

Effect of Rhythmic Breathing Technique on Pain Level among Patients Undergoing Cardiac Catheterization

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Abstract

Background: Pain is common in critically ill patients, inadequate pain relief post cardiac catheterization delays recovery and lead to increased workload of heart and increased hospital stays. Rhythmic breathing is simple, low cost, non-invasive technique and effective in reducing the pain severity. **Aim of this study is** conducted to examine the effect of rhythmic breathing technique on the pain intensity of patient after cardiac catheter. **Design:** A quasi-experimental design was used. **Setting:** this study was conducted in cardiac catheterization unit at Beni-Suef University Hospital. **Sample:** A purposive sample of (90) patients undergoing cardiac catheterization. **Tools:** Three tools were used Assessment interview questionnaire sheet includes personal data, Numerical rating pain intensity scale, Critical Care Pain Observation Tool. **Results:** there was a high statistically significant effect of rhythmic breathing technique on the pain intensity among study group after cardiac catheterization. **Conclusion:** the study concluded that the use of rhythmic breathing techniques among study group is effective in reducing the pain intensity after cardiac catheterization. **Recommendation that** Training program should be applied for critical care nurses on rhythmic breathing technique and use them as a part of usual routine nursing care for patients after cardiac catheterization.

Key word: Pain, rhythmic breathing, catheterization.

Introduction

Cardiac catheterization is a procedure used to measure pressures in the heart and to visualize flow of blood via injected a dye into coronary arteries. (Keogh and Weaver, 2021).

Cardiac Catheterization is the most definitive but most invasive test in the diagnosis of heart disease is cardiac catheterization which include studies of the right or left side of the heart and the coronary arteries. (Ignatavicius, et al., 2020).

Cardiac catheterization is routine diagnostic procedure for patients with known or suspected heart disease. It is indications include myocardial ischemia, unstable angina, evolving myocardial infarction, heart failure with a history that suggests coronary artery disease or valvular heart disease, and congenital heart disease. It is used to confirm physical findings

and to provide a baseline for medical or surgical therapy. (Urden, et al., 2021).

The critical patients admitted to the critical care unit are exposure to various painful procedures, and about 75% report acute pain, 30% report pain at rest, and 50% report pain during nursing procedures. (Koffis, et al., 2017).

Pain is an unpleasant sensual and emotional experience connected with actual or potential tissue damage, it is a complicated phenomenon that can impact a person's psychosocial, emotional, and physical functioning. (Hinkle and Cheever, 2018).

The most common complaint of patients undergoing cardiac catheterization procedures is acute pain at the vascular access site or discomfort in the chest and lower back area due to bedrest, limited movement of the accessed limb, to the injury of vascular puncture itself,

back pain or headache, are also very common. (Hilário, et al., 2017).

Inappropriate pain relief may lead to hemodynamic consequences, with increased workload of heart and period of hospital stay and death rate in patients. So that the appropriate pain management is the patient's right. (Modanloo, et al., 2019).

Assessment of pain and management for patients in critical care unit is a daily challenge for the nurses. (Aljumah, et al., 2018). Inappropriate pain relief can raise sympathetic response which motivate cardiac work and increases myocardial oxygen consuming. So, patients with restricted cardiac reserve and ventricular dysfunction are not able to increase oxygen supply for keeping adequate balance between demand and supply of oxygen that leads to tissues deprivation of oxygen, changes in normal cell function and hemodynamic changes; therefore, lack of controlling pain can leave negative effects on individuals' health. (Taman, et al., 2018).

Relaxation therapy has been confirmed to provide pain relief by decreasing anxiety, diminishing muscle strain and distract attention. Much stress can raise pain as a result of working hormones in the body such as cortisol. While relaxation can increase the activity of the endorphin hormone which is very effective in relieving pain. (Ju , et al., 2019).

Relaxation techniques regulates the heart and breath rates and promotes the comfort of the body. It is proved that it will be very effective when it is done continuously. Rhythmic breathing technique is a relaxation technique, which is done in the same way as deep breathing exercise, but it is timed to the rhythm of one's heartbeat. It enhances oxygen supply, re-establishes and improves the body's own natural rhythm and can bring good change in both physical and mental state. Breathing as a technique of relaxation is directly linked with the autonomic nervous system which control physiological arouse of human being. (Subakeerthi and Moses. 2019).

Rhythmic breathing is simple, cheap, and acceptable method by patients because it is non-

invasive method used to relief pain. (Foji, et al., 2015).

Rhythmic breathing is distracting technique enable the patients intentionally distract themselves from a painful stimulus and thus help them to hold pain. Distraction is based on the concept that different and enough sensory stimuli, the reticular formation in the brainstem can select to block or neglect the transmission of this feelings as pain. (Hoseini, et al., 2019).

Moreover, Rhythmic breathing alleviate pain, anxiety, and stress by raising the activity of the parasympathetic nervous system through the vagus nerve and raising the restrained action of the Gamma- Aminobutyric Acid receptors in the brain pathways that are necessary to perception fear, emotional regulation, and stress response. (Mohammadpour, 2016).

Nurses play a very important role in pain assessment and define pain intensity and perform medical and non-medical treatment for these patients. (Kiavar, et al., 2016)

Significance of the study:-

In Egypt 2020 death from cardiovascular disease are estimated to account for 28% of all deaths according world health organization. (WHO, 2021)

Discover, determine and management of pain in critical ill patients have long been a concern of nurses. Nevertheless, pain is common in critically ill patients, despite of their condition, precise assessment using suitable equipment allows for the use of more useful therapeutic measures. (Pinheiro, et al., 2019)

Physiological reaction to pain may lead to harmful effects on the convalescence of the body after cardiac catheterization. Pain occurred after cardiac catheterization caused by tissue retraction and dissection, multiple intravascular cannulations and invasive procedures that patients undergo as part of their therapeutic regimen. (Hassan, et al., 2019).

Rhythmic breathing is a solution to increase the oxygen uptake available in cardiovascular patients. Performing this method of treatment by the nurse as the person who is most available to the patient and also as a person who has a professional and caring role in this field will help to operationalize the role of nurses in assisting patients in improving their condition through non-pharmacological methods. (Pouryousef, et al., 2021).

Aim of the study:

The current study is conducted to examine the effect of rhythmic breathing technique on the pain intensity of patient after cardiac catheterization.

Research Hypothesis:

Rhythmic breathing technique will decrease patient's pain post cardiac catheterization.

Methods

Research Design:

A quasi-experimental research design was used in this study.

Setting:

The study was conducted in cardiac catheterization unit at Beni-Suef University hospital.

Subject:

A purposive sample of (90) patients undergoing cardiac catheterization that randomly was divided into two groups within six months from the beginning of July 2021 till the end of December 2021. They were randomly assigned into two equal groups and divided into two study and control groups (45 patients in the study group who received instruction and implement rhythmic breathing technique and (45 patients in the control group who did not participate in rhythmic breathing technique. Patients are selected who met the following criteria:

- ❖ Both sexes and their aged between 20 and 60 years old.
- ❖ Patients with all types of cardiac catheterization.
- ❖ Patients agree to participate in the study.

Exclusion criteria were:

- ❖ Patients with regular sedative drugs.
- ❖ Patients had a mental disorder.

Tools of data collection:

Three tools were constructed and tested by the researcher to collect data pertinent to this study, these tools are:-

A. An interview questionnaire sheet:

It was developed by the researchers. It concerned with personal characteristics as; sex, age, educational level, and job.

B. Numerical rating pain intensity scale:

It was adopted from Breivik, et al., 2008 this tool translated to Arabic. It assesses pain intensity level for both study and control group.

Scoring system:

The pain scale allows the patients easily describe pain intensity simply by asked them to circle the number between 0 and 10. Data suggested that a score of 0= No pain, 1-3= Mild pain, 4-6= Moderate pain, 7-8= Sever pain and 9-10 = Worse pain.

C. Critical Care Pain Observation Tool:

It was adopted from Rijkenberg and van der Voort., (2016) and Severgnini et al., (2016). It was providing an accurate perception of pain in patients who are critically ill. it includes four main categories: facial expressions, body movements, muscle tension and verbalization.

Scoring system:

Each of these categories has a score of zero, one, or two, with a total score between zero and eight. Data suggested that a score of 2 or less can be used to rule out the presence of pain, and a score more than 2 confirm the presence of pain in the patient.

Field work:

The data were included the following phases:

- Preparatory phase.
- Implementation phase.

- Evaluation phase.

Preparatory phase:

Approval was obtained from the director of Beni-Suef university hospital to obtain permission for collection of data .

Content validity:

The tools were revised for content validity by a group of seven experts of critical care nursing and medicine Specialties. The expertise reviewed the tool for accuracy, clarity, relevance and comprehensiveness, minor modification was done.

Pilot study:

It was carried out on 10% of the total study. This was done to test applicability, clarity and efficiency of the tools. minor modification was done, so the patients who shared in the pilot study were excluded from the sample.

Ethical consideration:

The aim and purpose of the study was clarifying by the researchers to the studied patients.

The researchers informed the subject's their rights to take part or withdraw from the study at any time without any rational and they were assured that their data would be confidential for the cause of this research.

Program implementation:

Data were collected from the beginning July 2021 to the end of December 2021.

In this phase, the selected patients who were recruited are randomly assigned to two equal arms (45 patients per each), researchers conducted individual interviews two times throughout the study period for every patient

First interview:

Each patient of both groups was interviewed preoperatively to collect baseline data about personal data. The interview was carried out in the patient's room in hospital one

day before cardiac catheter. It took about 20 minutes.

Then the researchers started to give the subsequent instructions to the study group regarding rhythmic breathing technique using pictures, video films, and demonstration and re-demonstration to learn patients this technique and the way to try and do it. The instructions of include this step:

- 1.Lie down quietly in a comfortable position.
- 2.Close your eyes.
- 3.Relax all your muscles.
4. Inhale deeply through the nose. Be aware of your breathing and pay attention to it. Then, exhale quietly through your mouth while repeating a word on the lips.
- 5.Repeat these actions several times for 15e20 min. Then, open your eyes for a few moments while you are lying down.
- 6.Try to ignore When annoying thoughts occur.

Second interview:

This interview conducted by the researchers for each patient, in this time each patient of the control group receives the hospital routine care while the study group starts to implement the previous instructions of rhythmic breathing technique after the recovery from the anesthesia by two hours and in the presence of the researchers to clarify any question. Each session lasts 20-30 minute.

The Evaluation stage:

This phase was stressed on recognizing the effect of the intervention post applying rhythmic breathing technique on patient's level of pain through making a comparison between the two groups.

Statistical Design:

The data entry and data analysis were done using SPSS version (SPSS) version 23 was used for statistical analysis of data, data were summarized using the arithmetic mean as an average, central tendency, the standard

deviation as a measure of dispersion of results around the mean and frequency and percentage of observations. Other statistical tests such as A chi-square test was used to compare qualitative variables and p value.

Results

Table (1): Demonstrates that 82.2% of the control group' their age more than 40 years old with a mean age of 54.17 ± 7.58 years. And 84.4% of the study group' their age more than 40 years old with mean age of 55.20 ± 7.43 respectively. Regarding to gender 60% and 71.1% respectively of the control and study groups were males. Regarding educational level 33.3% of the control group had preparatory education, while the study group 42.2% had secondary education. Regarding occupation 35.6% and 40% respectively of the control and study groups were had unofficial worker.

Table (2): The table revealed that there was high statistically significant difference

Table (1): percentage distribution of demographic characteristics for the study and control group (No =45 for each group)

Variable	Control group No =45		Study group No =45	
	Frequency	%	Frequency	%
Age in years				
Less than 40	8	17.8	7	15.6
More than 40	37	82.2	38	84.4
Mean \pmSD	54.17 \pm 7.58		55.20 \pm 7.43	
Gender				
Male	27	60	32	71.1
Female	18	40	13	28.9
Educational qualification				
Illiterate	8	17.8	9	20.0
Read and write	5	11.1	2	4.4
Preparatory.	15	33.3	8	17.8
Secondary.	8	17.8	19	42.2
University	9	20.0	7	15.6
Occupation				
Unemployed	6	13.3	6	13.3
Employee	13	28.9	10	22.2
Unofficial worker	16	35.6	18	40.0
House wife.	10	22.2	11	24.4

between pain intensity scores pre and post intervention of the study group ($P \leq 0.000$). There was no statistically significant difference between pain intensity scores pre and post intervention of the control group.

Table (3) and Fig. (1) showed that there was highly statistically significant difference in the total mean score of the critical care observational checklist of the study group between pre and post intervention ($P < 0.000$). Also, there was no statistically significant difference in the total mean score of the critical care observational checklist of the control group between pre and post intervention.

Table (4) and Fig. (2) showed that there was highly statistically significant difference in the total mean score of the numerical pain scale of the study group between pre and post intervention ($P < 0.000$). Also, there was no statistically significant difference in the total mean score of numerical pain scale of the control group between pre and post intervention.

Table (2): Comparison between pain scores among control and study groups pre and post intervention according to pain categories.

Variable	Total score	Control group No =45				X ² and Sig	Study group No =45				X ² and Sig
		Pre		Post			Pre		Post		
		No	%	No	%		No	%	No	%	
No pain	0	0	0.0	0	0.0	0.19	0	0.0	0	0.0	53.0
Mild	1-3	0	0.0	0	0.0	0.90	0	0.0	26	57.8	0.000*
Moderate	4-6	24	53.3	22	48.9		18	40	19	42.2	
Severe	7-8	18	40	20	44.4		22	48.9	0	0.0	
Worst pain	9-10	3	6.7	3	6.7		5	11.1	0	0.0	

Table (3): Comparison of total mean score of the critical care pain observation checklist for the study and control group pre and post intervention

Variable	Control group No =45					Study group No =45				
	Pre		Post		T-test P - value	Pre		Post		T-test P - value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Total score	6.22	1.47	6.37	1.43	0.507 0.613	6.60	1.54	3.48	1.29	10.37 0.000**

Fig. (1): Differences between total score of critical care pain observation checklist in study and control groups pre and post intervention.

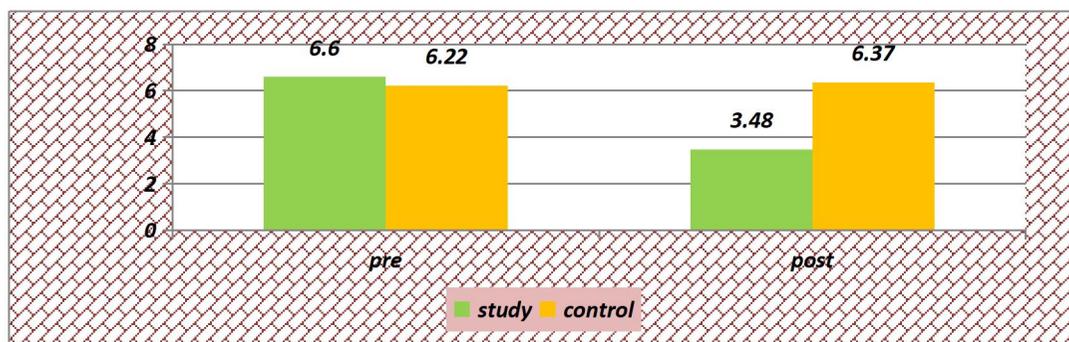
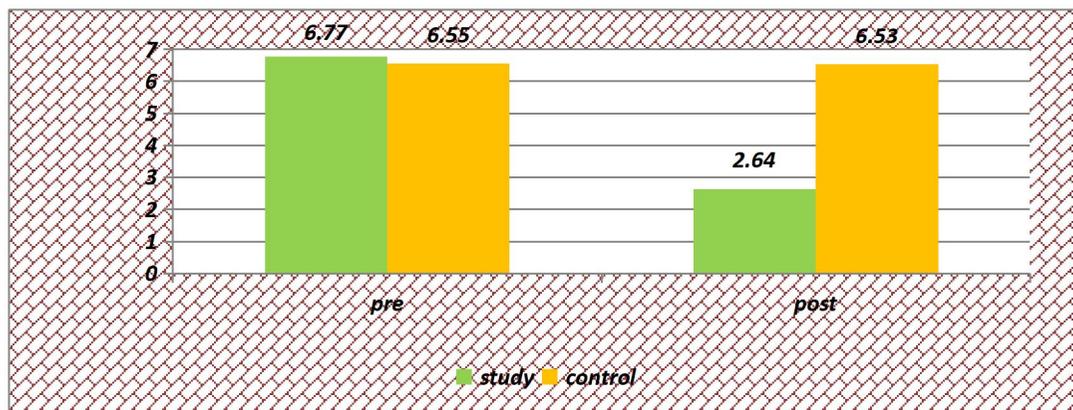


Table (4): Comparison of total mean score of the numerical pain scale for the study and control group pre and post intervention

Variable	Control group No =45					Study group No =45				
	Pre		Post		T-test P - value	Pre		Post		T-test P - value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Numerical pain scale	6.55	1.35	6.53	1.39	0.77 0.93	6.77	1.5	2.64	1.2	14.0 0.000**

Fig. (2): Differences between total score of numerical pain scale in study and control groups pre and post intervention.



Discussion:

Pain can affect length of hospitalization in the postoperative period in patients who undergo major procedures such as cardiac surgeries. They usually suffer intense pain, anxiety and stress, negatively reflecting on treatment, recovery and quality of life. The use of non-pharmacological therapies in the postoperative period represents efficient methods to relieve pain for these surgeries. (Chandrababu, et al., 2020).

Pain is a commonly reported symptom in cardiac surgery postoperative. It affects the functional recovery of the individual because it involves physical and psychological aspects such as distress and complications in the postoperative period, namely: changes in the ability to cough, breathe and move, influencing their morbidity and mortality. (Menezes, et al., 2018).

Pain management occurs through the use of pharmacological or non-pharmacological therapies, although it is a common symptom, it becomes challenging for the health team. Factors such as difficult diagnosis or lack of protocols or lack of association between pain and analgesic prevent its management in care. (Varndell, et al., 2017).

In the care of critically ill clients, pain is a serious obstacle. Pain is defined as bad sensual and emotional experience associated with, actual or potential tissue damage.

Additionally, pain is a big obstacle and one of the major causes people seek medical attention. It is a frequent stressful manifestation for numerous clients in the intensive care unit. Raja, et al. (2020).

The present study revealed that the level of pain intensity was decreased among study group after using rhythmic breathing technique than control group especially pre- and post-cardiac catheter.

Similar data were confirmed by Babamohamadi, et al., (2021). Who stated that the level of pain severity after the rhythmic breathing intervention was significantly reduced in the rhythmic breathing group compared to the control and recommended it to use as a post coronary artery by bass graft to control pain.

This confirms that benefits to apply rhythmic breathing technique, as lower costs without side effects and decreased pain. These results are supported by Sarmiento, et al., (2021) who found the same result.

This result may be due to the rhythmic breathing techniques is distraction technique which make patients distract themselves from a painful stimulus and thus help control their pain.

Agreed with Subakeerthi and Moses. (2019). who stated that the regular practice of rhythmic breathing technique helps to reduce postoperative pain level among patients undergone major abdominal surgery. Also,

Farzin, et al., (2018) found that the rhythmic breathing reduces pain after orthopedic surgery.

This result may be due to the fact of rhythmic breathing methods have a beneficial effect on heart rate and respiratory which reduces sympathetic system activity and increases parasympathetic activity by decreasing metabolic energy requirement and autonomic system balance.

This study agreed with Nasirnejad, et al., (2020). Who found that the rhythmic breathing effective to reduce pain in patients after coronary artery bypass graft. In addition, Hilário, et al., (2017), who reported that non-pharmacological pain treatment feels more comfortable and improve patient satisfaction.

Furthermore Gan, (2017) who reported that insufficient controlled postoperative pain delays recovery and results in longer hospital stay. It is also a common cause for readmission and is connected with bad patient satisfaction and experience, and increased in pain thresholds among patients using the relaxing breathing techniques.

Conclusion

Based on the findings of the current study, it could be concluded that the use of rhythmic breathing techniques after cardiac catheterization is effective in reducing the pain intensity. Therefore, using these techniques as an effective, simple noninvasive, low cost, uncomplicated, and easy to implement methods in reducing the pain level with patients after cardiac catheterization.

Recommendations

Based on results of the present study the following recommendations can be suggested:

1. Training program should be applied for critical care nurses on rhythmic breathing technique and use them as a part of usual routine nursing care for patients after cardiac catheterization.

2. Established booklet guideline about rhythmic breathing technique should be available on each Cardiac catheterization unit.

3. Implementing this study on larger sample selected from different setting and different geographical areas of Egypt for generalization.

References

- Aljumah, M. I., Aboshoushah, E. F., Coric, D., Alaithan, A. M., Abdullah, A. A., AlOtaibi, N. M., Sadoun, M. H., kammass, F. H., Al saeed, A. S. and Alharthi, A. (2018). Assessment and Management of Pain in the Intensive Care Unit. The Egyptian Journal of Hospital Medicine (October 2018) Vol. 73 (4), Page 6439-6445
- Asta, R. and Rini P. (2018). The Effectiveness Of Deep Breathing Relaxation Technique And Guided Imagery To Decrease Pain Intensity On Postoperative Fracture Patients In Bougenville Ward Of Dr Soegiri Hospital Lamongan. 9th Int Nurs Conf 2018. 2018;1(1):115–21.
- Babamohamadi, H., Karkeabadi, M. and Ebrahimian, A. (2021). The Effect of Rhythmic Breathing on the Severity of Sternotomy Pain after Coronary Artery Bypass Graft Surgery: A Randomized Controlled Clinical Trial. Evidence-Based Complementary and Alternative Medicine. Volume 2021, Article ID 9933876, <https://doi.org/10.1155/2021/9933876>
- Brevik, H., Borchgrevink, P. C. and Allen, S. M. Assessment of pain. Br J Anaesth. 2008.101(1):17–24
- Chandrababu, R., Nayak, B. S., Pai, V. B., George, L. N. and Devi, E. S.(2020) . Effects of foot massage and patient education in patients undergoing coronary artery bypass graft surgery: a randomized controlled trial. Complement Ther Clin Pract [Internet]. 2020 [Cited 2020 nov 23];40(2020):1-9. Available from: <https://doi.org/10.1016/j.ctcp.2020.101215>
- Farzin Ara F, Zare M, Mousavi Garmaroudi SM, Behnam Vashani HR, Talebi Sh. [Comparative study of the effect of Allah's recitation and rhythmic breathing on postoperative pain in orthopedic patients (Persian)]. Anesthesiology and Pain. 2018; 9(1):68-78.

- Foji, S., Tadayonfar, M. A., Mohsenpour, M. and Rakhshani M. H. (2015).** The study of the effect of guided imagery on pain, anxiety and some other hemodynamic factors in patients undergoing coronary angiography. *Complementary Therapies in Clinical Practice*. 2015; 21(2):119-23.
- Gan, T. J. (2017).** Poorly controlled postoperative pain: prevalence, consequences, and prevention. *J Pain Res.* (2017) 10:2287–98. doi: 10.2147/JPR.S144066
- Hassan, H. E., Mokabel, F. M., and AL_Radwan, N. A., (2019).** “Effect of Massage Therapy on the Mood and Pain of Post Cardiac Catheterization Patients.” *American Journal of Nursing Research*, vol. 7, no. 3 (2019): 392-399. doi: 10.12691/ajnr-7-3-21
- Hilário T. S, Santos S. M, Kruger J, Goes M. G, Casco M. F, Rabelo-Silva E. R. (2017):** Pain assessment and management in patients undergoing endovascular procedures in the catheterization laboratory. *Rev Esc Enferm USP.* 2017;51:e03229. journal of school of nursing.
- Hinkle, J. L. and Cheever, K. H. (2018).** Brunner and Suddarth’s textbook of medical surgical nursing.14th ed. Wolters Kluwer Health/ Lippincott Williams and Wilkins. P. 745.china
- Hoseini, T., Golaghaie, F., and Khosravi, S. (2019).** “Comparison of two distraction methods on venipuncture pain in children,” *Journal of Arak University of Medical Sciences*, vol. 22, no. 3, pp. 27–35, 2019.
- Ignatavicius, D.D., Workman, M. L Rebar, C. R., & Heimgartner, N. M. (2020).** Medical-surgical nursing concept of interprofessional collaborative care. 9th ed. Saunders, an imprint of Elsevier Inc. pp. 703.
- Ju, W., Ren, L., Chen, J. U.N., and Du, Y. (2019).** Efficacy of relaxation therapy as an effective nursing intervention for post - operative pain relief in patients undergoing abdominal surgery : A systematic review and meta - analysis. *Exp Ther Med.* 2019;1(1):2909–16.
- Kotfis K, Zegan-Barańska M, Szydłowski Ł, Żukowski M, Ely EW. (2017).**Methods of pain assessment in adult intensive care unit patients - Polish version of the CPOT (Critical Care Pain Observation Tool) and BPS (Behavioral Pain Scale). *Anaesthesiol Intensive Ther.* 2017;49(1):66-72.
- Keogh, J and Weaver, A. L. (2021).** *Critical Care Nursing Demystified*. 2nd ed. McGraw Hill.
- Kiavar, M., Azarfarin, R., Totonchi, Z., Tavakoli, F., Alizadehasl, A and Teymouri, M. (2016).**Comparison of Two Pain Assessment Tools, “Facial Expression” and “Critical Care Pain Observation Tool” in Intubated Patients After Cardiac Surgery *Anesth Pain Med.* 2016;6(1):e33434.
- Maciejewski, M. (2020).** Quasi-Experimental Design, *Biostatistics & Epidemiology*; 4 (1): 38-47.
- Menezes TC, Bassi D, Cavalcanti RC, Barros JESL, Granja KSB, Calles ACN and Exel, A.L. (2018).** Comparisons and correlations of pain intensity and respiratory and peripheral muscle strength in the pre- and postoperative periods of cardiac. *Rev Bras Ter Intensiva.* 2018;30(4):479-486
- Mirhosseini, S., Mohammadi, A., Rezaei, M. and , Ajorpaz. N. M. (2019).** The Effect of Benson Relaxation Technique on the Fatigue Severity of Patients With MS. *Journal of Client-Centered Nursing Care*, 5(3), pp. 175-182.
- Mohammadpour, A., Basiri, M. and Saber, N. (2016)**“ Effect of rhythmic breathing on the cardiorespiratory parameters in Acute Coronary Syndrome patients admitted at CCU,” *Journal of Sabzevar University of Medical Sciences*, vol. 23, no. 2, pp. 377–385, 2016.
- Modanloo, M., Mohsenpour, A., Rahmani, H., Moghaddam, S. and Khoddam, H. (2019).** Impact of Implementing the Critical Care Pain Observation Tool on Nurses’ Performance in Assessing and Managing Pain in the Critically Ill Patients. *Indian Journal of Critical Care Medicine*, Volume 23 Issue 4.
- Nasirnejad, S., Molavynejad, S., Jahani, S. and Maraghi, E. (2020).** Effect of Rhythmic breathing on the Severity of Pain and Anxiety in Patients after Coronary Artery Bypass Graft: a clinical trial study. *1260 P J M H S Vol. 14, NO. 2, APR – JUN 2020.*

- Pinheiro, Q., Margarida. R. and Marques, D. (2019).** Behavioral Pain Scale and Critical Care Pain Observation Tool for pain assessment in orotracheally intubated critically ill patients 573 *Rev Bras Ter Intensiva.* 2019;31(4):571-581
- Pouryousef, F., Navidian, A., Rafizadeh Ghahdarjani, O. and Yaghoubinia F. (2021).** Comparing the Effect of Virtual Reality and Rhythmic Breathing on the Anxiety of the Patients Undergoing Coronary Angiography (Persian)]. *Quarterly of "The Horizon of Medical Sciences"*. 2021;27 (1):2-17.<https://doi.org/10.32598/hms.27.1.3325.1>.
- Raja, S. N., Carr, D. B., Cohen, M., Finnerup, N. B., Flor, H., Gibson, S., Keefe, F. J., Mogil, J. S., Ringkamp, M., Sluka, K. A., Song, X. J., Stevens, B., Sullivan, M. D., Tutelman, P. R., Ushida, T., & Vader, K. (2020).** The revised international association for the study of pain definition of pain: concepts, challenges, and compromises. *Pain.* 2020;161(9):197682.<https://doi.org/10.1097/j.pain.197682>.
- Rijkenberg, S. and van der Voort., P. H. (2016):** Can the critical-care pain observation tool (CPOT) be used to assess pain in delirious ICU patients? *J Thorac Dis.*, 8: 285-7.
- Sarmiento SD, Santos KV, Dantas JK, Silva BV, Dantas DV, Dantas RA.** Non-pharmacological therapies in the relief of cardiac surgery postoperative pain: a scoping review. *Online Braz J Nurs [Internet].* 2021 Mês [cited year month day];20:e20216494. Available from: <https://doi.org/10.17665/1676-4285.20216494>
- Severgnini, P., Pelosi, P., Contino, E., Serafinelli, E., Novario, R., and Chiaranda, M. (2016):** Accuracy of Critical Care Pain Observation Tool and Behavioral Pain Scale to assess pain in critically ill conscious and unconscious patients: prospective, observational study. *J Intensive Care,* 4: 68.
- Subakeerthi V and Moses E. F. (2019).** Effectiveness of Rhythmic Breathing Exercise on Postoperative Pain among Patients Undergone Major Abdominal Surgery in MGMCRI at Puducherry, India. *Pon J Nurs* 2019;12(1):5-7.
- Taman, R. O., Shehata, A. E., Sallam, S. A. and Mady, M. M.(2018).** Effect of Foot Massage on Pain Level among Patients Undergoing Cardiac Catheterization. *Menoufia Nursing Journal,* Vol. 3, No. 2, Nov 2018 64
- Urden L.D, Stacy K.M, Lough M.E. (2021).** *Critical care nursing: Diagnosis and management.* 9th ed. St. Louis: Elsevier. Pp. 319.
- Varndell W, Fry M. and Elliott D.** Exploring how nurses assess, monitor and manage acute pain for adult critically ill patients in the emergency department: protocol for a mixed methods study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine.* 2017. 25(1):75. Available form: <https://doi.org/10.1186/s13049-017-0421-x>