A Study to Assess the Effectiveness of Cold Application versus Breathing Exercises to Reduce Pain and Anxiety during Chest Tube Removal among Postoperative Cardiac Surgery Adult Patient in CTVS Ward KGMU Lucknow

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ABSTRACT

Background: Inserting chest tube following any chest trauma or Coronary Artery Bypass Grafting surgery is a frequent practice. This severe pain results due to chest endothelial tissue which is adhered to the tube tip and at the time of tube removal the pulling force will shear this adhesion and cause severe pain.[1]According to American Heart Association, annually more than 448,000 patients undergo cardiothoracic surgery annually including coronary artery bypass grafting (CABG), valve replacement or repair, or repair of structural defects. Insertion of chest tubes (CT) after CABG was done to maintain heart and lung functioning and essential to prevent from pleural effusion, pneumothorax and hemothorax. **Objectives:** 1. To compare the effect of cold application and breathing exercise on anxiety score after chest tube removal.2.To compare the effect of cold application and breathing exercise on pain score during chest tube removal.3.To compare the effect of cold application and breathing exercise on pain score after chest tube removal. **Method:** In this study the research approach was Quasi-experimental Three group pre-test, post-test design was applied. Total 60 samples selected by Non probability purposive sampling technique. The intervention was cold application therapy and breathing exercise therapy methods were given to experimental group and routine care to control group. **Results:** It is observed that after giving cold application therapy and breathing exercise therapy there was a significant ($p<0.05$) difference between anxiety scores among cold application group and breathing exercise group as compared to control group after chest tube removal, anxiety scores were significantly ($p<0.05$) lower among breathing exercise group as compared to cold application group, this reveals that anxiety was lower among patient who received breathing exercise than cold application. There was no significance ($p>0.05$) difference in pain scores during chest tube removal as measured by visual analogue scale. This shows that cold application is not effective on pain during chest tube removal. The pain was significantly ($p<0.05$) lower among the patient of cold application (1.60 ± 0.50) and breathing exercise (2.40 ± 0.51) than controls (3.55 ± 1.05) after chest tube removal, this reveals that pain is was significantly lower in cold application and breathing exercise group as compared to control group. The pain was significantly ($p<0.05$) lower among cold application (1.60 ± 0.50) than breathing exercise (2.50 ± 0.51), this reveals that pain was lower among the patient who received cold application than breathing exercise. **Conclusion:** The study concluded that, cold application and breathing exercise therapy is an effective way to reduce pain and anxiety level in chest tube removal. The study recommended that Cold application and breathing exercise therapy is a safe, inexpensive nursing intervention that can be used as a pain relief technique during chest tube removal.

KEYWORDS: Chest Tube Removal; Pain; Anxiety; Breathing Exercises; Cold Application

1. Background

Inserting chest tube following any chest trauma or Coronary Artery Bypass Grafting surgery is a frequent practice. This severe pain results due to the chest endothelial tissue which is adhered to the tube tip and at the time of tube removal the pulling force will shear this adhesion and cause severe pain.[1]

According to American Heart Association, annually more than 448,000 patients undergo cardiothoracic surgery annualy including coronary artery bypass grafting (CABG), valve replacement or repair, or repair of structural defects. Insertion of chest tubes (CT) after CABG was done to maintain heart and lung functioning and is essential to prevent from pleural effusion, pneumothorax and hemothorax.[2]

2. Statement of the Problem-
A study conducted to assess the effectiveness of cold application versus breathing exercises to reduce pain and anxiety during chest tube removal among postoperative cardiac surgery adult patients admitted in CTVS ward at KGMU Lucknow, U.P.

3. OBJECTIVES:
A. To compare the effect of cold application and breathing exercise on anxiety score after chest tube removal.
B. To compare the effect of cold application and breathing exercise on pain score during chest tube removal.
C. To compare the effect of cold application and breathing exercise on pain score after chest tube removal.

HYPOTHESIS:
H_{01}- There will be no significant difference between anxiety scores after chest tube removal among the patients who will receive cold application and breathing exercise as compared to control group as measured by Likert anxiety scale at a p value <0.05.

H_1- There will be significant difference between anxiety scores after chest tube removal among the patients who will receive cold application and breathing exercise as compared to control group as measured by Likert anxiety scale at a p value <0.05.

H_{02}- There will be no significant difference between pain scores during chest tube removal among the patients who will receive cold application and breathing exercise as compared to control group as measured by visual analogue scale at a p value <0.05.

H_2- There will be significant difference between pain scores during chest tube removal among the patients who will receive cold application and breathing exercise as compared to control group as measured by visual analogue scale at a p value <0.05.

H_{03}- There will be no significant difference between pain scores after chest tube removal among the patients who will receive cold application and breathing exercise as compared to control group as measured by Numeric pain scale at a p value <0.05.

H_3- There will be significant difference between pain scores after chest tube removal among the patients who will receive cold application and breathing exercise as compared to control group as measured by Numeric pain scale at a p value <0.05.

4. Methodology
Research approach: A quantitative research approach

Research design: Quasi-experimental - Three group pre-test, post-test design.

Setting of the study: Study was conducted in department of CTVS in CTVS Ward and ICU at KGMU Lucknow at King George's Medical University.

Research variables:
Independent variable: Cold application and Breathing exercise

Dependent Variables: Level of pain and level of anxiety.

Demographic variables: This includes age, gender, educational status, occupational status, monthly income, area of residence, monthly income and socio-economics status. Clinical profile variable includes diagnosis, duration illness, types of chest tube, number of days chest tube was inserted, type of cardiac surgery, Any other comorbidity.

Sample size: The total sample size was 60.

Sampling Technique
In this study the purposive sampling technique was used to select the subjects, data was collected from 5/09/18 to 14/2/19. Total 60 samples were selected who met the inclusion criteria and were randomly allocated in into three groups i.e. 20 in control group, 20 in cold application group and 20 in breathing exercise group.

Criteria for Samples Selection:
Inclusion criteria:
Adult patient age from 18 to 69 years old.

Able to use Visual Analogue Scale, Numeric pain scale and Likert anxiety scale.

Patient who have mediastinal or pleural chest tubes.

Exclusion criteria:
Patient who are on mechanical ventilation support.

Unconscious or cognitively impaired because patient with these conditions cannot report pain anxiety during chest tube removal.

Description of Tool
Section 1: Demographic Variables and Clinical profile.
Demographic variables include age, gender, educational status, occupational status, monthly income, area of residence, monthly income and socio-economics status. Clinical profile variable includes diagnosis, duration illness, types of chest tube, number of days chest tube was inserted, type of cardiac surgery, Any other comorbidity.

It is structured tool in which the most appropriate response has to tick and some open ended questions was also has to be completed by investigator.

Section 2: Visual analogue scale for assessment of level of pain.
Consist point to the position on the line between the faces to indicate how much pain they are currently feeling. The extreme left end indicates "no pain" and the extreme right end indicates "worst pain."

In this standardized visual analogue scale the scoring range from 0 to 10 where 0 score represent no pain and 10 score represent hurts and worst pain

Section 3: Numeric pain scale for assessment of level of pain.
It consist of number from 0 to 10 that best describes their current pain. 0 mean "no pain" and 10 mean "worst pain". Correct answer carries 1, 2 and 3 marks respectively.

Section E: Likert anxiety scale for assessment of level of anxiety.
In this standardized Likert anxiety scale consist of the 9 symptoms and patient has to mark X on the line to the right

showing how intense you are feeling that symptom right now. The score of feeling goes from 0, meaning none, to 10, means extreme.

Reliability: The reliability of the tool was established by Cronbach's Alpha method and the calculated correlated coefficient was (>0.80)

Data collection procedure: The investigator administered cold application in which cold gel packs were placed over chest tube removal area for 10 minutes. (Duration of cold application is determined to achieve the therapeutic effect of cold therapy, which requires cooling down tissues for at least 10 minutes and breathing exercise in which patients were instructed to inhale calmly and deeply through their nose and exhale slowly through semi-closed lips, all with closed eyes for 10 minutes. Level of pain was measured during chest tube removal and 15 minutes after chest tube removal. Post level of anxiety the anxiety level was measured 15 minutes after chest tube removal.

Description of intervention (cold application):
Cold gel packs were kept in the freezer for at least 2 hours and then will be wrapped with gauze and were applied to the area surrounding the chest tube for 10 minutes. cold gel packs were used to reduce the body temperature around the chest tube during undressing. A layer of sterile gauze pad were placed around the skin area of pericardial tube insertion (according to the cardiac surgery ICU regulations,

pericardial tube is the first tube to be removed) and cooling packs (14×18) were twisted in gauze and were placed on top of it. Cold gel packs were placed over chest tube removal area for 10 minutes. (Duration of cold application is determined to achieve the therapeutic effect of cold therapy, which requires cooling down tissues for at least 10 minutes. Complete aseptic technique was followed during the procedure. After removal of the cooling packs, the physician removed the pericardial tube within 1-2 minutes.

(Breathing exercise)
In the breathing exercises group, Participants were instructed to inhale calmly and deeply through their nose and exhale slowly through semi-closed lips, all with closed eyes for 10 minutes. The researcher ask the participants to do breathing exercise and then the chest tube were removed.

Plan for data analysis
Statistical analysis is the organization and analysis of quantities data using statistical procedures including both descriptive and inferential statistics.

Ethical consideration
Ethical approval obtained from the ethical committee of institution and permission was taken from the HOD's of department. Informed consent was taken from the subjects. Confidentiality and anonymity of information was maintained.

5. Result

Table 1 Distribution of subjects as per demographic variables in cold application, breathing exercise and control groups

n=60

S. No.	Demographic variable	Category	Control Group (n₁=20) F (%)	Breathing exercise group (n₂=20) f(%)	Cold application group (n₃=20) f(%)	P - value
1.	Age	18-30 years 31-43 years 44-56 years 57-69 years	5(25.0) 4(20.0) 7(35.0) 4(20.0)	4(20.0) 6(30.0) 3(15.0) 7(35.0)	4(20.0) 4(20.0) 5(15.0) 7(35.0)	0.76
2.	Gender	Male Female	12(60.0) 8(40.0)	11(55.0) 9(45.0)	16(80.0) 4(20.0)	0.21
3.	Educational Status	Illiterate Primary Education Secondary education Graduate Post Graduate	3(15.0) 6(30.0) 3(15.0) 8(40.0) 0(0.0)	1(5.0) 8(40.0) 5(25.0) 6(30.0) 0(0.0)	1(5.0) 5(25.0) 8(40.0) 6(30.0) 0(0.0)	0.48
4.	Occupation	Self employed Government job Private job Agriculture Unemployed	4(20.0) 11(55.0) 3(15.0) 2(10.0) 0.00	8(40.0) 8(40.0) 3(15.0) 1(5.0) 0.00	3(15.0) 11(55.0) 5(25.0) 1(5.0) 0.00	0.59
5.	Area of residence	Rural Urban	13(65.0) 7(35.0)	11(55.0) 9(45.0)	12(60.0) 8(40.0)	0.68
6.	Monthly income	Below Rs 5,000 Rs 5000-10,000 Rs 11,000-15,000 Rs16,000-25,000 Rs26,000-29,000	2(10.0) 7(35.0) 5(25.0) 5(25.0) 1(5.0)	0(0.0) 9(45.0) 1(5.0) 7(35.0) 3((15.0)	1(5.0) 2(10.0) 9(45.0) 5(25.0) 3((15.0)	0.07

7.	Socio -economic status	Lower V	2(10.0)	0(0.0)	1(5.0)	0.06
		Upper lower IV	7(35.0)	9(45.0)	2(10.0)	
		Lower Middle III	5(25.0)	1(5.0)	9(45.0)	
		Upper Middle II	5(25.0)	7(35.0)	5(25.0)	
		Upper I	1(5.0)	3(15.0)	3(15.0)	

*Chi-square test

Table 1 shows distribution of samples based on demographic characteristics in study. About one third of patients of Controls (35%), 15% of Breathing exercise and 25% of Cold application were 44-56 years of age. More than half of patients of Controls (60%), Breathing exercise (55%) and Cold application (80%) were males. More than one third of patients of Controls (40%), 30% of Breathing exercise and 30% of Cold application were educated up to graduate. More than half of patients of Controls (55%), 40% of Breathing exercise and 55% of Cold application were in private job. More than half of patients of Controls (65%), 55% of Breathing exercise and 60% of Cold application belonged to rural areas. About one third of patients of Controls (35%), 45% of Breathing exercise and 10% of Cold application had income Rs 5000-10,000 per month. About one third of patients of Controls (35%), 45% of Breathing exercise and 10% of Cold application belonged to upper middle II.

Table2: Distribution of the Subject as per clinical profile in breathing exercise, cold application and control group.

S. No.	Clinical Profile	Category	Control Group (n$_1$=20) f(%)	Breathing exercise group (n$_2$=20) f(%)	Cold application group (n$_3$=20) f (%)	P-value
1.	Diagnoss	coronary artery disease	3(15.0)	7(35.0)	9(45.0)	0.12
		Rheumatic Heart disease	17(85.0)	11(55.0)	10(50.0)	
2.	Duration of illness	ACHD	0(0.0)	2(10.0)	1(5.0)	0.92
		Less than 6 months	1(5.0)	1(5.0)	1(5.0)	
		6months – 1 year	5(25.0)	2(10.0)	5(25.0)	
		1year – 2 years	4(20.0)	3(15.0)	3(15.0)	
		3years – 4 year	2(10.0)	5(25.0)	3(15.0)	
		More than 4 years	8(40.0)	9(45.0)	8(40.0)	
3.	Type of chest tube	Pleural chest tube	4(20.0)	3(15.0)	3(15.0)	0.88
		Mediastinal	16(80.0)	17(85.0)	17(85.0)	
4.	Number of days chest tube was inserted	2- 3days	8(40.0)	6(30.0)	7(30.0)	0.80
		3 - 4 days	12(60.0)	14(70.0)	13(70.0)	
		More than 4 days	0.00	0.00	0.00	
5.	Type of cardiac surgery	Open heart surgery	16(80.0)	14(70.0)	11(55.0)	0.23
		Closed heart -surgery	4(20.0)	6(30.0)	9(45.0)	
6.	Any other comorbidity	Diabetes	2(10.0)	4(20.0)	3(15.0)	0.67
		Gastritis	18(90.0)	16(80.0)	17(85.0)	

*Chi-square test

Table 4 shows more than half of patients of Controls (85%), 55% of Breathing exercise and 50% of Cold application had Rheumatic Heart disease. More than one third of patients of Controls (40%), 45% of Breathing exercise and 40% of Cold application had duration of illness >4 years. In 80% patients of Controls, 85% of Breathing exercise and 85% of Cold application, mediastinal tube was inserted. In 60% patients of Controls, 70% of Breathing exercise and 70% of Cold application, 3-4 days was inserted. In 80% patients of Controls, 70% of Breathing exercise and 55% of Cold application, closed heart surgery was performed. Majority of patients of Controls (90%), 80% of Breathing exercise and 85% of Cold application had gastritis.

To compare the effect of cold application and breathing exercise on anxiety score after chest tube removal.
Table-3: Comparison of anxiety score among the groups after chest tube removal

Symptoms	Controls (n=20)	Breathing exercise (n=20)	Cold application (n=20)	p-value[1]
Tense	4.00±0.72	2.00±0.98	3.45±0.88	0.003*
Panicky	3.65±0.58	1.65±0.50	2.50±1.01	0.001*
Uneasy	4.15±0.93	2.10±0.91	2.55±1.43	0.02*
Nervous	4.05±0.99	1.80±1.19	3.60±1.63	0.001*
Anxious	3.70±0.92	1.60±0.78	2.80±1.36	0.004*
Shaky	4.00±1.07	1.48±0.96	2.30±1.30	0.01*
On edge	4.05±0.82	1.64±0.88	2.85±1.18	0.001*
Restless	4.35±0.58	1.45±1.14	2.30±1.41	0.0001*
Insecure	4.05±1.19	1.40±0.68	2.35±1.26	0.0001*

[1]ANOVA test, *Significant

Table 3 shows the comparison of anxiety score among the groups after chest tube removal. The analysis of variance showed that there was significant (p<0.05) difference in the anxiety score among the groups after chest tube removal.

Table-4: Post-hoc tests anxiety score between the groups

Dependent Variable	Groups	Groups	p-value[1]
Tense	Controls	Breathing exercise	0.001*
		Cold application	0.04*
	Breathing exercise	Cold application	0.002*
Panicky	Controls	Breathing exercise	0.0011*
		Cold application	0.034*
	Breathing exercise	Cold application	0.024*
Uneasy	Controls	Breathing exercise	0.002*
		Cold application	0.002*
	Breathing exercise	Cold application	0.04*
Nervous	Controls	Breathing exercise	0.0001*
		Cold application	0.04*
	Breathing exercise	Cold application	0.001*
Anxious	Controls	Breathing exercise	0.001*
		Cold application	0.02*
	Breathing exercise	Cold application	0.012*
Shaky	Controls	Breathing exercise	0.0001*
		Cold application	0.016*
	Breathing exercise	Cold application	0.003*
On edge	Controls	Breathing exercise	0.0001*
		Cold application	0.003*
	Breathing exercise	Cold application	0.014*
Restless	Controls	Breathing exercise	0.001*
		Cold application	0.011*
	Breathing exercise	Cold application	0.009*
Insecure	Controls	Breathing exercise	0.0001*
		Cold application	0.016*
	Breathing exercise	Cold application	0.021*

[1]Tukey's post-hoc tests, *Significant

The post-hoc analysis reveales that tense was significantly (0.001), (0.04) lower among the patients of Breathing exercise (2.00±0.98) and cold application (3.45±0.88) than controls (4.00±0.72) after chest tube removal. Panicky was also significantly (0.0011), (0.034) lower among the patients of Breathing exercise (1.65±0.50) and cold application (2.50±1.01) than controls (3.65±0.58) after chest tube removal. Uneasy was also significantly (0.0001), (0.002) lower among the patients of Breathing exercise (2.10±0.91) and cold application (2.55±1.43) than controls (4.15±0.93) after chest tube removal. Nervous was also significantly (0.0001), (0.04) lower among the patients of Breathing exercise (1.80±1.19) and cold application (3.60±1.63) than controls (4.05±0.99) after chest tube removal. Anxious was also significantly (0.001), (0.02) lower among the patients of Breathing exercise (1.60±0.78) and cold application (2.80±1.36) than controls (7.50±1.10) after chest tube removal. Shaky was also significantly (0.0001), (0.016) lower among the patients of Breathing exercise (1.48±0.96) and cold application (2.30±1.30) than controls (4.00±1.07) after chest tube removal. On edge was also significantly (0.0001), (0.003) lower among the patients of Breathing exercise (1.64±0.88) and cold application (2.85±1.18) than controls (4.05±0.82) after chest tube removal. Restless was also significantly (0.001), (0.011) lower among the patients of Breathing exercise (1.45±1.14) and cold application (2.30±1.41) than controls (4.35±0.58) after chest tube removal. Insecure was also significantly (0.0001), (0.016) lower among the patients of Breathing exercise (1.40±0.68) and cold application (2.35±1.26) than controls (4.05±1.19) after chest tube removal. This reveals that anxiety was lower among the patient who received breathing exercise than the patient who received cold application as compared to control group.

Section-C to compare the effect of cold application and breathing exercise on pain score during chest tube removal.
Table-5: Comparison of pain score among the groups during chest tube removal.

Time period	Controls (n=20)	Breathing exercise (n=20)	Cold application (n=20)	p-value[1]
During chest tube removal	6.35±0.93	6.10±0.78	5.95±0.68	0.29

[1]ANOVA test

Table-5 shows the comparison of pain scores among the groups during chest tube removal. The analysis of variance showed that there was no significant (p=0.29) difference in pain scores among the groups during chest tube removal.

Section D to compare the effect of cold application and breathing exercise on pain score after chest tube removal.
Table-6: Comparison of pain score among the groups after chest tube removal

Time period	Controls (n=20)	Breathing exercise (n=20)	Cold application (n=20)	p-value[1]
After chest tube removal	3.55±1.05	2.40±0.51	1.60±0.50	0.001*

[1]ANOVA test, *Significant, p=0.001 (Post hoc tests)

Table-6 shows the comparison of pain scores among the groups after chest tube removal. The analysis of variance showed that there was significant (p=0.001) difference in pain scores among the groups after chest tube removal. The post-hoc analysis revealed that pain was significantly (p=0.002) lower among the patients of Cold application (1.60±0.50) and (p=0.003) lower among the patients of breathing exercise (2.10±0.51) than controls (3.55±1.05) after chest tube removal, this reveals that pain was lower in cold application and breathing exercise group as compared to control group. On comparison among cold application and breathing exercise it revealed that pain was significantly (p=0.04) lower among cold application (1.60±0.50) than breathing exercise (2.40±0.51), this reveals that pain was lower among the patient who received cold application than breathing exercise.

6. Discussion

In this study after giving cold application therapy and breathing exercise therapy there was a significant (p<0.05) difference between anxiety scores among cold application group and breathing exercise group as compared to control group after chest tube removal, anxiety scores were significantly (p<0.05) lower among breathing exercise group as compared to cold application group, this reveals that anxiety was lower among patient who received breathing exercise than cold application.

The above mentioned findings are supported by the following study:

Vaishali R Sinha1, Koushal Dave,Conducted a study on Effectiveness of cold application on pain & anxiety during chest tube removal among post operative cardiac surgery adult patients. The findings of the study showed that the mean post test pain scores with cold application, 15 minute and 30 minute respectively were significantly (< 0.05) lower than the mean pre-test score of 6.10 ±1.27 in the experimental group without cold application. It indicates that cold application was effective to reduce pain among post-operative cardiac surgery patients while removing chest tube. It indicates that the cold application on chest tube removal was effective in reducing anxiety among post-operative cardiac surgery patient.[3]

In this study there was no significance (p>0.05) difference in pain scores during chest tube as measured by visual analogue scale. This shows that cold application is not effective on pain during chest tube removal.

Naglaa Mohamed EL Mokadem, Shimaa EL-Sayed Ibraheem,(2017) Conducted a study to assess the effectiveness of Cold Application and Breathing Exercises to Reduce Pain and Anxiety During Chest Tube Removal. The findings of the present study revealed that a statistically significant decrease in pain level immediately, 15 and 30 minutes after chest tube removal in the studied groups compared to the control group.[4]

The pain was significantly (p<0.05) lower among the patient of cold application (1.60±0.50) and breathing exercise (2.40±0.51) than controls (3.55±1.05) after chest tube removal, this reveals that pain is was significantly lower in application and breathing exercise group as compared to control group. The pain was significantly (p<0.05) lower among cold application (1.60±0.50) than breathing exercise (2.50±0.51), this reveals that pain was lower among the patient who received cold application than breathing exercise.

The above mentioned findings are supported by the following study:

Vaishali R Sinha, Koushal Dave,Conducted a study onEffectiveness of cold application on pain & anxiety during chest tube removal among post-operative cardiac surgery adult patients. The findings of the study showed that the mean post-test pain scores with cold application at zero minute, 15 minute and 30 minute respectively were significantly (< 0.05) lower than the mean pre-test score in the experimental group without cold application. In control group, pre-test mean pain score as compared to mean post-test pain score at zero minute, 15 minute and 30 minute were lower respectively. It indicates that cold application was effective to reduce pain among post-operative cardiac surgery patients while removing chest tube.[3]

7. Conclusion

Based on these findings of the study, it shows that the level of pain and anxiety was lower after chest tube removal among the patients who received cold application therapy and breathing exercise therapy than compared to control group. This study demonstrates that Cold application and breathing exercise is an effective technique to reduce the intensity of pain and anxiety level in chest tube removal. Cold application and breathing exercise technique is a safe, inexpensive, and a non-pharmacologic nursing intervention that can be recommended as a pain relief technique in chest tube removal. Nurses make important decisions regarding application of non-pharmacologic therapeutic interventions for pain management.

So, health care provider should provide cold application therapy and breathing exercise therapy to patient with chest tube.

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