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Cryotherapy as Comfort Measure for Magnesium Sulfate Administration

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ABSTRACT

Preeclampsia is a disorder when hypertension arises in pregnancy, endangering the life of both the mother and the baby. With no proper management, it may progress to eclampsia where life-threatening seizures and organ failure may occur. As a preventive measure, preeclamptic women are given magnesium sulfate as muscle

relaxant. This study determined the effectiveness of cryotherapy in pain reduction for patients receiving intramuscular magnesium sulfate. There were 30 preeclamptic women in VSMMC given magnesium sulfate. One group pre-test post-test only design was used in the study. Pain score of those without ice pack application was taken to find which of factors is or are responsible for the change in pain levels during the course of the observations. Results show that cryotherapy is an effective intervention in decreasing pain during the intramuscular magnesium sulfate administration.

Keywords - Cryotheraphy, magneksium sulfate, experimental design, Philippines.

INTRODUCTION

Preeclampsia is a disorder where hypertension arises in pregnancy that can endanger the life of the mother and the baby. The global incidence of preeclampsia has been estimated at 5-14% of all pregnancies. In developing countries, hypertensive disorders were the second most common obstetrical cause of stillbirths and early neonatal deaths, accounting for 23.6% (Semenovskaya, 2010). In severe preeclampsia, blood pressures rise higher than 160 mmHg systole and 110 mmHg diastole, accompanied by proteinuria and edema. With no proper management, the disease may progress and seizures and total organ failure may occur that are very life-threatening. Such is referred to as eclampsia. As preventive measure against the development of seizures, preeclampsia women are given magnesium sulfate.

Magnesium sulfate is the drug of choice for preventing and treating seizures in postpartum clients who have severe preeclampsia. Magnesium sulfate is administered by the intravenous or intramuscular routes as electrolyte replenisher, anticonvulsant, and muscle relaxant (Greene, 2003).

As observed by the researchers, almost all of the patients receiving magnesium sulfate in Ward I (Obstetrics Ward) of Vicente Sotto Memorial Medical Center in Cebu City, Philippines complained of pain especially after their first intramuscular medication. Pain is experienced because an intramuscular injection itself is an invasive procedure, in that the body's natural barrier of skin is penetrated. When a new muscular site is invaded and a volume of substance is injected therein, there is often some soreness associated with such an injection. The muscle group is not used to containing an additional volume of a substance, thus pain can result. As nursing students, the researchers, during their related learning experience, were instructed by the nurse-on-duty to place ice packs on the injection site (gluteal muscle) before and after every magnesium sulfate administration. Such instance motivated the conduct

of this study that primarily determined the effectiveness of cryotherapy as comfort measure during the pain brought about by intramuscular injection of magnesium sulfate.

FRAMEWORK

This study is anchored on the Gate Control Theory introduced by psychologist Ronald Melzack and anatomist Patrick Wall (1978). They suggested that there is a "gating system" in the central nervous system that opens and closes to let pain messages through to the brain or to block them. According to the gate control theory of pain, a person's thoughts, beliefs, and emotions may affect how much pain he/she feels from a given physical sensation. The fundamental basis for this theory is the belief that psychological as well as physical factors guide the brain's interpretation of painful sensations and the subsequent response. One factor is counter-stimulation in which ice pack application is used (Holisticonline.com, 2007).

Ice pack application diverts pain perception on the response to cold stimulation. Sensory messages travel from stimulated nerves to the spinal cord, the body's pain highway. There, they are reprocessed and sent through open gates to the thalamus, the brain's depot for tactile information. Once the nerve signal reaches the brain, the sensory information is processed in the context of the individual's current mood, which influences the perception and experience of pain and guides the individual's response (Holisticonline.com, 2007).

Magnesium sulfate is an anticonvulsant drug administered to pre-eclamptic patients to prevent seizures and is usually given via intravenous (IV) or intramuscular injections (Euser and Cipolla, 2009).

In an article in muscletalk.co.uk (July, 2008) titled "A Guide to Post-Injection Muscular Pain", the main causes of localized muscular pain, tenderness and soreness that are experienced as a result of intramuscular (IM) injections were discussed. There is pain due to route of administration, mainly the invasiveness of injection wherein the body's natural barrier of skin is being penetrated by a sharp needle and any further cellular content along the needle's path is being sheared. This in itself, although relatively invasive, can cause some pain. This pain tends to be initial, however due to the design of sterile needles for injection, the curved nature of the needle point allows for minimal pain, and thus this is not a common cause of post-injection pain. Physical location of injection can also be considered a factor in the resulting discomfort after administration. The volume of injection will also make a significant difference to any soreness and pain experienced. Generally larger volumes are better tolerated in larger muscle groups (gluteus, quadriceps, etc), with smaller

muscle groups (biceps, triceps, etc) fair better with smaller volumes (<2ml). As the volume injected is increased, the amount of substance normally presents within the muscle is increased, risking an inflammatory response and soreness.

Magnesium sulfate intramuscular injections have been reported as painful by patients undergoing the said therapy. Measures to alleviate the discomfort caused by the administration of this drug are continuously being identified, one of which is cryotherapy.

Ice pack use (cryotherapy) has been widely acknowledged in the medical field. It is currently prescribed in various therapies and results have shown that it is beneficial to the clients. To further improve and expand its application in medicine, several researches have been conducted.

In one related study, Martinez (2008) research scientist of Parker College of Chiropractic Research Institute, wrote that cold application (cryotherapy) is the simplest and most commonly used method for treatment of acute musculoskeletal injury. Among chiropractic practitioners, it is the most often utilized (94.5%)passive adjunctive therapy.

The physiological eects of cold have been well documented. Studies have shown that cold applications can reduce the metabolic rate of a tissue, decrease pain and swelling, and reduce muscle spasm.Most health care practitioners are taught to use ice therapy for treatment of bruises, strains, sprains, or muscle tears. Most are familiar with the "rest, ice, compression, and elevation" (RICE) principle following acute soft tissue injury, yet there is little agreement in the literature on the optimum application technique for such care (Zeigler, 2010).

Hubbard and Denegar (2004) also showed that cryotherapy seems to be effective in decreasing pain. "The exact effect of cryotherapy on more frequently treated acute injuries (eg, muscle strains and contusions) has not been fully elucidated. Additionally, the low methodologic quality of the available evidence is of concern. Many more high-quality studies are required to create evidence-based guidelines on the use of cryotherapy. These must focus on developing modes, durations, and frequencies of ice application that will optimize outcomes after injury."

According to Taylor (2002) in her article IceTherapy (Cryotherapy), cryotherapy has historically been used to provide pain relief, reduce fever, slow the damage of thermal burns, control bleeding, and prevent or reduce edema caused by soft tissue trauma.

Kalyani Premkumar (2004), quoting Yurtkuran M. Kocagil, wrote that "ice massage or immersion, applied using specific techniques, is especially helpful in pain relief and, thereby, in the introduction of early mobilization exercises. Thus, Premkumar concluded that massage prior to mobilization is very useful. In

addition, Waldman (2009) explained that injection of contrast dye with or without steroid should be discontinued if the patient complains of any significant pain on injection. Transient mild pressure paresthesia is often noted. Waldman showed that there is a way to prevent such occurrence. He added that after the needle is removed, the ice pack should be placed on the injection site to decrease postblock bleeding and pain.

Independent nursing actions fall within the scope of nursing practice and include controlling the environment, giving emotional support, and providing comfort. Comfort measures include applications of cold as an effective pain-relieving measure when used appropriately. Cold decreases blood flow, edema, and inflammation and may decrease muscle spasm and pain (Hamilton, 2010).

With these existing literatures and researches, it can be implied that ice pack application is indeed widely used as a comfort and non-pharmacological management of pain.

Figure 1. Conceptual Framework

The irritating effect of magnesium sulfate medication and the invasive application of the drug, which is given intramuscularly, cause injury to the affected site. Chemical mediators produce vasodilation, which increases blood flow and brings phagocytes and other white blood cells to the area. Local inflammatory symptoms may occur such as redness, heat, swelling and pain. Cold application brings pain relief because it reduces inflammation. Ice decreases the conduction velocity of nociceptive nerve fibers, rendering the fiber incapable of transmitting the pain signal to the spinal cord. The client perceives the application area as numb. Ice pack applications to the surface of the body will also cause a contraction of the small blood vessels in that area. This will have an immediate effect on reducing the flow of blood and other fluids through that area, therefore helping reduce local swelling.

OBJECTIVES OF THE STUDY

This study determined the effectiveness of ice pack application in pain reduction among patients receiving intramuscular magnesium sulfate.

Specically, to sought to achieve the following objectives:

1. Determine the pain score of the patients after the intramuscular administration of magnesium sulfate without ice pack application;
2. Determine the pain score of the patients receiving ice pack application fifteen minutes before and after intramuscular administration of magnesium sulfate; and,
3. Compare the pain scores of the patients receiving magnesium sulfate with and without ice pack application.

Hypothesis

Ice pack application reduces pain caused by magnesium sulfate administration without any significant alteration in drug efficacy.

MATERIALS AND METHODS

Research Design

One group pre-test post-test, only design was employed to compare the pain scores before and after the injection of magnesium sulfate. Though the design only had two observations, a third observation was conducted to serve as another baseline. This observation was conducted after an hour of the experiment. This was done to further determine the duration of pain reduction among the subjects.

Research Locale

The study was conducted in the labor room (LR)/ delivery room (DR) and Ward I (Obstetrics Ward) of Vicente Sotto Memorial Medical Center (VSMMC) in Cebu. It was in the LR and DR where the first dose of magnesium sulfate was administered for patients having the diagnosis of Severe Pre-eclampsia and in Ward I was where the rest of the doses were administered.

Research Respondents

The research respondents included conscious and coherent patients in the latent phase of labor, diagnosed with severe pre-eclampsia, and receiving magnesium sulfate intramuscular therapy for the first time.

Research Sampling Techniques

In this study, a purposive sampling was used in selecting of 30 patients diagnosed with severe preeclampsia, undergoing the latent phase of labor, and receiving magnesium sulfate intramuscular therapy for the first time. The sample was isolated for intensive study.

Research Instruments

The instruments used in data gathering were the following: 0-10 Numeric Pain Rating Scale by McCaery (1999), Seizure Monitoring Sheet, Reex Scale, and reex hammer.

The 0-10 Numeric Pain Rating Scale by McCaery (1999) was used to measure the pain experienced by the patients during the administration of magnesium sulfate via intramuscular route. e scale grades were 0 as no pain, 1-3 as mild pain, 4-6 as moderate pain, 7-9 as severe pain, and 10 as worst pain.

To use the 0-10 Numeric Pain Rating Scale, the researchers let the patient get acquainted with the scale and instructed the patient to think of the pain. Then, the researchers asked the patient, "On the scale of 0-10, what is the grade of the pain you are experiencing right now?" e patient's response was recorded.

The researchers used a Seizure Monitoring Sheet to record the pain score of the patients.

The Reflex Scale and a reflex hammer were used to determine the deep tendon reexes of the patients. The reflex scale grades were 4+ as hyperactive, very brisk, rhythmic oscillations (clonus), 3+ as more brisk or active than normal, 2+ Normal, 1+ as less active than normal, and 0 as no response.

Research Data Gathering Procedures

Permission to conduct the study was obtained from the administrator and Ward Supervisor of the LR/DR of the Vicente Sotto Memorial Medical Center. Informed consent form was given to each of the selected patients. During data collection, on

the first dose, (W1) ice pack was note not applied to the injection site before and after the intramuscular administration of magnesium sulfate. The patient's pain score was obtained immediately after the injection. The patient was monitored for presence of seizures and the findings were recorded in the Seizure Monitoring Sheet. On the second dose, (0) ice pack was applied to the injection site 15 minutes before the administration of magnesium sulfate and 15 minutes immediately after the administration. These ice packs were 6 inches in size, made of thick fabric filled with ice cubes to its full capacity. On the third dose/injection, (W2) the ice pack was not applied anymore, but pain score was again reassessed.

Statistical Analysis

The data were tested for normality using Anderson-Darling test, which showed a p-value of 0.028. Hence, parametric tests could not be done. The researchers used the non-parametric test alternative of paired t-test, which was Wilcoxon Signed Rank test.

RESULTS AND DISCUSSION

Table 1. Mean Pain Scores

GROUP	MEAN PAIN SCORE	*INTERPRETATION
Without Cryotherapy (W1)	6.95	moderate
With Cryotherapy (O)	5.15	moderate
Without Cryotherapy (W2)	6.42	moderate

* 0 - no pain
1-3 - mild pain
4-6 - moderate pain
7-9 - severe pain
10 - worst pain

As presented in Table 1, W1 had the highest mean pain score of 6.95 (moderate pain) among the three groups.

Comparing W1 and W2, both without ice packs, there was a difference of 0.53, indicating that the decrease in pain score is due to the development of pain tolerance. Between W1 and O, there was a difference of 1.80. Using the first

comparison as basis, the difference indicated an accumulation of a decrease in pain due to cryotherapy and the development of pain tolerance. Comparing O and W2, there was a difference of -1.27, indicating that O, even on the second administration, had lower pain score than W2, implying that cryotherapy played a huge role in changing the pain scores.

Table 2. Comparison of pain scores between observations

Pair-wise comparison	z-value	p-value
W1 vs W2	2.631	0.009
W1 vs O	4.395	0.000
O vs W2	3.788	0.000

Table 2 shows the z-value and p-value of the different comparisons made using Wilcoxon Signed Rank test. Comparing W1 and W2, the test yielded a p-value of 0.009. Between W1 and O, and O and W2 the p-value result was 0.000. All p-values were less than 0.05, suggesting that each comparison was significant. Changes in pain scores were attributed to the respondent's level of comfort from the administration of the ice pack, which is supported by the Gate Control Theory.

The fundamental basis for this theory is the belief that psychological as well as physical factors guide the brain's interpretation of painful sensations and the subsequent response. One of these factors is counter stimulation in which ice pack application is used. Cryotherapy diverts pain perception on the response to cold stimulation (Holisticonline.com, 2007).

CONCLUSION

From the results of the study, tit is concluded that cryotherapy is an effective intervention in decreasing the pain during intramuscular administration of magnesium sulfate. With the observations, it is reasonable to conclude that cryotherapy is the most plausible and perhaps the only explanation for pain alleviation.

RECOMMENDATIONS

Based on the conclusion above, the researchers advance the following recommendations:

1. To nursing practitioners, that the application of ice pack be included in the plan of care provided that there is due consent for the given intervention.
2. To future researchers, that further studies be conducted to rule out other factors that affect pain perception of the patient such as labor pains, pain medications, surgical incisions, and tolerance.
3. Other studies should be done for cryotherapy as comfort measure for intramuscular injections considering:
    2.1. An increase in sample size
    2.2. An extended length of time for conducting the research

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