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Effect of Cryoanalgesia on Pain Associated with Arterial Blood Gases Sampling for Critically Ill Patients

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Abstract

Background: Arterial puncture can be a painful procedure for many patients, To reduce pain related to arterial blood sampling, Cryotherapy is a general term that has been used to describe the local or general use of low temperatures for medical treatment. **Aim:** the present study aimed to determine Effect of cryoanalgesia on pain associated with arterial blood gases sampling for critically ill patients. **Subjects and methods:** A quasi-experimental research design was used in the study. **Setting**: The present study was conducted at medical ICU and trauma ICU of Beni-Suef University Hospital. **A** convenient sample consisting of 80 adult patients from both genders and they were divided randomly into two equal groups (No = 40) for each the (study and control group). Data were collected using two tool: **Tool I:** Patient characteristics, it includes: demographic data and Past & Present Health Status Assessment Sheet **Tool II:** Numerical Rating Scale. **Results**: The study group who were applied cryoanalgesia, reported less pain from arterial puncture compared with the control group. A statistically significant differences between the study group and control group in the level of pain and their age (χ 2 =7.766, P=0.050). And their previous arterial puncture (χ 2 =6.857, P=0.009). **Conclusion**: based on the result presented in this study, Cryoanalgesia before arterial puncture is well tolerated, reduces pain, Also, it is non-expensive, effortless, and available. **Recommendations:** A critical care nurses should use cryoanalgesia in the daily routine care of patients who require arterial blood gases sampling.

Key words: Arterial blood gases – Critical ill patients – Cryoanalgesia - Pain

Introduction

Hospitalization in (ICU) typically requires extensive diagnostic testing and procedures as a component of the management of critical illness. Daily laboratory and X-ray testing are commonly performed in the ICU for diagnosis and monitoring of critically ill patients as well as assessing their response to treatment. Also, the most important of these testing are arterial blood gases sampling (ABG). **(Yoo et al 2020)**

An arterial blood gas **(ABG)** test: is a blood test that requires a sample from an artery in the body to measure the levels of oxygen and carbon dioxide in the blood. The test also checks the balance of acids and bases, known as the pH balance, in the blood .the body normally tightly regulates the amount of oxygen and carbon dioxide in the blood, because low blood oxygen levels hypoxemi can lead to many serious conditions and damage to individual organ systems, especially the brain and heart. **(Castro et al., 2024).**

The Sites of punctures: Use the radial, brachial or (femoral artery is also used, especially during emergency situations or with children). Use the radial artery as first choice, because it is small, superficial and it can be easily stabilized during the procedure as it passes over a bony groove located at the wrist. Advantages: Good collateral circulation (radial & ulnar arteries), Easy to palpate (close to surface of skin), Less chance of hematoma formation after collection . Disadvantages: Requires considerable skill to puncture it successfully due to small size**. (Sheikh & Fox., 2022).**

Complications of ABG: The most common complications include temporary arterial occlusion, permanent ischaemia, local infection, bleeding, or hematoma formation with reported mean incidence rates of 19.7%, 0.09%, 0.72%, 0.53% and 14.4%, respectively .Less severe but still 4 common complications include vasospasm, hemorrhage, and pain. With a reported incidence of 0.09%, radial artery pseudoaneurysm is a rare but serious complication of arterial puncture presenting a risk of infection and rupture**. (Pagnucci et al., 2020)**

Collecting blood from an artery is more painful, because the arteries are deeper and are surrounded by nerves, most people feel a brief, sharp pain as the needle to collect the blood sample enters the artery, This is the pain resulting from the needle insertion site, and the pain may increase when blood is drawn with repeated attempts to puncture the appropriate vein. **(Gonella et al.,2022).**

Pain is an unpleasant sensory and emotional perception that is usually, but not always, the result of underlying tissue pathology. It is often the initial complaint that brings a patient to the physician's office and is the primary chief complaint in the emergency department. however, the history can sometimes be difficult to obtain, as pain is interpreted differently depending on the patient's culture, language, prior experiences, the acute to chronic nature of pain, and the varied descriptions of pain. Pain history includes location, duration (acute or chronic), exacerbating and relieving factors, and accompanying symptoms. Understanding the neurological basis of pain is important in establishing a diagnosis and treatment plan. (**Wang & Mullally., 2020)**

Cryoanalgesia, also known as cryoneuroablation, cryoneurolysis, is a specialized technique for

providing long-term pain relief. It was first formally described by Hippocrates and was also used by ancient Egyptians, Persians, and Romans to alleviate pain. Since that time, cryoanalgesia has been widely used to reduce pain associated with numerous injuries, illnesses, and invasive procedures. Cryoanalgesia would offer a noninvasive, non-pharmacologic, nonexpensive, and readily available tool to reduce pain associated with arterial puncture. **(Canakci .,2021).**

Cryoanalgesia, use of cold temperature to treat pain, is a concept that dates to ancient times. occurs when nerves are subjected to temperatures between −20 and −100°C resulting in reversable axonal death distal to the treatment site, but leaving an intact endo-, peri-, and epineurium. As axons regenerate at a rate of 1-2 mm per day, the duration of analgesia is related to the distance between the cryoneurolysis site and the location of the pain. Cryoneurolysis produces a prolonged sensory and motor block, hence optimal target nerves are those with limited or no motor function**. (Finneran & Ilfeld., 2021).**

Significance of the study

The most common complications of ABG include temporary arterial occlusion, permanent ischaemia, local infection, bleeding, or hematoma formation with reported mean incidence rates of 19.7%, 0.09%, 0.72%, 0.53% and 14.4%, respectively .Less severe but still 4 common complications include vasospasm, hemorrhage, and pain. With a reported incidence of 0.09%, radial artery pseudoaneurysm is a rare but serious complication of arterial puncture presenting a risk of infection and rupture.Arterial punctures for arterial blood gas analysis are safe procedures with a major complication rate within 7 days of 0.14% (95% CI 0.13– 0.15%). Patients on antithrombotic medication have an increased risk of developing major complications. Although considered a safe procedure, complications may occur during radial artery puncture with a reported rate limited to < 5%. (**Rowling, et al.,2022)**

As it is easy to use, has no side effects, cost effecting, and practical, it is essential to determine effect of cryoanalgesia on pain associated with ABG.

Aim of the study

The current study aimed to determine Effect of cryoanalgesia on pain associated with arterial blood gases sampling for critically ill patients.

Research hypothesis

At the end of this study the level of pain associated with arterial blood gases sample for critical ill patient who applied cryoanalgesia less than those patient who don’t apply cryoanalgesia.

Subjects and methods

Research design.

A quasi-experimental research design (study group and control group) was utilized to achieve the aim of the present study.

Setting:

This study was conducted in Trauma Intensive Care Unit (TICU) which consisted of 36 beds and medical (MICU) of Beni-Suef University Hospital. Medical ICU department located at the 2nd floor and consisted of 2 rooms (17 beds), one room includes 8 beds and the other room includes 9 beds.

Subjects:

A Purposive sample consisting of 80 adult patients from both genders who attended to the above-mentioned setting from the beginning of August 2023 to ending of August 2024 and were divided randomly into two equal groups (No=40) for each study group and control group. Sample size was calculated using Thompson formula:

$$n = \frac{N \times p(1-p)}{[[N-1 \times (d^2 \div z^2)] + p(1-p)]}$$

Inclusion criteria:

- Adult Patients from both gender >20years old.
- Free from any psychotic disorder

Exclusion criteria:

- Unconscious patients
- Patients with any burn or inflammation at site of the sampling

Tools of data collection:

To achieve the aim of the study the following tools were used to collect data.

Tool I: Patient Assessment sheet:

It was developed by the researcher based on review of relevant recent literature. **(Jarvis,.2023)** & **(Abd El Fatah, et al.,2024).** It was divided into two parts:

Part (1): Demographic Data Sheet:

It including data about patient' group ,age, gender, the level of education, marital status, Previous arterial puncture and Occupation.

Part (2): Medical Related Data Sheet (Past & Present Health Status Assessment):-

It including the past and present history taking; Past medical history, current medication, Allergy, Smoking and Causes of ICU admission

Tool II Numerical Rating Scale (NRS)

It was adopted from **(de Arruda et al., 2022)** & **(Stijic et al., 2024**). it was used to assess the level of pain .An NRS typically consists of a series of numbers with verbal anchors representing the entire possible range of pain intensity. Generally, patients rate their pain from 0 to 10, where (0) means no pain, (1-3) means Mild pain, (4-6) means Moderate pain, and (7-10) means Sever pain. The NRS is simple and easily understood, and is easily administered and scored.

Scoring system: One end of the scale represented no pain (0) whereas the other end represented worst pain (10).

Administrative design

An approval was obtained from the Research and Ethics committee at Faculty of medicine Beni-Suef University. An official approval was obtained from Dean of Faculty of Nursing-Beni-Suef University to conduct the study. A letter containing the title and aim of the study and was be directed to the director of the Beni-Suef university hospital to seeking the permission for data collection. Total confidentiality of any obtained information was ensured. Also, the study maneuvers couldn't harm the participants.

Ethical considerations:

The necessary approval was obtained from faculty of nursing Beni-Suef University, and from the directors of Beni-Suef University hospital, explaining the aim of the study in order to obtain permission for collection of data.

Pilot study:

A pilot study was conducted on eight patients (10%) from the study subjects to test clarity, feasibility, applicability and relevance of the tools use and to determine the needed time for application of the study tools, the patients who were included in the pilot study were included from the sample because no modification was done after conducting pilot study.

Validity and Reliabilty

Test face and content validity of the suggested tool through experts' opinion which will be assessed through a group of experts (5 experts, three in medical surgical nursing and two critical care nursing).

The Cronbach's alpha (α) coefficient was used to evaluate the internal consistency of the instrument, which obtained a value of (0.89) which indicates a reliable tool.

Data collection:

The actual work of this study started and completed within 12 months, beginning from August 2023 to ending of August 2024 and the self–administered questionnaire distributed to the patient in their place, each questionnaire took 5 to 10 minutes to be filled. The study was carried out through four phases as follows: Assessment phase, Planning phase, Implementation phase, Evaluation phase

A. Assessment phase:

- ✓ At the first, Subjects and their allocation to study or control group was determined.
- ✓ Clinical demographic data was extracted from their medical records in the hospital and recorded them in the data collection tool.
- ✓ The Past & Present Health Status was taken and recorded them in the data collection tool

B. Planning phase

Made the data collection tool and patient' oral consent to participate in the study obtained and every patient was informed that confidentiality was assured. Data were collected by the

researcher on Three or Two days per week , at morning shift in the previous mentioned setting, Maximum five patients were assessed in the day during the arterial blood gases sampling time,). Also prepared the equipment prepared that are used in procedure.

C. Implementation phase

In the study group:-The procedure and the purpose of the study was explained to the patient, also the bag of ice was placed on the wrist of the patient for three minutes before taken the arterial blood gases sampling. After 3th minutes, Take the sample and then assess the patient′s pain by using Numerical Rating Scale by asking the patient to choose number from (zero to 10) which indicated his level of pain sensation and recording the result.

In the control group: The procedure and the purpose of the study was explained, also the arterial blood gases sampling was taken immediately without ice bag placed and asses the patient′s pain by using Numerical Rating Scale by asking the patient to choose number from (zero to 10) which indicated his level of pain sensation and recording the result.

A- Evaluation phases

Finally for all studied patients the level of pain was evaluated using (Tool II) to determine the effect of cryoanalgesia on pain associated with arterial blood gas sampling for critically ill patients.

Statistical design

The collected data were analyzed using statistical package for social sciences (SPSS 22.0) for descriptive statistics in the form of frequencies and percentages for categorical variables. Means and standard deviations were used for continuous variables. Chi square tests ($\chi 2$) were used for correlating categorical variables. Independent sample t test was used for analyzing difference in pain score between control and study groups. Significance level was set at p05.

RESULTS

Table (1): Revealed that age of patients enrolled in the study and control group (40 each) were aged between 30 and 40 years. It was noted that (57.5%) in the study group and control group were male. Also, found (82.5% and 75%) of studied patients in both control and study groups were married. also, the studied patients in both control and study groups hold university degrees (42.5% and 40%). (32.5%) were housewives in study group, while (32.5%) had office work in control group. Also, showed in control group (60%) had no previous arterial puncture while in study group (55%) had previous arterial puncture, The table also, showed that there was no statistical difference between the two groups in their selected demographic data.

Table (2): Displayed that there was the percentage (52.5% and 45%)

of Hypertension disease was the most prominent medical history in both control and study group, followed by diabetes mellitus (25% and 27.5%). Also, of studied patients in both control and study groups had previous medical history (67.5% and 62.5%)

Also, showed the GIT problems were the most common cause of admission for control group (32.5%) while DKA were most common cause of admission for study group (27.5%).

That there was non-significant statistical differences between both control and study groups regarding almost all medical data indicating that both groups were homogenous.

Table (3): showed the overall mean score of studied patients' pain associated with arterial blood gases sampling among study group (2.81±0.78) was lower than of control group (6.80±0.79).

Figure(1): displayed the distribution of studied critically ill patients' pain levels associated with arterial blood gases sampling among control and study group, that the difference in pain levels between both control and study group was statistically significant (χ^2 =58.727, P=0.000).in control group (67.5%) had severe pain levels, while in study group (77.5%) had mild pain levels.

Table (5): revealed that there was statistical significant relation between studied critically ill patients' pain levels and their previous arterial puncture (χ^2 =6.857, P=0.009). that there was statistical difference between studied critically ill patients' pain levels and their age (χ^2 =7.766, P=0.050).among both study and control group patients.

Table (6): showed the relation between studied critically ill patients' medical data and their pain levels in study and control group. There was statistical significant relation between studied critically ill patients' pain levels and their past medical history (χ^2 =5.403, P=0.020) in control group. Also, There was statistical significant relation between studied critically ill patients' pain levels and their past medical history (χ^2 =4.215, P=0.040) in study group.

Table (1) Percentage *distribution of studied critically ill patients according to their demographic characteristics (n=80).*

Items	*Control Group (n=40)*		*Study Group (n=40)*		*χ2*	*P-value*
	No.	**%**	**No.**	**%**		
Age						
20<30	5	12.5	4	10		

30<40	16	**40**	16	**40**	0.778	0.855
40<50	12	30	15	37.5		
≥50	7	17.5	5	12.5		
Gender						
Male	23	**57.5**	23	**57.5**	0.000	1.000
Female	17	42.5	17	42.5		
Marital Status						
Single	3	7.5	3	7.5	2.254	0.521
Married	33	**82.5**	30	**75**		
Divorced	0	0	2	5		
Widow	4	10	5	12.5		
Education						
Illiterate	**9**	22.5	12	30	0.613	0.736
Secondary	**14**	35	12	30		
University	**17**	**42.5**	16	**40**		
Occupation						
Hard work	11	27.5	12	30	1.028	0.794
Office work	13	**32.5**	9	22.5		
Housewife	11	27.5	13	**32.5**		
Not work	5	12.5	6	15		
Previous Arterial Puncture						
Yes	16	40	22	**55**	1.805	0.179
No	24	**60**	18	45		

Table (2) Percentage *distribution of studied critically ill patients' related health data (n=80).*

Patients' Medical Data	Control Group (*n*=40)		Study Group (*n*=40)		χ^2	P-value
	No.	%	No.	%		
Past Medical History						
Yes	27	**67.5**	25	**62.5**	0.220	0.639
No	13	32.5	15	37.5		
Type of medical history+						
Respiratory	3	7.5	5	12.5	0.556	0.456
Cardiac	0	0	3	7.5	3.117	0.077
Neurological	7	17.5	5	12.5	0.392	0.531
Surgery	2	5	4	10	0.721	0.396
Diabetes	10	**25**	11	**27.5**	0.065	0.799
Hypertension	21	**52.5**	18	**45**	0.450	0.502
Hepatic	8	20	1	2.5	6.135	0.013*
Causes of ICU Admission+						
Respiratory	2	5	5	12.5	1.409	0.235
Renal	7	17.5	5	12.5	0.392	0.531
Neurological	4	10	5	12.5	0.125	0.723
Cardiac	0	0	1	2.5	1.013	0.314
GIT	13	**32.5**	6	15	3.382	0.066
Trauma	11	27.5	7	17.5	1.147	0.284
DKA	3	7.5	11	**27.5**	5.541	0.019*
Smoking						
Yes	19	47.5	19	47.5	0.000	1.000
No	21	**52.5**	21	52.5		
Allergy						
Yes	0	0	1	2.5	1.013	0.314
No	40	**100**	39	**97.5**		

Current Medications+						
Antibiotics	40	100	40	100	-	-
Analgesics	38	95	34	85	2.222	0.136
Antacid	18	45	13	32.5	1.317	0.251
Muscle Relaxant	25	62.5	22	55	0.464	0.496
PPI	21	52.5	13	32.5	3.274	0.070
Anticonvulsants	15	37.5	11	27.5	0.912	0.340
Corticosteroids	5	12.5	19	47.5	11.667	0.001**
Others	4	10	6	15	0.457	0.499

(+) This variable is not mutually exclusive.

(-) No statistics was computed because this variable is constant.

Table (3) ***Comparing overall mean score of studied critically ill patients' pain associated with arterial blood gases sampling among control and study group (n=80).***

Variables	Min - Max	Control Group (*n*=40)	Study Group (*n*=40)	*t* value	P-value
		Mean±SD			
1. Overall Pain	0 - 10	6.80±0.79	2.81±0.78	22.616	0.000**

t*: Independent sample *t* test** * Highly significant at P<0.01.**

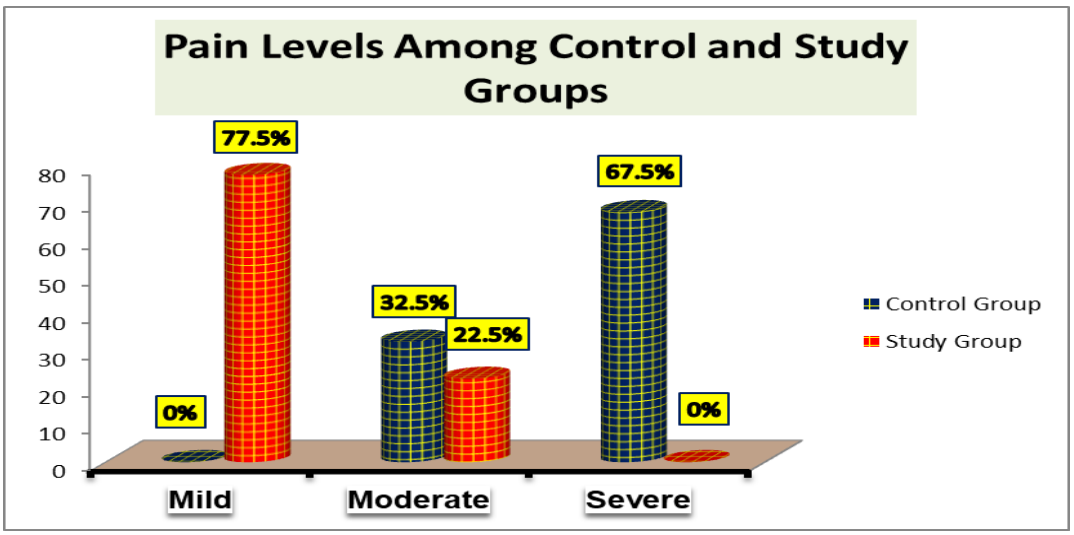

Figure (1) ***Comparing studied critically ill patients' pain levels associated with arterial blood gases sampling among control and study group (n=80).***

Table (5) ***Relation between studied critically ill patients' demographic characteristics and their pain levels in control and study group (n=80).***

Items	Control Group (*n*=40)								Study Group (*n*=40)							
	Mild		Moderate		Severe		χ^2	P-value	Mild		Moderate		Severe		χ^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Age (years)																
20<30	0	0	1	2.5	4	10	6.574	0.087	3	7.5	1	2.5	0	0	7.766	0.050*
30<40	0	0	5	12.5	11	27.5			9	22.5	7	17.5	0	0		
40<50	0	0	2	5	10	25			14	35	1	2.5	0	0		
≥50	0	0	5	12.5	2	5			5	12.5	0	0	0	0		
Gender																
Male	0	0	5	12.5	18	45	2.857	0.091	17	42.5	6	15	0	0	0.399	0.527
Female	0	0	8	20	9	22.5			14	25	3	7.5	0	0		
Marital Status																
Single	0	0	0	0	3	7.5	4.810	0.90	2	5	1	2.5	0	0	2.533	0.469
Married	0	0	10	25	23	57.5			22	55	8	20	0	0		
Divorced	0	0	0	0	0	0			2	5	0	0	0	0		
Widow	0	0	3	7.5	1	2.5			5	12.5	0	0	0	0		
Education																
Illiterate	0	0	5	12.5	4	10	3.037	0.219	11	27.5	1	2.5	0	0	3.680	0.159
Secondary	0	0	3	7.5	11	27.5			10	25	2	5	0	0		
University	0	0	5	12.5	12	30			10	25	6	12	0	0		
Occupation																
Hard work	0	0	2	5	9	6.771	0.080		9	22.5	3	7.5	0	0	0.163	0.983
Office work	0	0	3	7.5	10				7	17.5	2	5	0	0		
Housewife	0	0	7	17.5	4				10	25	3	7.5	0	0		
Not work	0	0	1	2.5	4				5	12.5	1	2.5	0	0		
Previous Arterial Puncture																
Yes	0	0	9	22.5	7	**6.857**	**0.009****	17	42.5	5	12.5	0	0	17	**0.001**	**0.970**
No	0	0	4	10	20			14	35	4	10	0	0	14		

**** Highly significant at P<0.01.**

Table (6) ***Relation between studied critically ill patients' medical data and their pain levels in control and study group (n=80).***

Patients' Medical Data	Control Group (*n*=40)								Study Group (*n*=40)							
	Mild		Moderate		Severe		χ^2	P-value	Mild		Moderate		Severe		χ^2	P-value
	No.	%	No.	%	No.	%			No.	%	No.	%	No.	%		
Past Medical History																
– Yes	0	0	12	30	15	37.5	**5.403**	**0.020***	22	55	3	7.5	0	0	**4.215**	**0.040***
– No	0	0	1	2.5	12	30			9	22.5	6	15	0	0		
Smoking																
– Yes	0	0	5	12.5	14	35	0.631	0.427	14	35	5	12.5	0	0	0.302	0.583
– No	0	0	8	20	13	32.5			17	42.5	4	10	0	0		
Allergy																
– Yes	0	0	0	0	0	0	-	-	1	2.5	0	0	0	0	0.298	0.585
– No	0	0	13	32.5	27	67.5			30	75	9	22.5	0	0		

(*) Significant at P<0.05. (-) No statistics was computed because this variable is constant.

Discussion

Arterial blood gas (ABG) analysis is an important and prevalent condition in intensive care units and a critical diagnostic tool for assessing a patient's oxygenation, ventilation, and acid-base status, Often, it is performed very frequently without influencing patient care. Can be an uncomfortable and painful procedure, and is often ordered as a routine test in 80% from patients in critical care units in the hospital **(Chandran, et al., 2021).** Therefore, the aim of the study was to reduce the pain associated with ABG sampling for the conscious patients in critical care units in the hospital, To achieve this aim the hypothesis was declared: the study group who applied the effect of cryoanalgesia had improved and reduce the pain compared to the control group, who didn't apply the effect of cryoanalgesia.

Regarding demographic characteristics of the studied critically ill patients, the current study related that the studied patients age, nearly half of the studied patients in both control and study groups were aged between 30 and 40 years. according to the researcher's point of view: This sample was collected from trauma department in ICU, this age is the most common risk factor for trauma.

This finding was in line with **(Hietbrink,et al., 2024).** In a study entitled "what trauma patients need" and found the trauma is still the leading cause of death for people under the age of 40, although mortality rates vary widely between countries. On the other hands These findings were disagreement with **(Olsen,et al., 2021).** In a study entitled "Pain in intensive care unit patients" and revealed that the In total, 285 patients with a mean age of 58.9 years .

Concerning to gender the present study findings revealed that more than half of the studied patients in both control and study groups were male. From the researcher's point of view this result could due to the nature of ICU admission as emergency and increase accident among male more than female.

These findings agreed with the results of the study conducted by **(Beaumont, et a., 2021).** In a study entitled the "Effect of Local Anesthesia on Pain During Arterial Puncture: The GAEL Randomized Placebo-Controlled Trial" and agreed with **(Stefiyan, & Permono.,2021).** In a study entitled the "Characteristic of Head Injury Patients Admitted" ICU-admitted head injured patients were mostly male more than three quarters.

On the other hand**, (Sheha., 2019).** Who carried out a study which entitled"Effectiveness of Cryotherapy Related Pain Management among Patients Undergoing Hemodialysis at the Site of Arteriovenous Fistula Puncture" and reported that More than half of them were female.

Regarding marital status the findings of the current study revealed that the majority of studied patients in both control and study groups were married respectively. From the researcher's point of view this result could be due to nearly half of the studied patients were aged between 30 and 40 years. And more than half of the studied were male most are expected to be married.

This finding was in line with **Kamble, et al., 2022),** in a study entitled "An efficacy of cryoanalgesia on arterial blood gas puncture-related pain" and reported that the majority patients were married. Also, this finding disagree with **Faqihi, & Sayed., 2021).** In a study entitled "Self-medication practice with analgesics (NSAIDs and acetaminophen), and antibiotics among nursing undergraduates in University College Farasan Campus, Jazan University, KSA" that reported that majority of the students unmarried.

Regarding their education, the findings of the current study revealed that about less than half of the studied patients in both control and study groups hold university degrees respectively From the researcher's point of view this result could be due to nearly half of the studied patients were aged between 30 and 40 years. And more than half were male most are hold university degrees. This

result disagree with (**Fahmy,et al., 2021).** in a study entitled "The Effect of Passive Range of Motion Exercises on Hemodynamic Parameters of Mechanically Ventilated Patients" and reported less than half of the study group had achieved a high school educational level and less than half of the control group had achieved a primary level of education.

For their occupation, about one third of studied patients in control group had office work. From the researcher's point of view this result could be due to regarding their education, that about less than half hold university degrees. while one third of studied patients in study group were housewives. due to Regarding their gender in study group they represent less than half of female. This finding was in line with **Fahmy, et al., 2021).** In a study entitled "The Effect of Passive Range of Motion Exercises on Hemodynamic Parameters of Mechanically Ventilated Patients" and reported half of the study group and less than half of the control group were employed.

Regarding previous arterial puncture More than half of studied patients in control group had no previous arterial puncture, While more than half of studied patients in study group had previous arterial puncture From the researcher's point of view this result could be due to collecting the most control samples from the new admission to trauma intensive care units and their had young age (30-40) years. While the most patients in ICU they have critical diseases that require arterial puncture as a routine. This study agree with (**Beaumont,et al ., 2021).** In a study entitle "Effect of Local Anesthesia on Pain During Arterial Puncture: The GAEL Randomized Placebo-Controlled Trial" and revealed that In the most of the subjects had a previous arterial puncture.

Regardimg medical data of studied critically ill patients: the current study revealed that the past medical history where about more than half of studied patients in both control and study groups had previous medical history respectively. From the researcher's point of view this result could be due to unhealthy lifestyle of the people it has become pervasive in food and lack of exercise. All of this has become a risk factor for many diseases such as Hypertension, Diabetes Mellitus and Gastrointestinal tract diseases.

Similar findings were found in (**Thomson, et al., 2020).** In a study entitled "Clinical characteristics and outcomes of critically ill patients with COVID-19 admitted to an intensive care unit" and mention that the minority of patient in ICU had no reported past medical history.

The current study revealed that the Hypertension disease was the most prominent medical history in both control and study group, where about almost one half respectively. From the researcher's point of view

this result could be due to the risk factors for hypertension can be divided into sociodemographic and modifiable risk factors. The sociodemographic risk factors described are sex, and in this study more than half of the studied patients in both control and study groups were male, so this result is predictable.

This findings Similar to were found in (**Mohammed Nawi, et al., 2021).** In a study entitled "The Prevalence and Risk Factors of Hypertension among the Urban Population in Southeast Asian Countries: A Systematic Review and Meta-Analysis" and mention that being male is a risk factor of developing hypertension.

Regarding Diabetes Mellitus disease where about more than one quarter prominent medical history in both control and study group respectively. From the researcher's point of view this result could be according to the Diabetes mellitus is a common, albeit potentially devastating, medical condition that has increased in prevalence over the past few decades to constitute a major public health challenge of the twenty-first century. This result was agreed with (**Thomson, et al.,2020).** In a study entitled "Clinical characteristics and outcomes of critically ill patients with COVID-19 admitted to an intensive care unit" and mention that the more than one third of patient in ICU had diabetes mellitus.

Regarding DKA were more than one quarter cause of admission for study group From the researcher's point of view this result could be Diabetic ketoacidosis (DKA) is a serious, potentially life-threatening complication of diabetes, and is the most common acute hyperglycaemic emergency in people with diabetes mellitus. This finding is consistent with **(Dhatariya, et al.,2020).** In a study entitled "Diabetic ketoacidosis" which explained Diabetic ketoacidosis (DKA) is the most common acute hyperglycaemic emergency in people with diabetes mellitus.

Regarding smoking, the findings of the current study revealed that the number of smoker patients who enrolled in the study was more than half of studied patients in both control and study group were not smokers. From the researcher's point of view this result could be due to the more than half of the studied patients in both control and study groups were male. This finding was similar to **Gonca, et al.,2020).** Who carried out a study which entitled "Is there any effect of smoking status on severity and mortality of hospitalized patients with COVID-19 pneumonia?" and revealed that more than half of studied patients were not smokers.

Regarding current medications, all studied patients in both control and study group almost all have antibiotics, from the researcher's point of view this result due to critically ill patient most suseptable to hospital acquired infection. This finding was agree with **(Krah, et al.,2021).** In a study entitled "The

impact of antibiotic allergy labels on antibiotic exposure, clinical outcomes, and healthcare costs" and found the most had antibiotics.

For allergies, almost all studied patients both control and study group not have allergies respectively, this finding was similar to **Pouessel,et al.,2023).** Who carried out a study which entitled "Fatal and near-fatal anaphylaxis: The Allergy-Vigilance" and revealed that the (2%) patients presented grade anaphylaxis. This finding was disagree with **Krah, et al.,2021).** Who carried out a study which entitled "The impact of antibiotic allergy labels on antibiotic exposure, clinical outcomes, and healthcare costs" and found the most of patients suffering from antibiotic allergy.

Regarding levels of pain associated with arterial blood gases sampling for critically ill patients among control and study groups: this result revealed the overall mean score of studied critically ill patients' pain associated with arterial blood gases sampling among control and study group. More than two thirds of studied patients in control group had severe pain levels. While more than three quarters of studied patients in study group had mild pain levels. From the researcher's point of view this result could be due to apply the ice bag with study group and not apply with control group. So the result of level of pain in control group had severe pain, while the result of level of pain in study group had mild pain. This finding was similar to **(Samy, et al., 2022).** In a study entitled "Effect of Precooling Puncture Site on Pain Associated with Arterial Puncture" and revealed that illustrated that more than three quarters of study group had mild pain.

Regarding Correlation between the study variables the current study illustrated that there was statistical significant relation between studied critically ill patients' pain levels and their previous arterial puncture, According to the researcher's point of view, this may be due to the people who have this experience before have become more sensitive and fear to the intensity of the pain. There was statistical significant relation between studied critically ill patients' pain levels and their age, According to the researcher's point of view, this may be due to the nearly half of the studied patients in both control and study groups were aged between 30 and 40 years and at this age verves and tissues are affected well it helps respond quickly to the ice application which causes change in the ill patients' pain levels.

There was statistical significant relation between studied critically ill patients' pain levels and their past medical history, According to the researcher's point of view, this may be due to the diabetes mellitus represent more than one quarter from the sample, this result agree with **(Sierra-Silvestre, et al.,2020).** In a study entitle "Altered pain processing in patients with type 1 and 2

diabetes" That reported Diabetes affects 8.5% of the total adult population. Elevated sugar levels over time can produce tissue damage at different levels to the nervous system. In the other way **Shehata, & Shehata,.2017).** In a study entitle "The effect of cutaneous stimulation on pain perception at arterial puncture site among critically Ill patients" that were performed in Menoufia University Hospital That reported no statistical significant differences were existed between study group and control group regarding to clinical data.

Conclusion

In the light of the present study findings, it concluded that the level of pain in the study group decrease after applied cryoanalgesia than the control group. Also, There was no statistical significant relation between studied critically ill patients' pain levels and their gender, education, marital status, occupation, smoking, current medications, and allergy. There was statistical significant relation between studied critically ill patients' pain levels and their age, their past medical history in control group, and their past medical history in study group, and their previous arterial puncture.

Recommendations

Based on the finding of the present study, the following recommendations are recommended:

-Critical care nurses can use cryoanalgesia (ice bag) as it is an effective, non-expensive, noninvasive, and safe method of improving and reduce pain associated with arterial blood gases sampling in critical ill patients.

- Cryoanalgesia it could be applied correctly to achieve the right gool.

-Same study can be carried out on larger population of patients, and in different regions of the state to accomplish more generalization of the study result.

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