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Deep wound infection on the sternum after open-heart surgery

Abstract

Open-heart surgery is usually performed through median sternotomy, as first described by Milton in 1897. A rare but serious complication associated with this approach is the development of a deep sternal wound infection (DSWI), which has a 4% incidence of occurrence after cardiac surgery. The development of a sternal wound infection often has a late onset and is usually detected only after discharge. DSWI can cause a high morbidity rate of up to 50%, with a prolonged hospital stay and an increased cost of care. In acute stages, sternal collapse and deep mediastinitis can often result in a functional disorder of the organ, which, if not treated adequately, may lead to the patient's death. Chronic infections are usually associated with chronic draining sinus tracts, osteomyelitis, and costochondritis, which can affect the patient's quality of life. Early detection and aggressive treatment with debridement, drainage, and immediate wound closure using various muscle flaps are necessary to prevent the development of sternal wound infection. Sternal stability is also an important factor in surgery.

Keywords: Median sternotomy, deep sternal wound infection, chronic infections

INTRODUCTION

In spite of the high development of surgical techniques and antibiotic therapy, wound infection remains one of the most complex complications that increases the length of hospital staying and mortality after heart surgery (1,2). Here it is important to distinguish between superficial and deep infections of the sternum. Thus, superficial infection involves the skin, subcutaneous tissue and the fascia of the large pectoral muscle. The incidence of superficial infection is 0.5-8%. Mortality rate in these infections is 0.5-9% (3). Although the incidence of deep sternal infections has dropped to 4%, this complication remains as a pathology with a high percentage of nosocomial deaths. In this complication, the mortality rate can rise up to 50% (4). Deep wound infections develop slowly and often appear after the patient is discharged home. In order to confirm a deep wound infection of the sternum the following criteria are necessary. 1) the development of microorganisms in smear taken from the wound and wound discharge. 2) symptoms of mediastinitis. 3) pain and destabilization in the sternum, a lot discharge from

mediastinum, temperature above 38°C and a positive result of the smear taken from the blood. In patients with acute sternal destruction and deep mediastinitis due to severe intoxication in organism, the percentage of lethal outcome increases without adequate treatment (5). However, early detection of the pathology, removal of the necrotic tissue from the sternum, and intensive treatment can save patients' lives by preventing the development of deep mediastinitis. It should also be noted that one of the main factors of effective treatment is to ensure the stability of the sternum. An important part of the treatment is the administration of specific antibiotic therapy against the agent, which is detected in the smear (6,7).

Surgical Technique

In 2018-2019 years on 260 children were performed heart surgeries in Pediatric Cardiac Surgery Department of Scientific Surgery Center named by acad. Topchubashov M.A.. The 220 of these operations were performed by cardiopulmonary bypass (CPB) using medium section.

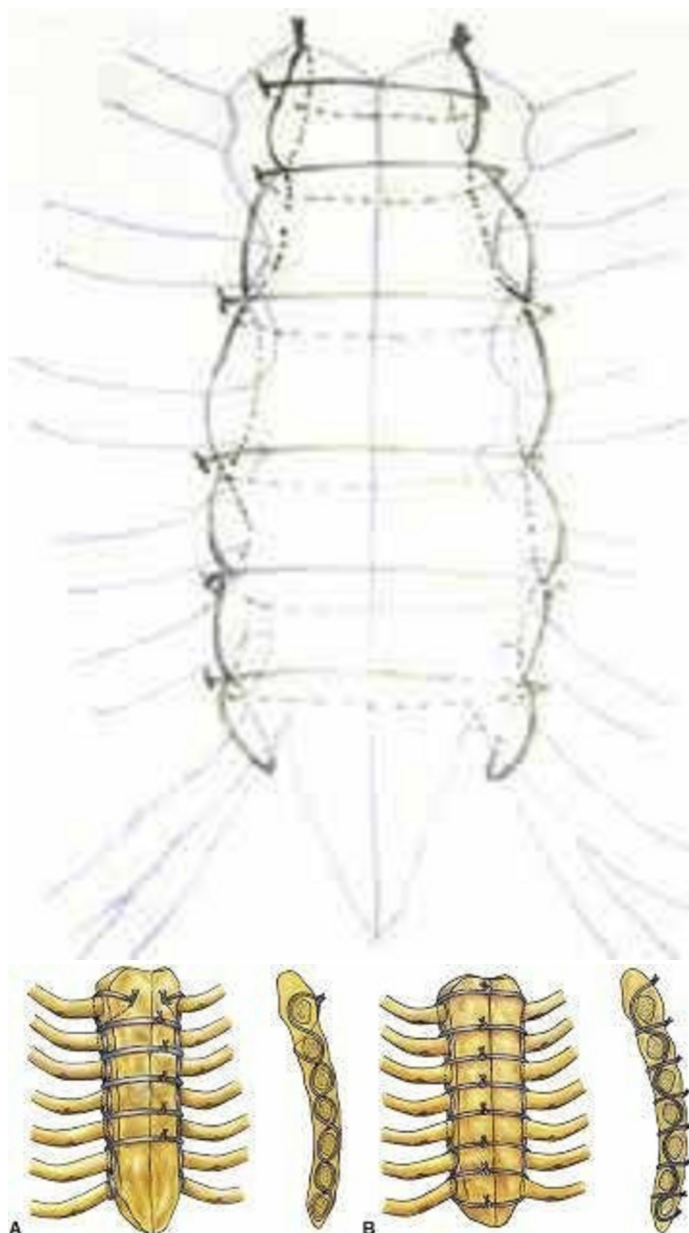


Figure 1. Robicsek plastic surgery of the sternum

The operations were performed under endotracheal narcosis according to the accepted protocol of general anesthesia. Cefazolin was used in all patients for prophylactic antibiotic therapy (according to the prophylactic antibiotic therapy protocol). The patients' average length stay in the intensive care unit was 2 days (minimum 1 day, maximum 40 days), and the average length of hospital stay was 6 days (minimum 4 days, maximum 50 days). The average body temperature after surgery was 37.60°C (minimum 36.60°C, maximum 39.80°C). In patients with a body temperature 38.0°C and above for more than two days, a smear was taken from the blood for the specific pathogen agents and the value of procalcitonin was checked. Empirical antibiotic therapy was initiated in patients until the results of the smear were obtained. In empirical antibiotic therapy was used a

combination of Ceftriaxon, Meropenem and Vancomycin. After the results of the smear were obtained, was used that antibiotic to which was susceptibility by the pathogen. Positive dynamics (decrease in temperature, return of procalcitonin to normal) was observed in patients on average 5-6 days after treatment with the antibiotic to which the pathogen agent was sensitive. Thus, after the operation in 24 patients was a high fever without criteria for deep wound infection of the sternum. In these patients were noted the high values of procalcitonin (septic condition). Positive dynamics was achieved in the treatment with antibiotic-sensitive antibiotics detected during bacteriological examination of blood samples taken from patients, and the value of procalcitonin returned to normal.

Signs of a deep wound infection of the sternum were found in 18 patients who underwent surgery. Fourteen of these patients were admitted to the hospital on average 10 days after discharge from the hospital with high body temperature, general weakness, anorexia, and profuse discharge. During the treatment out of the remaining 4 patients - 2 in inpatient and the other 2 in intensive care unit were noted signs of deep wound infection of the sternum on average 13-17 days after the surgery.

The patients were placed in the intensive care unit and treatment was started immediately. Thus, in all patients were noted decreasing Hemoglobin (mean Hemoglobin value was 8.5 g/l) and Albumin, and leucocytosis. After a day of preoperative preparation (erythrocyte mass, fresh frozen plasma and albumin infusion), the patients underwent surgery to perform plastic surgery on the sternum. Prior to surgery, blood samples were taken from all patients for bacteriological examination and procalcitonin. During the operation, a swab was taken from the wound contents of all patients. Necrotic tissue in the skin, subcutaneous tissue, fascia, and sternum was removed. The wound and mediastinum were washed and lavaged with an antiseptic (dioxidine solution) solution. Then patients' mediastinum and pleura cavity were drained. The sternum was plasticized by Robicsek method. (Figure 1).



Figure 2. Defect after removal necrotic tissue

After the operation the patients were connected to the “Macquet Servo I” ventilator. Empirical antibiotic therapy (Ceftriaxon, Meropenem and Vancomiycn) was implemented in patients until the results of bacteriological examination were obtained. In addition, all patients underwent comprehensive treatment measures (erythrocyte mass fresh frozen plasma, albumin, parenteral and enteral nutrition with a nasogastric tube). All patients were extubated on average after two days. After the results of the bacteriological examination were obtained, treatment was continued with that antibiotic, to which was susceptibility by the pathogen agent. Thus, staphylococcus epidermidis was detected in 4 out of 18 patients, pseudomonas aeruginosa in 7 patients, and klebsiella pneumoniae in 7 patients. Positive dynamics was observed in patients against the background of appropriate antiniotic therapy. The patients were transferred on average after 4 days from the intensive care unit to the stasionary department. The average length of hospital stay of the patients was 10 days. After the thoracic plastic syrgery by Robicsek method, in 14 patients out of 18 patients was provided complete bone stability, reduced of wound discharge gradually and the patients were discharged home in a completely stable condition. The patients’ smear with staphylococcus epidermidis susceptibility was to Linzolid, with pseudomonas aeruginosa and klebsiella pneumoniae to Colimycine and Ciprofloxacin. During impatient treatment, using the additional complex treatment measures with these antibiotics resulted in returning to the normal of procalcitonin value and clinical symptoms were disapierred.

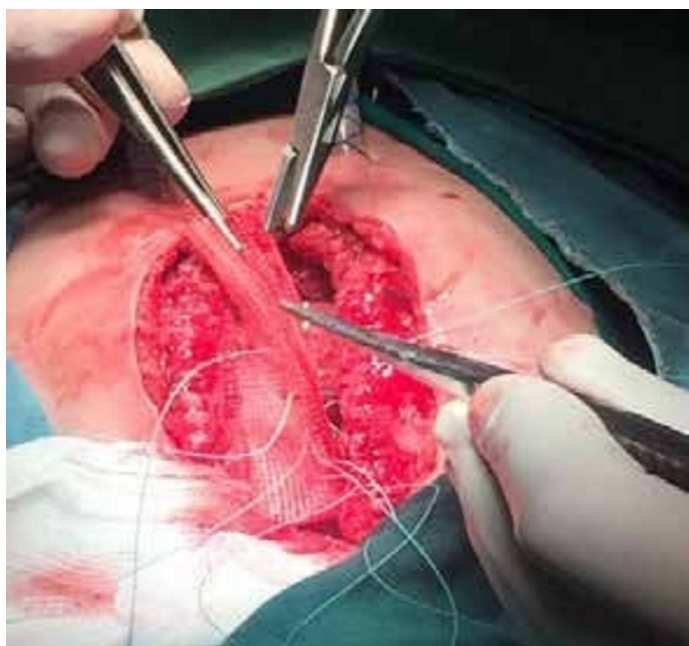


Figure 3. Plasticization of the defect with Teflon mesh

In 4 out of 18 patients who underwent sternal plastic surgery using Robicsek method, despite the complex treatment, an average of 12 days after surgery following changes were noted: high body temperature, signs of severe intoxication (tachycardia,

tachypnoe, weakness and lose of appetite), a lot of wound discharge, and in general blood analysis a sharp decrease of formed elements of blood (thrombocytopenia, leucopenia) and haemoglobin. Biochemical examination of blood in hese patients showed a sharp decrease in protein fraction, an increase in the value procalcitonin to the level of septic shock. Taking account all of these, the patients were operated on after one day of preoperative preparation (erythrocyte mass, infusion of fresh frozen plasma and thrombocyte mass). During the operation, complete destruction of the sternum was found. Thus, during the operation, it was found that the inflammation spread to the rib cartilage. For this reason, massive excision of necrotic tissue was performed in these patients. A smear was taken from the cut necrotic tissue for bacteriological examination. After that, a large defect formed in the chest. It was decided to use synthetic material to overcome this. Teflon Mesh and Goretex prostheses were used to close the defect and replace the sternum.



Figure 4. Chest plastic with Teflon mesh

Teflon mesh was sewn to the intercostal space according to the size of defect, at intervals with “II” shaped stitches using ethibond threads (Figure 3). Then, according to the created defect of fascia of pectoralis major muscle(Figure 4), Goretex prosthesis was continuously sewn to the healthy edges of the fscia (Figure 5). The skin and subcutaneous tissue were sewn together (Figure 6) intermittently using Donati method (Figure 7). After the operation, the patient was transferred to intensive care unit, where he was kept on artificial ventilation for two days. During this period, the patient underwent complex treatment measures. Against the background of antibiotic therapy, the patient’s body temperature retured to normal. After 10 days,

the value of procalcitonin dropped to normal. During the daily dressing, the secretion from the wound was not noted. The drains were removed from the mediastinal cavity on average 3 days after surgery due to small amount of fluid. The patients were discharged home after on average 12 days.



Figure 5. Plasticization of defect of the fascia with Goretex prosthesis



Figure 6. Defect of the fascia was covered with Goretex prosthesis

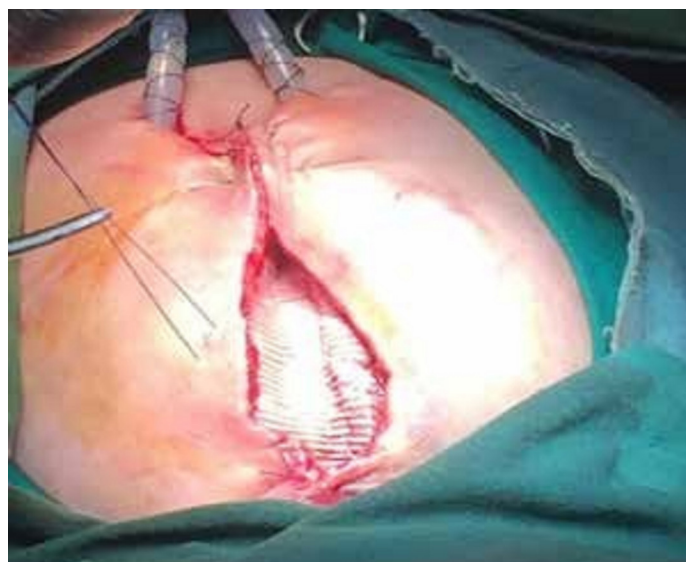


Figure 7. Plasticization of defect of the fascia with Goretex prosthesis

CONCLUSION

In consideration of above, we can say that deep wound infection of the sternum is a complex complication that can occur after heart surgery. This complication can increase the length of hospital stay, as well as increase the percentage of lethal outcomes if appropriate treatment measures are not implemented. For this reason, it is necessary to carry out complex treatment measures immediately if the patient is diagnosed with a deep wound infection of the sternum in the nearest postoperative period. Only under this condition, can be achieved positive outcome and possible to decrease the percentage of lethal outcome.

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Informed Consent: Written consent was obtained from the patient and his parents.

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