USING PRESSURE TO DECREASE THE PAIN OF DORSOGLUTEAL INJECTIONS

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CHAPTER I

INTRODUCTION

Statement of Problem

Nurses are the health care professionals who administer the great majority of intramuscular (IM) injections. IM injections are the route of choice when the volume of the medication is too large for subcutaneous injection, the solution is known to be irritating to the skin's layers, or the oral route is contraindicated. Injections often cause patients discomfort and anxiety, and may lead some patients to fear all procedures involving needles.

Over the years, nurses have searched for effective and feasible methods to decrease the discomfort of injections. Various techniques have been investigated, including muscle relaxation, topical applications, and mechanical methods. The use of different body positions, such as internal rotation of the femur, has been demonstrated as one effective means of decreasing discomfort (Rettig & Southby, 1982). However, many patients are unable to be positioned properly to allow internal femoral rotation. Topical applications, such as application of cold or anesthetic spray, are often costly or require that nurses assemble supplies, adding extra work and decreasing the feasibility of use in clinical practice. Mechanical methods to reduce injection discomfort have included the Z-track and pinch-grasp techniques. Keen (1986) found that the Z-track method actually increased immediate postinjection

discomfort, but decreased the injection discomfort at later time intervals. Locsin (1985) used the pinch-grasp method and found that discomfort ratings were decreased with this technique. However, only the deltoid muscle was used for the injections in Locsin's study and no evidence regarding other sites was provided.

No studies to date have examined the use of pressure applied prior to injection at the IM site as a means of decreasing pain. The use of pressure, applied with the thumb for 10 seconds immediately prior to injection, may provide both a feasible and cost effective method for dealing with injection discomfort. Anecdotally, in our clinical practice, we had observed the effectiveness of pressure application, although the technique had not been formally tested. According to the gate control theory of pain, the application of pressure may stimulate the large conducting nerve fibers, closing the "gate" in the spinal cord, blocking pain signals and thereby reducing or alleviating discomfort (Melzack & Wall, 1988). The application of pressure would certainly be a time efficient method, a critical factor in the current nursing shortage.

Purpose of Study

In this experimental study, the application of manual pressure to the site prior to dorsogluteal IM injection was compared to the standard technique, in which no pressure was applied, to determine the intensity of immediate postinjection pain. The specific question asked was: Do

subjects report less pain immediately following dorsogluteal IM injection when pressure is applied to the site for 10 seconds prior to the injection?

CHAPTER II

REVIEW OF LITERATURE AND CONCEPTUAL FRAMEWORK

This chapter provides a context for the study by reviewing the literature about methods to decrease injection pain. The focus is on the dorsogluteal site because of its wide use in clinical practice. The chapter also includes a description of the gate control theory of pain, the conceptual framework for the study.

Over three decades ago, Travell (1955) discussed means of decreasing IM injection pain as well as causes of immediate pain following injection. She listed three possible causes for the pain that immediately follows injection: local irritation related to either the antiseptic or parenteral solution, mechanical trauma following introduction of the needle or rapid injection, and abnormal sensitivity of tissues at the site of injection. In addition, Travell described topical methods to decrease the injection pain, such as application of cold or ethyl chloride spray to anesthetize the skin, and mechanical methods, such as evaporation of antiseptic (alcohol) at the site prior to injection, as well as proper selection of a nontender site. Various methods to decrease injection discomfort have been studied. The methods reviewed include site selection, solution administered, muscle relaxation, topical methods, and mechanical methods.

Methods to Decrease Injection Pain

Site Selection

The choice of an injection site is one factor affecting the pain of injection. Zelman (1961) advocated use of the upper outer quadrant of the buttocks as the site of choice because of decreased pain sensation, adequate muscle depth, and reduced risk of injury to nerves and vessels. Hanson (1966) agreed with Zelman, but warned of possible sciatic nerve damage following injection in the dorsogluteal site and therefore advocated the use of the ventrogluteal site. Pitel and Wemett (1964) endorsed the use of the gluteal muscle (either the dorsogluteal or ventrogluteal site) for IM injections, because activities such as walking, sitting, and standing stimulate circulation and were presumed to aid in absorption of the injected solution. Farley, Joyce, Long, and Roberts (1986) agreed with Hanson and recommended the use of the ventrogluteal site, but in their survey of nurses, found that the dorsogluteal site was still preferred by 52% of 525 respondents. Cockshott (1982) found through use of computerized tomography that in 50% of 123 patients receiving dorsogluteal injections, the distance through the subcutaneous region before reaching muscle was 1.63 inches (4 cm) or greater. In addition, the mean gluteal fat thickness of women was found to be 1 inch (2.5 cm) greater than that of men.

Solution Administered

The solution administered also affects injection pain.

In a retrospective study of 12,134 hospitalized patients receiving intramuscular injections, Greenblatt and Allen (1978) found that only 48 patients had local complications associated with the injection. These were most commonly associated with the irritating properties of the drugs given, especially cephalothin sodium.

Svendsen (1982) administered 10 different neuroleptic drugs in each of four different vehicles: Viscoleo (a triglyceride vegetable oil), sesame oil, methyl oleate, and squalane and water. The drugs were administered intramuscularly to rabbits, which were killed three days later for examination and weighing of muscle tissue. One particular oily agent, Viscoleo, most efficiently neutralized the local muscle damaging effects, possibly by altering the concentration, pH, or chemical properties of the drug. Svendsen hypothesized that the slower absorption rates of oily vehicles resulted in the initial exposure of fewer cells to the drug concentration, as compared with aqueous solutions which immediately contact large numbers of muscle cells.

Svendsen and Blom (1984) studied the effects of the concentration of different neuroleptic drug preparations injected in the muscle tissue of rabbits. Each rabbit received one injection. The necrotic muscle tissue was excised after three days and weighed. The investigators found that a small volume of a concentrated solution caused less muscle damage than a large volume of a less

concentrated solution.

Muscle Relaxation

The pain of dorsogluteal IM injection has been found to be decreased when the muscle is relaxed. This is achieved when the patient lies in the prone position with the toes pointed inward, which internally rotates the femur (Zelman, 1961; Pitel & Wemmett, 1964). In 1979, Kruszewski, Lang, and Johnson tested the hypothesis that dorsogluteal injections cause less discomfort when the femur is internally rotated. The gluteal maximus was relaxed while injections were administered, with the muscle visibly less prominent when the patients shifted from external to internal rotation. A descriptive pain rating scale was used to support the findings that the perceived level of discomfort in using an irritating solution with internal rotation did not significantly differ from a nonirritating solution with external rotation. The hypothesis was supported, in that an irritating solution injected into a relaxed gluteal muscle tended to feel the same as a nonirritating solution into a tense muscle. Rettig and Southby replicated this study in 1982 and also found decreased discomfort with injection when patients had internally rotated their femurs.

Topical Methods

Ice. For centuries, ice has been used prior to amputations and dental extractions as a means of decreasing pain. In 1986, Hillman and Jarman investigated the use of

ice preceding needle pricks in the upper arm. Twenty-five gauge needles attached to a DeFonbrune Micro-Manipulator were advanced one time at each of ten different sites on the same arm. A microscope was focused on the tip of the needle to determine when it touched a hairless area of skin. Subjects were asked to report when they first perceived the sensation of touch, followed by the sensation of sharpness. Following the application of ice, 89 of 200 needle advances were not felt; when ice was not applied, 190 out of 200 needle pricks were felt.

Mechanical Methods

Vibration. Pantaleo, Duran, and Bellini (1986) investigated the effect of vibratory stimulation on muscular pain threshold in 28 subjects. Vastus medialis muscle pain was elicited using an electrical stimulator which delivered a painful stimulus every 10 seconds. Pain sensation was measured using both verbal reports and blink responses (a component of the startle reaction). Both high (110 Hertz) and low (<40 Hertz) frequency vibrations were administered prior to the electrical stimulation. High frequency vibration was associated with a prolonged increase in muscular pain threshold, peaking in 20 minutes after the treatment ended, while low frequency vibration failed to produce a consistent effect on the pain threshold.

Pinch-grasp technique. The pinch-grasp technique tested by Locsin in 1985 is the method of grasping the area of muscle at the IM injection site tightly enough to elicit

initial discomfort prior to the needle puncture. The technique was tested in subjects receiving IM injections in the deltoid muscle in comparison to 12 control subjects. The experimental group had a mean pain rating score of 0.8 on a scale of 0 (no pain) to 4 (severe, unbearable pain) while the control group had a mean pain rating score of 1.5. This suggests that less pain was felt by those receiving the pinch-grasp technique.

Z-track technique. The Z-track technique involves the application of pressure to shift the skin and subcutaneous tissue to one side. This is done to seal the needle track when the tissue is released. Keen (1986) found that the Z-track technique increased discomfort immediately following injection as measured by a four-point Likert scale. The incidence and severity of lesions at the injection site and discomfort secondary to leakage of solution was decreased by using the Z-track technique.

Summary

The review of literature has indicated that although many methods exist for decreasing the pain of IM injection, no one method is consistently implemented in clinical practice. The decision to use a given method may be related to many factors, including awareness of the method, cost, availability, simplicity, and feasibility. No previous study has examined the simple use of manual pressure applied to the site prior to injection as a possible means of decreasing postinjection pain. There is need for research

to investigate the effect of this potentially helpful and easily used technique.

Conceptual Framework

The gate-control theory of pain, first proposed in 1965 by Melzack and Wall, was used as the conceptual framework for the study. This theory of pain incorporates known facts about the nervous system; provides a sound explanation for clinical pain, including injection pain; and stimulates experiments to test the theory and potentially useful interventions, including the technique of pressure application prior to injection tested in this study (Melzack & Wall, 1988). The gate control theory proposes that when pain impulses are transmitted from nerve receptors through the spinal cord to the brain, they can be altered in the spinal cord, brain stem, and cerebral cortex, thus affecting transmission of pain impulses to the brain and the subjective experience of pain (Siegele, 1974).

The basic concepts of the gate-control theory are illustrated in Figure 1. The theory places emphasis on the role of a gating mechanism in the dorsal horn of the spinal cord which acts as an excitation-inhibition center for incoming pain impulses carried by small diameter A-delta and C-peripheral nerve fibers. The opening and closing of this gate is achieved by relative activity of small and large nerve fibers. When small diameter peripheral nerve fibers are stimulated, an excitatory pain signal is produced, enhancing the opening of the gate and transmission of pain

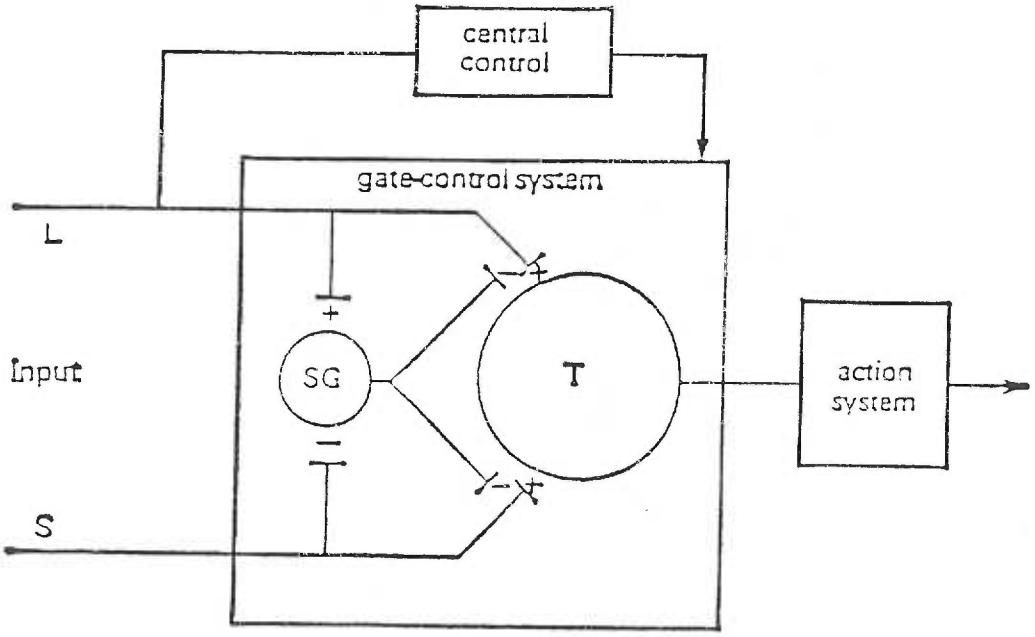

Figure 1. The gate control system. Schematic diagram of the gate-control theory of pain: L, the large-diameter fibers; S, the small-diameter fibers. The fibers project to the substantia gelatinosa (SG) and first central transmission (T) cells. The inhibitory effect exerted by SG on the afferent fiber terminals is increased by activity in L fibers and decreased by activity in S fibers. The central control trigger is represented by a line running from the large fiber system to the central control mechanisms; these mechanisms, then project back to the gate-control system. The T cells project to the action system +, excitation; -, inhibition. From "Pain Mechanisms: A New Theory" by R. Melzack and P.D. Wall, 1965, Science, 150, p. 22.

signals to the brain. In contrast, when large diameter afferent nerve fibers are stimulated, an inhibitory action is produced to close the gate (Melzack & Wall, 1988). When an incoming pain signal is not interrupted or blocked at the gate, it travels to transmission cells in the dorsal horn of the spinal cord and along the anterolateral nerve tract to the thalamus and cerebral cortex (Nathan & Rudge, 1974).

Blocking of pain signals is hypothesized to take place in a unit of densely packed cells in the dorsal horn, extending the length of the spinal cord, called the substantia gelatinosa. This unit works as a "gate" that facilitates or inhibits sensory input. As mentioned earlier, the gating mechanism depends on the balance of large and small nerve fiber activity. If the small nerve fiber activity predominates, the gate is "open" with facilitation of pain impulses and increased transmission cell activity. In contrast, when the large nerve fiber activity predominates, it "closes" the gate by blocking small fiber activity temporarily (Melzack & Wall, 1988).

Several mechanisms are hypothesized to close the gate through stimulation of large diameter nerve fibers that synapse in the substantia gelatinosa. For example, large cutaneous afferent nerves on the surface of the skin can be stimulated by vibration, massage, pressure, rubbing, and scratching. These forms of stimulation thus encourage closure of the gate, inhibiting incoming pain signals of the small diameter excitatory fibers (Melzack & Wall, 1988).

Melzack and Wall propose that other pain inhibitory mechanisms involve nerve fibers that descend from the brain stem (the central biasing mechanism) and from the thalamus and cerebral cortex (the central control center). They propose that the whole brain is the "pain center." When the central control center is activated it triggers a descending blocking action, closing the gate. The gate control theory suggests that anxiety, attention, anticipation, excitement, emotion, and memories of past experiences influence the central control system. This would make it possible to have control over sensory input, through the mediation at the gate (Melzack & Wall, 1988).

The gate control theory incorporates a complex and interacting neural system which not only alters the perception of pain but also the response. The implication of the gate theory for this study involves the control of pain through the selective stimulation of large, rapidly conducting nerve fibers. These fibers, when stimulated, have been hypothesized to be capable of transmitting inhibitory impulses to close the gate to incoming pain signals. It is proposed that the application of pressure to the site prior to intramuscular injection will stimulate these large peripheral fibers.

CHAPTER III

METHODS

Design

The study used an experimental design to determine whether the application of pressure at the site of injection decreased the amount of immediate postinjection pain. The investigators gave injections at a health department gamma globulin immunization clinic. For half of the subjects, the immunizations were preceded by the application of pressure, while the other half did not receive the treatment. In addition, the subjects were blind as to their particular group assignment. It was expected that subjects given IM injections preceded by pressure applied at the site for ten seconds would report less pain than those not receiving the pressure treatment.

Subjects and Setting

The subjects in the study were a convenience sample of 93 individuals attending several different gamma globulin immunization clinics at a county health department over a three month period. All subjects were at least 18 years of age, able to understand English, and had no pre-existing condition which interfered with their ability to rate pain. One potential subject was excluded due to having had more than 10 injections in the past year. The injections were given in an examination room to provide the subjects with privacy and a comfortable environment.

Experimental Treatment

The independent variable was the application of pressure to the site prior to dorsogluteal IM injection. Subjects assigned to the experimental group received pressure applied to the injection site for 10 seconds. The pressure was applied by the investigator's noninjecting thumb until resistance was felt and then maintained for 10 seconds. Subjects in the control group received no pressure application.

Prior to data collection, the actual level of thumb pressure at the dorsogluteal site was estimated. Three volunteers measured thumb pressure applied to the dorsogluteal site four times in each volunteer, for a total of 12 measurements. A dolorimeter was used to measure the thumb pressure. The mean pressure obtained for the twelve measurements was 1.0 kg/cm^2 with a standard deviation of 0.2 kg/cm^2.

Due to lack of an examination table at the research site, subjects received their injections in a standing position. In order to rotate the femur internally and relax the dorsogluteal muscle, they were asked to lean against the counter, bear weight on the side opposite the injection site, and point the toes on the injection side toward the opposite foot.

The dorsogluteal site was located by palpating the posterior superior iliac spine and the greater trochanter of the femur, then drawing an imaginary line between them. The

site of the injection was slightly superior to the midpoint of the line and two to three inches below the crest of the ilium.

For subjects in both the experimental and control groups, the skin at the injection site was held taut by the noninjecting thumb and forefinger and the injection was given in no less than five seconds and no more than ten seconds following aspiration to check for blood. A standard length 1-1/2 inch needle was used, making this method readily available and feasible. The volume of gamma globulin administered was determined according to the subject's weight (1 ml/45.4 kg) and ranged from 1.2 to 2.5 ml.

Pain Measurement

The dependent variable was subjects' rating of immediate postinjection pain on a visual analogue scale (VAS)(Appendix C). They made a vertical mark on a 100 mm horizontal line indicating the amount of pain felt at the time of injection. The left hand anchor words were "no pain," and the right hand anchor words were "pain as bad as it could be."

The VAS was developed approximately 60 years ago to assess the intensity of subjective pain. The VAS consists of a straight horizontal line, usually 100 mm in length, anchored by two verbal extremes of pain, such as "no pain" and "pain as bad as it could possibly be" (McQuire, 1988). Subjects are asked to complete the scale by making a

vertical mark along the line at the point that best represents their perceived level of pain at any given time. Pain scores are calculated by measuring in millimeters the distance from the left end of the line to the mark, allowing quantification at the ratio level.

Ornhaus and Adler (1975) used the VAS and the verbal rating scale (VRS) to compare the effects of two analgesics and a placebo in subjects with metastatic cancer. They concluded that the VAS was a reflection of the subjects' affective perception of pain, while the VRS reflected the subjects pain intensity. Sriwatankul, Kelvie, Lasagna, Calimlim, Weis, and Mehta (1982) found the VAS to be useful in providing measurements in regards to pain intensity in 107 healthy volunteers and postoperative patients. The VAS scale was found to be representative of pain intensity as compared to the four point pain scale, verbal rating scale, and the descriptive pain scale. Lee and Kieckhefer (1989) also found the VAS to be superior to other pain scales because of its sensitivity to small changes in pain and its ability to provide quantitative, ratio level data that allows a greater distribution of responses. The VAS is easy to use, and more preferred by subjects (Jensen, Karoly, and Braver, 1986; Joyce, Zutshi, Hrubes, and Mason, 1975; Langley & Sheppeard, 1985; Ornhaus & Adler, 1975; Sriwatankul et al., 1982). There are a few disadvantages in using the VAS. One is that the researchers must take into consideration that subjects with impaired motor skills or

visual ability may have difficulty using the scale, and it is too abstract for some individuals (Lee & Kiechhefer, 1989).

Data Collection Procedures

The protocol for the study is shown in Appendix A. Individuals scheduled for injections in the gamma globulin immunization clinic were approached for inclusion in the study by verbally explaining the study to them and requesting that they read the consent form (Appendix B). The investigator answered any questions and requested their participation. If they agreed, they were asked to sign two copies of the consent form, one to keep and one for the study records.

Subjects were then interviewed regarding their previous experience with injections and background information. The data collection booklet is shown in Appendix C. Data were collected from each subject regarding background variables of age, gender, ethnicity, education, and marital status. Subjects' reports of weight and height were collected for later calculation of the body mass index (weight/square of height in kg/m^2). The procedural variables of type and volume of medication given were also recorded. In addition, the subjects received instructions on how to use the VAS to record their perceived injection pain.

Male and female subjects were separately randomized into the experimental and control groups by the use of a coin toss on the first day of data collection. It was

anticipated that a similar gender distribution in the two groups would provide increased generalizability of the study results. The coin toss placed the first male subject and the first female subject into either the experimental or control group. The remaining subjects were then placed alternately by gender in the two groups.

The site was palpated for sensitive or nodular tissue; if any was located, the opposite side was utilized. No subjects were deleted from the study because of sensitive or nodular dorsogluteal tissue on both sides.

Subjects assigned to the experimental group received pressure applied to the injection site. The pressure was applied by the investigator's noninjecting thumb until resistance was felt, and then maintained for 10 seconds. For subjects in both the experimental and control groups, the skin at the injection site was held taut by the noninjecting thumb and forefinger, and the injection was given in no less than five seconds and no more than ten seconds. No subjects were deleted from the study due to aspiration of blood into the syringe at the time of injection.

Immediately following the injection, subjects were provided with a pencil and a clipboard with the visual analogue scale attached. The investigator explained the use of the scale and allowed time for questions and privacy for its completion.

Consistent conditions were maintained by giving the

same instructions to all subjects, using the same examination room, and using only the dorsogluteal site for injections. Two investigators participated in collection of data. Investigator 1 approached subjects, obtained informed consent, and conducted the initial subject interviews and explained the VAS, without knowledge of the subjects' group assignment. Investigator 2 randomly assigned subjects to the experimental or control groups and administered the injections. Following the injection the investigator left the room while the subject completed the VAS.

Protection of Human Subjects

Prior to data collection, the study was reviewed by the Oregon Health Sciences University Committee on Human Research. Written informed consent was obtained from each subject (Appendix B). Subjects were free to withdraw from the study at any time. Confidentiality was maintained by the use of identification numbers on all study data. Subjects received the required injections regardless of their inclusion in the study. The study involved common injection procedures and standard supplies. The pressure treatment that was tested had no known risks or discomfort.

Data Analysis

Data were analyzed using the Crunch Statistical Package, version 3 (Crunch Software Corporation, Oakland, CA). Group equivalence in regard to background variables was evaluated using chi square tests for nominal level variables (age, gender, ethnicity) and two-sample t-tests

for ratio level variables (weight, body mass index, volume of medication). A two-sample t-test also was used to compare pain intensity immediately following injection in the experimental and control groups. The level of statistical significance was set at .05. Finally, the relationship of selected background variables with the subjective pain ratings was evaluated using t-test, one-way analysis of variance, and correlational procedures.

CHAPTER IV

RESULTS

Characteristics of the Sample

As shown in Table 1, the sample of 93 subjects included 32 males and 61 females. The majority of subjects (31%) were in the 30 to 39 year age group (n=29). All subjects except two were Caucasian; 61 (66%) of the subjects were married and 19 (20%) were single. The sample was well educated, with 63 (68%) having education beyond high school and 15 (16%) having postgraduate education.

The groups did not differ significantly in regard to personal variables of age, gender, marital status, education, ethnicity, or procedural variables of number of injections in the past year and the side on which the injection was given. Subjects in the experimental group tended to have a slightly higher weight and body mass index (p=.07). The small difference in injection volume, larger by 0.1 ml in the experimental group, was statistically but not clinically important.

Effect of Pressure Treatment on Pain Intensity

As shown in Table 1 and illustrated in Figure 2, the mean VAS pain intensity score for the experimental group (n=48) was 13.8 $\pm$ 13.6 mm, while the mean score for the control group (n=45) 21.3 $\pm$ 19.3 mm. The pressure treatment was demonstrated as having a statistically significant influence on decreasing the pain of dorsogluteal injection (t=-2.16, p=.03).

Table 1

Comparison of background variables in experimental and control groups

	Experimental group (n=48)	Control group (n=45)	Test statistic	p value
Personal Variables				
Gender			Fishers Exact	
Male	18	14	Test= 0.33	.66
Female	30	31		
Marital status				
Single	7	12	X^2= 3.08	.55
Married	33	28		
Other	8	5		
Education				
High school or less	16	14	X^2= 0.72	.95
Some College	15	17		
4 year college degree	9	7		
Post graduate	8	7		
Ethnicity				
Caucasian	46	45	X^2= 0.45	.50
Hispanic	2	0		
Body mass index (kg/m^2)	26.2±5.3	24.4+3.7[a]	t= 1.8	.07[b]
Procedural Variables				
Number in injections				
in past year	0.3±0.8	0.4±0.9	t=−0.75	.46
Injection Volume (ml)	1.8±0.3	1.7±0.3	t= 2.39	.02
Side of injection				
Right	29	22	X^2= 0.18	.67
Left	19	19		
Pain Intensity				
Visual analogue				
scale score (mm)	13.8±13.6	21.3±19.3	t=−2.16	.03

[a] *Values are mean ± standard deviation for ratio level variables and fequencies for nominal and ordinal variables.*

[b] *Based on separate variances with all other t-tests results based on pooled variances.*

Figure 2

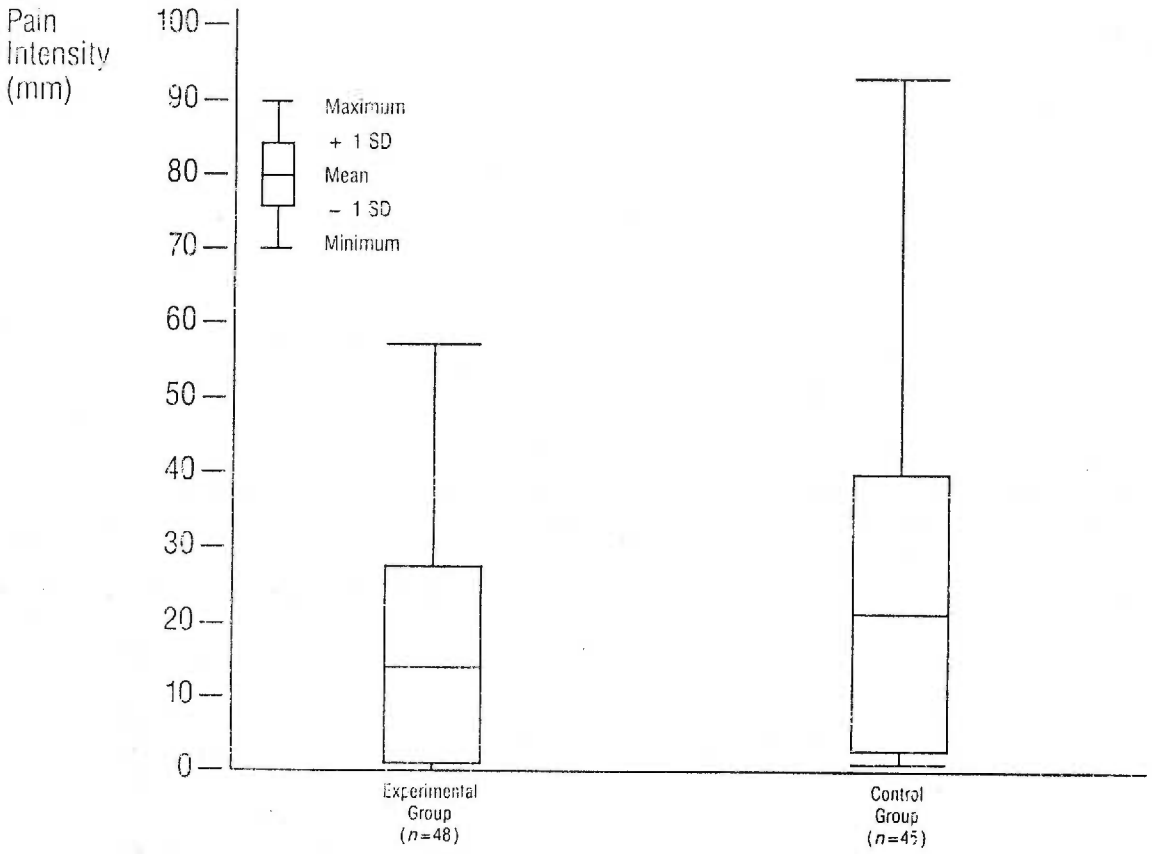

Figure 2— Visual analogue ratings of immediate postinjection pain intesity in the experimental and control groups.

Relationship of Other Variables to Pain Intensity

As shown in Table 2, postinjection pain intensity did not differ according to age group, gender, marital status, or education. A tendency for a lower pain score was noted for subjects who received injections in the right versus left dorsogluteal site ($p=.10$). As shown in Table 3, no correlation was found between pain intensity and body mass index, the number of injections in the past year, or the volume of solution administered.

Table 2

Effect of selected background variables on pain intensity

Variable	Pain intensity[a]	Test	*p* value
Age groups		F= 1.27	.29
18-29	15.5±15.4		
30-39	22.0±21.4		
40-49	17.5±14.2		
50-59	9.2± 8.6		
60-over	18.0±17.5		
Gender			
Male	15.1±15.0	t=−1.03	.33[b]
Female	18.7±17.9	F= 0.14	.97
Marital status			
Single	17.7±16.7		
Married	16.8±17.2		
Separated	27.0±00.0		
Divorced	19.5±20.1		
Widowed	19.2±12.2		
Education		F= 0.23	.92
Less than high school	13.2±18.3		
High school diploma	16.2±14.8		
Some college	17.2±21.0		
4 year college degree	17.6±10.7		
Post graduate	20.8±17.5		
Side of injection			
Right	14.5±12.2	t=−1.68	.10[c]
Left	20.9±21.1		

[a] *Values are mean ± standard deviation.*

[b] *Based on pooled variances.*

[c] *Based on separate variances.*

Table 3

Correlation of selected background variables with pain intensity

Variable	*r*	*p* value
Body mass index (kg/m²)	.08	.43
Number of injections in past year	.01	.94
Volume of solution (ml)	.01	.94

CHAPTER V

DISCUSSION, CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

Injections are known to cause patients anxiety and discomfort, and nurses have searched for effective methods to decrease these problems. This study investigated the use of thumb pressure at the injection site as one feasible and economical method to decrease injection discomfort. The findings support the pressure treatment as an effective procedure.

The gate-control theory provided a conceptual framework for the study. The nature of pain has been a concern to health care professionals for many years, and researchers have speculated that pain is influenced by many different variables. The thumb pressure used prior to injection may have stimulated large nerve fibers that inhibited the transmission of incoming pain signals. While the gate-control theory was not the focus for this study, the findings are consistent with the predictions of the theory.

Three trends were noted in the study. First, the experimental group tended to have a slightly higher weight and body mass index than the control group. This may have affected the study results, due to the possibility that they may have received their injections subcutaneously instead of intramuscularly. Second, the higher weight of the experimental group also meant that they received a larger volume of medication, which may have increased injection

discomfort. However, while the increased volume of medication this group received was statistically significant ($p=.02$), the small difference involved (0.1 ml) was not clinically important. Finally, subjects receiving their injections on the right side tended to report less pain ($p=.10$) than those receiving their injections on the left. The injections were given by a right handed investigator, which may have changed the amount of pressure applied on the right versus the left side.

Several limitations were noted. First, some subjects had difficulty understanding how to mark the VAS to rate their pain. The literature indicated that advantages of the VAS include accuracy, sensitivity, and ease of administration. However, several subjects in this study asked multiple questions after receiving their instructions, suggesting that it was difficult for them to understand.

The second limitation was the ethnic homogeneity of the sample. Of the 93 subjects who participated in the study, only two were non-Caucasian, both in the experimental group. Pain is reported to be perceived differently by various cultures and the study results may not be generalizable to non-Caucasian groups (Abu-Saad & Tessler, 1986).

Possible variation in the amount of thumb pressure applied was a third limitation to the study. Although the amount of thumb pressure was highly consistent in testing prior to data collection, it may have varied among experimental subjects.

The fourth limitation may have been investigator bias. The investigator administering the injections was aware of the specific group placement of each subject. Although this information was needed by the investigator, it may have contributed to bias.

In addition, subjects may have been aware of their group assignment. This knowledge may have biased the subjects in marking the VAS. However, comments made by the subjects indicated that most subjects were not aware of their group assignment.

Finally, a standard length (1 1/2-inch) needle was used on all subjects, which may have resulted in the injections being given subcutaneously in some individuals. Injection pain might differ depending on whether the injection was administered subcutaneously or intramuscularly.

This study investigated the use of thumb pressure at one IM injection site in adults using one type of medication. Further study is needed to determine if the pressure treatment decreases immediate injection pain at other locations, such as the ventrogluteal or deltoid sites. Studies done with pediatric subjects would also be valuable as children are often particularly upset over injections. Studies involving different types of medication would be helpful to generalize the findings of this study, although the gamma globulin injections used in the present study are generally believed to be very painful. Other studies involving varying needle lengths, subcutaneous injections,

different ethnic groups, and individuals of varied body mass would provide useful clinical information.

In summary, this study supported the use of thumb pressure applied to the dorsogluteal site for 10 seconds prior to injection as a means of decreasing immediate injection discomfort. The pressure treatment has no risks or side effects, no costs are incurred, and no additional supplies are necessary. The time involved in using the pressure treatment adds only 10 seconds to a routine injection.

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APPENDIX A

DATA COLLECTION PROTOCOL

Obtain Subjects (Investigator 1)

1. Obtain names of individuals scheduled for gamma globulin injections at the health department from the clinic secretaries.
2. Randomize subjects in advance: (Investigator 2)
   a. Make coin toss for the first scheduled male and female subject on the first data collection day.
   b. If heads on the coin toss, the first male and the first female subject will be assigned an odd number ("1"), and placed in separate experimental groups; if tails, the male and female subjects will be placed in separate control groups.
   c. All other subjects will follow in an alternating fashion.
3. Verbally explain the study to potential subject, using a script to help with consistency; request individual to read consent form. Ask if there are any questions, and answer them.
4. Request participation in the study. If affirmative, obtain subject's signature on two consent forms.
5. Leave copy of consent form with the subject, and the investigator will retain the other copy.

Obtain Background Data From Subject (Investigator 1)

1. Record background data from subject interview on the information sheet.

a. Age

b. Gender

c. Marital status

d. Height and weight

e. Highest grade completed

f. Ethnicity

g. Number of prior injections in past year

h. Prior injection problems or complications

2. Check inclusion/exclusion criteria to determine the subjects ability to participate in the study.

3. Instruct the subject about how to complete the scale: "The far left of the line represents 'no pain' and the far right side is 'pain as bad as it could be.' Draw a vertical line on the scale which represents the amount of pain you felt at the time of your injection."

Obtain Supplies and Medication (Investigator 2)

1. Determine the weight of the subject and calculate the amount of gamma globulin to be given.

2. A 22 gauge, 1-1\2 inch needle will be used for all subjects.

3. Draw up the gamma globulin vaccine, using aseptic technique. If the subject is to receive more than one immunization, only the first injection will be evaluated in the study.

Administer Injection (Investigator 2)

1. Verify subject's name and medication to be given.

2. Introduce researcher and explain procedure to subject.

3. Wash hands thoroughly.
4. Ask subject to internally rotate the femur on the injection side by pointing the toes inward, and to put their weight on the side opposite the injection side.
5. Locate the dorsogluteal site: palpate posteriorsuperior iliac spine and the greater trochanter of the femur, and draw an imaginary line between them. The site of the injection will be slightly superior to the midpoint of the line, and two to three inches below the crest of the ilium.
6. Palpate for sensitive or nodular tissue at injection site: if found, use the opposite dorsogluteal site for injection. Delete subject from the study if non-sensitive dorsogluteal tissue cannot be located. In this situation, the next subject will assume the deleted subject's assigned number.
7. If subject assigned to treatment group, using the thumb of the non-injecting hand, apply pressure to the injection site until resistance is felt, with pressure maintained for 10 seconds.
8. If subject assigned to control group, apply no thumb pressure prior to the injection.
9. Give the injection with skin held taut between the thumb and index fingers. Once the needle is inserted, release the skin and place the hands on the syringe. Aspirate to check for blood return; if blood returns into the syringe, reposition needle,

re-aspirate, and then inject medication if no blood returns. Medication will be injected for no less than 5 and no more than 10 seconds. If blood returns into the syringe, delete the subject from the study. Keep the angle of injection perpendicular to the frontal plane. With non-injecting hand lightly place a dry cotton ball on the skin.

10. Withdraw needle, and place needle and syringe in proper receptacle without recapping the needle.
11. Assist subject as necessary to assume a comfortable position.
12. On the data form record:
    a. experimental or control group
    b. injection site
    c. immunization administered
    d. volume
    e. hip and waist measurement
13. Provide subject with a pen and a clipboard containing the visual analogue scale for pain.
14. Allow adequate time and privacy for subject to complete scale and thank subject for participation in the study.

APPENDIX B

CONSENT FORM

OREGON
HEALTH SCIENCES UNIVERSITY
3181 S.W. Sam Jackson Park Road, L-456, Portland, Oregon 97201-3098 (503)279-7839/ 279-7846

School of Nursing
Department of Adult Health and Illness

C O N S E N T F O R M

TITLE — Using Pressure to Decrease the Pain of Dorsogluteal Injections

INVESTIGATORS
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FACULTY ADVISOR — Roberta S. Erickson, PhD, RN 279-7839

PURPOSE

During intramuscular injections, many people complain of pain in the injection site. We are conducting a research study involving approximately 100 people to compare the effect of two injection techniques on the discomfort experienced. One group of subjects will receive pressure applied with the thumb at the site prior to injection. The second group will not receive the pressure treatment. Selection into either group will be by chance.

PROCEDURES

You will be interviewed regarding your previous experience with injections and to obtain background information so that we can describe the study group. This will be done prior to your scheduled injection. One group of people will receive pressure applied with the thumb at the site prior to injection. The second group will not receive the pressure treatment. Selection into either group will be by chance. Immediately following your injection, you will be asked to mark a pain rating scale requiring one brief response.

RISKS AND DISCOMFORTS

The study involves common injection procedures. The pressure treatment that you may receive has no known risk or discomfort. There is no cost to you to be in the study. You will receive your scheduled immunization whether or not you participate in the study. The injections may cause some local discomfort or bruising in the site, but there are no risks associated with the pressure treatment you may receive as a participant of the study.

BENEFITS

Being in the study may or may not benefit you directly, but the information we obtain may be of benefit to future patients receiving injections. You will not be paid for participating in the study.

ALTERNATIVES
If you choose not to participate in this study, the nurse giving your injection will use whatever method she believes is best for minimizing pain, or you may ask her to use a method you believe works better for you.

CONFIDENTIALITY
Neither your name nor identity will be used for publication or publicity purposes. Your study records will be identified by a code number rather than by name. We will keep the coded data indefinitely and may use it in future related research.

COSTS
There is no cost to you for being in the study. However, you will be responsible for the cost of the immunization.

LIABILITY
The Oregon Health Sciences University, as an agency of the State, is covered by the State Liability Fund. If you suffer any injury from the research project, compensation would be available to you only if you establish that the injury occurred through the fault of the University, its officers, or employees. If you have further questions, please call Dr. Michael Baird at (503) 279-8014.

OTHER
The investigators have offered to answer any questions you might have. Their phone numbers are on the front of this form. Your participation in the study is voluntary. You may refuse to participate or you may withdraw from the study at any time without affecting your relationship with or treatment at the Jackson County Health Department. You will receive a copy of the consent form. Your signature indicates that you have read the foregoing and agree to participate in the study.

Subject: _____ Date: _____

Witness: _____ Date: _____

cc: Subject

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APPENDIX C

DATA COLLECTION FORM BOOKLET

INTRAMUSCULAR INJECTION STUDY

Barbara J. Barnhill, BSN, RN
Melinda D. Holbert, BSN, RN
Nisha M. Jackson, BSN, RN
Investigators
1989

ID#_____
Date _____
Interview []
Injection []
VAS []

Intramuscular Injection Study

INFORMATION SHEET ID#_____

1. CAI Age:____
   1 [] 18-29
   2 [] 30-39
   3 [] 40-49
   4 [] 50-59
   5 [] 60-over

2. Gender:
   1 [] Male
   2 [] Female

3. Marital Status:
   1 [] Single
   2 [] Married
   3 [] Separated
   4 [] Divorced
   5 [] Widowed

4. CAI Height in inches ____
   CAI Weight in pounds _____

5. CAI Highest grade completed ____
   1 [] Less than high school education
   2 [] High school diploma or equivalent
   3 [] Some college
   4 [] 4-year college degree
   5 [] Post graduate education

6. Ethnicity:
   1 [] Caucasian/White
   2 [] Hispanic
   3 [] Black/African-American
   4 [] American Indian
   5 [] Other _____

7. CAI Number of intramuscular injections in past year _____

8. Prior Problems with injections in the past year:
   1 [] None
   2 [] Bruising
   3 [] Redness
   4 [] Swelling
   5 [] Tenderness
   6 [] Pain down leg
   7 [] Other _____

9. EXCLUSION CRITERIA ID#_____

	Yes	No	
1	[]	[]	Frequent injections - 10 or more in past year of any route
2	[]	[]	inability to understand English
3	[]	[]	Inability to stand
4	[]	[]	Incompetent to consent
5	[]	[]	Blood aspirated in syringe
6	[]	[]	No non-sensitive dorsogluteal tissue found
7	[]	[]	Refused dorsogluteal site
8	[]	[]	Physically unable to mark scale
9	[]	[]	Other:_____

INJECTION INFORMATION

10. Group: 1 [] experimental
2 [] control

11.CAI Date _____

12.CAI Time _____

13.CAI Needle length: 1-1/2"

14. Medication: 1 [] Cholera
2 [] Polio
3 [] Hepatitus
4 [] other:_____

15.CAI Volume: _____

16. Site: 1 [] right dorsogluteal
2 [] left dorsogluteal

17.CAI Hip measurement _____

VISUAL ANALOGUE SCALE (VAS) ID# _____

Place a mark on the line that best describes the injection today

No pain |----------| Pain as bad as it could be

ABSTRACT

In this experimental study, the question asked was: Do subjects report less pain immediately following dorsogluteal IM injection when pressure is applied to the site for 10 seconds prior to the injection? The application of pressure to the site prior to injection was compared to the standard technique, in which no pressure is applied. Adults scheduled to receive gamma globulin injections at a county immunization clinic served as a convenience sample for the study.

The sample of 93 subjects included 32 males and 61 females. The groups did not differ significantly in regard to personal variables of age, gender, marital status, ethnicity, and education. The subjects in the experimental group tended to have a slightly higher body mass index ($p=.07$). The small difference in injection volume was statistically but not clinically important. The mean pain intensity score on a (100 mm) visual analogue scale was 13.8 ± 13.6 mm for the experimental group and 21.3 ± 19.3 mm for the control group ($p=.03$).

The findings of this study suggest that thumb pressure applied to the injection site was an effective procedure to decrease injection pain. This method may provide nurses with a technique that is not only convenient and cost effective but able to reduce patient discomfort, fear, and anxiety associated with injections.