SELECTED METHODS OF THE CHEST WALL RECONSTRUCTION FOR STERNAL DEHISCENCE AFTER MEDIAN STERNOTOMY

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Dehiscence of a median sternotomy wound is a potentially devastating and life-threatening complication of cardiac procedures. Depending on the localization, extensiveness, and profundness of the defect a variety of muscle flaps may be used to cover the frontal mediastinum, in particular: pectoralis major, rectus abdominis or latissimus dorsi. In spite of several options for restoration of sternal integrity we cannot avoid following serious local complications increasing patients morbidity.

The aim of this paper is to report a method of sternal dehiscence management. Surgical technique and its results are presented on the example of two patients treated in Plastic, Reconstructive and Aesthetic Surgery Clinic, Medical University in Łódź because of sternal dehiscence after cardiovascular procedure with sternotomy. Our experience indicates that modified bilateral pectoralis major flap seems to be effective surgical method of sternal dehiscence treatment. Also it is worth to remember that surgical procedure in this complication should be performed as soon as possible to decrease patient’s disability and to avoid following complications.

Key words: sternum, complication, pectoralis major flap

Dehiscence of a median sternotomy wound is rare but potentially devastating and life-threatening complication of cardiac procedures. Deep sternal infections secondary to bony instability and malunion, can subsequently result in: mediastinitis, sternal osteomyelitis or costochondritis (1, 2). The frequency of the infections following median sternotomy incision varies from 0.5% to 10%. Despite current treatment methods these cases are related to morbidity and mortality rates between 10 and 25% and 5 and 47% respectively (3, 4). High risk of sternal dehiscence and subsequent mediastinitis is defined as patients having 3 or more established factors, including: chronic obstructive pulmonary disease (COPD), re-operative surgery, renal failure, diabetes, chronic steroid use, morbid obesity, concurrent infection and acquired or iatrogenic immuno-suppression. Intra-operative risk factors include off-midline sternotomy, osteoporosis, long cardio-pulmonary bypass run (>2 h), transverse fractures of the sternum (5).

Postoperative management of sternal dehiscence requires the complex treatment performed by a multidisciplinary medical team, including orthopedists, plastic surgeons, microbiologists and rehabilitation experts also (6). Current treatment of sternal infection with wound dehiscence comprises surgical debridement, drainage and irrigation, antibiotics, frequent changes of wound dressing and direct or secondary reconstruction with either sternal plating, rarely steel bands, or interosseous sutures and/or muscle or omental flaps after vacuum – assisted closure therapy (1, 4, 7-10). Prophylactic rigid plate fixation after cardiac surgery is especially useful in high-risk patients. This method together with pectoralis flap coverage decreases the risk of developing
sternal dehiscence and therefore is recommended in cases with a history of chest irradiation (1, 5). Depending on the localization, extensiveness, and profoundness of the defect a variety of muscle flaps may be used to cover the frontal mediastinum, in particular: pectoralis major, rectus abdominis (VRAM, TRAM) or latissimus dorsi (LD) (11-14). There are several ways to use them for the individual situations, sometimes in modified fashions, as bipedicile advancement pectoralis flap togeth-

er with thoracoacromial perforators (“tripedicle”) or with greater omental transposition (15, 16). Chest wall reconstruction can demand combining pectoralis muscle flap coverage with other surgical procedures for example reduction mammoplasty in cases of sternal wound dehiscence complicated by macromastia (17, 18). Omentoplasty should be considered in patients with the sternum recurrently open after plate reapplication, or in those, in which sternal defect is too extended (7). In spite of several options for restoration of sternal integrity we cannot avoid following serious local complications increasing patients morbidity: wound dehiscence, herniation of the donor side, flap loss, infection of sternal plating material, recurrent chondritis, or even colonic cancer metastasis within the omental flap (2, 7, 19).

The aim of this paper is to report a method of sternal dehiscence management. Surgical technique and its results are presented on the example of two patients treated in Plastic, Reconstructive and Aesthetic Surgery Clinic, Medical University in Łódź because of sternal dehiscence after cardiovascular procedure with sternotomy.

CASE REPORTS

1. Patient B.R. aged 62 presented to the Plastic Surgery Out-patient Clinic because of an extensive wound in sternal area. Length of the wound was about 15 centimeters, it affected all tissues of thoracic wall in the midline, in its wedges necrotic bony tissues of sternum were detected and in wound bed pericardium covered with fibrous and granulation tissue was seen. Patient’s medical history revealed that in 2010 he underwent coronary artery bypass grafting because of myocardial infarction NSTEMI. During postoperative period wound dehiscence appeared and its re-suturing was performed in the Cardiac Surgery Department. The patient was discharged from the hospital, however after a month wound dehiscence appeared again. In December 2011 after mechanical debridement and a VAC device application, in Cardiac Surgery Department removal of sternal wires and suturing of all layers of the wound was done and the patient was discharged in a good local condition. After a short period of time, wound dehiscence occurred again and the patient was referred to Plastic Surgery Out-patient Clinic. He was qualified for surgical treatment in Plastic, Reconstructive and Aesthetic Surgery Clinic, Medical University in Łódź after wound preparation in ambulatory care. The patient was treated with local antibiotics and the wound was debrided mechanically throughout three months. Once a healthy granulating bed was achieved, the final flap closure was scheduled. Medical history revealed that he suffered from hypertension, lower limb atherosclerosis, chronic obstructive pulmonary disease, asymptomatic right internal carotid artery occlusion and underwent partial gastrectomy because of peptic ulcer. In laboratory tests (full blood count, APTT, PT, INR) no abnormalities were found and a wound was sampled for culture revealing a presence of methicillin-resistant Staphylococcus epidermidis. In terms of patient’s general condition the decision was made to perform operation in local anesthesia.

Surgical technique

In local anesthesia the non-viable, necrotic margins of the sternum were debrided to reach healthy bone that bleeds, the necrotic soft tissues were excised to reach healthy tissues and the deficit was planned to be covered with musculocutaneous flaps. The edges of sternum were sewn in the midline with non-absorbable suture. The sternal origins of pectoralis major were identified on the both sides of the defect, released along the body of sternum and ribs and separated from skin and subcutaneous tissue to allow their approximation over the sternum without tension. Accurate haemosta-
tasis was achieved. Triple “Z” plasty was planned in the skin of sternal area to enable tension-free skin closure. Suction Redon drain was placed deep to the muscle flaps. Subcutaneous tissue and skin were closed. Drain was re-
moved in the 7-th day after operation. During postoperative period antibiotic therapy (Ciprofloxacin 200 mg, twice a day) was administered. After nine days of uncomplicated wound healing the patient was discharged from the hospital and followed-up in the out-patient clinic each month. After 6 months post the surgery, no complications were observed, the treatment result was good and the wound healed normally. The patient is going to be followed-up in Plastic Surgery Out-patient Clinic twice a year.

2. Patient S.K, aged 62 presented to the Plastic Surgery Out-patient Clinic with a wound in the sternal area. Physical examination revealed a wound of about 10 centimeters and a fistula located 5 centimeters superior the upper margin of the wound and communicating with its bed. Tissues defect involved all tissues of chest wall in the midline, in its bed and margins necrotic elements of sternum covered with fibrous and granulation tissue were observed (fig. 1). In 2009 the patient underwent coronary artery bypass grafting because of ischaemic heart disease. After operation Staphylococcal infection appeared and caused wound dehiscence. Moreover, the infection involved conjunctiva and in the course of Staphylococcal conjunctivitis atrophy of left eye-ball occurred. The patient was treated pharmacologically with antibiotics administered according to the antibiogram. Due to the complications in poststernotomy wound healing, the patient was referred to the Plastic Surgery Out-patient Clinic. Moreover, medical history revealed that since 1997 he has been treated with steroids because of rheumatoid arthritis and suffers from steroid-induced diabetes treated with insulin. The patient was qualified for surgical treatment in Plastic, Reconstructive and Aesthetic Surgery Clinic, after wound preparation in ambulatory care. Laboratory test (morphology, APTT, PT, INR) did not disclose any disturbances and bacterial culture revealed presence of Proteus vulgaris. The surgery was performed in local anesthesia using the presented technique. In the 7th day the patient was discharged from the hospital. Currently, 6 months after the surgery its result is good, the wound has healed without complications and the patient is going to be followed-up twice a year in the Plastic Surgery Out-patient Clinic (fig. 2).

DISCUSSION

Usage of pectoralis muscle flap is quite popular technique to close sternal dehiscence after cardiac operations (1, 7, 20, 21). Wong et al. recommended this approach in all severe deep sternal wound but not in patients with chronic unstable sternum (21). It seems to be the best choice because the access to those

![Fig. 1. Patient no 2 with extensive wound in sternal area](image1)

![Fig. 2. Patient no 2 – six months after the surgery](image2)
Selected methods of the chest wall reconstruction for sternal dehiscence after median sternotomy

Muscles is the easiest and their application does not affect the function of the shoulder joint (11). Also individual clinical conditions need to be taken into account when making a decision between the different available reconstructive options (7).

There are many methods for reconstruction of the median sternotomy wound dehiscence. Moreover authors pay attention to the necessity of adapting separately particular tissue layers. Schols et al. while performing surgical treatment of sternal dehiscence first close sternum, than make muscle plasty and at the end suture the skin (7). Exactly the same pattern was introduced in our patients. First stitches were put to the sternum, second to connect mobilized pectoralis muscles and then to the skin. Additional triple Z-plasty was performed on the skin to lower the tension in the skin wound.

Clinical care of patients with sternal dehiscence impacts heavily on health-care costs, length of hospital stay and the time to full recovery and return to regular work activity (6, 16). As Wong et al. noticed the key to the successful management in such cases is early referral to plastic surgeons (21). We definitely agree with those authors and we think that surgical procedure in this complication should be performed as soon as possible. Conservative treatment only prolongs wound healing and long-term antibiotic therapy promotes drug resistance.

In literature many high risk factors of sternal dehiscence are described, mainly chronic obstructive pulmonary disease, diabetes and chronic steroids use (5). Unfortunately the above mentioned elements were present in our patients. That is why complications in wound healing after primary operation were predictable to occur. However in life-threatening conditions performing primary life-saving surgery is essential. What is also important in patients with additional diseases introducing general anesthesia can be problematic. Using described modified method of pectoralis major muscles flaps can be done in local anesthesia, also does not disturb the shoulder joint function. Moreover it is quite easy to perform and does not take much time.

In conclusion, our experience indicates that modified bilateral pectoralis major flap seems to be effective surgical method of sternal dehiscence treatment. Also it is worth to remember that surgical procedure in this complication should be performed as soon as possible to decrease patient’s disability and to avoid following complications.

REFERENCES