cannot be treated with other procedures.

**INTRODUCTION**

In the present era of modernisation and industrialisation to cover the damage or defect of the physiologic protective layer i.e. the skin and underlying delicate structures, caused by road traffic accidents, railway accidents, mechanical and thrasher injuries, pressure sores, trophic ulcer, burns, chronic osteomyelitis or even surgically created wounds, as by excision of scar, release of contracture or a tumour, especially to provide a better biological environment for future surgery, skin graft does not always suit, and in these conditions coverage with flap is required. Flaps are the blocks of tissues in general, which keep their blood supply intact during all the stages of its transfer, through the preserved structural integrity of its vasculature. Antricht (1944)<sup>1</sup> concluded that skin flap is better than a skin graft to provide a better coverage for preservation of contour and function of deeper tissues. In this study 38 flap procedures done at our institution are being presented and results of various type of flaps have been evaluated.

**MATERIAL AND METHODS**

In the present study 38 flaps procedures have been done over 27 patients to cover various skin defects in the following conditions of limbs or back, in the Deptt. of Orthopaedics, Rama Medical College Hospital & Research Centre, Kanpur.

- (i) Open fracture with exposed bone.
- (ii) Exposed tendons, hyaline cartilage and synovial joint.
- (iii) Thrasher injuries of hand.
- (iv) Pressure sores.
- (v) Non-healing ulcers.
- (vi) Chronic osteomyelitis.
- (vii) Surgically created fresh wounds.

For flap transfer pre-operative planning is very necessary. Both donor and recipient sites are painted and draped. First recipient site is prepared for flap take up, surgical defects is debrided cleaned and scar tissue is removed, if any. Flap is raised at donor site, depending upon its anatomy, feasibility and pre-operative planning; haemeostasis at donor and recipient sites is secured, flap is stitched at the recipient site. A suction drain or a plain rubber drain is put at the site of flap transfer. Secondary defect, from where flap has been raised, is closed either by primary suturing or a partial thickness skin graft. Wounds are covered with non-sticky dressings. To retain the flap at its new position, the parts of the body are immobilized in a meaningful way by external fixator, plaster of Paris cast, adhesive bandage or prone lying in the bed especially in case of a pressure sore.

Mcgregor I.A. and Morgan (1993)<sup>2</sup> Described flaps in detail based upon main constituents i.e. tissue transferred Flaps used are

- (1) Skin flap :- Flap consists of skin and superficial fascia. Depending upon anatomical basis of vascular supply skin flaps can be of two types
  - A) Random pattern flap :- With undefined blood supply so

length/breath ratio is 1:1 and we cannot use long flap.

B) Axial pattern flaps :- These are flaps with well defined blood supply. Example deltopectoral flap, Groin flap. here length / breath ratio is 3-4 : 1 i.e. long flaps can be used.

To, augment the blood supply of the random pattern flap for the consideration of a flap of larger dimensions, and even to increase the length and width ratio of an axial pattern flap, we did use the "Method of delay" (Blair 1921)<sup>3</sup> by surgically outlining the flap during any stage of its transfer. This procedure is also of particular importance, where the vascularity of the flap, specially at its tip is doubtful, before detachment from the donor site.

- (2) Fasciocutaneous Flap : (Ponten 1981)<sup>4</sup> Skin and superficial and investing layer of deep fascia. It has a great merit of increased length to with ratio upto 3:1, e.g. cross leg flap, cross finger flap and very useful axial pattern groin flap (Mc Gregor I.A. and Jackson I.T. 1972)<sup>5</sup>
- (3) Muscle Flap: (Ger 1966)<sup>6</sup>: Flap may consists of muscle usually detached at one end and moved to cover the defect for example bare bone, a surface which is generally unsuitable for skin grafting. When covered by such a muscle flap surface of muscle accepts skin graft readily for example gastrocnemius, soleus, gluteus maximus and latissimus dorsi muscles are used as flaps.
- (4) Myocutaneous Flap : (Iginio Tansini 1906)<sup>7</sup>

Muscle is transferred as a composite flap with its vascular pedicle, and the skin covering the muscle e.g. Latisimus Dorsi to cover the defect of upper extremity, the use of tensor fascia lata myocutaneous flap in coverage of trochanferic sores and the use of lateral and medial gastrocnemius flaps for upper tibial defects. Kaster T.R., and Hill H.L. (1982)<sup>8</sup>.

A flap is transferred to reconstruct primary defect and is set into this defect. A transfer usually leave a secondary defect which in most instances is either closed by direct suture or covered by free skin graft.

On the basis of distance between donor and recipient sites, they may be -

- (I) Local Flaps:
  - a) Rotational - Rotated in a semicircular manner.
  - b) Transpositional - Shifted, laterally.
  - c) Advancement - Advanced directly towards defect. either V-Y or V-V type.
- (II) Distant flaps, e.g. adboimnal flap for hand.

**OBSERVATIONS**

To cover post-traumatic, pathological or surgically created skin defects in 17 patients out of 27, a single flap was done, while in 6 patients, two flaps and in one patient, three flaps were done simultaneously, to partially cover a big defect. In 3 patients, a

second flap was done after partial or full failure of the first flap procedure. Age group of patients ranged from 11 years to 45 years, out of which two were females with the age of 25 years and 26 years, respectively. Most vulnerable age group for flap surgery was 11-20 years. Males of age group 11-30 years, constitute about three fourth of total number of patients. Total number of patients of road traffic accidents and train accidents constituted about 50% of these cases. The next common etiology was mechanical injuries, including Thrasher injuries. Commonest type of defect was compound fracture with exposed cortical bone, either at leg, hand or forearm. Overall, among the extremities, right side i.e. the dominant side was more commonly involved. Among these all, left leg was the most common part upon which flap was done, followed by right leg. and right hand. Most of the defects atleast once were contaminated with different bacteria, staphylococcus aureus being the commonest, therefore most of the flaps (about 50%) were done after a period of 4 weeks, after proper debridement, regular cleaning and dressing of the wound along with anti-microbial therapy. Being more convenient, local flaps were done about 192 times more than distant flaps. Maximum number of flaps (24/38) were of fasciocutaneous variety of which 8 were, distally based, followed by muscle flaps, skin flaps and myocutaneous flaps.

Our observations are summarised in different tables

**Table 1 : Type of defects**

S. No.	Type of defect	No. of Patient	No. of Flap	%
1.	Open Fracture with exposed bone	14	20	52.6
2.	Pressure sore	03	04	10.5
3.	Removing scar or adhesions i.e. surgically created wound	04	05	13.2
4.	Non-healing ulcer 01	01	2.6	
5.	Post-burn (Electric or Fire)	02	03	7.9
6.	Miscellaneous	03	05	13.2
	Total	27	38	100

**Table 2 : Showing time duration of defect before flap surgery**

Duration	No. of flaps	Percentage
Immediate	05	13.2
Within 2 week	09	23.6
2 to 4 weeks	05	13.2
More than 4 weeks	19	50.0
<b>Total</b>	<b>38</b>	<b>100</b>

**Table 3 : Showing parts of the body involved**

	Parts of body	Total
Upper Limb	• Arm	1
	• Forearm	3
	• Hand	8
Lower Limb	• Thigh	-
	• Leg	21
	• Ankle and foot	1
Pressure sore	• Ischial	1
	• Greater trochanter	1
	• Sacral	2
<b>Total no. of flaps</b>		<b>38</b>

**Table 4 : Various flap procedures, as used to cover the defect**

Type	Local	Distant	Total
Skin Flap	Transverse back = 2	Abdiminal = 1 Pectoral Burial = 1	04
Fasciocutaneous	Thigh/Gluteal = 1 Thumb = 1 Index finger = 1 Advancement flaps = 3 Leg = 8	Groin = Same side = 3 Opp. side = 4 Cross leg = 6	24

Muscle flap	Medical Gastrocnemius = 5 Soleus = 3	Latissimus Dorsi = 1	
Myocutaneous	Tensor fascia Lata = 1		01
<b>Total</b>	<b>22</b>	<b>16</b>	<b>38</b>

**Table 5 : Various flap procedures, as used to cover the defect**

Healing	Time	No. of flaps	Percentage
Less than	2 weeks	03	07.9
	2 weeks	03	07.9
More than	3 weeks	09	23.7
	4 weeks	17	44.7
	5 weeks	04	10.5
More than	5 weeks	02	05.3
	<b>Total</b>	<b>38</b>	<b>100</b>

**DISCUSSION**

Skin cover is required in Orthopaedic surgery because of need for a sterile field during and after surgery of bone and joint. Skin cover is also required prior to secondary surgery of nerve or tendon. The importance of skin cover for pressure sores in paraplegic and nonparaplegic patient cannot be overemphasized.

Ponten (1981) described the utility of fasciocutaneous flaps for covering the soft tissue defect on lower leg. He also suggested alternative in form of myocutaneous flaps proximally and free flap distally. O'brien (1978)<sup>9</sup> advised the use of simplest procedure that will provide adequate cover.

Management of pressure sore is a complicated one, because of infection, nutritional deficiency and recurrence of ulceration. Intercostal neurosensory flap is ideal to provide sensations in the patients with low spinal cord injury (Daniel & Terzis, 1976)<sup>10</sup> but this requires an extensive difficult dissection.

Transverse lumbar back flap (Hill 1978)<sup>11</sup> is a reliable alternative coverage for sacral defects It's design is anatomically round and flap can be directly elevated without delay in 2:1 length and width ratio in case of sores, Over bony prominence these flaps, especially the muscle or myocutaneous ones provide a thick padding to resist considerably the wear and tear in future. Myocutaneous flap of tensor fascia lata provides a good neurosensory coverage over pressure sores. Upto 4 weeks, more than 80% flaps healed, maximum in 4th weeks, in this prolonged period of immobilization in an uncomfortable posture, boost up and assurance to the patient is very necessary to get his/her co-operation, for the success of the procedure. Main complications, which we encountered were haematoma collection underneath the flap, infection either low grade or frank one, partial or total necrosis of the flap and non-closure of the secondary defect, either due to infection or physical stress on stitches. Most common complication of flap surgery in our series is partial necrosis of the flap, for which a secondary suturing or a partial thickness skin graft or rarely a second flap is necessary on a later date. Here "delay" procedure helps to augment the blood supply on the flap. Next common complication is, infection either low grade or frank one. Judicious use of antibiotics, and/ proper pre-operative cleaning of the wound, the suction drain, play an important role to minimise the infection, especially in muscle and myocutaneous flaps.

As greater distortions, disfigurements and deformities are caused by soft tissue loss than by the damage of underneath skeletal support, the flap procedure provides a better and more natural coverage in such a defect, as well as it is of particular value in orthopaedics to provide a better biological environment for future surgery over locomotor system. Early coverage of defect by a flap in a healthy environment reduces the morbidity and period of hospital stay, and improves the end results.

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