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A new classification of post-sternotomy dehiscence

Uma nova classificação das deiscências após esternotomias

Jaime Anger[1], MD; Daniel Chagas Dantas[1], MD; Renato Tambellini Arnoni[1], MD, PhD; Pedro Sílvio Farsky[1], MD, PhD

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Abstract

The dehiscence after median transesternal sternotomy used as surgical access for cardiac surgery is one of its complications and it increases the patient's morbidity and mortality. A variety of surgical techniques were recently described resulting to the need of a classification bringing a measure of objectivity to the management of these complex and dangerous wounds. The different related classifications are based in the primary causal infection, but recently the anatomical description of the wound including the deepness and the vertical extension showed to be more useful. We propose a new classification based only on the anatomical changes following sternotomy dehiscence and chronic wound formation separating it in four types according to the deepness and in two sub-groups according to the vertical extension based on the inferior insertion of the pectoralis major muscle.

Descriptors: **Thoracotomy. Surgical wound infection. Sternum. Postoperative complications.**

Resumo

A deiscência após a esternotomia transesternal mediana utilizada em cirurgia cardíaca é uma de suas complicações e provoca o aumento da morbidade e mortalidade dos pacientes. Várias técnicas cirúrgicas têm sido descritas para o seu tratamento, o que contribuiu para aumentar a importância da classificação destas deiscências. Os métodos de classificação inicialmente descritos se baseavam na infecção do sítio cirúrgico, entretanto, é cada vez mais clara a relevância da descrição exata da localização e a extensão da área cruenta resultante como parâmetros para definição da técnica cirúrgica a ser escolhida. Neste relato é sugerida uma nova classificação baseada somente nas alterações anatômicas das feridas que as classifica em quatro tipos, de acordo com a profundidade, e em dois subgrupos, de acordo com a sua extensão vertical, tendo como referência a inserção da margem inferior do músculo peitoral maior.

Descritores: **Toracotomia. Complicações pós-operatórias. Infecção da ferida operatória. Esterno.**

INTRODUCTION

The median transsternal thoracotomy was first described as an access route in cardiac surgery in 1957[1] and, since then, is widely used. One of the complications is the dehiscence of edges that usually occurs after infection, and is associated with high rates of morbidity and mortality[2].

In cases of infection, the first-line treatment in the acute phase is early debridement, use of antibiotics and, in some cases, the use of retail of the pectoralis major muscle or omentum to improve vascularization. However, some patients develop dehiscence of the sutures and the chronicity of wounds[3,4].

Some of dehiscence can be corrected only with debridement of the edges and its approach after improvement of the conditions of the tissues involved. For the correction of more complex defects, various techniques were being described including muscle, musculocutaenous and skin flaps, also omentum flaps with subsequent skin graftting, and recently the fasciocutaneous flap including the pectoralis major muscle fascia[3-8].

[1]Dante Pazzanese Institute of Cardiology of São Paulo (IDPC), São Paulo, SP, Brazil.

This study was carried out at Dante Pazzanese Institute of Cardiology of São Paulo, São Paulo, SP, Brazil.

Correspondence address:
Jaime Anger
Instituto Dante Pazzanese de Cardiologia de São Paulo
Avenida Dr. Dante Pazzanese, 500 - Vila Mariana - São Paulo, SP, Brazil - Zip code: 04012-909
E-mail: anger@uol.com.br

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Abbreviations, acronyms & symbols	
CDC	Center for Disease Control and Prevention

Due to the recent increase of surgical options, it became necessary to classify these wounds in order to assist the decision-making process of the surgeons as to the best technique to be used, and to facilitate the exchange of knowledge in scientific reports. The first classification was described by Pairolero& Arnold in 1984[3], based on the postoperative time of establishment of the infection (Table 1), subsequently, Oakley in 1996[9] used the same criteria, but added risk factors of the establishment and attempts of treatment of the initial infection (Table 2).

Infections following a sternotomy are generically termed in the literature as mediastinitis, although infection may be limited to a tissue or anatomical area, not necessarily involving the mediastinum. Other terms are used: esternites, mediastinitis, dehiscence of sternotomy and post-sternotomy infection.

According to the Center for Disease Control and Prevention (CDC), the infection in surgical wounds after sternotomy should be classified into three types: (A) surface when only the skin and subcutaneous are involved; (B) when the infection reaches the sternum, but not affecting it, and (C) of cavity or organ when there is sternum osteomyelitis and/or when there is involvement of the mediastinum[10]. These definitions clarify the site of infection, but do not keep exact correlation with the existing real anatomical change.

Jones et al.[5] in 1997, suggested for the first time a classification based on the affected anatomical site but still using as parameter the presence of infection (Table 3). Greig et al.[11] in 2007 proposed a classification based on the affected anatomical site (Table 4). The author was the first to specify the vertical extent of the wound, because it is recognized the more difficult to reconstruct the lower portion when it extends below the insertion of the lower border of the pectoralis major muscle. However, the concept of emphasizing only the location of the wound was not widely used in scientific reports and classifications based on infection continued to be the most used[12].

The recent expansion of the variety of surgical techniques and the discussion of their indications proved to be fundamental the anatomical description of the raw area to facilitate understanding and discussion of the results[6-8].

Consequently, we created a uniquely classification based on the depth and anatomical extent of the wounds which seemed to us to be more complete and objective. Initially, we

Table 1. The classification proposed by Pairolero based in the postoperative period that installs the infectious process in the surgical wound.

Classification	Postoperative phase on which the infection occurs
Type I	In the first week
Type II	Between 2 to 6 weeks
Type III	After 6 weeks to years (in general are fistulas and chronic osteomyelitis)

Table 2. Classification reported in 1996 by Oakley, based on postoperative period of the infectious process and the presence of clinical risk factors.

Classification	Description
Type I	Mediastinitis present in up to two weeks after the operation in the absence of risk factors
Type II	Mediastinitis present in 2 to 6 weeks after surgery in the absence of risk factors
Type IIIA	Mediastinitis type I in the presence of one or more risk factors
Type IIIB	Mediastinitis type II in the presence of one or more risk factors
Type VAT	Mediastinitis type I, II or III after treatment failure
Type IVB	Mediastinitis type I, II or III after failure of one or more treatments
Type V	Mediastinitis present for the first time after 6 weeks postoperatively

Table 3. Classification proposed by Jones in 1997 based on anatomical site plus a type including sepsis.

Classification	Depth	Description
Type 1a	Superficial	Skin and subcutaneous
Type 1b	Superficial	Exposure of sutured deep fascia
Type 2a	Deep	Bone exposure, sternum with stable steel suture
Type 2b	Deep	Bone exposure, sternum with unstable steel suture
Type 3a	Deep	Necrotic bone exposure or fractured, unstable sternum, exposed heart
Type 3b	Deep	Type 2 or 3 with septicemia

Table 4. Classification proposed by Greig in 2007, considering the regional location of the wound.

Type of surgical wound	Extension of sternal wound	Kind of a retail recommended for reconstruction
Type A	Upper half of the sternum	Major pectoralis
Type B	Lower half of the sternum	Major pectoral combined with bipedicle abdominal rectus
Type C	The whole sternum	Major pectoral combined with bipedicle abdominal rectus

divided the surgical wound into four types, according to the depth affected: type I, when there is loss of skin and subcutaneous tissue; type II, when the bone is exposed; type III, when there is loss of bone tissue of sternum or ribs; type IV and when there is exposure of the mediastinum (Table 5). Next, we define whether it is partial or total in relation to its vertical extent and in the end whether it is of higher or lower position, considering as reference the inclusion of the lower margin of the pectoralis major muscle. To illustrate the use of this classification we present three examples of patients with chronic wounds in which different surgical techniques have been adopted based on anatomical changes of the surgical wound (Figures 1A, 1B, 2A, 2B, 3A, 3B). The result of the classification proposed in these cases was more precise and specific than if we used the classification methods previously used.

It should be noted that use the infectious process, related to the length of its establishment or its depth, as classification criteria seems to be inappropriate, since the infection is not the only cause of dehiscence of the edges in these patients, and surgical reconstruction is only performed when there is no infection at the site of dehiscence and possible donor sites.

Table 5. Classification proposed by the authors based on anatomical changes, considering the depth and location of the surgical wound. The limit that defines upper and lower region is the inclusion of the lower margin of the pectoralis major muscle.

Classification	Affected tissues	Wound location as the vertical extension	
Type I	Skin and subcutaneous tissue	Partial	Upper Lower
		Total	
Type II	Exposure of the sternum or ribs	Partial	Upper Lower
		Total	
Type III	Bone loss of sternum or ribs	Partial	Upper Lower
		Total	
Type IV	Exposed mediastinum	Partial	Upper Lower
		Total	

We therefore consider that this classification is objective and easy to understand, thereby facilitating the exchange of data. This favors the exchange of information between teams and systematises the evaluation of the success of the various existing surgical techniques.



Fig. 1A - Male patient, 60 years of age with post-CABG dehiscence in the 37th postoperative day, treated with fasciocutaneous flap of bilateral pectoralis major muscle.
CABG=coronary artery bypass grafting

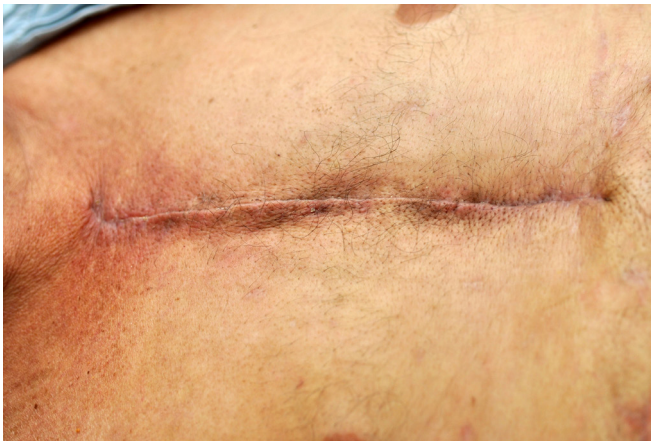


Fig. 1B - Male patient, 60 years of age with post-CABG dehiscence in the 35th day after reconstruction. Classified as Type II, total length.
CABG=coronary artery bypass grafting

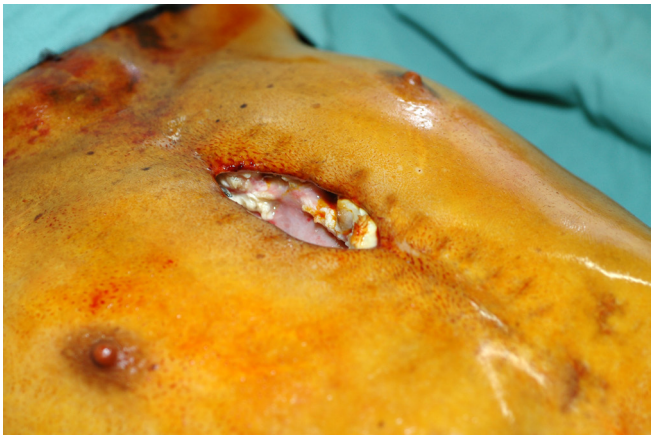


Fig. 2A - Female patient, 47 years old with cardiac transplantation dehiscence after 32 postoperative days, treated with transposition of musculocutaneous flap of the left pectoralis major muscle.



Fig. 2B - Patient with dehiscence after cardiac transplantation on the 25th day after the reconstruction.Classified as Type IV, upper partial vertical extension.



Fig. 3 - Female patient, 65 years of age with post-CABG dehiscence in the 42th postoperative day, treated with patch composed of mammary tissue and right lower pedicle.



Fig. 3B - Patient with post-CABG on the 10th postoperative day of dehiscence reconstruction.Classified as Type I, lower partial extension.

Authors' roles & responsibilities	
JA	Creation and study design; evaluation and classification of recalcitrant wounds of patients
DCD	Literature search
RTA	Verification of records, evaluation and classification of recalcitrant wounds of patients
PSF	Creation and study design; evaluation and classification of recalcitrant wounds of patients

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