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# Evaluation of pain intensity and vital signs in the cardiac surgery postoperative period\*

AVALIAÇÃO DA INTENSIDADE DE DOR E SINAIS VITAIS NO PÓS-OPERATÓRIO DE CIRURGIA CARDÍACA

EVALUACIÓN DE LA INTENSIDAD DEL DOLOR Y SIGNOS VITALES EN EL POST OPERATORIO DE CIRUGÍA CARDÍACA

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## ABSTRACT

The objective of this study is to analyze the changes in vital signs of postoperative cardiac surgery patients, according to the referred pain intensity. This descriptive-exploratory study was performed using quantitative analysis to investigate 38 patients submitted to a first dressing change. The analysis of the data, measured before and after performing the nursing procedure, indicated that the manifestation of pain occurred at different levels. The main changes in vital signs referred to blood pressure. In conclusion, there is a relationship between pain intensity and vital signs, and the care that is delivered is indispensable to reestablishing the health state of the postoperative patient.

## DESCRIPTORS

Pain  
Thoracic surgery  
Pain measurement  
Vital signs  
Nursing care

## RESUMO

O objetivo do estudo é analisar as alterações nos sinais vitais de pacientes em pós-operatório de cirurgias cardíacas, mediante intensidade de dor referida. Trata-se de estudo descritivo-exploratório, que utilizou o método de análise quantitativa na investigação de 38 pacientes submetidos à primeira renovação de curativos. A análise dos dados, mensurados antes e após a realização do procedimento de enfermagem, indicaram que a manifestação da dor ocorreu em diferentes classificações. As principais alterações nos sinais vitais ocorreram na pressão arterial. Concluiu-se que a intensidade dolorosa mantém relações com os resultados dos sinais vitais e o cuidado prestado é imprescindível ao restabelecimento do estado de saúde do paciente no pós-operatório.

## DESCRIPTORES

Dor  
Cirurgia torácica  
Medição da dor  
Sinais vitais  
Cuidados de enfermagem

## RESUMEN

El objetivo del estudio es analizar las alteraciones en signos vitales de pacientes en post operatorio de cirugías cardíacas, mediante intensidad de dolor referida. Se trata de un estudio descriptivo-exploratorio, que utilizó el método de análisis cuantitativo en la investigación de 38 pacientes sometidos al primer cambio de curativos. El análisis de los datos, medidos antes y después del procedimiento de enfermería, indicó que la manifestación de dolor ocurrió en diferentes clasificaciones. Las principales alteraciones en los signos vitales ocurrieron en la presión arterial. Se concluyó en que la intensidad dolorosa mantiene relación con los resultados de los signos vitales y el cuidado prestado es imprescindible para el restablecimiento del estado de salud del paciente en el post operatorio.

## DESCRIPTORES

Dolor  
Cirugía torácica  
Dimensión del dolor  
Signos vitales  
Atención de enfermería

\* Taken from the thesis "Assessment of pain intensity and vital signs: reactions to a nursing procedure", Universidade Estadual do Ceará, 2009. <sup>1</sup> RN. M.Sc. in Clinical Care and Health, Universidade Estadual do Ceará. Fortaleza, CE, Brazil. adrianafamiranda2@yahoo.com.br <sup>2</sup> RN. Ph.D. in Nursing. Faculty at Universidade Estadual do Ceará. Nurse at Hospital de Messejana Dr. Carlos Alberto Studart Gomes. Fortaleza, CE, Brazil. luciadeafatima@hm.ce.gov.br <sup>3</sup> RN. Ph.D. in Nursing. Faculty at Universidade Federal do Ceará. joselany@unifor.br <sup>4</sup> RN. Ph.D. in Nursing. Faculty at Universidade Estadual do Ceará. Fortaleza, CE, Brazil. claudia\_leite2012@hotmail.com <sup>5</sup> Statistician. Ph.D. in Public Health. Faculty at Universidade Estadual do Ceará. Fortaleza, CE, Brazil. pc49almeida@gmail.com

## INTRODUCTION

In the postoperative (PO) period, different organic alterations affect patients, due to their exposure to the effects of the surgery on tissue. Pain is one of these main manifestations, and is considered a determinant of the clinical condition imposed by the surgical procedure.

Pain is an unpleasant sensory and emotional experience, associated with actual or potential tissue damage and described in terms of this damage<sup>(1)</sup>. This definition is used by different studies in the area and also in this research.

Acute postoperative pain, due to acute tissue lesions, entails modifications in quality of life, which can impair health and cause physiological alterations that, if not solved, result in organic and psychological problems that will negatively influence lifestyles and associated comorbidities<sup>(2)</sup>.

Pain symptoms negatively affect patients' postoperative pain evolution, causing functional and organic damage and reflecting in difficulties for patients to reestablish their adequate vital parameters, such as breathing, thermal and cardio-circulatory capacity, to the detriment of surgical problems.

The main causes of postoperative pain include the surgical incision, tissue traumas, tracheal and chest tubes, besides different invasive procedures that are part of the adopted therapeutics<sup>(3)</sup>.

Clients' complaints should be assessed to identify the repercussions of PO pain and a physical assessment should be made to identify biological alterations. The obtained results provide clinical analysis data that, when measured and observed, provide an assessment of the symptom.

In combination with these manifestations, vital signs are important to direct pain sensitivity as, in case of pain, blood pressure, respiratory and cardiac frequencies are modified, and significant influences on body temperature can occur<sup>(4)</sup>. Thus, patients' postoperative exposure to pain provokes alterations in parametric biological data, demanding further research on the associations between pain intensity and its effects on modifications in vital signs.

Hence, in case of pain, manifestations in vital signs should be investigated, with a view to minimizing discrepancies between those resulting from pain or from post-surgical complications.

## OBJECTIVE

To analyze alterations in patients' vital signs in the postoperative phase of cardiac surgery, through referred pain intensity.

## METHOD

A descriptive and exploratory study was carried out at an Intensive Care Unit (ICU) in the postoperative phase of cardiac surgeries at a state hospital in Fortaleza-CE, Brazil. Data were collected in August and September 2008 and quantitative analysis was used to examine patients aged 18 years or older, submitted to the first PO dressing change. Authorization for the research was obtained from the Institutional Review Board of *Hospital Dr. Carlos Alberto Studart Gomes* (protocol CEP/ HM 519/08), in Fortaleza-CE, 2008.

Initially, 65 patients in the preoperative phase of elective surgeries were contacted, find out about the study objectives and were trained about pain classification, according to the numerical-verbal scale, which scores pain from zero to 10, so as to classify its intensity as absent (zero), mild (1 to 3), moderate (4 to 6), intense (7 to 9) and unbearable (10)<sup>(1)</sup>.

When they agreed to participate, patients signed the informed consent term. Thirty-eight of these patients were part of data collection as they complied with the established inclusion criteria: they should be conscious, oriented and able to verbally express themselves during postoperative pain and vital signs assessment, going through a first postoperative cardiac surgery experience and with surgical access through median sternotomy.

Male and female patients participated, with a mean age of 49.5 years, submitted to heart surgeries, grouped as coronary artery bypass graft, correction of cardiac myxoma, valve correction and correction of congenital defects, with or without extracorporeal circulation (ECC).

Patients were assessed in the immediate PO period (until 48 hours after the end of the surgical procedure) at two times: before and after the first surgical dressing change, performed by nurses from the hospital unit where the research took place.

Before changing the dressings, pain was classified, using criteria from the numerical-verbal pain assessment scale, and the following vital signs were checked: systolic blood pressure (SBP), diastolic blood pressure (DBP), cardiac frequency (CF), respiratory frequency (RF) and body temperature (T). At the end of the nursing procedure, the same evaluation steps were repeated and registered on a form developed for the study.

The collected data were processed in SPSS version 14.0, and later analyzed with the Fisher-Freeman-Halton and Maximum likelihood tests. Statistical significance was set at  $p < 0.05$ . The findings were organized in tables, in addition to descriptive and inferential analysis.

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## RESULTS

Thirty-eight patients participated in the study, 60.5% of whom were men. The most prevalent age group (47.4%) was 60 years or older. Half of the population suffered from Diabetes mellitus (DM) and/or systemic arterial hyperten-

sion (SAH) and the paramount surgical diagnosis was coronary artery bypass graft (68.4%). The most frequent duration of surgery ranged between two and less than four hours in 63.1% of cases and most patients (92.1%) were in the first 24 hours after surgery.

**Table 1** - Patient distribution according to characteristics, clinical-surgical data and pain intensity - Fortaleza - 2008

CHARACTERISTICS	f	%		
<b>Gender</b>				
Male	23	60.5		
Female	15	39.5		
<b>Age</b>				
18 –  45	8	21.0		
45 –  60	12	31.6		
≥60	18	47.4		
<b>CLINICAL-SURGICAL DATA</b>				
<b>Associated comorbidities</b>				
None	19	50.0		
DM and/or SAH	19	50.0		
<b>Surgical diagnosis</b>				
Coronary artery bypass graft	26	68.4		
Others	12	31.6		
<b>Duration of surgery (in hours)</b>				
2 –  4	24	63.1		
≥4	14	36.9		
<b>Postoperative time (in hours)</b>				
13 –  24	35	92.1		
≥ 24	3	7.9		
<b>PAIN INTENSITY</b>	<i>f</i>	%		
	BEFORE	AFTER	BEFORE	AFTER
Zero (absent)	9	8	23.7	21.0
1 to 3 (mild)	15	17	39.5	44.8
4 to 6 (moderate)	9	10	23.7	26.3
7 to 9 (intense)	4	3	10.5	7.9
10 (unbearable)	1	-	2.6	-
<b>TOTAL</b>	<b>38</b>		<b>100.0</b>	

(n=38)

Regarding pain intensity, the assessment of this phenomenon before dressing change resulted in a different classification at both times, particularly for the perception of unbearable pain, which one single participant reported before the procedure, but was not observed after nursing care delivery.

When relating pain intensity reactions with vital sign measurements, it is observed that, before the dressing changes, among 27 patients with SBP below 130 mmHg, 11 perceived mild and nine moderate to unbearable pain intensity. Out of eight people with SBP levels considered as mild to moderate systolic arterial hypertension, the strongest pain intensity was found in the moderate to unbear-

able pain classification ( $p = 0.471$ ). After the dressing changes, SBP values demonstrated that levels below 130 mmHg were associated with mild pain manifestations in 14 patients and moderate to unbearable manifestations in nine people. The most suggestive variations occurred in SBP values between 130 and 140 mmHg, where three patients mentioned moderate to unbearable pain intensity ( $p = 0.602$ ) after the dressing change.

As for DBP before the dressing change, out of 32 patients with excellent/normal DBP, 14 presented mild pain. Half of the four patients with mild diastolic hypertension presented moderate to unbearable pain. An association was identified between DBP and pain before the dressing change ( $p = 0.005$ ).

**Table 2** - Distribution of patient numbers according to association between vital signs and pain variables before and after dressing change - Fortaleza - 2008

VITAL SIGNS	PAIN						P	
	Before			After			Before	After
	0 (Absent)	1 to 3 (Mild)	4 to 10 <sup>(1)</sup> (Moderate to unbearable)	0 (Absent)	1 to 3 (Mild)	4 to 10 <sup>(1)</sup> (Moderate to unbearable)		
<b>SBP</b>								
< 130 (Excellent/Normal)	7	11	9	8	14	9	0.471 <sup>(2)</sup>	0.602 <sup>(2)</sup>
130 –  140 (Borderline)	2	2	1	-	2	3		
140 –  179 (mild to moderate hypertension)	2	2	4	-	1	1		
<b>DBP</b>								
< 85 (Excellent/ normal)	8	14	10	8	16	12	0.005 <sup>(2)</sup>	0.999 <sup>(2)</sup>
85 –  90 (Borderline)	-	-	2	-	-	-		
90 –  99 (Mild hypertension)	1	1	2	-	1	1		
<b>RF</b>								
14 –  20	-	6	4	-	8	2	0.095 <sup>(2)</sup>	0.152 <sup>(3)</sup>
≥ 20	9	9	10	8	12	8		
<b>CF</b>								
60 –  100	8	12	12	7	14	12	0.786 <sup>(3)</sup>	0.211 <sup>(3)</sup>
≥ 100	1	3	2	1	4	-		

(n=38)

<sup>1</sup>Categories were combined for statistical test purposes; <sup>2</sup> Fisher-Freeman-Halton test; <sup>3</sup> Maximum Likelihood test.

After the end of the nursing procedure, excellent/normal DBP levels were found in 16 patients with mild pain. Eight patients with DBP below 85mmHg denied any pain ( $p=0.999$ ).

Respiratory frequency (RF) before the nursing procedure highlighted that, out of 28 patients with tachypnea, 10 felt moderate to unbearable pain, while nine patients in the same group did not mention any pain ( $p=0.095$ ).

At the end of the dressing change, respiratory frequencies showed that most participants' levels increased by 20 respiratory movements in 1 minute or more, that 12 patients experienced mild pain and that eight classified the symptom as moderate to unbearable. Among eupneic subjects, eight mentioned mild pain and two more intense pain. No absence of pain was found among the research subjects with physiological RF ( $p=0.152$ ).

Before the dressing change, cardiac frequency was kept at physiological levels in 32 patients. Twelve of them affirmed mild pain, 12 others moderate to intense pain and 8 did not complain of this symptom. Three ( $p=0.786$ ) out of six patients who experienced increased pulse rate presented mild pain complaints.

At the end of the dressing change, in most patients, cardiac frequencies remained at physiological levels (between 60 and 100 beats per minute). Fourteen of these patients classified their pain as mild and 12 as moderate to intense. In the same group, seven patients did not report pain. None of the five patients with increased pulse rate reported in-

tense pain. No association was found between CF and pain after the dressing change ( $p=0.211$ ).

Body temperature was classified as physiological when results varied between 35.8°C and 37.4°C (armpit measure), observed in all participants, without any modifications in these levels when the nursing intervention was accomplished.

## DISCUSSION

This research reveals that some clinical-surgical variables can affect the proposed associations between pain intensity and blood pressure, cardiac and respiratory frequency and body temperature.

Findings for these variables are in line with other related studies which, in a study of Diabetes Mellitus (DM) patients and the cardiovascular and neurological conditions of this comorbidity, reveal that they can cause autonomous cardiac alterations, leading to a reduction or even absence of pain in case of ischemic cardiac events<sup>(5)</sup>. The frequent association between Diabetes mellitus and arterial hypertension entails a great increase in cardiovascular risks<sup>(6)</sup>.

These comorbidities collaborate in the prevalence of cardiac events with surgical repercussions, particularly coronary artery bypass graft surgery. A recent study identified that 35% of patients submitted to this procedure had DM, making it difficult to reach a diagnosis based on the absence of pain manifestations indicating heart problems, which can interfere in pain assessment responses in the postoperative period<sup>(7)</sup>.

The prevalence of coronary artery bypass graft surgeries was important for a better approximation with pain classifications. Other pain assessment studies also highlighted this type of surgery and found no significant differences in reactions to pain in terms of different surgical diagnoses<sup>(3)</sup>. Pain intensity can also influence pulmonary function alterations in the postoperative period<sup>(8)</sup>. It can be affirmed that, when establishing physiological respiratory conditions, the chances that patients will feel more intense pain are minimized.

Pain results in respiratory, hemodynamic and metabolic changes, predisposing patients to probable unforeseen homeostatic events, causing greater energy and protein consumption and a decrease in ventilation volume. This contributed to the development of consequent relations between pain and vital signs, observed in this research<sup>(9)</sup>.

In pain interpretation, it should be emphasized that the subjective and multidimensional nature of pain entails difficulties regarding the determination and quality of the symptom in the postoperative period. Its assessment needs to be based on multidimensional considerations, facilitating its measurement and, thus, the indication of adequate treatment, with a view to validating the phenomenon's role in the patient's clinical situation<sup>(10)</sup>. Pain classification before and after dressing change showed little variation in these study results. It is noteworthy that patients who reported intense (10.5%) and unbearable pain (2.6%) before the dressing change had their pain intensity reduced through the procedure. Despite the small sample size, these variations served to identify the benefits of nursing care.

About the relations between pain intensity and vital signs in the postoperative period, few studies were found on the same theme as the present research, among which a study of patients submitted to cardiac surgery is highlighted<sup>(11)</sup>, which was important to conduct discussions on the findings regarding pain and vital signs.

When relating SBP with pain, the results were insufficient to confirm a significant association between the variables, although they demonstrated important modifications in pressure values depending on pain intensity, due to a significant reduction in pain classification after the dressing change (from six to two events), thus decreasing the number of people with SBP considered mild to moderate hypertension. It could be clarified that pain intensity interferes exactly in pressure levels, as pain was reduced and, consequently, SBP levels.

The relations between pain and BDP, analyzed before and after dressing changes, demonstrate that the non-association between diastolic pressure and pain classification after the procedure shows the relevance of accompanying both variables, so that the decrease in pain can satisfactorily affect the reduction of diastolic blood pressure levels.

These results are similar to the abovementioned study of patients submitted to cardiac surgery<sup>(11)</sup>. In that research,

it was observed that, in patients with pain complaints at the moment of the assessment, the mean rise in SBP was 14.2 mmHg. In patients who had felt pain within 24 hours before the assessment and those who had not felt pain in the last 24 hours, a discrete drop occurred (0.7 and 2.0 mmHg, respectively). The tests applied to the pain-related pressure levels, in the same study, did not confirm a significant difference in the comparison between the research groups.

In the same research<sup>(11)</sup>, diastolic BP levels in patients feeling pain showed a mean rise of 9.1 mmHg, against an increase by 3.4 mmHg in patients who had experienced pain in the last 24 hours and 2.3 mmHg in patients who did not mention pain.

The verification of RF after the dressing change demonstrated a significant decrease in pain intensity, which was more considerable in people with eupnoea criteria (RF 14 ; 20), but showed suggestive alterations in patients with tachypnea. The number of patients who did not feel pain after nursing care decreased (although by one only), emphasizing that pain intensity was a determining factor to indicate RF alterations.

Frequency changes in respiratory patterns were also observed in a comparative analysis, identifying that the number of respiratory movements increased in all patients who felt pain. Patients in pain showed an average increase of 6 respiratory movements/minute, against a mean increase by 3 movements/minute among patients who felt pain in the last 24 hours. Among patients who did not feel pain in the interval of up to 24 hours, the mean RF increased by 4 respiratory movements/minute<sup>(11)</sup>.

When associated with pain intensity, statistical test results did not confirm the association of cardiac frequency. In a comparative analysis, however, when confronting the levels of both variables before and after dressing changes, it is identified that, after the nursing procedure, the crossing between pain and CF approximate significance levels more closely than before the care delivery.

It is important to take into account that pain influences neuro-vegetative reactions and that, in combination with anxiety, pulse frequency, oxygen consumption and cardiac overload increase. Sinus tachycardia, with CF above 100 beats/minute, is a frequent complication in the postoperative period<sup>(12-13)</sup>.

In a study involving patients in the postoperative period of heart surgery<sup>(11)</sup>, research results were similar to the present research, with an increase by up to 17 beats/minute in patients who experienced pain within 24 hours after heart surgery, showing a significant relation with cardiac frequency in the three research groups when compared with the preoperative situation. This may suggest that CF is not a defining characteristic of pain.

These research findings show that increased CF did not suggestively modify pain reactions, although dressings, as



an intervention proposal, improved pulse frequency levels, collaborating in the maintenance and re-establishment of cardiovascular balance in the postoperative period of cardiac surgery.

Body temperature seemed to be the most resistant variable to modifications in pain intensity and to the execution of dressing changes in the immediate postoperative period, as no temperature modifications were perceived during the research. Thus, no parallels could be drawn between the increased painful reaction and consequent repercussions on body temperature, differing from other authors' assertions<sup>(4)</sup>. Nevertheless, the changes in the other vital signs were important to determine the pain dimension and its influences in the postoperative phase.

## CONCLUSION

Based on the associations between pain intensity and blood pressure, cardiac frequency, respiratory frequency and temperature levels, it could be identified that the non-association between the crossing of reactions was not determinant to confirm that pain intensity is related with changes in vital parameters. It was also observed that perceived alterations in vital signs, obtained through the nursing procedure, took forms that differed from pain classification patterns, turning pain manifestations into subjective experiences, based on the occurrence of the event in each patient under analysis. The dressing changes confirm the quality of nursing care to grant comfort to patients in the postoperative phase of cardiac surgery.

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