

## The Effect of Progressive Muscle Relaxation and Proper Patients' Preparation on Selected Complications Post Extracorporeal Shock Wave Lithotripsy

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### Abstract

**Background:** Extracorporeal shock wave lithotripsy (ESWL) is one of the most important non-surgical procedures for treating urinary tract stones, so proper patient preparation for this procedure with applying progressive muscle relaxation (PMR) had a vital role in reducing pain and complications as well as improving the recovery rate. **Aim:** to evaluate the effect of progressive muscle relaxation and proper patients' preparation on selected complications post extracorporeal shock wave lithotripsy. **Design:** Quasi-experimental research design was used. The study was conducted in the urology outpatient clinic and shock wave lithotripsy unit at the University Hospital, Shebin El-kom district, Menoufia Governorate. A purposive sample of (232) patients undergoing extracorporeal shock wave lithotripsy were included in the study. Three instruments were used for data collection. Instrument 1; Structured interview questionnaire: It composed off our parts; part one; patient's demographic data, part two: patient's medical data, Part three: patients' knowledge about urolithiasis and extracorporeal shock wave lithotripsy, Part four: patient's urological assessment. Instrument 2: The visual analog pain scale. Instrument 3: Beck anxiety inventory scale. **Results:** There was statically significant increase regarding patients' level of knowledge that related to ESWL treatment, decreasing of pain, anxiety level and urological symptoms among the study group than the control group. **Conclusion:** The present study established that progressive muscle relaxation and proper patient's preparation had a positive effect in reducing pain, anxiety, and urological symptoms following post extracorporeal shock wave lithotripsy. **Recommendations:** Appropriate patient preparation prior shock wave lithotripsy at the unit is necessary to reduce complications risk, also Plans should be made for ongoing education for nurses so they can give patients the essential oral and written information regarding urolithiasis.

**Key words:** Extracorporeal shock wave lithotripsy, Progressive muscle relaxation, Patients preparation, Selected complications.

### Introduction:

Urolithiasis is a disorder that develops when the stones leave the renal pelvis and move to parts of the urinary collecting system as ureters, bladder, and urethra. As 80% of the kidney stones are made of calcium oxalate or phosphate, also there are another various type of kidney stones as well as uric acid, struvite, and cysteine. There are various risk factors for stone formation, including food, a personal or family history of stones, environmental variables, medications, and the patient's medical history which contribute to the different types of stones (Chung, 2017).

Poor oral fluid intake, high animals' protein consumption, increase oxalate intake

from foods including beans, beer, berries, coffee, chocolate, some nuts, some teas, soda, spinach, potatoes, and excessive salt intake are all common risk factors for stones formation. Additionally, the chance of developing kidney stones is increased by conditions such as chronic renal disease, hypertension, gout, diabetes mellitus, hyperlipidemia, obesity, endocrine disorders, and malignancies. Moreover some drug could cause urolithiasis which compromises only 2% of stones one of these drugs is protease inhibitors that is utilized form an aging of HIV (Chung, 2017). Most of patients with renal stones are asymptomatic, symptoms usually appear during stones movement that may include sever colicky flank pain radiating to the groin or scrotum that may be accompanied with nausea, vomiting,

persistent urge to urinate, hematuria, pain during urination, fever and chills if infection is present (Han et al., 2019).

Based on the patient's condition, urolithiasis is treated with a combination of conservative medical and surgical procedures. Anti-inflammatory drugs (NSAIDs) used orally and intravenously are suggested as initial pain management strategies. Opioids could be used; only for persistent pain. Alpha-blockers, including doxazosin and tamsulosin, are an important adjuvant in medical expulsive therapy (MET) to help in moving the larger stones (5–10 mm), but they did not be helpful in moving the smaller stones. Patients who appear dehydrated as a result of recurrent vomiting could be given IV crystalloid fluids (Gottlieb, 2018)

In between thirty and forty days, 86% of stones will spontaneously be dissolved. Overall, the size of the stone greatly influences how long it will take to pass. Different levels of disease or urolithiasis-related consequences might manifest in patients with the disorder. MET could be used to treat patients who had slight stones, physiological blood work, no symptoms of infection, or acute blockage. If the patient complained from oliguria or anuria accompanying with infection, or had a history of solitary kidney may necessitate crucial intensive urologic intervention for the individuals who arrive with big stones, acute renal failure, or both (Fontenelle & Sarti, 2019 and Thakore & Liang, 2021).

Patients with severe pain or vomiting, inability to tolerate oral intake, pregnancy or pediatric patients may require hospitalization for closer observation. Further interventions and an appropriate plan of care should be made according to the patient's risk factors, medical history, acute presentation, and urologist's comfort and preference. There are various methods of acute urologic interventions, including extracorporeal shockwave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL) and laparoscopy such as the flexible ureteroscopy (URS) (Thakore and Liang, 2021).

Patients who experience uncontrollable pain or vomiting, are unable to swallow, or the pregnant, or pediatric patients may need to be admitted to the hospital for careful monitoring. The patient's risk factors, medical history, acute presentation, and the urologist's preference should all be taken into consideration when determining additional interventions and a suitable course of therapy. Acute urologic therapies could be performed through using a variety of techniques, such as Extracorporeal Shock Wave Lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL) and laparoscopy such as the flexible ureteroscopy (URS) (Thakore and Liang, 2021).

ESWL is considered one of the most important and noninvasive procedure to treat urinary stones lesser than two centimeters. Many factors could affect the outcomes of ESWL as stone composition, site, size, location, thickness, and presence of ureteral stent, the anatomical structure of the urinary system, the efficacy of lithotripter and experience of operator. There are possible complications that may result from ESWL as hematuria, hematoma, nausea, vomiting, pain, anxiety, and urinary tract infection (Mourad et al., 2021 and Elawady et al., 2021).

Complications that result from ESWL come from formation and passage of fragments, infections, effects of shock wave on the renal and non-renal tissues including kidney function impairment and hypertension. Each of these complications could be prevented by adopting appropriate measures, such as considering patients contraindications, the recognition and the correction of concomitant diseases or infection and using the ESWL in the most efficient and safe way (Smolic & Markic 2021 and Dogan & Ceylan 2021).

The production and transit of the fragments, infections, as well as the shock wave effects on renal and non-renal tissues, including kidney function impairment and hypertension, which are complications that arise with ESWL. By taking the proper precautions, such as adhering to the contraindications, identifying, and treating the concurrent disorders or infections, and employing the ESWL in the most effective and secure manner, so each of

these issues could be avoided (**Smolic & Markic 2021** and **Dogan & Ceylan 2021**).

Pain is considered an undesired side effects of ESWL that may lead to interruption of treatment session so the treatment protocol should include analgesic prophylaxis and applying nursing measures to manage pain during the treatment session. Moreover, nursing care should be applied in agreement with ESWL protocol to improve patients' recovery and lessen side effects and problems. Nursing education should be started from tacking the decision of treatment until follow up stage to reduce rate of stone recurrence through obtaining the stone fragments for composition analysis. This knowledge may influence decision-making if additional treatments are needed in the future and will assist in guide diet and drug choices. Repeat stone investigation could be helpful as its composition which potentially could be alter over time due to ESWL treatment. (**Abd El Guid et al., 2023**)

Progressive muscular relaxation (PMR) is considered a non-pharmacologic technique that is affordable, simply applied by the patient, and recently become an important component in nursing care as it is a systematic manner to reduce anxiety, stress, and pain perception. Also it leads to restore or promote psychological and physiological well-being through relaxation of the mind and lower arousal in the central and the autonomic nervous system. (**Aziz and Elgzar, 2018**). The exercise includes tensing and releasing muscles, progressing throughout the body, with emphasis on the release of the muscle as the relaxation phase. (**Parás-Bravo et al., 2018**)

Patient's needs should be taken into consideration while planning for ESWL procedure preparation, safety precautions must be followed during the procedure, then the discharge plan instructions should be educated to patient that help for prevention of stone recurrence (**Aziz and Elgzar, 2018**). Numerous research indicated that patient's knowledge about urolithiasis disease, ESWL procedure and reducing pain was inadequate and there is a need for further researches about it.

There is a need for more research on this subject because numerous studies had shown that patients' knowledge about the urolithiasis disease, the ESWL method, and pain relief are insufficient.

### **Significance of the study**

Nephrolithiasis occurs in all parts of the world. The incidence of urinary tract stone disease in developed countries is similar to that in the United States. The lifetime prevalence of nephrolithiasis is about 11% for men and 7% for women in United States. Approximately 30 million persons are at risk in USA, about two million patients admit to the outpatients with stone disease yearly. While in Egypt, the prevalence of renal stone was estimated at 3% of all individuals and affect up to 12% of the general population during their lifetime (**Abdelwahab et al., 2021** and **Turk et al., 2021**)

Extracorporeal shock waves lithotripsy considered the first line and only truly non-invasive method for treatment of smaller renal stone less than 2 cm size in addition to have a successful stone free rate about 75%. (**Smolic & Markic 2021** and **Manzoor & Saikali 2021**)

Nurses play an important role to improve recovery rate by reducing complications for patients following ESWL through appropriate patient assessment to identify if there is any contraindications for performing ESWL, proper preparation for the procedure through administering evidenced nursing guidelines, monitor the patients' vital signs and assess patients' level of pain during procedure, also they give patients instructions about warning signs that require immediate medical attention, all of nurses play an important role in improving patients' knowledge about life style modifications, decreasing pain and the risk of recurrence of renal stones. (**Manzoor & Saikali 2021** and **Renuka & Poongodi 2020**). A little research was carried about progressive muscle relaxation to overcome pain and anxiety post ESWL, so the researcher used progressive muscle relaxation beside good preparation for patient through providing knowledge about selected complications post extracorporeal shock wave lithotripsy as (hematuria, fever and

hesitancy) as well for pain and anxiety to improve patient 'condition

### **Aim of the study:**

This study aimed to evaluate the effect of progressive muscle relaxation and proper patients' preparation on selected complications post extracorporeal shock wave lithotripsy.

**Research hypothesis:** The following research hypothesis has been formulated in an attempt to fulfill the study purpose:

1. Patients who receive preparation instructions and muscle relaxation (study group) are more likely to have a good knowledge compared to patient who don't receive that (control group).

2. Patients who receive preparation instructions and muscle relaxation (study group) are less likely to have urological complications compared to patient who don't receive that (control group).

3. Pain level is lower among patients who receive preparation instructions and muscle relaxation (study group) than patients who don't receive (control group).

4. Anxiety level is lower among patient who receive preparation instructions and muscle relaxation (study group) than patients who don't receive (control group).

### **Methodology:**

#### **Research design:**

Quasi-experimental research design (pre/post-test) was used to attain the research purpose.

#### **Research setting:**

The study was conducted in the urology outpatient clinic at the first floor and in the shock wave lithotripsy unit at the seven floor in Menoufia University Hospital at Shebin El-kom district, Menoufia Governorate, Egypt.

#### **Sample:**

A purposive sample of (232) patients undergoing extracorporeal shock wave lithotripsy that divided randomly and alternatively into two groups study (group I) and control (group II), each one consisted of 116 patients. The study (group I) consisted of

116 adult patients received an information about the proper preparation prior extracorporeal shock wave lithotripsy and progressive muscle relaxation. The control (group II) consisted of 116 adult patients exposed to the routine hospital care only that contained instructions related to preparation for extracorporeal shock wave lithotripsy.

### **Sample size calculation:**

It was selected by using the following Equation: Sample size for frequency in a population:

Population size (for finite population correction factor or fpc) (N): 576

Hypothesized % frequency of outcome factor in the population (p): 50% +/-5

Confidence limits as % of 100 (absolute+/-%)(d): 5%

Design effect (for cluster surveys-DEFF): 1

Sample size  $n = [DEFF * Np(1-p)] / [(d^2 / Z_{1-\alpha/2}^2 * (N-1) + p * (1-p))]$ .

**Sampling criteria:** subjects were selected according to the following inclusion and exclusion criteria:

### **Inclusion criteria:**

- Adult patients age from 18-60 years old.
- Able to operate and participate in the study.
- With normal renal anatomy and will perform extracorporeal shock wave lithotripsy for the first time.

### **The exclusion criteria:**

- Patients with urinary and systemic complications as bilateral or multiple stones, coagulopathy which increase incidence of renal hematomas.
- Patients that use platelet aggregation inhibitors, aortic aneurysms which could put patients at a risk for bleeding.

▪ Extreme uncontrolled hypertension that exacerbated hemorrhage and perinephric hematoma, untreated urinary tract infections as this category of patients was contraindicated to perform ESWL.

#### **Variables:**

The independent variable was progressive muscle relaxation and proper patients' preparation, while the dependent variable was urological symptoms as (hematuria, fever, dysuria, irritation, and intermittency), pain and anxiety.

**The study instruments:** Three instruments were used for data collection.

**Instrument 1; Interviewing questionnaire:** It consisted of four parts.

#### **Part one: Patient's demographic data:**

It included the personal data as patient's name, sex, age, marital status, level of education and place of residence.

#### **Part two: Patient's medical data:**

It included the presence history of the chronic disease and stone characteristics (location of renal stone and stone diameter (mm.).

#### **Part three: Patient's knowledge:**

It was used to assess the patient's knowledge level that related to extracorporeal shock wave lithotripsy preparation. It consisted of eight questions about causes of stone formation, signs and symptoms, prevention and treatment methods, advantages of using ESWL, Instructions for preparation before ESWL, instruction followed after ESWL, and side effects of ESWL treatment.

#### **Scoring System.**

• Each question received a score between 0 and 2, with 0 denoting an incorrect response, 1 indicating a correct but incomplete response, and 2 denoting a correct and complete response, then all scores of all questions were summed up to give the total knowledge score from 0-16 marks and classified as the following:

- less than 60% (less than 9.6) indicating unsatisfactory level.
- 60% or more ( $\geq 9.6$ ) indicating satisfactory level.

#### **Part four: Patients urological assessment:**

It was used to assess the urological symptoms of renal stone as hematuria, fever, dysuria, irritation, and intermittency.

#### **Instrument 2: The visual analog pain scale (VAS)**

The visual analog pain scale (VAS) is a subjective measure for intensity of pain. It was developed by McCormack et al., (1988) and revised by Couper et al., (2006). The pain scores are represented in a continuum between (0) indicated no pain and (10) indicated worst pain, that interpreted in the following:

(0)=No pain, (1-3) mild pain, (4-6) moderate pain, (7-9) severe pain, (10) worst pain.

#### **Instrument 3: Beck Anxiety Inventory Scale**

This scale was developed by Beck et al., 1988 to measure the subject's level of anxiety. It composed of twenty-one items, each item is rated on a four-point rating scale ranging from zero to three, as zero means not at all, one mild anxiety, two moderate and three means severe anxiety.

#### **Score interpretation:**

Scoring is easily accomplished by summing scores for items. The overall score ranges from (0–63), that interpreted as the following: (0–9) normal or no anxiety, (10–18), mild anxiety, (19 – 29) moderate anxiety, and (30 – 63) severe anxiety.

#### **Instruments validity and reliability:**

Instrument 1(part one, two, three, and four) were developed by the researchers after extensive review of the relevant related literature. The content validity of the instrument 1 was tested by a panel of five experts specialized in Medical Surgical Nursing and the reliability was tested by intra class reliability coefficient, it was 0.90.

Instrument 2: Internal consistency for the scale = (Cronbach's  $\alpha = 0.92$ ). Test – retest

reliability for the scale = 0.97 (Alghadir et al., 2018).

Instrument 3: Internal consistency for the scale = (Cronbach's  $\alpha$  = 0.93). Test – retest reliability (1week) for the scale = 0.84. (Lee et al., 2016).

### **Ethical Considerations:**

An official approval was obtained from the Ethical and Research Committee of Faculty of Nursing, Menoufia University, then the study aim was explained to the hospital director, the researcher was given official authorization to proceed. A written consent was obtained from patients to participate in the study. Patients was informed about the purpose, procedure, and benefits of the study and the researcher explained to patients that participation in the study is voluntary and they can withdraw from the study at any time without penalty. Confidentiality and anonymity of patients' information assured through coding all data and put all paper in a secured closed cabinet.

### **Method**

#### **Pilot study:**

It was conducted on 10% of the study sample (23) patients to evaluate the study instruments for its' clarity and applicability as well as to estimate time needed to fill in the study instruments then the appropriate modifications is done.

#### **Data collection:**

Data collection was extended from December 2022 to the end of June 2023.

The data were collected from the previously mentioned setting. At the beginning the researchers explained the purpose of the study to the study subjects and obtained their consent for participation according to the inclusion criteria, then the questionnaire was completed from the subjects during the interview, it took about 20 minutes to fill in, after that the researchers recorded the subjects' telephone number to communicate with them during the follow up period. The research was conducted through four phases: assessment phase, planning phase, implementation phase, and evaluation phase.

**Assessment phase (pretest):** During this phase the researchers met all the patient in the study and control group individually to collect the base line data using instrument 1 (part 1, 2, 3, and 4), 2, and 3.

**Planning phase:** After collecting the base line data in the assessment phase the researchers design an educational booklet based on patients needs contained the important information about patients preparation for extracorporeal shock wave lithotripsy (ESWL) and technique of progressive muscle relaxation.

**Implementation phase:** During this phase the researchers interviewed the study group only to achieve the study aim that included increase patient knowledge that related to renal stone and preparation of ESWL in addition to demonstration of progressive muscle relaxation technique. This phase was conducted in three teaching sessions at a week before performing ESWL and during patient preparation as during doing the investigations which related to ESWL. Each education session took about (30 – 40) minutes.

**Session 1:** The researchers explained the information that related to ESWL preparation as the causes of stone formation, signs and symptoms, prevention and treatment methods, as well the advantages of using ESWL, Instructions for preparation before ESWL, instruction followed after ESWL, and side effects of ESWL treatment.

**Session 2:** The researchers explained the technique of progressive muscle relaxation to the study group patients and learn them how to perform progressive muscle relaxation techniques as the following: place the patients in supine position, ask them to contract body muscles (foot, leg, hip, waist, chest, arm, shoulder, and face) and ask them to focus on the feeling of tension and try to grasp this feeling of tension for 3 to 5 seconds, and then ask them to relax for 10 to 15 seconds. Afterward, the patient should experience the sensation of muscle relaxation. Patient perform this technique in bed half an hour before getting up in the morning and 30 minutes before going to bed.

**Session 3:** The researcher revised with the study group patients all information explained that related to ESWL and redemonstrate the progressive muscle relaxation.

**Evaluation phase (posttest):** All subjects among the study and control group were evaluated using instrument 1 (part 3 and 4), 2, and 3 two times, immediately post extracorporeal shock wave lithotripsy and the second time after two weeks during follow up phase at the urology outpatient clinic, then the comparison was done between the result of the study and control group to evaluate the effect of preparation instructions among the study group (the progressive muscle relaxation and proper patients preparation on selected complications post extracorporeal shock wave lithotripsy) and the routine hospital care among the control group.

#### **Statistical analysis:**

Data were collected, tabulated, statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 20 where the following statistics were applied.

1. **Descriptive statistics:** in which quantitative data were presented in the form of mean ( $\bar{X}$ ), standard deviation (SD) and qualitative data were presented in the form numbers and percentages.

2. **Analytical statistics:** used to find out the possible association between studied factors and the targeted disease. The used tests of significance included:

- **Chi-square test ( $\chi^2$ ):** was used to study association between two qualitative variables.

- **Student t-test:** is a test of significance used for comparison between two groups having quantitative variables.

- **Spearman's correlation:** is a test used to measure the association between two quantitative variables. Statistically significant P value < 0.05 and highly significant p value < 0.001 .

#### **Results:**

Table (1) showed the demographic characteristics of the studied sample. Regarding age the mean age of the study group was

43.10±11.27 and 42.07±12.27 of the control group, while the gender was more than two third among the study and control groups were male (82.76% and 80.17%) respectively. The majority of the study and control groups were married (75% and 74.15%) respectively and more than half of them coming from rural regions (57.76% and 53.45%) respectively. Regarding the educational level less than half of the study and control groups were illiterate (40.52 and 39.66%) respectively. There was no statistically significant difference between the study and control group regarding the demographic characteristics.

Table (2) showed the medical data for the study and control groups. Concerning presence of chronic disease about (48.28% and 55.17%) had chronic disease among the study and control group respectively, that divided into (18.97% and 23.28%) respectively had hypertension, (18.10% and 20.69%) respectively had diabetes, (7.76 and 6.03) respectively had asthma, (3.45 and 5.17) respectively had peptic ulcer. Regarding to the location of renal stone the most site of renal stone among the study and control groups was ureters as about one third of them 37.07% and 36.21% had renal stone at the right ureter and less than one third of them 28.45% and 30.17% had renal stone at the left ureter. In relation to the stone diameter (mm) the mean was 4.45±0.76 and 4.37±0.75 for study and control group respectively. There was no statistically significant difference between the study and control group regarding the characteristics of renal stone.

Table (3) presented the level of knowledge among the studied groups at pre intervention, post intervention, and follow up. There was highly statistically significant increase in patient level of knowledge at post intervention and at the follow up phase as well (73.28% and 76.72%) respectively among the study group patients with satisfactory level of knowledge versus (23.28% and 19.83%) respectively among the control group.

Figure (1) illustrated that the mean of the total knowledge score for the study and control groups. There was statistically significant improvement regarding the mean knowledge

score among the study group patients from (4.68 to 10.65) compared to the control group from (4.60 to 6.10) at the follow up phase.

Table (4) described the urological symptoms for the studied groups at pre, post intervention, and follow up phase. There was statistically significant decrease in the occurrence of urological symptoms as hematuria, dysuria, irritation post intervention, and at the follow up phase with ( $P= 0.15, 0.011; 0.030, 0.021; \text{ and } 0.034, 0.019$ ) respectively and the intermittency symptom only at the follow up phase among the study group than control group with  $P \text{ value} < 0.05$ .

Table (5) illustrated the percentage distribution of pain intensity among the study and control groups at pre, post intervention and follow up phase. There was statistically significant decrease regarding pain intensity level among the study group as 8.62% for patient who had moderate level of pain, 76.72% for patient who had severe pain, 14.66% for patient who had worst pain and 33.62% for patient who had mild level of pain, 53.45% for patient who had moderate pain, 12.93% for patient who had severe pain at follow up while among the control group 1.73% for patient who had moderate level of pain, 75.86% for patient who had severe pain, 22.41% for patient who had worst pain at post intervention and 18.10% for patient who had mild level of pain, 40.42% for patient who had moderate pain, 41.38% for patient who had severe pain at the follow up.

Figure (2) showed the mean value of total pain score for the study and control groups at pre, post intervention and follow up phase. There was statistically significant decrease in mean value of the total pain score among the study group from  $8.69 \pm 0.95$  at pre intervention to  $7.98 \pm 1.06$  and  $4.71 \pm 1.77$  at post intervention and follow up respectively versus

$8.79 \pm 0.89, 8.35 \pm 1.13, \text{ and } 5.96 \pm 1.59$  for the study group at pre, post intervention and follow up respectively.

Table (6) presented the anxiety level among the study and control groups. There was statistically significant decrease in anxiety level among the study group as 18.10% for patient who had mild level of anxiety, 44.83% for patient who had moderate of anxiety, 37.07% for patient who had severe anxiety with mean value  $29.49 \pm 9.59$  at post intervention and 6.90% for patient who didn't had anxiety, 23.27% for patient who had mild anxiety, 50% for patient who had moderate anxiety, and 19.83% for patient who had severe anxiety with mean value  $24.76 \pm 7.54$  at follow up. While among the control group 7.76% for patient who had mild anxiety, 36.21% for patient who had moderate anxiety, 56.03% for patient who had severe anxiety with mean value  $33.93 \pm 9.85$  at post intervention and 1.72% for patient who didn't had anxiety, 8.62% for patient who had mild anxiety, 41.38% for patient who had moderate anxiety, and 48.28% for patient who had severe anxiety with mean value  $31.80 \pm 10.45$  at follow up.

Table (7) revealed correlation between total knowledge score, pain & anxiety score for the study group at post intervention and follow up. There was statistically significant negative correlation between the total knowledge score, pain & anxiety score among the study group at post intervention with  $P \text{ value} < 0.05$  and highly statistically significant negative correlation between total knowledge score, pain & anxiety score for the study group at the follow up phase with  $P \text{ value} < 0.001$ .



Table (1): Demographic characteristics of the study and control groups (N=232):

Demographic Characteristics	Study (N=116)		Control (N=116)		$\chi^2$ p value
	No.	%	No.	%	
• Age / years ( $\bar{X} \pm SD$ )	43.10 $\pm$ 11.27		42.07 $\pm$ 12.27		t-test=0.669 p value=0.504
• Gender					
- Female	20	17.24	23	19.83	0.257
- Male	96	82.76	93	80.17	0.612
• Level of education:					
- Illiterate	47	40.52	46	39.66	0.689
- Read and write	28	24.14	28	24.14	0.953
- Basic education	14	12.06	18	15.52	
- Secondary education	19	16.39	17	14.66	
- Higher education	8	6.89	7	6.02	
• Marital state:					
- Single	24	20.69	21	18.10	2.539
- Married	87	75.00	86	74.15	0.468
- Widowed	5	4.31	7	6.02	
- Divorced	0	0.00	2	1.73	
• Place of residence					
- Rural	67	57.76	62	53.45	0.437
- urban	49	42.24	54	46.55	0.509

Table (2): Percentage distribution of medical data among study and control groups (N=232):

Medical data	study (N=116)		Control (N=116)		$\chi^2$ p value
	No.	%	No.	%	
<b>Chronic disease:</b>					
- No	60	51.72	52	44.83	1.932
- Hypertension	22	18.97	27	23.28	0.748
- Diabetes	21	18.10	24	20.69	
- Asthma	9	7.76	7	6.03	
- Peptic ulcer	4	3.45	6	5.17	
<b>Location of renal stone</b>					
- left ureteral calculi	33	28.45	35	30.17	
- right ureteral calculi	43	37.07	42	36.21	0.114
- left renal calculi	12	10.34	11	9.48	0.998
- right renal calculi	20	17.24	19	16.38	
- bladder calculi	8	6.90	9	7.76	
Stone diameter (mm.): ( $\bar{X} \pm SD$ )	4.45 $\pm$ 0.76		4.37 $\pm$ 0.75		t-test = 0.799 p value = 0.425

**Table (3): Percentage distribution of knowledge among studied groups atpre intervention, post intervention and follow up (N=232).**

Knowledge level	Study (N=116)		Control (N=116)		$\chi^2$ p value
	No.	%	No.	%	
	<b>Knowledge pre intervention</b>				
• Satisfactory	5	4.31	6	5.17	0.095
• Unsatisfactory	111	95.69	110	94.83	0.757
<b>Knowledge post intervention</b>					
• Satisfactory	85	73.28	27	23.28	58.07
• Unsatisfactory	31	26.72	89	76.72	<0.001*
<b>Knowledge follow up</b>					
• Satisfactory	89	76.72	23	19.83	75.19
• Unsatisfactory	27	23.28	93	80.17	<0.001*

\* Highly significant p value < 0.001

**Figure (1): Mean value of total knowledge score for study and control groups at pre intervention, post intervention and follow up (N=232).**

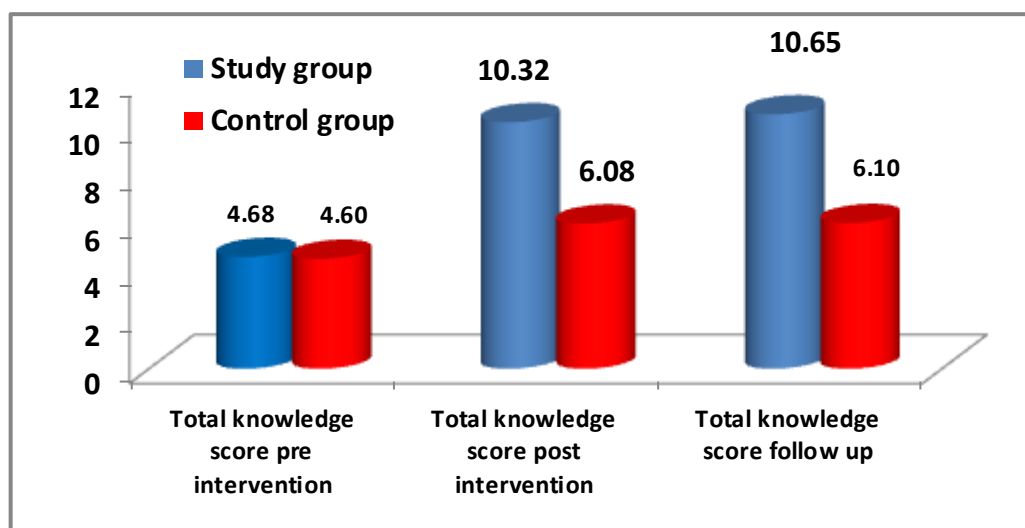


Table (4): Percentage distribution of urological symptoms for studied groups at pre intervention, post intervention and follow up (N=232).

Urological symptoms	Study (N=116)		Control (N=116)		$\chi^2$ p value
	No.	%	No.	%	
<b>Hematuria</b>					
<b>Pre intervention</b>					
- Yes	99	85.34	96	82.76	0.289
- No	17	14.66	20	17.24	0.591
<b>Post intervention</b>					
- Yes	72	62.07	89	76.72	5.87
- No	44	37.93	27	23.28	<b>0.015*</b>
<b>follow up</b>					
- Yes	11	9.48	25	21.55	6.44
- No	105	90.52	91	78.45	<b>0.011*</b>
<b>Fever</b>					
<b>Pre intervention</b>					
- Yes	86	74.14	79	68.10	1.028
- No	30	25.86	37	31.90	0.311
<b>Post intervention</b>					
- Yes	16	13.79	26	22.41	2.907
- No	100	86.21	90	77.59	0.088
<b>follow up</b>					
- Yes	9	7.76	11	9.48	0.219
- No	107	92.24	105	90.52	0.640
<b>Dysuria</b>					
<b>Pre intervention</b>					
- Yes	109	93.97	107	92.24	0.269
- No	7	6.03	9	7.76	0.604
<b>Post intervention</b>					
- Yes	92	79.31	104	89.66	4.735
- No	24	20.69	12	10.34	<b>0.030*</b>
<b>follow up</b>					
- Yes	16	13.79	30	25.86	5.315
- No	100	86.21	86	47.14	<b>0.021*</b>
<b>Irritation</b>					
<b>Pre intervention</b>					
- Yes	107	92.24	103	88.79	0.803
- No	9	7.76	13	11.21	0.370
<b>Post intervention</b>					
- Yes	95	81.90	106	91.38	4.505
- No	21	18.10	10	8.62	<b>0.034*</b>
<b>follow up</b>					
- Yes	22	18.97	8	6.90	5.497
- No	94	81.03	108	93.10	<b>0.019*</b>
<b>Intermittency</b>					
<b>Pre intervention</b>					
- Yes	68	58.62	77	66.38	1.490
- No	48	41.38	39	33.62	0.222
<b>Post intervention</b>					
- Yes	100	86.21	108	93.10	2.974
- No	16	13.79	8	6.90	0.085
<b>follow up</b>					
- Yes	12	10.34	23	19.83	4.071
- No	104	89.66	93	80.17	<b>0.044*</b>

\* Statistically significant P value &lt; 0.05

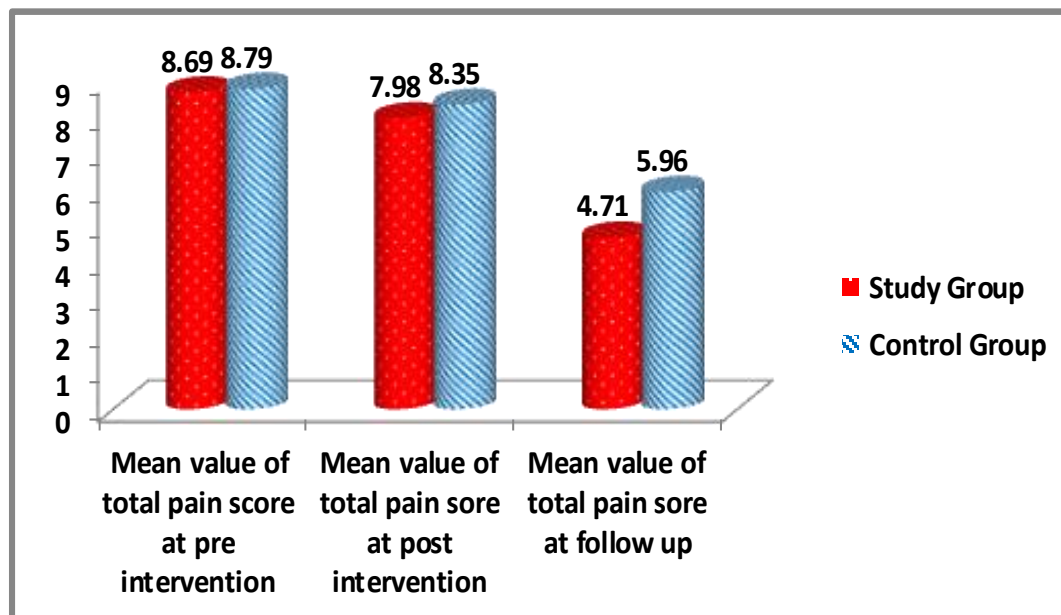
Table (5): Percentage distribution of pain intensity for study and control groups at pre intervention, post intervention and follow up (N=232)

Intensity of pain	Study (N=116)		Control (N=116)		$\chi^2$ p value
	No.	%	No.	%	
<b>Pain intensity at pre intervention</b>					
• Sever	92	79.31	88	75.86	0.397
• Worst pain	24	20.69	28	24.14	0.529
<b>Pain intensity at post intervention</b>					
• Moderate	10	8.62	2	1.73	7.223
• Sever	89	76.72	88	75.86	<b>0.027*</b>
• Worst	17	14.66	26	22.41	
<b>Pain intensity at follow up</b>					
• Mild	39	33.62	21	18.10	24.750
• Moderate	62	53.45	47	40.52	<b>&lt;0.001**</b>
• Sever	15	12.93	48	41.38	

\* Statistically significant P value &lt; 0.05

\*\* Highly significant value &lt; 0.001

Figure (2): Mean value of total pain score for study and control groups at pre intervention, post intervention and follow up (N=232)



**Table (6): Percentage distribution and mean value of anxiety level for study and control groups at pre intervention, post intervention and follow up (N=232).**

Anxiety level	Study (N=116)		Control (N=116)		$\chi^2$ p value
	No.	%	No.	%	
<b>Anxiety level pre intervention</b>					
• Moderate	44	37.93	34	29.31	1.931
• Severe	72	62.07	82	70.69	0.165
<b>Total Anxiety score pre intervention</b> ( $\bar{X} \pm SD$ )	37.378± 9.50		38.82±8.86		t-test = 1.193 p value = 0.234
<b>Anxiety level post intervention</b>					
• Mild	21	18.10	9	7.76	10.345
• Moderate	52	44.83	42	36.21	<b>0.006*</b>
• Severe	43	37.07	65	56.03	
<b>Total anxiety sore post intervention</b> ( $\bar{X} \pm SD$ )	29.49± 9.59		33.93± 9.85		t-test = 3.143 p value = <b>0.002*</b>
<b>Anxiety level follow up</b>					
• No anxiety	8	6.90	2	1.72	26.139
• Mild	27	23.27	10	8.62	< <b>0.001**</b>
• Moderate	58	50.00	48	41.38	
• Severe	23	19.83	56	48.28	
<b>Total Anxiety sore follow up</b> ( $\bar{X} \pm SD$ )	24.76± 7.54		31.80±10.45		t- test = 5.111 p value< <b>0.001**</b>

\* Statistically significant P value < 0.05 \*\* Highly significant p value < 0.001

**Table (7): Correlation between total knowledge score and pain & anxiety score for study group at post intervention and follow up (N=232)**

Studied variables	Total knowledge score	
	R	P value
<b>At post intervention</b>		
• Pain score	-0.169	<b>0.010*</b>
• Anxiety score	-0.146	<b>0.026*</b>
<b>At follow up</b>		
• Pain score	-0.309	< <b>0.001**</b>
• Anxiety score	-0.209	<b>0.001*</b>

\* Statistically significant P value < 0.05

\*\* Highly significant p value < 0.001r: Spearman's correlation

## Discussion

ESWL considered a revolution for the management of renal and ureteric calculi in a minimally invasive manner. However, ESWL causes shock wave induced pain and other complications. Nursing role is very important to increase recovery rate by reducing complications of ESWL (Rafaqat et al., 2023 and Fockens et al., 2020). We performed this study in order to evaluate the effect of progressive muscle relaxation and proper

patient's preparation on selected complications post extracorporeal shock wave lithotripsy.

Regarding the demographic characteristics the current study subjects revealed that the mean age for the study and control groups was more than forty years old. The majority of the study and control groups were male, married and more than half of them coming from rural regions and less than half of them had secondary education in addition, most of them employed and had insufficient income.

There was no statistically significant difference between the study and control group regarding the demographic characteristics which revealed that both group was homogenous with no statistically significant differences. These results were consistent with a study done by **Cao et al., (2020) and Bovelander et al. (2019)** in which they found that, the median age was 52 years old, more than two thirds of the studied subjects were male. There were no significant differences among patient demographic data, such as gender and age. Thus, the two groups were comparable. The researchers in the current study explained that from their point of view people who lived in rural areas and were uneducated, ignored any symptoms they may had and failed to seek medical attention due to insufficient income so all of them make their health situation worse.

Also the current study is in line with a study done by **Gezginci et al., (2018)** who conducted a study about Comparison of two different distraction methods affecting the level of pain and anxiety during extracorporeal shock wave lithotripsy and reported that approximately less than half of the patients were between the ages of 18 and 29 years old and the majority of the patients were male. Approximately more than half of the patients were married, and two third of the patients graduated from high school or higher. Approximately two thirds of the patients were employed and were also in the middle-income level range, with no statistically significant difference was found between the groups regarding the demographic characteristics.

Regarding to the location of renal stone the current study revealed that the most site of renal stone among the study and control groups was ureters as about one third of them had renal stone at the right ureter and less than one third of them had renal stone at left ureter. In relation to the stone diameter mean, it was  $4.45 \pm 0.76$  and  $4.37 \pm 0.75$  for study and control group respectively, with no statistically significant difference between the study and control group regarding characteristics of the renal stone. These finding was in line with a study done by **Rafaqat et al., (2023)** who found that right side of stone formation was more than left side among both groups and more than three quarters

of both groups had single stone. Also the results revealed that renal pelvis stones represented the highest percentage among both groups as the stone location and mean of stone size was (14.71mm and 17.23 mm) for the study and control group respectively.

Concerning total knowledge score: the current study revealed that there was highly statistically significant increase in patient knowledge among the study group at post intervention and follow up stage compared to the control group at pre, post intervention, and follow up. This result might be due to that the majority of the patients should become aware about the urinary calculus causes, signs and symptoms risks and also they should know how to prevent stone formation through providing teaching about ESWL preparation, post complications and how to manage during such situation so nursing information significantly improve patients' outcomes and treatment success. This result was consistent with a study done by **Kasab et.al., (2023); Abdelmowla et al., (2018)** who stated that there was a highly statistically significant difference between patients' knowledge levels after implementation of the nursing guidelines through the study period. The current study findings revealed that implementation of the nursing guidelines successfully improved the clinical outcomes and knowledge score for patients undergoing ESWL.

Moreover a study done by **Mahmoud et. al., (2019)** illustrated the effect of total knowledge score on total stone clearance rate after ESWL among the study and control group. It was noticed that patients who get free from stone after ESWL in the study group had mean of knowledge score more than the patients of the control group who get free stone after ESWL, with statistically significant difference between stone clearance rate and total knowledge score among the study and control group. The researchers made it clear that educating patients sufficiently before any procedure improves their comprehension, awareness, and outcome.

Regarding the urological symptoms: the current study revealed that there was statistically significant decrease in the

occurrence of the urological symptoms as hematuria, dysuria and irritation at the post intervention, and follow up phase. As the intermittency symptoms occur only at the follow up phase and only among the study group than the control group. This result is consistent with a study done by **Mahesar et al., (2023)** who conducted a study about "Effectiveness of Extracorporeal Shockwave Lithotripsy in Removing Small and Large Stones and displayed that in study group, and reported that there was statistically significance difference between the study and control group regarding stone clearance. The most common complaint among the patients was isolated hematuria.

These results corroborated with a study done by **Elsayed's (2019)** in which they compare between the study and control groups in terms of acute complications. The results showed that the nursing protocol's execution greatly increased the rate of stone clearance with a negative impact on the side effect rate. Additionally, patients undergoing shock wave lithotripsy with renal and ureteric calculi had a lower risk of developing acute complications as a result of the procedure.

Concerning to pain level among the studied sample. The present study revealed that there was statistically significant decrease in pain level between the study and control group after intervention. This finding was in line with a study done by **Kwon et al., (2023)** who conducted a study about effects of audiovisual virtual reality stimulation on pain, anxiety, and relaxation during extracorporeal shock wave lithotripsy for ureteral stones: A Prospective Cohort Study and showed statistically significant decrease in procedure-related pain and increases patient relaxation among the study group after intervention.

Also this finding was in agreement with a study done by **Kisaarslan and Aksoy, (2019)** who found significant differences between the mean visual analog scale pain severity values among the intervention group, who received the progressive muscle relaxation exercise and the control group. Also, a study done by **Rady and El-Deeb, (2020)** showed that after the intervention, PMR significantly decreased pain

severity among the study group compared to the control group.

The current study revealed that anxiety level between the study and control groups showed statistically significant decrease in the anxiety level among the study group compared to control group post preparation. This finding agreed with the finding of a study done by **Wang, Feng and Wei, (2021)** and **Chen and Cho, (2019)** in which they found that there was statistically difference between the two groups in terms the anxiety and pain scores which were lower in the music session when they were listening. Moreover in a study done by **Kwon et al., (2023); Sahin and Basak, (2020)** they stated that anxiety score was statistically significantly lower among the study group compared to control group.

According to the current study, when a patient is advised by their doctor to undergo a diagnostic procedure or treatment, this raises their fear and anxiety because they don't know much about it. Additionally, the majority of the studied sample was illiterate so absences from work will be depleted the financial resources, which in turn increased the stress and anxiety levels. In contrast, patients in the study group experienced lower levels of anxiety due to early preparation, which included providing adequate knowledge and psychological support. Additionally relaxation technique also reduces tense

This finding was inconsistent with a study done by **Hu et al., (2021)** and **Gezginç et al., (2018)** in which they stated that there was no statistically significant difference among the three groups regarding the anxiety and pain mean scores. Whereas there was a statistically significant difference between pain scores during and after lithotripsy. This may be due to that their sample was small and cannot generalized the finding.

The present study reported that there was statistically significant negative correlation between the total knowledge score, pain & anxiety score among the study group at post intervention and also showed statistically significant negative correlation between total knowledge score, pain & anxiety score among

the study group at the follow up phase. This outcome matched with a study done by **Kasab et al., (2023)**; **Ketsuwan et al., (2021)** and **Zhanget al., (2019)** who stated that there was statistically significant difference between patients' knowledge levels after nursing intervention, patients' outcomes and clearance of stones after ESWL. The study findings revealed that implementation of PMR and proper patient preparation successful improving the clinical outcomes and knowledge score among patients undergoing ESWL.

### **Conclusions:**

The present study concluded that progressive muscle relaxation and proper patient's preparation had a positive effect in reducing pain, anxiety, and urological symptoms post extracorporeal shock wave lithotripsy.

### **Recommendations for practice and research:**

- Appropriate patient preparation in shock wave lithotripsy unit is necessary to reduce complications risk.

- Nurses should participate in ongoing education program, so they could give patients undergoing urolithiasis the oral and written information they need.

- Replication of the study using a larger probability sample and longer follow up period for studied patients is recommended.

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