Original Research Paper

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Plastic Surgery

RECONSTRUCTION OPTIONS IN FULL THICKNESS CHEST WALL DEFECTS AND OUTCOME ANALYSIS AT TERTIARY CARE CENTER.

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ABSTRACT Chest wall defects are commonly encountered in relation to burn injuries with wide defects of skin, skeletal & visceral tissues, multiorgan damage & even death.The primary goals of any chest wall reconstruction is the re-establishment of skeletal stability and soft tissue coverage that can be achieved using local advancement flap, perforators based flaps or pedicled myo cutaneous flaps.The study recruited 11 patients in whom severe electrical burn injuries , present over anterior, lateral, posterior chest wall extending upto shoulder region.Various flaps used in this study were Deltopectoral flap , Pectoralis Major turn over flap, Latissimus dorsi flap,Thoracodorsal artery perforator flap & Parascapular flap with positive outcomes and little complications .It is imperative that soft tissue coverage be achieved, using one of multiple available rotational, advancement,perforator based & pedicled myocutaneous flaps.Due to their different locations and application methods,these flaps have their own unique advantages and disadvantages.With the innovation in surgical techniques ,outcomes for chest wall reconstruction are expected to continue to improve.

KEYWORDS : Full thickness, Chest wall defects, Flap, Electrical burn.

INTRODUCTION

Reconstruction of chest wall defects presents a challenge in plastic surgery to restore respiratory function and protect underlying intrathoracic organs.[1] Large, life threatening chest wall defects can arise as a result of burn, trauma, infection, neoplasm resection, or radiation-induced skin damage.[2] The principles of chest wall reconstruction include wide debridement of all necrotic and devitalized tissues, coverage with healthy tissue to heal a wound, restoration of the continuity and skeletal stability of the chest wall, and immediate or early definitive coverage for vital structures.[3,4] There are no precise guidelines in the literature on the resultant reconstructive needs of complex chest wall defects, but commonly, defects of more than 5 cm in diameter when four or more ribs are absent require repair due to the risk of lung herniation and paradoxical motion of the chest wall.[5]

Tansini, in 1906, reported the first chest wall reconstruction by covering mastectomy defects with pedicled latissimus dorsi muscle.[6] Traditionally, for soft tissue coverage in chest wall reconstruction, locoregional random pattern flaps and fasciocutaneous flaps were used. However, with the advancements leading to a spectrum of innumerable techniques from skin grafting to microvascular free tissue transfer, acceptable morbidity and mortality rates have been achieved in more extensive resections and reconstructions.[7] The choice of technique depends on the size, location and depth of the defect (partial or full-thickness), viability of the surrounding tissue and donor site availability with consideration to prior operative procedures.[8]

Several authors have reported pedicled myocutaneous flaps as the first choice for soft tissue reconstruction, with pectoralis major, latissimus dorsi, and vertical rectus abdominis flaps used in 63 to 78% of chest wall reconstructions. These workhorse muscle flaps are robust and reliable, with the versatility to cover a wide range of defects of different sizes because of consistent vascular anatomy.[9] This study was aimed to evaluate the different types of flap techniques & their complications, when used in reconstruction of full thickness chest wall defects following burn injuries.

MATERIALS AND METHODS

The study recruited 11 patients who were admitted to the burn casualty center of S.M.S Medical College,tertiary care center from Jan 2021 to Jan 2022. Patients included in study were in age range of 22-55 years and had full thickness electrical burn injuries. Patients with partial thickness burn, were previously operated or with burn injuries other than electric burn were excluded from the study. After obtaining the necessary clearance from the institutional ethics committee, patient characteristics, comorbidities were recorded and complete blood investigations & chest X rays were undertaken.

Fluid resuscitation was started aggressively & maintained until hemodyanamic stability achieved as evident by an adequate urinary output.Antibiotics were prescribed which were escalated according to pus culture. Wound dressings were done with silver sulphadiazine cream.

Surgical debridement was performed before flap surgery in two patients, while the rest of the patients underwent debridement and flap surgery simultaneously. Fluid resuscitation was started aggressively & maintained until hemodyanamic stability achieved as evident by an adequate urinary output.

Large full thickness chest wall defects identified measuring from 10× 5 cm to 15 × 30 cm. Based on location, defects were divided into anterior, lateral, posterior. Anterior chest wall defects are covered by Deltopectoral flap & Pectoralis major turn over flap. Anterolateral and posterior chest wall defects by Latissimus Dorsi flap. Posterolateral and lateral chest wall defects are covered by Thoracodorsal artery perforator flap & Parascapular Flap.Images are illustrated in figure-1 and figure-2.

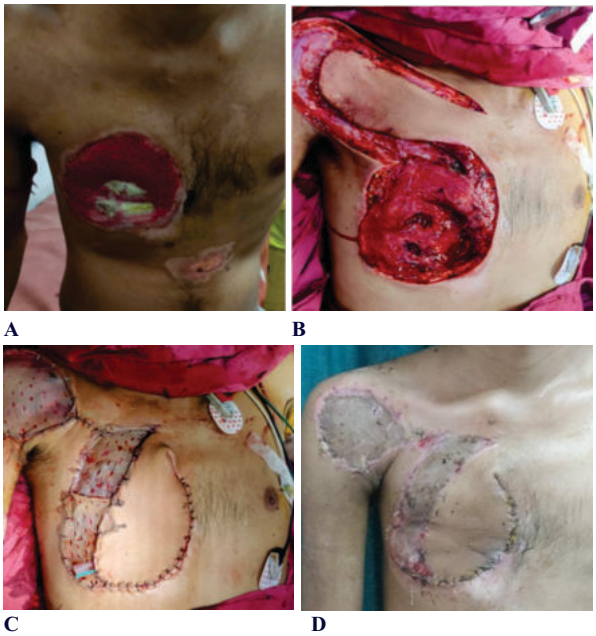

Figure 1: Reconstruction undertaken using deltopectoral flap.A-preoperative image showing anterior chest wall defect, B-intraoperative image showing flap raised,C- immediate postoperative image ,D-well settled flap.

A B

C

Figure 2:Reconstruction with thoraco dorsal artery perforator flap,A-preoperative image showing electric contact burn over shoulder region, B-intraoperative image showing flap raised over thoracodorsal artery perforator,C-well settled flap.

RESULTS

During the study period, a total of 11 patients underwent chest wall reconstruction. Out of 11 patients, 8 were males and 3 were females. The mean age of patients was 45.2 years. Different types of flaps, including deltopectoral flap (n = 4), latissimus dorsi flap (n = 3), pectoralis major (n = 2), thoracodorsal artery perforator flap (n = 1), and parascapular flap (n = 1), were used **(Table 1)**.

Table 1: Summary statistics for the association between Flap Type and Gender of patient

	Gender			P value For Monte Carlo test
Flap Type	Female	Male	Total	
1.Deltopectoral Flap	2 (50%)	2 (50%)	4 (100%)	0.85
2.Latissimus Dorsai Flap	1 (33.3%)	2 (66.7%)	3 (100%)	
3.Pectoralis Major Flap	0 (0%)	2 (100%)	2 (100%)	
4.Thoracodorsal artery perforator Flap	0 (0%)	1 (100%)	1 (100%)	
5.Parascapular Flap	0 (0%)	1 (100%)	1 (100%)	
Total	3 (27.3%)	8 (72.7%)	11 (100%)	

There were 9 cases of primary healing, and 2 case of delayed healing of the skin incision. Wound dehiscence, graft loss, donor site morbidity,post of infections and partial flap necrosis were seen in 4% cases of latissimus dorsi flap, 4% cases of deltopectoral flap and 2 %cases of pectoralis major flap, 1 %case of thoracodorsal artery perforator flap, and 1% case of parascapular flap,respectively. Seroma developed in 3% cases of latissimus dorsi flap and 1 %case of thoracodorsal artery perforator flap

Post operative follow ups:

After 6 and 12 months of surgery, complete recovery was seen in all patients who were given different flaps **(Table 2).**

Table 2: Summary statistics for the Percentage of Recovery regarding various flap Type after 6 months and after 12 months.

	Recovery	
Flap Type	After 6 Months	After 12 Months
1.Deltopectoral Flap	4 (100%)	4 (100%)
2.Latissimus Dorsai Flap	3 (100%)	3 (100%)
3.Pectoralis Major Flap	2 (100%)	2 (100%)
4.Thoracodorsal artery perforator Flap	1 (100%)	1 (100%)
5.Parascapular Flap	1 (100%)	1 (100%)
Total	11 (100%)	11 (100%)

DISCUSSION

Multiple techniques exist for the reconstruction of complex chest wall defects that may stem from burn, trauma, tumor extirpation, previous abdominal procedures, and surgical management. In a retrospective study, an algorithm for soft and skeletal tissue reconstruction of chest wall defect was created and showed that pectoralis major flap ,latissimus dorsi muscle flap , vertical rectus abdominis muscle flap , omentum flap , transversal rectus abdominis muscle flap, free antero-lateral thigh flap , and local rotation flap were used for soft tissue reconstruction.[10]The flaps employed in this study included the deltopectoral flap, the pectoralis major turn over flap, the latissimus dorsi flap, the thoracodorsal artery perforator flap, and the parascapular flap, all of which demonstrated excellent healing (98-100%) and graft uptake, as well as improved aesthetics and minimal problems (0-10%). Akan M et al. (2006) treated 13 patients with full-thickness chest wall defects using local skin, musculocutaneous, free latissimus dorsi, and anterolateral thigh flaps to cover soft tissue with a follow-up of 12 days to 19 months. Three patients reported having recurrent breast carcinoma; seven patients relapsed after excision of a sarcoma; two patients had lesions of the chest wall after irradiation; and one patient had a sternal fistula.[11]

The pectoralis major flap has been considered the workhorse flap for chest and sternoclavicular defect reconstruction. It is most commonly used as a muscle advancement or rotation flap based on the thoracoacromial pedicle. Although not necessary, it can be used as a musculocutaneous or even osteomusculocutaneous flap.[12] Jo GY et al (2022) reported reconstruction of large chest wall defect using bilateral pectoralis major myocutaneous advancement flaps augmented with axillary V-Y advancement rotation flaps for additional flap advancement in older patients.[13] Each of the muscle flaps has its own set of advantages and limitations due to their unique locations and application processes. Deepithelized turnover deltopectoral flap have served extensively in the repair of anterior chest wall defects.[14] Nnabuko RE et al. (2011) demonstrated the use of an extended reverse double turnover deltopectoral flap in a full-thickness left anterior chest wall defect following an electrical burn, with 98% of the graft taken by the patient.[15] The major limitation of the flap is its inability to extend to the lateral or posterior chest wall, limiting its use in those areas.

The latissimus dorsi flap is a versatile flap that can be used to cover defects in the anterior, lateral, and posterior parts of the chest, as well as the upper half of the sternum. The latissimus dorsi muscle or musculocutaneous flaps are easy to elevate; their arc of rotation is wide, making them efficient for coverage of large soft tissue defects.[16] Borisov V. (2020) reported a case of rigid chest wall reconstruction with a latissimus dorsi muscle flap after an infection of alloplastic material, showing its valuable salvage option in case of infection and suggesting alloplastic material to be highly risky in these situations.[17]

The thoracodorsal artery perforator flap is a relatively new member of the perforator flap family in reconstructive surgery and is capable of resurfacing large defect areas (18×55 cm). It is a thin modified flap, raised as a fasciocutaneous flap based on a medial or lateral branch of the thoracodorsal arteries, drained by two venae comitantes.[18] Sever c et al. (2012) established a 100% success rate with satisfactory cosmetic results in thirteen patients who underwent soft tissue reconstruction using thoracodorsal artery perforator flaps. Minor complications observed related to transferred flaps were wound dehiscence in one case and transient venous congestion in two cases. In one case, seroma developed at the donor site.[19]

The parascapular flap design is also used for covering posterior chest wall defects, which almost completely overlap an oblique design of the latissimus dorsi musculocutaneous flap or the thoracodorsal perforator flap.[20]

CONCLUSION

Reconstruction of chest wall deformities can be a difficult task. Soft tissue coverage must be obtained by employing one of the numerous available rotational, advancement, perforator-based, or pedicled myocutaneous flaps.

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