

## Pain and Anxiety among Hemodialysis Elderly Patients after Cryotherapy Intervention

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### Abstract

**Background:** Elderly patients undergoing hemodialysis reported pain, anxiety, drowsiness, fatigue, nausea, and dry mouth, loss of appetite, itch, and breathlessness.

**Aim** of this study was to evaluate pain and anxiety Among Hemodialysis Elderly Patients After Cryotherapy Intervention.

**Research design:** A quasi-experimental pretest-and-posttest design was utilized.

**Setting:** The study was conducted at the hemodialysis unit at the internal medicine department of Zagazig University Hospital and the hemodialysis unit at Al Ahrar hospital affiliated to the Ministry of Health.

**Subject:** This study included 60 elderly patients.

**Tools:** Three tools were used. Tool I: Structured Interview Questionnaire to assess demographic characteristics and medical history. Tool II: Numerical Rating Pain scale. Tool III: Beck Anxiety Inventory (BAI) scale.

**Results:** Illustrates a statistically significant difference in total mean anxiety score among studied elderly patients pre and post the intervention ( $P \leq 0.001$ ). Before the intervention, total mean score of anxiety was  $35.78 \pm 6.32$  which decreased to  $23.78 \pm 5.06$  at the post intervention phase. This change was statistically significant. Regarding pain, the total mean score of pain was  $6.75 \pm 1.48$  and decreased to  $4.68 \pm 1.42$  in the post-intervention phase. Pain score had a statistically significant positive correlation with the anxiety score.

**Conclusion:** Cryotherapy intervention was found to be effective in reducing the pain and anxiety levels caused by venipuncture.

**Recommendation:** It is recommended that Educational programs about the application of cryotherapy intervention and its effect on minimizing pain and anxiety should be conducted for nursing staff and caregivers.

**Keywords:** Anxiety, Cryotherapy intervention, Pain, Hemodialysis, Elderly.

## Introduction

Egypt is expected to maintain the highest rank in absolute numbers in both old and oldest populations in the region, in 2050 Egypt is expected to have the largest number of old (23.7 million) and oldest old (3.1 million) populations in the region. The percent of geriatric people was 6.27% in 2006. The percentage is expected to reach 20.8% in 2050 (Hassan, Abd Allah & El-Badawy, 2021).

Chronic kidney disease (CKD) is a progressive, irreversible drop in renal functions in which the body fails to sustain metabolic, fluid, and electrolyte balance (Kallenbach, 2020). The incidence of chronic kidney disease is increasing worldwide, and the number of individuals diagnosed with it doubles every seven years (Rangaswami et al., 2019).

Dialysis is a treatment for elderly patients whose kidneys have almost completely stopped working. Dialysis treatments use equipment to do about 10% of the healthy kidney work. This percentage means enough toxins and fluids are removed from the body to keep it working (Megawati, Abdurachman & Muliani, 2019). Dialysis treatments are classified as hemodialysis and peritoneal dialysis (Jain, Haddad & Goel, 2019).

Hemodialysis (HD) is a medical procedure used to remove excess fluid and waste products directly from the vascular system by passing the blood through the artificial kidney, a dialyzer (Chazot & Jean, 2019). As a consequence, the age, co-morbidity and dependency of the HD population has increased, and the technique has become the default modality for the treatment of end stage renal disease (ESRD) (He et al., 2020).

In a study of prevalence of ESRD in Assuit Governorate, Upper Egypt, A cross-sectional multi centric study was carried out with 1109 at Assuit Governorate patients in 13 HD units found that more than 25 % of ESRD patients are > 50 years old age (Hassan et al., 2020).

## I. Literature review

Pain is characterized as a hateful sensory or emotional experience that leads to actual harm, including sleep disturbances, symptoms of anxiety and depression, reduced physical activity, impaired interpersonal relationships, and the inability to perform usual activities (Samoudi et al., 2021).

Pain is a frequent complaint among ESRD elderly patients predicted to have impacts on more than 58% of CKD elderly patients, of which 49% is moderate to severe in intensity, negatively affects the quality of life (QOL) and has mental, physical, and social consequences among these patients (Senanayake et al., 2020).

Elderly patients undergoing HD also reported anxiety, drowsiness, fatigue, nausea, and dry mouth, loss of appetite, itch, and breathlessness. Anxiety and depression are the most common psychiatric disorders that coincide with renal failure. It contributes significantly to a diminished

QOL in this population and can have a negative impact on elderly patients' nutritional status and their compliance with dialysis treatment (Al-Ali et al., 2021).

Anxiety is a subjective feeling of uneasiness, discomfort, or fearful concern accompanied with autonomic and somatic manifestations (Chapman & Kirby-Turner, 2018). The exact prevalence of anxiety disorders in HD elderly patients is unclear, but estimates have ranged from approximately 12% to 52% in various studies. The wide disparity in range likely reflects differences in the screening methods for anxiety disorders used by the investigators and the different patient populations which were sampled found that 45.7% of the 70 randomly selected HD patients in a single dialysis center (Kimmel, Cohen & Cukor, 2021).

Effort on pain management from health professionals at all department levels must be implemented as an important portion toward changing ineffective pain management practices (Akbar et al., 2019). There are different strategies to improve pain in HD elderly patients during AVF cannulation (Alzaatreh, & Abdalrahim, 2020).

The common non-pharmacological interventions for pain management include music therapy, deep breathing techniques, distraction and cold therapy (Yaban, 2019). Cryotherapy or cold therapy is another effective method for reducing pain, edema, and inflammation. The cold stimulates the body's nervous system to secrete beneficial biochemicals which includes endorphins, adrenaline, oxytocin and others are produced and infused during the body. The discharge of these all natural anti-anxiety hormones, consequences in more desirable mood and reduce anxiety ranges. Due to the fact cryotherapy intervention increases the immune device and raises power. It also enables people sense mentally and emotionally higher as well (Abozeid et al., 2019).

Gerontological nurses play an important role in improving quality, adequacy and helping the elderly patient to understand his or her condition; Hemodialysis nurses play a large role in preventing complications during the process. They review a laboratory results before HD to make sure fluid and electrolyte balances are within acceptable limits, weight the elderly patient before and after the procedure to make sure that the right amount of fluid is returned, and ensure that elderly patients don't take medications that could cause problems during HD. Blood pressure medications, for example, can cause blood pressure -which lowers during treatment in any case -- to drop to dangerous levels (Algadi, 2018).

## II. Method

### 1) Study Design and Ethical Considerations

A quasi-experimental pre-test and post-test design was utilized to conduct the current study from May 2021 to October 2021 at the hemodialysis unit at the internal medicine department of Zagazig University Hospital and the hemodialysis unit at Al Ahrar hospital affiliated to the Ministry of Health, Sharkia governorate, Egypt. The study was approved by the Research Ethics Committee (REC) and the Postgraduate Committee of the Faculty of Nursing at Zagazig

**2) Sample:**

A purposive sample composed of 60 elderly patients or above able to communicate, have AV fistula at the forearm and undergoing hemodialysis furthermore, healthy skin, able to verbalize pain and no allergic reaction to cold application.

**3) Sample size calculation:**

It was calculated using SPSS (version 21). A sample size (N) of 60 achieves 97% power to detect a mean of paired differences of 0.8 with an estimated standard deviation of differences (S) of 1.4 and effect size of 0.5 and with a significance level (alpha) of 0.05000 using a two-sided Wilcoxon test assuming that the actual distribution is normal (Abozeid et al., 2019).

**4) Tools for data collection:**

**A: Structured interview questionnaire**

It was developed by the researchers based on the literature review. It was used to assess the demographic characteristics which included age, sex, marital status, educational level (illiterate, read and write, basic education, secondary education, university education and post graduate), work before retirement, residence, income, and income source.

**B: Numerical Rating Pain scale. (Hawker, 2011).**

It was used to assess level of pain among the study subjects before and after the implementation of the cryotherapy intervention. The 11-point numeric scale ranges from '0' representing no pain extreme (e.g. "no pain") to '10' representing the other pain extreme (e.g. "pain as bad as you can imagine" or "worst pain imaginable"  $r=0.89$  (*highly reliable*)).

**C: Beck Anxiety Inventory (BAI) scale. (Beck, 1988).**

It was used to assess level of anxiety among the study subjects before and after the implementation of the cryotherapy intervention. Study subjects were asked to rate each item on a 4-point scale ranging from 0 (not at all) to 3 (severely, can barely stand it). The total score is calculated by finding the sum of the 21 items. Total scores ranging from 0 to 63 and its scores were divided into the following: from (0-21) represent low anxiety, while from (22-35) moderate anxiety, and from (36 and above) represent severe anxiety.  $r=0.86$  (*highly reliable*).

**D. Pilot study**

Before performing the main study, a pilot study was carried out on 6 elderly from the study setting, constituting about 10% of the calculated sample for the main study. They were selected randomly from the selected village and were later excluded from the main study sample of research work to assure stability of the answers. The purposes of the pilot were to test the questions for any obscurity and to assess the practicability and feasibility of using the structured interview questionnaire sheet for the elderly. It also helped the researcher to determine the time needed for filling out the forms, which turned to be 25 to 35 minutes. The tools were finalized after doing necessary modifications according to the pilot study results.

### ***Implementation phase***

The cryotherapy intervention was implemented for the studied elderly. The intervention was offered to the studied elderly in the form of six sessions for small groups to give more chances for discussions, interactions, and practical training. The total sample was divided into small groups (4 to 6 elderly in each group).

All groups received the same content using the same teaching methods, media, discussions, and the same booklet. The length of each session was variable according to elderly's responses and active participation, as well as the time available, and the content of each session. The sessions were aided by using pictures, posters, as well as the booklet.

### ***Procedure***

The cold application was made with ice packs on the web between the thumb and index finger of the contralateral arm (the hand not having the AVF). The procedure was started ten minutes before venipuncture and was continued to the puncturing procedure (approximately two or three minutes).

### ***Evaluation phase***

The evaluation of the effectiveness of the nursing intervention was done after its implementation. A post-test was carried out immediately after the intervention. This was done using the same data collection tools of the pre-test.

## **IV. Statistical Analysis**

All statistical tests were conducted using SPSS for windows version 25.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean  $\pm$  standard deviation (SD). Categorical data were expressed in frequency and percentage. The comparisons were determined using Student's t-test for two variables with continuous data; Paired t-test was used to compare means for one variable. ANOVA test for more than two variables with continuous data. Chi-square test was used for comparison of variables with categorical data. Pearson correlation analysis was used for assessment of the inter-relationships among quantitative variables. Statistical significance was set at  $p < 0.05$ .

## **V. Results**

**Table 1** Among 60 elderly patients, the mean age was  $69.73 \pm 5.85$  years, 58.3% were females, 66.7% of the studied elderly were married, 53.3% were living in urban with their wives/husbands (63.4%) and 58.3% of the elderly patients had enough income.

**Table 2** demonstrated a statistically significant difference in percentages of Pain levels among studied elderly patients pre- post the intervention ( $P=0.000$ ). Before the intervention, 75% of the studied elderly patients had severe pain and 21.3% had moderate level to pain. This changed to be 46.7% who had severe pain, and 23.3% has mild level and 21.7% had moderate level. This change was statistically highly significant.

**Figure 1** illustrated a statistically significant difference in total mean anxiety score among studied elderly patients pre and post the intervention ( $P \leq 0.001$ ). Before the intervention, total mean score of anxiety was  $35.78 \pm 6.32$  which decreased to  $23.78 \pm 5.06$  at the post intervention phase. This change was statistically significant.

**Table 3** pointed to that pain score had a statistically significant positive correlation with the anxiety score.

**Table 1:** Demographic characteristics of the studied elderly patients (N=60)

Demographic characteristics	(N=60)	
	Frequency	Percent
<b>Age group</b>		
60-69 years	37	61.7
70-79 years	18	30.0
$\geq 80$ years	5	8.3
<b>Mean <math>\pm</math> SD</b>	$69.733 \pm 5.853$	
<b>(Range)</b>	(60 -71)	
<b>Gender</b>		
Male	25	41.7
Female	35	58.3
<b>Residence</b>		
Urban	32	53.3
Rural	28	46.7
<b>Marital status</b>		
Unmarried (single, widow, divorced)	20	33.3
Married	40	66.7
<b>Monthly income</b>		
Enough	35	58.3
Not enough	20	33.4
Enough and saving	5	8.3

@Responses are not mutually exclusive

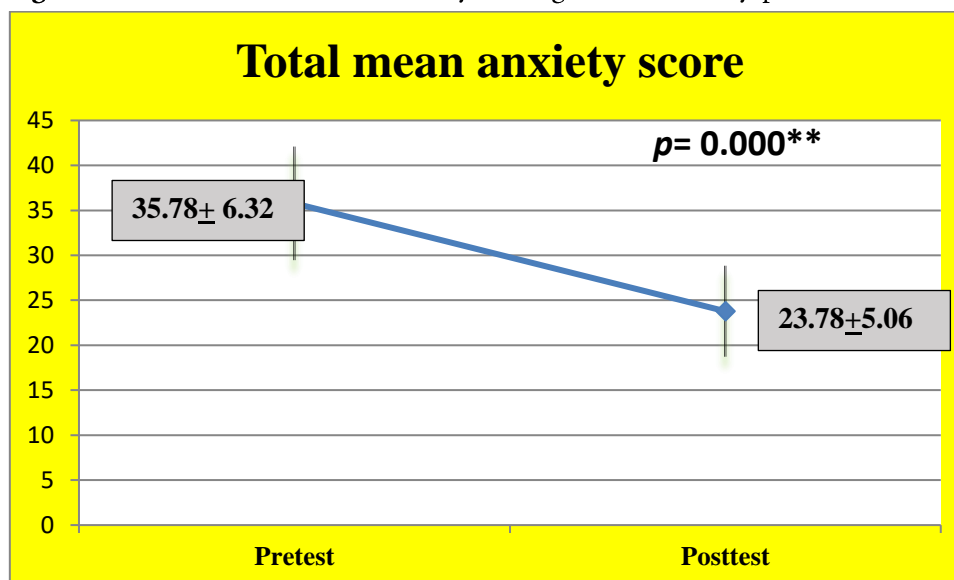
**Table 2:** Pain levels among studied elderly patients pre- post the intervention (N=60)

Pain Level	Pretest		Post test		P- value
	No	%	No	%	
No pain	0	0.0	5	8.3	$X^2=17.959$ $p=0.000^{**}$
Mild	2	3.3	14	23.3	

Moderate	13	21.7	13	21.7	
Severe	45	75.0	28	46.7	

$X^2$  refers to chi square test, \*\* refers to highly significance if  $p$  value is less than 0.001.

**Figure 1:** Total mean score of anxiety among studied elderly patients (N= 60).



**Table 3:** Correlation matrix between pain, and anxiety score.

Items	Pain score post
Anxiety score posttest	.429**

\* Significance if  $p$  less than 0.05. \*\* Highly significance if  $p$  less than 0.001.

## VI. Discussion

Elderly patients undergoing HD also reported puncture pain, anxiety, drowsiness, fatigue, nausea, and dry mouth, loss of appetite, itch, and breathlessness. **Concerning demographic characteristics**, the mean age of the elderly in the present study was  $69.733 \pm 5.853$  which is close to the mean reported by Mohamed, Abdel-Salam, and Mohamed, (2021) in Egypt (67.19 years) and Ireland (66.1 years) by Maguire et al., (2022). The same point is confirmed by Sehrawat et al., (2022) in Northern India who mentioned that the age range was between 65–84 years and the mean age was 68.5 years.

The present study revealed that more than half of the studied elderly were women. The higher percentage of women may be due to their increased risk for repeated urinary tract infections, which can also lead to kidney infections and can cause long-term damage to the kidneys (Kaufman, Temple-Smith, & Sancu, 2019). The finding is in congruence with Bikbov, Perico, and Remuzzi, (2018) who stated that there are some particularly vulnerable groups with high

disease prevalence, and one of these is women. Also, the national kidney foundation reported that kidney disease is more common in women than men (**Centers for Disease Control and Prevention, 2021**). On the other hand, in Senegal **Seck, et al., (2014)** declared that chronic kidney disease prevalence in women was lower than in men, and these differences may be due to age differences, or differences in the settings of the studies.

Patients with end-stage renal disease undergoing hemodialysis are repeatedly exposed to pain from approximately 300 punctures per year (**Arab et al., 2017**). The researcher depended on the "Numerical Rating Scale" because of its simplicity, reproducibility, easy comprehensibility, and sensitivity to small changes in pain. Before the intervention, three-quarters of the studied elderly patients had severe pain, but this percentage decreased after the intervention to be less than half. This significant difference indicates that cryotherapy intervention is an attractive analgesic option since it is non-invasive, nonpharmacologic, inexpensive, non-time consuming, and readily available (**Çetin & Çevik, 2019**).

In this regard, the current study findings are supported by the results of several studies that investigated the effect of cryotherapy (cold application) on arterial puncture pain (**Badr et al., 2020; Khalil, 2017**). These studies concluded that cold application is a practical, affordable, and simple method to decrease puncture pain and increase the patient's comfort during the procedure.

Supporting our results, a randomized control trial was conducted by **Pagnucci et al. (2020)** in Italy to compare the effect of three anesthetic methods (lidocaine cream application, subcutaneous infiltration of mepivacaine, and ice application) on reducing puncture pain, and proved that cryotherapy in the form of ice application is an effective anesthetic method in reducing the perception of pain and can be the most economical of the three interventions. Psychologically, A.V fistula puncture pain causes pressure, tension, anxiety, depression, and fear. Moreover, the greater the A.V fistula puncture pain, the lower quality of life for HD patients (**Liu, 2021**).

The study findings demonstrated a statistically significant difference in percentages of anxiety levels among the studied elderly patients' pre-and-post intervention. Before the intervention, slightly more than half of the studied elderly patients had moderate levels, and slightly less than half had severe anxiety. This decreased after the application of the cryotherapy intervention, as nearly two-thirds of these elderly had moderate levels, and more than one-third had mild levels. This can be explained as the cold promotes smooth muscle relaxation and blood circulation with physiological warming effects, and reduces pain by alleviating the congestion of deep tissue.

Previous studies had been done to find out whether cryotherapy aids patients with long-term anxiety, and the findings showed that cryotherapy does in fact help. That may be interpreted as the cold stimulating the body's nervous system. Biochemicals as endorphins, adrenaline, oxytocin, and others are produced and infused throughout the body. The release of these natural anti-anxiety hormones results in improving mood and lowering anxiety levels. This was

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evidenced by **Aruna, (2015)** who declared that cryotherapy boosts the immune system, increases energy, and cryotherapy helps people feel mentally and emotionally better as well.

Also, this may be due to that most of the studied elderly were cooperative and had much enthusiasm to participate in cryotherapy intervention and they were keen to learn the technique of ice massage, and then they preferred to perform it by themselves. All these points reduced their anxiety levels (manifestations) from fistula puncture and their thinking was diverted toward implementing the intervention, asking about the duration of massage that they had until feeling numbness and its effect.

In congruence with this finding, the study of **Emami, Vashani, and Sahebkar, (2016)** in Iran, identified a statistically highly significant reduction in anxiety levels after the application of cryotherapy.

In Egypt (Mansoura), **Abozeid et al., (2019)** used the Beck Anxiety Inventory scale before and after the cryotherapy intervention during the puncture of arteriovenous fistula among hemodialysis patients, they showed that there was a statistically highly significant reduction in anxiety level after application of cryotherapy. This is incongruent with **Demir, and Khorshid, (2010)** who showed that cold application reduced patients' intensity of pain but did not affect anxiety levels or the type of pain. These differences may be due to the aging differences of the study subjects, or differences in the settings of the studies.

The post-test results of the present study revealed a statistically significant negative correlation between the elderly patients' pain score and the anxiety score. Also, the pain score was statistically positively correlated with the anxiety score.

This goes in the same line with **Kishore et al., (2021)** in India who showed that there was a significant relationship between their HD patients' levels of pain and anxiety. Also, in France, the finding of the study by **Kosmadakis et al., (2022)** revealed that during AV fistula cannulation, anxiety was associated with pain. They indicated that the highest of pain increases the level of anxiety as well. Moreover, in Portugal, **Sousa et al., (2020)** found that anxiety level was associated with higher pain values and stated that they are common among individuals with CKD and are known to negatively affect the quality of life.

Based on the results of this study, cryotherapy intervention was found to be effective in reducing the pain and anxiety levels caused by venipuncture. Therefore, the use of cryotherapy is recommended as an easy, self-administrable method for elderly patients undergoing HD during A.V fistula puncture.

## VII. Conclusion

Based upon the findings of the present study and approving of the hypothesis, it was concluded that the cryotherapy intervention was found to be effective in reducing pain and anxiety during arteriovenous fistula puncture among elderly patients undergoing hemodialysis. Pain among studied elderly was decreased post intervention to less than half and anxiety level was decreased also post intervention to as nearly two-thirds of elderly patients undergoing hemodialysis had

moderate levels, and more than one-third has mild levels. Therefore, the interventional study is a widely accepted approach to improving pain and anxiety.

## VII. Recommendations

*On the basis of the current study findings*, the applied cryotherapy intervention should be implemented in the study setting on a long-term basis to test its sustainability, and in other settings to confirm its effectiveness and for further improvements. Educational programs about the application of cryotherapy intervention and its effect on minimizing pain and anxiety should be conducted for nursing staff and caregivers.

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