

Assess the Severity of Pain among Patients Post Cardiac Surgery

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Abstract

Background: Pain following cardiac surgery is a multifaceted phenomenon resulting from a number of mechanisms. High-levels of post-operative pain are associated with cardiovascular and respiratory complications and adequate pain management is crucial for enabling fast recovery. **Aim of the study:** Assess the severity of pain among patients post cardiac surgery **Design:** A descriptive design was used in carrying out the study. **Setting:** The study was conducted Al-Hayat Hospital El- Fayoum in the Open Heart Surgery Intensive Care Unit. **Subjects:** A purposive sample of newly admitted adult post cardiac surgery patients to open heart surgery intensive care unit. **Tools:** structured interview questionnaire and Subjective and objective Pain Assessment Scale. **Result:** this study represent 85.0% had abnormal physiological indicators of pain and more than half 55.0% had sever critical pain manifestation among patients post cardiac surgery . **Conclusion:** it can be concluded that, cardiac surgery patients suffered from severe pain during coughing, deep breathing exercise, incentive spirometry and mobility . **Recommendation:** it's recommended for design different nursing interventions protocol to reducing the severity of pain among post cardiac surgery patients.

Key words : Assessment, Cardiac surgery , Severity of pain.

Introduction:

Based on *Cani et al., (2019)* the leading cause of death worldwide is cardiovascular disease, according to the World Health Organization (WHO), predominating in elderly patients. The treatment for these diseases is through surgery, the vast majority being performed by the Unified Health System, medications, changes in eating habits and physical activity. Surgery is a safe procedure for the treatment of coronary artery disease (CAD), as it can be performed in elderly, diabetic patients with low left ventricular ejection fraction. This procedure controls persistent ischemia and the evolution of acute myocardial infarction, relieving symptoms and preventing ischemic complications .

According to *Beccaria et al.,(2020)* in Brazil, the prevalence of cardiac surgeries has been increasing every year, the most common being myocardial revascularization and valve replacement, and several studies have shown that both are the best way to treat coronary insufficiency. In 2015 there were 91,738 deaths, an average of 7,645 deaths per month and in 2016 there were 45,900 deaths an average of 7,650 per month, an increase of 0.7%.

According to *Kang& Brennan (2022)* management of acute postoperative pain is an essential component of perioperative patient care. Good pain control after surgery is important to facilitate overall recovery, improve patient satisfaction, and reduce health care cost. Effective post-operative pain management is also likely to decrease morbidity and improve functional outcome. Moreover, severe acute post-operative pain is a risk factor for chronic post-surgical pain, raising more awareness regarding the importance of adequate perioperative pain management, despite heightened awareness and clinical advancements in pain management post-operative pain continues to be significant clinical problem.

Aim of the study

The aim of this study to assess the severity of pain among patients post cardiac surgery through:

- Assess the level of pain during coughing exercise, deep breathing exercise, incentive spirometer and mobility for post cardiac surgery patients.

Significance of the study

According to *Ali (2019)* the cardiovascular disease is responsible for 17.7 million people every year which constitutes 31% of all global deaths. Worldwide 80% of all CVD cases occur in developing countries. In Egypt (CVDs) mortality according to the latest WHO data published in 2017 reached 126.312 or 24. 58% of total deaths. Post cardiac surgery acute pain which is not relieved can lead to physical and psychological distress that can leave negative effect on the prognosis and outcome of the disease and the surgery.

Subject and methods

Research design: A descriptive research design was used in this study.

Setting of the study: The study was conducted Al-Hayat Hospital El- Fayoum in the Open Heart Surgery Intensive Care Unit.

Subject: A purposive sample 60 of newly admitted adult post cardiac surgery patients to open heart surgery intensive care unit and accepted to participate in the study were included.

Exclusive criteria:

- Hemodynamically unstable such as (hypotension, tachycardia and Bradycardia).
- Diabetic patient.
- Postoperative cardiac complications such as bleeding.

Tools of data collection:

1st tool: structured interview questionnaire was designed by the researcher to the following data.

Part (1): Demographic characteristics which contained: age, gender, level of education, marital status, occupation, smoking history, physical activity and overweight.

Part (2): Assess the past, surgical and medical history questionnaire and any psychological features e.g. depression and anxiety

2nd Tool: Subjective and objective Pain Assessment Scale used to assess subjective and objective components of pain. This part consists of four parts:

Part one namely (pain intensity scale):

Pain intensity scale; it was adopted from MaCaffery (1982). This scale consists of 10 points numerical scale with “0” representing no pain, “1-3” representing mild pain, “4-6” representing moderate pain, “7-9” representing severe pain and “10” representing unbearable pain.

Scoring system: The scores were distributed as 0 for no pain, 1-3 for mild pain, 4-6 for moderate pain 7-9 for severe pain and 10 for unbearable pain.

- < 50.0% was considered mild pain.
- 50.0% -70.0% was considered moderate pain.
- 70.0% was considered sever pain

Part two namely (physiological indicators of pain):

It was developed by the re searcher after reviewing the relevant literature (Nesbitt et al., 2012). It included heart rate (HR) in beats/min, pulse strength, mean arterial pressure (MAP) in mmHg, respiratory rate (RR) in breath/min, temperature in °C, pupils' assessment, perspiration and SPO2.

Scoring system: The scores were distributed as 0 for abnormal and (1) for normal.

Part three namely critical care pain observation tool (CPOT).

It was adopted from Gelinis et al. (2006) to assess behavioral indicators of pain. It is composed of four behavioral indicators of pain. The first behavioral indicator namely facial expression, a score of “0” was marked when there is no muscle tension, a score of “1” was marked when there is tense facial muscles and a score of “2” was marked when grimacing with tense facial muscles. The second behavioral indicator namely body movements, a score of “0” was marked when there is absence of movements, a score of “1” was marked when there is protective movements and a score of “2” was marked when there is restlessness or agitation. The third behavioral indicator; namely muscle tension in upper extremities, a score of “0” was marked when relaxed muscle, a score of “1” was marked when there is tense or rigid muscle and a score of “2” was marked when there is very tense muscle. The fourth indicator; namely vocalization, a score of “0” was marked when there is no sound or the patient talking in the normal voice tone, a score of “1” was marked when there is sighing or moaning sound and a score of “2” was marked when there is crying out or sobbing sound. The total score of CPOT are eight points.

Scoring system: The scores were distributed as (0) for mild pain and (1) for moderate pain and (2) for severe pain.

- < 50.0% was considered mild pain.
- 50.0% -70.0% was considered moderate pain.
- > 70.0% was considered sever pain

Part four namely (Self report of pain Scale).

It was developed by the researcher after reviewing the relevant literature (Elcokany, 2008) self-report of pain regarding pain characteristics such as onset, radiation, location, quality, frequency, and duration.

Validity and reliability:

Validity of tools was done by five experts to check the relevance, clarity, comprehensiveness and applicability of the questions. According to their opinions, modifications were done and the final form was developed. Face and content validation of the studied tools were according to opinions of the experts.

Tools of data collection were test to face validity of content, by five professions and experts, one assistant professor of Medical and Surgical Nursing Department in Faculty of Nursing at Al-Fayoum University, one assistant professor of Adult Health Nursing at Faculty of Nursing at Helwan University and three lectures in Critical and Emergency Nursing Department at Helwan University.

The reliability of developed tools was estimated using the Chronbach's alpha test to measure the internal consistency of the tools; it was found that the reliability questionnaire using Chronbach's alpha equation as illustrated in the following table:

Tool	No	Chronbachs Alpha
Pain intensity scale	4	0,843
Critical pain observation tool	4	0,833
Physiological indicator of pain	8	0,843

Ethical and legal consideration:

- The research approval was obtained from the ethical committee before starting the study.
- The researcher clarified the objective and aim of the study to patients included in the study.
- The researcher assured maintaining anonymity and confidentiality of patients' data.
- Patients were informed that they were allowed to choose to participate, and they had the right to withdraw from the study at any time without giving any reason.
- The patients (oral and written consent approval was obtained from them to participate in this study.

Pilot study:

It was carried out on 10 % of the studied patients. A pilot study was conducted before performing the application on group (6) patients in order to test for clarity and applicability of the study tools. Required modifications were done in the form of adding or omission of some questions. Patients involved in the pilot study were excluded from the main study subjects.

Field work:

The actual process of data collection for this study was carried out period from March to July 2020 and divided into two phases, first phase the researcher asked the patients about demographic characteristic and medical history then, educated the patient how to demonstrate the four procedural pains (coughing exercise, incentive spirometer, deep breathing exercise and mobilization). Second phase The researcher asked the patient to make four procedural pains then, the researcher made pain assessment after each procedure by using tool number II then, gave the patient approximately 15 minutes as a rest time between each procedure (each procedure was done three times).

Statistical analysis

Data were presented in the form of tables and figures using the Statistical Package for Social Sciences version 21.0 (SPSS). Qualitative variables were presented in the form of frequencies and percentages and quantitative variables were presented in the form mean and SD. Test of significance was used to find out associations between study variables. Chi-square (χ^2) test of significance was used in order to compare proportions between two qualitative parameters. Spearman's rank correlation coefficient (r) was used to assess the correlation between two variables. The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:

- P value $\leq 0.05^*$ was considered significant.
- P value $\leq 0.001^{**}$ was considered as highly significant
- P value > 0.05 was considered insignificant.

Results:

Table (1): Distribution of studied patients according to their demographic characteristics (n=60).

Demographic Characteristics	No	%
Age		
<20	4	6.7
20<40	26	43.3
40<60	30	50.0
Mean=39 SD=11.578		
Gender		
Male	34	56.7
Female	26	43.3
Occupation		
Working	52	86.7
Not working	8	13.3
Work Nature		
Manual	32	53.3
Administrative	28	46.7
Change of work nature after disease		
Yes	44	73.3
No	16	26.7
Educational level		
Non educated	30	50.0
Educated	30	50.0

Table (1): illustrates that half of studied patients (50.0%) aged from 40 to <60 years with a mean age (39 ±11.578) years old and non-educated respectively. Moreover, more than half (56.7%) were male, regarding working condition the study shows that, the majority (86.7%) were working, nearly three quarters of them (73.3%) changed their work nature after disease.

Table (2): Distribution of studied patients according to their operative history (n=60).

Patient history	No	%
Pre-operative ejection fraction		
>50%	35	58.4
≤50%	25	41.6
Onset of signs and symptoms of cardiac problem		
<3 years	50	83.3
3-5 years	8	13.3
5-7 years	0	0.0
>7years	2	3.3
Signs and symptoms of cardiac problem (number not mutually exclusive)		
Chest pain	18	30.0
Difficult breathing	20	33.3
Nauseas	8	13.3
Fatigue	50	83.3
Type of present cardiac surgery		
CAPG	40	66.6
Valve surgery	20	33.3
Duration of chest tube		
<48 hrs	60	100.0
Duration of MV weaning		
<6hrs	50	83.3
6-24 hrs	10	16.7
Length of ICU stay		
<72 hrs	60	100.0

Table (2): illustrates that more two fifth of studied patients (41,6%) had pre- operative ejection friction <50.0%. This table also shows that the majority of patients (83.3%) had disease onset <3 years ago and weaned off mechanical ventilator < 6 hrs respectively, this table also illustrated the majority of them had fatigue as a sign of cardiac problem (83.3%),also illustrated two thirds had

Table (3): Distribution of studied patients according to their pain intensity during coughing, mobility, breathing and use of spirometry (n=60)

Pain intensity	Pre								X ²	P value
	No Pain		Mild		Moderate		Sever pain			
	No	%	No	%	No	%	No	%		
Coughing	10	16.7	8	13.3	18	30	24	40	49.097	0.000**
Mobility	4	6.7	10	16.7	26	43.3	20	33.3	35.116	0.000**
Breathing	8	13.3	10	16.7	20	33.3	22	36.7	52.526	0.000**
Spirometry	10	16.7	10	16.7	18	30	22	36.7	46.726	0.000**

Table (3): illustrates that there was a highly statistically significant of pain intensity during coughing, mobility, breathing and use of spirometry (p = 0.000**).

Figure (1): Distribution of studied patients according to their total critical pain manifestations level (n=60).

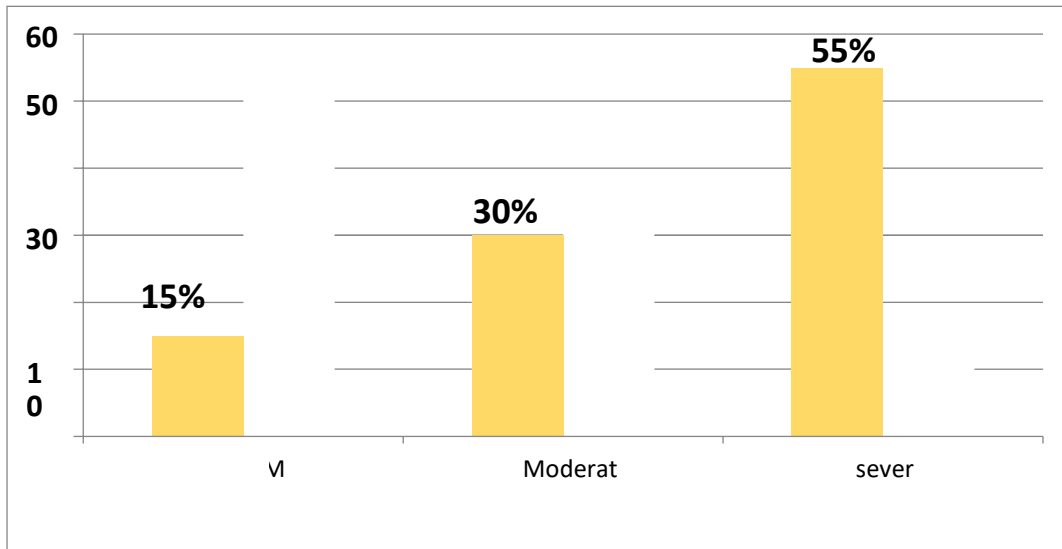


Figure (1): illustrates that the minority of studied patients (15.0%) had a mild total critical pain manifestations. In addition, more than half of them (55.0%) had severe critical pain manifestations.

Figure (2): Distribution of studied patients according to their total physiological pain indicator level (n=60).

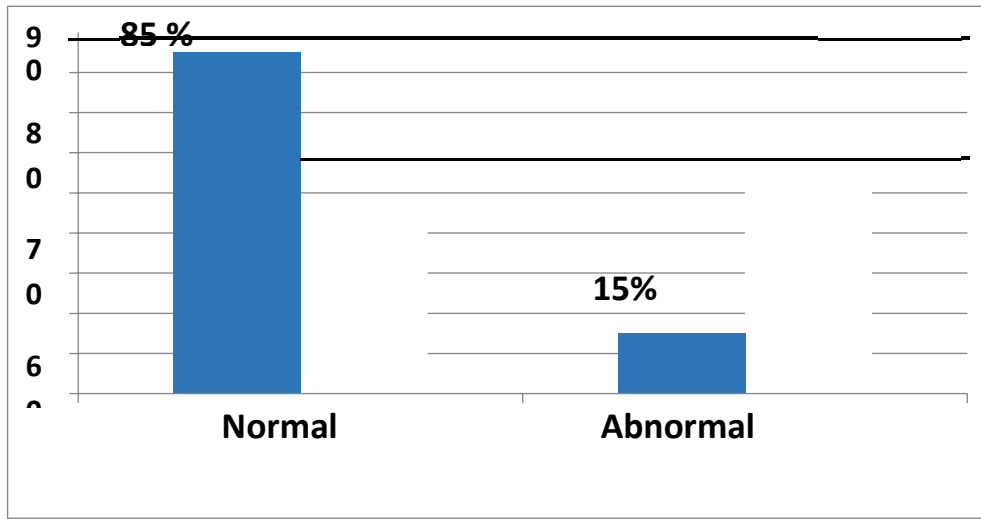


Figure (2): illustrates that the majority of studied patients (85.0%) had abnormal physiological. However, the minority of them (15.0%) had normal physiological indicators.

Table (4): Relation between patients' demographic characteristics & their total pain intensity (n=60).

	Mild		Moderate		Sever	
	No	%	No	%	No	%
Age						
<20	0	0.0	2	7.1	2	10.0
20<40	8	66.7	12	42.9	6	30.0
40<60	4	33.3	14	50.0	12	60.0
Chi & p value			4.539		0.338	
Gender						
Male	6	50.0	14	50.0	14	70.0
Female	6	50.0	14	50.0	6	30.0
Chi & p value			2.172		0338	
Occupation						
Working	10	83.3	24	85.7	18	90.0
Not working	2	16.7	4	14.3	2	10.0
Chi & p value			0.330		0.848	
Work nature						
Manual	0	0.0	20	71.4	12	60.0
Administrative	12	100.0	8	28.6	8	40.0
Chi & p value			17.755		0.000**	
Change in work nature						
Yes	4	33.3	24	85.7	16	80.0
No	8	66.7	4	14.3	4	20.0
Chi & p value			12.468		0.001**	
Eduactional level						
Non educated	6	50.0	14	50.0	10	50.0

Educated	6	50.0	14	50.0	10	50.0
Chi & p value value	0.00		1.000			

Table (4): illustrates that there was no statistically significant relation between total pain intensity level and all items of patients' demographic characteristics except for items related to (working nature and change in work nature) there was a highly statistically significant relation ($p \leq 0.001^{**}$).

Discussion:

Regarding to patients Age, the findings of the present study illustrated that half of studied patients aged from 40 to < 60 years with mean =39. **This may be due to that** age-related intrinsic changes in cardiac morphology and may be expected to worsen cardiac performance and lead to cardiac surgery. As evidenced by basic assessment and supported by *Heidari et al., (2022)* whose study is entitled (Patient-specific finite element analysis of heart failure and the impact of surgical intervention in pulmonary hypertension secondary to mitral valve disease) and *Riffel et al., (2021)* whose study is entitled (Age-and gender-related reference values of cardiac morphology and function in cardiovascular magnetic resonance), the stiffness of the left ventricle is known to increase with age and the cardiac morphology and physiology affected with the age.

Regarding to patients **gender,** the findings of the present study showed that more than half of them were male patients. **This may be due to that most of** males are smokers and lead to cardiac disease and can lead to cardiac surgery. As evidenced by basic assessment and supported by *Ma et al., (2020)* whose study is entitled (China cardiovascular diseases report 2018: an updated summary) and *Dziedzic et al., (2022)* whose study is entitled (Small Differences in Vitamin D Levels between Male Cardiac Patients in Different Stages of Coronary Artery Disease); they reported that the smoking was good risk factor between male patients for cardiac surgery.

Regarding the **working condition,** the present study showed that the majority of them were working. **This could be a result** of that minor stress can trigger heart problems like poor blood flow to the heart muscle. This is a condition in which the heart doesn't get enough blood or oxygen. As evidenced by basic assessment and supported by *Upadhyay (2022)* whose study is entitled (Chronic Non-communicable Diseases: Risk Factors, Disease Burden, Mortalities and Control) and *Challoob (2022)* whose study is entitled (Relationship between Omentin-1 and Oxidative Stress in Myocardial Infarction Patients) who showed that the minor working stress can lead to cardiac problems and affected on the oxygen and blood flow level.

Regarding to **changing of working nature after disease,** the present study showed the nearly three quarter of them changed their work nature after disease; **this may be due to that** These work stressors can produce chronic biologic arousal and promote unhealthy behaviors and thus, increased CVD risk. As evidence by basic assessment and supported by *Rudolph et al., (2022)* whose study is entitled (Biological embedding of peer experiences: The contribution of peer adversity to stress regulation) and *Stoney et al., (2022)* whose study is entitled (Integration of implementation science in cardiovascular behavioral medicine) who reported that job stressors can produce chronic biologic arousal and increased CVD risk.

Regarding the patients' **education,** the present study that showed half of them were educated, **this may be due to that** improving knowledge and skills in order to influence the attitudes and behaviour are required to maintain or improve health or health style and improve the co-operation during implamentation of the intervention. As evidence by basic assessment and supported by *Cestari et al., (2022)* whose study is entitled (Requirements for building educational and care technology on heart failure) who showed that the the education had positive influence on health condition for cardiac patients.

Regarding **pre- operative ejection fraction** the present study illustrated that more than two fifth had pre-operative ejection fraction <50%, **this may be due to that ejection fraction** can be a way of assessing the status and progression of heart failure over time, as well as a way to track the benefits of various heart failure treatments. As

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evidence by basic assessment and supported by *Das et al., (2022)* whose study is entitled (Heart Failure with Preserved Ejection Fraction in Children) and *Çamc & Yılmaz, (2022)* whose study is entitled (Effects of Sodium-Glucose Co-Transporter-2 Inhibition on Pulmonary Arterial Stiffness and Right Ventricular Function in Heart Failure with Reduced Ejection Fraction) who reported that the ejection fraction is away to assess stage of heart failure.

Regarding the **onset of signs and symptoms of cardiac problem**, the present study illustrated the majority of the signs and symptoms of cardiac disease occurs less than 3 years, **this may be due to that** it is related to different patients tolerance. As evidence by basic assessment and supported by *Chowdhury et al., (2022)* whose study is entitled (Return to activity after SARS-CoV-2 infection: cardiac clearance for children and adolescents) who reported that onset cardiac signs and symptoms, A more gradual approach may be necessary depending on patient tolerance.

Regarding to **the signs and symptoms of cardiac problem**, the present study showed the majority of them had fatigue; **this may be due to that** fatigue and psychophysiological reactions to mental stress are known to be problematic in coronary artery disease (CAD) patients. As evidence by basic assessment and supported by *Gecaite-Stonciene et al., (2021)* whose study is entitled (Fatigue is Associated with Diminished Cardiovascular Response to Anticipatory Stress in Patients with Coronary Artery Disease) who reported that Fatigue and psychophysiological reactions to mental stress are known to be problematic in coronary artery disease (CAD) patients.

Regarding **type of present cardiac surgery** the present study showed more than two third of them had CABG; **this may be due to that** blockages in any of the coronary arteries cause a corresponding defect in myocardial perfusion, ischemia and if unrepaired can lead to permanent infarct or damage to the myocardium. As evidence by basic assessment and supported by *Wang et al., (2021)* whose study is entitled (Three-year clinical outcome of unprotected left main coronary artery disease patients complicated with chronic kidney disease treated by coronary artery bypass graft versus percutaneous coronary intervention) who reported that any blockage of the coronary arteries can cause a corresponding defect in myocardial perfusion.

Regarding **duration of Chest tube** the present study showed all the studied patients had removed less than 48hr, **this may be due to that** in cases where no excessive drainage accumulates, early removal of the chest tubes was found to be a policy that improves the postoperative outcome and decreases the need for supportive treatment such as analgesics, physiotherapy, nurse care, and oxygen. As evidence by basic assessment and supported by *Adil et al., (2021)* whose study is entitled (Image-guided chest tube drainage in the management of chylothorax post cardiac surgery in children) who reported that chest tube removal done if no excessive drainage accumulates.

Regarding to **duration of mechanical ventilation weaning**, the present study showed the majority of them had weaned through less than 6 hr, **this may be due to that** stabilization with this time and the prolonged mechanical ventilation has been demonstrated to be associated with increased hospital and intensive care unit (ICU) lengths of stay, higher health care costs and morbidity resulting from atelectasis, intrapulmonary shunting, and pneumonia. As evidence by basic assessment and supported by *Na et al., (2022)* whose study is entitled (Factors associated with prolonged weaning from mechanical ventilation in medical patients) who showed that Prolonged mechanical ventilation has been demonstrated to be associated with increased hospital and intensive care unit (ICU) lengths of stay, higher health care costs and hospital mortality.

Regarding to **length of ICU stay**, the present study illustrated the all patients stay in the ICU less than 72hr, **this may be due to that** stabilization of the patients at this time and the Prolonged ICU stays are associated with lower survival rates, as well as reduced quality of life, They also lead to increased hospital costs and reduced ICU bed availability. As evidence by basic assessment and supported by *Diab et al., (2018)* whose study is entitled (The influence of prolonged intensive care stay on quality of life, recovery and clinical outcomes following cardiac surgery) who reported that Prolonged ICU stays are associated with lower survival rates, as well as reduced quality of life.

Regarding to **their pain intensity scale, critical observation pain scale, physiological indicator scale and pain self-report** the currant study noted the level of pain was sever post cardiac surgery during coughing , mobility, breathing exercise & use incentive spirometry also this could be due to surgery and the procedural pain this agreement with *Mekdad, A. K. (2022)* whose study in titled (The Effect of Nursing

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Intervention on the Reduction of Pulmonary Complications after Thoracotomy) who reported Postoperative pulmonary complications are a common occurrence after major cardiac and thoracic surgeries because the effect of surgical procedures, anesthesia, and pain can impede chest wall movement and lung expansion.

Regarding to **relation between patients demographic characteristics & their total pain intensity**, the current study shows no statistically significant relation between total pain intensity level and all items of patients' demographic characteristics except for items related to (working nature and change in work nature) there was a highly statistically significant relation, **this could be as a result** of that as patients' age increases their pain tolerance decreases also male patients had greater pain tolerance than female patients.

As evidence by basic assessment and supported by **Ertürk & Ünlü (2018)** whose study is titled (Effects of pre-operative individualized education on anxiety and pain severity in patients following open-heart surgery) who reported that women have less tolerance for pain and expressed it more than male patients.

Conclusion:

In the light of the current study results, it can be concluded that, the mean age of the studied patients was 39 years, and half of them aged from 40 to <60, more than half of them were male, and majority of them were working, and three quarters of them were overweight, and majority of them had fatigue as a sign and symptoms of cardiac problem. Additionally, there was highly statistical significance of severe pain post cardiac surgery, there is a need for special attention regarding non-pharmacological treatment to obtain optimum level of pain care.

Recommendation:

- Special attention and Further studies are needed to confirm the impacts of the non-pharmacological therapy e.g (cold therapy) on the severity of pain.
- Further studies should compare the effect of different modes of cold application after cardiac surgery (e.g., ice pack, ice towel, ice massage, and ice chip) on incisional pain associated with the use of incentive spirometry, mobility, deep breathing exercise and coughing.
- Increase medical staff awareness regarding importance of non-pharmacological therapy and its impact on the pain severity.

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