

Deep sternal wound infection after Coronary Artery Bypass Graft (A Comparative Study between PMMC v/s Omentum Pedical Flap)

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Abstract: Sternal wound infection is a life threatening complication after cardiac surgery associated with high morbidity and mortality. The aim of this study is to evaluate the results of reconstructing deep sternal wound infection after coronary artery bypass graft, with either pectoralis major flap and/or pedicled omentoplasty after previous vacuum- assisted closure (VAC) therapy. For six patients, sternal refixation and reconstruction was obtained by sternal internal plate fixation combined with Pectoralis major Myocutaneous flap. In four patients a pedicle omentoplasty was performed with or without split-skin graft and additional VAC therapy. We evaluated preoperative characteristics and post-operative course. Our all PMMC Flap patients had an uneventful post-operative course. Complications in pedicled omentoplasty patients included wound dehiscence, infection of sternal plating material etc. Average sternal wound healing after pectoralis plasty and omentoplasty respectively accounted 6.0 and 12 weeks. From our experience, we recommend VAC therapy plus delayed sternal plating pectoralis major flap advancement as first repair option in case of DSWI. However, individual clinical conditions need to be taken into account when making a decision between the different available reconstructive options. Omentoplasty should be reserved for cases in which the sternum has recurrently fallen open after previous sternal plate refixation, or for cases in which the sternum defect is too extended.

Keywords: pectoralis major flap, deep sternal wound infection, pedicled omentoplasty, VAC therapy.

I. Introduction

Although Deep sternal wound infection (DSWI) after CABG with median sternotomy is infrequent, it increases mortality, morbidity, and hospital stay. Since introduction of median sternotomy to allow access to intrathoracic organ, sternal wound infection and dehiscence have been reported to occur in 0.2 – 1.0% and mortality in such cases ranges from 5% to 20% [1].

The risk factor for sternal dehiscence post median sternotomy includes diabetic [2], prolonged surgery time [3], postoperative ventilator [4], previous surgery [5], post operative dialysis [5], post operative hemorrhage [6], smoking, low cardiac output, use of either left internal mammary or right internal mammary artery or both [6], obesity [7].

Treatment option includes multiple debridement, resuturing, vacuum-assisted closure (VAC), and flap cover with muscle flaps like Pectoralis major, Rectus abdominis, Latissimus dorsi and Omentum.

The possible and most devastating complication that can occur patient of sternal dehiscence is mediastinitis. The incidence is 47%. The mortality in such cases as highest 50% [8-11].

There is no consensus on which of these option superior. Several publication recommended Omentoplasty reconstruction of chest wall defect after post sternotomy after CABG or as a final solution when muscle flap have failed [12, 13, 14]. The main goal of this study is to evaluate the outcome of a several cases in which either pectoralis major muscle flap advancement or Omentum flap transposition has been used for repair of DSWI.

II. Material and Methods

We perform retrospective review of 10 cases of patient of sternal dehiscence managed by either by pectoralis major flap or Omentum flap in Mahatma Gandhi Hospital and Medical College.

Next to gender, age & medical history of each patient the clinical records were studied for data regarding indication for reconstructive intervention, detected pathogen in the sternal wound, type of surgical procedure, postoperative course and complication, additional treatment and follow up Surgical Technique

Pectoralis Major Myocutaneous Flap (PMMC) Flap:-

The non viable, necrotic tissue and costal cartilage are debrided and sternal wires removed. The margins of the sternum are debrided to reach the healthy bone that bleeds. Than VAC device system applied with 100 mmHg pressure till the healthy granulation tissue is achieved.

The sternal origin of Pectoralis major is identified on one side. It is released along the entire length of the body of sternum on one side. Blunt dissection and diathermy are used to separate the P. major muscle from skin, subcutaneous tissue and underlying P. minor. The muscle flap is released inferiorly by dividing its attachment from lower margin of chest wall and the interdigitating fibres of external oblique abdominal muscle. The fascia over the rectus may be harvested as extension of pectoralis flap. This helps in filling the cavity in lower end of defect. The superiolateral limit of dissection of the flap is the anterior axillary fold. If the flap reaches comfortably across midline the tendon of P. major is not divided from its humeral attachment otherwise humeral attachment is divided by separate incision in axillary crease and P. muscle is isolated on the thoracoacromial artery. Hemostasis is achieved. The P. major muscle flap thus swung across medially over the sternal defect. The dead space is thereby obliterated. Multiple drains are placed both superficial and deep to muscle flap. The subcutaneous tissue and skin is closed.

Pedicle omentoplasty:-

After debridement of sternal wound edges, a median laparotomy ± 8 cm is performed. The omentum is detached from the transverse and mesocolon. Based on surgeon's preference, a decision is made whether the right or left gastroepiploic artery (or both) should be spared.

The right gastroepiploic artery is larger and has more epiploic branches and therefore is generally used as nutrient vessels. After ligation of one gastroepiploic artery, the branches of the stomach from the gastroepiploic arcade are divided as far as necessary to obtain a real pedicled omentoplasty. Compression or kinking of the vascular pedicle is prevented. An artificial incisional hernia with sufficient diameter is left in the midline laparotomy wound for passing the pedicled omentoplasty through cranially. Via subcutaneous route, the thoracic region is reached. The Omentum is then placed without any traction in the sternum defect and fixed with some suture at the edges. The sternum wound is either primary closed or covered by a 1 or 1.5 meshed split skin graft. All patients received antibiotic and thrombotic prophylaxis during the procedure.

Post op. care

The suction drains are left in situ for at least 5 days, and patient receive antibiotic cover as per culture and sensitivity. If bone culture are positive than antibiotic are given for a minimum period of 6 weeks or till with C-reactive protein levels are within normal range. It is important those hematomas are avoided. Patients are advised against lifting heavy objects and contact sports for at least 3 months. Physiotherapy is gradually initiated.

III. Results

The study assessed the outcome of our experience with PMMC flap v/s Omentum flap for management of sternal dehiscence. In our study of 10 patients 6 patients were male and 4 patient were female. Average age was 62.5 years. All patient received VAC therapy before sternal wound repair for 2 weeks to 4 weeks Most common organism isolated from wound were Staphylococcus aureus 50%, Second most common staphylococcus epidermis – 20% or E. coli. – 10 %.(Table 1 and 2)

Table-1 Patient preoperative characteristics-

Preoperative characteristics	
Deep sternal wound infection	10 patients
Male to Female ration	6:4
Age (year), average and range	62.5 (45 to 87)
Wight (kg), average and range	74.8 (64 to 96)
Preoperative vacuumed assisted therapy	10 patients
Sternal plating + PMMC flap	6 patients
Sternal plating + omentoplasty	4 patients
Double breasting of PMMC flap	1 patients
Combined PMMC + Omentoplasty	1 patients

Table 2 Pathogen detected

Pathogen detected in sternum wound		
Staphylococcus aureus	5 patients	50%
Escherichia coli	1 patients	10%
Staphylococcus epidermis	2 patients	20%
Klebsiella pneumonia	1 patients	10%
No pathogen detected	1 patients	10%

Six patients, who suffered for DSWI after CABG, received regional myoplasty for reconstruction. In 4 cases unilateral pectoralis major muscle was transposed to the defect, in two cases, pectoralis transposition was combined with advancement of contra lateral muscle flap with double breasting. Average wound healing time was 6 weeks and post operative course was uneventful for all six patients.

Four patients underwent Omentum flap transposition. In our all four patient, a pedicle omentoplasty and split skin graft was performed for reconstruction of sternal defect. The Omentum was pedicled on one gastroepiploic artery in all four patients. In one patient omentoplasty was combined with PMMC flap. Flap loss did not occur in any of these patients. Our 3 patients had on uneventful post op. course. Wound dehiscence occurred in our one patient who needed a necrosis necrosectomy of the wound. Average wound healing time after omentoplasty was 12 weeks.

IV. Discussion

According to literature VAC therapy + sternal internal fixation is most effective method for repair of post-sternotomy wound infection or dehiscence [15]. In addition to this Baillot et al- concludes in a large 15 years review that VAC therapy with sternal preservation, followed by delayed sternal plating and PMMC flap for a good therapeutic strategy [16]. Because finding in literature lacks, a large multicentric controlled trial comparing myoplasty to omentoplasty, controversy still remain in this area of surgery.

Ortak et al – Summarise that PMMC flap should be first choice in treatment of DSWI [17].

Myoplasty is not feasible in patient with previous axillary radiation therapy or in patient with low muscle density or in patient with extensive soft tissue loss in sternal area especially in lower mediastinum.

Given its rich vascularisation and angiogenic and immunological features, the greater omentum seems as ideal and outmost viable solution for repair of infected sternotomy wound [18]. Lopez–Monjardin et al concludes in their study that using omentum flap in patients with mediastinitis secondary to open heart surgery is associated with fewer septic complications than using Pectoralis major flap [19].

Now days, Pedical omentoplasty is reserved for situation in which Myocutaneous flap coverage has failed or where myoplasty is not sufficient. Use of musculocutaneous flaps also depends on the vitality and the condition of the regional muscles. By not making use of the omentum, the patient can be spared a laparotomy. Besides, the greater omentum is not always available, for example, when a patient already had previous abdominal surgery.

Ghazi et al report an overall recipient site morbidity 23% and donor site complication rate 27% in a group of 52 patients, in which the greater omentum was used for the reconstruction [20]. These percentage of flap related complication and donor site complication match our results.

Laparoscopically harvested omentoplasty compare to open, is a minimally invasive technique with several advantages, for e.g. a decrease in the chances of herniation of donor site [21].

Given the previously discussed pros and cons the choice for either omentoplasty or pectoralis major muscle advancement technique will probably remain dependent on experience of individual surgeons, complexity of wound and more over an availability and quality and vitality of donor site.

V. Conclusion

Base on personal experience we would recommend initial preservation of sternum with VAC therapy followed by sternal refixation and Pectoralis major Myocutaneous flap. This is in line with review of Baillot et al [16].

Pedicle omentoplasty should be reserved for cases in which sternum has recurrently fallen open after previous sternal plate refixation, or for cases in which sternum defect is too extensive and / or soft tissue loss is too extensive.

References

- [1]. Landes G, Harris PG, Sampalis JS, Brutus JP, Cordoba C, Ciaburro H, et al. Outcomes in the management of sternal dehiscence by plastic surgery: A ten-year review in one university center. *Ann Plast Surg.* 2007;59:659–66. [PubMed]
- [2]. Jungheim C, Isgro F, Werling C, Sloot N, Saggau W. Analysis of infections after cardiac surgery. *J Thorac Cardiovasc Surg.* 2000;48(Suppl 1):50.
- [3]. Engelmann RM, Williams CD, Gouge TH. Mediastinitis following open-heart surgery: Review of two years experience. *Arch Surg.* 1973;107:772–6. [PubMed]

- [4]. Newman LS, Szezukowski LC, Bain RP, Perlino CA. Suppurative mediastinitis after open heart surgery. A case control study of risk factors. *Chest*. 1988;94:546–53. [[PubMed](#)]
- [5]. Belcher P, McLean N, Breach N, Paneth M. Omental transfer in acute and chronic sternotomy wound breakdown. *J Thorac Cardiovasc Surg*. 1990;38:186–91. [[PubMed](#)]
- [6]. Kouchoukos NT, Wareing TH, Murphy SF, Pelate C, Marshall WG. Risks of bilateral internal mammary artery bypass grafting. *Ann Thorac Surg*. 1990;49:210–5. [[PubMed](#)]
- [7]. Wilson AP, Livesey SA, Treasure T, Gruneberg RN, Sturridge MF. Factors predisposing to wound infection in cardiac surgery. A prospective study of 517 patients. *Eur J Cardiothorac Surg*. 1987;1:158–63. [[PubMed](#)]
- [8]. Malani P, Dyke D, Pagani F, Armstrong W, Chenoweth C. Successful treatment of vancomycin resistant enterococcus faecium mediastinitis associated with left ventricular assist device. *Ann Thorac Surg*. 2003;76:1719–21. [[PubMed](#)]
- [9]. de Feo M, de Santo L, Romano G, Renzulli A, della Corte A, Utili R. Treatment of recurrent staphylococcal mediastinitis: Still a controversial issue. *Ann Thorac Surg*. 2003;75:538–42. [[PubMed](#)]
- [10]. Kirsch M, Mekontso-Dessap A, Houel R, Giroud E, Hillion M, Loisançe D. Closed drainage using Redon catheters for poststernotomy mediastinitis: Results and risk factors for adverse outcome. *Ann Thorac Surg*. 2001;71:1580–6. [[PubMed](#)]
- [11]. Ridderstolpe L, Gill H, Ahlfeldt H, Rutberg H. Superficial and deep sternal wound complications: Incidence, risk factors and mortality. *Eur J Cardiothorac Surg*. 2001;20:1168–75. [[PubMed](#)]
- [12]. Cayci C, Russo M, Cheema FH, Martens T, Ozcan V, Argenziano M, et al. Risk analysis of deep sternal wound infections and their impact on long-term survival: a propensity analysis. *Ann Plast Surg*. 2008;61(3):294–301. doi: 10.1097/SAP.0b013e31815acb6a. [[PubMed](#)] [[Cross Ref](#)]
- [13]. Schroyers P, Wellens F, Degrieck I, Geest R, Praet F, Vermeulen Y, et al. Aggressive primary treatment for poststernotomy acute mediastinitis: our experience with omental- and muscle flaps surgery. *Eur J Cardiothorac Surg*. 2001;20(4):743–746. doi: 10.1016/S1010-7940(01)00873-9. [[PubMed](#)] [[Cross Ref](#)]
- [14]. Chang RR, et al. Chapter 68: Thoracic reconstruction. In: Grabb WC, Smith JW, Thorne CH, Bartlett SP, Beasley RW, Aston SJ, et al., editors. *Grabb and Smith's Plastic Surgery 6 Philadelphia USA: Lippincott Williams & Wilkins; 2006. pp. 665–669.*
- [15]. Daya M, Barnes N. Use of VAC therapy and sternal plating in the treatment of sternotomy wound dehiscence. *Eur J Plast Surg*. 2009;32:287–291. doi: 10.1007/s00238-009-0361-4. [[Cross Ref](#)]
- [16]. Baillet R, Cloutier D, Montalin L, Cote L, Lellouche F, Houde C, et al. Impact of deep sternal wound infection management with vacuum-assisted closure therapy followed by sternal osteosynthesis: a 15-year review of 23,499 sternotomies. *Eur J Cardiothorac Surg*. 2010;37(4):880–887. doi: 10.1016/j.ejcts.2009.09.023. [[PubMed](#)] [[Cross Ref](#)]
- [17]. Ortak T, Uraloğlu M, Uysal A, Orbay H, Tekin F, Şensöz O, et al. Reconstruction of sternal defects with pectoralis major muscle flap. *Eur J Plast Surg*. 2007;30(5):223–228. doi: 10.1007/s00238-007-0194-y. [[Cross Ref](#)]
- [18]. Krabatsch T, Fleck E, Hetzer R. Treating poststernotomy mediastinitis by transposition of the greater omentum: late angiographic findings. *J Card Surg*. 1995;10(1):46–51. doi: 10.1111/j.1540-8191.1995.tb00589.x. [[PubMed](#)] [[Cross Ref](#)]
- [19]. Lopez-Monjardin H, de-la-Pena-Salcedo A, Mendoza-Munoz M, Lopez-Yanez-de-la-Pena A, Palacio-Lopez E, Lopez-Garcia A. Omentum flap versus pectoralis major flap in the treatment of mediastinitis. *Plast Reconstr Surg*. 1998;101(6):1481–1485. doi: 10.1097/00006534-199805000-00008. [[PubMed](#)] [[Cross Ref](#)]
- [20]. Ghazi BH, Carlson GW, Losken A. Use of the greater omentum for reconstruction of infected sternotomy wounds: a prognostic indicator. *Ann Plast Surg*. 2008;60(2):169–173. doi: 10.1097/SAP.0b013e318054718e. [[PubMed](#)] [[Cross Ref](#)]
- [21]. Puma F, Fedeli C, Ottavi P, Porcaro G, Battista Fonsi G, Pardini A, et al. Laparoscopic omental flap for the treatment of major sternal wound infection after cardiac surgery. *J Thorac Cardiovasc Surg*. 2003;126(6):1998–2002. doi: 10.1016/S0022-5223(03)00709-8. [[PubMed](#)] [[Cross Ref](#)]