

# Sternal plate closure post coronary artery bypass surgery appears to increase the risk of surgical site infection

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M. K. Charles<sup>1</sup>, L. Saxinger<sup>2</sup>, S. Smith<sup>2-3</sup>

Corresponding Author: marthe@ualberta.ca

University of Alberta, Edmonton, AB; Department of Medical microbiology<sup>1</sup>, Division of Infectious Diseases<sup>2</sup> and Department of Infection Control<sup>3</sup>

## Background

Sternal wound infections are an important cause of morbidity and mortality in patients undergoing cardiac surgery. Wire cerclage is currently the standard of care for sternotomy closure. However, for the last decade, studies have suggested that sternal closure with rigid titanium plates is associated with greater sternal stability, shorter length of stay, and decreased post-operative complications.

In our facility, the use of sternal fixation was initiated in 2010. This method is generally reserved for patients deemed to be at high risk of sternotomy complication, as defined by the presence of 3 or more risk factors for sternal wound complications.

We report on our preliminary experience with this technique in high risk-patients for primary closure and compare it to a historical cohort of matched controls.



Figure 1: Titanium Sternal Fixation system source: Technique guide by SYNTHES



Figure 2: Patient with primary closure with Sternal plates and deep sternal wound infection. Courtesy of Dr. Saxinger

## Methods

This is a case-control study. From August 2010 to August 2012, 1476 CABG were performed at the University Of Alberta Hospital, Edmonton, Canada. Titanium plate fixation was used in 32 patients for primary sternotomy closure. The infection rate of the study population was compared to 58 historical controls matched for age, sex and risk factors. Risk factors including obesity, COPD, diabetes, renal failure, CHF or PVD were collected, with high risk defined as  $\geq 3$  risk factors.

## Results

The overall infection rate (deep and superficial) during the study period was 3.23% for all cardiac surgery involving sternotomy (valve replacements, and CABG) (Fig. 3). The infection rate for CABG alone was 4.40%.

The rate of sternal wound infection in the sternal plate group compared with the historical control group (using wire cerclage) was 25% and 7% respectively (OR: 3.62,  $p=0.02$ ). The majority of the patients in both groups were high-risk. The mean length of stay was 16.97 days for the cases and 13.93 days for the controls. The total mortality rate (6.3% vs. 13.8%) was higher in the control group. (Table 1,2)

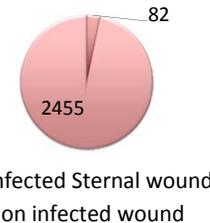


Figure 3: August 2010-2012 total cardiac surgery related infected sternal wound

Table 1. Description of the population of all patients who received sternal plate sternotomy closure from August 2010-2012

Characteristics	Numbers	Percentage
Age	65.87	
Sex (n=60)		
M	48	80.0%
F	12	20.0%
BMI	36.15	
> 3 risk factors	51	85.0%
> 5 risk factors	27	45.0%
Primary closure	32	53.3%
Secondary closure	28	46.7%
Number of plate (mode)	2	
Sternal wound infection	17	28.3%
Deep	11	18.3%
Superficial	6	10.0%
Time to infection (days)	21.18	
Hospitalization day	26.24	
Mortality	7	11.7%

Table 2. Comparison of sternal plate sternotomy as primary closure vs sternal wires from August 2010 to 2012

Characteristics	Case (n=32)	Control (n=58)
Age	66.88	65.16
Sex		
M (%)	24 (75.0)	43 (74.1)
F (%)	8 (25.0)	15 (25.29)
BMI	38.13	35.32
> 3 risk factors (%)	29 (90.6)	50 (86.2)
> 5 risk factors (%)	17 (53.1)	11 (19.0)
Number of plate (mode)	2	N/A
Sternal wound infection (%)	8 (25)	4 (6.9)
Deep (%)	7 (87.5)	1 (25.0)
Superficial (%)	1 (12.5)	3 (75)
Microbiology	MSSA (x5) P. aeruginosa Proteus sp. Candida sp. Anaerobes	E. coli (ESBL) CNS MSSA (x2) Anaerobes
Time to Infection (Days)	20.9	24.75
Hospitalization day	16.97	13.63
Mortality (%)	2 (6.3)	8 (13.8)

MSSA: Methicillin Susceptible S. aureus, CNS: Coagulase Negative Staphylococcus, ESBL: Extended spectrum Beta-lactamase

## Discussion / Conclusion

Sternal wound infection causing post operative mediastinitis is a complication that is associated with high mortality.

Rigid fixation is commonly used in bone fractures and titanium plate sternotomy closure was developed to allow rigid fixation post sternotomy, in an attempt to decrease pain and infection post operatively.

The surgical literature suggests this technique is superior to wire cerclage, with greater stability decreasing post operative pain and the length of stay.

To our knowledge, no one has reported high infection rates with the use of sternal plates. At our institution we did not observe the benefits expected for the titanium plate fixation of sternotomies, seeing instead an OR of 3.62 for infection with plate fixation. The concept of improved stability and outcomes is appealing, however the high infection rate observed outweighed a possible stability benefit. From a microbiologic perspective, the addition of large surface areas of hardware could predispose to difficult to eradicate bacterial infection.

We hypothesize the rate of infection observed in our study may partially reflect the novelty of this approach in our hospital, and perhaps the physical surface area and characteristics of the plates. Long-term follow up and large scale studies will be needed to assess the benefits, complications and indication for primary closure with titanium plate fixation.

## Acknowledgements / References

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