Advanced Medical Journal, Vol.11, No.2, P.219-228,2026 https://doi.org/10.56056/amj.2026.478

Chronic thoracic pain in cardiothoracic surgery via thoracotomy and sternotomy: risk factors and outcomes

Sangar Sarkaut Mohammed* Bashar Hanna Azar Aram Baram*****

Abstract

Background and Objective: With a frequency of 9%–64% within 1 or 2 years following the procedure, chronic thoracic pain is a prevalent issue among patients receiving thoracic surgery. The purpose of this research was to identify the risk factors for chronic pain one year following thoracotomy and sternotomy, and to document its detrimental effects.

Methods: We have enrolled 102 individuals who had thoracotomies and sternotomies at the Rizgari Teaching Hospital and the Erbil Cardiac Center between May and July 2023 in this case series study. Patients were contacted a year later to inquire about the development of chronic pain following surgery and whether or not the pain was interfering with their day-to-day activities. During the tele interview, certain potential risk factors like advanced age, smoking, diabetes mellitus, and duration of surgery were also sought after.

Results: The incidence of pain following surgery was 79.4%. Following a review of the patient's medical history, 66.7% of diabetic patients, 77.8% of those with a positive smoking history, and all 10 thoracotomy cases (12.3%), had postoperative pain with statistically significant p values of (0.04), (0.05), and (0.03) respectively. Mean health scale score was considerably poorer among patients who had pain, p value (0.03).

Conclusions: Postoperatively, a number of variables were substantially linked to persistent thoracic pain. Prior to surgery, patients should be informed of this and its implications.

Keywords: Cardiothoracic surgery, Chronic pain, Predictors, Sternotomy, Thoracotomy

*M.B.Ch.B., Cardiothoracic and Vascular surgery at Kurdistan Higher Council of Medical Specialties (KHCMS), Erbil, Kurdistan Region, Iraq. Corresponding Author: Sangar Sarkaut Mohammed, sangar8j@gmail.com
**M.B.Ch.B., F.I.C.M.S (Cardiothoracic and Vascular surgery), Senior lecturer at College of Medicine, Hawler Medical University, Erbil, Kurdistan Region, Iraq, basharsaqat68@gmail.com
***M.B.Ch.B., MD, MRCSED, FACS, AFSCTS (Cardiothoracic and Vascular surgery), Professor of Cardiothoracic and Vascular surgery at College of Medicine, University of Sulaymaniyah, Sulaymaniyah, Kurdistan Region, Iraq, aram.baramm@gmail.com

Introduction

Chronic chest discomfort after cardiothoracic surgery is a major problem for a large proportion of patients, estimated to be between 18 and 59%.[1-4] Individuals who experience pain tend to have worse physical and mental health than those who do not.[5-7] As per the International Association for the Study of Pain (IASP), "pain that recurs or persists along a thoracotomy scar at least three months after the surgical procedure" is classified as chronic pain following thoracotomy.[8] While the exact cause of the pain is unknown, some studies point to a number of risk factors, including smoking, preoperative opioid use, lung cancer, pneumothorax, malignant state, intraoperative bleeding, length of chest tube, surgery lasting longer than two and a half hours, reaction to the wire used to close the sternum, young age, internal mammary artery harvesting, intercostal nerve damage and dysfunction, and so on.[2,9-12] Nevertheless, few prospective studies have looked for potential causes of persistent thoracic pain following sternotomy.[3] Determining the factors that contribute to such adverse result in chronic pain as, once the pain has started, therapy will become more challenging, leading to a markedly worsening of the patients' health.[13] The goal of the current retrospective study was to determine the characteristics that were associated with chronic pain one year following cardiothoracic surgery, including thoracotomy and sternotomy. Following this, it is also documented how patients' everyday lives are negatively impacted by lack of sleep and analgesic use. After thoracotomy, chronic pain is not uncommon and has been found to affect 21–61% of patients. There has long been evidence linking the procedure to intercostal nerve damage. In addition to being chronic, the pain frequently manifests as aching, pressure-like effects, burning, and squeezing.[14] In addition to impairing sleep and appetite, chronic pain can incapacitate patients to the point where doing basic everyday tasks becomes challenging.[15] Intercostal nerve damage and dysfunction are implicated in the development of chronic pain following thoracotomy.[9] The aim of this study was to identify the perioperative risk factors and timing of neuropathic pain following major cardiothoracic surgery.

Patients and methods

We included patients who underwent posterolateral thoracotomy (ages 18 and above) at Rizgary Teaching Hospital (Erbil, Iraq) and patients older than 30 who underwent median sternotomy at the Surgical Specialty Hospital-Cardiac Center (Erbil, Iraq) between May 2022 and July 2022 in this retrospective case series study. Interventions included lobectomy, pneumonectomy, hydatid cyst resection, debridement and decortication, diaphragmatic hernial repair, and coronary artery bypass grafting. Sternotomy for aortic operations (Bentall) and congenital heart disease were not included. A single-lumen endotracheal tube was used to establish general anesthesia. Patients were positioned supine (median sternotomy) and in the lateral decubitus posture (thoracotomy). Midazolam, fentanyl, and propofol were the standard anesthetic techniques utilized on all patients to induce anesthesia. Postoperatively, patients were given an IV infusion of opioids (morphine 10 mg/1 mL or tramadol 100 mg/2 mL) every 8 hours or, if necessary, every 6 hours in conjunction with acetaminophen (1 g/100 mL) as soon as they arrived in the intensive care unit (ICU) and stayed there for at least 24 hours.[16] Ten to twelve months following surgery, all patients were called, and a questionnaire was used to record the following information about the patients and the surgery: age, sex, history of smoking, diabetes, procedure type, surgical approach (median sternotomy vs. thoracotomy), duration of surgery, presence of chronic

https://doi.org/10.56056/amj.2026.478

thoracic pain, including its feature and location, and potential impact on daily life, Table (1). Pain levels were rated by the patients as low, moderate, or severe. For entering the collected data and performing statistical analysis, we utilized SPSS 26. For continuous variables, the independent sample t-test was employed, and for categorical variables, the appropriate statistical tests (Fisher's exact and Chi-square tests) were utilized. All characteristics that may be used to compare patient groups with and without chronic thoracic pain were considered in the univariate analysis. The independent factors were "chronic thoracic pain" and the dependent variable was "possible predictors." The threshold for statistical significance was fixed at $p < 0.05$. Because of the study's retrospective design and anonymous data analysis, the Kurdistan Higher Council of Medical Specialties Ethics Committee granted its approval and waived the need for a written consent.

Table (1): Questionnaire on chronic thoracic pain 1 year after surgery

Question	Answer
Have you experienced pain related to surgery?	Yes/No
Degree of the pain	Mild/Moderate/Severe
Where was the pain localized?	Operated area/Elsewhere/Diffuse pain
How would you characterize the pain?	Aching/Burning/other
Have you used analgesics for the pain?	Yes/No
Has the pain interrupted your sleep?	Yes/No
Has the pain limited your daily activities?	- Not at all - A little - A lot
Did you resume your job?	Yes/No

Results

This study included 102 patients who underwent cardiothoracic surgery who presented with a mean age of (55.5 years) and range of 19-70 years; 7.8% of them were in the age group of less than 40 years, 10.9% of them were in the age group of 40-49 years, 43.1% of them were in the age group of 50-59 years and 38.2% were aged ≥ 60 years. The number of male patients was higher than that of female patients (69.6% vs. 30.4%). Smoking history was positive in 73.5% of the patients. The predominant cardiothoracic surgery was sternotomy for coronary artery bypass grafting (CABG) (72.5%), followed by sternotomy for mitral valve replacement (MVR) (10.8%), thoracotomy (9.8%), sternotomy for aortic valve replacement (AVR) (4.9%) and sternotomy for double valve replacement (DVR) (2%). For CABG surgery, left internal mammary artery (LIMA) was harvested in 87.8% of patients. Diabetes mellitus was observed in 61.8% of the patients who underwent cardiothoracic surgery. Most patients underwent cardiothoracic surgery for the first time, while four patients underwent redo surgery. The mean duration of surgery was (3.1 hours); 86.3% of them had a surgery duration of 3 h or more, Table (2).

Table (2): General characteristics of patients who underwent cardiothoracic surgery

Variable	No.	%
Age/ <40 years	8	7.8
40-49 years	11	10.9
50-59 years	44	43.1
≥60 years	39	38.2
Gender/ Male	71	69.6
Female	31	30.4
Smoking history /Yes	75	73.5
No	27	26.5
Surgery type/Thoracotomy	10	9.8
Sternotomy (CABG)	74	72.5
Sternotomy (AVR)	5	4.9
Sternotomy (MVR)	11	10.8
Sternotomy (DVR)	2	2.0
LIMA harvested/Yes	65	87.8
No	9	12.2
Diabetes mellitus /Yes	63	61.8
No	39	38.2

https://doi.org/10.56056/amj.2026.478

Order of surgery/First time	98	96.1
Redo	4	3.9
Duration of surgery mean±SD (3.1±0.5 hours)		
<3 hours	14	13.7
≥3 hours	88	86.3
Total	102	100.0

Chronic thoracic pain was experienced by 79.4% of the patients who underwent cardiothoracic surgery; 27.2% mild, 59.2% moderate and 13.6% severe. The most common pain location was around the operated area (69.1%) and aching was the most common characteristic of pain (76.5%). Analgesics were used by 85.2% of patients with pain, while only 16% of patients with pain revealed sleep interruption and 66.7% of them showed limited daily activities. Working full - time was reported by 42.2% of patients with pain, while 5.9% of them had no job because of pain. The mean rate of health as perceived by patients was (8.3), and 48% had a rate of 9-10, Table (3).

Table (3): Pain characteristics of patients underwent cardiothoracic surgery

Variable	Category	No.	%
Have you experienced thoracic pain related to surgery?	Yes	81	79.4
	No	21	20.6
Degree of pain	Mild	22	27.2
	Moderate	48	59.2
	Severe	11	13.6
Location	Around the operated area	56	69.1
	Localized elsewhere on the thorax	22	27.2
	Diffuse pain in/on the thorax	3	3.7
Character	Aching	62	76.5
	Burning	3	3.7
	Painful when touched	1	1.2
	Painful even when still (tightness, prickling etc.)	1	1.2
	Painful during movement (coughing)	14	17.3
Have you used analgesics for the pain?	Yes	69	85.2
	No	12	14.8
Has the pain interrupted your sleep?	Yes	13	16.0
	No	68	84.0
Has the pain limited your daily activities?	Not at all	15	18.5
	A little	54	66.7
	A lot	12	14.8
Did you resume your job?	Yes, working full-time	43	42.2
	Yes, working part-time	19	18.6
	No, because of the pain	6	5.9
	No, different reason (retirement)	34	33.3
Quality of health scale (mean ± SD = 8.3 ± 1.2)	5–6	9	8.8
	7–8	44	43.1
	9–10	49	48.0
Total		102	100.0

No significant differences were observed between patients with pain and those without pain in terms of age Figure. (1), sex, LIMA, order, and duration of surgery.

https://doi.org/10.56056/amj.2026.478

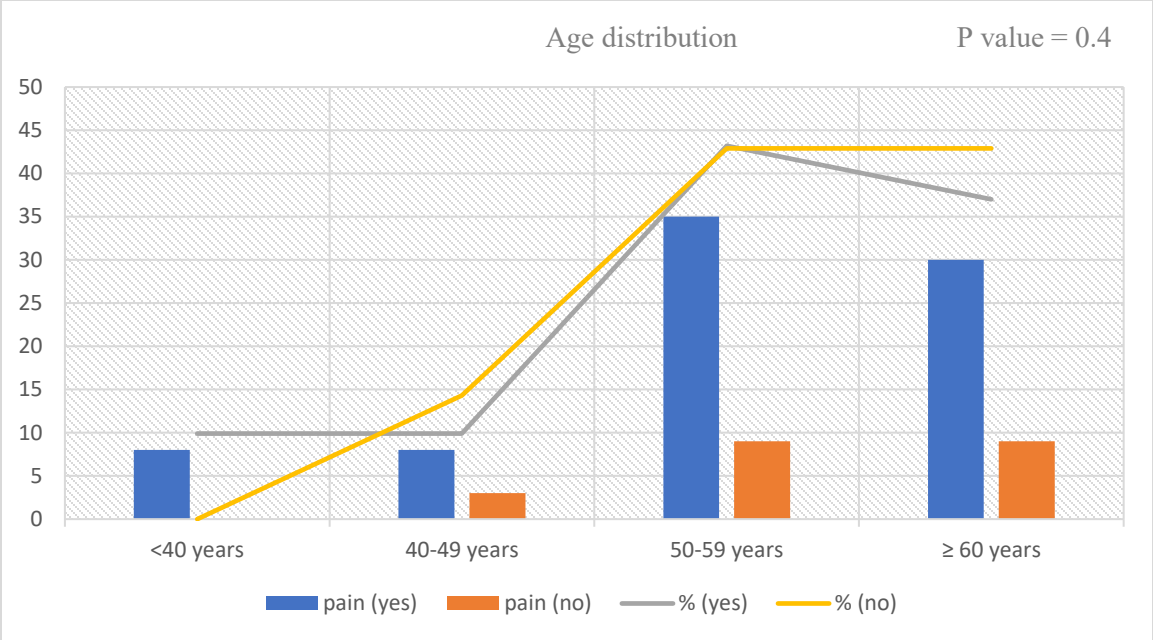

Figure (1): Age and chronic pain relation.

A positive smoking history was significantly associated with chronic thoracic pain (P = 0.05) Figure. (2).

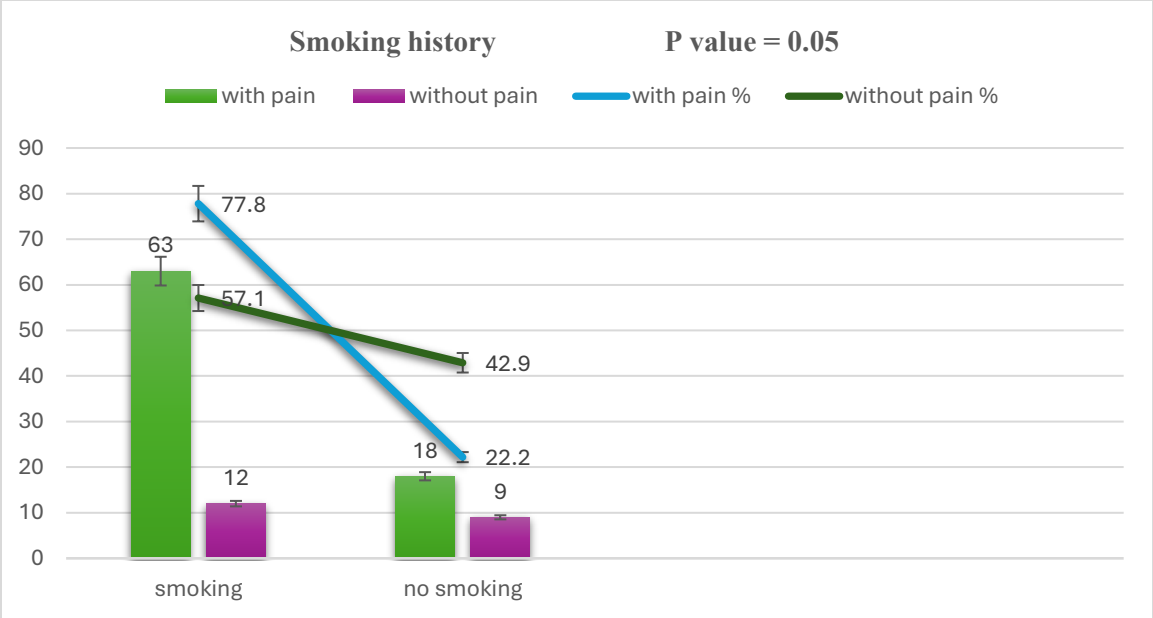

Figure (2): Effect of smoking on the development of chronic pain.

A significant association was observed between thoracotomy and chronic thoracic pain (P = 0.03), and with diabetes mellitus (DM) and chronic thoracic pain (P = 0.04), Figure. (3) and Table (4).

https://doi.org/10.56056/amj.2026.478

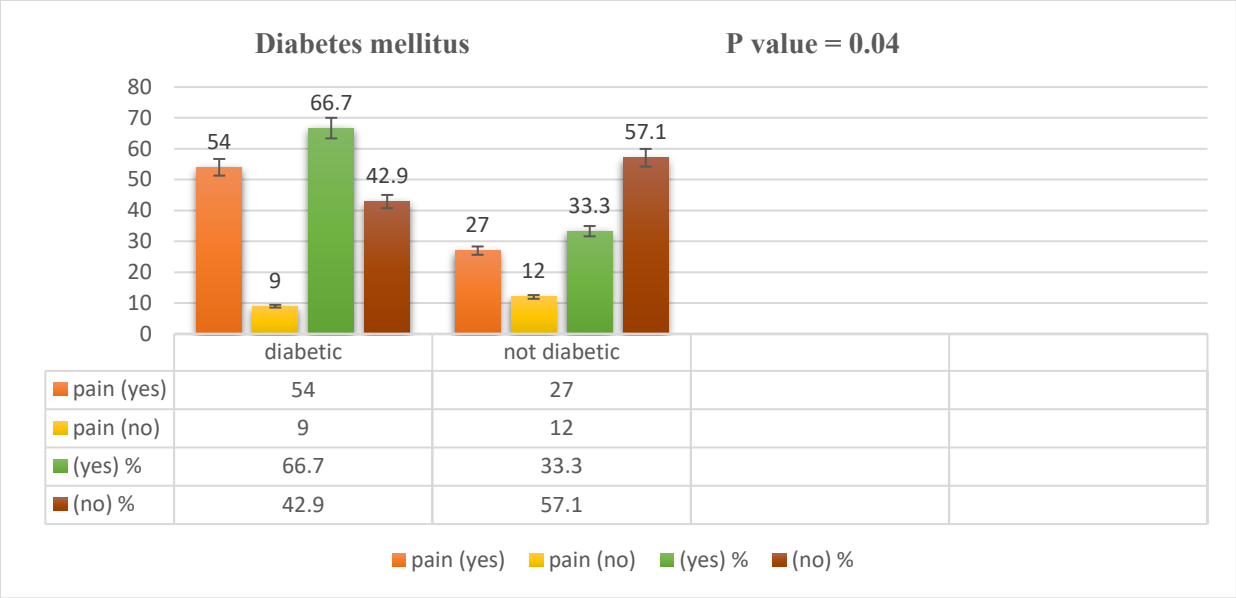

Figure (3): Association between DM and pain.

Table (4): Distribution of general characteristics according to chronic thoracic pain

Variable	Category	Yes (No.)	Yes (%)	No (No.)	No (%)	P-value
Age	<40 years	8	9.9	0	–	0.4 (NS)
	40–49 years	8	9.9	3	14.3	
	50–59 years	35	43.2	9	42.9	
	≥60 years	30	37.0	9	42.9	
Gender	Male	58	71.6	13	61.9	0.38 (NS)
	Female	23	28.4	8	38.1	
Smoking history	Yes	63	77.8	12	57.1	0.05 (S)
	No	18	22.2	9	42.9	
Name of surgery (incision)	Thoracotomy	10	12.3	0	–	0.03 (S)
	Sternotomy (CABG)	61	75.3	13	61.9	
	Sternotomy (AVR)	2	2.5	3	14.3	
	Sternotomy (MVR)	7	8.6	4	19.0	
	Sternotomy (DVR)	1	1.2	1	4.8	
If CABG, LIMA harvested?	Yes	53	86.9	12	92.3	0.58 (NS)
	No	8	13.1	1	7.7	
Diabetes mellitus	Yes	54	66.7	9	42.9	0.04 (S)
	No	27	33.3	12	57.1	
Order of surgery	First time	77	95.1	21	100.0	0.29 (NS)
	Redo	4	4.9	0	–	
Duration of surgery	<3 hours	10	12.3	4	19.0	0.42 (NS)
	≥3 hours	71	87.7	17	81.0	

No significant differences were observed between patients with and without pain regarding job resumption. The mean health scale score perceived by patients was significantly lower among patients with chronic thoracic pain (P = 0.03), Figure. (4) and Table (5).

https://doi.org/10.56056/amj.2026.478

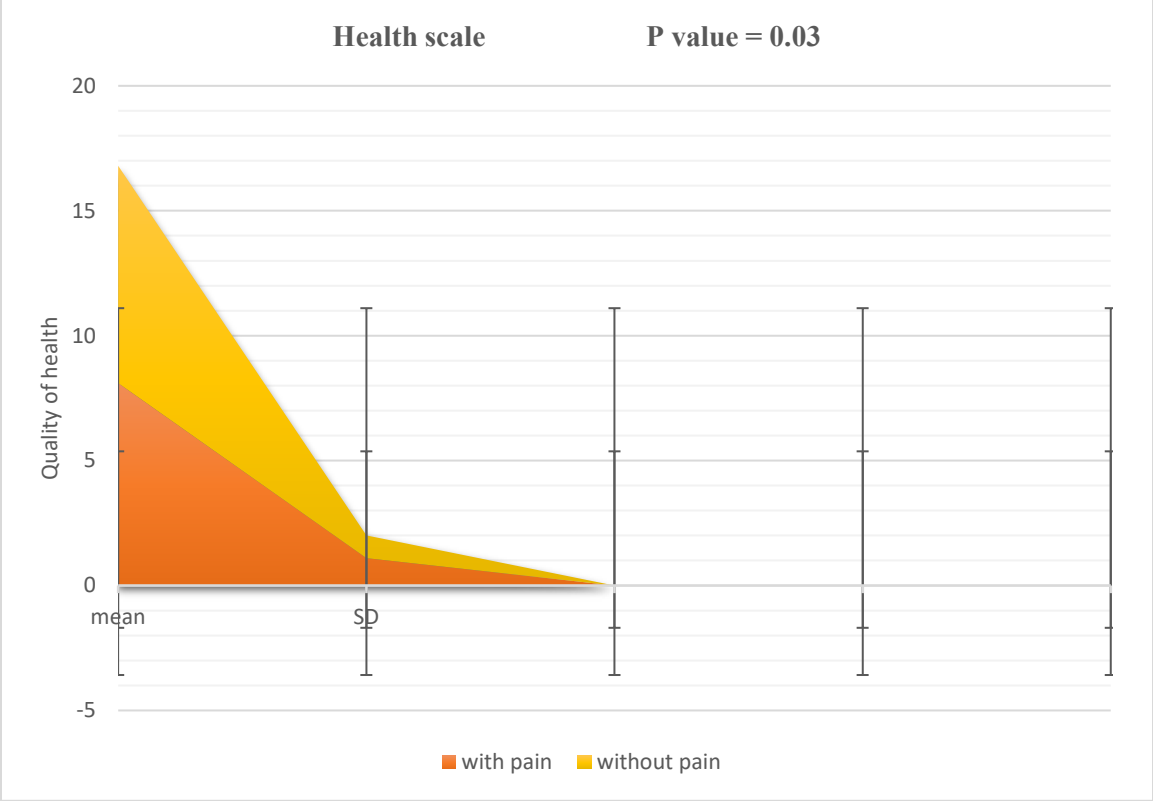

Figure (4): Impact of chronic pain on quality of health.

Table (5): Distribution of resuming job and health scale according to chronic pain

Variable	Chronic thoracic pain (Yes) No.	%	Chronic thoracic pain (No) No.	%	P-value
Did you resume your job?					0.6 (NS)
Yes, working full-time	34	42.0	9	42.9	
Yes, working part-time	15	18.5	4	19.0	
No, because of the pain	6	7.4	0	–	
No, different reason (retirement)	26	32.1	8	38.1	
Quality of health scale					0.03 (S)
Mean ± SD	8.1 ± 1.1		8.7 ± 0.9		

Discussion

As a first step toward early therapy and prevention, we aimed to determine the risk factors for chronic thoracic pain following cardiothoracic surgery via sternotomy and thoracotomy in this retrospective analysis. Using phone interviews, we gathered information about the patient's characteristics, pain levels, and demographics 10–12 months following surgery. Of the 102 patients who had cardiothoracic surgery, 79.4% had chronic thoracic discomfort: 27.2% had mild pain, 59.2% had moderate pain, and 13.6% had severe pain. Chronic chest discomfort is a common adverse effect of open-heart surgery operations and is therefore seen as a major concern in the majority of high-volume facilities.[17] In light of pain management and the whole hospital experience, patient satisfaction has a significant influence in the

https://doi.org/10.56056/amj.2026.478

development of pain after surgery.[18] In our investigation, a number of patient characteristics were found to be associated with the emergence of persistent thoracic discomfort one year after surgery. In particular, DM, a thoracotomy incision, and a positive smoking history were found to be highly associated with persistent thoracic pain and were identified as risk factors for the condition. Pain following surgery increases hospital stay duration and expenses. The majority of patients are treated with nonsteroidal anti-inflammatory drugs (NSAID) analgesics in combination. After major surgery, narcotics are the preferred analgesics for managing moderate to severe pain.[19,20] While several studies have examined persistent pain following thoracic surgery, few have examined the beginning, course, and location of postoperative pain.[21,22] Research indicates that 80% of patients have pain three months following thoracic surgery; however, at one year, the prevalence drops to an estimated 61%.[22] Despite this, our data indicate a higher rate of discomfort than the aforementioned findings. The majority of individuals in this study who had chronic thoracic discomfort had the pain near the surgical incision. Damage to the intercostal nerve may worsen in direct proportion to the time of operation.[9] However, the current study found no evidence of a significant relationship between the length of the surgery and the occurrence of postoperative pain.

Numerous research investigations have indicated a connection between nerve damage and persistent postoperative pain. Nevertheless, chronic pain following thoracic surgery can be both neuropathic and non-neuropathic, indicating that post-thoracic surgical pain cannot be solely attributed to direct nerve injury.[8] The study's limitations are: First, throughout the screening process, there were much fewer thoracotomies performed than sternotomies. Second, because each patient had a distinct pain threshold and level of social and cognitive awareness, it is impossible to determine if the patients overstated or understated their complaints due to the subjective nature of the answers to the pain features. Third, there was no comparison made between the symptoms one year later and the early postoperative phase, when the discomfort peaked.

Conclusion

According to our research, DM, a thoracotomy incision, and a positive smoking history may all be associated with chronic chest pain. Given the existing paucity of information regarding the causes, preventative strategies, and therapy of persistent thoracic pain, it is probably appropriate for future research to focus on the risk factors stated above. Further research is necessary because it tends to improve many patients' postoperative quality of life. Preoperative counseling regarding chronic thoracic discomfort is necessary for high-risk patients to help them understand the potential outcomes of their upcoming surgery.

Conflict of interest

The author declared no conflict of interest.

Acknowledgements

The author would like to thank registration departments at both Erbil Cardiac Center and Rizgary Teaching Hospital for their support, my deepest gratitude and respect to both my mentors and supervisors Dr. Bashar Hanna Azar and Dr. Aram Baram for their unconditional help and guidance throughout my residency.

References

1. Meyerson J, Thelin S, Gordh T, Karlsten R. The incidence of chronic post-sternotomy pain after cardiac surgery—a prospective study. Acta Anaesthesiol Scand. 2001 Sep;45(8):940-4. doi: 10.1034/j.1399-6576.2001.450804. x. PMID: 11576043.

https://doi.org/10.56056/amj.2026.478

2. Kalso E, Mennander S, Tasmuth T, Nilsson E. Chronic post-sternotomy pain. Acta Anaesthesiol Scand. 2001 Sep;45(8):935-9. doi: 10.1034/j.1399-6576.2001.450803. x. PMID: 11576042.
3. Lahtinen P, Kokki H, Hynynen M. Pain after cardiac surgery: a prospective cohort study of 1-year incidence and intensity. Anesthesiology. 2006 Oct;105(4):794-800. doi: 10.1097/00000542-200610000-00026. PMID: 17006079.
4. Eisenberg E, Pultorak Y, Pud D, Bar-El Y. Prevalence and characteristics of post coronary artery bypass graft surgery pain (PCP). Pain. 2001 May;92(1-2):11-7. doi: 10.1016/s0304-3959(00)00466-8. PMID: 11323122.
5. Taillefer MC, Carrier M, Belisle S, Levesque S, Lanctot H, Boisvert AM, et al. Prevalence, characteristics, and predictors of chronic nonanginal postoperative pain after a cardiac operation: a cross-sectional study. J Thorac Cardiovasc Surg. 2006 Jun;131(6):1274-80. doi: 10.1016/j.jtcvs.2006.02.001. PMID: 16733157.
6. Bruce J, Drury N, Poobalan AS, Jeffrey RR, Smith WC, Chambers WA. The prevalence of chronic chest and leg pain following cardiac surgery: a historical cohort study. Pain. 2003 Jul;104(1-2):265-73. doi: 10.1016/s0304-3959(03)00017-4. PMID: 12855337.
7. Gjeilo KH, Klepstad P, Wahba A, Lydersen S, Stenseth R. Chronic pain after cardiac surgery: a prospective study. Acta Anaesthesiol Scand. 2010 Jan;54(1):70-8. doi: 10.1111/j.1399 6576.2009.02097.x. Epub 2009 Aug 13. PMID: 19681771.
8. Bayman EO, Parekh KR, Keech J, Selte A, Brennan TJ, Gergis SD. A prospective study of chronic pain after thoracic surgery. Anesthesiology. 2017 May; 126(5): 938–951. doi: 10.1097/ALN.0000000000001576. PMCID: PMC5395336; NIHMSID: NIHMS848113; PMID: 28248713.
9. Homma T, Doki Y, Yamamoto Y, Ojima T, Shimada Y, Kitamura N, et al. Risk factors of neuropathic pain after thoracic surgery. J Thorac Dis. 2018 May; 10(5): 2898–2907. doi: 10.21037/jtd.2018.05.25. PMCID: PMC6006121; PMID: 29997955.
10. Fine PG, Karwande SV. Sternal wire-induced persistent chest pain: a possible hypersensitivity reaction. Ann Thorac Surg. 1990 Jan;49(1):135-6. doi: 10.1016/0003-4975(90)90372-d. PMID: 2297262.
11. Mueller XM, Tinguely F, Tevaearai HT, Revelly JP, Chiolero R, von Segesser LK. Pain location, distribution, and intensity after cardiac surgery. Chest. 2000 Aug;118(2):391-6. doi: 10.1378/chest.118.2.391. PMID: 10936130.
12. Cohen AJ, Moore P, Jones C, Miner TJ, Carter WR, Zurcher RP, et al. Effect of internal mammary harvest on postoperative pain and pulmonary function. Ann Thorac Surg. 1993 Nov;56(5):1107-9. doi: 10.1016/0003-4975(95)90025-x. PMID: 7902073.
13. van Gulik L, Janssen LI, Ahlers SJ, Bruins P, Driessen AH, van Boven WJ, et al. Risk factors for chronic thoracic pain after cardiac surgery via sternotomy. Eur J Cardiothorac Surg. 2011 Dec;40(6):1309-13. doi: 10.1016/j.ejcts.2011.03.039. Epub 2011 May 10. PMID: 21561786.
14. Butler S, Jonzon B, Branting-Ekenback C, Wadell C, Farahmand B. Predictors of severe pain in a cohort of 5271 individuals with self-reported neuropathic pain. Pain. 2013 Jan;154(1):141-146. doi: 10.1016/j.pain.2012.10.001. Epub 2012 Oct 9. PMID: 23140908.
15. Gerner P. Postthoracotomy pain management problems. Anesthesiol Clin. 2008 Jun;26(2):355-67, vii. doi: 10.1016/j.anclin.2008.01.007. PMID: 18456219; PMCID: PMC2453516.

16. van Gulik L, Ahlers SJ, Brkic Z, Belitser SV, van Boven WJ, van Dongen EP, et al. Improved analgesia after the realisation of a pain management programme in ICU patients after cardiac surgery. Eur J Anaesthesiol. 2010 Oct;27(10):900-5. doi: 10.1097/eja.0b013e32833d91c3. PMID: 20848698.
17. Pezzella AT. Global aspects of cardiothoracic surgery with focus on developing countries. Asian Cardiovasc Thorac Ann. 2010 Jun;18(3):299-310. doi: 10.1177/0218492310370060. PMID: 20519304.
18. Maher DP, Wong W, Woo P, Padilla C, Zhang X, Shamloo B, et al. Preoperative factors associated with HCAHPS responses of 2,758 surgical patients. Pain Med. 2015 Apr;16(4):791-801. doi: 10.1111/pme.12651. Epub 2014 Dec 28. PMID: 25545695.
19. Dahl JB, Nielsen RV, Wetterslev J, Nikolajsen L, Hamunen K, Kontinen V K, et al. post-operative analgesic effects of paracetamol, NSAIDs, glucocorticoids, gabapentinoids, and their combinations: a topical review. Acta Anaesthesiol Scand. 2014 Nov;58(10):1165-81. doi: 10.1111/aas.12382. Epub 2014 Aug 14. PMID: 25124340.
20. Miguel R, Hubbell D. Pain management and spirometry following thoracotomy: a prospective, randomized study of four techniques. J Cardiothorac Vasc Anesth. 1993 Oct;7(5):529-34. doi: 10.1016/1053-0770(93)90308-8. PMID: 8268431.
21. Searle RD, Simpson MP, Simpson KH, Milton R, Bennett M I. Can chronic neuropathic pain following thoracic surgery be predicted during the postoperative period? Interact Cardiovasc Thorac Surg. 2009 Dec;9(6):999-1002. doi: 10.1510/icvts.2009.216887. Epub 2009 Sep 18. PMID: 19767301.
22. Perttunen K, Tasmuth T, Kalso E. Chronic pain after thoracic surgery: a follow-up study. Acta Anaesthesiol Scand. 1999 May;43(5):563-7. doi: 10.1034/j.1399-6576.1999.430513. x. PMID: 10342006.