

Chest Wall Defects and their Reconstruction

F A KHAN M U FAROOQ H ZAFAR

Department of Plastic & Reconstructive Surgery, King Edward Medical University/ Mayo Hospital Lahore.
Correspondence to: DR. Farid Ahmad Khan E-mail: drfaridahmadkhan@yahoo.co.uk

Background : Chest wall reconstruction remains one of the most challenging areas of Plastic and Reconstructive Surgery. The purpose of this study is to report our 4 year experience with chest wall reconstruction. **Methods:** A review of 62 patients who had chest wall reconstruction from 2001 to 2004, is included in the paper. Indications include, defects secondary to congenital deformity correction, post neoplastic reconstructions, post burn defects and sternotomy wounds. Procedures performed included direct closure after debridement, vacuum assisted closure with and without skin grafting, pectoralis major flap, rectus abdominis flap, omental flap and free flaps including latissimus dorsi flap. The average hospital stay was 13 days. The uneventful recovery was seen in 50 patients. Minor complications were seen in 12 patients whereas major complications were not seen in any patient. **Conclusion:** Chest wall reconstruction can be performed with satisfactory outcome provided that reconstruction ladder is followed.

Key words: Chest wall defects, sternal defects, chest wall reconstruction, vacuum assisted closure (VAC),

Chest wall defects pose a great challenge to every plastic surgeon. Since the first known chest wall reconstruction in 18th century improvements in surgical techniques and developments and refinements in reconstruction techniques have allowed extensive chest wall reconstructions to be performed with negligible morbidity and mortality^{1,2}. A variety of procedures including vacuum assisted closure (VAC) and flaps have been used to provide adequate wound coverage that allows quick healing, rehabilitation and cosmesis. In this study we will review our four year experience with chest wall reconstruction and conclude that careful evaluation and meticulous reconstruction can result in satisfactory outcome to these challenging injuries.

Patients and Methods

This study was carried out at the Departments of Plastic and Reconstructive Surgery, Mayo Hospital, Shaukat Khanum Hospital, Ittefaq Hospital and Surgimed Hospital, Lahore on consecutive patients from 2001 to 2004. Total number of patients were 62, out of which 45 (73%) were males and 17 (27%) were female, with age range of 1 to 68 years.

The indications for reconstruction included defects secondary to congenital deformity correction (03 patients, 5%), post neoplastic reconstructions (09 patients, 15%), post burn defects (12 patients, 19%) and sternotomy wounds (36 patients, 58%). (Table 1)

Table1. Indications for reconstruction (n=62)

	n=	%age
Defects secondary to congenital deformity correction	3	5
Post neoplastic reconstructions	9	15
Post burn defects	12	19
Sternotomy wounds	36	58
Miscellaneous	2	3

Procedures performed included, direct closure of debridement (7 patients, 11%), vacuum assisted closure (VAC), (9 patients, 14%), vacuum assisted closure with split skin grafting (12 patients, 19%), pectoralis major flap (14 patients, 23%), rectus abdominis flap (14 patients, 23%), omental flap (3 patients, 5%), transverse rectus abdominis myocutaneous flap (TRAM) (1 patient, 2%) and latissimus dorsi free flap (2 patients, 3%). (Table 2)

Table2. Procedures performed (n=62)

	n=	%age
Direct closure after debridement	7	11
VAC	9	14
VAC with graft	12	19
Local flaps:		
Pectoralis major	14	23
Regional flaps:		
Rectus abdominis	14	23
Omentum	3	5
TRAM	1	2
Free flaps:		
Latissimus dorsi	2	3

Results:

The average hospital stay was 13 days. The uneventful recovery was seen in 50 patients (81%). Minor complications (which did not prolong the hospital stay), were seen in 12 patients (19%) whereas major complications were not seen in any patient.

Discussion

With an increase in the number of coronary artery bypass grafting operations the acquired chest wall deformities need more and more reconstructions³.

With the advent of vacuum assisted closure (VAC) in the management of sternal defects, the algorithm for the management of these defects has changed⁴ (Fig. 1). Vacuum assisted closure creates a negative pressure which help in wound contraction and increase in granulation tissue⁵. Following is the algorithm used for sternal wounds management.

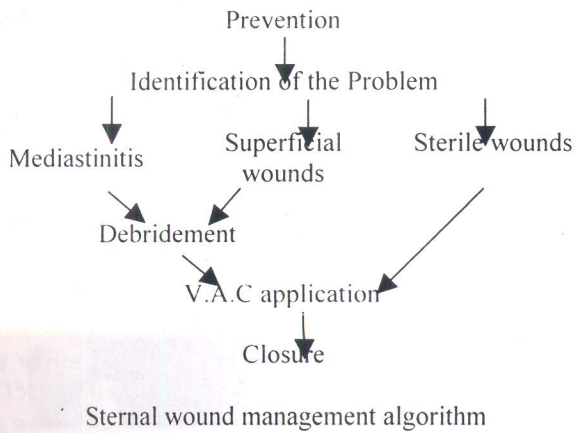


Fig 1. Application of VAC

The pectoralis major muscle is usually used for anterior defects of chest wall and anterior intrathoracic reconstruction (e.g. bronchopleural or tracheoesophageal fistula)⁶. Apart from harvesting the flap on thoracoacromial pedicle, it can also be based on perforators of internal mammary artery, which can be used for middle and lower sternal defects.

The rectus abdominis is a useful flap either as a muscle flap or as a combined myocutaneous flap⁷. Furthermore the skin pattern can be designed as transverse vertical or oblique in accordance with need. The surgeon must ensure that the internal thoracic artery is patent on the side, where the flap is based upon. Any incision dividing the muscle contraindicate its use distal to incision. This flap can easily reach the sternal notch and is also reliable for anterolateral defects of chest wall. An interesting observation was made during the study that even with full thickness sternal defects, there is no need for synthetic mesh as rectus muscle hardens itself with time (Fig 2,3,4,5).

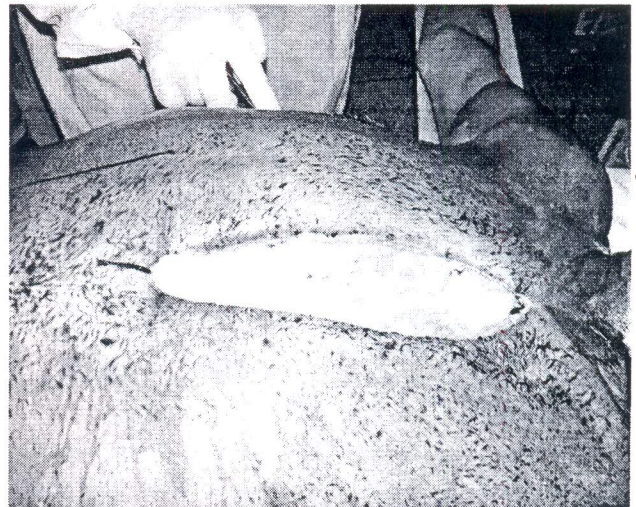


Fig 2. Preoperative case of post CABG sternal defect

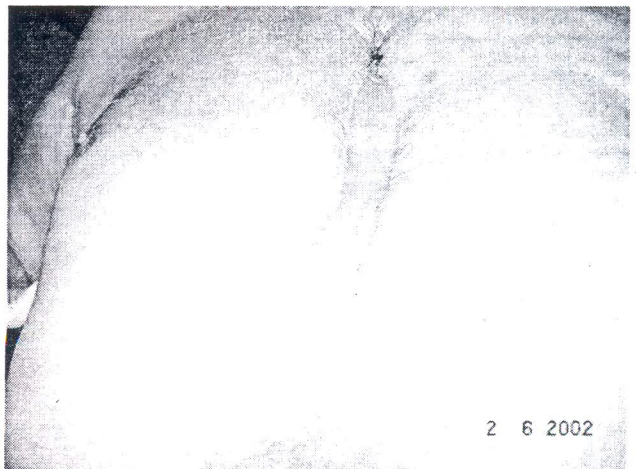


Fig 3. Sternal defect treated with rectus abdominis flap

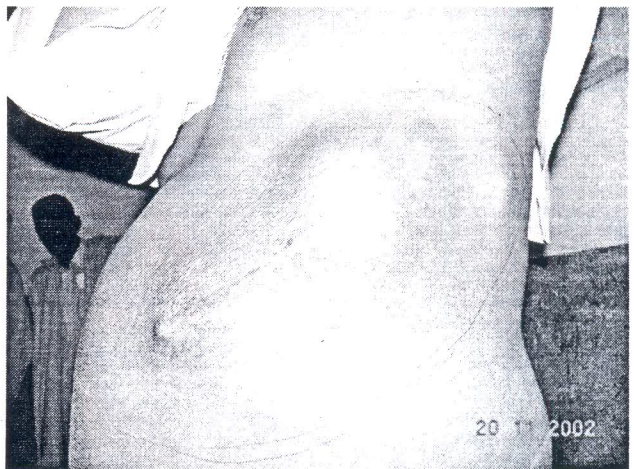


Fig 4. Preoperative case of chondrosarcoma of ribcage

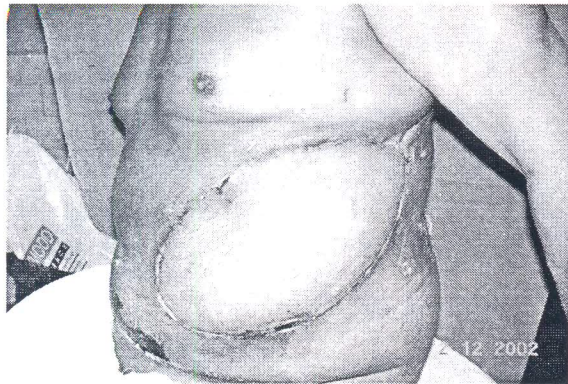


Fig 5. The patient in Fig 4. treated with TRAM

The omentum can be mobilized by dividing the short vessels between the gastroepiploic arcade and the greater curvature of stomach so that the omentum is attached by left and right gastroepiploic arteries. The flap can be transferred to the chest either by large subcutaneous tunnel or direct incision. In the rare situation of pedicled muscle flap loss, the pedicled omental flap can be used as a salvage procedure^{8, 9}. (Fig 6,7,8)

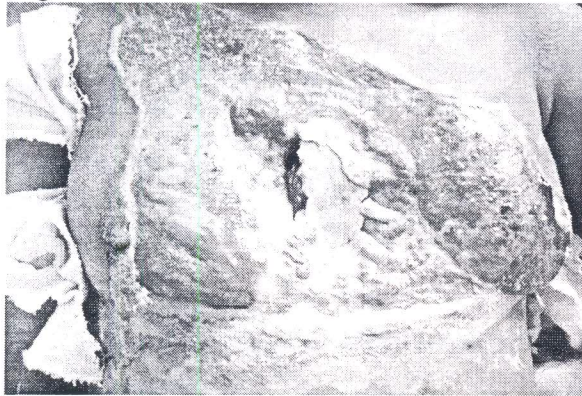


Fig 6. Preoperative case of post electric burn wound



Fig 7. Omental flap being raised in patient.



Fig 8. The patient in Fig 6. postoperatively

The latissimus dorsi can be used as a muscle or a musculocutaneous flap can provide cover for upper lateral aspect of the anterior thorax, the supraclavicular fossa and nape of the neck. The presence of scar crossing the area of pedicle usually contraindicate its use.

The use of free flaps is the highest rung of reconstruction ladder. The latissimus dorsi is the main flap to executed because of the large diameter of donor vessels¹⁰. In conclusion, the chest wall defects can be reconstructed with satisfactory outcome, provided that the reconstruction ladder is followed.

References

1. Grabber GM, Jones DR, Pairolero PC. Primary neoplasm. In Pearson FG et al (eds); Thoracic Surgery. Churchill Livingstone 2002; 1417-30
2. Pairolero PC. Chest wall tumors. In Shields TW, LoCicero J, Ponn RB (eds); Thoracic Surgery Lippincott Williams and Wilkins 2000; 589-598.
3. Gummort JF et al. Mediastinitis and Cardiac surgery: An updated risk factor analysis in 10,373 consecutive patients. J. Thorac Cardiovasc Surg 2002; 50:87.
4. Agarwal JP, Ogilvie M et al. Vacuum assisted closure for sternal wounds: A first line therapeutic management approach. Plast Reconstruct Surg 2005; 116:1035.
5. Argenta LC, Morykwas MJ. Vacuum assisted closure: A new method for wound control and treatment. Clinical experience. Ann Plast Surg 1997; 38:553.
6. Turkmen A, Perks AG, Endoscopic assisted harvest of pedicled pectoralis major muscle flap. Br J Plast Surg 2005; 58(2): 170-4.
7. Shibata T, Hattori K, Hirai H. Rectus abdominis myocutaneous flap after unsuccessful delayed sternal closure. Ann Thorac Surg 2003; 76(3): 956-8.
8. Jurkiewicz MJ, Arnold PC. The omentum: an account of its use in reconstruction of the chest wall. Ann Surg 1977; 185:548-54.
9. Hultman CS, Culbertson JH, Jones GE et al. Thoracic reconstruction with omentum: indications, complications and results. Ann Plast Surg 2001; 46:242-
10. Andrej B, Hans R, Dominique E. Free latissimus dorsi flap for chest wall repair after complete resection of infected sternum. Thorac Surg 1995, 60:1028-1032.