ORIGINAL ARTICLE

https://doi.org/10.1590/1806-9282.20221655

Assessment of pain and quality of life in patients undergoing cardiac surgery: a cohort study

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SUMMARY

OBJECTIVE: This study aimed to evaluate postoperative pain and quality of life in patients undergoing median sternotomy.

METHODS: A cohort study was carried out on a sample of 30 patients who underwent elective cardiac surgery by longitudinal median sternotomy. Patients were interviewed at Intensive Care Unit discharge and hospital discharge, when the Visual Numeric Scale and the Brief Pain Inventory were applied, and 2 weeks after hospital discharge, when the World Health Organization Quality of Life-Bref questionnaire was administered. The normality of the results was analyzed by the Shapiro-Wilk test, and Wilcoxon Rank Sum and McNemar tests were utilized for the analysis of numerical and categorical variables. For correlation between numerical variables, Spearman's linear correlation test was applied. To compare numerical variables, Mann-Whitney U and Kruskal-Wallis tests were applied. Differences between groups were considered significant when the p-value was <0.05.

RESULTS: Between Intensive Care Unit and hospital discharge, there was a reduction in median pain intensity assessed by the Visual Numeric Scale from 5.0 to 2.0 (p<0.001), as well as in eight Brief Pain Inventory parameters: worst pain intensity in the last 24 h (p=0.001), analgesic relief (p=0.035), and pain felt right now (p=0.009); and in interference in daily activities (p<0.001), mood (p=0.017), ability to walk (p<0.001), relationship with other people (p=0.005), and sleep (p=0.006). Higher pain intensity at Intensive Care Unit discharge was associated with worse performance in the psychological domain of quality of life at out-of-hospital follow-up.

CONCLUSION: Proper management of post-sternotomy pain in the Intensive Care Unit may imply better quality of life at out-of-hospital follow-up.

KEYWORDS: Pain. Quality of life. Postoperative care. Sternotomy. Cardiac surgical procedures.

INTRODUCTION

Moderate-to-severe post-sternotomy pain is reported by up to 75% of patients in the first 4 days of surgery, and persistent pain is reported by 58% in the first month and 39% in the first year. Adequate analgesia in the postoperative period can reduce the incidence of chronic pain and improve the patient's quality of life[1-4].

Quality of life is a broad concept, comprising "an individual's perception of his or her place in life in the context of the culture and value systems in which he or she lives and concerning his or her goals, expectations, standards, and concerns"[5]. Improving the quality of life is the ultimate goal of cardiac surgery[6].

However, the improvement in cardiovascular symptoms cannot be associated with post-sternotomy pain, as the improvement in quality of life caused by the reduction in cardiovascular symptoms can be minimized by the chronicity of pain in the postoperative period.

Many recent initiatives have been focused on limiting opioid use in surgical patients, since excessive administration of opioids for pain treatment after surgery has been recognized as an important concern for public health and a potential contributor to patterns of opioid misuse and related harm[7-11]. However, in developing countries, the problem with these surgeries seems to be different. There is undertreatment of pain due to a lack of resources[9]. This context becomes even more evident in the postoperative period, in which adequate pain management could promote positive outcomes in patient recovery.

Besides, poorly controlled pain is associated with an increased hormonal response to stress. This may contribute to the multiple postoperative adverse events[12], causing a worsening of quality of life.

The present study aimed to analyze the incidence and characteristics of postoperative pain after median sternotomy, identify possible associated variables, and assess the impact of pain intensity and duration on postoperative quality of life.

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Conflicts of interest: the authors declare there is no conflicts of interest. Funding: none.
Received on December 14, 2022. Accepted on December 15, 2022.

METHODS

This is a cohort study, with a convenience sample, conducted in a university hospital in Brazil. The sample was composed of patients of both genders aged ≥18 years, who underwent elective cardiac surgery with longitudinal median sternotomy in the period between August 2020 and April 2021. Patients undergoing previous sternotomy, urgent or emergency surgery, chronic pain, or using analgesics 2 weeks before surgery were not included.

Patients were evaluated at three moments in the postoperative period: at discharge from the Intensive Care Unit (ICU) (T0), at hospital discharge (T1), and at home 14–28 days after discharge (T2). At T0 and T1, pain intensity was characterized by the Visual Numerical Scale (VNS) and Brief Pain Inventory (BPI). At T2, to assess the postoperative quality of life, the World Health Organization Quality of Life Questionnaire – Bref (WHOQoL-Bref) was used.

The Visual Numerical Scale is a quick, practical, and easily applied instrument. It consists of a 0–10 visual scale that rates the intensity of pain the patient reports feeling anywhere in the body. Pain is classified as mild (0 to 3), moderate (4 to 6), and severe (7 to 10).

The Brief Pain Inventory is a more detailed multidimensional questionnaire. It starts with two screening questions about the presence and location of pain and is then divided into two main scales, namely, pain intensity and pain interference. As for the first scale, the questions: "worst pain in the last 24 hours", "use of analgesics", "intensity of analgesic improvement", and "pain felt now" were selected. The anchors of the pain intensity scale are 0="no pain" and 10="worst pain imaginable." As for the pain interference scale, the questions addressed the influence of pain on general activity, mood, ability to walk, relationship with other people, sleep, and ability to enjoy life. The anchors of this scale are 0="no interference" and 10="completely interferes."

The WHOQoL-Bref standardized structured questionnaire of quality of life, developed by the World Health Organization, is an abbreviated version of the WHOQoL-100, composed of the 26 questions that obtained the best psychometric performances of the original questionnaire, containing two general quality-oflife-questions and 24 other questions representing each of the 24 facets that compose the following four domains: physical (7 items), psychological (6 items), social relations (3 items), and environment (8 items)[13]. The higher the score, the better the quality of life.

Data were tabulated and analyzed in the statistical program SPSS 25.0®. For the analysis of results, numerical variables were presented as mean and standard deviation, median, and range (minimum and maximum), and categorical variables as absolute (n) and relative (%) frequencies. Normality was checked using the Shapiro-Wilk test. To compare numerical and categorical variables at T0 and T1, the Wilcoxon and McNemar tests were applied, respectively. For correlation between numerical variables, Spearman's linear correlation test was applied. To compare numerical variables with metrics in up to two categories, the Mann-Whitney U test was applied, and in three categories or more, the Kruskal-Wallis test was applied. Differences between groups were considered significant when the p-value was <0.05.

The present study was approved by the Research Ethics Committee of the institution (No. 23523.023901/2018-1/CAAE:14783119.5.0000.5087) and was conducted in accordance with the Declaration of Helsinki. All participants signed the informed consent form.

RESULTS

The sample included 30 patients, mostly females (60%, n=18) and in the age range of 46–59 years (40%, n=12), ranging from 18 to 78 years (49.73±16.60 years). The most frequent surgical procedures were coronary artery bypass grafting (40%, n=12) and valvular replacement (40%, n=12). The mean times of surgery, cardiopulmonary bypass (CPB), and aortic cross-clamping were 209±65 min (120 to 343), 91.86±33.91 min (18 to 154), and 75±34.56 min (32 to 175), respectively. The most commonly observed American Society of Anesthesiologists preoperative physical status classification was ASA III (40%, n=12), followed by II (36%, n=11). Mean ICU and in-hospital stays (including the preoperative period of clinical stabilization of baseline conditions) were 6.45±6.25 days (2 to 26 days) and 32.10±19.34 days (7 to 93 days), respectively (Table 1).

At T0, 10 (33.3%) patients had severe pain, and 7 (23.33%) patients had moderate pain (median: 5, 0–10). At T1, 10% had severe pain and 16.67% had moderate pain (median 2, 0–10). Between these two moments, clinical improvement was observed in all parameters assessed by the BPI, except "pain interference with the ability to enjoy life" (p=0.161) (Table 2). The most commonly reported areas of pain were sternal, scapular, and lumbosacral. However, no statistically significant differences were observed between the moments of the interview.

The female gender was correlated with higher pain intensity and parameters interference, both at T0 and T1, but with statistical significance only for interference in general activity (p=0.052; Mann-Whitney U test) and walking ability (p=0.044; Mann-Whitney U test) at T0 and for pain now (p=0.028; Mann-Whitney U test) at T1.

Table 1. Sociodemographic, clinical, and surgical aspects of patients undergoing median sternotomy in a referral hospital.

Variables	n
Gender	
Female	18 (60.0%)
Male	12 (40.0%)
Age (years)	
18–30	5 (16.7%)
31–45	6 (20.0%)
46–59	12 (40.0%)
60 and over	7 (23.3%)
Mean±SD	49.7±16.6
Color	
Brown	19 (63.3%)
White	7 (23.3%)
Black	4 (13.3%)
Habits	
Physical activity	2 (6.7%)
Current alcoholism	1 (3.3%)
Previous alcoholism	11 (36.7%)
Current smoking	1 (3.3%)
Previous smokig	7 (23.3%)
BMI[a] (kg/m²)	25.4±5.3
Heart disease	
Mitral insufficiency	12 (40.0%)
Heart failure	8 (26.7%)
Mitral stenosis	4 (13.3%)
Aortic insuficciency	4 (13.3%)
Tricuspid insufficiency	4 (13.3%)
CAD[b]	5 (16.7%)
Aortic stenosis	3 (10.0%)
ASD[c]	3 (10.0%)
Surgical procedures	
Valvular replacement	12 (40.0%)
CABG[d]	12 (40.0%)
Closure of ASD[e]	4 (13.3%)
Valve repair or replacement	1 (3.3%)
Combined procedures	1 (3.3%)
Surgery time (min)	209±65
ICU[f] stay (days)	6.4±6.3
Hospitalization (days)	32.1±19.3
Cross clamping (min)	75.0±34.6
CPB[g] (min)	91.9±33.9
ASA[h]	
I–II	12 (40.0%)
III	18 (80.0%)
Analgesia	
Morphine	29 (96.7%)
Tramadol	8 (26.7%)
Codein	8 (26.7%)
Dipyrone	26 (86.7%)
Paracetamol	11 (36.7%)
Analgesia-related symptoms	
Constipation	11 (36.7%)
Altered appetite	8 (26.7%)
Altered diuresis	10 (33.3%)

[a]Body Mass Index; [b]Coronary Artery Disease; [c]Atrial Septal Defect; [d]Coronary Artery Bypass Graftin; [e]Atrial Septal Defect; [f]Intensive Care Unit; [g]Cardiopulmonary bypass; [h]American Society of Anesthesiologists.

The longer time of aortic cross-clamping was associated with greater interference with mood (p=0.011; Spearman's correlation), walking ability (p=0.026; Spearman's correlation), and relationship with other people (p=0.003; Spearman's correlation) at T0, and with interference with general activity (p=0.028; Spearman's correlation) and again with mood (p=0.007; Spearman's correlation) at T1.

The most commonly used analgesics were morphine (96.7%, n=29), dipyrone (86.7%, n=26), and/or paracetamol (36.7%, n=11). The total daily dose in the first 24 h postoperatively was 3.29±2.27 mg morphine and 5.12±1.64 g dipyrone.

The total dose of morphine during the ICU stay and on the ward was 221 and 5 mg, respectively, for the group with mild pain at ICU discharge, 38 and 7 mg for moderate pain, and 90 and 18 mg for severe pain.

At T2, the WHOQoL-Bref questionnaire was self-administered 19.32±9.48 days after hospital discharge. The median overall quality of life was 70.27, ranging from 36.76 to 86.62. The worst performing domain was physical (12.93±2.76), followed by environment (13.15±2.03). Pain intensity at ICU discharge (T0) was associated with more unfavorable parameters in the psychological domain (p=0.022). This relationship was not observed with pain intensity at hospital discharge (T1) (Table 3).

DISCUSSION

The vast majority of patients achieved a significant improvement in key BPI parameters between ICU discharge and hospital discharge. However, important pain values persisted during hospitalization. The post-sternotomy pain of moderate intensity at ICU discharge and mild at hospital discharge is in agreement with the results of other studies[13-17], showing that there is still room for improvement in analgesic techniques, especially in the first postoperative days[13].

The systematic use of opioids in the immediate postoperative period was verified; however, the total daily dose may have been insufficient for adequate analgesia. One of the factors for the inadequacy of post-sternotomy pain control is the fear of side effects of intravenous opioids, which should be the preferred choice in this context, associated with a second type of analgesic therapy[12].

There is evidence in the literature of a relationship between post-sternotomy pain and younger age, female gender, and higher BMI[19]. In this study, it was found that age was correlated positively with the intensity of analgesic relief at hospital discharge.

The female gender was associated with greater pain interference in daily activities and walking ability at ICU discharge,

Table 2. Comparison of responses to the Visual Numerical Scale and Brief Pain Inventory, at Intensive Care Unit discharge (T0) and hospital discharge (T1), of patients submitted to median sternotomy for cardiac surgery in a tertiary hospital.

Variáveis		T0	T1	p§
		#	#	
Visual Numerical Scale		5.0 (0–10)	2.0 (0–10)	0.001
Brief Pain Inventory				
Intensity	The worst pain in the last 24 hours	5.0 (0–10)	1.5 (0–10)	0.001
	From pain relief	8.0 (0–10)	10.0 (5–10)	0.035
	Of the pain felt now	1.0 (0–10)	0.0 (0–7)	0.009
Pain influence	On general activity	5.0 (0–10)	0.5 (0–10)	0.001
	Mood	3.5 (0–10)	0.0 (0–10)	0.017
	Ability to walk	7.0 (0–10)	0.0 (0–10)	0.001
	Relationship with other people	0.5 (0–10)	0.0 (0–10)	0.005
	Sleep	6.0 (0–10)	3.0 (0–10)	0.006
	Ability to enjoy life	2.0 (0–10)	0.0 (0–10)	0.161

§Wilcoxon; #Median (min–max).

Table 3. Relationship between the Visual Numerical Scale at Intensive Care Unit discharge (T0) and hospital discharge (T1) with the post-discharge Quality of Life (World Health Organization Quality of Life Questionnaire – Bref) (T2) of patients submitted to median sternotomy for cardiac surgery in a reference hospital.

WHOQoL-Bref		Visual Numeric Scale			p¥
		Mild pain (0–3)	Moderate pain (4–6)	Severe pain (7–10)	
		#	#	#	
T0	Physical domain	13.7 (7.4–20.0)	13.1 (9.7–17.1)	12.3 (9.1–14.3)	0.431
	Psychological domain	16.0 (6.7–20.0)	14.0 (11.3–16.0)	13.3 (11.3–14.7)	0.022
	Social relations domain	14.7 (10.7–18.7)	14.7 (10.7–17.3)	14.7 (8.0–16.0)	0.633
	Environmental domain	13.5 (8.0–18.0)	13.0 (11.5–15.0)	12.5 (10.5–15.0)	0.374
T1	Physical domain	13.7 (7.4–20.0)	12.6 (10.3–13.7)	12.0 (9.1–13.7)	0.371
	Psychological domain	15.0 (6.7–20.0)	12.7 (12.0–14.7)	14.0 (12.0–14.7)	0.211
	Social relations domain	14.7 (10.7–18.7)	14.7 (8.0–17.3)	14.7 (10.7–16.0)	0.814
	Environmental domain	13.2 (8.0–18.0)	12.0 (11.5–13.0)	12.5 (12.0–15.0)	0.383

¥Kruskal-Wallis; #Median (min–max).

and with pain intensity at hospital discharge. Females were associated with greater areas of pain at the end of the first week of cardiac surgery[14], more postoperative complications and length of stay, more symptoms 2 weeks after discharge, and lower quality of life for 6 months after surgery[19].

Thus, as observed in this study, surgery may imply some degree of impairment of psychological function during the first weeks because patients have to face the challenges of a new life phase that may be accompanied by physical and mental deterioration[20]. However, the psychological consequences of sternotomy and anginal pain, including depression and anxiety, may be clinically evident for up to a year after surgery[21]. This wide time interval of unfavorable manifestations in the psychological domain is another indication of the complexity of the consequences of pain caused by the punctual surgical event, which has repercussions on the quality of life in the short and long term, requiring readjustments in lifestyle.

In our sample, we observed a correlation between CPB time and the parameter interference in relationships with other people (T0) and mood (T1). Another study observed that CPB time <60 min was associated, with statistical significance, with a lower incidence of moderate to severe pain[2].

Comparing the data found with those of another author who investigated the mean BPI values in 70 patients at ICU discharge, equivalent to T0, higher values were found for influence of pain on walking (7×6.67) and sleep (6×5.37) and lower

values for worst pain in 24 h (5×4.66), pain now (1×2.61), influence of pain on activities (5×7. 30), mood (3.5×4.16), relationship (0.5×1.54), and enjoy life (2×3.04). As for the parameter "influence on the ability to enjoy life", it decreases according to the pain relief score[17].

In the elderly group, cardiac surgery has less effect on increasing life expectancy, while its impact on improving quality of life is relevant. The variables associated with greater gains in quality of life in the elderly are poor preoperative physical status, female gender, older age, and longer hospital stay[22].

The most frequent location of acute postoperative pain is in the sternal region[2,3,4,14,15], sometimes accompanied by significant impairment of lung function[4]. In our study, there was no significant variation in pain location at T0 and T1.

Several analgesic techniques can be used. Pharmacological techniques, such as opioids and anti-inflammatory drugs, infiltration with local anesthetics, nerve blocks, and spinal analgesia[12], and non-pharmacological techniques, such as heat/cold application, massage, hypnosis, and distraction techniques, exist. Continuous infusion of local anesthetics can reduce the intensity of acute postoperative pain, opioid use, mechanical ventilation time, hospital stay, and atelectasis, and it is a simple and effective method for treating pain after median sternotomy[23].

The patient with pain tends to have greater physical and emotional exhaustion, reduce his movement, remain in dorsal decubitus, maintain more superficial ventilation, and awaken from sleep. Thus, it is reinforced that pain control must be seen as a priority in health care[24].

Among the limitations of the study, the coronavirus pandemic (SARS-CoV-2) reduced the number of elective surgeries, leading to a reduction of the sample, the prolongation of the length of hospital stay, and the wide range of T2 follow-up, which can lead to significantly different pain findings at days 14 and 28. Future studies with higher samples are needed for a better comparison of findings.

As the relevance of this study, one can highlight the use of validated questionnaires to assess pain and quality of life, the follow-up performed with three interviews in the postoperative period, delimiting the short-term postoperative follow-up, as well as the execution in the reference service of the region.

CONCLUSION

The persistence of postoperative pain had an unfavorable impact on the quality of life after hospital discharge in the short term, especially in the psychological domain. The correct management of post-sternotomy pain in the ICU is necessary to relieve the patient's discomfort during hospitalization, minimize clinical complications associated with pain, and improve the quality of life in out-of-hospital follow-up.

AUTHORS' CONTRIBUTIONS

LBRV: Conceptualization, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **EJSGO:** Data curation, Formal Analysis, Writing – original draft, Writing – review & editing. **CMBO:** Conceptualization, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **ECRM:** Conceptualization, Writing – original draft, Writing – review & editing. **LHLV:** Conceptualization, Investigation, Methodology, Supervision, Validation, Visualization, Writing – review & editing. **VJSN:** Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **EF:** Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **PCL:** Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing.

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