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journal homepage: <http://www.elsevier.com/locate/crvasa>Original research article – *Special issue: Cardiovascular Surgery*

A retrospective analysis of deep sternal wound infections after longitudinal median sternotomy



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ARTICLE INFO

Article history:

Received 11 February 2015

Received in revised form

21 February 2015

Accepted 24 February 2015

Available online 25 March 2015

Keywords:

Cardiac surgery

Risk factors

Sternotomy

Wound infections

Sternum

Sepsis

ABSTRACT

Median sternotomy is the most commonly performed surgical procedure in the treatment of heart conditions in both adults and children. Deep sternal wound infections (DSWI) present a serious complication occurring after surgery, highly demanding both of patients and surgery departments. The present study is a retrospective analysis of 9110 patients who underwent a cardiac surgery at the Center of Cardiovascular Surgery and Transplantations, Brno, Czech Republic, in the years 2005–12, and as its objective it has a definition of risk factors of DSWI after median sternotomy.

In this study, a multivariate analysis found sepsis to be the most serious risk factor, in addition to harvesting of the mammary artery (to be used as a graft for revascularisation), haemodynamic instability, reintubation and male sex.

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Introduction

The procedure of longitudinal median sternotomy was first used in surgery in 1897 by Milton [1] and became widespread after 1957, thanks to the popularisation efforts by Julian [2]. Despite the development of modern minimally invasive and robotic methods of surgery, median sternotomy remains the most frequently used approach in cardiac surgery of both adults and children. The reason is a good exposure of the sternum and mediastinal structures, and relatively low postoperative pain (as compared to thoracotomy, for instance) [3].

The first comprehensive classification of healing defects after median sternotomy was defined by El Oakley and Wright

(Table 1) in 1996 [4]. A subgroup of the most severe defects comprises inflammations of the mediastinum, i.e. mediastinitis (for the criteria according to the Centers for Disease Control and Prevention, or CDC, see Table 2 [5]) the mortality level of which (with incidence between 0.4 and 5%) has been, historically, as high as 40% [1]. Routine implementation of vacuum activated closure (VAC) methods in the 1990s resulted in decreased mortality (under 10%) in patients with this postoperative complication [6,7]. Despite this, deep sternal wound infections (DSWI) remain a serious problem, usually necessitating long-term hospitalisation in order for the defect to heal and for a definitive solution to be found, which has dire consequences both for the well-being of the patient and for the economy of the cardiac surgery department.

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<http://dx.doi.org/10.1016/j.crvasa.2015.02.014>

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Table 1 – El Oakley and Wright classification.

1. Mediastinal dehiscence	Wound disintegration after median sternotomy when clinical and/or microbiological signs of infection are absent.
2. Early mediastinal infection	Clinical and/or microbiological signs of infection of presternal tissue and sternal osteomyelitis in combination with mediastinal sepsis, or mediastinal sepsis only, or with unstable sternum, or unstable sternum only.
A. Superficial sternal wound infection	Early infection limited to subcutaneous tissue.
B. Deep sternal wound infection	Early infection associated with osteomyelitis of the sternum with retrosternal space infection, or with retrosternal infection only.

Modified from El Oakley and Wright [4].

Table 2 – Criteria of mediastinitis according to CDC [28].

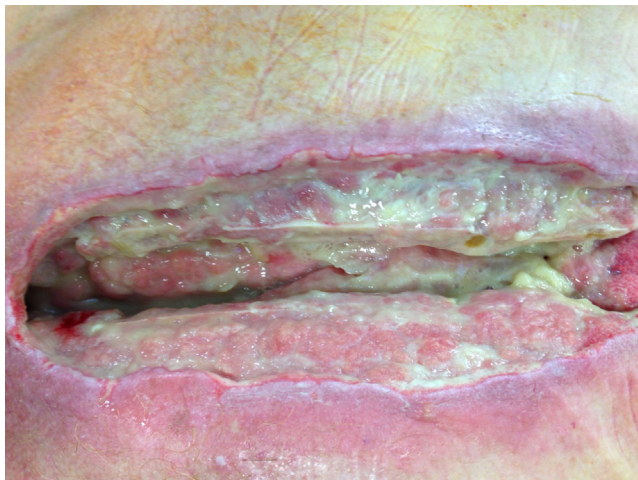
- 1) An organism is isolated from culture of mediastinal tissue or fluid
- 2) Evidence of mediastinitis is seen during operation or by histopathological examination
- 3) At least one of the following signs and symptoms without evidence of other causes: fever (body temperature higher than 38 °C), chest pain, instability of the sternum and at least one of the following signs and symptoms:
 - a. purulent exudate from the mediastinum
 - b. organisms cultured from blood, or discharge from mediastinal area
 - c. mediastinal widening on X-ray

Risk factors concerning DSWI have in recent decades become the focus of a number of studies. Amongst the most serious risk factors the authors include obesity, diabetes mellitus, and impairing of pulmonary function [8–10]. Other frequently quoted risk factors are resternotomy (repeated sternotomy), renal failure, urgent surgeries, ischaemia of lower extremities and others [11–13].

The aim of our study is a retrospective analysis of the data from the Centre of Cardiovascular Surgery and Transplantations, Brno, Czech Republic (CKTCH – Centrum kardiovaskulární a transplantací chirurgie) sourced from the National Cardiac Surgery Registry (NCSR) of the Czech Republic, with the definition of risk factors of DSWI in our patients.

Patients and methodology

We retrospectively analysed 9110 cardiac surgery patients in CKTCH Brno, who underwent cardiac surgery between 1st January 2005 and 31st December 2012. The data source was



Picture 1 – Acute purulent poststernotomic mediastinitis. Photo from the archives of the author.

NCSR, which represents the most comprehensive database available. Data are divided into three parts:

- 1) preoperative
- 2) perioperative
- 3) postoperative

Patients with DSWI included those who, according to El Oakley and Wright classification, belong to Group 1 (sternal wound dehiscence) or Group 2B (early infection associated with osteomyelitis of the sternum accompanied by retrosternal space infection, or early infection associated with retrosternal space infection only) – [Picture 1](#). The assessment of classification of the defect was done by the surgeon performing the revision of the wound.

Microsoft Excel (Microsoft, Redmond, WA, USA) and Statistica (StatSoft, Dell, Round Rock, TX, USA) software applications were employed for the processing of the data set and for its statistical evaluation. Univariate analysis according to Fisher's exact test and chi-squared test was used to process the data statistically. Statistically significant values were then processed by multivariate analysis according to the model of logistic regression and sorted by odds ratio calculation with 95% confidence interval.

Results

Incidence and mortality

Within the group of all the observed 9110 patients who underwent sternotomy at the CKTCH, DSWI occurred in 208 cases throughout the given period, which represents 2.28%. The rate of hospitalisation mortality in the group of patients with DSWI was 9.62%, which, in comparison with the patients without this complication (2.94%), is a statistically significant difference ($p < 0.001$).

A calculated predictor of mortality after surgery – Euroscore I (European System for Cardiac Operative Risk Evaluation)

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