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Mediastinitis: mortality rate comparing single-stage surgical approach and preconditioning of wound

Mediastinite: mortalidade comparando abordagem cirúrgica em tempo único e o pré-condicionamento da ferida operatória

Marcelo Curcio Gib[1], Juglans Souto Alvarez[2], Orlando Carlos Belmonte Wender[3]

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Abstract

Objective: **This study aims to compare hospital mortality rate of surgical debridement followed by primary wound closure versus surgical debridement with closure after preconditioning of the wound.**

Methods: **A historical cohort of 43 patients with postoperative mediastinitis type III and IV between 2000 and 2008. The diagnosis of mediastinitis was based on physical examination and laboratory tests. Patients were divided into two groups: patients who received the protocol of preconditioning of the wound (Group 2) and those who did not (Group 1).**

Results: **Of the 43 patients, 15 received the protocol and were assigned to Group 2, and 28 patients to Group 1. Myocardial revascularisation was the surgical intervention most affected by infection, accounting for 69.8% of patients in Group 1 and 64.3% in Group 2. *Staphylococcus aureus* was the predominant pathogen, accounting for 58.1% of all cases, 50% in Group 1 and 73.3% in Group 2. Hospital mortality rate was 42.9% in Group 1 and 20% in Group 2 (*P*=1.86), with relative risk of 2.14 and CI [0.714-6.043]. Among the 28 (65.1%) patients who underwent single-stage surgical approach, 12 (27.9%) underwent primary wound closure with irrigation, seven (16.3%) only primary closure, six (14%) omental flap, and three (7%) pectoralis muscle flap.**

Conclusion: **Due to the lack of established guidelines, the choice of the surgical approach is based largely on low-level evidence references. Preconditioning of the wound appears to lead to a reduction in mortality in these patients, being a good surgical option.**

Descriptors: **Mediastinitis. Mortality. Infection. Surgical wound infection.**

Resumo

Objetivo: **Este estudo tem por objetivo comparar a taxa de mortalidade intra-hospitalar do debridamento cirúrgico seguido de fechamento da ferida operatória, com a do debridamento cirúrgico com fechamento após pré-condicionamento da ferida.**

Métodos: **Coorte histórica composta por 43 pacientes portadores de mediastinite pós-operatória tipo III e IV entre os anos de 2000 e 2008. O diagnóstico de mediastinite foi feito com base em exames físico e laboratoriais. Os pacientes foram divididos em dois grupos, os que seguiram o protocolo de pré-condicionamento da ferida operatória (Grupo 2) ou não (Grupo 1).**

Resultados: **Dos 43 pacientes, 15 seguiram o protocolo e foram alocados no Grupo 2. A revascularização do miocárdio foi a cirurgia mais afetada pela infecção, sendo responsável por 69,8% dos pacientes no Grupo 1 e 64,3% no Grupo 2. O *Staphylococcus aureus* foi o germe mais prevalente, sendo responsável por 58,1% do total dos casos, sendo 50% e 73,3%, respectivamente, nos Grupos 1 e 2. A mortalidade intra-hospitalar foi de 42,9% no Grupo 1 e de 20% no Grupo 2**

1. MSc; Cardiovascular surgeon at Cardiovascular Surgery Department of the Hospital de Clínicas de Porto Alegre, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil.
2. Cardiovascular surgeon at Cardiovascular Surgery Department of the Hospital de Clínicas de Porto Alegre, UFRGS, Porto Alegre, RS, Brazil.
3. PhD, Professor at Faculty of Medicine, UFRGS, Porto Alegre, RS, Brazil.

Research performed at Cardiovascular Surgery Department of the Hospital de Clinicas de Porto Alegre UFRGS - Graduate Program in Medicine: Surgery, Porto Alegre, RS, Brazil.

Correspondence address:
Marcelo Curcio Gib
Travessa Pedra Redonda, 450 – casa 9 – Porto Alegre, RS, Brazil
Zip code: 91760-630.
E-mail: mcgib@terra.com.br

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Abbreviations, Acronyms & Symbols	
CCIH	Commission on Hospital Infection Control
ECC	Extracorporeal circulation
HCPA	Hospital de Clínicas de Porto Alegre
ICU	Intensive care unit
PRBC	Packed red blood cells
PVPI	Polyvinylpyrrolidone-iodine

(*P*=1,86), com risco relativo de 2,14 e IC [0,714-6,043]. Entre os 28 (65,1%) pacientes do estudo que seguiram a abordagem cirúrgica em um único tempo, 12 (27,9%) foram submetidos a fechamento primário com irrigação, sete (16,3%), a fechamento primário isolado, seis (14%), rotação de retalho de epíplon, e três (7%), interposição de retalho de músculo peitoral.

Conclusão: **Na ausência de uma diretriz bem estabelecida, a escolha do tipo de intervenção cirúrgica é feita utilizando-se referências com baixo nível de evidência. O pré-condicionamento da ferida operatória parece levar a redução da mortalidade nesses pacientes, sendo uma boa alternativa cirúrgica.**

Descritores: **Mediastinite. Mortalidade. Infecção. Infecção da ferida operatória.**

INTRODUCTION

Median sternotomy is the technical approach most used in the surgical treatment of cardiopathies. Mediastinitis is a severe complication leading to an increase in hospital costs, morbidity and mortality [1,2]. The treatment, however, has progressed with new antibiotics, along with technical and surgical care.

Postoperative incidence of mediastinitis ranges from 0.5% to 5% [3-5]. However, mortality associated with such surgical complications, even after appropriate treatment, is extremely high, ranging between 14% and 47% [1,6,7]. Several studies have identified risk factors such as obesity, diabetes, reoperation, smoking, prolonged operative time, bilateral use of the internal thoracic artery, and postoperative bleeding [4,5,8,9].

Surgical management of postoperative mediastinitis counts on several techniques described in the literature [5,10-17]. Treatment may include single- or multiple-stage procedures, with or without the use of muscle or omental flap [11,12,18]. Therapeutic modalities encompass two options: preconditioning of the wound, leaving the wound open for a better cleaning and mediastinal drainage with dressings, or using one of the several closure techniques available. Single-stage closure shows a recurrence rate between 5%-50% in comparison to two-stage closure whose rate ranges from 2%-30% [19,20], however the long term exposure of the mediastinum enhances the morbidity.

The present study aims to compare inpatient mortality rate from surgical debridement followed by primary wound closure with that from surgical debridement with closure after preconditioning of the wound.

METHODS

From January 2000 to December 2008, at Hospital de Clínicas de Porto Alegre (HCPA), southern Brazil, 3,166 cardiac surgeries were performed in adults using median sternotomy and extracorporeal circulation (ECC). A historical cohort of patients who had postoperative mediastinitis was followed up during hospital stay after the first surgery and reintervention(s). From 2007, we implemented the protocol of preconditioning of the wound for all patients. Data were abstracted from the patient's medical records. The entire patient sample that showed mediastinitis during this period was identified through the Cardiovascular Surgery Division records in combination with those from the Commission on Hospital Infection Control (CCIH) of HCPA. Mediastinitis was defined as deep surgical wound infection with clinical and microbiologic evidence of compromised retrosternal space. During this period, 49 patients developed mediastinitis, an incidence of 1.55%. Of these, 43 patients met the classification criteria (El Oakley) [3] as type III or IV and were included in the study.

The diagnosis of mediastinitis was based on physical examination and laboratory tests. Three diagnostic criteria were elected during initial evaluation: sternal instability; leukocytosis of more than 15,000; and wound secretion. All patients were evaluated by members of the Cardiovascular Surgery Division at the moment of diagnosis. After the established diagnosis, the following data were collected from all patients: blood cultures, bedside culture of wound secretion, and culture of this same secretion during surgical procedure. After initial data collection, a double intravenous antibiotic regimen, 500 mg of vancomycin every 12 hours and 1000 mg of cefepime every 8 hours, was started until the identification of the pathogen, with subsequent adjustment of treatment according to antibiogram results.

Patients were divided into two groups:

• Group 1 – Composed of 28 patients who underwent single-stage surgical intervention without preconditioning of the wound, regardless of closure technique;

• Group 2 – Composed of 15 patients who received the protocol of preconditioning of the wound.

Protocol of preconditioning of the wound

Radical subcutaneous and sternal edges debridement with complete removal of foreign materials (steel wires, skin and subcutaneous sutures, hemostatic foam). Pericardial cavity wash with 5 L of 0.9% saline solution and 0.5% polyvinylpyrrolidone-iodine (PVPI) solution. Compression

dressings and clinical follow-up until improvement of the following parameters: fall in leukocyte blood count, negative blood cultures, end of fever peaks, and beginning of wound granulation. Dressing changes three times per day, or more, in the case of abundant secretion, which were performed by the HCPA nursing team specialized in complex dressings and scar care. Clinical evaluation guided the surgical team in relation to the solution to be used: papain, if chemical debridement was needed, 0.5% PVPI, when with purulent aspect, or, if none of these situations was present, only saline solution was used. After clinical stabilization and improvement of wound conditions, the patient was then taken to the surgical block for definitive closure of sternotomy wound. For closure, we evaluated criteria for viability of the sternal bone, mediastinum aspect, and subcutaneous granulation. Whenever necessary, a plastic reconstruction procedure was associated: pectoralis muscle or omental flap.

Statistical analysis and ethical aspects

The present study was approved by HCPA Graduate and Research Group and the Research Ethics Committee of this institution (Project 08-588 approved in 15/12/2008), as well as the use of medical records. Patients with mediastinitis type I, II and V were excluded from the study, as well as those patients with incomplete inpatient follow-up information in the medical records. The final sample comprised all cases that fulfilled the eligibility criteria for inclusion in the study.

Fisher's exact test and the chi-square test were used for statistical analysis. The level of significance was set at 5% and 95% confidence interval. Data were entered into a database converted into a 2007 Excel spreadsheet for Windows and subsequently exported and analyzed using the Statistical Package for the Social Sciences software, version 17.0. The results obtained were expressed as mean ± standard deviation for quantitative variables and frequency and percentage for categorical variables.

RESULTS

Of the 43 patients with mediastinitis included in the study, 15 received the protocol of preconditioning of the wound (Group 2) and the remaining 28 patients composed Group 1. Both groups were matched for the preoperative variables analyzed (Table 1). Classic risk factors for mediastinitis were homogeneously distributed between groups, the most relevant being diabetes, obesity and systemic hypertension.

Table 1. Demographic variables.

	n = 43	Group 1 (n=28)	Group 2 (n=15)	*P*
Sex				
Male	31 (72.1%)	22 (78.6%)	9 (60%)	
Female	12 (27.9%)	6 (21.4%)	6 (40%)	0.287
Age	62.45 ±10.99	64.71± 10.47	59.67 ± 11.54	0.154
Race				
White	41 (95.3%)	27 (96.4%)	14 (93.6%)	
Black	1 (2.3%)	—	1 (6.7%)	0.299
Mulatto	1 (2.3%)	1 (3.6%)	—	
BMI	28.18 ± 3.72	28.11 ± 3.65	28.33 ± 3.96	0.852
Smoking	17 (39.5%)	12 (42.9%)	5 (33.3%)	0.745
Diabetes	25 (58.1%)	15 (53.6%)	10 (66.7%)	0.523
Stroke	4 (9.3%)	2 (7.1%)	2 (13.3%)	0.602
COPD	17 (39.5%)	12 (42.9%)	5 (33.3%)	0.745
Immunosuppression	—	—	—	—
HIV	—	—	—	—
Re-do surgery	3 (7%)	2 (7.1%)	1 (6.7%)	1.0
Renal insufficiency	9 (20.9%)	5 (17.9%)	4 (26.7%)	0.696
Oral anticoagulation	3 (7%)	2 (7.1%)	1 (6.7%)	1.0
Previous AMI	12 (27.9 %)	8 (28.6%)	4 (26.7%)	1.0
Dyslipidemia	16 (37.2%)	8 (28.6%)	8 (53.3%)	0.185
Hypertension	40 (93%)	26 (92.9%)	14 (93.3%)	1.0
PVD	4 (9.3%)	2 (7.1%)	2 (13.3%)	0.602
Ejection fraction (%)	53,71 ± 12,68	53.64 ± 13.35	53.87 ± 11.81	0.957

BMI = body mass index; COPD = chronic obstructive pulmonary disease; HIV = human immunodeficiency virus; Previous AMI = previous acute myocardial infarction; PVD = peripheral vascular disease

Myocardial revascularization was the surgical intervention most affected by infection, accounting for 69.8% of patients in Group 1 and 64.3% in Group 2. The left internal thoracic artery was used in 94.7% of patients in Group 1 and 100% in Group 2. None of the patients underwent bilateral mammary grafting. In Group 1, 21.4% of patients were admitted to the intensive care unit (ICU) for some time before the first procedure, whereas in Group 2 the rate was 33.3% (Table 2). One patient in Group 1 needed intra-aortic balloon pump. In none of the groups reintervention was needed due to bleeding.

In 23 (53.5%) patients, blood-derived concentrates were necessary during the surgery of underlying pathology. Of these, 14 patients belonged to Group 1 and 9 to Group 2. Packed red blood cells were the blood component most used in both groups. However, Group 2 used a significantly greater number of transfused units than Group 1 (1.58±0.67 vs. 2.4±0.72). There were no statistical differences in the number of other blood component units transfused, as described in Table 3.

Several pathogens were identified as causing mediastinitis (Table 4). *Staphylococcus aureus* was the predominant

Table 2. First procedure.

	n = 43	Group 1 (n=28)	Group 2 (n=15)	*P*
LPHS (days)	8.07 ± 11	5.75 ± 6.61	12.4 ± 15.75	0.137
Admission via ER	11 (25.6%)	6 (21.4%)	5 (33.3%)	0.473
ER stay (days)	2.64 ± 1.69	3 ± 2.1	2.20 ± 1.1	0.464
ICU admission	—	—	—	—
ICU stay (days)	9.17 ± 5.38	8 ± 6.93	10.33 ± 4.51	0.651
URG procedure	3 (%)	2 (7.1%)	1 (6.7%)	1.0
Baseline surgery				
CABG	30 (69.8%)	18 (64.3%)	12 (80%)	
AVR	7 (16.3%)	6 (21.4%)	1 (6.7%)	
MVR	3 (7%)	2 (7.1%)	1 (6.7%)	0.467
MV repair	1 (2.3%)	1 (3.6%)	—	
Aortic dissection	1 (2.3%)	1 (3.6%)	—	
Others	1 (2.3%)	—	1 (6.7%)	
Combined approach	4 (9.3%)	3 (11.9%)	1 (6.7%)	0.768
Use of internal mammary artery n=31	30 (96.8%)	18 (94.7%)	12 (100%)	1.0
No. of anastomoses	2.97 ± 0.85	2.83 ± 0.78	3.17 ± 0.94	0.301
CPB time	85.44 ± 45.52	90.54 ± 51.33	75.93 ± 31.42	0.322
Cross clamp time	60.98 ± 37.06	64.64 ± 41.93	54.13 ± 25.53	0.382
Procedure time	247.91± 69.62	251.46 ± 81.32	241.27 ± 41.40	0.653
Re-exploration for bleeding	—	—	—	—
Intubation time	23.19 ±43.47	18.96 ± 16.14	31.07 ± 71.17	0.526
IABP	1 (%)	1 (3.6%)	—	1.0

AVR = aortic valve replacement; CABG = coronary artery bypass grafting; CPB = cardiopulmonary bypass; ER = emergency room; IABP = intra-aortic balloon pump; ICU = intensive care unit; LPHS = length of preoperative hospital stay; MV repair = mitral valve repair; MRV = mitral valve replacement; URG = urgent; Preop = preoperative; Reop = reoperation

Table 3. Use of blood components.

	n = 34	Group 1	Group 2	*P*
Transfusion	23 (53.5%)	14 (50.0%)	9 (60.0%)	0.749
Type of BC				
PRBC	21 (48.8%)	12 (42.9%)	9 (60%)	0.347
Plasma	5 (11.6%)	4 (14.3%)	1 (6.7%)	0.643
Platelets	6 (14%)	5 (17.9%)	1 (6.7%)	0.403
Amount of BC				
PRBC	1.95 ±0.80	1.58 ± 0.67	2.4 ± 0.72	0.011
Plasma	2.40 ± 0.89	2	4	0.618
Platelets	11.33 ±1.03	11.20	12	0.541

BC = blood components; PRBC = packed red blood cells

pathogen, accounting for 58.1% of all cases, 50% in Group 1 and 73.3% in Group 2. Blood culture was positive in 79.1% of cases. Wound secretion collected during reintervention enabled to identify the causal agent in 74.4% of cases. In four patients (14.3%) in Group 1, none of the diagnostic means used in the study enabled to identify the pathogen.

Among 28 (65.1%) study patients who underwent single-stage surgical approach, 12 (27.9%) received primary wound closure with irrigation, seven (16.3%) only primary closure, six (14%) omental flap, and three (7%) pectoralis muscle flap. Inpatient mortality rate was 42.9% in Group 1 and 20% in Group 2 (P=1.86), with relative risk of 2.14 and CI [0.714-6.043], as described in Table 5. After definitive treatment, the need for new interventions was similar in both groups, 13 (46.4%) patients in Group 1 and 7 (46.7%) in Group 2.

DISCUSSION

The incidence of postoperative mediastinitis after cardiac surgery is low [3-5]. However, mortality and morbidity rates during treatment are high [1,6,7]. Much has been done to identify and treat its risk factors, which are multiple and, when two or more factors occur concomitantly, its action seems to be enhanced [4,5,8]. When analyzed alone, there seems not to be a most important risk factor in its genesis. Classic factors of surgical site infection such as trichotomy, infection in other sites, antibiotic prophylaxis, antisepsis, personal experience, and experience of medical and nursing team remain important.

In our cohort, demographic variables as well as risk factors were homogenously distributed between both groups. Myocardial revascularization using the internal thoracic artery remains the surgery most affected by mediastinitis. In none of the cases the bilateral use of the internal thoracic artery showed infection.

The use of blood-derived concentrates is high, being used in more than half the patients who developed mediastinitis. Packed red blood cells (PRBC) were the most predominant blood component. The preconditioning group received a significantly higher amount of PRBC during baseline surgery. Erythrocyte transfusion causes immunomodulation, although its extension and deficiency type are variable [21]. Randomized clinical trials, analyzing ICU inpatients, demonstrated that the use of non-leukocyte-reduced erythrocyte concentrates leads to multiple organ failure and death in up to 10% of patients, against 5% in those who used leukocyte-reduced erythrocyte concentrates [22]. This is the complication most often associated with blood transfusion and lung injury.

Currently, risk of infection associated with PRBC transfusion is 1:2,000 for bacterial infection; 1:58,000-149,000

Table 4. Pathogens.

	n = 43	Group 1	Group 2	*P*
Pathogen				
S. aureus	25 (58.1%)	14 (50%)	11 (73.3%)	
S. epidermidis	5 (11.6%)	3 (10.7%)	2 (13.3%)	
S. aureus and epidermidis	1 (2.3%)	0	1 (6.7%)	
Klebsiella	3 (7%)	3 (10.7%)	0	0.121
Pseudomonas aeruginosa	4 (9.3%)	3 (10.7%)	1 (6.7%)	
Morganella	1 (2.3%)	1 (3.6%)	0	
Non-identified	4 (9.3%)	4 (14.3%)	0	
BC +	34 (79.1%)	21 (75%)	13 (86.7%)	0.458
Swab +	7 (16.3%)	3 (10.7%)	4 (26.7%)	0.215
Wound secretion +	32 (74.4%)	20 (71.4%)	12 (80%)	0.719

BC = blood culture; Swab = wound secretion collected before reintervention

Table 5. Management.

	n = 43	Group 1	Group 2	*P*
Surg-reint time	18.65 ±15.45	16.75 ± 15.29	22.20 ± 15.64	0.276
ATB time (days)	27.19 ±24.64	24.75 ± 25.44	31.73 ± 23.31	0.372
Postop ICU time (days)	18.40 ±30.75	14.25 ± 29.26	26.13 ± 32.99	0.232
Mortality	15 (34.9%)	12 (42.9%)	3 (20%)	0.186
Postop time (days)	32.40±41.50	26.67 ± 43.27	55.33 ± 27.79	0.301
New interventions	20 (46.5%)	13 (46.4%)	7 (46.7%)	1.0

ATB = antibiotics; ICU = intensive care unit; Postop = postoperative; Surg-reint time = time between first surgery and reintervention for mediastinitis.

for hepatitis B; and 1:872,000-1,700,000 for hepatitis C [23]. Analyzing these data, we may consider Group 2 as possibly more severe than Group 1.

The attempt to identify a causal agent and a rapid surgical intervention accompanied by a comprehensive antibiotic coverage remains as the best treatment approach to mediastinitis. *Staphylococcus aureus* was the most frequent causal agent, leading to infections with rapid clinical course and more aggressive characteristics. Its elimination during the preoperative period should have top priority, in addition to strengthened care by the surgical team during the intraoperative period. Brazilian studies indicate *Staphylococcus aureus* as the most predominant causal agent in mediastinitis, whereas international reports demonstrate a predominance of *Staphylococcus epidermis* [9,10,24,25].

Using the preconditioning wound can reduce mortality by approximately 22% compared to the procedures of time only. This improvement in survival seems mainly related best clinical conditions of the patient and the wound at the time of final closure of the chest. Despite the clinical relevance motivating obtained statistical significance. However, most modern techniques for the treatment of mediastinitis and still not available in our country, such as vacuum therapy, is worth the preconditioning of the wound, which leads us to believe that this really is the best way to combat mediastinitis.

A single approach that may be successfully applied to all mediastinitis cases remains unknown [3]. Several reports have failed to differentiate or classify the type of associated infection always using the same management approach. Acute infection that develops during the two first postoperative weeks have a disease mechanism different from that of chronic or recurrent infection, which may take months or even years to develop after baseline pathology repair surgery [3]. Management approach in these cases, therefore, is different. The lack of knowledge on these facts is likely to be the reason why there are so many conflicting reports in the literature regarding the best approach to poststernotomy mediastinitis.

Mediastinitis type I, which was not included in this study, seems to respond well to debridement with primary resuture and use of irrigation. Wound debridement with two-stage closure using or not flaps is considered, for some authors, as the ideal treatment for chronic mediastinitis type V. Pairolero & Arnold [16] reported excellent results with the use of preconditioning of the wound and subsequent reconstruction with flaps. In that case series, 38 consecutive cases of mediastinitis type V were treated with no deaths during the first 30 postoperative days and five deaths during the mean study follow-up period of 24.8 months, none of them related to reconstruction or sepsis. Infection recurrence rate in those patients was 13.2%.

Prolonged antibiotic therapy alone is associated with mortality and morbidity rates currently unacceptable, and its use has been abandoned in early years [6]. An important advance in the treatment of mediastinitis occurred in 1963 when, for the first time, the use of continuous mediastinal irrigation with saline solution using routine chest drainage tubes after closure of the sternum was proposed [14]. Afterward, the addition of antibiotics in the irrigation was suggested, which was associated with an increase in bacterial resistance and fungal contamination, especially of the genus *Candida* [13]. As an alternative, then, the use of PVPI was started for continuous mediastinal cavity wash since it is a fungicidal and bactericidal solution associated with low toxicity. The use of primary resuture with or without mediastinal irrigation offers the advantage of a procedure that produces a closed wound with stable sternum, but studies have reported high therapy failure associated with a high mortality rate [20].

An approach often used in the presence of compromised sternal edges is the use of muscle and omental flaps. Lee et al. [11], in 1976, were the first to describe the use of omental flaps for filling the substernal dead space. The use of pectoralis muscle flap was described for the first time in 1980, but recent studies have reported conflicting results, and some authors still defend the use of flaps of rectus abdominus muscle as the technique of choice [12]. Reconstruction performed with the use of flaps, which aims at filling anterior mediastinal dead space and an increase in blood supply, has shown low mortality rates. Nevertheless, disadvantages associated with this method include an increase in surgical trauma, persistent pain in the flap, muscle weakness, and hernias [7]. Moreover, there are several series exhibiting poor long-term results with these techniques. Moreschi et al. [18] reported 81 consecutive mediastinitis cases treated with different modalities, early intervention with the use of flaps being a good treatment option with low mortality rates.

Therapy failure in mediastinitis leading to infection recurrence aggravates significantly an already difficult situation, resulting in an even higher mortality rate [3,10].

In an attempt to reduce high recurrence and treatment failure rates associated with primary resuture, several alternatives and technical refinements have been suggested over the past decades. Among them, we point out plastic reconstruction procedures using pectoralis muscle or omental flap [11,12]. More recently, the use of vacuum has been introduced as an intermediate stage between first-approach surgical debridement and definitive wound closure, but this approach is yet to be commercially spread in our field [17,20].

Based on our experience, preconditioning of the wound seemed to be a good therapeutic option in severe patients who develop postoperative mediastinitis. Despite the difficulty in maintaining a patient with the chest open, it seems an important technical improvement, which enables a definitive closure of the cavity in better technical and, mainly, clinical conditions. Preconditioning requires a better integration of surgical, clinical, nursing, and physical therapy teams, in

addition to technical care. Despite showing morbidity, routine dressing changes seem to reduce inpatient mortality. Although without statistical significance, the results herein obtained seem encouraging and in agreement with clinical findings.

After the wound preconditioning period, patients were re-evaluated and the definitive procedure was performed according to sternum conditions. In cases of viable bone, debridement of sternal edges was performed with resuture and use of irrigation. In cases of compromised bone, sternectomy was performed with filling of dead space. In cases in which the upper two thirds of the sternum were compromised, we used the rotation of the pectoralis major muscles; however, when the defect was in the lower third, omental flap was performed and, in some cases, both techniques were performed.

However, our study has some limitations. First, this was a retrospective study and this is not the best design to evaluate treatment. Due to small number of patients, the different techniques of late esternal closure could not be analyzed individually. Finally, the low annual incidence of this complication may cause small changes in the surgery process along the time.

CONCLUSION

Due to the lack of established guidelines, the choice of the mediastinitis procedure is based largely on low-level evidence references. Our study encourages the search for an effective intervention, there seems to be a reduction in hospital mortality with preconditioning of the wound although this difference was not statistically significant. The preconditioning wound has been in our midst, a good alternative in the treatment of severe mediastinitis. Further studies involving greater standardization of case reports and patient randomization are warranted to better understand the interventions applied to this severe affection.

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