

Use of the pectoralis major fasciocutaneous flap in the treatment of post sternotomy dehiscence: a new approach

Utilização do retalho fasciocutâneo do músculo peitoral maior na deiscência de esternotomia: uma nova abordagem

Jaime Anger¹, Pedro Silvio Farsky², Antonio Flavio Sanches Almeida², Renato Tambellini Arnoni², Daniel Chagas Dantas²

ABSTRACT

Objective: To describe a new surgical technique for the treatment dehiscence after median thoracotomy transsternal using fasciocutaneous flap composed of the pectoralis major fascia. **Methods:** Between January 2009 and December 2010, from 1,573 patients submitted to coronary artery bypass graft, 21 developed wound dehiscence after sternotomy and were treated with bilateral pectoralis major muscle fasciocutaneous flap, including partial portion of the rectus abdominis fascia. Patients were followed for a minimum of 90 days postoperatively. **Results:** All patients had favorable outcome following 90 days, not having any partial or total dehiscence. There were no cases of postoperative infection. **Conclusion:** The procedure was rapid and effective. Compared with techniques using muscle, myocutaneous or greater omentum flaps, this surgery was less aggressive and maintained the integrity of tissue region. The authors considered that this technique should be used as the first option, leaving the flaps to more complex cases of relapse.

Keywords: Sternotomy/methods; Surgical wound infection; Fascia; Surgical flaps; Mediastinitis

RESUMO

Objetivo: Descrever uma nova técnica cirúrgica para a reparação das deiscências pós-toracotomia mediana transesternal com o uso de retalho composto fasciocutâneo da fáscia do músculo peitoral maior. **Métodos:** Entre janeiro de 2009 e dezembro de 2010, de um total de 1.573 cirurgias de revascularização do miocárdio, 21 pacientes que apresentaram deiscência da esternotomia foram submetidos à correção com retalho fasciocutâneo bilateral do músculo peitoral maior, incluindo parcialmente a fáscia do músculo reto abdominal. Os pacientes foram acompanhados por um mínimo de 90 dias de período pós-operatório. **Resultados:** Todos os pacientes apresentaram

evolução favorável no seguimento de 90 dias, não ocorrendo nenhuma parcial ou total da deiscência. Não houve nenhum caso de infecção pós-operatória. **Conclusão:** Este procedimento mostrou ser rápido e efetivo. Comparando com o uso de retalhos musculares, musculocutâneos ou de omento, foi uma cirurgia menos agressiva e que manteve a integridade dos tecidos da região. Considerou-se que essa técnica deveria ser utilizada como primeira opção, deixando os retalhos mais complexos para os casos de recidivas.

Descritores: Esternotomia/métodos; Infecção da ferida operatória; Fáscia; Retalhos cirúrgicos; Mediastinite

INTRODUCTION

The median transsternal thoracotomy was first described as a surgical approach in cardiac surgery in 1957, and since then it has been widely used. One of its complications is dehiscence of the edges, which usually occurs after infection and is associated to high mortality and morbidity rates^(1,2).

In cases of acute infection, the management comprises early debridement, use of antibiotics and, in some patients, use of a pectoralis or omentum flap to improve vascularization⁽³⁻⁵⁾. However, some of these patients progress with dehiscence of sutures and chronic wound.

Some dehiscences can be corrected only with debridement and approximation of the edges until the tissues involved are in better conditions. Several methods were described to correct the most complex defects, including muscle, musculocutaneous, simple skin, omentum with skin graft flaps, and more recently, breast tissue flaps⁽⁶⁻¹⁰⁾.

Study carried out at Instituto Dante Pazzanese de Cardiologia de São Paulo – IDPC, São Paulo (SP), Brazil.

¹ Hospital Israelita Albert Einstein – HIAE, São Paulo (SP), Brazil.

² Instituto Dante Pazzanese de Cardiologia de São Paulo – IDPC, São Paulo (SP), Brazil.

Corresponding author: Jaime Anger – Avenida Brigadeiro Luiz Antonio, 3.889 – Jardim Paulista – Zip code: 01401-001 – São Paulo (SP), Brazil – Phone: (55 11) 3887-8524 – E-mail: dr.anger@uol.com.br

Received on: Jun 26, 2012 – Accepted on: Nov 12, 2012

Conflict of interest: none.

The choice of flap to be employed is related to the type of abnormality observed. The most important indication is amount of tissue loss. The discussion about preference between a muscle, musculocutaneous or skin flap is based on the amount of donor tissue and degree of vascularization, since a well irrigated tissue can favor eradication of infection and increase vitality of the tissues involved, resulting in faster stabilization of the clinical picture, besides enabling preparation of larger flaps⁽¹¹⁾.

The use of the pectoralis major fascia has been recently described in plastic surgery procedures^(12,13). This fascia is well vascularized, resistant, and has appropriate thickness.

In our surgical experience, we observed that most dehiscences of sternotomies have no loss of tissues on the edges; thus they required no extra amount of tissue. Actually, it is difficult to place the edges closer due to laceration of the subcutaneous tissue; consequently, we started using the pectoralis major fascia for suture and medial traction of the edges, in cases of short dehiscences with no tissue loss.

Considering the favorable results achieved, we then used flaps containing skin and subcutaneous tissue, including the pectoralis major fascia in larger wounds. In this report, this new technique is presented to repair post-sternotomy wound.

OBJECTIVE

To describe a new surgical technique to repair median transsternal thoracotomy dehiscences using fasciocutaneous flaps from the pectoralis major fascia.

METHODS

From January 1st, 2009 to December 31st, 2010, a total of 1573 patients were submitted to myocardial revascularization surgery by transsternal approach at the *Instituto Dante Pazzanese de Cardiologia de São Paulo*. Twenty-six (0.65%) patients presented dehiscence of suture after surgery and were indicated to have flaps. Infection of the surgical site was the primary cause of dehiscence in 22 patients, and, mediastinitis, in four. Twenty-one patients were treated with bilateral fasciocutaneous flap of pectoralis major; two with breast tissue flap; and three with myocutaneous flap from pectoralis major – in that, two were bilateral and one unilateral. The criterion to choose the breast tissue flaps was effective loss of tissue in the lower third of the sternal wound, in female patients. The muscle or myocutaneous flaps were indicated in cases of effective

loss of tissue in male patients, with no possibility of direct approximation.

Of the 21 individuals treated with fascia flap, 8 presented partial or total loss of bone tissue in the sternum, and two patients had additional loss of portions of the costal arches. Twelve were female, and age ranged from 56 to 75 years. The patients were followed up for at least 90 days postoperatively (Table 1).

The study was approved by the Research Ethics Committee of the *Instituto Dante Pazzanese of Cardiologia*, under number CAAE 0011.0.131.000-09.

Table 1. List of patients submitted to post-sternotomy resuturing

Patient	Age	Gender	Cardiac surgery	Classification of infection	Resuturing
1	70	F	Coronary	SI	First
2	68	F	Coronary	DI	First
3	56	F	Coronary + internal thoracic	DI	First
4	69	M	Coronary	SI	Second
5	71	M	Coronary + internal thoracic	MED	Second
6	65	F	Coronary	SI	First
7	56	M	Coronary	DI	First
8	59	F	Coronary	DI	First
9	63	M	Coronary	SI	First
10	65	M	Coronary	SI	First
11	71	F	Coronary	SI	First
12	61	M	Coronary + internal thoracic	DI	First
13	69	F	Coronary	SI	First
14	70	M	Coronary + internal thoracic	MED	Terceira
15	60	F	Coronary	SI	First
16	67	F	Coronary	SI	First
17	66	F	Coronary + internal thoracic	MED	First
18	72	M	Coronary	SI	First
19	75	F	Coronary	MED	First
20	68	F	Coronary	SI	First
21	70	M	Coronary	DI	First

F: female; DI: deep infection; M: male; MED: mediastinitis; SI: superficial infection.

Surgical technique

The initial stage was incision on the skin and subcutaneous tissue in normal tissue on the wound edges, up to the margin of the pectoralis major fascia. A vertical incision was made along the fascia, as close as possible to its medial insertion, until reaching the

pectoralis major. The fascia was carefully laterally detached from the muscle in its vertical extension. The extension of this dissection depended on the evaluation of the advancement level of the flap. After releasing the fascia on the pectoralis muscle inferior margin, the medial and upper edges of the rectus abdominis fascia were identified. A vertical incision was made, two-millimeter apart from the medial insertion of this fascia, continuing with another, horizontally, also two-millimeter apart from the upper edge of this fascia. Later the rectus abdominis fascia was detached from the muscle to complement the fasciocutaneous flap of the pectoralis major, maintaining the skin attached. The length depended on evaluation and gain of the flap, as it was released (Figure 1).

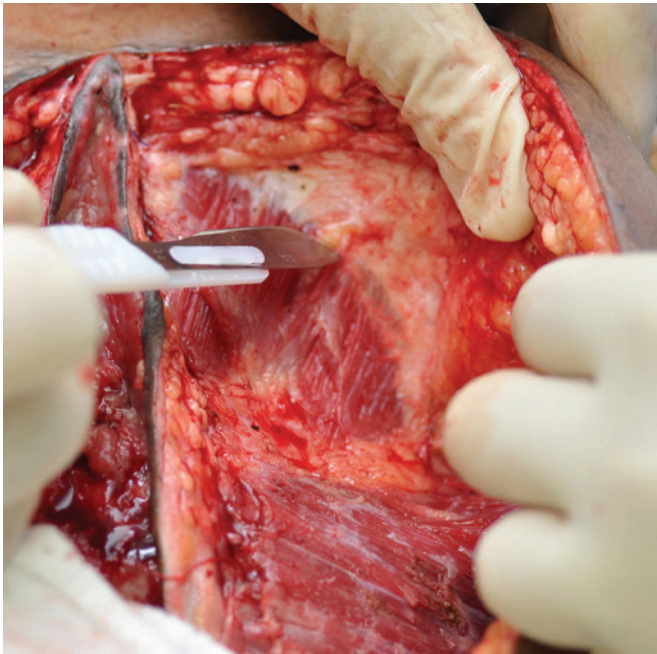


Figure 1. Dissection of the rectus abdominis fascia, keeping it attached to the subcutaneous tissue

When the flaps achieved the midline, all the wound area, with its granulation tissue and adjacent fibrosis, were removed and, if necessary, the affected bone tissue was revised, excising the devitalized tissue, and stabilizing the bone with steel wire.

Next, absorbable suture 0 was used to fixate the fascia to the base of the flap, on the bloody surface of the defect. Two to three vertical sutures were made, one-centimeter apart from each other, in order to fill as much as possible the sternal defect and to decrease traction on the final suture of the skin edges (Figure 2).

The skin and subcutaneous tissue were approximated in three plans, the deepest with absorbable suture 2-0,

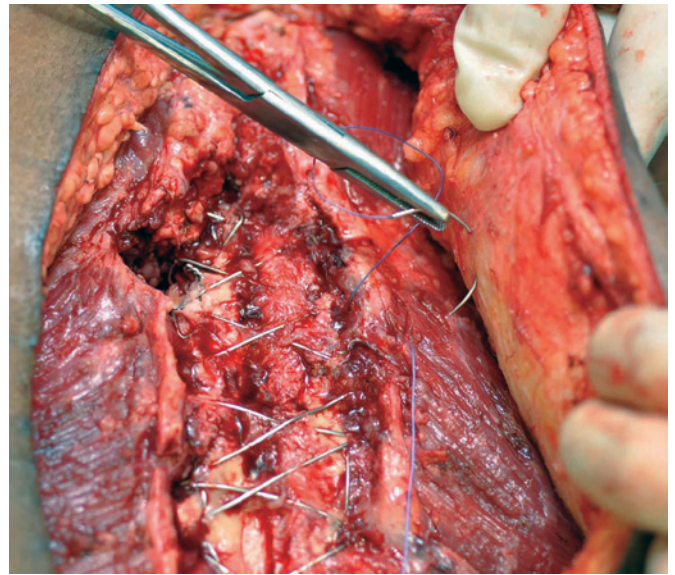


Figure 2. Approximation, with absorbable suture 0, of the pectoralis major fascia to the wound fibrotic tissue

bringing close to the edge of the fascia (Figure 3). The second layer was composed of non-absorbable mononylon 3-0 suture, crossing the deep dermis in inverted U stitches. The skin was then approximated with separate stitches with non-absorbable mononylon 4-0 suture (Figure 4).

Two tubular drains, measuring 4.8-millimeter in diameter, were placed on the bed of the wound.



Figure 3. Approximation of the fascia edges with absorbable suture

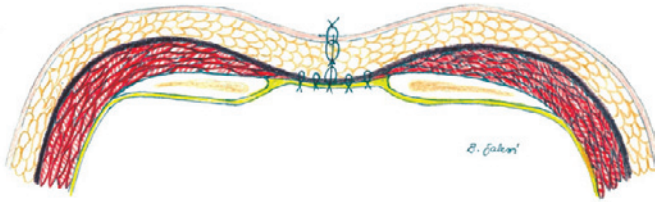


Figure 4. Saggital slice of the thorax after completing approximation of the fasciocutaneous flaps. The fascia is represented by a brown line. (Author: Beatriz Souza Nazaré Galezi)

RESULTS

All 21 patients had a good progression, and were discharged, on average after 12 days. The drains were kept for 10 days, on average. No complications, such as dehiscence of sutures or fistulas were observed (Figures 5 and 6).



Figure 5. Female patient in the preoperative period, showing sequela of infection of sternotomy, with total resection of the sternum and part of the costal arches



Figure 6. Same patient shown in Figure 5, on the 7th postoperative day

DISCUSSION

A new surgical technique is described using the pectoralis fascia to correct dehiscences of sternal suture with loss of soft tissue and/or bone. Most dehiscences after median sternotomy can be treated by debridement of the affected tissues and suture of the edges. For the past 40 years, the scientific reports, especially those published after the article by Jurkiewicz⁽³⁾, have emphasized the need to use vascularized tissue to fill in the defect in the sternal region and to reduce the possibility of infection. These articles mentioned decreased morbidity when employing muscle or omentum flaps^(3,6,7).

Nevertheless, these techniques lead to large detachments, sequelae in donor areas, reduced or absent activity of muscles and increased morbidity, although the final closure is made on the skin and subcutaneous tissue, over the tissues repaired.

This approach is widely used in the acute phase of infection, even in our department; however, today these principles are no longer useful for us in cases of dehiscence with stable infection and inflammatory reaction of the adjacent tissues. This was demonstrated by Ascherman et al.⁽¹⁴⁾, who described 114 cases using the pectoralis major as an advancement musculocutaneous flap, with no need to release the pedicles or its medial edge, obtaining a satisfactory result and, even better, if compared to the previous series of patients treated according to Jurkiewicz et al.⁽³⁾ principles.

In the chronic patients in our department we used advancement musculocutaneous flaps, aiming to fill in the sternal defect and maintain vascularization of the edges in cases of major losses, in particular, skin and subcutaneous tissue losses. In female patients with important losses, a breast tissue flap was employed⁽¹⁰⁾ and, in even larger defects, the musculocutaneous flap of the pectoralis major, based on its medial pedicle, rotated to the medial area; or, yet, the musculocutaneous flap with skin island of the rectus abdominis.

When comparing the result of using skin flaps and musculocutaneous flaps to treat pressure ulcers, Anger et al.⁽¹¹⁾ demonstrated that the simple skin flaps can have the same efficacy of the muscle flaps and, eventually provide a better cosmetic result, due to less destruction in the donor area. Hence, the muscle flaps would be an option in case of relapses.

The fascia of several regions of the body has been used as simple or compound flap for reconstruction in plastic surgery for many years. The interest in the superficial fascia of the pectoralis major rose from a description of the subfascial insertion of silicon implants for breast augmentation, which led to a more detailed study of its anatomy⁽¹³⁾. The superficial pectoralis fascia

extends from the clavicle to the sternum. In its lateral margin, it unites to the deep fascia of the pectoralis major and both, together, continue with the serratus anterior fascia. In the inferior portion, it contacts the sheath of the rectus abdominis, at the level of the sixth intercostal space. Multiple perforating vessels cross the pectoralis major fascia, especially in the medial region, deriving from the intercostal arteries⁽¹³⁾.

The report by Jinde et al.⁽¹³⁾ demonstrated that the thickness of fascia varies from 0.20 to 1.14mm, and it is thinner in the upper portion and thicker in the lateral margin. In the medial edge, in contact with the sternum, its average thickness is 0.56mm. Although thin, the fascia is composed of a dense connective tissue and its fibers have a nearly perpendicular orientation regarding the pectoralis major fibers; in other words superomedial to inferolateral.

In the surgeries performed, we observed the fascia in the medial margin is thicker than expected, possibly due to presence of tissue fibrosis resulting from chronic inflammatory reaction of the wound (Figures 7 and 8).

This fascia assumes the characteristic of a tissue that is firm enough to retain the deep approximation stitches. In the use of simple skin flaps, frequent tear of subcutaneous tissue is observed when attempting to approximate the edges, even employing thicker tissues. The fixation of the fascia in the base of the sternal tissue loss, particularly in the fibrotic edges of the resulting wound, reduces dead space and tension in the edge suture.

After the initial success using this technique, we believe the most complex flaps should be reserved for cases with greater losses of contiguous tissues or that require resuturing. Even though, larger samples are required to better evaluate this procedure.



Figure 7. Fasciocutaneous flap detached from the pectoralis major. The edge of the fascia is indicated by dark arrows. The white arrow shows the released margin of the pectoralis major

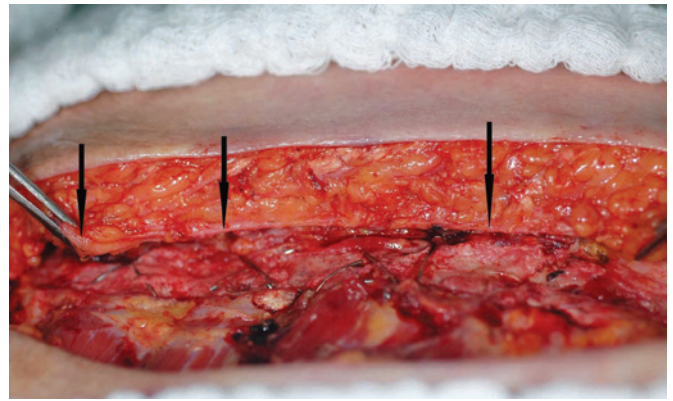


Figure 8. Edge of the fascia showing the required thickness to assist approximating the wound margins (indicated by dark arrows)

CONCLUSION

The use of the pectoralis major fascia is a less invasive, fast and effective surgery. This initial report had good progression in all patients treated, with no complications.

We consider this technique should be the first option, and the more complex flaps be reserved for relapses.

REFERENCES

- Borges FM, Grinbaum RS, Pasternak J, Medeiros EAS. Risk factors for surgical-site infection after cardiac surgery. *einstein*. 2005;3(2):91-5.
- Farsky PS, Graner H, Duccini P, Zandonadi Eda C, Amato VL, Anger J, et al. Risk factors for sternal wound infections and application of the STS score in coronary artery bypass graft surgery. *Rev Bras Cir Cardiovasc*. 2011;26(4):624-9.
- Jurkiewicz MJ, Bostwick J 3rd, Hester TR, Bishop JB, Craver J. Infected median sternotomy wound: Successful treatment by muscle flaps. *Ann Surg*. 1980;191(6):738-44.
- Pairolero PC, Arnold PG. Management of infected median sternotomy wounds. *Ann Thorac Surg*. 1986;42(1):1-2.
- Lee AB, Schimert G, Shatkin S, Seigel JH. Total excision of the sternum and thoracic pedicle transposition of the greater omentum. *Surgery*. 1976;80(4):433-6.
- Jurkiewicz MJ, Arnold PG. The omentum: an account of its use in the reconstruction of the chest wall. *Ann Surg*. 1977;185(5):548-54.
- Jones G, Jurkiewicz MJ, Bostwick J, Wood R, Bried JT, Culbertson J, et al. Management of the infected median sternotomy wound with muscle flaps. The Emory 20-year experience. *Ann Surg*. 1997;225(6):766-76; discussion 776-8.
- Nahai F, Rand RP, Hester TR, Jurkiewicz MJ. Primary treatment of the infected sternotomy wound with muscle flaps: a review of 211 consecutive. *Plast Reconstr Surg*. 1989;84(3):434-41.
- Hallock GG. The breast musculocutaneous flap for complete coverage of the median sternotomy wound. *Plast Reconstr Surg*. 2003;112(1):199-203.
- Anger J, Farsky PS, Amato VL, Abboud CS, Almeida AF, Arnoni RT, et al. [Use of a flap composed of skin and breast tissue for repairing a recalcitrant wound resulting from dehiscence of sternotomy in cardiac surgery]. *Arq Bras Cardiol*. 2004;83:43-5. Article in Portuguese.
- Anger J, Militelli N, Monteiro AA Jr, Ferreira MC. Tratamento cirúrgico das úlceras por pressão em pacientes portadores de síndrome de secção medular. *Rev Hosp Clin Fac Med São Paulo*. 1984;39(4):173-7.

12. Graf RM, Bernardes A, Auersvald A, Damasio RC. Subfascial endoscopic transaxillary augmentation mammoplasty. *Aesthetic Plast Surg.* 2000;24(3):216-20.
13. Jinde L, Jianliang S, Xiaoping C, Xiaoyan T, Jiaqing L, Qun M, et al. Anatomy and clinical significance of pectoral fascia. *Plast Reconstr Surg.* 2006;118(7):1557-60.
14. Ascherman JA, Patel SM, Malhotra SM, Smith CR. Management of sternal wounds with vbilateral pectoralis major myocutaneous advancement flaps in 114 consecutively treated patients: refinements in technique and outcomes analysis. *Plast Recons Surg.* 2004;114(3):676-83.