

## FREQUENCY OF POST STERNOTOMY PAIN AFTER REDO CARDIAC SURGERY

Rizwan Ahmed Yaqoob<sup>a\*</sup>, Zameer ul Asar<sup>b</sup>, Imran Abid<sup>a</sup>, Zohaib Sadiq<sup>a</sup>, Nasrullah<sup>a</sup>, Abubakar Maqbool<sup>c</sup>

<sup>a</sup>Punjab Institute of Cardiology, Lahore. <sup>b</sup>Rawalpindi Medical University, Rawalpindi. <sup>c</sup>Wazirabad Institute of Cardiology, Wazirabad.

Date of Submission: 19-11-2021; Date of Acceptance: 14-12-2021; Date of Publication: 31-12-2021

### ABSTRACT:

#### INTRODUCTION:

*Although the most serious complications following cardiac surgery are fairly well known. The most common complication of post sternotomy pain, which is associated with redo cardiac surgeries.*

#### AIMS & OBJECTIVE:

*The main aim of the study was to determine the incidence of chronic post sternotomy pain in patients undergoing redo cardiac surgery for coronary arteries or valve disease.*

#### MATERIAL & METHODS:

*This was a cross-sectional, quantitative study by recruiting 100 patients at Punjab Institute of Cardiology, Lahore over a period of six months in 2020. The data about patient's demographics, type of surgery, history of surgery as well as risk factors like Diabetes Miletus, hypertension, smoking, and Hyperlipidemia was recorded. The visual analogue scale (VAS) pain scale was used to assess pain intensity from 1-10 on the VAS scale. We also assessed differences based on gender and age groups.*

#### RESULTS:

*From the results, males 72 (72%) were more affected from post sternotomy pain than females 28 (28%). Similarly, among age groups, frequency of pain was lesser in younger patients (6%) than patients with age 37 to 72 (94%). There were 89% diabetic and 81% of patients suffered from hypertension while 46% of patients were smokers and 73% of patients were found to be patients of hyperlipidemia. A total of 84% of patients underwent CABG surgery, 13% underwent valvular surgery while 3% of patients underwent valvular and CABG surgery. All patients suffered from post sternotomy pain had undergone redo cardiac surgery. Among them 34% of patients represented their pain intensity as 2/10 at the VAS pain scale while 2% marked their pain intensity as 6/10 and 7/10.*

#### CONCLUSION:

*Different disease factors, as well as the type of cardiac surgeries, are associated with post sternotomy pain, with most patients experiencing mild pain. There is paucity of work on this topic and further prospective multicenter trials are needed to study early signs, risk factors ad clinical implications of PSP.*

#### KEY WORDS:

*Post sternotomy pain, redo surgery, frequency, risk factors, age*

**Correspondence :** Rizwan Yaqoob, Punjab Institute of Cardiology, Lahore. Email: bravem15@gmail.com

**Author's Contribution:** RAY: Conducted the study and wrote the article. ZA: Helped in conducting the study and article writing. IA: Helped in rearranging data and tables. ZS: Helped in data correction and analysis. N: Gave frequent advises during data correction. AM: Data analysis and proof reading.

**INTRODUCTION:**

Post sternotomy pain (PSP) is defined as the discomfort that persists in the chest or sternotomy incision for more than 2 months following surgery is known as post sternotomy pain.<sup>1,2</sup> The reported incidence of PSP is from 38% and 66% of patients.<sup>3</sup> Generalized post-sternotomy pain is defined as persistent or intermittent pain in the surgical area that lasts longer than the normal tissue rehabilitation period of three months and is distinct from pre-operative pain.<sup>4</sup> Severe uncontrolled pain, particularly in the initial postoperative period, severely impact patient recovery following cardiac surgery. Untreated pain can not only result in adverse hemodynamic repercussions (tachycardia, arrhythmias, hypertension) but also pulmonary complications (atelectasis and pneumonia) and coagulation disorders (hypercoagulability and platelet activation). As a result it can increase hospitalization and cost.<sup>5,6</sup> Pain also activates sympathetic nervous system and increase stress hormone levels. It can result in several postoperative adverse effects, including myocardial ischemia, cardiac arrhythmias, hypercoagulability, and increased risks of delirium and slow wound healing / wound infection. Significant pain also harms patient satisfaction, delays the initiation of walking, and affects recovery and hospital discharge.<sup>7</sup> PSP is not well understood in terms of its incidence, predisposing / clinical features, and progression. It is important to understand the frequency and

early symptoms to prevent and treat in a timely manner.<sup>8,9</sup> The aim of the current analysis is to identify the prevalence of chronic post-sternotomy pain in patients who had undergone redo cardiac surgery, with the majority undergone coronary artery bypass graft (CABG) and/or valve surgery. The visual analogue scale (VAS) was employed to quantify the pain. The VAS tool is commonly used for pain measurement.<sup>8-10</sup> In this scale, the patient is asked to rate the intensity of felt pain along a horizontal line on a scale ranging from 1 to 10 points.

**MATERIALS AND METHODS:**

This was a cross-sectional, quantitative study which was carried out at Punjab Institute of Cardiology, Lahore Pakistan, in a prospective manner among the group of 100 patients. All information was kept confidential. A questionnaire was designed to record data about patient’s demographics, type of surgery, history of surgeries, VAS pain scale as well as cardiovascular risk factors like diabetes mellitus (DM), Hypertension (HTN), smoking, and hyperlipidemia. In this study, patients with cardiac surgery in previous 3 months were included. Patients with any connective tissue disorder, malignancy, chronic kidney disease, endocrine disorder, musculoskeletal disorders, previous chest wall trauma or spinal surgery were excluded. Statistical analysis was performed with SPSS v.20 (IBM SPSS, Inc.). Frequencies and percentages of variables were calculated and compared.

**RESULTS:**

**Table 1: Frequency distribution of different factors among patients**

Features of patients			Number	percent
Demographic factors	Gender	Male	72	72.0
		Female	28	28.0
	Age groups (years)	12-40	13	13.0
		41-60	68	68.0
> 60		19	19.0	
Risk factors	Diabetes mellitus	Yes	89	89.0
	Hypertension	Yes	81	81.0
	Smokers	Yes	46	46.0
	Hyperlipidemia	Yes	73	73.0
History of surgery	Redo surgery	Yes	100	100
Surgery type	CABG		84	84.0
	Valvular surgery		13	13.0
	Valvular surgery+ CABG		3	3.0

**Table 2: Frequency distribution of patients among VAS pain scale (Mild pain – score 1-3, moderate – score 4-6 and severe score > 6)**

VAS pain scale	Number	Percent
0/10	7	7.0
1/10	10	10.0
2/10	34	34.0
3/10	22	22.0
4/10	17	17.0
5/10	3	3.0
6/10	2	2.0
7/10	2	2.0
8/10	3	3.0
Total	100	100.0

In this study, frequencies and percentages changes for different parameters were calculated to see their relationship with post sternotomy pain.

Frequency distribution of demographics among patients:

A total of 72 patients (72%) were males with mean age mean  $\pm$  Standard deviation (table 1). Patients ranged from 12 to 72 years and the frequency distribution of different age groups is listed in table 1.

Frequency distribution of risk factors:

The incidence of cardiovascular risk factors e.g. diabetes mellitus (89%), hypertension (81%) and smoking (46%) is listed in table 1.

Frequency distribution of type and history of surgery:

A total of 84 patients (84%) had redo CABG and 13 (13%) had redo valve surgery. Only, 3 patients (3%) had CABG after previous valve surgery as shown in table 1. In the case of history of surgeries, all patients who suffered from post sternotomy had undergone redo cardiac surgery as shown in table 1.

Frequency distribution of patients among VAS pain scale:

On the VAS pain scale frequencies of patients

suffering from post sternotomy pain is shown in table 2.

#### **DISCUSSION:**

Demographic data of the study population are presented in Tables 1. In the present study, males (72%) and middle age patients were significantly more susceptible to post sternotomy pain after redo cardiac surgery. This was in agreement with the results of Costa et al.<sup>11</sup> who reported that males and age group 50-60 years suffered more from chronic post sternotomy pain. Similarly, Veal et al.<sup>12</sup> reported 84.5% of patients with post sternotomy pain were males, with an average age of 69.6 years and that 84.5 % of patients were females. These findings regarding gender were different from the current research. Similarly, the results of van et al.<sup>13</sup> were also opposite to the present work.

Regarding risk factors, in the present study, 89% of patients with post sternotomy pain were diabetics. It shows a possible association between the two. Results of Jalil et al.<sup>14</sup> supports the present work. In contrast to our findings, the outcomes of similar work by Costa et al.<sup>11</sup> were not consistent with our findings. In current study, 81% of patients who experienced pain after surgical intervention also had high blood pressure. The studies conducted

by Costa et al.<sup>11</sup> on hypertension were consistent with the present study with high blood pressure in 83.1% patients. There was no significant disparity in pain between smokers and nonsmokers. At this point, there has been no literature on the link between smokers and post-sternotomy pain; therefore, there is a need to fill this gap in the existing knowledge.

About 73% patients were suffering from hyperlipidemia. Gündeş et al.<sup>15</sup> found an association between the two. These findings are in stark contrast to current investigation. Furthermore, Arnesen et al.<sup>16</sup> also published similar work, the outcomes were also different from our study. Similarly, Zheng et al.<sup>17</sup> observed increased levels of hyperlipidemia in association with sternotomy, and the findings were consistent with the findings of the current investigation. According to the National Center for Health Statistics, the function of different risk factors for cardiovascular disease is debated in the literature.<sup>18</sup> Some studies have suggested that variable risk factors may be associated with cardiac pain.<sup>19, 20</sup> The connection between all of these risk factors however, requires further prospective cohort studies.

In our study almost all patients who suffered from

post sternotomy pain did not have any previous history of redo surgery and re-exploration histories. Results from many research were in line with present work.<sup>21, 22</sup> However in study by Veal et al. there is link between previous surgery and post sternotomy pain.<sup>23</sup> The intensity of pain after redo cardiac surgery among most of the patients was mild i.e. 2/10 on the VAS pain scale. Costa et al.<sup>11</sup> conducted a case-control study on the factors related to the development of chronic post-sternotomy pain and found that the majority of cardiac patients (13.2%) rated their pain severity as 2/10 on a pain scale. These findings were consistent with the current investigation. Similarly, Flo et al.<sup>24</sup> investigated acute and chronic post-sternotomy pain before and after the implementation, results were also consistent along with other studies.<sup>25, 26</sup> While results of Meyerson along with other studies were in contrast to present work.<sup>27</sup>

#### CONCLUSION:

In conclusion, different disease factors, as well as the type of cardiac surgeries, are associated with post sternotomy pain, with most patients experiencing mild pain. There is paucity of work on this topic and further prospective multicenter trials are needed to study early signs, risk factors and clinical implications of PSP.

#### References:

1. Mazzeffi M, Khelemsky Y. Poststernotomy pain: a clinical review. *J CardiothoracVascAnesth*. 2011;25: 1163---78.
2. Bordoni B, Marelli F, Morabito B, Sacconi B, Severino P. Post-sternotomy pain syndrome following cardiac surgery: case report. *Journal of Pain Research*. 2017 May;Volume 10:1163–9.
3. Hacibaramoglu M, Kati C, Muller D, Flöter J, Moritz A, Papadopoulos N. Chronic Poststernotomy Pain after Cardiac Surgery: Correlation of Computed Tomography Findings on Sternal Healing with Postoperative Chest Pain. *The Thoracic and Cardiovascular Surgeon*. 2012 Jul 20; 61(03):202–8.
4. Bruce J, Drury N, Poobalan SA, Jeffrey RR, Smith SWC, Chambers AW. The prevalence of chronic chest and leg pain following cardiac surgery: a historical cohort study. *Pain [Internet]*. 2003 Jul [cited 2020 Jan 10]; 104 (1):265–73.
5. Meyerson J, Thelin S, Gordh T, Karlsten R. The incidence of chronic post-sternotomy pain after cardiac surgery - a prospective study. *ActaAnaesthesiologicaScandinavica*. 2001 Sep; 45(8):940–4.
6. Huang APS, Sakata RK. Pain after sternotomy – review. *Brazilian Journal of Anesthesiology (English Edition)*. 2016 Jul;66(4):395–401.
7. Grosen K, Laue Petersen G, Pfeiffer-Jensen M, Hoejsgaard A, Pilegaard HK. Persistent post-surgical pain following anterior thoracotomy for lung cancer: a cross-sectional study of prevalence, characteristics and interference with functioning†. *European Journal of Cardio-Thoracic Surgery*. 2012 Apr 20; 43 (1):95–103.
8. Gerbershagen HJ, Aduckathil S, van Wijck AJM, Peelen LM, Kalkman CJ, Meissner W. Pain Intensity on the First Day after Surgery. *Anesthesiology*. 2013 Apr;118(4):934–44.
9. Mota FA, Marcolan JF, Pereira MHC, Milanez AM de M, Dallan LAO, Diccini S. Comparison

- study of two different patient-controlled anesthesia regimens after cardiac surgery. *Revista Brasileira de Cirurgia Cardiovascular*. 2010 Mar;25(1):38–44.
10. Oddershede L, Andreasen JJ, Ehlers L. Estimation of utility values from visual analog scale measures of health in patients undergoing cardiac surgery. *ClinicoEconomics and Outcomes Research*. 2014 Jan;21.
  11. Costa MAC da, Trentini CA, Schafranski MD, Pipino O, Gomes RZ, Reis ES dos S. Factors Associated with the Development of Chronic Post-Sternotomy Pain: A Case-Control Study. *Revista Brasileira de Cirurgia Cardiovascular*. 2015;30(5):552–6.
  12. Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM, Orlikowski CE. Pain and Functionality Following Sternotomy: A Prospective 12-Month Observational Study. *Pain Medicine*. 2016 Jan 6;pnv066.
  13. Van Leersum NJ, Van Leersum RL, Verwey HF, Klautz RJM. Pain Symptoms Accompanying Chronic Poststernotomy Pain: A Pilot Study. *Pain Medicine*. 2010 Nov;11(11):1628–34.
  14. JalilMirhosseini S. Figure-of-Eight Wire Sternal Closure Technique Can Reduce Post-Open Cardiovascular Surgery Chest Re-Exploration and Pain Scores in Diabetic Patients with Severe Obesity (Body Mass Index: 35-40). *International Journal of Clinical and Experimental Medical Sciences*. 2015;1(3):38.
  15. Gündeş A, Çelik A, Yeşil E, Özcan T. PP-057 Acute Myocardial Infarction due to Diffuse Severe LMCA Stenosis in Young Woman with Familial Hypercholesterolemia. *The American Journal of Cardiology*. 2015 Mar;115:S122–3.
  16. Arnesen K-E, Mork I, Thorwall M, Retterstøl K. Treat-to-target familial hypercholesterolemia (TTT-FH)-a prospective study of high-intensity lipid treatment in free living patients with familial hypercholesterolemia (FH). *Atherosclerosis*. 2017 Aug;263:e232–3.
  17. Zheng Q, Wang Q, Wu C, Wang Z, Ao H. Is hyperlipidemia a potential protective factor against intraoperative awareness in cardiac surgery? *Journal of Cardiothoracic Surgery*. 2016 Apr 12;11(1).
  18. Omidvar B, Ayatollahi F, Alasti M. The prognostic role of serum uric acid level in patients with acute ST elevation myocardial infarction. *Journal of the Saudi Heart Association*. 2012 Apr;24(2):73–8.
  19. Basar N, Sen N, Ozean F, Erden G, Sokmen E. PP-234: elevated serum uric acid predicts angiographic impaired reperfusion and one-year mortality in st-segment elevation myocardial infarction patients undergoing percutaneous coronary intervention. *International Journal of Cardiology*. 2011 Mar;147:S155.
  20. Krishnan E, Sokolove J. Uric acid in heart disease: a new C-reactive protein? *Current Opinion in Rheumatology*. 2011 Mar;23(2):174–7.
  21. Meyerson J, Thelin S, Gordh T, Karlsten R. The incidence of chronic post-sternotomy pain after cardiac surgery - a prospective study. *Acta Anaesthesiologica Scandinavica*. 2001 Sep;45(8):940–4.
  22. Bordoni B, Marelli F, Morabito B, Sacconi B, Severino P. Post-sternotomy pain syndrome following cardiac surgery: case report. *Journal of Pain Research*. 2017 May;Volume 10:1163–9.
  23. Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM, Orlikowski CE. Pain and Functionality Following Sternotomy: A Prospective 12-Month Observational Study. *Pain Medicine*. 2016 Jan 6;pnv066.
  24. Flo A, Rodriguez M, Moret E, Roca G, Sariñena M, Escudero A. P-02 Acute and chronic post-sternotomy pain before and after implementation of an ultra fast-track protocol in cardiac surgery. *Journal of Cardiothoracic and Vascular Anesthesia*. 2011 Jun;25(3):S35.
  25. Korsik E, Balga I, Zakhary WZA, Ender J, Forner AF. Incidence of acute and persistent postoperative pain in cardiac surgery after sternotomy and lateral thoracotomy using a fast track protocol. *Journal of Cardiothoracic and Vascular Anesthesia*. 2019 Sep;33:S108.
  26. Saxena P, Newman MA, Shehatha JS, et al. Remote ischemic conditioning: evolution of the concept, mechanisms, and clinical application. *J Card Surg* 2010; 25: 127-34.
  27. Meyerson J, Thelin S, Gordh T, Karlsten R. The incidence of chronic post-sternotomy pain after cardiac surgery - a prospective study. *Acta Anaesthesiologica Scandinavica*. 2001 Sep;45(8):940–4.