

Ambulatory setting of patients with surgical site infections after a cardiac intervention



Cenário ambulatorial de pacientes com sítio cirúrgico infectado após intervenção cardíaca
Escenario ambulatorial de pacientes con sitio cirugía infectado después intervención cardíaca

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ABSTRACT

Objective: Verifying the clinical-surgical profile and the results of patients monitored in an surgical wound ambulatory after a cardiac surgeries.

Methods: This is a historical cohort research with patients submitted to cardiac surgery and monitored for a year in an outpatient surgical wound clinic from a hospital specialized in cardiology. The study analyzed the prevalent microorganisms in infections, the products used in the dressings, the time of follow-up, and the type of therapy established in the dressings.

Results: Among the 150 patients, most were sexagenarians (61.7 ± 11.4 years), hypertensive patients (75%), and diabetic (44.7%). There were 12 patients with mediastinitis (8%) and 44 with surgical site infection (29.3%). Fatty acids (80%) and calcium alginate (19%) were used for wound healing. The mean follow-up time was 35 ± 71 days.

Conclusion: Sexagenary, hypertensive, diabetic and revascularized patients constituted the population monitored in the wounds outpatient clinic. The SSI and mediastinitis rates found were acceptable and similar to those in literature.

Keywords: Sternotomy. Thoracic surgery. Surgical wound infection. Mediastinitis. Ambulatory care.

RESUMO

Objetivo: Verificar o perfil clínico-cirúrgico e os resultados de pacientes acompanhados em um ambulatório de ferida operatória após cirurgia cardíaca.

Métodos: Coorte histórica com pacientes submetidos à cirurgia cardíaca e acompanhados por um ano em um ambulatório de feridas de um hospital especializado em cardiologia. Foram analisados os micro-organismos predominantes nas infecções, os produtos utilizados nos curativos, tempo de acompanhamento e o tipo de terapêutica instituída nos curativos.

Resultados: Entre os 150 pacientes, predominaram sexagenários ($61,7 \pm 11,4$ anos), hipertensos (75%), diabéticos (44,7%). Evidenciou-se 12 pacientes com mediastinite (8%) e 44 com infecção de sítio cirúrgico (29,3%). Utilizou-se para realização dos curativos os ácidos graxos (80%) e alginato de cálcio (19%). O tempo de acompanhamento foi de 35 ± 71 dias.

Conclusão: Pacientes sexagenários, hipertensos, diabéticos e revascularizados constituíram a população acompanhada no ambulatório de feridas. As taxas de ISC e mediastinite encontradas foram aceitáveis e semelhantes às da literatura.

Palavras-chave: Esternotomia. Cirurgia torácica. Infecção da ferida cirúrgica. Mediastinite. Assistência ambulatorial.

RESUMEN

Objetivo: Verificar el perfil clínico-quirúrgico y los resultados de pacientes acompañados en un ambulatorio de heridas operatorias después de cirugía cardíaca.

Método: Cohorte histórica con pacientes sometidos a la cirugía cardíaca y acompañados por un año en el ambulatorio de heridas de un hospital especializado en cardiología. Fueron analizados los microorganismos predominantes en las infecciones, los productos utilizados en las curaciones, el tiempo de seguimiento, o el tipo de tratamiento utilizado en las curaciones.

Resultados: Entre los 150 pacientes predominaron el sexo masculino (58%), sexagenarios ($61,7 \pm 11,4$ años), hipertensos (75%), diabéticos (44,7%). Se evidenciaron 12 pacientes con mediastinitis (8%) y 44 con infección en el sitio quirúrgico (29,3%). Se utilizó en las curaciones fueron los ácidos grasos (80%) y el alginato de calcio (19%). El tiempo medio de seguimiento fue de 35 ± 71 días.

Conclusión: Los pacientes sexagenarios, hipertensos, diabéticos y revascularizados constituyeron la población acompañada en el ambulatorio de heridas. Las tasas de ISC y mediastinitis encontradas fueron aceptables y similares a las de la literatura.

Palabras clave: Esternotomía. Cirugía torácica. Infección de la herida quirúrgica. Mediastinitis. Atención ambulatoria.

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■ INTRODUCTION

Surgical site infections (SSI) are an important challenge in cardiac post-surgery patients, since they have a high impact in the recovery of patients and cause an expressive increase in hospital rates and expenditure, be it due to longer hospitalization times or to the need for interventions⁽¹⁻²⁾. Studies have pointed out an incidence of 0.9 to 20% of infections in sternum incisions, 25% of superficial infections, 5.8% of mediastinitis and a high mortality rate from this serious complication, varying from 14 to 47%⁽³⁻⁴⁾. The infections can be superficial, in which case they compromise the skin and subcutaneous tissues, or incisional, when they involve deep soft tissues⁽⁵⁾.

Different predictors for the risk of infection have been identified in previous studies, among which are the presence of diabetes mellitus (DM), chronic obstructive pulmonary disease, obesity, repeated surgical interventions, multiple transfusion, advanced age, malnutrition, smoking, prolonged hospitalization, inadequate skin cleansing, and the use of broad-range antibiotics⁽⁶⁻⁷⁾.

Strategies for the prevention and treatment of SSIs have been frequently discussed, especially those targeted at populations at risk, such as elder patients and those with chronic and critical diseases. Many resources and therapies for the dressing of surgical wounds (SW) are commercially available, and have often been successful when associated to assistance protocols developed and standardized by health teams, together with the professionals which act in the control of hospital infections (HIC)⁽⁸⁻⁹⁾.

Periodic surveillance of surgical patients after hospital discharge has also been showing itself as increasingly relevant for the early detection of signs of infection, since more than 50% of SSIs manifest from the 7th to the 14th day after discharge, not to mention the problem of under-notification⁽¹⁰⁾. The monitoring of this risk group, by professionals trained specifically for recognizing SSIs, brings benefits to planning and to interventions whose priority is defined according to the individual needs of each patient, improving their prognostic and diminishing the costs from re-hospitalizations⁽¹¹⁻¹²⁾.

Considering this setting, individual ambulatory follow-up after cardiac surgeries for patients with multiple clinical conditions, with slower cicatrizations, is essential to identify early the signs of infection, while also monitoring these lesions and the immediate surgical results. This study was designed, considering the issues mentioned, with the objective of verifying the clinical-surgical profile and the results of patients whose cases were followed in an ambulatory for wound dressings after cardiac surgeries.

■ METHODOLOGY

This is a historic cohort study with patients who underwent cardiac surgeries and were monitored for one year in the wound dressing ambulatory of a hospital specializing in cardiology. The study included adults aged ≥ 18 years old, from both genders, who underwent myocardium revascularization surgeries (MRS), valve-related surgeries, or the placing or exchange of implantable electronic cardiac devices (IECD), which were referred to ambulatory monitoring.

This study was executed in the nursing unit for cardiac surgery wound dressing. Patients who were referred to said unit during discharge or up to 30 days after the intervention, and presented early signs of dehiscence from SW or SSI, were cared for there. Nursing consultations and wound dressing are conducted by a nurse from the skin lesions team of the institution, by a resident nurse and by a nursing technician. From an institutional protocol of infection prevention adopted by the skin lesions team and the evaluation of the professionals, the adequate therapeutic conduct for treating the wound is defined, as well as the interval between each wound dressing. More critical cases that require the use of antibiotic therapy or broad surgical debridement are evaluated by the team's cardiovascular surgeon.

The institution's protocol of prevention of infections in surgical sites prescribed the use of the SSI prevention bundle, a group of measures to be applied together to obtain better results than they would when applied separately. This bundle was, in summary, characterized by six items, which are: antiseptic pre-surgery bath with chlorhexidine 2%, a substance which has anti-microbial residual action that lasts for up to six hours; the application of pure chlorhexidine in the perineal area, since the gastrointestinal tract has many micro-organisms that tend to colonize the skin; epilating with an adequate electrical device immediately before the surgical procedure, inside the surgical room; the maintenance of normothermia (temperature equal or higher than 36°); the maintenance of glycemia below 200mg/dl, to be measured at 6 a.m. in the first post-surgery day, and at 6 a.m. into the second post-surgery day; the use of surgical prophylactic antibiotics, with cefuroxime 1.5g infused into the anesthetic induction up to 30 minutes before incision. In the post-op, the antibiotic should be maintained at a dosage of 750mg every 8 hours, for 48 hours. Also, as an alternative for patients allergic to penicillin and cephalosporin, the use of clindamycin 900mg, every 8 hours for 24 hours, is recommended. The use of mupirocin in the perinasal area every 12 hours in the day before surgery and the continued use of this dosage for 5 days⁽¹³⁾.

A database was elaborated with the sociodemographic, clinical, and lesion-related variables, such as location and characterization of the SW, predominant micro-organisms, products used in the caring of wounds, antibiotics being used, and the duration of wound healing and of outpatient monitoring.

The evaluated outcomes were SSI and mediastinitis. The SSI was verified according to the infection criteria mentioned below⁽⁸⁾.

This study considered as superficial incision SSI those that took place in less than 30 days after surgery, involving only the skin and the subcutaneous area, and at least one of the following criteria: purulent drainage of the superficial incision and/or positive culture of secretion or of tissue from the superficial incision, as long as it was got aseptically; superficial incisions deliberately opened by the surgeon which presented symptoms such as pain, increased sensibility, local edema, hyperemia or heat, with the exception of cases with negative results for culture; and a medical diagnostic of infection, also considered to be incisional SSI.

The investigation considered as deep SSIs those that took place within a year from the surgery, whose incisions involved deep soft tissues, such as fascia or muscles, as well as those in which prosthesis were inserted, those whose deep incisions presented purulent drainage — with the exception of organs or cavity —, opening of the wound by the surgeon when axillary temperature was equal or higher than 38°, an increase in local sensitivity, in addition to the presence of abscesses or other evidences indicating that the infection involved deeper parts of the wound identified in a repeated surgery, or in clinical, histopathological and image exams, or diagnostics of deep incisional infection by the assistant physician.

The SSI of organs or cavities were those that took place up to a year after surgery, involving any organ or cavity which was open or manipulated during surgery, with or without the need for prostheses, and attending to at least one of the following criteria: positive culture of secretion or organ/cavity tissue obtained aseptically; presence of an abscess or other evidence that the infection involves deep levels of the wound identified in a repeated surgery, or in clinical, histopathological or image exams, or organ/cavity infection diagnosed by the assistant physician.

This study considered as mediastinitis cases of profound SW infections, with clinical and/or micro-biological evidences of retrosternal involvement, associated to sternum osteomyelitis, with or without instability⁽¹⁴⁾.

This research was developed respecting the Directives and Regulating Norms for researches with Human Beings, according to Resolution 466/2012. It was approved by the

Research Ethics Committee of the Cardiology Institute at the Fundação Universitária de Cardiologia, under protocol 1.563.037. A Term of Medical Data Confidentiality was used, and a commitment was made to only use the information to scientific ends, integrally preserving the anonymity of patients.

Data was analyzed using the statistical software Statistical Package for Social Sciences (SPSS), version 23.0. The continuous variables were described as mean and standard deviation, in the case of those with normal distribution, or as median and percentage 25-75. The categorical variables were described using absolute (n) and relative (%) values. To evaluate the association between the categorical variables, the Chi-square test was used. The significance level was 5%.

■ RESULTS

This research evaluated 150 patients cared for in the surgical wound unit, most of whom were male (58%), with a mean age of 61.7 ± 11.4 years old, who were receiving attention through the unified health system (79.3%). The most common comorbidities were: systemic arterial hypertension (74.7%), diabetes mellitus (44.7%), and dyslipidemia (40.7%). The most common surgical intervention was the MRS (79.3%). The mean time of monitoring in the unit for the healing of the wound was 35 ± 71 days. Three deaths took place (2%) during this study. These and other clinical data can be found in Table 1.

Surgical site infections

The study found that 29.3% of patients had SSI. From these, 45% had thoracic infections, 36% had saphenectomies, and 8% were diagnosed with mediastinitis. This data is presented on Table 2. The use of the institutional infection prevention protocol was recorded on the medical records in nearly all cases of SSI (96%).

Among patients with DM, 46.3% developed SSIs, and 16.4% had it evolve to a mediastinitis, there being a statistically significant difference in the association between thoracic SSIs and DM ($p < 0.001$), as well as in the association between mediastinitis and the presence of DM ($p = 0.002$).

Therapeutics for the infected lesions

Among the patients, 63.3% evolved with a good surgical wound healing, receiving, therefore, ambulatory discharge. 25.3% needed to be re-hospitalized for monitoring

and/or surgical re-intervention, while 30% evaded the consultations and 6.7% remained under monitoring.

It was found that 43.2% of SSIs took place with no growth of germs in culture exams. The most common micro-organisms were *Serratia sp* (6.7%) and *Klebsiella Pneumoniae Carbapenemase (KPC)* (4.7%). *Pseudomonas*, *Enterobacter*, *Escherichia coli*, *Acinetobacter sp* and *Proteus* were also found, but less frequently.

The most commonly used products in lesion therapy were dressings containing essential fatty acids (EFA) (80%)

and calcium alginate (19.3%). Considering the pharmacological therapeutics used, 22.7% of patients required treatment with only one type of antibiotics; the other cases required two or more antibiotics of different types (77.3%). The most used antibiotics were cefepime (52.3%), piperacillin (36.4%), meropenem (34.1%), vancomycin (27.3%), and oxacillin (22.7%). Other antibiotics, such as sulfamethoxazole, bactrim, clindamycin, ampicillin + sulbactam, norfloxacin, and cefazolin, were used in isolated cases. This data is demonstrated in Charts 1 and 2.

Table 1 - Clinical-surgical profile of the population attended in the outpatient clinic (n=150)

Variables	n (%)
Male	87 (58)
Age*	61.7±11.4
Comorbidities	
Arterial hypertension	112(74.7)
Diabetes mellitus	67(44.7)
Dyslipidemia	61(40.7)
Smoker	61 (40.7)
Coronary arterial disease	50 (33.3)
Ischemic heart disease	40 (26.7)
Obesity	31 (20.7)
Chronic pulmonary obstructive disease	11 (7.3)
Renal failure	7 (4.7)
Family history of DAC	7 (4.7)
Surgeries	
Myocardium revascularization	119 (79.3)
Mammary myocardium revascularization	99 (66)
Mitral or Aortic Valve	26 (17.3)
IECD	11 (7.3)
Re-interventions	11 (7.4)
Length of surgery (hours) *	5.0 ± 1.2
Length of monitoring in the outpatient clinic (days) *	35 ± 71

Source: Research data, 2018.

*Variables expressed as mean/standard deviation

Table 2 - Location of SWs and characterization of SSIs. (n=150)

Variables	n (%)
SW location	
Sternotomy (thoracic)	20 (45)
Saphenectomy (lower limb)	16 (36)
MP/CDI insertion	8 (18)
Surgical site infection	
Superficial	25 (16.7)
Deep	11 (7.3)
Organ or cavity	9 (6)
Mediastinitis	12 (8)

Source: Research data, 2018.

Variables expressed as mean/standard deviation PM: pacemaker ICD: Implantable cardioverter defibrillator

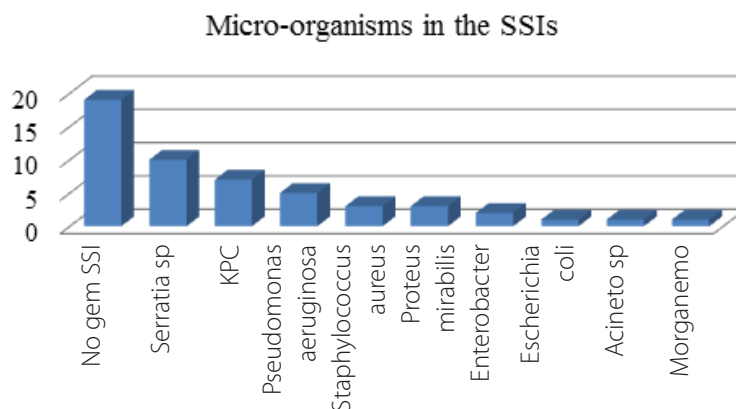


Chart 1 - Micro-organisms related to the SSI in the population analyzed (n=44)

Source: Research data, 2018.

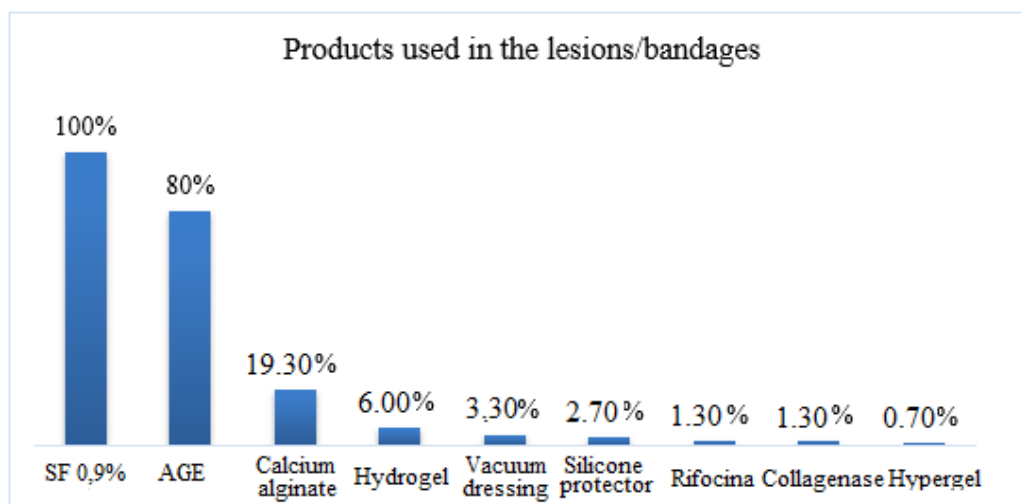


Chart 2 - Products used in the dressings (n=150)

Source: Research data, 2018

■ DISCUSSION

In the clinical centers where this study was developed, all patients admitted for surgical interventions undergo a prophylactic protocol, which is guided by nurses who use chlorhexidine as a body antiseptic, and epilate their thorax, fists and legs immediately before the intervention. Mupirocin is applied in the nose to prevent *Staphylococcus aureus* infections, operation site asepsis is carried out, as well as a rigorous trans-surgery glycemic control. However, despite the careful use of the protocol standardized by the health team, they cannot completely prevent the patients from said complications, since sternotomies are multi-factoral resultants, and the best strategy to avoid them will always be prevention.

This study found that 29.3% of patients developed SSI, and in 8% of cases it evolved into mediastinitis. Literature data, with similar populations, show SSI rates from 4.3% to 19.1%, and mediastinitis rates from 1 to 20%⁽¹⁵⁻¹⁷⁾. The comorbidities identified among these cases that can be risk factors are: smoking, SAH, obesity, and DM. Stress-induced hyperglycemia and high post-surgery rates of glycosylated hemoglobin, even among patients with no previous diagnosis of this disease, contribute to increase the number of infections, leading to a worst prognosis and to an increase in cardiovascular morbidity-mortality, making an adequate glycemic control essential. The same is true for smoking, which is, even in isolation, associated to SSI development^(14,17). Similarly, other authors reiterate that obesity and smoking are important predictors of complications, making worst clinical outcomes more likely in the short and long terms, and being determinant in pulmonary complications. An age > 70 years old, metabolic diseases, and some surgical intervention related factors do the same, as do surgeries lasting for more than 3 hours, long periods of extra-corporeal blood circulation, and major thoracic surgeries⁽¹⁸⁾.

SW infections from CRM were the most common, with a predominance of superficial lesions both in sternotomies and in saphenectomies. The wound treatment includes clinical and surgical methods, and wound dressing is the most common clinical treatment for tissue reparation. Currently, there are many bandages available that include active agents which can aid in this process, and a continuous assessment of the evolution of healing stages must be made for a correct usage. The most commonly used products in this practice were bandages based on essential fatty acids and calcium alginate. The EFA promotes chemotaxis and angiogenesis keeps the mean moisturized, and accelerates the process of tissue granulation. Calcium alginate

aids in the process of autolytic debridement, with a great capacity for absorption, in addition to also keeping the mean moist, which is necessary for healing. In addition, calcium alginate is indicated for cavity wounds, and bandages should be exchanged every 24 hours in infected wounds; in lesions with low exudation, the exchange can be done every 48 to 72 hours, allowing the patient to be more comfortable and to go with less frequency to the hospital service to exchange the bandages⁽¹⁹⁾.

In the setting of this ambulatory, other products are also used for debridement, granulation, and to prevent maceration in the borders of the wound. Patients are also received after the use of negative pressure therapy (vacuum dressings) to prepare the wound bed, as a continuation to the treatment. In the cases found here, most patients needed to be treated with two or more antibiotics, and the most common micro-organisms in SSIs were *Serratia sp* and *KPC*. These findings are similar to those of other authors⁽²⁰⁾. A previous study with patients who underwent transplantations in the same institution of this research found 5.6% of infections in surgical incisions, and the *Staphylococcus aureus* was the most common etiological agent. Micro-organisms are mutant, but an explanation for the change of etiological agent in the population, from the previous study to this one, may be the implantation of the SSI prevention protocol, which was carried out after the evidences involving transplant patients came to light. This protocol reiterates the use of topic (nasal) mupirocin, to prevent infections caused by this germ. It also makes it mandatory to epilate the patient within the surgical center itself, immediately before surgical intervention.

This investigation leads to believe that strategies that allow for a continued care after hospitalization, in this case, with continuous evaluations and positive reinforcements related to healing and to the adequate therapies, can contribute for a better performance of patients in their self-care, while minimizing the exacerbation of infections and, consequently, the rate of re-hospitalizations.

■ CONCLUSION

The results found in this study make it possible to conclude that male, sexagenarian, hypertensive, diabetic, and revascularized patients are the population who most commonly undergo cardiovascular diseases, and who, therefore, is more monitored in this wound dressing Institution in the south of Brazil than any other. SSI and mediastinitis rates found were acceptable and similar to those in literature. Specialized follow-up and the dressing of surgery

wounds with specific products enabled an effective healing of the wounds.

Early recognition of infection signs is essential, for patients, family members, as well as for health teams, to minimize their severity, and to define and use available therapies to prevent re-hospitalizations.

Since this study is a historic cohort, it had as a limitation the shortcomings of medical record registers made by health professionals, which sometimes were incomplete or non-existing. Even undernotification may have taken place in some cases. However, these findings are relevant for clinical practice, since they reiterate the relevance of infection control for surgical wounds in all stages of hospitalization. Prospective studies made by multi-professional skin lesion teams, with standardized protocol, are necessary, as tools for clinical practice.

The actions of nurses in the assistance, from complete medical records to evaluations of the aspect and dimension of lesions, in addition to their deepness, the presence of exudate, phlogistic signs, and the healing evolution according to the therapy used, coupled with the surgical team and to the control of hospital infections, are extremely important to minimize the growth of these different germs, as well as to keep the protocols of SSI preventions active in the health services. Clinical practice must include systematic nursing interventions to inhibit factors that can worsen infections, while diminishing the odds of negative outcomes from diseases, whatever the situation and setting.

This study resulted from a monograph submitted as a requirement for obtaining the degree of Specialist in the Multidisciplinary Integrated Residence Program in Health: Nursing in Cardiology, at the Fundação Universitária de Cardiologia/Instituto de Cardiologia do Rio Grande do Sul⁽²¹⁾.

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