

Research Article

## Our Experience with Using Reciprocating Saw in Re-sternotomy Cases

Dr. Mohammad Alşalaldeh<sup>1\*</sup>, Dr. A.V.Özcan<sup>1</sup>, Dr. Mehmet Bozkurt<sup>1</sup>

1. Pamukkale University, Faculty of Medicine Hospital Cardiovascular Surgery Department. Denizli / TURKEY.

**\*Corresponding Author: Dr. Mohammad Alşalaldeh.** Pamukkale University, Faculty of Medicine Hospital Cardiovascular Surgery Department. Denizli / TURKEY.

**Received Date:** March 19, 2021

**Publication Date:** April 01, 2021

### Abstract

**Objective:** In this study, we aimed to study the safety and efficacy of using the reciprocating saw in re-sternotomy cases. Generally, re-sternotomies are done by using a micro oscillating saw to prevent heart or main vessels injury. We used reciprocating saw in such cases in 38 patients and the results were satisfying.

**Material and methods:** 38 patients had been involved in this study. All of them had previous cardiac surgery with sternotomy. Resternotomies were done by using a reciprocating saw and by one surgeon. The average age of the patients was 56.4 years. 52.6% of all patients were males while 47.4% were females. Previous cardiac surgeries varied from coronary artery bypass grafting surgery, valvular and congenital defects to ascending aortic surgery. New cardiac surgeries were for the same pathologies or other cardiac pathologies. Some patients had combined surgeries for two or more cardiac diseases. Aortic and caval/bicaval venous cannulations were done post sternotomy in all cases.



**Results:** only two patients from 38 had complications presented as right atrium injury in one patient while the other suffered from innominate vein injury and both of them were managed immediately without any need for urgent femoral cannulation.

**Conclusion:** In re-sternotomy cases, the safety of using a reciprocating saw is high as well as a micro oscillating saw if it is performed carefully with caution.

**Keywords:** Re-sternotomy, Reciprocating saw, Micro oscillating saw, Cardiac injury, Hemorrhage

## Introduction

The first median sternotomy was performed firstly by Milton in 1897 and since 1957 median sternotomy became the standard incision in most cardiac surgeries (1). In the last few decades, the improvement of surgical skills, techniques, and equipment increased the success rate of the operations and the number of operations too, so the population started expanding and aging. According to the US Census Bureau, the domestic population will increase up to 17% by the year 2020 (2). The increased success rate in cardiac operations walked side by side with the increasing of the patient's ages and the need to redo cardiac operations for the same pathology or other cardiac pathologies.

The re-sternotomy may be associated with injury to the heart and/or the other mediastinal structures, such as the main vessels. While a lot of surgeons prefer to use a micro oscillating saw in re-sternotomy to prevent any possible injury, some still using a reciprocating saw and declare that it is safe as well as a micro oscillating saw.

## Material and Methods

From October 2009 to November 2019, 38 patients who underwent redo cardiac surgery were involved in our study. All the operations were done by one surgeon. Re-sternotomies were performed by using a reciprocating saw in all those patients. The mean age of the patients was 56.5 (28-74) years. 52.6% (n=20) of the patients were males while 47.4% (n=18) were females. The data of the patients' co-morbidity was collected (Table 1).



Co-morbidity of the patients	
Disease	Sum
DM	12
HT	25
HPL	18
MI	3
CHF	1
CVA	2
PAD	2
COPD	7
Infective Endocarditis	2
Radiotherapy	0

**Table 1:** co-morbidity of the patients. (DM: diabetes Miletus, HT: hypertension, HPL: hyperlipidemia, MI: myocardial infarct, CHF: congestive heart failure, CVA: cerebrovascular accident, PAD: peripheral artery disease, COPD: chronic obstructive pulmonary disease)

17 of the previous operations were done for coronary artery bypass grafting (CABG) operations, 14 for mitral valve replacement (MVR), 13 for aortic valve replacement (AVR), 1 for ventricular septal defect (VSD), 1 for ascending aortic replacement, and the others were done for valvular repairs. Most of the operations were performed for combined cardiac surgeries.

All the types of the previous operations are shown in **(Table 2)**. Our new cardiac operations which required re-sternotomy were done usually for CABG (n=16), MVR (n=16). The other types of surgeries are shown in **(table 3)**. Postoperative mean drainage was around 627.6 ml (200- 3000ml). The total hospitalization time 16 days on average (7- 47 days).



Previous operation type	Frequency	Percent
AVR	6	15,8
AVR + ASENDAN AORT REPLASMANI	1	2,6
AVR + MVR	4	10,5
AVR + MVR + TAP	1	2,6
CABG	14	36,8
CABG + MÍTRAL REPAİR + TRÍCUSPÍD REPAİR	1	2,6
CABG + MVR	2	5,3
MÍTRAL REPAİR + AORTIC REPAİR	1	2,6
MVR	6	15,8
MVR + AVR	1	2,6
VSD	1	2,6
Total	38	100,0

**Table 2:** Previous operations types and frequencies. (AVR: aortic valve replacement, CABG: coronary artery bypass grafting, MVR: mitral valve replacement, TAP: tricuspid annuloplasty, VCD: ventricular septal defect)



New operation type	Frequency	Percent
ARCUS AORTIC DEBRANCHING	1	2,6
AVR + ASCENDING AORTIC REPLACEMENT	1	2,6
AVR + CABG	1	2,6
AVR + MVR + ASCENDING AORTIC PLICATION AND WRAPPING	1	2,6
AVR + MVR + TAP	1	2,6
AVR + MVR + TVR	1	2,6
BUTTON BENTALL OP	1	2,6
CABG	12	31,6
CABG + MVR + TAP	1	2,6
CABG + TAP + RIGHT CEA	1	2,6
MAIN PULMONARY ARTERY CONDUIT	1	2,6
MVR	7	18,4
MVR + AVR	2	5,3
MVR + CABG + ASCENDING AORTIC PLICATION AND WRAPPING	1	2,6
MVR + TAP	2	5,3
TVR	4	10,5
Total	38	100,0

**Table 3:** New operations types and frequencies. (AVR: aortic valve replacement, CABG: coronary artery bypass grafting, MVR: mitral valve replacement, TAP: tricuspid annuloplasty, CEA: carotid endarterectomy, TVR: tricuspid valve replacement)



## Surgical Technique

The midsternal incision is done over the old incision. Old wires are removed. Gentle blunt dissection is done from suprasternal notch by index finger downward and retro-sternally to clean the adhesive tissues from the retrosternal region as possible. The same is done from the xiphoid edge upward and retro-sternally. Retractors can be used to lift the xiphoid process to help the index finger to go upward as far as possible.

Ventilation is stopped for a few seconds before starting cutting the sternum longitudinally to keep the pleura, lungs, and heart far away from the sternum. A foot piece of the reciprocating saw is placed at the sternal notch lifting the sternum during sternotomy. Ventilation is continued. The sternum is then dissected gently from the adhesive tissues by using a surgical cautery pencil while the Hemi sternum is lifted by an army retractor, bone wax is used to ensure hemostasis and then sternum retractor is applied. Cannulation is done routinely.

## Results

In all our sternotomy cases the reciprocating saw was used safely with no complications except in two cases. In one case the right atrium was injured and immediately after sternotomy primer repair was done with no further problems. In the other case, the innominate vein was cut where vascular clamps were applied at its two edges till the two sides of the hemi sternums were freed from the adhesive tissues, and sternum retractors were applied then end-to-end anastomosis was done.

In the other cases, there was no excessive hemorrhage or any other structure injury. The average hospitalization time was 16 (7-41) days, while the drainage was found to be 627.6 (200-300)ml, the mean cardiopulmonary bypass (CPB) time was 181 (0-410) minutes (we had one patient who was operated on with off-pump technique).

## Discussion

In the last three decades, cardiac surgery increased side by side with the increased improvement in surgical equipment, diagnostic tools, and surgical techniques. The increasing number of operated cardiac patients and the advanced aging of the population led to an increase in the need for cardiac



surgery for the second or third time, mainly in the advanced aged people (3).

Re-sternotomy became one of the difficulties the surgeons face when compared with the first sternotomy. It is well known that the micro oscillating saw has a high safety profile but takes a longer time in the sternotomy process than the reciprocating saw. Many studies had been made to discuss the advantages and disadvantages of both saws. Here in this study, we used reciprocating saw in all our re-sternotomy cases and by one surgeon. Among 38 patients we had in our study, only two patients suffered from complications such as right atrium injury in one case and innominate vein injury in the other one. Both of them were recorrected immediately with no excessive hemorrhage or mortality.

In re-sternotomies, hemorrhage is one of the most faced problems where the injured structure requires a quick repair and the bleeding must be managed as soon as possible. when we searched the literature we found many articles handling this subject. From 15 studies among 3640 patients who underwent re-sternotomy, there were 66 patients developed excessive hemorrhage (4).

In 2003 Kuralay et al. had studied the efficacy of performing femoral cannulation before and after re-sternotomy in two hundred patients. Where there were a hundred patients in each group and he found that the usage of femoral (artery and vein) cannulation before reentering sternum is safer and reduces the risk of cardiac injury and excessive hemorrhage but increased the time of cardiopulmonary bypass (5). In our study, we started the redo-operations by re-sternotomy using a reciprocating saw, and the calculations were done after re-sternotomy without any need to canulate the femoral artery or vein In 2013 Saleh, H. Z. et al presented a study for 158 patients who had been operated on with a re-sternotomy using a reciprocating saw. There was only one patient who had significant bleeding that required urgent femoral cannulation (6).

## Conclusion

In re-sternotomy cases, a reciprocating saw can be used safely as well as a micro oscillating saw if used carefully with cautions and by experienced hands.

**Ethics Committee Approval:** The study was approved by the institutional ethics committee and it was conducted by the principles of the Helsinki Declaration. The approval had been taken on 26.06.2020 under the approval number (60116787-020/38223) from Pamukkale university-Faculty of Medicine / Ethics Committee / Denizli / TURKEY.

**Patient consent statement:** patient consent statement had been taken.



**Declaration of conflicting interests:** The authors declared no conflicts of interest concerning the authorship and/or publication of this article.

**Funding:** The authors received no financial support for the research and/or authorship of this article.

**Data Availability Statement:** The authors confirm that all data underlying the findings are fully available without restriction, deposited in our university hospital patients' Database, and available from the authors on request.

## References

1. Julian OC, Lopez-Belio M, Dye WS, Javid H, Grove WJ. The median sternal incision in intracardiac surgery with extracorporeal circulation: "a general evaluation of its use in heart surgery". *Surgery* 1957;42(4), 753-761.
2. Etzioni DA, Liu JH, Maggard MA, Ko, C. Y. "The aging population and its impact on the surgery workforce". *Annals of surgery* 2003;238(2), 170.
3. Lee JJ, Park NH, Lee KS, Chee HK, Sim SB, Kim MJ, Park CS. "Projections of demand for cardiovascular surgery and supply of surgeons". *The Korean Journal of thoracic and cardiovascular surgery*, 49(Suppl 1) 2016; S37.
4. Morales D, Williams E, John R. "Is sternotomy in cardiac surgery still a problem?". *Interactive cardiovascular and thoracic surgery* 2010;11(3), 277-286.
5. Kuralay E, Bolcal C, Cingoz F, Günay C, Yildirim V, Kilic S, Tatar, H. "Cardiac reoperation by Carpentier bicaval femoral venous cannula: GATA experience". *The Annals of thoracic surgery* 2004;77(3), 977-981.
6. Saleh HZ, Yates J, Moulton L, Pullan DM, Fabri BM. "Using the reciprocating saw for resternotomy". *Türk Göğüs Kalp Damar Cerrahisi Dergisi* 2013;21(2), 547-549.

**Volume 2 Issue 4 April 2021**

**©All rights reserved by Dr. Mohammad Alshalalkeh**