



Journal Homepage: -[www.journalijar.com](http://www.journalijar.com)

## INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/18649  
DOI URL: <http://dx.doi.org/10.21474/IJAR01/18649>



### RESEARCH ARTICLE

#### ASTUDYTOASSESTHEEFFECTOF CRYOTHERAPYONPAINAND SELECTEDBIOPHYSIOLOGICALPARAMETERS DURINGAVFISTULACANNULATIONAMONGPATIENTSONHEMODIALYSIS AT KMCH,COIMBATORE

Rekha M. Ninan<sup>1</sup> and Prof. Dr. S. Madhavi<sup>2</sup>

1. M.Sc. (N), KMCH College of Nursing, Coimbatore - 641014, Tamilnadu.
2. M.Sc.(N),Ph. D(N),, PrincipalandHOD ofMedical-SurgicalNursing,KMCH CollegeofNursing, Coimbatore - 641014,Tamilnadu.

#### Manuscript Info

##### Manuscript History

Received: 29 February 2024  
Final Accepted: 31 March 2024  
Published: April 2024

#### Abstract

The current study entitled “a study to assess the effect of Cryotherapy on pain and selected Biophysiological parameters during arteriovenous fistula cannulation among patients on maintenance Hemodialysis” at KMCH, Coimbatore was undertaken, during the year 2010 - 2011 in partial fulfillment of the requirement for the degree of Master of Science in Nursing at KMCH College of Nursing, Coimbatore which is affiliated to Dr. M.G.R. Medical University, Chennai.

**Objectives:** To assess the pain intensity during Xylocaine infiltration. To determine the effect of Cryotherapy on pain and Biophysiological parameters during AV fistula cannulation. To associate the level of pain with selected demographic variables.

**Design:** Repeated Measures design.

**Setting:** Hemodialysis unit of Kovai Medical Center and Hospital, Coimbatore.

**Sample:** Sample size was 50.

**Conceptual framework:** Modified Orlando’s Nursing process model.

**Outcome measures:** The demographic data was collected from the subjects. The pain intensity was measured during cannulation with Xylocaine and with Cryotherapy using Numerical Pain rating Scale. The investigator recorded the Biophysiological parameters during the procedure.

**Intervention:** Cold application was done prior and during cannulation over on the web between the thumb and index finger of the hand which does not have the AV fistula.

**Results:** The mean pain score with Xylocaine infiltration at arterial site was 4.81 and at the venous site was 4.86. There was a significant reduction in the pain score during cannulation with the application of Cryotherapy. The mean pain score during cannulation after Xylocaine at the arterial site was 1.59 and at the venous site was 1.51 whereas the mean pain score during cannulation after Cryotherapy was 0.96 and 0.92 correspondingly. But there was no statistically significant

**Corresponding Author:- Prof. Dr. S. Madhavi**

Address:-M.Sc.(N),Ph. D(N),,PrincipalandHOD ofMedical-SurgicalNursing,KMCH  
CollegeofNursing, Coimbatore -641014,Tamilnadu.

difference between the values of Biophysiological parameters such as BP, PR and RR during cannulation done with Xylocaine and with Cryotherapy. There was no significant association between pain score and age and gender of the subjects but there was significant association between pain and duration of illness and duration of treatment

**Conclusion:** Cryotherapy is an effective nonpharmacological measure in reducing pain during AV fistula cannulation among Hemodialysis patients.

*Copy Right, IJAR, 2024,. All rights reserved.*

## Introduction:-

“Bones can break, muscles can atrophy, glands can loaf, even the brain can go to sleep without immediate danger to survival. But should the kidneys fail . . . neither bone, muscles, gland nor brain could carry on” (Smith, 1953). This statement underlines the value of kidneys in our lives.

The kidneys excrete a number of end products of metabolism in urine. The kidneys eliminate these substances from the body at a rate that matches their production. In addition to the metabolic wastes, the kidneys also excrete foreign substances from the body such as drugs, pesticides and other chemicals ingested in the food. Regulation of water and inorganic ion balance and regulation of acid-base balance are also the functions of kidneys. So, the proper functioning of the kidneys is highly essential for the normal bodily homeostasis. If there is a complete kidney failure and treatment is not given, death is inevitable.

End-stage renal disease (ESRD) or Chronic Renal Failure (CRF) is a worldwide public health problem. It is a mammoth medical, social and financial crisis for both patients and their families. Among India's total population, around 7.85 million are suffering from CRF. This condition is a progressive, irreversible deterioration in renal function in which the body fails to maintain metabolic and fluid and electrolyte balance and results in uremia or azotemia (retention of urea and other nitrogenous wastes in the blood). The incidence of ESRD has increased by almost 8% per year in the past 5 years, with more than 3,00,000 patients being treated in the United States (USRDS, 2001). Comorbid conditions contribute to the high morbidity and mortality among patients with ESRD. Dialysis or kidney transplantation becomes necessary for patient's survival.

A patient with Chronic Kidney Disease (CKD) requires astute nursing care to avoid the complications and to manage stress and anxiety of dealing with a life-threatening illness. The increasing prevalence of CKD and its associated symptoms is a major concern for nurses and health professionals attempting to provide these patients with comprehensive care. Methods of therapy for CRF include dialysis and kidney transplantation.

Dialysis is an effective means of correcting metabolic toxicities at any age (Wood et al., 2001). It is used to remove fluid and uremic waste products from the body when the kidneys cannot do so. The need for dialysis may be acute or chronic. Chronic maintenance dialysis is indicated in CKD when there are uremic signs and symptoms affecting all body systems, hyperkalemia, fluid overloading not responsive to diuretics and fluid restriction and general lack of wellbeing. Dialysis can be either hemodialysis or peritoneal dialysis.

Hemodialysis is the most commonly used method of dialysis and it is used for patients who are acutely ill and require short term dialysis (days to weeks) and for patients with ESRD who require long term or permanent therapy. In hemodialysis, the blood laden with toxins and nitrogenous wastes is diverted from the patient to the dialysis machine, in which the blood is cleansed and then returned to the patient. A Dialyzer serves as a synthetic semi permeable membrane, replacing the renal glomeruli and tubules as the filter for the impaired kidneys. For patients with ESRD, hemodialysis prevents death, but it neither cures renal disease, nor does it compensate for the loss of endocrine or metabolic activities of the kidneys. Patients receiving hemodialysis must undergo treatment for the rest of their life or until they undergo successful kidney transplantation. Patients receive chronic or maintenance dialysis is usually done three times a week for at least 3-4 hours per treatment.

Obtaining vascular access is one of the most difficult problems associated with Hemodialysis. Access to the patient's vascular system must be established to allow blood to be removed, cleansed and returned to the patient's vascular system at

rates between 200- 800ml/min. Several types of access are available include arteriovenous fistulas (AVFs) and grafts (AVGs), permanent and semi permanent catheters, subcutaneous ports and shunts for the cannulation to start hemodialysis. Hemodialysis is the most frequently used Renal Replacement Therapy with the AVF being the gold standard for vascular access which is surgically created by anastomosing an artery to a vein, either side to side or end to side. The arterial segment of the fistula is used for arterial flow and the venous segment for reinfusion of the dialyzed blood. The fistula takes 4-6 weeks for maturation before it is ready for use. This gives time for healing and for the venous segment of the fistula to dilate to accommodate two large-bore (14-16 gauge) needles used in hemodialysis. The patient is also encouraged to perform exercise to increase the size of these vessels (i.e., squeezing a rubber ball for forearm fistulas). Once mature, native fistulas have excellent long term patency rates and rarely become infected. Palder et al (1985) have reported that primary AV fistulas provide adequate vascular access for even 20 years. On an average, a patient on maintenance Hemodialysis undergoes 12 AV fistula punctures a week and would continue to do so throughout their lifetime or until a successful renal transplantation.

International Association for Study of Pain, (1979) defined pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Epidemiologic data of pain in patients with ESRD are extremely limited; however, recent studies have shown that moderate to severe chronic pain is common in ESRD. The literature suggests that 37% to 50% of hemodialysis patients experience chronic pain and that for 82% of these patients' pain is moderate to severe in intensity (Davidson, 2003). Moreover, pain during arteriovenous fistula cannulation remains a common problem in Hemodialysis patients. Most of the patients complain of moderate pain during AV fistula cannulation. Many healthcare institutions have integrated local anesthesia into the standard of care for patients during AV fistula cannulation. Intradermal Lidocaine is a vasoconstrictor, so it may cause the vein to become smaller and sometimes make it a little deeper. It causes a bee sting-type burning sensation that can be minimized by injecting the Lidocaine more slowly. There are no studies citing scarring from Lidocaine use. However, certain ethnic groups form keloid scars that can make cannulation through them very difficult (Ball, 2003). In the researcher's clinical experience, many patients on Hemodialysis have complained pain during AV fistula cannulation but, majority of the patients with renal failure on Hemodialysis reported that pain during injection of local anesthesia as more terrible than the pain from the cannulation itself.

"It would be good for us to remember that one of the greatest gifts we can share with others in pain, despair, or confusion is a clear sense of our peace and knowledge that we are loved"

Robert J. Wicks

Now a days, health professionals increasingly focus on the management of pain to improve the quality of life for many patients living with chronic and terminal pain (Ferrell, 1996; McCaffery & Ferrell, 1997; Howell, et al., 2000). Pain management is now considered as the significant patient outcome when evaluating the effectiveness of nursing care (Padilla et al., 1990; Ferrell et al., 1991; Barnason et al., 1998). However, a substantial body of research indicated that pain continues to be a problem for 45-75% of hospitalized patients who report experiencing moderate to severe levels of pain (Nash et al., 1994; Carr & Thomas, 1997; Breitbart, Rosenfeld, & Passik, 1998; Yates et al., 1998) despite educational programs aimed at improving nurses' pain management. Pain control among ESRD patients is a challenge to the health care providers due to the relationship between medication clearance and renal function. This leads to under treatment of pain or over sedation and untoward side effects/complications when using certain types of medications (Rehm, 2003). Here comes the need for alternative therapies in managing pain in patients with CRF.

Non-pharmacologic pain management strategies can reduce the dose of an analgesic required to relieve pain and thereby minimize the side effects of drug therapy. Many studies have shown that alternative therapy techniques have a dramatic impact on the overall health and performance of persons with even high levels of chronic pain. Those interventions are suitable for procedures such as IV insertion that cause acute, transitory pain (Jacobson, 2006) by increasing patient's sense of personal control about managing their pain and bolster their coping skills. Benefits include possibly no side effects, a more positive patient experience, enhanced comfort, and an improved perception toward the procedure.

Cryotherapy is a convenient and simple alternative pain management technique in which cold is used for the treatment of injury or disease that can help the person to reduce pain quickly and cost effectively. The application of Cryotherapy has a long history, having been used in the ancient Greek and Roman civilizations. Its primary objective is to lower the temperature of a tissue and thereby achieve a therapeutic benefit by suppressing the metabolic rate of the tissues thus preventing the tissue damage that can be caused by hypoxia. In addition, vasoconstriction is induced, which reduces pain, bleeding and edema in damaged tissues. Today the use of Cryotherapy is widespread in the medical

arena. Studies have proven that it is an established method used in treating acute soft tissue injuries and as part of the treatment protocol for chronic injuries. Cryotherapy has also been proved to reduce pain effectively and reduce the recovery period in the postoperative time after reconstructive surgery of the joints.

The Gate Control Theory of Pain emphasizes on the modulation of inputs in the spinal dorsal horns and the dynamic role of the brain in pain processes. Psychological factors are found to be an integral part of pain processing and new avenues for pain control were opened. Based on the gate control theory, chronic pain tends to move a C-fiber pathway. Once the slow pain message reaches the brain, it takes a pathway to the hypothalamus and limbic system where the hypothalamus is responsible for the release of certain stress hormones in the body, while the limbic system is responsible for processing emotions. The brain sends signals down the spinal cord to open and close the nerve gates. If the person is in anxiety or in stress, descending messages from the brain amplify the pain signal at the nerve gate as it moves up the spinal cord. Alternatively, impulses from the brain "close" the nerve gate, preventing the pain signal from reaching the brain and being experienced as pain. Most of the techniques in developing non-pharmacological treatments are based on these principles.

In addition to that, there are two types of nerve fibers that carry the majority of pain signals to the spinal cord: small diameter unmyelinated (A-delta) fibers and large diameter myelinated (A-beta) fibers. Physical stimulation such as rubbing, massage, and vibration cause excitation in the A-beta nerve fibers, which conduct the signal more quickly than the A-delta fibers, where pain due to tissue injury is transmitted. If a pain signal is traveling to the brain via the A-delta fibers and a simultaneous physical stimulation signal is sent via A-beta fiber, the physical stimulation signal will reach the brain first because they move more quickly than the pain signal. This supports the concept of cutaneous stimulation in pain management.

### Need For The Study

Over 1 million people with CRF worldwide are alive on dialysis with a functioning graft. Incidence of CKD has doubled in the last 15 years. In India, reports reveal that there is an increase in the prevalence of CKD by 53% as compared to the statistics a decade ago. It is one of the most common illnesses in the country as it is estimated that there is one CKD patient in every 2000 population.

Everyone would have definitely experienced some degree of pain and discomfort in the lifetime. Pain is the most common reason for why people seek healthcare. Despite being one of the most commonly occurring symptoms in the medical world, pain is the one of the least understood. The context of comfort is the umbrella under which pain and pain management options are viewed. Pain management is considered as an important part of health care that the American Pain Society coined the phrase- "Pain; The Fifth Vital Sign" (Campbell 1995) to emphasize its significance and importance of effective pain management. Every member of the health care team should possess knowledge about the assessment of pain and its management both pharmacologically and non-pharmacologically.

The nurses, who are spending most of their working hours in interaction with the patient unlike other members of the health care team have a central role in pain assessment and management. The extent of nurse's involvement depends on the unique factors associated with the patient, the setting and the cause of the pain. Strategies include both pharmacologic such as opioids, NSAIDs etc and non pharmacologic by making use of alternative therapies in order to control the pain these are widely in the clinical practice. The nurses assess the effectiveness of those interventions, monitoring for adverse side effects and serve as an advocate for the patient when prescribed interventions are ineffective in relieving pain. Procedural pain is one of the primary types of pain which the health care team encounter in their daily practice.

Effective procedural pain control is an essential component of the care of a patient. Apart from being inhumane, inadequate pain control, may result in increased morbidity or decreased compliance to the treatment. Patients with end-stage renal failure (ESRF) are repeatedly exposed to stress and pain from approximately 300 punctures per year in their Arteriovenous fistula when they are on maintenance Hemodialysis. Repeated punctures at the AV fistula site lead to a considerable degree of pain, due to the caliber and length of the bevel of fistula needles. Pain being a sensitive, emotional, subjective and multi factorial feeling of the patient, lack of education, fear of complications associated with analgesic drugs, poor pain assessment, and inadequate staffing are the causes for insufficient pain control. After hundreds of years of advances, the mainstay of procedural pain therapy is still the local anesthesia. When used properly, local anesthetics are safe and are effective in reducing

procedural pain, but they also carry with them undesirable side effects such as pain while injecting, allergic reactions, pruritus, and burning sensation. In high doses, local anesthetics may produce toxic effects caused by being absorbed through the bloodstream into the rest of the body (systemic toxicity). This may significantly affect patient's breathing, heartbeat, blood pressure, and other body functions (Webmed, 2010).

Pain management of patients with chronic renal failure is an important aspect of care. Pharmacological pain management in renal failure is complex and is to be conducted with caution, because of the fine line between pain relief and toxicity, and consideration of the patient's concomitant health problems that influence the type of analgesia given. The alternative medicine is an area of healthcare that has been rapidly evolving over the past few years. Some of the practices have been around for centuries, while others have become popular within the last few decades. Recent research supports non-pharmacological pain control measures such as distraction, especially humor, relaxation using the patient's own memory of peaceful events, and cutaneous stimulation, especially use of cold. Cutaneous stimulation can be effectively used at sites other than the site of pain (McCaffery, 2000).

Touch is the language spoken through hands and understood by heart. Cutaneous stimulation will promote comfort by reducing the pain. Together, intention and touches set the tone and provide the basis for healing. The cutaneous stimulation is an independent nursing intervention which is used in various painful conditions, and is explained by Gate Control Theory. Cutaneous stimulation modalities are clubbed with Acupressure to increase its effectiveness in pain management. The large intestine meridian is an acupressure point which is located on the back side of the hand between the thumb and the first finger. Its dominant uses are to relieve pain in the shoulder and arm, rigidity of the neck, scapula, and eye diseases, and to treat constipation or other bowel disorders. Studies have also been conducted on the fact that Cryotherapy is equally effective in alleviating pain as a cutaneous stimulation technique safely and cost-effectively (Waters, 2003).

As recorded by Williams and Manias (2005) in their report on Pain Assessment and Management of Patients with Chronic renal failure, although studies have examined the renal effects of analgesia and have identified that pain is poorly managed in the patient with end stage renal failure, there were no studies that examined pain assessment in renal failure prior to reaching end stage renal disease, or pain control in renal failure from the nurses' perspective. There is only very little information available to guide health professionals in pain management in patients with renal failure. Renal text books also do not directly address the difficulties surrounding pain management in renal failure (Daugirdas et al. 2001), although drug dosing in renal failure in general has been described in pharmacological monographs not readily available in the nurses' workplace (Aronoff et al. 1999, Bunn & Ashley, 2004). This literature has stimulated the investigator to stick on to the study. The emergence of analgesic nephropathy 50 years ago remains a prominent untoward effect of analgesics that may significantly influence pain management practices; the abuse of over-the-counter analgesic compounds remains a significant and current cause of kidney failure, McDonald & Russ (2003).

Moreover, during ten years of clinical experience, the researcher could recognize the need for alleviating pain with some non-pharmacological method for patients who are suffering from pain throughout their life time. Hence, the researcher identified the need for implementing some alternative therapies in managing procedural pain during AV fistula cannulation among Hemodialysis patients because she felt that the patients with CRF who are on dialysis suffer a lot with chronic as well as procedural pain. In addition to, the researcher was interested to find out the effect of Cryotherapy in pain so that it can be effectively used in managing pain in various conditions. This study was therefore undertaken to find out the effectiveness of the Cryotherapy on pain during AV Fistula puncture in HD patients so that it can be implemented in such population as evidence-based practice.

**Statement Of The Problem**

Effect of Cryotherapy on pain and selected Biophysiological parameters during arteriovenous fistula cannulation among patients on Hemodialysis at KMCH, Coimbatore.

**Objectives Of The Study Were To**

1. assess the pain intensity during Xylocaine infiltration
2. determine the effect of Cryotherapy on pain and Biophysiological parameters during AV fistula cannulation.
3. associate the level of pain with selected demographic variables

**Operational Definitions**

**Effect** – in terms of reduction of pain and change in Biophysiological parameters which is brought about by Cryotherapy

**Cryotherapy** – is the application of cold by using ice cubes over twelve minutes at LI 4 meridian which corresponds to the web space between thumb and the index finger of the hand

**Pain** – an unpleasant sensory and emotional experience as measured by numerical pain rating scale (NPRS) during AV fistula cannulation

**Hemodialysis** - is a procedure by which toxin laden blood is diverted from the patient into a dialyzer and then returning clean blood to the patient

**AV Fistula cannulation** – is the venipuncture of the surgically created connection between a vein and an artery to use as a vascular access for Hemodialysis

**Biophysiological parameters** – refers to blood pressure, pulse rate and respiratory rate of the patient

**Patients** – are those who are diagnosed to have chronic renal failure and are on maintenance hemodialysis

**Hypotheses**

1. There will be significant difference between patients who receive Cryotherapy and those who receive Xylocaine in pain during AV Fistula cannulation.
2. There will be significant difference between patients who receive Cryotherapy and those who receive Xylocaine in Biophysiological parameters during AV Fistula cannulation.

**Assumptions**

1. Patients who undergo hemodialysis experience pain during AV fistula cannulation
2. Pain will have an effect on Biophysiological parameters
3. Level of pain varies from person to person

**Conceptual Framework**

“Nursing is a distinct profession providing direct assistance to individuals in whatever they are found for the purpose of avoiding, relieving, diminishing or curing the individual's sense of helplessness” (Orlando, 1972)

Nursing is a complex field of study with a need for practical and hands-on training as well as knowledge of theoretical and historical basis. Conceptual framework for this study was formed on the basis of **Nursing Process theory**, created by Ida Jean Orlando who was one among the early leaders in the field of nursing, developed her theory in 1961 as Dynamic Nurse- Patient Relationship; she furthered the development of her theory and published it as Nursing Process theory in 1972.

According to Orlando, the role of the nurse is to find out and meet the patient's immediate need for help. Therefore, nurses need to use their perception, thoughts about the perception or the feeling engendered from their thoughts to explore with patients of their behavior. This process helps nurse to find out the nature of the distress and what help the patient needs. The function is fulfilled when the nurse finds out and meets the patient's need for help. Orlando's theory focuses on how to produce improvement in the patient's condition. She asserts that the limitations on the patient's ability to meet his or her needs independently arises when the patient is receiving medical care or under medical supervision. Her theory follows the steps in nursing process and meets the patient's need. The major dimensions of the theory are:

1. The presenting behavior of the patient is expressed either in terms of verbal or non-verbal language
2. Nurse's response by exploring the patient's behavior
3. Nurse's action by delivering the needed care to solve the patient's problem
4. Outcome in terms of patient's satisfaction as the need for help is resolved.

Orlando's conceptualization of the deliberative nursing process fulfills the criteria of a theory. Incorporating validation into the nursing process discipline allows for maximal participation by the patient in his or her care. The nursing process discipline allows nurses to view the patient from a nursing perspective rather than from a medical disease orientation.

Patients with End-Stage Renal Disease on maintenance hemodialysis require hemodialysis 3-4 times a week. This procedure requires arterial and venous access which is established by cannulation of AV fistula. Patients experience pain and discomfort during cannulation.

Nurse's response to patient's problem is by assessing the pain and biophysiological parameters.

Nurses' action is to solve the patient's problem by applying cryotherapy which is a non-pharmacological measure for pain relief. This action helps in pain reduction and improves the patient's comfort. Moreover, nurse-patient interaction enhances the psychological well-being of the patients.

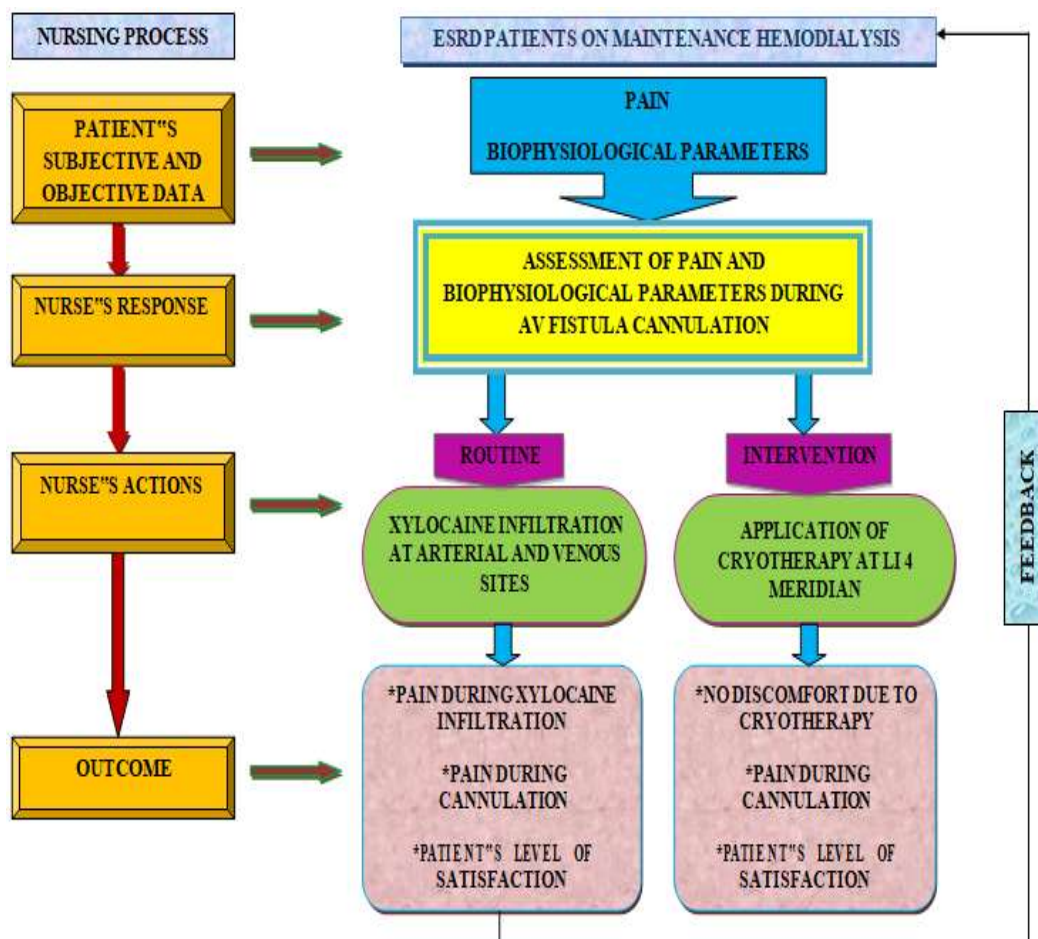


Fig.1:-Conceptual Framework - Modified Orlando's Nursing Process Theory (1972).

## Chapter-II

### Review Of Literature: -

A literature review involves scanning the pages of any published literature like newspaper, magazine, website, webpage, collection, books, paper, pamphlet or even unpublished manuscripts. Literature review is a part of the research where the researcher has the opportunity to strengthen the paper with the poured thoughts by the reliable authors on the topic. This chapter deals with the facts gathered by the researcher which is relevant to the study by extensive review of available literature in order to fortify the present study.

The collected information is analyzed and organized under the following headings:

1. Literature related to Hemodialysis and AV fistula
2. Literature related to Cryotherapy and Gate Control Theory
3. Literature related to pain measurement and management in patients with CRF
4. Literature related to factors affecting pain and Biophysiological parameters

### Literature Related to Hemodialysis and AV fistula

ESRD is a worldwide public health problem and concern with increasing incidence and prevalence, poor patient outcomes and high cost. In 2002, Chalmers defined Chronic Renal Failure as a gradual and progressive loss of the ability of the kidneys to excrete wastes, concentrate urine, secrete hormones and conserve electrolytes. End stage kidney failure is the deterioration in renal function to the stage where renal dialysis or transplantation is required for survival (Terrill 2002).

In 2002, Antolin and his colleagues have performed a retrospective analysis with a follow-up time of seven years among 3106 hemodialysis patients and 542 peritoneal dialysis patients and they studied on the significance of comorbidity factors such as age >70 years, cardiovascular disease, liver disease, diabetes mellitus and dyslipidaemia. They observed that the global survival is the same in both groups up to 32 months of treatment and they identified that those with comorbidity had a better survival on hemodialysis.

As first described by Brescia et al in 1961, the primary arteriovenous fistula remains the best form of permanent vascular access. It is more cost-effective and is associated with less mortality when compared to other vascular accesses (USRDS, 2009). Even then establishing and maintaining a vascular access is one of the biggest problems among patients on Hemodialysis (Bonello, 2004); 20% of hospital admissions for clients on dialysis are for vascular access complications as stated by Saran, 2004.

Kevan et al has conducted a study in 2001 on epidemiology of vascular access in the Australian Hemodialysis population. The findings of the study revealed that despite a high overall prevalence of AVF use in Australia, a significant number of patients had AVG and catheter with age, gender and late referral were found to be reasons. Their study concluded that the provision of adequate pre-ESRD care for all patients with renal failure is required to further enhance the utilization of AVF and to reduce catheter rates in patients commencing hemodialysis as renal replacement therapy to minimize the detrimental effects of other vascular accesses.

Chhetri et al (2009) carried out a study on vascular access in Nepal among 82 patients attending HD unit over a period of one year. The analysis of the observed data revealed to the investigators that initial vascular access used was temporary ones such as subclavian and internal jugular vein catheters. Only 47 patients were analyzed for the second vascular access and was found to be associated with fever in 7 (14.9%) and limb swelling in 1 (2.1%). Complications with the vascular accesses were found negligible by the investigators.

In a prospective observational study, Lacson (2009) investigated on relation between change in vascular access and mortality in maintenance hemodialysis patients. At baseline, 79,545 patients had 43% fistulas, 29% catheters, and 27% grafts. The study data showed that compared with fistulas, deaths were higher for grafts and catheters. The analysis proved that catheters have the worst associated mortality risk. Change from a catheter to a fistula or graft was noted by the investigators with significantly improved survival.

Ravani et al (2010) compared outcomes of arteriovenous grafts and fistulas and studied the variations in risk. Longitudinal data from 535 incident hemodialysis patients were collected and utilized by the investigator to study the relationship between access type and access survival. They reported that hazard for failure of fistulas and grafts declined over time, and became proportional after 3 months from surgery. The investigators considered the entire observation period and found out that grafts had slower hazard decline ( $P < 0.001$ ) with shorter median survival times than fistulas (8.4 versus 38.3 months).

Solesky et al (2010) have done a prospective survey and maintained vascular access data based on a comprehensive, patient-centered analysis of arteriovenous access placement and interventions, central venous catheter use, and associated complications. 39 patients with AVF, 8 prosthetic grafts and 52 catheters were followed longitudinally for an average of 4.1 yr to determine the time of initial cannulation, need for revision, and the time of abandonment for each angio access. The collected data showed that an AVF prevalence rate was 66%, meeting the 65% goal set by the investigators.

Deiham (2010) have investigated on determinants of hemodialysis on access survival. The investigator retrospectively analyzed the vascular access procedures performed over a two-year period and clinical data and concomitant medication were retrieved from files. Outcome parameters observed were primary (PP) and secondary patency (SP) and also freedom from repeated revascularization. The investigator's minimal follow-up with functioning access was 679 days. During the observation period, 244 patients underwent vascular access procedures. PP and SP were 35.6% and 45.6%, respectively, at 540 days. Presence of diabetes mellitus was associated with decreased PP and SP, whereas female gender was associated with lower SP and freedom from repeated revascularization rates. In contrast, presence of hyperparathyroidism was observed by the investigator as associated with higher SP and freedom from repeated revascularization rates.

#### **Literature Related to effect of Cryotherapy and Gate Control Theory**

Among the physical treatments to reduce pain, ice has had its place for many years. Cryotherapy is the simplest and most commonly used method in the treatment of acute musculoskeletal injury to reduce pain and inflammation. It is used to reduce tissue temperature and has various physiolo



gical effects, i.e. vasoconstriction of blood vessels, decreased local metabolism, decreased blood histamine release during inflammation and reduced nerve excitability (Schafer, 1990). This makes Cryotherapy first in line for management of acute injuries concerning swelling, bleeding and pain relief (MacAuley, 2001). Among chiropractic practitioners it is the most often utilized (94.5%) passive adjunctive therapy.

In the early 1960s, Melzack and Wall had described Gate Control Theory of pain in detail as follows: stimulation of the skin creates nerve impulses to the spinal-cord and it either gets inhibited nerve impulses or enhanced at the level of the spinal cord. Nerve impulses traveling toward the brain in smaller nerve fibers of the spinal cord proceed at a steady rate. Continuous discharge keeps the pain gate open and enhances the transmission of pain. Burst-type impulses are mainly inhibitory and have the effect of keeping the pain gate partially closed resulting in diminishing the perception of pain intensity. When the large fiber impulses get artificially stimulated by vibration, scratching, or ice massage, the gate further closes resulting in a decrease in the sensation of pain. That was the reason for ice being successfully used in the treatment of musculoskeletal pain over the years. Melzack studied the use of ice massage of the web of skin between the thumb and forefinger for the reduction of acute dental pain. His work showed a 50 percent reduction in acute dental pain.

Melzack and Wall did not explain in their study that how they decided on the selected anatomical area to use ice massage. However, the two Physicians did studies comparing acupuncture to transcutaneous electrical nerve stimulation for pain relief. They have located within the anatomical area on the hand, as a pressure meridian point described in Acupuncture literature as Hoku or Large Intestine 4 (LI4). Large Intestine 4 has a pathway which travels from the tip of the forefinger up to the face and circles the teeth; it bifurcates at the shoulder to move downward wrapping around the entire colon. According to them, the skin between the thumb and forefinger is part of the thick, hard, and horny texture of the palm which can withstand the intermittent friction and cold temperatures used in this technique.

A research paper was presented at the University of Southern Queensland, Australia in June, 1992 on Ice Massage for the Reduction of Labor Pain, and at a Midwifery Education Seminar, Florida, 1993. A second, larger study was also carried out by a group of researchers in 1999-2002. The results on Ice Massage for the Reduction of Labor Pain, was published in the Journal of Midwifery and Women's Health, November 2003. Medscape (WebMD Health Professional Network) had chosen the protocol as best in maternal health journals for the week and printed on the internet in its entirety. In 2010 it was included in Midwifery Best Practice, Vol 5.

A study conducted by Nicholson and his colleagues in 1994 with the purpose to identify and validate the effectiveness of selected cutaneous stimulation pain management interventions including heat and cold application, massage and Transcutaneous Electrical Nerve Stimulation (TENS). The authors concluded that cutaneous stimulation interventions are very effective means to manage pain.

In 1994, Park, studied to identify the effect of cutaneous stimulation on reduction of AVF puncture pain. One group repeated measure post test research was designed and carried out among 45 hemodialysis patients. The researcher measured AVF puncture pain of control period first, and then the pain of experimental period (with cutaneous stimulation). He observed that the subjective pain score in experimental period was slightly lower than in control period but the objective pain behavior score of arteriovenous fistula pain in experimental period was observed as higher.

Barber et al (1998) conducted research to evaluate the effects of cold therapy for post operative pain in outpatient Arthroscopic Anterior Cruciate Ligament Reconstructions. 51 patients received cold therapy for 7 days. 49 patients had no cold therapy. Evaluation of pain was done by the investigators at 1, 2 and 8 hours after surgery and then daily. Pain was assessed using Visual Analogue Scale and Likert scales. The study reported that cold therapy lowered pain, reduced analgesic usage, increased knee flexion and continuous passive movement among experimental group than the control group.

Morsi (2002) conducted research on cold therapy after Total Knee Arthroplasty (TKA). Thirty patients who had undergone bilateral TKA were selected randomly. For every patient, one limb was connected with cooling device applied over the surgical dressing postoperatively and the other limb with TKA with no cooling device attached. The limb connected to the cooling device was observed by the investigator with increased range of motion and decreased pain.

Edzard et al (2004) performed a study on Ice freezes pain? A review of the clinical effectiveness of analgesic cold therapy by the researchers revealed that ice has a strong short-term analgesic effect in many painful conditions. They have suggested that serial applications may also be helpful because mechanisms by which cryotherapy elevates pain threshold were found to be due to an antinociceptive effect on the gate control system.

Studies have shown that cold applications reduce the metabolic rate of a tissue, decrease pain and swelling, and reduce muscle spasm. Most health care practitioners use ice therapy for treatment of bruises, strains, sprains, and muscle tears. Cryotherapy is familiar with the RICE (rest, ice, compression, and elevation) principle following acute soft tissue injury (Daniel, 2008).

Hubbard in 2004 stated that one of the primary reasons that clinicians use Cryotherapy in the management of acute injuries is due to its analgesic effect. Cold can increase pain threshold and decrease the sensation of pain by reducing nerve conduction velocity.

Bleakley et al (2004) had assessed on the use of ice in the treatment of acute soft-tissue injury by means of a systematic review of randomized controlled trials strongly suggested that based on the available evidence, cryotherapy was seemed to be effective in decreasing pain. Their study had concluded that ice and compression seemed to be significantly more effective than ice alone in terms of decreasing pain. In the majority of the studies, they could find out that difference in the effectiveness of ice and compression compared with compression alone.

Kuzhanthaivel (2004) performed a project on the effect of Cryotherapy on postoperative pain among 30 patients with fracture and reported that Cryotherapy can be included in nursing care among patients with fracture and surgical interventions as a modality to relieve pain.

Rodrigues et al in 2005 analyzed the side effects, such as pain, trismus and swelling, after the removal of third molars, by comparing the use or absence of Cryotherapy in the reduction of these effects 24 and 48 hours after surgery. It was an intra-individual, self-controlled, single-blind study. Cryotherapy was found to be effective in reducing swelling and pain in the study sample, and they recommended using it to reduce postoperative swelling and pain safely.

Seiki (2002) had reported that pain relief with cold application could be due to many mechanisms including altered Nerve Conduction Velocity (NCV), inhibition of nociceptors, a reduction in muscle spasms and/or a reduction in metabolic enzyme activity levels.

Waters and Raisler conducted a study on ice massage for the reduction of labor pain in 2003. They have investigated the use of ice massage over the acupressure energy meridian point large intestine 4 (LI4) to reduce labor pain during contractions. A one-group, pretest-posttest design was chosen by the investigators in which they used Visual Analog Scales (VAS) and the McGill Pain Questionnaire (MPQ) ranked numerically and verbally to measure pain levels. They used pretest as the control group. The investigators noted a pain reduction mean on the VAS of 28.22 mm on the left hand and 11.93 mm on the right hand. The post-delivery rank was reported as MPQ dropped from number 3 (distressing) to number 2 (discomforting). The study results supported that ice massage is a safe, noninvasive, nonpharmacological method of reducing labor pain.

Kuo et al (2004) carried out a study on the soreness and numbness effect of acupuncture on skin blood flow with the purpose to investigate the effect of the De-Qi sensation of acupuncture (sourness-distension and distension- numbness) stimulation. 42 healthy medical student volunteers were given acupuncture by the investigators at the Hoku (LI-4) acupoint when they were resting. During a test that lasted 30 minutes, the respondents' skin blood flow was measured at the Quchi (LI-11) acupoint and their palm temperature was measured by the investigators. In conclusion, when the test persons felt the sore and numb De-Qi sensation, the investigators could identify an increase of blood flow at the acupuncture points. Their study results suggested that increased flow can be one of the mechanisms accounting for meridian system responses during acupuncture and acupressure.

Hayward et al (2006) found in their randomized clinical trial that 16 of the 20 participants reported that the soreness caused by two lignocaine injections into the hallux was significantly reduced with a six-minute application of ice prior to injection.

Algaflly, (2006) investigated the effect of Cryotherapy on Nerve Conduction Velocity (NCV), Pain Threshold (PTH) and Pain Tolerance (PTO) and described that Cryotherapy can increase pain tolerance and pain

threshold at the ankle and that was associated with a significant decrease in Nerve Conduction Velocity. In the control ankle, there was no alteration in NCV, PTH and PTO when they reassessed. In the ankle receiving Cryotherapy, it was found that NCV was significantly and progressively reduced as ankle skin temperature was reduced to 10°C.

Ownby (2006) conducted a pilot study using randomized control trials on the effects of ice massage on neuropathic pain in persons with AIDS to determine the feasibility of a larger study. Two treatments were used by the investigator consisted of ice massage and dry-towel massage among 33 persons with AIDS who had neuropathic pain. The obtained data showed that there was a decrease in pain intensity over time with both the ice massage and towel massage and the researcher concluded that the intervention had some clinical benefit.

Bastian et al (2007) investigated prospectively among 107 patients who required extraction of two wisdom teeth, one on the left and one on the right side of the lower jaw to determine the effect of cryotherapy during the surgical removal of wisdom teeth in reducing the intensity of pain and general discomfort. They have carried out Cryotherapy on one side only. They have recorded intensity of pain by employing a Visual Analogue Scale. They have concluded that cryotherapy is effective in reducing pain, swelling and general discomfort following extraction of a wisdom tooth in the lower jaw without creating irreversible sequelae.

A study on the effects of Cryotherapy, Transcutaneous Electrical Nerve Stimulation and their combination on Femoral nerve electrical activity by Santuzzi et al (2008) clearly depicted that Cryotherapy produces analgesia by two main local mechanisms, the neural and the vascular mechanisms. They explained that in the neural mechanism, topical ice application reduces the local temperature that lowers the activation threshold of tissue nociceptors and, consequently, the transmission signs of pain and with regard to the vascular effects of cryotherapy, the analgesia was associated with a decrease in blood flow, caused by cold-induced vasoconstriction as well as reduced neural metabolism.

A project on the efficacy of Ethyl Chloride spray and ice cube as an analgesic pre-treatment for antibiotic skin test among 50 healthy adult volunteers. Each subject was given an intradermal skin test on both the arms after different analgesic pre-treatment and the pain and discomfort assessed using Visual Analogue Scale. It was depicted by the investigator that ice cube application was more effective than the vapocoolant spray in reducing pain of antibiotic skin test and 90% of subjects preferred the ice cube pre-treatment for the intradermal skin test. (Yoon & Chung, 2008).

Klein (2009) studied that Cryotherapy has the primary effect of cooling tissue. The researcher identified basic physiologic effects such as decreased local metabolism, vasoconstriction, reactive hyperemia, reduced swelling/edema, decreased hemorrhage, reduced muscle efficiency, analgesia secondary to impaired neuromuscular transmission, pain reduction associated with the application of cold, reduction in muscle spasm and minimal upper motor neuron spasticity based on method of application and duration of the therapy.

A Randomized Controlled Crossover Study was conducted by Laura et al (2009) on Effect of Ice Massage on Pressure Pain Thresholds and Electromyography Activity Postexercise concluded that ice massage after isokinetic exercise produced an immediate increase of pressure pain thresholds over the Vastus Medialis (VM), Vastus Lateralis (VL), and Rectus Femoris (RF) muscles. They have recorded that EMG activity over the VL muscle in recreational athletes, had suggested ice massage may result in a hypo analgesic effect and improvements in EMG activity.

Sabitha et al (2010) has undertaken a study to assess the effect of Cryotherapy on pain due to AVF puncture in hemodialysis patients. A convenient sample of 60 patients (30 in experimental and 30 in control groups) who were undergoing hemodialysis by using AVF were assessed in a Randomized Control Trial by the group. The objective and subjective AVF pain scores on days 1 and 2 of HD within the experimental group were found to be significantly reduced from an average of 3.8 on day 1 of HD (when the patient received routine care) to 0.7. Pain scores on days 1 and 2 of HD within the control group were found to be similar on two consecutive days of HD. They have concluded that cryotherapy is effective in reducing AV fistula puncture pain of hemodialysis patients.

#### **Literature related to pain measurement and pain management in CRF**

Patients with renal failure often experience pain. Moreover, they suffer from the pain during AV fistula cannulation every other day which is unavoidable as dialysis is their life-saving treatment option. But local anesthesia is not often used due to concerns of vasoconstriction, burning sensation,

scarring, and infection in most of the dialysis centers. Optimal pain assessment and management are key clinical activities yet inadequate pain control among renal patients by health professionals persists.

Bennett and Porter (1998) stated that as many questions about the exact etiology of analgesic nephropathy remain, there exists the need for more research to determine the exact prevalence of this disease and for pharmaceutical companies to conduct stringent tests on the safety of their analgesics.

Miller et al (2001) performed a prospective, randomized, quasi-experimental study by using a convenient sample who were undergoing outpatient or same-day surgery to assess patient's perception of pain associated with peripheral intravenous cannulation, using 3 methods of applying local anesthetics such as injection of 1% lidocaine, application of topical EMLA cream and treatment with "Numby Stuff". After the intended analgesic treatment was completed, 18-gauge IV catheters were inserted, and the investigators asked the patients to rate the amount of pain experienced with it. They utilized visual analog scale as the tool of measurement for pain by the investigators. Results of the study showed that out of 3 methods tested by the researchers, the data indicated that the Numby Stuff system using iontophoresis is the superior method for decreasing the pain associated with peripheral IV cannulation.

A study entitled "Pain Measurement Tools And Methods In Clinical Research In Palliative Care" was conducted by an Expert Working Group of the European Association of Palliative Care (2002) to review the status of the use of Pain Measurement Tools (PMTs) in palliative care in a multilingual-multicenter setting. Their study recommended that standardized methods should be applied for the use of PMTs in palliative care researches. VAS, NPRS, Verbal Rating Scales, the McGill Pain Questionnaire and Brief Pain Inventory were recommended by the investigators in palliative care settings.

Kurella et al (2003) had reviewed the evidence on pharmacokinetics and side effects of the various analgesic drugs in renal failure. Most of the analgesics are excreted renally or by the liver, and so even the use of paracetamol (acetaminophen) was cautioned among renal failure patients.

Cohen et al (2000) conducted a prospective observational study among 131 renal patients who have withdrawn themselves from the dialysis treatment demonstrated that 42% of patients experienced pain in their last 24 hours and due to pain during AV fistula cannulation.

A Research into Pain Perception with Arteriovenous Fistula Cannulation conducted by Figueiredo et al (2008) recorded that patients with end-stage renal failure undergoing haemodialysis are repeatedly exposed to stress and pain from frequent punctures to their arteriovenous fistula. The objective of the study was to measure pain associated with AVF needling and they used an analogue visual scale. Patients' perceptions were measured in three different HD sessions. Pain was considered mild during AVF needling. The buttonhole technique caused a mean degree of pain of 2.4 ( $\pm 1.7$ ), compared to 3.1 ( $\pm 2.3$ ) using the conventional rope ladder technique. They could analyze reduction in pain from the collected data associated with the buttonhole technique.

### **Literature related to factors affecting Pain and Biophysiological parameters**

Carlson et al (1997) conducted research to identify the psychological and physiological variables among 35 persons reporting Masticatory Muscle Pain (MMP) from 35 Normal Controls (NC). They have evaluated subjects' emotional and physiological responses (Heart Rate, Blood Pressure, Respiration, Skin Temperature, and Muscle Activity). They have drawn a conclusion that persons with MMP reported greater fatigue, disturbed sleep, depression, anxiety, menstrual symptoms, and less self-deception than matched controls. At rest, MMPs were found to have lower end tidal carbon dioxide levels and lower diastolic blood pressures than the NCs. Muscle pain patients reported lower pressure pain threshold than the NCs at the right or left Masseter and right Temporalis sites.

A study conducted by Tanaka et al (2001) investigated to compare the effect of two types of superficial Acupuncture stimulation using various physiological parameters and pain index. The subjects were 10 chronic tension type headache sufferers and 2 types of Acupuncture procedures were administered. At the beginning and end of the experiment session, the investigators asked the subjects to rate the headache intensity with a VAS. Following the stimulations, the static EMG, heart rate and pulse height were continuously monitored for 30 min. Thirty minutes after the first stimulation, an averaged 59.1% pain score reduction was obtained whereas the second stimulation produced only an averaged 21.9% pain score reduction. They found no statistically significant difference in the EMG, heart rate, and pulse height.

Bossart et al (2004) performed a prospective, observational study to determine the correlation between change in heart rate (HR) and change in pain among 975 Emergency Department (ED) patients. They included a convenience

sample of patients presenting to an academic ED with pain. Heart rate and pain intensity were determined at the time of triage, 30min post pain treatment, and at discharge. They have finished the study stating that there was a poor correlation between change in pain intensity and change in heart rate among ED patients with acute pain.

To sum up, pain is not just physiological response, but the psychological variables like behavioral and emotional responses influence the perception of pain. Each person is reacting to pain in a different way. Rarely studies have been conducted on the measures to reduce the pain experienced during procedures. Considering this aspect the researcher was interested to conduct the study to reduce the pain perception during AV fistula cannulation with the application of Cryotherapy. The purpose of which was to aid cost effective nursing care if found effective.

### Chapter III

#### Methodology:-

Research methodology is a logical way to solve a problem. It is a discipline of studying how study is to be carried out. In actual fact, the procedures by which researchers go about their work of describing, explaining and predicting phenomena by which findings were obtained. It is essential for a researcher to design a methodology for the selected problem to have blue print of the study in advance. So, in this chapter the investigator portrays the methods adopted to accomplish the research and it deals with the research design, variables under study, setting of the study, population, sample size, sampling technique, criteria for the selection of sample, description of the tool, testing of the tool, pilot study, procedure for data collection and statistics analysis.

#### Research Design

The design adopted for the study is Repeated Measures Experimental Design (Crossover Design).

Schematic representation of the design:

E                    X1    O1    X2    O2    X1    O3    X2    O4    X1    O5    X2    O6

X1 – With Xylocaine

X2 – With Cryotherapy

O1 – Observation 1 with Xylocaine on day 1  
O2 – Observation 2 with Cryotherapy on day 2  
O3 – Observation 3 with Xylocaine on day 3  
O4 – Observation 4 with Cryotherapy on day 4  
O5 – Observation 5 with Xylocaine on day 5  
O6 – Observation 6 with Cryotherapy on day 6

The researcher used Repeated Measures Design to accomplish the study because Pain is a subjective variable which changes time to time.

#### Variables Under Study

In this study, the independent variable was Cryotherapy and the dependent variables were Pain and Biophysiological parameters namely Blood Pressure, Pulse rate and Respiratory rate.

#### Setting Of The Study

The study was conducted at Kovai Medical Centre and Hospital, Coimbatore. It is an 800 bedded super specialty hospital. KMCH has got an exceptional Hemodialysis department run for 24 hours a day. There are 2 dialysis units, one for infected patients and the other for non-infected patients. Totally, there are 15 hemodialysis machines, 5 for the infected cases and 10 for the non-infected cases. There are 5 technicians and 20 staff nurses for the unit and the unit performs approximately 60 Hemodialysis per day.

#### Population

Population for the study were the adult patients with Chronic Renal Failure who were undergoing Hemodialysis at KMCH Hemodialysis unit.

#### Sample Size

Sample size for the study was 50. The same subjects were exposed both to routine care and to the intervention on alternative days.

#### Sampling Technique

Simpler random sampling technique was adopted to select the sample from the population. Totally, 93 patients were there under the consultant Nephrologist. Out of them, 78 patients have met the inclusion criteria. Lottery method without replacement was adopted to select 50 samples by giving equal chance to each patient to be a subject in the study.

**Criteria For Sample Selection****Inclusion criteria**

1. Patients who undergo maintenance Hemodialysis with AV fistula as the vascular access
2. Both male and female adult patients between the age group of 20-60 years
3. Patients who undergo at least three Dialysis per week

**Exclusion criteria**

1. Patients with any Psychiatric illness
2. Patients who do not report any pain during the procedure.

**Development Of The Tool**

The tool used in this study consisted of 3 sections:

**Section-1- Demographic and clinical profile**

It included age, sex, marital status, occupation, and educational status, duration of illness and duration of treatment.

**Section -2- Biophysiological parameters**

Measurement of blood pressure, pulse rate, respiration rate during cannulation.

**Section -3- Numerical pain ratings scale (NPRS)**

It was a 10-point subjective pain rating scale with 1cm= 1 point in which 0 represents no pain and the pain intensity increases and the worst possible pain is represented by the point 10.

**Description Of The Tool**

Omron digital automatic monitor was calibrated for BP and pulse from the biomedical department. For the respiratory rate, inter-rater reliability showed  $r=0.96$ .

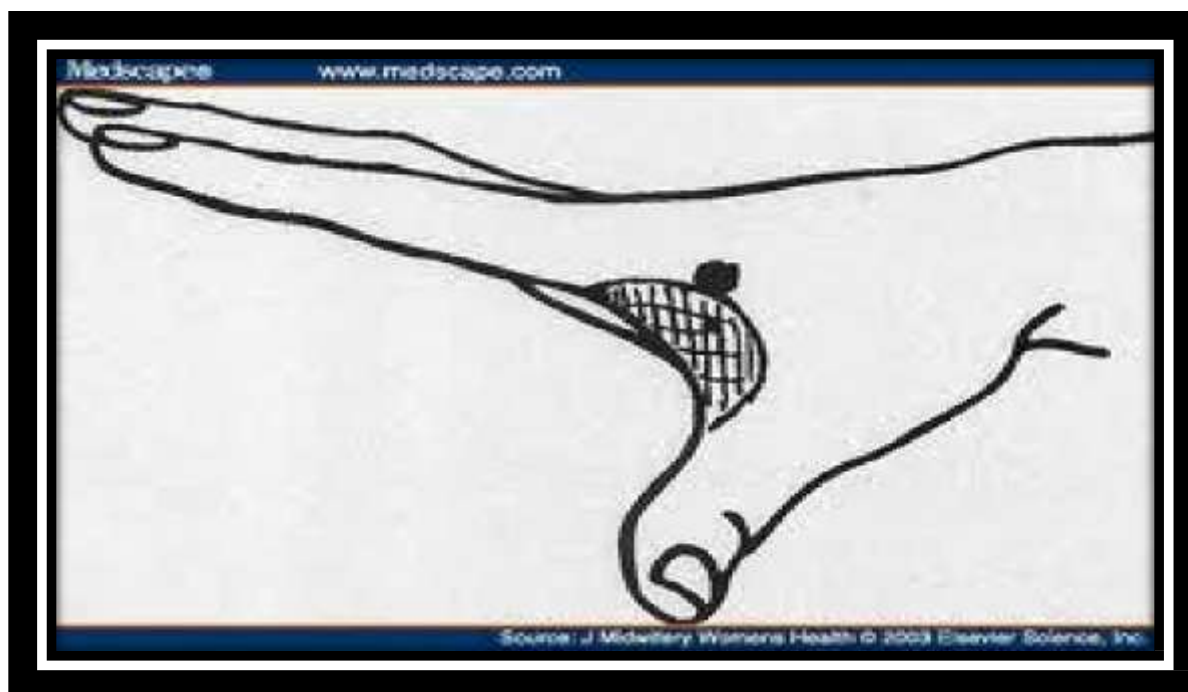
**Reliability and Validity of NPRS**

The Numeric Pain Rating Scale has demonstrated good levels internal consistency with Cronbach's alpha coefficient of 0.86 - 0.88 and test-retest reliability coefficient ranged from 0.57-0.83 suggesting acceptable reliability of the measures. (Hadjistarropoulos et al 2007). Herr and colleagues (2004) reported that a factor analysis showed that the Numeric

Pain Rating Scale was valid. The validity of the NPRS has been well documented, and has demonstrated significant, positive relationship with other measures of pain intensity and sensitivity to changes due to treatment.

**Description Of The Intervention**

The primary purpose of the intervention (application of cryotherapy) was to reduce the pain intensity of the subjects during AV fistula cannulation. The required ice cubes for the application were kept ready in the freezer by the investigator. The prepared ice cubes were of 6-8 degree Celsius. Explanation regarding the procedure was given after making the subject lie comfortably on bed in the dialysis unit. Cold application was done on the web between the thumb and index finger of the hand which does not have the AV fistula (opposite arm). The procedure was started ten minutes before cannulation and was continued throughout the puncturing procedure and until two minutes after the procedure. Biophysiological parameters were recorded during cannulation and the pain was assessed with cannulation after Cryotherapy both at the arterial and venous sites of the AV fistula.



**Fig. 2:-** Anatomical allocation of LI4 Meridian/ Hoku point.

#### **Pilot Study**

Pilot study was conducted for a week among 5 patients to find out the feasibility of the study, the practicability of the intervention and to make sure the protection of the human subjects. The pilot study revealed the consistency of the application of Cryotherapy in reducing the pain during AV fistula cannulation. No changes were made in the methodology after the pilot study as the results were reasonable.

#### **Procedure For Data Collection**

Formal permission was obtained from the Chairman of the hospital and the consultant Nephrologist, KMCH. The permitted time for the data collection was 6 weeks. Subjects were selected based on the inclusion criteria. The investigator explained the details and benefits of the intervention. An informed consent was obtained from the subjects, and explained about their right to withdraw from the study at any time. The demographic data were collected from the subjects and the clinical data were retrieved from the file. Each subject was followed for six consecutive days of dialysis. The calibrated Omron digital automatic monitor was used measuring BP and pulse rate. The researcher counted the respiratory rate manually. On the first, third and fifth days of Dialysis, cannulation was done with Xylocaine infiltration. Biophysiological parameters were recorded during cannulation and the pain was assessed with Xylocaine infiltration and with cannulation both at the arterial and venous sites of the AV fistula using NPRS. On second, fourth and sixth days of dialysis, the data were collected when the subjects were given Cryotherapy.

#### **Statistical Analysis**

The data collected were analyzed by descriptive statistics by means of Mean, Standard Deviation, and Percentage to describe the demographic characteristics of the subjects and to describe the pain intensity of the subjects during Xylocaine infiltration and during AV fistula cannulation. Inferential statistics namely, paired and independent "t" test were used to compare the pain intensities and biophysiological parameters measured during various observations during cannulation done with Xylocaine infiltration and with Cryotherapy. One way ANOVA was performed to associate the pain intensity and selected variables.

#### **Chapter IV**

##### **Data Analysis And Interpretation**

The science of collection, analysis, interpretation or explanation, and presentation of data is statistics. In fact, all the data collection and interpretation techniques used in Research are part of statistics. It makes use of descriptive statistics for collection of data and inferential statistics for drawing inferences from the set of data. This chapter deals with the analysis

and interpretation of the data collected to assess the effect of Cryotherapy on Pain and Biophysiological variables during AV fistula cannulation among patients on Hemodialysis

The analyses and interpretation are organized as follows:

SECTION A: Description of Subjects according to their Demographic and Clinical profile

SECTION B: Description about the Mean Pain score of the Subjects

SECTION C: Description about the Biophysiological parameters during Cannulation

SECTION D : Comparison of the Mean Pain score on various Observations

SECTION E: Comparison of Biophysiological parameters on various Observations

SECTION F : Comparison of Pain score during AV fistula cannulation done with Xylocaine and done with Cryotherapy.

SECTION G: Comparison of Biophysiological parameters during AV fistula cannulation done with Xylocaine and done with Cryotherapy.

SECTION H: Association of Pain scores with selected Demographic and Clinical variables

#### SECTION-A

Description of Subjects according to their Demographic and Clinical profile:

**Table 1:-** Description of Subjects according to their Demographic profile.

S.No	Demographic variables	f (N=50)	Percentage(%)
1.	Age in years a) 21-30 b) 31-40 c) 41-50 d) 51-60	10 8 18 14	20 16 36 28
2.	Sex a) Male b) Female	41 9	82 18
3.	Marital status a) Single b) Married	5 45	10 90
4.	Educational status a) Primary b) Secondary c) Higher secondary d) Graduate e) Postgraduate	9 20 10 6 5	18 40 20 12 10
5.	Occupational status a) Employed b) Unemployed	38 12	76 24

Table 1 represents distribution of subjects according to their demographic characteristics. Out of 50 subjects; maximum subjects (18) were in the age group of 41-50. Regarding gender, 41 (82 percent) were males. According to their marital status, majority of them 45 (90 per cent) were married. 40 per cent of the subjects had secondary education and 10 had higher secondary education. 38 among 50 (76 percent) subjects were employed.



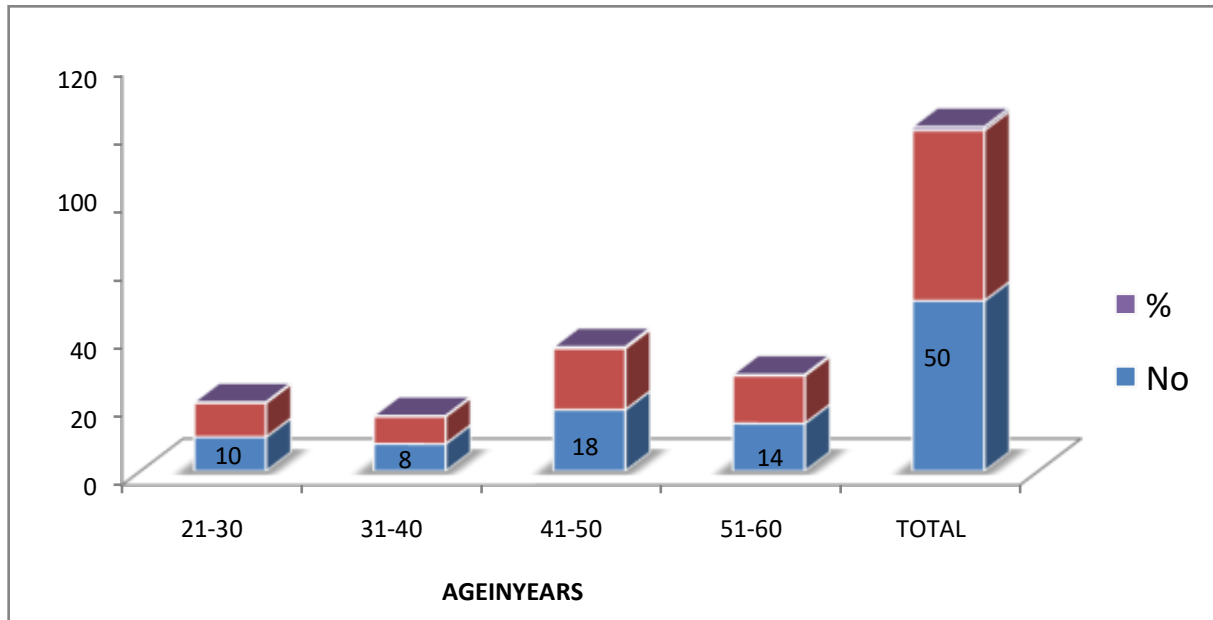


Fig.3:- Agewisedistributionofthe subjects.

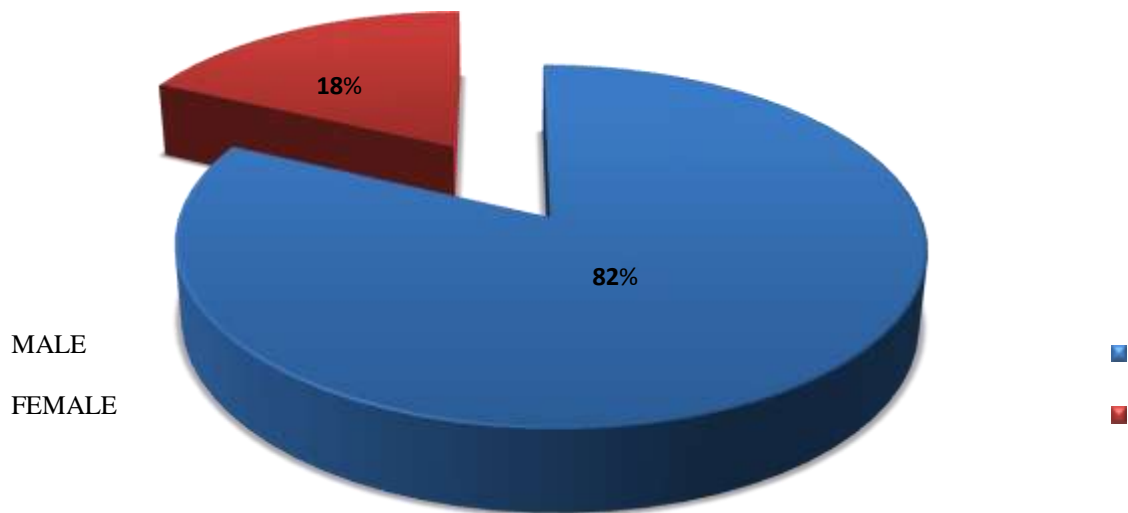


Fig.4:- Genderwise distributionofthesubjects.

Table2:- Description oftheSubjectsaccordingtotheirClinicalprofile.

S.No	Characteristics	f (N=50)	Percentage(%)
1.	Durationofillness inyears)a)1-3	12	24
	b)3-5	23	46
	c)5-7	15	30
2.	DurationofHemodialysisinyears)a)1-3	31	62
	b)3-5	9	18
	c)5-7	10	20

Table2showsthat23(46percent)subjectsweresufferingfromrenalfailureforthepast3-5yearsand31(62percent)were undergoingHemodialysisfora periodof1-3years

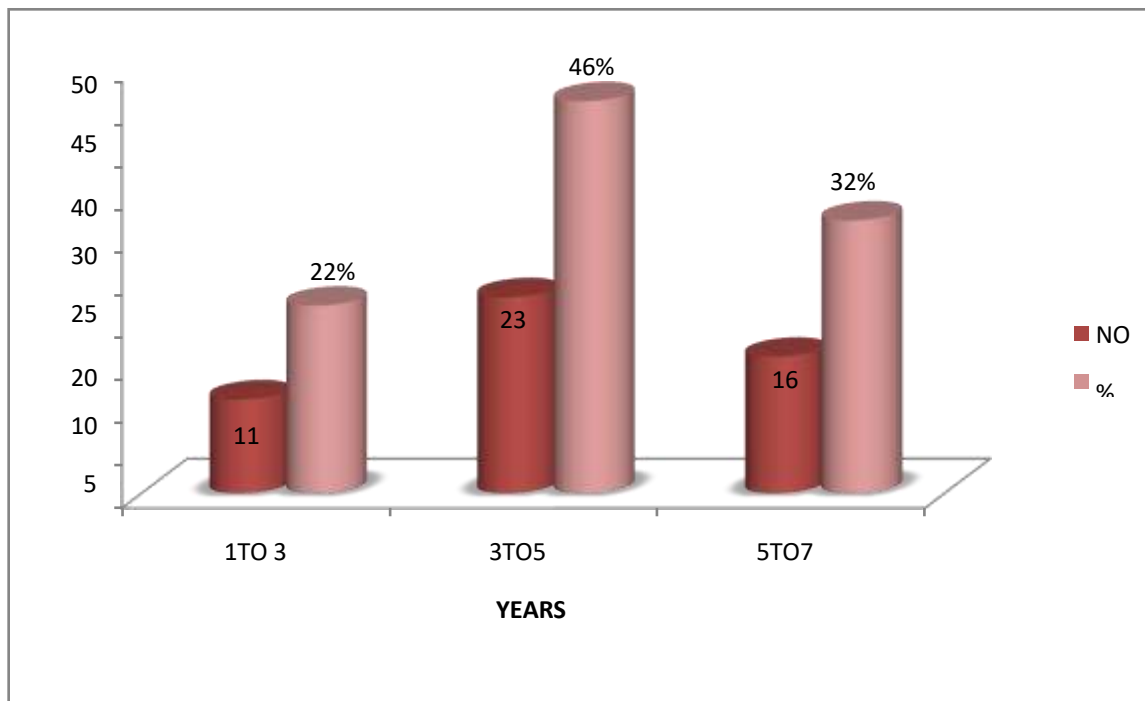


Fig.5:- Distribution of Subjects according to their Duration of Illness in years.

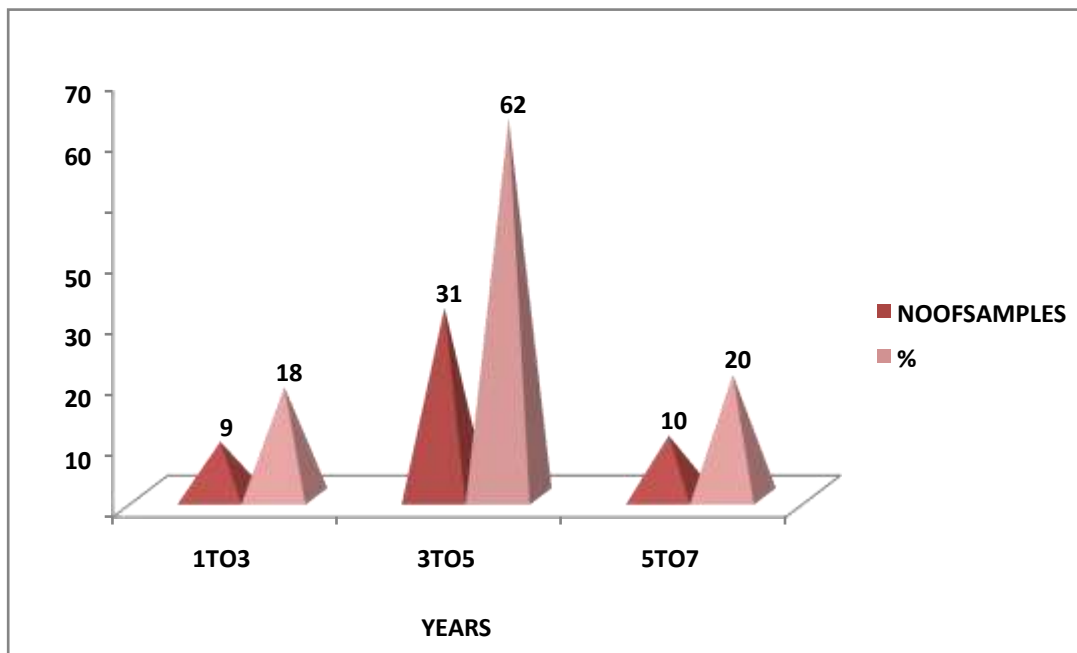


Fig.6:- Distribution of Subjects according to their Duration on Hemodialysis in years.

Section –B

Description about the Mean Pain score of the Subjects:

Table 3:- Mean and S.D of Pain scores during Xylocaine infiltration on Day 1, 3 and 5 N=50

Day	Puncture site	Mean	S.D
1	Arterial	4.88	1.15
	Venous	4.96	1.20
3	Arterial	4.78	1.20

	Venous	4.88	1.17
5	Arterial	4.76	1.13
	Venous	4.74	1.12

The table 3 shows the mean and the standard deviation of the pain scores of the subjects during Xylocaine infiltration at arterial site and venous site on three consecutive days of dialysis. With regard to the arterial site, 4.88 were the maximum score and the minimum score was 4.76 whereas 4.96 was the maximum score at the venous site and 4.74 was the minimum pain score.

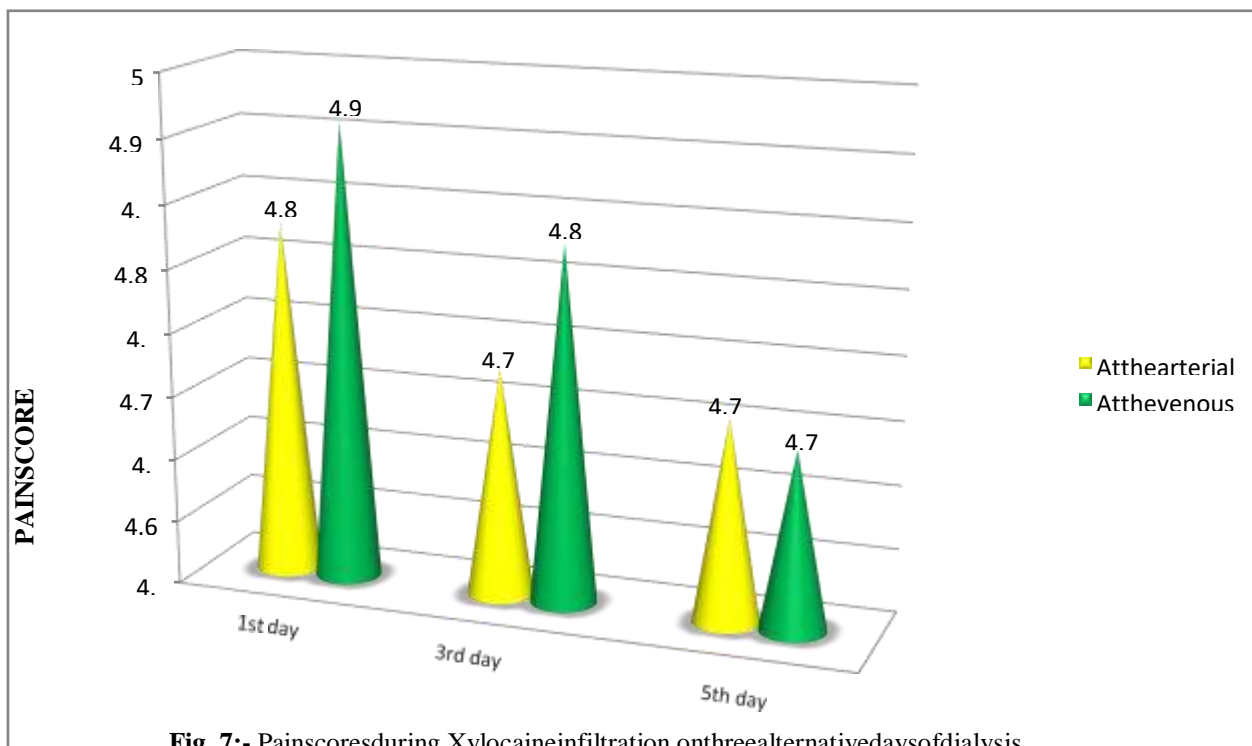


Fig. 7:- Pain scores during Xylocaine infiltration on three alternative days of dialysis.

Table 4:- Mean and SD of the Pain scores during Cannulation after Xylocaine infiltration on Day 1, 3 and 5.

Day	Puncture site	Mean	S.D.
1	Arterial	1.62	0.60
	Venous	1.54	0.61
3	Arterial	1.58	0.54
	Venous	1.50	0.51
5	Arterial	1.56	0.50
	Venous	1.48	0.51

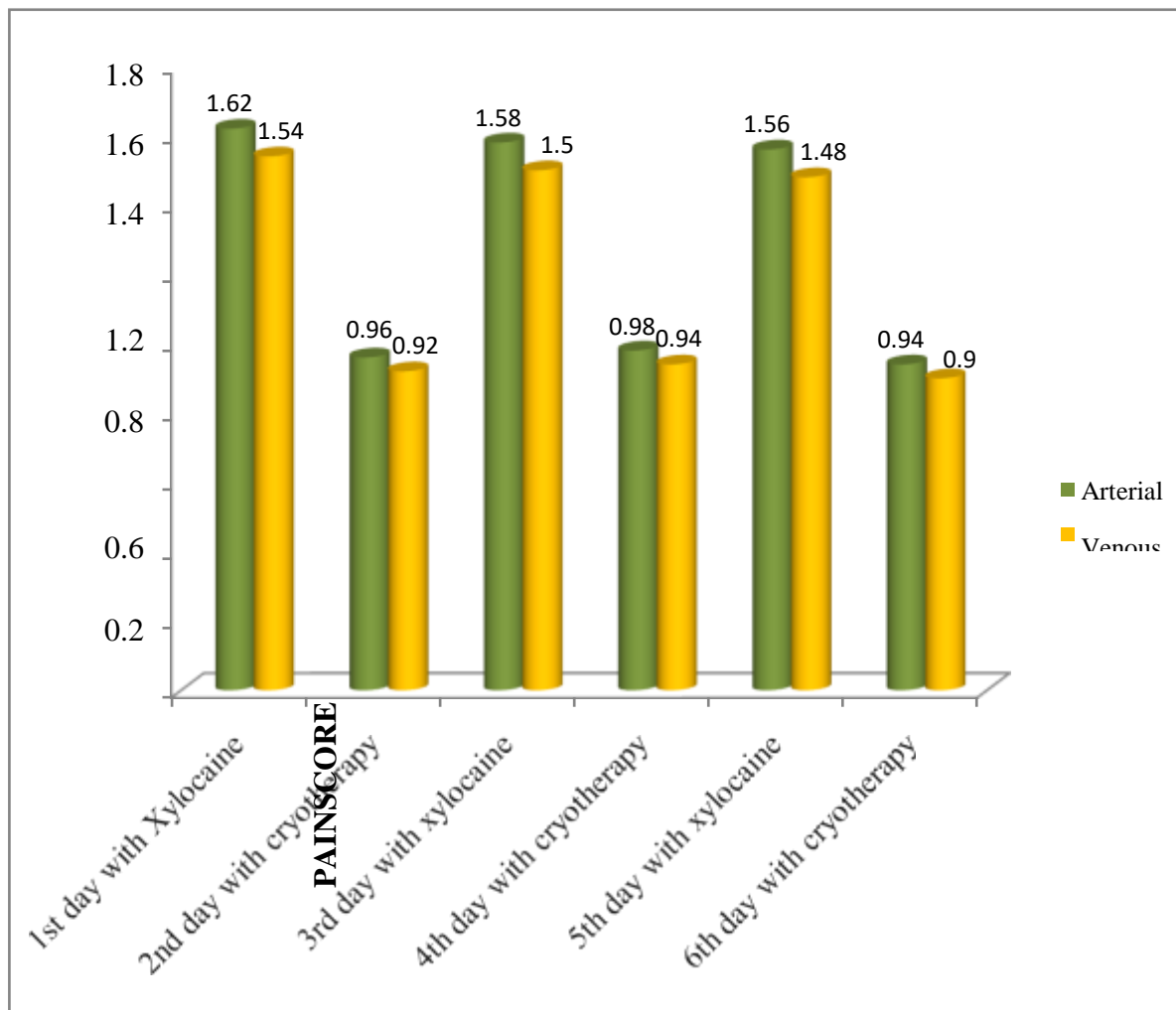
This table describes the mean and the SD of the pain scores of the subjects during AV fistula cannulation after Xylocaine infiltration at arterial site and venous site on day 1, 3 and 5. With regard to the arterial site, 1.62 was the maximum and the minimum score was 1.56 whereas 1.54 was the maximum and 1.48 was the minimum pain score at the venous site.

Table 5:- Mean and SD of Pain scores during Cannulation after Cryotherapy on Day 2, 4 and 6.

Day	Puncture site	Mean	S.D.
2	Arterial	0.96	0.35
			0.40

	Venous	0.92	
4	Arterial	0.98	0.25
	Venous	0.94	0.37
6	Arterial	0.94	0.31
	Venous	0.90	0.36

This table depicts the mean and SD of the pain scores of the subjects during AV fistula cannulation at arterial site and venous site after Cryotherapy on day 2, 4 and 6. In regard to pain score at the arterial site, 0.98 was the maximum and the minimum was 0.94 whereas 0.94 was the maximum and 0.90 was the minimum pain score at the venous site.



**Fig. 8:-** Painscores during Cannulation after Xylocaine infiltration and after Cryotherapy on various Observations. **Section C**

Description about the Biophysiological parameters during cannulation:

**Table 6:-** Mean and SD of Systolic and Diastolic Blood Pressure during Cannulation on various Observations.

S.No.	Blood Pressure	With Xylocaine		With Cryotherapy	
		Mean	S.D	Mean	S.D
1	Systolic	148.7	20.62	148.8	20.63
	Diastolic	82.08	8.92	82.20	8.91
2	Systolic	148.82	20.50	148.84	20.50
	Diastolic	82.32	7.52	82.14	7.53
3	Systolic	148.88	20.66	148.82	20.66
	Diastolic	82.22	7.78	82.20	7.77

The above table displays the description of the mean and standard deviation of systolic and diastolic blood pressure readings on various observations during AV fistula cannulation done after Xylocaine infiltration and after Cryotherapy. The values show that there is no noticeable difference among various observations.

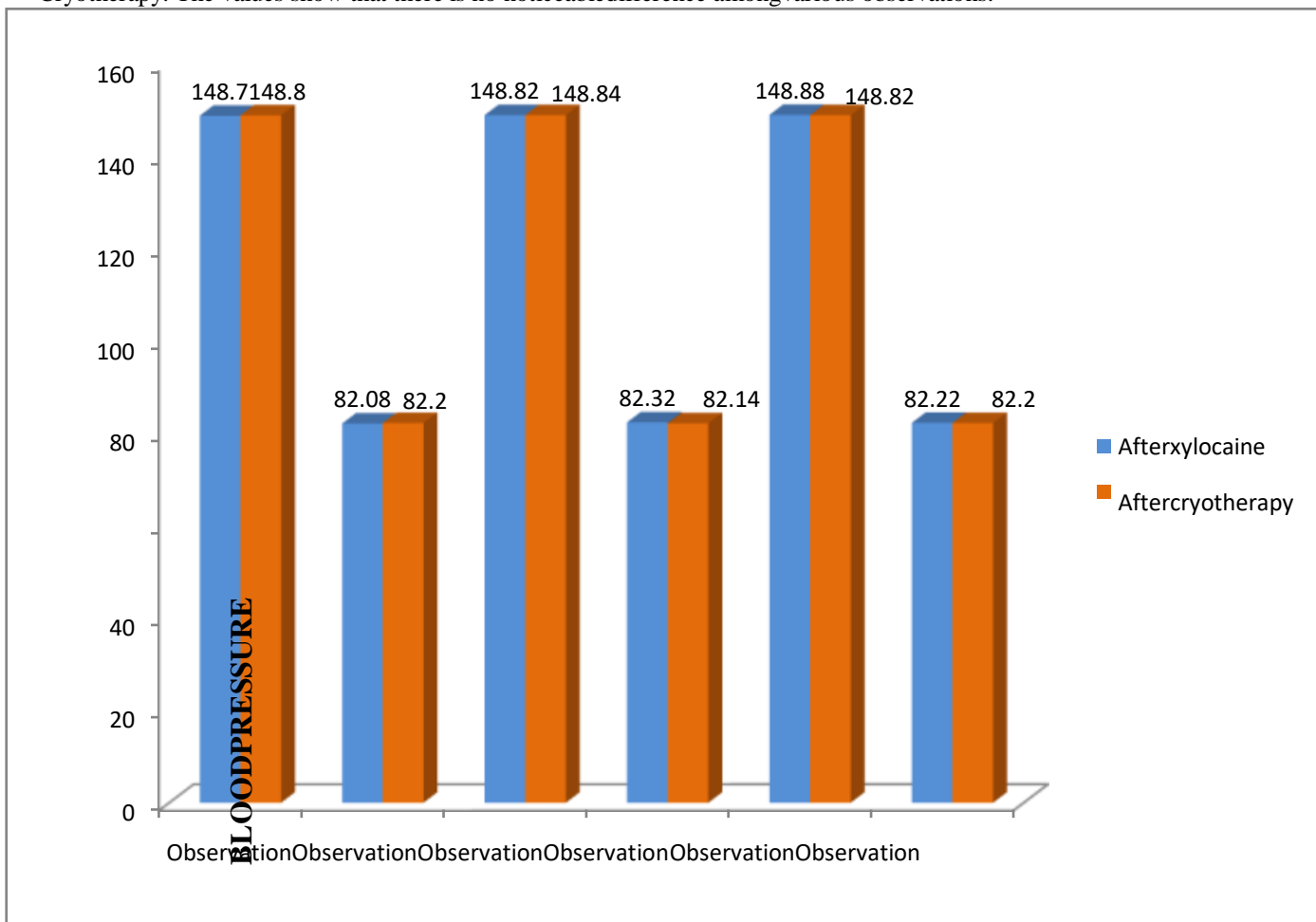


Fig.9:- Mean Systolic and Diastolic Blood Pressure during Cannulation on various Observations.

Table 7:- Mean and SD of Pulse rate during Cannulation on various Observations.

Observation	Mean	S.D	Mean	S.D
	With Xylocaine		With Cryotherapy	
1	76.64	5.01	76.82	4.44
2	76.96	5.00	76.84	4.85
3	76.52	4.57	76.63	4.60

Table 8 gives the description of the mean and standard deviation of pulse rates on six days of AV fistula cannulation with Xylocaine and with Cryotherapy. The values show that there is no noticeable difference between two modes of care.

Table 8:- Mean and SD of Respiratory rate during Cannulation various Observations.

Observation	Mean	S.D	Mean	S.D
	With Xylocaine		With Cryotherapy	
1	20.48	1.37	20.28	1.47
2	20.52	1.42	20.56	1.69
3	20.76	1.56	20.32	1.54

Table 8 illustrates the details of the mean and standard deviation on various observations of respiratory rates during AV fistula cannulation with Xylocaine and with Cryotherapy. The values illustrate that there is no noticeable variations between various observations.

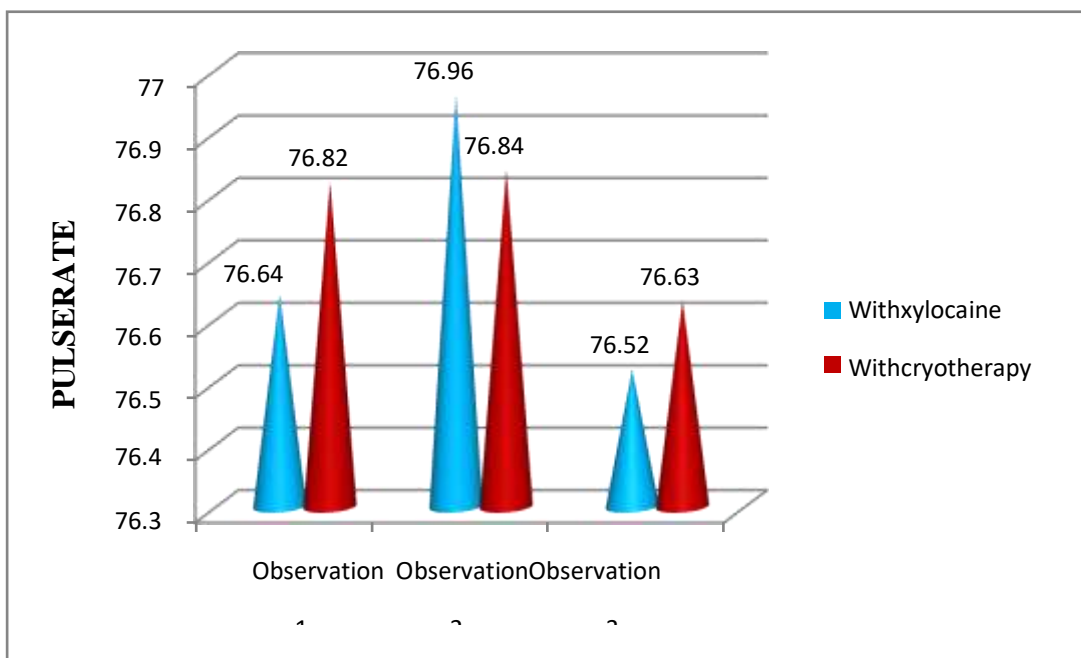


Fig. 10:- MeanPulserateduringCannulationonvariousObservations.

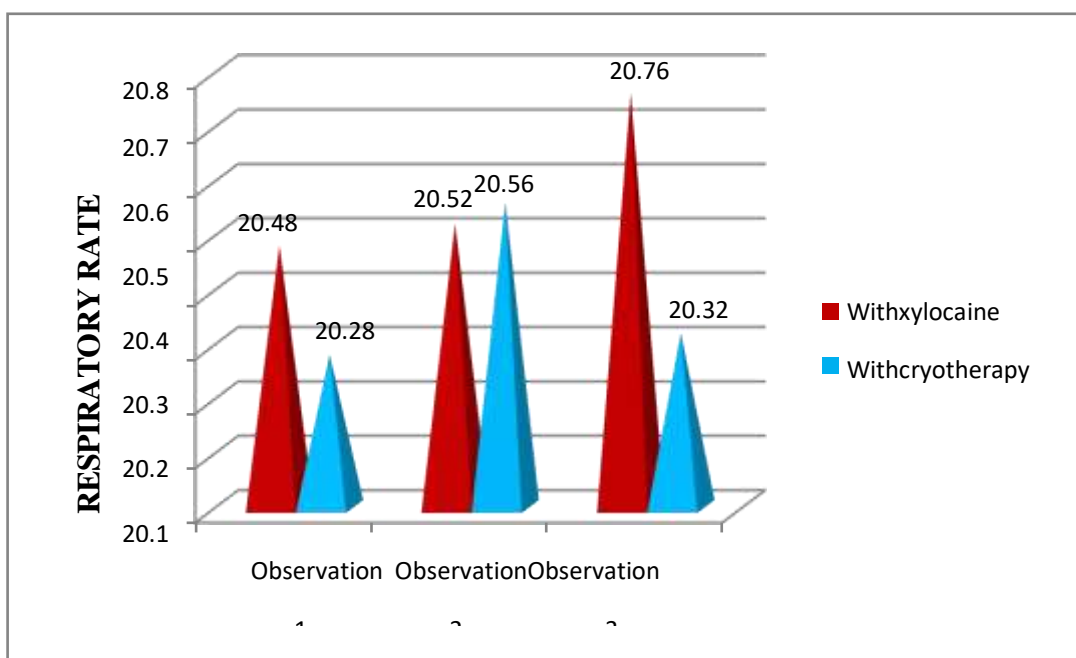


Fig.11:- MeanRespiratoryratesduringCannulationonvariousObservations.

**SectionD**

**ComparisonoftheMeanPainscoresonvariousObservations:**

**Table9:- ComparisonofMeanPainscoresduringXylocaineinfiltrationattheArterialandVenoussitesN=50**

Day	Mean	S.D.	“t”value
<b>At thearterialsite</b>			
Observation1&3			
1	4.88	1.15	1.068(NS)
3	4.78	1.20	
Observation1&5			
1	4.88	1.15	1.122(NS)
5	4.76	1.13	

Observation3&5			
3	4.78	1.20	0.314(NS)
5	4.76	1.13	
<b>At the venous site</b>			
Observation1&3			
1	4.96	1.19	0.912(NS)
3	4.88	1.17	
Observation1&5			
1	4.96	1.20	0.718(NS)
5	4.90	1.12	
Observation3&5			
3	4.88	1.17	0.304(NS)
5	4.90	1.12	

This table shows the comparison between the pain scores at arterial and venous sites among 3 observations with Xylocaine. The computed "t" values show no significant difference in the pain scores both at the arterial and venous site

**Table 10:-** Comparison of Mean Pain scores during Cannulation after Xylocaine infiltration at the Arterial and Venous sites N=50

Day	Mean	S.D.	"t" value
<b>At the arterial site</b>			
Observation1&3			
1	1.62	0.60	0.514(NS)
3	1.58	0.54	
Observation1&5			
1	1.62	0.60	0.750(NS)
5	1.56	0.50	
Observation3&5			
3	1.58	0.54	0.344(NS)
5	1.56	0.50	
<b>At the venous site</b>			
Observation1&3			
1	1.54	0.61	0.504(NS)
3	1.50	0.51	
Observation1&5			
1	1.54	0.61	0.710(NS)
5	1.48	0.51	
Observation3&5			
3	1.50	0.51	0.330(NS)
5	1.48	0.51	

This table shows the comparison between the pain scores at the arterial and venous sites during AV fistula cannulation after Xylocaine infiltration on various observations. The computed "t" values show no statistically significant difference in the pain score among 3 different observations

**Table 11:-** Comparison of Mean Pain scores during Cannulation after Cryotherapy at the Arterial site and Venous sites N=50

Day	Mean	S.D.	"t" value
<b>At the arterial site</b>			
Observation2&4			
2	0.96	0.35	0.324(NS)
4	0.98	0.25	
Observation2&6			
2	0.96	0.35	0.328(NS)
6	0.94	0.31	
Observation4&6			
4	0.98	0.25	0.590(NS)
6	0.94	0.31	

<b>At the venous site</b>			
Observation 2&4			
2	0.92	0.39	0.344(NS)
4	0.94	0.37	
Observation 2&6			
2	0.92	0.39	0.306(NS)
6	0.90	0.36	
Observation 4&6			
4	0.94	0.37	0.582(NS)
6	0.90	0.36	

This table shows the comparison between the pain scores at the arterial and venous sites during cannulation after Cryotherapy application on day 2, day 4 and day 6 of dialysis. The computed "t" value shows no statistically significant difference in the pain score among various observations.

### Section E

#### Comparison of Biophysiological parameters on various observations:

**Table 12:-**

Comparison of Mean Systolic Blood Pressure during Cannulation after Xylocaine infiltration and after Cryotherapy N=50

Day	Mean	S.D.	"t" Value
<b>With Xylocaine</b>			
Observation 1 & 3			
1	148.70	20.62	0.862(NS)
3	148.82	20.50	
Observation 1 & 5			
1	148.70	20.62	0.974(NS)
5	148.88	20.66	
Observation 3 & 5			
3	148.82	20.50	0.516(NS)
5	148.88	20.66	
<b>With Cryotherapy</b>			
Observation 2 & 4			
2	148.80	20.63	0.294(NS)
4	148.84	20.49	
Observation 2 & 6			
2	148.80	20.63	0.297(NS)
6	148.82	20.66	
Observation 4 & 6			
4	148.84	20.49	0.291(NS)
6	148.82	20.66	

This table shows the comparison between the blood pressure readings during cannulation after Xylocaine infiltration and after Cryotherapy on various observations. The computed "t" values show no statistically significant difference in the blood pressure readings among 3 days of both with Xylocaine and with Cryotherapy.

**Table 13:-**

Comparison of Mean Diastolic Blood Pressure during Cannulation after Xylocaine infiltration and after Cryotherapy N=50

Day	Mean	S.D.	"t" Value
<b>With Xylocaine</b>			
Observation 1 & 3			
1	82.08	8.92	0.892(NS)
3	82.32	7.52	
Observation 1 & 5			
1	82.08	8.92	0.703(NS)
5	82.22	7.78	
Observation 3 & 5			
3	82.32	7.52	0.671(NS)
5	82.22	7.78	



<b>With Cryotherapy</b>			
Observation 2&4			
2	82.20	8.91	0.742
4	82.14	7.53	(NS)
Observation 2&6			
2	82.20	8.91	0.443(NS)
6	82.26	7.77	
Observation 4&6			
4	82.14	7.53	0.604(NS)
6	82.26	7.77	

This table shows the comparison between the Diastolic blood pressure readings during cannulation after Xylocaine infiltration on various observations. The computed "t" values show no statistical significant difference in the blood pressure readings among various observations.

**Table 14:-** Comparison of Mean Pulse rates during Cannulation with Xylocaine infiltration and with Cryotherapy N =50

Day	Mean	S.D.	"t" Value
<b>With Xylocaine</b>			
Observation 1&3			
1	76.82	4.44	0.374(NS)
3	76.84	4.85	
Observation 1&5			
1	76.82	4.43	0.497(NS)
5	76.63	4.60	
Observation 3&5			
3	76.84	4.85	0.505(NS)
5	76.63	4.59	
<b>With Cryotherapy</b>			
Observation 2&4			
2	76.64	5.01	0.783(NS)
4	76.96	5.00	
Observation 2&6			
2	76.64	5.01	0.397(NS)
6	76.52	4.57	
Observation 4&6			
4	76.96	5.00	0.812(NS)
6	76.52	4.57	

This table shows the comparison between the pulse rates during cannulation after Xylocaine infiltration and with Cryotherapy on various observations. The computed "t" values show no statistical significant difference in the pulse rates among various observations.

**Table 15:-** Comparison of mean Respiratory rates during Cannulation after Xylocaine infiltration and after Cryotherapy.

Day	Mean	S.D.	"t" Value
<b>With Xylocaine</b>			
Observation 1&3			
1	20.48	1.37	0.098(NS)
3	20.52	1.42	
Observation 1&5			
1	20.48	1.37	0.438(NS)
5	20.76	1.56	
Observation 3&5			
3	20.52	1.42	0.208(NS)
5	20.76	1.56	
<b>With Cryotherapy</b>			
Observation 2&4			
2	20.28	1.47	0.431(NS)
4	20.56	1.69	
Observation 2&6			

2	20.28	1.47	0.096(NS)
6	20.32	1.54	
Observation4&6			
4	20.56	1.69	0.272(NS)
6	20.32	1.54	

This table shows the comparison between the respiratory rate during cannulation with Xylocaine infiltration and with Cryotherapy on various observations. The computed "t" values show no statistically significant difference in the respiratory rates among various observations

**Comparison of pain scores during AV fistula cannulation after Xylocaine and after Cryotherapy:**

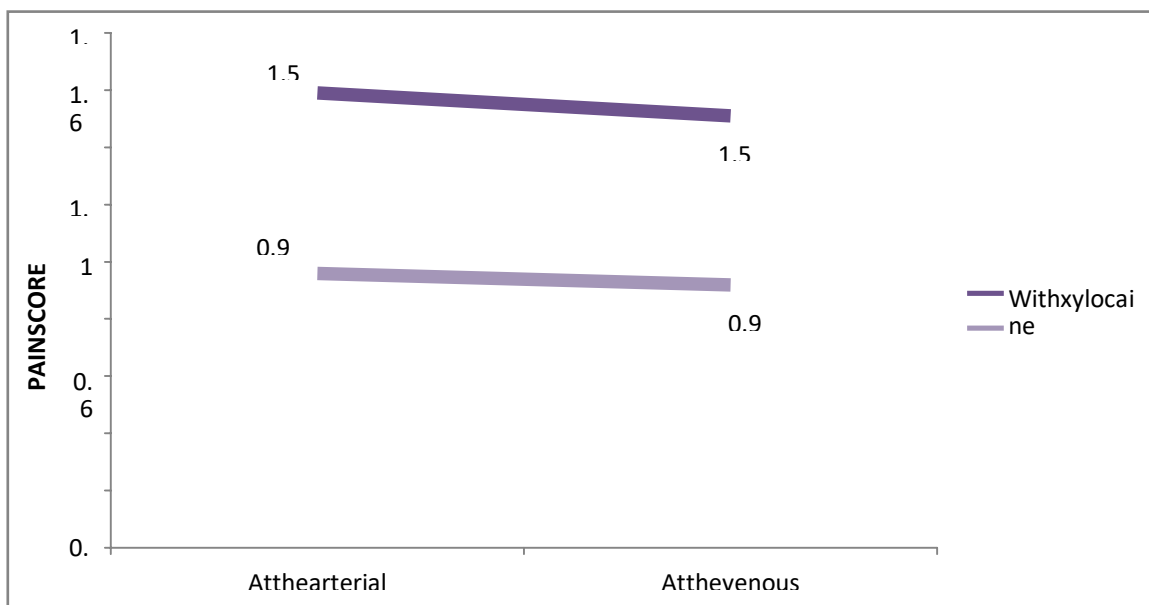
**Table 16:-**

Comparison of Mean Pain scores during AV fistula cannulation done with Xylocaine infiltration and done with Cryotherapy.

At the arterial site: -				
S.No.	Pain score	Mean	S.D.	"t" value
1.	With Xylocaine with Cryotherapy	1.59	0.546	11.885**
		0.96	0.345	
At the venous site: -				
2	With Xylocaine with Cryotherapy	1.51	0.540	11.273**
		0.92	0.338	

\*\*Significant at 0.01 level

The above table compares pain scores during cannulation after Xylocaine infiltration and after Cryotherapy application. The independent "t" computed and the values obtained were 11.885 and 11.273 for the arterial site pain scores and venous site correspondingly the values are more than the table value (2.390) at df 48 which is statistically highly significant. The values infer that Cryotherapy has an effect in reducing pain during AV fistula cannulation among Hemodialysis patients.



**Fig. 12:-** Comparison of Mean Pain scores during Cannulation done with Xylocaine infiltration and done with Cryotherapy.

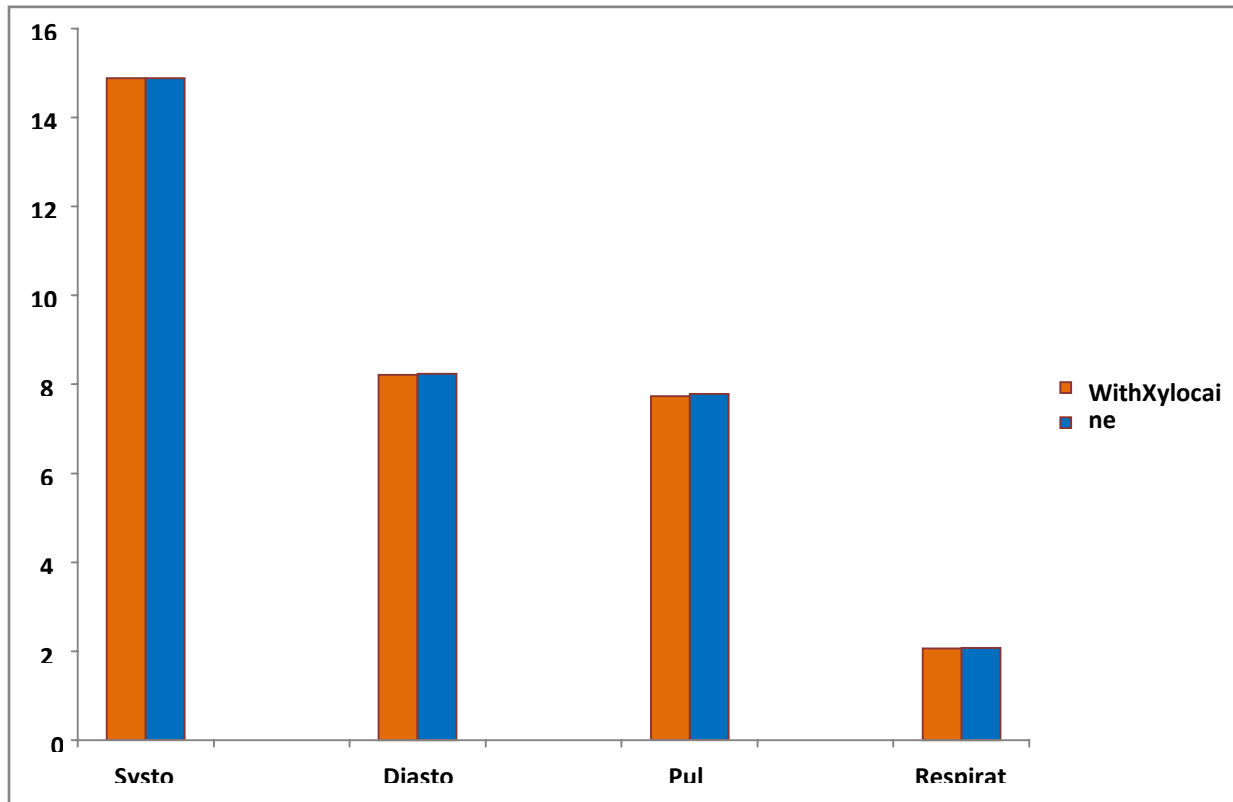
**SectionG**

ComparisonofBiophysiologicalparametersduringAVfistulacannulationdonewithXylocaineanddonewithCryotherapy:

**Table17:-**ComparisonofBiophysiologicalparametersduringcannulationdonewithXylocaineanddonewithCryotherapy.

S.No	Variables	Mean		S.D.		“t”value
		Xylocaine	Cryotherapy	Xylocaine	Cryotherapy	
1.	Systolic BloodPressure	148.80	148.98	20.59	20.59	0.905(NS)
2.	DiastolicBlood Pressure	82.21	82.47	8.07	8.16	0.987(NS)
3.	PulseRate	77.32	77.80	4.81	4.24	0.917(NS)
4.	RespiratoryRate	20.67	20.70	1.50	1.58	0.210(NS)

The given table explains the comparison between selected biophysiological parameters duringcannulation done with Xylocaine and done with Cryotherapy. The computed” t” values give aninference that there is no statistically significant difference among biophysiological parametersamong various observations during AV fistula cannulation done with Xylocaine infiltration andwith Cryotherapy which gives an inference that Cryotherapy has no effect on biophysiologicalparameters duringAVfistulacannulation.



**Fig. 13:-**ComparisonofBiophysiologicalparametersduringCannulationdonewithXylocaine anddonewithCryotherapy.

**SectionH**

Association of pain score with selected variables:

**Table18:-** Association between pain score and demographic variables.

S.No.	Demographic variables	N	Mean pain score	SD	F-value
1	Age(in years) a) 21-30	10	0.92	0.40	0.78
	b) 31-40	8	0.96	0.35	
	c) 41-50	18	0.94	0.37	
	d) 51-60	14	0.94	0.31	
	Total	50	0.94	0.36	
2	Gender				0.12
	a) Male	41	0.94	0.37	
	b) Female	9	0.95	0.35	
	Total	50	0.95	0.36	

The above table displays that F values computed to associate pain score with age and gender of the study samples. F values show that there is no significant association existing between pain score and these selected demographic variables

**Table19:-** Association between Pain score and Duration of illness in years.

S.No.	Clinical variable	N	Mean pain score	SD	F-value
1	Duration of illness in years				6.063*
	a) 1-3	12	1.10	0.35	
	b) 3-5	23	0.90	0.33	
	c) 5-7	15	0.82	0.27	
	Total	50	0.94	0.36	

\*Significant at 0.05 level

The above table displays the association between the pain score and clinical variables. The computed F value to associate pain score and duration of illness was 6.063 (Table value is 4.46 for 2 and 8 degrees of freedom) which is significant at 0.05 level. It gives an inference that there is significant association between the pain score of the subjects and duration of their illness.

**Table20:-** Post Hoc tests of association with Pain score and Duration of illness.

S.No.	Clinical Variable	Mean	SD
1	Duration of illness in years		
	a) 1-3	1.10	0.35
	b) 3-5	0.90	0.33
	c) 5-7	0.82	0.27

Post Hoc comparisons using the Turkey HSD test indicated that the pain score of 3-5 years (mean-0.90, SD-0.33) and the pain score of 1-3 years (mean-1.10, SD-0.35) were significantly different from the pain scores of 5-7 years (mean-0.82, SD-0.27). However, there was no significant difference existed between the pain score of 1-3 years and 3-5 years.

**Table21:-** Association between Pain score and Duration of Hemodialysis in years.

S.No.	Clinical variable	N	Mean pain score	SD	F-value
1	Duration on Hemodialysis in years				6.013*
	a) 1-3	9	1.06	0.34	
	b) 3-5	31	0.96	0.33	

	c)5-7	10	0.80	0.31	
	Total	50	0.94	0.36	

\*Significant at 0.05 level

The above table displays the association between the pain score and duration of hemodialysis in years. The computed F value to associate pain score and duration on Hemodialysis was 6.013 (Table value is 4.46 for 2 and 8 degrees of freedom) which is significant at 0.05 level. It indicates that there is significant association between the pain score of the subjects and their duration on Hemodialysis.

**Table 22:-** Post Hoc test of association with Pain score and Duration of Hemodialysis.

S.No.	Clinical Variable	Mean	SD
1	Duration on Hemodialysis in years		
	a) 1-3	1.06	0.34
	b) 3-5	0.96	0.33
	c) 5-7	0.80	0.31

Post Hoc comparisons using the Turkey HSD test indicated that the pain score of 3-5 years on hemodialysis (mean-0.96, SD-0.33) and the pain score of 1-3 years (mean-1.06, SD-0.34) were significantly different from the pain scores of 5-7 years (mean-0.80, SD-0.31). However, there was no significant difference existed between the pain score of 1-3 years and 3-5 years.

## Chapter V

### Discussion, Summary, Conclusion, Implication, Limitation And Recommendations:-

The present study was designed to assess the effect of cryotherapy on pain and biophysiological parameters during AV fistula cannulation among patients on maintenance hemodialysis at KMCH, Coimbatore. To evaluate the effect of cryotherapy on pain and selected biophysiological variables, the researcher carried out the study on 50 patients and adopted Repeated Measures Design.

The major results of the study are discussed according to the below objectives:

#### Discussion:-

##### The first objective was to assess the pain intensity during xylocaine infiltration

The hemodialysis unit has a routine to administer intradermal xylocaine injection to anesthetize the arterial and venous site prior to cannulation. Almost every patient complains of pain with xylocaine infiltration. So in this study, the investigator assessed the pain intensity of subjects with xylocaine infiltration by using Numerical Pain Rating Scale for three consecutive days of hemodialysis.

The mean pain scores of the subjects during xylocaine infiltration at arterial site and venous site on three alternative days of dialysis were 4.88, 4.78, 4.76 and 4.96, 4.88, 4.74 respectively. These findings of the study indicate that all the patients are suffering from moderate pain during the xylocaine infiltration.

The second objective was to determine the effect of cryotherapy on pain and biophysiological parameters during AV fistula cannulation

To determine the effect of cryotherapy on pain and biophysiological parameters, the investigator assessed the level of pain of the subjects with cannulation after xylocaine and after cryotherapy by using the same tool and both the values were compared. Blood pressure, pulse rate and respiratory rate were recorded under both situations and were compared.

The mean pain score of the subjects during cannulation after xylocaine injection at arterial site and venous site on the 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> days of dialysis were 1.62, 1.58, 1.56 and 1.54, 1.50, 1.48 respectively. The findings indicate that the patients suffer from mild pain during cannulation even after xylocaine is administered as local anaesthetic. The mean pain score of patients with cannulation after cryotherapy at arterial site were 0.96, 0.98 and 0.94 and at venous site were 0.92, 0.94 and 0.90 on the 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup> days of dialysis respectively. The findings of the study suggest that the patients suffer from mild pain during cannulation after cryotherapy but the pain intensity is lesser than the pain during cannulation after xylocaine infiltration.

The pain scores during cannulation with xylocaine and with cryotherapy were compared using independent "t" test. The "t" value of the comparison between the pain score at the arterial site with cannulation after xylocaine injection and with cannulation after cryotherapy was 11.885 indicated that the pain intensity with cryotherapy was very less. The "t" value of the comparison between the pain perception at the venous site with cannulation after xylocaine injection and with cannulation after cryotherapy was 11.273 indicated that the pain intensity with cryotherapy was less. The researcher therefore concluded that cryotherapy had an effect in reducing pain during AV fistula cannulation among the subjects. This proves that cryotherapy has an effect in reducing pain during AV fistula cannulation and xylocaine infiltration needle pricks (i.e. 2 pricks per each dialysis) and associated pain can be avoided.

The comparison between the selected biophysiological parameters with xylocaine and with cryotherapy was performed using independent "t" test. The mean systolic BP with xylocaine and with cryotherapy were 148.80 and 148.98 with standard deviations of 20.590 and 20.592 respectively. The calculated "t" value was 0.905 which gave an inference that there was no significant change in the systolic blood pressure between cannulation done with xylocaine and cryotherapy among the subjects. The mean score of diastolic BP with xylocaine and with cryotherapy were 82.21 and 82.47 with a Standard Deviation of 8.070 and 8.155 respectively. The calculated "t" value was 0.987 which indicated that there was no significant change in the diastolic blood pressure readings under both conditions. The mean pulse rates with xylocaine and with cryotherapy were 77.32 and 77.80 with standard deviations of 4.810 and 4.239 respectively. The calculated "t" value was 0.917 which showed that there was no significant change in the pulse rates under both conditions. The mean respiratory rates with xylocaine and with cryotherapy were 20.67 and 20.70 with standard deviations of 1.496 and 1.580 correspondingly. The computed "t" value was 0.210 which indicated that there is no significant change in the respiratory rates between AV fistula cannulation done with xylocaine and with cryotherapy. The overall inference is that cryotherapy has no effect on biophysiological parameters such as blood pressure, pulse rate and respiratory rate among the subjects. These findings of the study portray that cryotherapy as a cutaneous stimulation among hemodialysis patients during AV fistula cannulation has no effect on biophysiological parameters.

The results of the present study are in contradictory to the findings of the study conducted by Park (1994). In that study, Cardiopulmonary signs of arteriovenous fistula puncture pain in experimental period was found to be higher than in control period (pulse paired  $t = -0.8$ ,  $p = 0.42$ ; systolic BP paired  $t = 0.98$ ,  $p = 0.33$ ; diastolic BP paired  $t = 0.43$ ,  $p = 0.66$ ).

### **The third objective was to associate the level of pain with selected demographic variables**

One way ANOVA was used to associate the pain score with age of the subjects and gender differences. The results showed that pain was neither associated with age nor with gender of the subjects. Therefore, it is concluded that baseline factors are independent of their pain score with regard to their demographic variables.

A study conducted by Kelly to determine the minimum clinically significant difference in visual analogue scale (VAS) pain scores for acute pain in the emergency department setting and to determine whether this difference varies with demographic profile and pain intensity. Results of their study showed that there was no statistically significant difference between the minimum clinically significant differences in VAS pain scores based on gender ( $p = 0.172$ ), age ( $p = 0.782$ ), or cause of pain ( $p = 0.84$ ). The study supports the findings of the present study indicating that baseline factors are independent of their pain score with regard to their demographic profile.

One way ANOVA was used to associate the pain score with duration of illness and duration of treatment. The obtained F values were 6.063 and 6.013 which showed that there was significant association (at 0.05 level) between the pain score and the clinical profile of the subjects such as duration of illness and duration of treatment. The pain was found to be reduced with the increase in duration of illness and treatment.

The findings of this study proves that there exists no significant association between the pain score and the selected demographic variables such as age and gender of the patients whereas there exists a significant association between association between the pain score and the selected clinical variables such as duration of illness and duration of non-hemodialysis.

### **Summary**

The study was conducted to assess the effect of cryotherapy on pain and biophysiological parameters during AV fistula cannulation among patients on hemodialysis at KMCH, Coimbatore.

The study tested and proved the hypothesis that there will be significant difference between subjects in the level of pain during AV Fistula cannulation who receive cryotherapy and those who are on xylocaine.

The study tested and rejected the hypothesis that there will be significant difference between subjects in biophysiological parameters during AV Fistula cannulation who receive cryotherapy and those who are on xylocaine.

The tools used by the investigator for data collection consisted of 3 sections as follows: Section-1 Demographic and clinical profile of the subjects

Section-2 Record of blood pressure, pulse rate and respiratory rate Section-3 Numerical Pain Rating Scale

The data were collected for a period of 6 weeks. Both xylocaine infiltration and cryotherapy application were used in same subject as the investigator adopted repeated measures design. Based on the objectives and hypotheses, data were analyzed using both descriptive and inferential statistics.

### **Major findings of the study:-**

1. The mean pain score with xylocaine infiltration at arterial site was 4.81 and at the venous site was 4.86.
2. There was a significant reduction in the pain score during cannulation after the application of cryotherapy when compared to the pain score during cannulation after xylocaine infiltration. The mean pain score during cannulation after xylocaine infiltration at the arterial site was 1.59 and at the venous site was 1.51 whereas the pain score after cryotherapy was 0.96 and 0.92 respectively. The "t" values of the comparison between these scores were 11.885 and 11.273 which showed significance at 0.05 level
3. There was no statistically significant difference in the values of biophysiological parameters among xylocaine and cryotherapy application.
4. There was no significant association between pain score and demographic variables such as age and gender.
5. There was significant association between pain score and duration of illness and duration of treatment. The values showed that the patients had reduced pain intensity with increase in duration of illness and duration of treatment.

### **Conclusion:-**

Healthcare professionals have a duty to provide compassionate care to all patients (Zempsky et al 2004). Effort should be made to assess and manage acute pain, as by doing so; nurses can reduce pain, increase patient comfort and satisfaction, and improve patient outcomes. The investigator was very keen to find an alternative pain management strategy among hemodialysis patients to aid them in reducing the pain intensity during AV fistula cannulation.

### **The conclusion of the study was drawn as follows:**

The study findings revealed the effect of cryotherapy as superior to the xylocaine infiltration in reducing pain intensity during AV fistula cannulation

This study also revealed there is no variation in blood pressure, pulse rate and respiratory rate between cannulation done with xylocaine infiltration and with cryotherapy. These study findings agree with various other studies conducted in same field.

### **Implications**

Nurses can incorporate cryotherapy during painful procedures to reduce the patient's pain intensity. Pain associated with cannulation is a common complaint in hospitals. Present study findings have several implications in nursing practice, nursing education, nursing research and nursing administration.

### **Nursing practice**

Nursing practice has a direct and significant impact on human health. Providing optimal patient care is one of the vital functions of the nurse. The study reveals that cryotherapy application is effective in reducing pain intensity during AV fistula cannulation among hemodialysis patients. In order to promote the comfort of the patients, it is imperative that the nurses in hemodialysis unit to follow this technique before AV fistula cannulation rather than anesthetizing the area with xylocaine as it itself gives patients moderate pain due to infiltration. The study serves as an eye opener among nurses and other health care professionals to recognize the benefits of alternative pain management techniques such as cryotherapy.

**Nursing education**

Nursing education is to prepare nurses with the potential for imparting nursing care most effectively. The nurse educator can include alternative pain management techniques such as cryotherapy in in-service education which can be adopted by the students and the nursing personnel as an independent nursing intervention in their day-to-day clinical practice to promote the comfort of the patients and thereby to avoid the ill effects of the pharmacological agents. By inculcating knowledge and by demonstrating how to deliver it through staff development activities, their knowledge can be updated on the importance of alternative pain management strategies. The nurse educator can create awareness about the use of alternative pain management strategies among other healthcare professionals too.

**Nursing research**

Re-thinking and re-evaluation of the previous nursing art procedures and knowledge should be done, to keep the knowledge up to date. The main goal of nursing research should be to improve patient care ultimately. Since the healthcare system today is driven by cost, research about outcomes related to cost is especially important. Today's healthcare environment continually places increasing demands on nurses to communicate, share and synthesize information and to implement patient care based on scientific evidence. Appropriate utilization of research helps nurses to make decisions based on evidence for patient care. The finding of the present study can be a foundation to conduct a study on large population to prove the effect of cryotherapy strongly on reducing the pain during AV fistula cannulation. The study can be replicated in dialysis centers where no local anesthesia is used to find out the exact effect of cryotherapy to promote the patient's comfort and compliance toward hemodialysis. The implication of the study can be used as a motivation for nurses to conduct research in future on alternative methods of pain management. The study can be conducted to check the effect of cryotherapy among various other procedural pain controls.

**Nursing administration**

Prevention of pain provides more effective pain relief than treatment of established pain. Written guidelines should be provided to standardize and improve documentation related to pain assessment, necessary modification in pain relief strategies and presence of any side effects. Pain scores should be documented in writing, just like vital signs, making them readily available to all members of the healthcare team. Nurse as an administrator has a role in planning the policies for imparting healthcare services to the target population. Nursing administrator can formulate the protocol to practice cryotherapy among hemodialysis patients during cannulation. In-service education can be scheduled to disseminate the research findings among nursing staff and other healthcare professionals.

**Limitations Of The Study**

1. The study sample size was small.
2. The study included patients who were on hemodialysis at least 3 times a week

**Recommendations:-**

1. A similar study can be conducted with a large sample size
2. The study can be replicated by using other research designs
3. A study can be carried out in centers where there is no xylocaine infiltration prior to AV fistula cannulation
4. A study can be performed with combination of other alternative pain management strategies in controlling procedural pain
5. A comparative study between cryotherapy and other non-pharmacological methods in reducing procedural pain can be conducted
6. A study to assess the knowledge and attitude among nurses on complementary and alternative therapies in managing procedural pain can be carried out.

**References:-**

1. Anna, L.C., Gutch, C.F., & Stoner, H.M. (1999). Review of Hemodialysis for Nurses and Dialysis Personnel. (6<sup>th</sup> Edn). Philadelphia: Mosby Publications
2. Aronoff, G., Burns, J., Brier, M., Morrison, G., Singer, I., Bennett, W. et al (1999) Drug prescribing in renal failure: dosing guidelines for adults. (4<sup>th</sup> edn). Philadelphia: American College of Physicians
3. Black, J. M., & Jacobs, E.M. (1997). Medical and surgical nursing: clinical Management of continuity of care. (5<sup>th</sup> Edn). Philadelphia: W.B. Saunders Company.
4. Brenner, M.B. (1996). The Kidney. (5<sup>th</sup> Edn). Philadelphia: W.B. Saunders Company
5. Burns, N. & Groves, S.K. (1999). Understanding nursing research. (2<sup>nd</sup> Edn). Philadelphia: W.B. Saunders Company.



6. Christensen, K. (2003). *Fundamentals of Nursing*. (4<sup>th</sup> Edn). Philadelphia: Mosby Publications
  7. Davison, M.A., Cameron, S.J., Grunfeld, J.P., Kerr, S.N., Ritz, E. & Winearls, G.C. (1998). *Oxford Textbook of Clinical Nephrology*. (2<sup>nd</sup> Edn). Vol 1. New York: Oxford University Press
  8. Grunfeld, J.P., Bach, F.J., Kreis, H. & Maxwell, H.M. (1995). *Advances in nephrology*. 1<sup>st</sup> edn. Missouri: Mosby
  9. Gupta, S.C. & Kapoor, V.K. *Fundamentals of mathematical statistics*. (8<sup>th</sup> Edn) New Delhi: Sulthan Chand Publications
  10. Helen, H. (2000) *Fundamentals of Nursing – Caring and Clinical Judgement*. (1<sup>st</sup> Ed.). Philadelphia: W.B. Saunders Company
  11. Henrich, L.W. (1994). *Principles and Practice of dialysis*. (2<sup>nd</sup> edn) Pennsylvania: Williams & Wilkins
  12. Jacqueline, F. (1995). *Analysis and Evaluation of Conceptual models of Nursing*. (3<sup>rd</sup> Edn) Philadelphia: F.A. Davis Company
  13. Karen, J.B. & Marilyn, B.W. (1999). *Fundamentals of Nursing: Collaborating for Optimal health*, 3<sup>rd</sup> Vol. (2<sup>nd</sup> Edn). Stanford: Appleton publications.
  14. Lewis, S.M., Heitkemper, M.M., & Dirkse, S.R. (2000) *Medical and surgical nursing: Assessment and management of clinical problems* (5<sup>th</sup> Edn) London: Mosby.
  15. Massry, G.S. (1995). *Textbook of Nephrology*. (3<sup>rd</sup> Edn). Maryland: Williams & Wilkins
  16. Mautha, R.A., Ann, M., & Tumey. (1897), 'Nursing Theory Utilization & Application' (1<sup>st</sup> ed.) St Louis: Mosby.
  17. Morris, J.P. (1994). *Kidney transplantation*. (4<sup>th</sup> Edn) Philadelphia: W.B. Saunders Company
  18. Munro, B.H. (1999). *Nursing Research: Principles and methods* (6<sup>th</sup> ed.) Philadelphia: Lippincott.
  19. Polit, D.F., & Hungler, B.P. (1999). *Nursing Research: Principles and methods* (6<sup>th</sup> Edn). Philadelphia: Lippincott.
  20. Potter, A.P. & Perry, A.G. (1997). *Fundamentals of nursing* (4<sup>th</sup> Edn). Philadelphia: Lippincott.
  21. Retik, A.B., Vaughan, E.D., Wein, J.A., Kovoussi, R.L., Novick, C.A. & Partin, W.A. (2002). *Campbell's urology* (8<sup>th</sup> Edn). Pennsylvania: Saunders Company
  22. Schrier, W.R. & Gottschalk, W.C. (1997). *Diseases of the Kidney*. (6<sup>th</sup> Edn). Boston: Little Brown and Company.
  23. Sunder, R., & Richard, J. (1996) *An Introduction to Biostatistics: A manual for students in Health Science*. (3<sup>rd</sup> Edn) Chennai: Prentice Hall Publications
  24. Smeltzer, S.C, Bare, B, G., (1996). *Brunner and Suddarth's Text Book of Medical and surgical nursing* (8<sup>th</sup> ed.). Philadelphia: Lippincott
  25. Tomey, A.M., Alligood, R.M. (2000). *Nursing Theories and their work* (6<sup>th</sup> Edn) St. Louis: Mosby.
  26. Wilson, H.S. (1993). *Introduction Nursing Research*. (2<sup>nd</sup> Edn). California: Addison-Wesley Nursing.
- A. JOURNALS**
27. Barber, J. & Mayer, D. Evaluation of the efficacy and neural mechanism of a hypnotic analgesic procedure in experimental and clinical dental pain. *Pain*. 4(1):41-8, 197
  28. Bastian, H., Soholm, B., Marker, P., & Eckerdal, A. Comparative study of pain control by cryotherapy of exposed bone following extraction of wisdom teeth. *Journal of Oral Science*. 40(3):109-13, 1998
  29. Chertow, G.M., Burdick, E., Honour, M., Bonventre, J.V. & Bates, D.W. (2005). Acute kidney injury, mortality, length of stay, and costs in hospitalized patients. *J Am Soc Nephrol*. 16(11):3365-3370.
  30. Charra, B., Calzavara, E., Ruffet, M., et al. (1992). Survival as an index of adequacy of dialysis. *Kidney International*. 41, 1286
  31. Elseviers, M.M., Bosteels, V., Cambier, P., et al. (1992). Diagnostic criteria of analgesic nephropathy in patients with ESRD: results of a Belgian study. *Nephrology, Dialysis, Transplant*. 7, 479
  32. Ferrell, B.R., Wisdom, C., Rhiner, M., & Alletto, J. (1998). Pain management as a quality-of-care outcome. *Journal of Quality Assurance*, 5(2), 50-58
  33. Filho, J.R., Silva, E.D., Camargo, I.B., & Gouveia, F.M. (2005). The influence of cryotherapy on reduction of swelling, pain and trismus after third molar extraction: a preliminary study. *The Journal of the American Dental Association*, 136, 774-778.
  34. Hsieh, L. L., Kuo, C.H., Lee, C.H., Yen, A.M., Chien, K.L. & Chen, T.H. (2006). Treatment of low back pain with acupuncture and physical therapy. *British Journal of medicine*, 25, 332(7543), 696-700
  35. Johnson, J.P., McCauley, C.R., & Copley, J.B. (2000). Compliance in Hemodialysis patients. *Kidney International*, 22, 286-91

36. Kaveh, H. & Kurtner, P. S. (2001). Assessing patient outcomes on Maintenance Hemodialysis. *American Journal of Kidney Diseases*, 25, 88-91
37. McCaffery, M., & Ferrell, B.R. (1997). Influence of professional vs. personal role on pain assessment and use of opioids. *Journal of Continuing Education in Nursing*. 28(2), 69-77
38. Nash, R., Edwards, H., & Nebauer, M. (1993). Effect of attitudes, subjective norms and perceived control on nurses' intention to assess patients' pain. *Journal of Advanced Nursing*. 18(6), 941-947.
39. Padilla, G.V., Ferrell, B., Grant, M.M., & Rhiner, M. (1990). Defining the content domain of quality of life for cancer patients with pain. *Cancer Nursing*. 13(2), 108
40. Palder, S.B., Kirkman, R.L., Wittermore, A.D., et al. (1985). Vascular access for hemodialysis: patency rates and result of revision. *Annals of Surgery*. 202: 235
41. Parkerson, L.M. (2000). Concerns of clients in Renal Setting. *Journal Of Advanced Nursing*, 52(1), 104-12
42. Rehm, M. (2003) Pain in end stage renal disease. *Nephrology Nursing Journal: Journal of the American Nephrology Nurses' Association*. 30, 340-341.
43. Seiki, Y. (2002). Effect of local application of cold or hot for relief of pricking pain. *Nurse health Science*. 3(1), 497-507
44. Winsett, O.E., Wolma, E.J. (1985). Complications of Vascular access for hemodialysis. *South Medicine Journal*. 78, 513
45. Yates, P., Dewar, A. & Edwards, H. (1998). The prevalence and perception of pain among hospital in-patients. *Journal of Clinical Nursing*. 7, 521-530
- B. ONLINE ABSTRACTS**
46. Algaflly, A.A. & George, K.P. (2007). The effect of cryotherapy on Nerve Conduction velocity, pain threshold and pain tolerance. *Br J Sports Med* J. 40 (6). Retrieved from <http://www.bjsportmed.com>
47. Ball, L.K. (2005). Improving AV fistula cannulation skills. *Nephrology journal*. Retrieved from <http://www.findarticles.com>
48. Ball, L.K. (2006). The button hole technique for Arteriovenous cannulation. *Nephrology Nursing Journal*. 33(3). Retrieved from <http://www.google.com>
49. Barber, F.A., Mc Guire, D.A. & Click, S. (1998). Continuous-flow cold therapy for outpatients with Anterior Cruciate Ligament reconstruction. *Arthroscopy: The journal of Arthroscopic and related surgery*. 14(2). Retrieved from <http://www.arthroscopyjournal.org>
50. Barnason, S., Merboth, M., Pozehl, B., & Tietjen, M.J. Utilizing an outcomes approach to improve pain management by nurses: a pilot study. *Clinical Nurse*. Retrieved from <http://www.onlinelibrary.wiley.com>
51. Bleakley, C.M., Connor, S., Tully, M.A., Rocke, L.G., MacAuley, D.C. and McDonough, S.M. (2007). The PRICE study (Protection Rest Ice Compression Elevation): design of a randomised controlled trial comparing standard versus cryokinetic ice application in the management of acute ankle sprain. December, 8(125). Retrieved from <http://www.biomedcentral.com>
52. Borisut, S. (2006). Effect of stimulation sites of TENS on pressure pain threshold in asymptomatic females. Mahidol university. ISBN 974-04-7054-8, 1-89. Retrieved from <http://www.google.com>
53. Bossart, P., Fosnocht, D. & Swanson, E. (2004) Changes in heart rate do not correlate with changes in pain intensity in emergency department patients. Retrieved from <http://www.jemermed.com>
54. Brown, T.S., Douglas, C., & Flood, L.P. (2007). Women's evaluation of Intrapartum non pharmacological pain relief methods used during labour. Retrieved from <http://www.medline.com>
55. Caraceni, A. et al. (2002). Pain measurement tools and methods in clinical research in palliative care: recommendations of an expert working group of the European association of palliative care. Retrieved from <http://www.ncbi.nlm.nih.gov>
56. Carlson, R.C., Reid, I.K., Curran, L.S., Studts, J., Okeson, P.J. et al. (1998). Psychological and physiological parameters of masticatory muscle pain. Retrieved from <http://www.sciencedirect.com>
57. Davison, N.S. (2003). Chronic pain in End Stage Renal Disease. *Advances in Chronic Kidney Disease: a journal of National Kidney Foundation*
58. Edwards, E.H., Nash, E.R., Yates, P.M., Walsh, A.M., Fentiman, B.J., McDowel, J.K., Skerman, H.M. & Najman, J.M. (2001). Improving pain management by nurses: a pilot peer intervention program. 3(1), 45-55. Retrieved from <http://www.google.com>
59. Ernst, E. & Failaka, V. (2004) Ice freeze pain? A review of the clinical effectiveness of analgesic cold therapy. Retrieved from <http://www.sciencedirect.com>
60. Figueiredo, A.E., Viegas, A., Monteiro, M., Figueiredo, P. (2008). Research

- intopainperceptionwitharteriovenousfistulacannulation.Journalofrenalcare.34(4):169-172.Retrievedfrom<http://www.onlinelibrary.wiley.com>
61. George, Z. S., Wittmer, V.T., Fillingim, R.B. & Robinson, M.E. (2006). Sex andpain-Related psychological variables are associated with thermal painsensitivityfor patientswithchroniclowback pain.Retrievedfrom<http://www.jpain.org>
62. Hubbard, T. J. Aronson, S. L. &Denegar, C.R. (2004). Does cryotherapy hastenreturntoparticipation?Asystematicreview.Retrievedfrom<http://www.ncbi.nlm.nih.gov>.
63. Johnson, E.N. (2004). The effects of three different Ice bath immersion times onnumbness, surface temperature and perceivedpain. December, 1-110 BrighamYounguniversity.Retrievedfrom<http://www.google.com>
64. Kawakita, K., Shinbara, S., Imai, K., Fakuda, F., Yano, T.&Kuriama, K. (2006).How do acupuncture and Moxibustion act? Focusing on the progress on Japaneseacupunctureresearch.JournalOfPharmacologicalSciences.100,443-459.Retrievedfrom<http://www.google.com>
65. Kevan, R.P., McDonald, P.S., Atkins, C.R.& Kerr, G.P. (2003) Epidemiology of vascularaccess in the Australian HD population. Kidney International.64, 1893-1902. Retrievedfrom<http://www.nature.com>
66. Lacson, E., Wang, W, Lazerus, M. J. & Hakin, M.R. (2009). Change in vascularaccess andmortality inmaintenance HD patients. American Journal of KidneyDiseases.Retrievedfrom<http://www.ajkd.org>
67. Martinez,A.D. (2004).Cryotherapy:areviewof literature.Parker College ofChiropracticResearchInstitute.Retrievedfrom<http://www.chiroaccess.com>
68. Mc Donough,Mac Auley,S.M.,Bleakley,C.M.(2006).Cryotherapy foracuteankle sprains: a randomized control study of 2differenticing protocols. Br. J.SportsMed.40(8),Retrievedfrom<http://www.ncbi.nlm.nih.gov>
69. Melzack, R. & Wall, D.P. (1965). PainMechanisms: a new theory. Retrieved from<http://www.sciencemag.org>
70. Morsi,E. (2002).Continous-flowcoldtherapyafterTKA.Thejournalofarthroplasty.17(6).Retrievedfrom<http://www.arthroplasty.org>
71. Nicholson,A.C.,Herr,K.A.&Mobily,P.R.(1994)Validationofcutaneousstimulation interventions for pain management. Intl J. Nurs. Stud. 31(6). Retrievedfrom<http://www.ncbi.nlm.nih.gov>
72. Ownby, K.K. (2006). Effects of ice massage on neuropathic pain in persons withAIDS. Journal of the Association of Nurses in AIDS care. 17 (5). Retrieved from<http://www.nursesinaidscajournal.org>
73. Park, J.S. (1994) The effect of cutaneous stimulation on AV fistula cannulation onhemodialysispatients.Retrievedfrom<http://www.ncbi.nlm.nih.gov>
74. Pillay, R. (2007) A conceptual framework for the strategic analysis and managementof the brain drain of theAfrican health care professionals.African journal ofBusinessManagement.26-37.Retrievedfrom <http://www.google.com>
75. Quoba, O., Huntley, J.S., Bahia, H. & McKeweon, D.W. (2005). A user's guideforreducingthepainoflocalanaestheticadministration.EmergencyMedicalJournal.22,188-189.Retrievedfrom<http://www.medline.com>
76. Ravani, P., Parfey, P., Mc Rae, J., James, M., Quin, R. & et al (2009). Modelling survival of AV access for HD- semiparametric Vs parametric methods. Retrievedfrom<http://www.asnjournals.org>
77. Rodrigues,L.J.,Silva,O.D.,Camarago,B.I.&Gouveia,M.V.(2005).J.Am. Dent.Ass.136(6).Retrievedfrom<http://www.adajournal.com>
78. Sabitha, P.B., Khakha, D.C., Mahajan, S., Gupta, S., Agarwal, M., Yadav, S.L.(2008). Effectof cryotherapy on arteriovenous fistula puncture- related pain inhemodialysispatients.Indian JournalOfNephrology.18(4),155-158.Retrievedfrom<http://www.indianjnephrol.org>
79. Sakuja,V.,Jha,V.&Ghosh,A.K.(1994). ChronicRenalFailureinIndia.NephrologyDialysisTransplant,8.684-689.Retrievedfrom<http://www.pubmed.com>
80. Santuzzi, C.H, Gonçalves, W.L, Rocha, S.S,Castro, M.E., Gouveia, S.E. Abreu, G.R.(2008). Effects of cryotherapy,transcutaneous electrical stimulation andtheircombinationonfemoralnerveelectricalactivityinrats. December12(6),441-6. Retrievedfrom<http://www.google.com>
81. Saran, R., Pisoni, L.R. & Young, E.W. (2005). Timing of first cannulation of AVfistula:arewewaitingtoolong?Retrievedfrom<http://www.oxfordjournals.com>
82. Sareeso, P. (2009) Pain and pain management strategies in patients with brachialplexus injury post re-constructive surgery. Copy right by Manihol University.Retrievedfrom<http://www.google.com>
83. Tanaka, H.T. &Nishijo, K. (2001). Electrophysiological study of

acupuncturestimulationsynchronizedwithpatient'srespiratoryrhythm.Retrievedfrom<http://www.acupuncture-treatment.com>

84. Terrill, B. (2002). Renal Nursing- a practical approach. AusMed, Melbourne.Retrievedfrom<http://www.ausmed.co.au>

85. Terroba, A.L., Morales, M.A., Fernandez, C.P., Rodriguez, L.D. & Cleland, J.A.(2010)EffectsofIceMassageonPressurePainThresholdsandElectromyography Activity Postexercise: A Randomized Controlled CrossoverStudy. National university of Health Sciences.33 (3),212- 219. Retrieved from<http://www.jmpt.com>

86. Williams, A. & Manias, E. (2004). Pain assessment and management in patientswithChronic renalfailure.Retrievedfrom<http://www.medline.com>

#### C. UNPUBLISHEDTHESIS

87. Anbuselvi, K. (2009). Effectiveness of ice application on pain perception duringfirststageoflabouramongparturientmothersatselectedmaternitycenters,Coimbatore.UnpublishedM.Sc.,Nursingdissertation,KMCHCollegeofNursing,Coimbatore.TheTaminaduDr.M.G.R.MedicalUniversity

88. Kuzhanthai, P.(2004).EffectofcryotherapyonpostoperativepainamongpatientswithfractureatKMCH,Coimbatore.UnpublishedM.Sc.,Nursingdissertation, KMCH College of Nursing, Coimbatore. The Taminadu Dr. M.G.R.MedicalUniversity.

89. Lydia, G. (2008). A study to assess the effect of manually versus mechanicallydelivered preoxygenation before and after endotracheal suctioning on selectedphysiologicalparametersamongwhohadundergoneCABGatKMCH,Coimbatore.UnpublishedM.Sc.,Nursingdissertation,KMCHCollegeofNursing,Coimbatore.TheTaminaduDr.M.G.R.MedicalUniversity

90. Nash, R., Najman, J., Yates, P. Edwards, H., Fentiman, B., Dewar, A.,etalEducatingnursesandpatientsforeffectiveusageofanalgesicmedications.Brisbane:SchoolofNursing,QueenslandUniversityofTechnology,19-54

#### D. WEBSITES

91. [www.amjsportsmed.com](http://www.amjsportsmed.com)

92. [www.bmj.com](http://www.bmj.com)

93. [www.jada.ada.com](http://www.jada.ada.com)

94. [www.ndauk.org](http://www.ndauk.org)

95. [www.ondix.com](http://www.ondix.com)

96. [www.warriorpages.com](http://www.warriorpages.com).