# Population affected by mediastinitis in a university hospital in Recife-PE: a retrospective study

Raul Amaral de Araújo[1], Natália Benedito de Oliveira[1], Hilda Silva Carrilho Barbosa[1], Simone Maria Muniz da Silva Bezerra[1]

[1]Federal University of Pernambuco

**ABSTRACT**
**Aim:** to describe the population affected by mediastinitis in a university hospital in Recife-PE. **Method:** a descriptive, retrospective study of a sample of 26 patients. **Result:** prevails among males who are hypertensive, diabetic, obese and smokers, with a mean age of 57.54 years, from the metropolitan area. Subjects are hospitalized due to ischemia and have submitted to surgery for myocardial revascularization. A long hospital stay and high mortality was observed. **Discussion:** the predominance of males, the large proportion of elderly people studied, as well as the high prevalence of chronic diseases, are associated with the emergence of mediastinitis related to economic and social conditions. **Conclusion:** mediastinitis is highlighted as a serious complication of cardiovascular surgical procedures, mainly myocardial revascularization surgeries culminating in substantial morbidity, high mortality and high hospital costs.
**Keywords**: Nursing; Infection; Mediastinitis

## INTRODUCTION

Mediastinitis is an infection involving the deep tissues of the chest. There is an incidence of 1% to 3%, with mortality rates exceeding 20%. It is associating with increased hospital costs, and gains prominence when related to infectious processes that occur after cardiovascular surgery[1-3].

The prognosis is severe, despite treatment with antibiotics and wound debridement, because the infection can spread to the mediastinum and can involve cardiac structures. It can also lead to septic shock and haemorrhage[4,5].

On the other hand, the characteristics of patients undergoing cardiac surgery increase their susceptibility to infectious diseases, including cardiovascular diseases. Such individuals, over recent decades, have undergone changes in their profile, becoming increasingly older, more obese and with severe comorbidities[2,6].

Therefore, it becomes necessary to describe the population affected by mediastinitis in hospitals offering cardiovascular surgery since, in many studies, there appear to be variations in the population profile of this group, which presents characteristics intrinsic to the infection[1 2,4-8].

The description of this population is urgently needed to formulate or consolidate protocols or institutional measures aimed at the control and prevention of mediastinitis, because it will be important to the people to whom the study will be addressed.

Thus, the aim of this study is to describe the population affected by mediastinitis after sternotomy, who have been treated at a university hospital in Recife, PE.

## METHOD

This is a descriptive retrospective study, conducted through the analysis of the medical records of individuals who were diagnosed with mediastinitis after sternotomy, between June 2007 and September 2010. The initial mark was the first recorded case of mediastinitis at the study site, on June 24, 2007.

The study site was the Emergency Room of the Pernambuco Prof. Luiz Tavares (PROCAPE) Hospital, an education institute at the University of Pernambuco (UPE), located in Recife, PE. It provides medium and high complexity services in cardiology exclusively for the Unified Health System (SUS), and institutions in the North and Northeast regions.

The study population was composed of users who underwent cardiovascular surgery with sternotomy, hospitalized in PROCAPE/UPE. The sample consisted of individuals with a medical diagnosis of mediastinitis after cardiac surgery with sternotomy. We excluded patients whose diagnosis was inconclusive; who had died before confirmation; who had surgical site infection only or mediastinitis arising from procedures not involving sternotomy. The sample consisted of 26 individuals.

Data were collected using an instrument developed by the authors. This was pre-tested on five medical records to determine its usefulness and its ability to generate valid information for the study[9].

The analysis of the pre-test showed no need for modifications to the data collection instrument. It was decided to include the five patients whose medical records were used in this step.

Information collected covered the following variables: gender, age, origin, date of hospitalization, admission diagnosis, personal history, surgery, date of surgery, date of diagnosis of mediastinitis and outcome of the case (discharge for clinical improvement or death).

Data collection occurred after approval by the Ethics Committee in Research of UPE, under protocol 172/09.

The study sample was characterized by applying descriptive statistics, through the absolute distributions, percentages and statistics in the form of the following measures: mean, median, standard deviation, minimum and maximum values. We used the Statistical Package for the Social Sciences (SPSS), version 15, for data entry and for the retrieval of statistical calculations.

## RESULTS

The following are the results of the study, starting with the description of the individuals that comprised the study sample (Table 1).

**Table 1** – Description of patients included in the study. Recife-PE, 2010.

| Description of patients (n=26) | N | % |
|---|---|---|
| **Age** | | |
| 0-1 years | 2 | 7.7 |
| 49-58 years | 19 | 34.6 |
| ≥ 60 years | 15 | 57.7 |
| **Gender** | | |
| Male | 15 | 57.7 |
| Female | 11 | 42.3 |
| **Origin** | | |
| The Metropolitan Region of Recife-PE | 21 | 80.7 |
| Municipality provinces | 5 | 19.3 |

Most patients were aged more than 60 years (57.7%), followed by the age group of 49-58 years (34.6%). The average age of the respondents was 57.54 (± 18.44) years, with a median of 62 years, ranging from one to 77 years. Males prevailed (57.7%), as well as those from the metropolitan region of Recife, PE (80.7%).

In Table 2, we observe the admission diagnosis, personal history and the surgerical procedures preceding the diagnosis of mediastinitis.

**Table 2 –** Distribution of respondents for admission diagnosis, personal history and surgical procedure preceding the mediastinitis. Recife-PE, 2010.

| Admission Diagnosis | N | % |
| --- | --- | --- |
| Acute Myocardial Infarction | 10 | 38.5 |
| Acute Coronary Syndrome | 7 | 27.0 |
| Unstable angina | 3 | 11.5 |
| Stable angina | 2 | 7.7 |
| Interventricular communication | 2 | 7.7 |
| Aortic dissection type A | 1 | 3.8 |
| Mitral Stenosis | 1 | 3.8 |
| **Personal History** | **N** | **%** |
| Hypertension | 24 | 92.3 |
| Diabetes Mellitus | 14 | 53.8 |
| Smoking | 13 | 50.0 |
| Obesity | 7 | 26.9 |
| Coronary Artery Disease | 6 | 23.1 |
| Chronic Obstructive Pulmonary Disease | 2 | 7.7 |
| Congestive Heart Failure | 2 | 7,.7 |
| **Surgical Procedure Preceding the Mediastinitis** | **N** | **%** |
| Coronary Artery Bypass Grafting | 22 | 84.7 |
| Ventriculoseptoplasty | 2 | 7.7 |
| Mitral Valve Replacement | 1 | 3.8 |
| Correction of Aortic Dissection Type A | 1 | 3.8 |

Ischemic events accounted for 84.7% of admission diagnoses, which also included two congenital malformations, a valve and a vascular involvement.

In terms of personal history, hypertension (HAS), diabetes mellitus (DM) and smoking habits stood out, in that they were present in 92.3%, 53.8% and 50% of patients, respectively. They were followed by obesity (26.9%) and coronary artery disease (23.1%). Chronic obstructive pulmonary disease (DPOC) and congestive heart failure were infrequent.

It is observed that coronary artery bypass grafting (CRVM) preceded the occurrence of mediastinitis in 22 cases (84.7%). Of these, 18 had CRVM performed associated with a cardiopulmonary bypass. The emergence of mediastinitis after other surgical procedures was proportionately lower.

In Table 3 we see the information corresponding to the days elapsed between the surgery and the onset of mediastinitis, the clinical outcome for each individual, and the total days of hospitalization.

**Table 3** – Distribution of respondents in terms of days elapsed between surgery and the diagnosis of mediastinitis, the clinical outcome and days of hospitalization. Recife-PE, 2010.

| Days elapsed between surgery and the diagnosis of mediastinitis | N | % |
|---|---|---|
| 6 to 9 days | 9 | 34.6 |
| 10 to 15 days | 9 | 34.6 |
| ≥ 16 days | 8 | 30.8 |
| **Outcome** | **N** | **%** |
| Discharge for Clinical Improvement | 17 | 65.4 |
| Death | 9 | 34.6 |
| **Hospitalization days** | **N** | **%** |
| 20 a 44 days | 8 | 30.8 |
| 45 a 90 days | 7 | 26.9 |
| 91 a 120 days | 7 | 26.9 |
| > 120 days | 4 | 15.4 |

It was observed that 69.2% of the patients were diagnosed with mediastinitis within 15 days of surgery, with 34.6% of the sample being diagnosed between six and nine days after surgery. In this regard, the average number of days between surgery and diagnosis was 14.64 (± 10.23) days.

The majority of patients saw an improvement (65.4%), whereas the mortality rate was 34.6%.

Regarding days of hospitalization, the lowest percentage corresponded to patients who had more than 120 days of hospitalization (15.4%), while the largest percentage referred to patients who were hospitalized for 20-44 days (30.8 %). Hospitalization was for an average of 85.73 days, the lowest being 20 days and the longest 303 days.

## DISCUSSION

The predominance of males and those aged 60 years or more, along with the rare occurrence of mediastinitis among young people, is consistent with the literature, in which age is a risk factor for this disorder. In addition, male gender is recognized as an independent predictor for mediastinitis after cardiovascular surgery[2-6,10,11].

Advanced age has serious consequences, as it increases the chances of post-operative complications, increasing the need for emergency treatment, resulting in a greater predisposition to infectious events. Furthermore, the response to treatment will tend to be slower[2-6].

In this context, we emphasize the high proportion of individuals who have been hospitalized after suffering acute myocardial infarction (IAM), a fact that reflects the purpose of the institution, which deals with cardiac emergencies and cases in need of urgent treatment, as well as the preponderance of ischemic cardiovascular diseases in elderly people in the Western world. Such events need cardiovascular surgeons to be aware of such a predisposition especially when associated with an unfavorable personal history[1-5].

In terms of personal history, HAS is considered to be one of the main risk factors for mediastinitis, whereas DM is a risk factor which is feared because microvascular and glycemic alterations may interfere negatively in the healing process and lead to an increased risk of infection. Obesity also impairs wound healing as it relates to the disruption of surgical sutures, facilitating bacterial invasion of the surgical site[7.10 to 12].

Thus, obese individuals are particularly prone to the development of mediastinitis. Potential explanations include also the inadequacy of serum prophylactic antibiotics in the

obese, technical difficulties with regard to maintaining sterility of the skin folds in the pre-and intraoperative period, and the poor perfusion of adipose tissue[1-3].

The high prevalence of smoking was also revealed. This is a known risk factor for infectious processes, especially when associated with DPOC[1,2,7,11], a convergence that occurred in two patients in the study.

We emphasize the preponderance of surgery for coronary artery bypass grafting (CRVM) prior to the onset of mediastinitis. This surgery has major complications such infection, especially when associated with cardiopulmonary bypass. However, the responsible mechanism for the infection is not completely understood, but is believed to be multifactorial[3,4,6,10].

Among those surveyed, the average number of days which elapsed between surgery and the diagnosis of mediastinitis was 14.64 (± 10.23) days, which represents a relatively short period, a fact that contributes to effective treatment and better prognosis. The use of appropriate treatment as soon as it becomes essential after the diagnosis of mediastinitis, reduces the risk of further surgery.  This is either to wash the mediastinum, or to perform sternotomy procedures after the worsening of the infection[2 to 5.12].

Studies on this subject report an in-hospital mortality rate ranging between 10% and 47%, despite the implementation of early treatment with the use of the most advanced surgical techniques and drugs. These indexes suffer huge variation, depending on where the research was conducted, as well as the profile of the population studied[1-7,10,11]. Meanwhile, the mortality observed in this study was 34.6%.  This is high, but within the indexes described in the literature.

There were also high periods of hospitalization, with an average of 85.73 days (ranging from shorter than 20 days to greater than 303 days), related to the need for reoperation for the treatment of mediastinitis, and the need for to use antibiotics over an extended period. This average is higher than that found in individuals who have undergone surgery, but who did not develop mediastinitis [3,10,11].

Other research has shown an average period of hospitalization ranging from 45.67 to 74.3 days, and shorter hospitalization ranging from 15 days to the longest of 86 days[2,3,6,7].

These facts reflect the substantial degree of morbidity related to prolonged hospitalization, and elevated risks for nosocomial infections and adverse drug reactions. Costs for the care of these patients are also extremely high because a patient who develops mediastinitis raises hospital costs by a factor of three when compared to a patient who suffers no such involvement. This illness also carries serious psychological problems, both to the patient and to his or her family[4-11].

**CONCLUSION**

Mediastinitis is a serious complication associated with cardiovascular surgical procedures, mainly coronary artery bypass grafting surgeries, culminating in substantial morbidity, high mortality and high hospital costs arising from the long hospitalization of patients affected by this disease.

The characteristics of the individuals in the sample used in this study were at some point similar those of other studies. Data such as patient age and male predominance align with the results of the research addressed here.

Also consistent with the results of research in this area, is the fact that most patients underwent coronary artery bypass grafting, with the primary diagnosis at admission of acute myocardial infarction.

The highlights were the high proportion of hypertension, diabetes mellitus, smoking, and obesity, factors that, according to published data, support the recognized influence of these factors on the development of mediastinitis.

The mortality of individuals was in accordance with the values described in studies of this subject. However, the average length of hospitalization of these patients was above the average recorded in other studies.

The information obtained in this study allows us to build strategies for a specific population that is at risk of being affected by an infection with a high mortality rate. The data also allow the construction of a specific tool for this target population in order to streamline and enhance the systematization of nursing care.

## REFERENCES

1. Matros E, Aranki SF, Bayer LR, McGurk S, Neuwalder J, Orgill DP. Reduction in incidence of deep sternal wound infections: random or real. J Thorac Cardiovasc Surg. 2010; 139 (3): 680–5.
2. Risnes I, Abdelnoor M, Almdahl SM, Svennevig JL. Mediastinitis after coronary artery bypass grafting risk factors and long-term survival. Ann Thorac Surg. 2010; 89 (5):1502–9.
3. Sachithanandan A, Nanjaiah P, Nightingale P, Wilson I, Graham T, Rooney S et al. Deep sternal wound infection requiring revision surgery: impact on mid-term survival following cardiac surgery. Eur J Cardiothorac Surg. 2008; 33(4): 673–8.
4. Ennker IC, Malkoc A, Pietrowski D, Vogt PM, Ennker J, Albert A. The concept of negative pressure wound therapy (NPWT) after poststernotomy mediastinitis – a single center experience with 54 patients. J Cardiothorac Surg. 2009;4:1-8.
5. Dacey LJ, Braxton JH, Kramer RS, Schmoker JD, Charlesworth DC, Helm RE, et al. Long-term outcomes of endoscopic vein harvesting after coronary artery bypass grafting. Circulation. 2011; 123 (2):147-153.
6. Lola I, Levidiotou S, Petrou A, Arnaoutoglou H, Apostolakis E, Papadopoulos GS. Are there independent predisposing factors for postoperative infections following open heart surgery? J Cardiothorac Surg. 2011; 6: 1-9.
7. Lin M, Pan S, Wang J, Hsu R, Wu FL, Chen Y, et al. Prospective randomized study of efficacy of 1-day versus 3-day antibiotic prophylaxis for preventing surgical site infection after coronary artery bypass graft. J Formos Med Assoc. 2011; 110 (10):619-26.
8. Feijó E, Cruz ICF, Lima DVM. Infecção da ferida – revisão sistematizada da literatura. Online Braz J Nurs [serial in the internet]. 2008 [cited 2011 ago 14]; 7(3); Available from: http://www.objnursing.uff.br/index.php/nursing/article/view/j.1676-4285.2008.1819/433.
9. Polit DF, Beck CT. Fundamentos de pesquisa em enfermagem: avaliação de evidências para a prática da enfermagem. 7ª ed. Porto Alegre: Artmed; 2011.
10. Wingerdena JJ, Lapida O, Boonstrab PW, Molc BAJM. Muscle flaps or omental flap in the management of deep sternal wound infection. Interact Cardiovasc Thorac Surg. 2011; 13(2): 179-188.
11. Dessap AM, Vivier E, Girou E, Brun-Buisson C, Kirsch M. Effect of time to onset on clinical features and prognosis of post-sternotomy mediastinitis. Clin Microbiol Infect. 2010; 17(2): 292-9.
12. Grauhan O, Navasardyan A, Hofmann M, Müller P, Hummel M, Hetzer R. Cyanoacrylate-sealed donati suture for wound closure after cardiac surgery in obese patients. Interact Cardiovasc Thorac Surg. 2010; 11(6): 763-7.

**CONTRIBUTION OF AUTHORS**
- Design and study design: Raul Amaral de Araújo, Natália Benedito de Oliveira, Hilda Silva Carrilho Barbosa.
- Data Collection: Raul Amaral de Araújo, Natália Benedito de Oliveira.
- Analysis and interpretation of data: Raul Amaral de Araújo, Natália Benedito de Oliveira, Hilda Silva Carrilho Barbosa, Simone Maria Muniz da Silva Bezerra.
- Text the article: Raul Amaral de Araújo, Natália Benedito de Oliveira, Hilda Silva Carrilho Barbosa, Simone Maria Muniz da Silva Bezerra.
- Final approval of the article: Raul Amaral de Araújo, Natália Benedito de Oliveira, Hilda Silva Carrilho Barbosa, Simone Maria Muniz da Silva Bezerra.