

STAPHYLOCOCCAL MEDIASTINITIS – A RARE COMPLICATION FOLLOWING CARDIAC SURGERY A CASE REPORT AND REVIEW OF THE LITERATURE

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STAPHYLOCOCCAL MEDIASTINITIS – RARE COMPLICATION FOLLOWING CARDIAC SURGERY A CASE REPORT AND REVIEW OF THE LITERATURE (Abstract). Mediastinitis is a rare infection following cardiac surgery and is associated with a high rate of morbidity and mortality. The reported rate of post-sternotomy mediastinitis is between 0.8 and 2.3%, with up to 79% of cases caused by staphylococci. Obesity and diabetes are the risk factors consistently involved. We present a case of staphylococcal mediastinitis diagnosed at Cardiovascular Disease Institute Iași as a complication of cardiac surgery. We present the clinical and morphological picture of staphylococcal post-sternotomy mediastinitis; we also performed a review of the literature data about its management.

KEY WORDS: CARDIAC SURGERY, MEDIASTINITIS, MULTIRESISTANT STAPHYLOCOCCUS AUREUS

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INTRODUCTION

Mediastinitis is a rare infection following cardiac surgery but with a high mortality rate [1]. Oakley and Wright reported a 1.2% incidence of staphylococcal post-sternotomy mediastinitis. *Staphylococcus aureus* was isolated in 49 cases (82%); in 8 cases (16%) *Staphylococcus aureus* was methicillin-resistant, and the other 11 cases (18%) staphylococci were coagulase-negative [2]. Risk factors associated with mediastinitis were diabetes mellitus, emergent surgery, ejection fraction and length of preoperative hospital stay [3]. Early recognition of this septic complication is of uttermost importance, enabling to start a pathogenic treatment, sometimes with a rewarding result.

METHODS

The medical records of the patient with staphylococcal poststernotomy mediastinitis were retrospectively reviewed. Data collection included: patient comorbidities, type of surgery, microbiology and pathological findings, surgical and medical management and outcome.

A 48-year old male patient, presented with retrosternal pain and progressive dyspnea, having had recent history of cardiac surgery for an obstructive

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cardiomyopathy. The diagnosis work up consisted of multiple cardiac investigations, microbiological and histological exams, which confirmed the mediastinitis as a surgical complication. The patient was reoperated, undergoing the excision and drainage of the mediastinal space. The diagnosis was confirmed by using routine microbiological and morphological techniques, including haematoxylin and eosin (HE), elastic Van Gieson (EVG) and Brown and Brenn staining (BB).

CASE REPORT

The 48-year old, obese patient diagnosed since 1975 with obstructive hypertrophic cardiomyopathy since, was readmitted in December 2005 and advised for surgical treatment due to the aggravation of the disease by cardiac failure and moderate aortic regurgitation. Besides obesity, additional risk factors were diabetes mellitus and hyperlipidemia. In January 2006 septal miomectomy (Morrow operation) and mitral and aortic valve replacement were performed abroad. The early postoperative course was favorable and the patient was discharged. Three weeks postoperatively the patient presented with severe chest pain, not related to exercise and cold sweats. The physical examination revealed a patient with an altered general status, arterial hypotension, with moderate dyspnoea, without fever. Under the clinical suspicion of aortic dissection he was admitted in Cardiovascular Disease Institute Iași.

Lab tests on admission showed an inflammatory syndrome (leucocytosis - 21.000/mm³, ESR - 44 mm/h, fibrinogen - 806 mg/dL), a moderate kidney dysfunction (urea -69 mg/dL, creatinine – 2.24 mg/dL), and normal cardiac enzymes (ALT - 37 U/L; AST - 24 U/L, LDH - 544 U/L; CPK-MB 24 U/L, negative-troponin).

Chest X-Ray documented a left cardiomegaly and an opaque left costofrenic sinus. Echocardiography confirmed left cardiac failure and showed the lack of signs of aortic dissection at the level of the atheromatous thoracic aorta. There were no signs of dissecting fold involving ascending or descending aorta at computer tomography (CT) exam, excluding the initial diagnosis of aortic dissection. The most significant sign was the presence of a heterogeneous infiltration of the anterior fatty mediastinal space, raising the supposition of mediastinitis, sustained by the persistence of the thoracic pain associated with hypotension and cold sweats (toxico-septic shock).

Due to the hemodynamic instability requiring inotrope support and the presence of a purulent discharge at the upper part of the thoracic scar, along with the CT aspect, the mediastinal sepsis was diagnosed.

The patient was referred for surgical treatment and underwent a mediastinal exploration with excision, lavage and drainage. The obtained surgical specimen was sent to microbiology and pathology examination.

Microbiology analysis confirmed the presence of the mediastinal infection with *Staphylococcus aureus* multi-resistant to antibiotics (MRSA). Histological examination of the purulent tube casts or plugs revealed fibrin deposits including neutrophils and Gram positive bacterial colonies (positive Brown and Brenn staining) (Fig. 1A, 1B).

According to the sensibility of the tested germs, targeted antibiotherapy with linezolid was employed following surgery for six weeks. Tazobactam was subsequently associated due to enterobacter positive swab culture from the wound. The postoperative recovery was slowly favorable, mentioning the wound infection and a secondary left pleural effusion that required needle aspiration. Before hospital discharge, the check-up lab tests were within normal limits.

However the patient was readmitted after a couple of weeks for persistence of a subclinical inflammatory syndrome (ESR=75-90 mm/h; fibrinogen=775-1180 mg/dL; CRP=15-25).

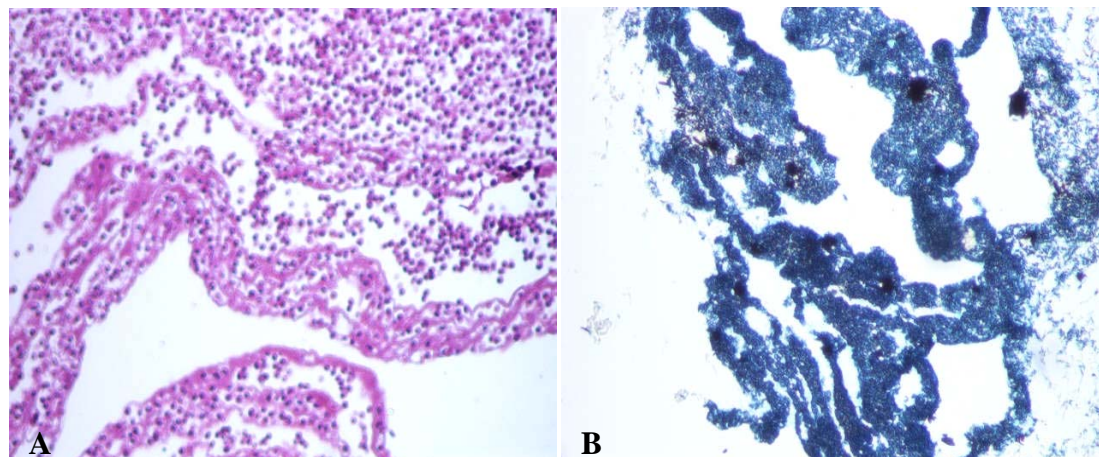


Fig. 1 Histological examination

- A. Redon tube purulent casts (HE), ob. X40;
 B. Positive staining for positive gram cocci (B&B), ob. X20

The physical examination revealed a purulent discharge at the middle part of the thoracic scar while microbiological exam of the pus found the same MRSA. The fistulography revealed a cutaneous–sternal fistula, without reaching the mediastinum, while CT examination revealed only a slight infiltration of the presternal tissue and lack of retrosternal collection. The histological study of the surgical biopsy confirmed the persistence of the inflammatory process of the level of presternal soft tissue and the presence of the Gram positive bacteria, as well. After complete excision of the fistula, linezolid i.v. was administered for 3 weeks with bacteriological sterilization and wound healing.

On discharge, the patient was advised to continue the antibiotherapy for one month in order to maintain the complete sterilization of the wound. At the end of the treatment all the biological tests were normal.

This study pointed out the necessity of a widely applicable method of morpho-clinical diagnosis in a septic complication of a presumed clean surgery and of careful analysis of the pathogenesis of disease.

DISCUSSIONS

Mediastinitis is an inflammation of the mediastinum, representing a life-threatening condition with an extremely high mortality rate if recognized late or treated improperly [4]. According to Milano, this complication occurs in less than 5% of all patients with open chest surgery, while Loop notes that most cases of mediastinitis are associated with cardiac surgery, affecting approximately 1% of these patients [4,5].

Discussing about risk factors for the development of mediastinitis, Lowy and Becker appreciate that they include diabetes mellitus, emergency surgery, obesity, sternal wound dehiscence and surgical technical factors (e.g. paramedian sternotomy) [6,7]. In this case the risk factors were: recent chest surgery, obesity and diabetes.

Prevalence is higher among males than females, with a male-to-female ratio of 6/1 and mediastinitis appears to be a disease of young men with a mean age in the mid fourth decade of life, notes Becker, while Hageman and Morrison observes that most persons with mediastinitis are in their third to fifth decades of life [7,8]. However, case reports have documented mediastinitis in patients as young as 2 months and as old as the eighth decade [9].

Taking into consideration the onset of this septic complication, in this case, the patient complained of sudden symptoms such as cough, shortness of breath, chest pain and cold sweats, occurring three weeks postoperatively. Wright notes that mediastinitis may occur suddenly (acute) or may develop slowly, progressive in time (chronic) [2]. The typical postoperative patient presents fever, high pulse and sternal wound infection [3]. Loop notes that approximately two thirds of patients present this complication within 14 days following surgery, while Milano appreciates that although a delay of months is occasionally observed, signs or symptoms typically develop within 1 month after operation [4,5].

Indeed, distinguishing between a superficial wound infection and a deeper chest infection, associated with mediastinitis can be challenging. But systemic signs of septic syndrome strongly suggest mediastinal involvement, observes Milano [5]. So, for differentiating the two processes, only the results of imaging studies and cultures may be decisive. The diagnosis of mediastinitis is often a clinical one, appreciates Roberson [3]. In addition, no single laboratory investigation can confirm the diagnosis; however, studies that may help in the diagnosis of mediastinitis include the following: 1) WBC count may be significantly elevated, showing leukocytosis; 2) glucose measurements may reveal an underlying diabetes, as in our case; 3) bacteremia established on blood cultures, is found in almost 60% of patients with postoperative mediastinitis; in our case, blood cultures were negative; 4) samples of any sternal drainage should be sent for Gram stain and culture.

In this case, the infection proved to be with *Staphylococcus aureus* multi-resistant to antibiotics, while the literature reveals various aetiologies. According to Roberts, most frequently mediastinitis occurring after cardiac surgery were due to gram-positive cocci with *Staphylococcus aureus* and *Staphylococcus epidermidis* accounting for 70-80% of cases. Mixed gram-positive and gram-negative infections account for approximately 40% of cases. But, isolated gram-negative infections are rare causes [1].

The origin of the infection following open heart operations is not known in most patients. Some believe that the process begins as an isolated area of sternal osteomyelitis [2,3]. Others consider that sternal instability is the inciting event, and bacteria then migrate into deeper tissues [4,5]. We consider that the patient's own skin flora and the bacteria in the local surgical environment were possible sources of infection. Because some bacterial contamination of surgical wounds is inevitable, host risk factors are likely critical in promoting an active infection.

Once the disease is suspected, the radiology studies are often helpful in diagnosis. Roberson appreciates that chest radiographs show the widening of the paratracheal soft tissues, which is not a reliable sign of mediastinitis [3]. Chest CT should be rapidly performed and may help to determine the mode of surgical approach for drainage and to monitor the course of treatment. MRI investigation is an useful alternative of diagnosis and it is becoming more frequently required [3]. In our case, the CT study was essential for diagnosis and decisive for surgical drainage, this procedure being both diagnostic and therapeutical one.

Generally, most patients receive prophylactic antibiotics, usually a first-generation cephalosporin for covering a broad microbial spectrum [10]. Once septic complication is proved, the well-directed antibiotic therapy is crucial for successful treatment of mediastinitis and antibiotherapy is usually prolonged, ranging from weeks to months. One recent study suggests that at least 4-6 weeks of therapy is adequate for most patients [1]. Patients with postoperative mediastinitis have to stay in the hospital 6-7 times longer than those without this complication, and total costs may triple [2].

Taking into consideration the relapsing cases, Wright appreciates that the most common cause of recurrent mediastinitis is inadequate debridement and sterilization of the wound site during the first procedure [2].

CONCLUSIONS

Early diagnosis and aggressive therapy seem to provide the best chance for recovery. Delays in the diagnosis of mediastinitis greatly increase morbidity and mortality rates. Future directions for research should focus on more accurate methods of diagnosis during the first 14 days after surgery, when CT scan findings are not reliable. Further research should also focus on the duration of antibiotic therapy required for optimal treatment.

REFERENCES

1. Upton A, Roberts SA, Milsom P, Morris AJ. Staphylococcal post-sternotomy mediastinitis: five year audit. *ANZ Journal of Surgery*. 2005; 75: 198-200.
2. Oakley RM, Wright JE. Postoperative mediastinitis: classification and management. *Ann Thorac Surg*. 1996; 61(3): 1030-1036.
3. Jolles H, Henry DA, Robertson JP. Mediastinitis following median sternotomy: CT findings. *Radiology*. 1996; 201(2): 463-466.
4. Loop FD, Lyttle BW, Cosgrove DM. J. Maxwell Chamberlain memorial paper. Sternal wound complications after isolated coronary artery bypass grafting: early and late mortality, morbidity, and cost of care. *Ann Thorac Surg*. 1990; 49(2): 179-186.
5. Milano CA, Kesler K, Archibald N. Mediastinitis after coronary artery bypass graft surgery. Risk factors and long-term survival. *Circulation*. 1995; 92(8): 2245-2251.
6. Lown F.D. Staphylococcus aureus infections. *N Engl J Med*. 1998; 339: 520-532.
7. von Eiff C, Becker K, Machka K, Stammer H, Peters G. Nasal carriage as a source of Staphylococcus aureus bacteremia. Study Group. *N Engl J Med* 2001; 344(1): 11-16.
8. Fridkin SK, Hageman JC, Morrisson M. Methicillin-resistant Staphylococcus aureus disease in three communities. *N Engl J Med*. 2005; 352(14): 1436-1444.
9. Smith TL, Pearson ML, Wilcox KR. Emergence of vancomycin resistance in Staphylococcus aureus. Glycopeptide-Intermediate Staphylococcus aureus Working Group. *N Engl J Med*. 1999; 340(7): 493-501.
10. Naimi TS, Le Dell KH, Como-Sabetti K. Comparison of community-and health care-associated methicillin-resistant Staphylococcus aureus infection. *JAMA*. 2003; 290(22): 2976-2984.