THE RELATIONSHIP BETWEEN THE USE OF PRESSURE DRESSINGS POST ANGIOCARDIOGRAPHY AND THE INCIDENCE OF ALTERATIONS IN SKIN INTEGRITY

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CHAPTER I

INTRODUCTION

Introduction to the Problem

In a short period of time, the field of angiography has rapidly expanded. There now exist the roentgenologic capabilities of selectively visualizing all of the vascular systems of the body. Probably the most widely used approach has been the transfemoral percutaneous route developed by Seldinger in 1958. This transfemoral approach was later modified by Judkins for angiocardiographic procedures.

Since Seldinger's approach was instituted, there has been no agreement on the post-angiographic care of the femoral artery puncture site. In theory, when a vessel is damaged, as is the case with a puncture wound, the body has its own mechanism for sealing the puncture site so that blood will not leak out. This process is called hemostasis. However, in the case of a large artery, external pressure must be maintained long enough for the body's hemostatic mechanism to be activated so the bleeding can be controlled.

Following transfemoral angiography, external pressure is usually applied to the puncture site for approximately 10-20 minutes or until all bleeding has ceased, even after the external pressure is released. In addition to the external pressure, some physicians use pressure dressings over the site for varying lengths of time, while other physicians do not use pressure dressings at all. In addition, most

physicians keep their patients on bed rest for approximately 2 to 24 hours following the procedure.

The rationale for the use of a pressure dressing by some physicians is that it will reduce the incidence of delayed bleeding following transfemoral puncture. Physicians who do not use pressure dressings, believe that the dressings are not necessary to prevent delayed bleeding.

There are a wide variety of pressure dressings that can be used. Every facility and/or physician seems to have a chosen method. Usually when a pressure dressing is applied, a gauze ball is placed over the femoral artery at the puncture site. Then approximately three, 3-4 inch wide, strips of an elastic type tape are placed over the gauze. The tape usually extends from the abdomen to the inner thigh, a length of approximately 8-12 inches.

Prior to the angiocardiography the skin is shaved and cleansed with Betadine. The removal of hair from some parts of the body, such as the femoral area, is done to decrease the bacterial count and, in those institutions using pressure dressings, to ensure better adherence of the tape. The shaving process is done carefully to limit any abrasions or nicking of the surface of the skin (Harmon, 1975).

A cleansing solution such as povidone-iodine betadine is used to swab the puncture site. The aim of this is to ensure an aseptic field (Harmon, 1975). The literature contains a few reports of varying skin reactions resulting from the use of povidone-iodine in people who are allergic to iodine. The reactions were localized to the area of application and were manifested by erythema, induration, and papulation.

In addition to the cleansing solution and of greater consequence, is the fact that the tape used with pressure dressings can cause skin alterations of varying degrees. The tape removal process can also damage the skin, as well as create varying degrees of patient discomfort. Therefore, the use of a pressure dressing may be detrimental because of the effect of the tape on the skin. This does generate a concern for the patient's welfare.

The purpose of this study is to determine whether or not there is an increased incidence of alterations in skin integrity in post angiocardiographic patients who have pressure dressings when compared to post angiocardiographic patients without pressure dressings.

Review of the Literature

Physiology of Clotting

Hemostasis is man's protective mechanism against bleeding when a vessel is damaged. For a vessel to bleed there must be either damage to the vessel or increased permeability so that cells can leak out. Also, the pressure inside the vessel must be greater than the pressure on the outside of the vessel. Bleeding will stop when the damaged portion of the vessel is plugged and the pressure difference is eliminated or the pressure is greater outside the vessel (Vander, Shuman, & Luciano, 1981).

One of the first responses when a blood vessel is damaged is vascular spasm. The vessel walls constrict immediately to decrease the blood flow from the damaged vessel. Vascular spasm can last up to 20-30

minutes during which time the formation of a platelet plug and blood coagulation takes place.

The formation of a platelet plug takes place at the site of injury in the vessel. When the damage is minor, the platelet plug can stop the blood loss from the vessel. However, when the hole in the vessel is large, the process of blood coagulation is needed along with the platelet plug. (The chemical events that take place in the process of blood coagulation are depicted in a schematic representation by Arthur Guyton (1977) that is reproduced in Appendix A.)

Usually within 3 to 6 minutes a clot fills the hole in the injured vessel. After a clot forms, its function of stopping blood loss is achieved. Then fibrous tissue grows into the blood clot to close the hole permanently. This process continues for several days. Endothelial cells grow over the vascular surface of the clot to form a new smooth lining on the inside of the vessel (Guyton, 1977).

In a large artery where the blood pressure is high, there is no way to slow the flow of blood to allow time for clotting without applying external pressure at the site (Sirridge, 1974). Also, the greater the pressure in the vessel, the greater the mechanical stresses the clot will have to endure (Biggs, 1976). Since the femoral artery has a higher pressure than most vessels, initial compression of the artery or external pressure must be applied to counteract the internal pressure.

Procedure to Facilitate Clotting Following Angiocardiography

The common procedure to facilitate clotting after angiocardiography is to apply external pressure over the femoral artery for at least 10 to 20 minutes to ensure that a clot has formed to prevent

bleeding. Halpern (1964) reports that digital pressure over the puncture site prevents bleeding and enhances the closure of the puncture in the artery. This pressure must be maintained until there is no bleeding when the pressure is released. Improper digital pressure or a shortened duration of application of pressure may permit excessive bleeding.

Use of Pressure Dressings

Most of the data related to the use of pressure dressings following transfemoral angiography have been anecdotal. Only three research studies have been conducted on the use of pressure dressings following transfemoral angiography and none of the research dealt with the use of pressure dressings in patients having angiocardiographic studies. However, the basic procedure is the same for all angiographic studies using the transfemoral approach. The difference lies in the system being studied, the number of catheters used, the size of the catheters used, and the type of guide wires used.

The first study on the use of pressure dressings following transfemoral angiography was conducted by Christianson et al. in 1973 with 899 consecutive patients. This study entailed using a pressure dressing on the post-angiographic site for 16 to 24 hours on half of the patients and a bandaid on the post-angiographic site for the other half of the patients (Christianson et al., 1976).

In this study the post-angiographic complications were divided into four categories:

1. insignificant hematomas (blood loss less than 100 cc);
2. significant hematomas (blood loss greater than 100 cc);

3. bleeding requiring medical attention (requiring manual compression, ice bag, or pressure dressing);
4. femoral artery thrombosis (requiring arteriotomy or thrombectomy).

All patients were required to be at bed rest for four hours following the angiography. The pressure dressings or bandaids were removed from the site the following morning and the post angiographic site was examined and Christianson et al. found an "alarming occurrence" of skin reactions as a result of the pressure dressing or tape removal. The reactions that occurred were not described.

In relation to clotting, the results indicated no significant difference in the occurrence of insignificant hematomas (22.25% with pressure dressings and 23.12% without pressure dressings); no significant difference in those with significant hematomas (.52% with pressure dressings and .54% without pressure dressings); a significant difference in bleeding requiring attention (.52% with pressure dressings and 3.76% without pressure dressings); and no significant difference in those with femoral thromboses (0% with pressure dressings and .27% without pressure dressings). Based on the above findings, Christianson et al. recommended pressure dressings be applied to the post-angiographic site for 16 to 24 hours following transfemoral angiography (Christianson et al., 1976).

Christianson et al. stated in their conclusions that two-thirds of the patients in their study had hypertension. They also stated that this had a positive influence on the increased incidence of delayed bleeding in the group without pressure dressings. Therefore they could

not predict the usefulness of their findings to the normotensive population (Christianson et al., 1976).

In 1964 Halpern reported his experiences with angiography procedures. That report contained statistics on the local complication rate following angiography in 1,000 consecutive normotensive and hypertensive patients. He used pressure dressings on all patients. His results were 12 cases of significant hematomas (1.27%), 4 cases of bleeding with or without hematomas (.4%), and 4 cases of thrombosis requiring surgery (.4%) (Halpern, 1964). Halpern did not address the issue of skin reactions due to pressure dressings.

Another study on this topic was done by Eisenberg and Mani in 1974. They reviewed the records of 900 consecutive patients who had transfemoral angiographic studies. They tabulated the local complication rate based on Christianson et al.'s criteria, except that they excluded the first category of insignificant hematomas. Their criteria were:

1. significant hematoma (blood loss greater than 100 cc requiring no treatment);
2. hematoma or bleeding requiring some medical therapy;
3. any surgical intervention for femoral artery thrombosis

(Eisenberg & Mani, 1977).

Eisenberg and Mani, however, did not use pressure dressings on the angiographic site of any of their patients post-transfemoral angiography. They had discontinued the use of pressure dressings four years earlier. Their study compared their statistics in the non-use of pressure dressings with those of Christianson et al. and Halpern.

In reviewing the records of 900 consecutive patients, both normotensive and hypertensive without pressure dressings following transfemoral angiographic studies, Eisenberg and Mani found a 0.2% rate of significant hematomas, a 0.1% rate of bleeding requiring treatment, and a 0.1% rate of arterial surgery. Since the surgery was done because a piece of catheter broke off during the procedure, the actual thrombosis rate was 0%. All of these rates were lower than those of Christianson et al. and Halpern. Therefore, Eisenberg and Mani (1977) concluded that pressure dressings were not needed post angiography. They did not discuss the issue of skin reactions.

The total local complication rates of all three studies are as follows:

1. Christianson et al. had a total complication rate of 1.0% with pressure dressings;

2. Christianson et al. had a total complication rate of 4.53% without pressure dressings;

3. Halpern had a total complication rate of 2.0% with pressure dressings.

4. Eisenberg and Mani had a total local complication rate of .4% without pressure dressings. (Appendix B contains a summary of the local complication rates following angiographic studies as reported by Eisenberg and Mani.)

In the study by Christianson et al. (1976) a questionnaire was also sent to 45 angiographers concerning the use of pressure dressings, to determine the local complication rates they experienced. Christianson et al. reported that 13 angiographers used pressure dressings and 32 did

not. The length of time the pressure dressings were in place varied from 2 to 24 hours. Their rationale for use or non-use of pressure dressings was reported as "personal experience" in all responses. Most of the angiographers reported that they rarely observed significant hematomas. Most of the angiographers also reported similar complication rates despite the disparity in the post-angiographic care of the puncture site. This may suggest that the use of the pressure dressing does not make a difference in the rate of delayed bleeding.

There was a wide variety of angiographic studies using the trans-femoral route reported in the literature. Their local complication rates all varied. The incidences cited for delayed bleeding were 2% for Green et al. (1972), 3% for Amplaz (1962), 0% for Shah (1975), and .9% for Segstedt (1978); all were insignificant complication rates.. None of these studies indicated whether a pressure dressing was used or not. Once again skin alterations were not addressed.

In 1975 Lebowitz and Lucia reported a 1.1% delayed bleeding rate from the puncture site following 1,250 angiocardiography studies. They did not use any pressure dressings. These were the only data that were found pertaining specifically to angiocardiography studies. These results compare favorably with those of Christianson et al. and Halpern who both used pressure dressings. Skin alterations were not discussed.

In Europe, temporary pressure over the puncture site and a period of rest following the procedure represent the total care of many of the patients after angiograms. The same approach is used by many of the cardiopulmonary laboratories in the United States following angiographic studies (Halpern, 1964).

Possible Causes of Delayed Bleeding

The reasons for delayed bleeding are both varied and conflicting. Green (1972), Kafkas et al. (1969), Sigstedt (1968), Schoonmaker (1974), and Luke and McGraw (1975) all have stated that hypertension is a contributing factor to delayed bleeding after angiographic studies. However, Eisenberg and Mani (1976) and Morris and Bouhoutos (1975) disagree. In a study by Eisenberg and Mani (1976) the difference in complication rates between hypertensive and normotensive patients was insignificant. Most of the reports in the literature regarding hypertension as a cause of delayed bleeding are anecdotal or impressionistic.

One of the factors that was mentioned in the literature most often as a contributing factor to delayed bleeding was catheter manipulation. There can be traumatic introduction of the catheters and traumatic advancement of guide wires into the femoral artery especially with inexperienced angiographers (Adams et al., 1973; Christianson et al., 1976; Green, 1972; Kafkas et al., 1969; Lang, 1967; Verel & Richards).

The site chosen for the femoral puncture appears to play a role in delayed bleeding (Kafkas et al., 1969; Lang, 1967; Verel & Richards, 1971). It was also reported by Verel and Richards that the angle at which the arterial wall was punctured was considered to be the most important factor in the amount of hemorrhage following angiography. He stated that because of the nature of the supporting structure surrounding the artery, the puncture needs to be made 2 to 3 centimeters below the inguinal ligament. At that site the artery is well supported on all sides by a tough fibrous tissue. In other areas the supporting structures are not as firm.

Other angiographers report that the number of catheters used for the study also has an effect on delayed bleeding. Verel and Richards (1971) disagree, saying that the size of the catheter or the number of catheters used is unrelated to bleeding.

Local conditions of the artery are also mentioned as a contributing factor to bleeding or hematomas (Christianson et al., 1976; Green, 1972; Long, 1967; Morris & Bouhoutos, 1975). Improper compression or initial compression for an inadequate time period have also been reported to cause bleeding (Amplaz, 1962; Christianson et al., 1972; Halpern, 1964; Lang, 1963). To be appropriate, external compression should be applied just proximal to the puncture site. Also, the improper application of the pressure dressing or displacement of the pressure dressing have been associated with delayed bleeding (Halpern, 1962; Long, 1967). In addition, early ambulation can promote the complication of delayed bleeding (Green, 1972; Lebowitz & Lucia, 1975).

Another important factor mentioned in the literature is the use of heparin with angiography and its contribution to delayed bleeding. There are many conflicting reports as to the efficacy of this therapy. Walker (1973) states that there was no increase in frequency of delayed bleeding in the heparinized patient but that the duration of the initial pressure needed to be prolonged. Wallace et al. (1972) reported the same results. However, Antonavic et al. (1976) reported that the use of systemic heparinization increased the incidence of delayed bleeding at the femoral site post angiography.

As evidenced from the literature, the causes of delayed bleeding have not been validated. Proper care of the site post angiography is

also controversial. There appear to be conflicting reports in the literature regarding the use of pressure dressings on the femoral puncture site. Some physicians use no pressure dressings and other physicians keep pressure dressings on for up to twenty-four hours.

Side Effects of Pressure Dressings

The pressure dressing can be considered a local irritant of varying degrees of severity to individual patients. In a study by Christianson et al. there was an "alarming" occurrence of skin reactions due to the adhesive tape used with the pressure dressing. Hypoallergenic tape was substituted in their study and the skin reactions decreased but were not totally eliminated. According to Christianson the pressure dressing also causes varying degrees of discomfort to the patient.

Eisenberg and Mani (1976) reported they discontinued the use of pressure dressings because a number of unsuspected hematomas and recurring incidences of oozing of blood were discovered under the dressings. They also stated that routine post-angiographic orders for inspection of the puncture site by the staff nurses were frequently frequently not adhered to because of the time-consuming efforts of removing and replacing the dressing.

Importance of Intact Integument

An intact integumentary system is vital to the emotional and physical well-being of an individual. The functions of an intact integument are numerous. The integument serves as a protective barrier between the host and the external environment to maintain homeostasis.

It protects against foreign bodies, ultraviolet rays, friction, heat and cold, and bacterial invasion (Wilkinson, 1969). It prevents the body from dehydrating and from absorbing various substances. The integument is also an important regulator of body temperature. Secretion and a limited amount of excretion are also functions of an intact integument (Crouch, 1972).

The integument consists of two layers. The outer layer is the epidermis and the underlying layer is the dermis. The epidermis consists of five layers. The outermost layer is the stratum corneum or horny layer; next is the stratum lucidum, the stratum granulosum, the stratum spinosum, and next to the dermis is the stratum germinativum (Junqueira & Carneiro, 1980). The epidermis ranges in thickness from .07 to .12 mm over most of the body.

The dermis or corium is a layer of dense connective tissue. It consists of an outer papillary layer which fits into the underside of the epidermis and the reticular layer which is the inner layer that blends into the hypodermis (Crouch, 1972).

The actual barrier in the integument system is in the stratum corneum. It is composed of dead epidermal cells compressed into a dense membrane usually 10 to 15 layers thick. It is a two way barrier. As long as the stratum corneum and epidermis are intact they prevent loss of substances such as water, sodium, chloride, etc. from the body. At the same time they also keep out dangerous and unwanted organisms such as bacteria or other chemicals (Baker, 1974).

Transepidermal absorption of various materials has been studied by Wolf and Sgakall. Wolf developed a method for removing the stratum

corneum and barrier layer by applying tape to the skin and then removing it. This has come to be known as "stripping". It has been found that the removal of the barrier allows a markedly increased absorption of almost any material placed on the skin surface (Sternberg, 1964).

Once a substance passes through the superficial barrier from the outside, it can diffuse into the entire epidermis. Following this, the substance can also pass into the dermis or corium and then into the circulation via the capillaries. However, some substances are stopped by a second barrier at the dermal-epidermal junction (Sternberg, 1964). With normal miotic activity and desquamation, the epidermis regenerates in about 28 days (Luckman & Sorenson, 1980). However, after stripping, barrier regeneration is shown to occur in 72 hours (Sternberg, 1964). The exact location of the barrier is not known. Since substances only penetrate the skin after injury or after removal of the stratum corneum, it has been postulated that the barrier is located within the stratum corneum.

An injured area of skin or loss of the barrier function can be a source of entry for infection. There are normally a large number of resident bacteria (coagulase positive staphlococcus, coagulase negative staphlococcus, diptheroids, mycobacterium, and pseudomonas) on the skin, especially in the warm moist groin area (Luckman & Sorenson, 1980). As long as the skin remains intact, infection does not occur. However, if the skin is damaged and the stratum corneum is removed, as happens with tape removal, the chance for infection is present.

Effects of Tape

Tape presents a problem for the integumentary system. The main property of tape is that it must adhere to the skin and is expected to be removed without difficulty (Harkiss, 1971). However, tape removal is often difficult. To make tape removal more comfortable for the patient, the skin should be shaved and the area dried before application of the tape (Johnson & Johnson, 1972). This process also makes the tape adhere to the skin better.

In the past, most tape reactions were considered to be of allergic origin because tapes consist of heterogeneous complex mixtures of organic compounds. However, recent investigations have found that allergic responses to tape are only a very small proportion of all of the reactions that are seen. Most reactions that are seen are due to other factors such as mechanical and chemical irritation (Johnson & Johnson, 1972). Allergic reactions are usually characterized by erythema, edema, papules, vesicles, and sometimes desquamation. Usually the skin reaction becomes more severe the longer the tape is left in place (Johnson & Johnson, 1972). Itching is almost always present (Harkiss, 1971).

Mechanical irritation results from removal of the tape. The first response of the skin is vasodilation which is transitory and does not damage the skin. However, the second response in mechanical irritation is skin stripping. Skin stripping is a traumatic mechanical response in which one or more layers of the epidermis are removed along with the tape causing some degree of damage to the epidermis. Mechanical irritation is the predominant cause of skin damage due to tape. As a result

of mechanical irritation, the skin becomes erythematous and can have varying degrees of epidermal damage.

Chemical irritation from tape occurs when the irritating compounds in the tape permeate the underlying tissues of the skin. When a portion of the stratum corneum has been removed, as with shaving the skin, the barrier capacity of the skin is decreased. In this situation, any irritating components of the tape have a ready access to the underlying tissues. When these substances penetrate the stratum corneum they can cause a degree of irritation that is much greater than would be observed on intact skin (Johnson & Johnson, 1972). It is very difficult to distinguish between allergic, mechanical or traumatic and chemical reactions caused by tape (Harkiss, 1971).

The presence of the tape over the skin results in blocking of sweat ducts, impedance to dekeritinization and the setting up of a traction or shearing force, especially when the tape is stretched over the skin. During removal of the tape, hairs may also be pulled out of their hair follicles (Harkiss, 1971). Usually there is no bleeding that occurs when tape is removed but sometimes nerve endings are exposed which makes the denuded area very painful (Luckman & Sorenson, 1980).

Statement of the Problem

This study was designed to answer the questions: (1) is there a relationship between the use of pressure dressings post angiocardiography and the incidence of alterations in skin integrity? (2) is there a relationship between the length of time a pressure dressing remains on the femoral site of the patient post angiocardiography and the degree of

alteration in skin integrity? and (3) is there a relationship between the complication of delayed bleeding and the use or non-use of a pressure dressing post angiocardiography?

Statement of Predicted Outcomes

The hypotheses that this research was designed to explore are that: (1) post angiocardiographic patients with pressure dressings over femoral sites will have an increased incidence of alterations in skin integrity when compared to patients who do not have pressure dressings over the site; (2) there is a positive relationship between the length of time a pressure dressing remains on the femoral site of the post angiocardiographic patient and the degree of alteration in skin integrity; and (3) there is no relationship between the complication of delayed bleeding and the use or non-use of pressure dressings post angiocardiography.

Rationale

When the technique of angiocardiography was first developed, pressure dressings were widely used. The use of pressure dressings is now controversial. Many physicians still use pressure dressings only because they have always used them. In the city of Portland, Oregon, almost all of the physicians in six of the seven major hospitals use pressure dressings following angiocardiography procedures. However, in one of the seven major hospitals, no pressure dressings are used. The physicians' rationale is that their patients do not have any greater

incidence of delayed bleeding than the patients of those physicians who use pressure dressings.

Given the physiological mechanisms of hemostasis, it would appear that the application of external pressure over the femoral site for an appropriate period of time is sufficient to deter bleeding and that a pressure dressing is not necessary.

Because of the wide usage of the pressure dressing following angiocardiography in this city, and given the skin reaction that pressure dressings can cause, it is imperative that the incidence of skin reactions be documented. Because of the low incidence of bleeding as a complication, the discrepancy over the effectiveness of the pressure dressing in decreasing the incidence of delayed bleeding and the potential alteration in skin integrity that can be caused by the pressure dressing, perhaps it would be better to delete the pressure dressings. Unfortunately, there are no empirical data reported dealing with the relationship between pressure dressings and skin integrity.

Significance for Nursing

The use of the pressure dressing is of concern to nursing because nurses perform the majority of care for the post-angiocardiographic patient. The nurse is responsible for assessing the site to determine if there is hidden, overt or delayed bleeding or infection. A hematoma or bleeding into the abdomen or thigh can easily be missed when a large dressing covers part of the abdomen and thigh as well as the puncture site. Routinely, the site is assessed by the nurse every 15 minutes for an hour to an hour-and-a-half, then every half hour for an hour or two,

then every hour for the next 4-6 hours. If a dressing is present, this necessitates lifting off the dressing to view the puncture site. Proper assessment of the puncture site and the surrounding area cannot be made accurately with a dressing in place.

In most hospitals, the nurse is also responsible for removing the dressing after the designated time period. When the tape is removed, the horny layer of the epidermis and sometimes all five cellular layers of the epidermis are removed. This removes the protective barrier which can result in a reddened and irritated integument that is a potential site for an infection. In addition, some patients develop blisters from the tape or have allergic skin reactions to the tape. In these cases, the nurse has to care for these skin problems and educate the patient to treat them following discharge. This results in increased nursing interventions and a possible increase in the number of hospital days for the patient. Sometimes the skin area where the tape was removed creates discomfort for the patient and medication is required to decrease the discomfort. The nurse is also responsible for assessing the patient's comfort level and medicating accordingly.

If a pressure dressing is not used, the nurse can directly view the puncture site and make a more accurate assessment of the site. Also, the injury to the skin may be decreased or eliminated if the pressure dressing is not used.

It is difficult to assess the cost benefit ratio of not using versus using a pressure dressing because nursing interventions are hard to isolate and quantify in terms of cost to the patient. There is the cost of the gauze and the tape along with the time it takes to assess

and remove the dressing as well as the cost factor for treating any skin alteration that may occur. There is also the cost of the time that it takes to educate the patient in caring for the skin alteration at home as well as the medication for treatment.

Because of these factors, perhaps it would be more advantageous to the patient if the pressure dressing was deleted post angiocardiography.

CHAPTER II

METHODS

Setting for the Study

Physicians in the Portland area have been performing angiocardiographic procedures for approximately 20 years. At the present time angiocardiographic procedures are being performed in cardiovascular laboratories in seven major hospitals in the city. This study was conducted in three of the seven major hospitals that perform angiocardiographic procedures. In one of these hospitals, no pressure dressings are used following angiocardiography. In the two other hospitals pressure dressings are routine. Approximately 50-100 angiocardiographic cases per month are done at each of these major institutions. The three hospitals are of relatively equal size.

The procedure following the angiocardiography is basically the same in the three hospitals. External pressure is applied to the puncture site in the femoral area for approximately 10-20 minutes or until all bleeding has stopped. Then a pressure dressing is applied to the femoral area of the angiocardiographic patients in two of the institutions and no pressure dressing is applied to the femoral site of angiographic patients in the other institution.

Patients are transferred from the catheterization laboratory to their rooms for observation. The patients's vital signs, the puncture site, and the pedal and posterior tibial pulses are checked at specified

intervals by the nurse for at least 6 hours. The patients are confined to strict bed rest (flat in bed with the affected leg straight) for 6 hours or longer if indicated by the physician. If the patient has a pressure dressing in place, it remains on for at least 6 hours before the nurse removes it. However, a few physicians leave pressure dressings on until the following morning. The observations made by the nurse are recorded in the patient's chart in varying degrees of specificity.

Population and Sampling Procedure

The subjects for this study were chosen from the population of individuals who had been admitted to the three hospitals previously indicated. All subjects met the following criteria:

1. Had angiocardiography performed.
2. Had been hospitalized for at least 8 hours following the angiocardiography.
3. Had not had previous femoral grafts.
4. Had returned to their room following the angiocardiographic procedure.
5. Were not on anticoagulation medication such as coumadin or heparin.
6. Had been shaved prior to the angiocardiographic procedure.
7. Had had the site cleansed with Betadine at the time of angiocardiography.

A total sample of 107 subjects, 57 subjects from the hospital not using pressure dressings, and 25 subjects from each of the two hospitals that do use pressure dressings, who met the above criteria were included

in this study. This sample size was selected so that the subjects in the sample would be fairly representative of the population as a whole. This study used a sample of convenience.

There was no attempt to match the two groups in the sample. Also there was no attempt to control the variables that might have been related to skin irritation resulting from the use of pressure dressings, because there was no documentation concerning risk factors associated with skin alterations related to pressure dressings in the literature.

Design and Instrumentation

The design of this study was descriptive and correlational. A study specific instrument was used for data collection (see Appendix C). The data were collected by nurses who were instructed how to observe and record alterations in skin integrity using the data collection instrument.

The alterations in skin integrity were ascertained from direct observation at the time of removal of the pressure dressing in those patients with pressure dressings (approximately 6-20 hours post angiocardiography) and 6 hours post angiocardiography in those patients without pressure dressings. The skin was assessed for injury using the following categories: (a) no skin injury; (b) erythema; (c) erythematous with blister; and (d) some loss of epidermis. The patient was also assessed for the presence or absence of the complication of delayed bleeding. If pressure had to be applied to the site for slight oozing or frank bleeding any time after the patient returned to his/her room

following the procedure, this was considered to be indicative of the complication of delayed bleeding.

Age, sex, and blood pressure were also recorded on the data collection instrument. Age was recorded to ascertain if there was a tendency for any certain age population to have a greater degree of alteration in skin integrity. Sex was included to ascertain the ratio of females to males in this study sample. The blood pressures were recorded because the literature alluded to the fact that patients with hypertension had a greater potential of developing the complication of delayed bleeding, and therefore hypertension may be a significant risk factor. All blood pressures were taken 6 hours after the procedure while the patients were resting, to decrease the possibility of obtaining artificially high blood pressures due to anxiety prior to the procedure.

Variables that may affect alterations in skin integrity were not included in the data collection instrument nor were they controlled for since they had not been elucidated in the literature. Also not included in the data collection instrument were factors that possibly could influence the complication of delayed bleeding, e.g., experience of physician, number of catheters used, because this was not the main focus of this study, nor were they found to be consistently significant factors in the previously reported studies.

Analysis of Data

To analyze whether or not those post angiocardiographic patients with pressure dressings had a greater degree of alteration in skin

integrity than those without pressure dressings a contingency table (Table 1) was constructed. A tabulation of the frequencies from the data collection instrument was calculated. These data were analyzed using a t test, Pearson's r, Spearman's Correlation Coefficient, and Kendall Correlation Coefficient.

The length of time a pressure dressing remained on the femoral site post angiocardiography and the degree of alteration in skin integrity were observed and tallied on a frequency table (Table 2) to ascertain if there was a relationship between length of time a pressure dressing remained on the patient and the degree of alteration in skin integrity. The data were analyzed using Pearson's r and one-way analysis of variance.

To ascertain whether there was a relationship between the use or non-use of pressure dressings post angiocardiography and the incidence of the complication of delayed bleeding, a frequency table (Table 3) was constructed. These data were analyzed using Chi-square, a t test, and Pearson's r.

CHAPTER III

RESULTS AND DISCUSSION

This chapter contains both the results and the discussion of the study and is presented in the following manner: first, a generalized statement of the purpose of the study is given; second, the data collection technique is discussed; third, the sample is identified; and fourth, the statistical analyses of the data are presented.

Purpose of the Study

A review of the literature suggests that pressure dressings are not necessarily a deterrent to the complication of delayed bleeding post angiography. It suggests that there are a variety of factors that could influence the complication of delayed bleeding.

Because there is still widespread use of pressure dressings following angiocardiography, this study examined the relationship between the use of pressure dressings and the incidences of alterations in skin integrity. Also the length of time the pressure dressing remained on the patient and the degree of alteration in skin integrity was described. In addition, since pressure dressings are applied as a deterrent to bleeding, this study examined the complication of delayed bleeding post angiocardiography in the sample.

Data Collection Techniques

At three separate hospitals, nurses caring for post angiocardiographic patients were instructed how to classify the degree of skin alterations into one of four categories ((1) no injury, no erythema, (2) erythematous, (3) erythematous with blister, and (4) some loss of epidermis). They were also instructed concerning the criteria for delayed bleeding versus no delayed bleeding (delayed bleeding was any bleeding or oozing of blood that required external pressure to be applied to stop the bleeding). In addition, instructions were given on how to complete the data collection instrument (Appendix C).

The data were gathered following the removal of the pressure dressing by the nurse caring for the patient. The degree of alteration in skin integrity and length of time the pressure dressing remained on the patient were recorded using the data collection instrument. The degree of skin alteration was assessed and recorded 6 hours post angiocardiography on all patients that did not have pressure dressings on the femoral site.

Data were also recorded on all patients regarding: (1) the incidence of the complication of delayed bleeding up to 24 hours post angiocardiography; (2) blood pressure measurements 6 hours following angiocardiography; (3) age; and (4) sex. An identification number was recorded as well so that records could be verified if needed. This researcher made two to three visits to the hospitals to answer any questions the nurses had or to clarify the information that they had received on the prior visits. Telephone contact was maintained until

all the data had been collected. The data collection instruments were then collected from the three hospitals in the study by the researcher.

Description of the Sample

The sample in this study included 107 patients who had angiocardiographic studies performed in one of the three hospitals included in the study and who had met the preestablished criteria.

Originally the sample included 50 patients from one hospital where pressure dressings were not used routinely and 25 patients from each of the two hospitals that did use pressure dressings routinely on all patients. However, during the course of the study, 7 patients from the hospital that did not use pressure dressing routinely had pressure dressings applied. One pressure dressing was put on in the catheterization laboratory for an unknown reason and 6 patients had pressure dressings applied post angiocardiography because of oozing or delayed bleeding. Therefore, of the 107 patients in the sample, 57 (53.3%) patients had pressure dressings post angiocardiography and 50 (46.7%) patients did not have pressure dressings post angiocardiography. The final sample included 57 (53.3%) patients from one hospital where pressure dressings are not routinely used and 25 (23.4%) patients from each of the other two hospitals where pressure dressings are used routinely.

The ages of the individuals comprising the sample ranged from 18 years old to 81 years old, with a mean of 58 years and range of 63 years (Figure 1). There were 32 (29.9%) females and 75 (70.1%) males in the sample. The mean age and sex ratio compare with the other studies

reported in the literature. The blood pressures ranged from a low of 80/50 to a high of 160/78. This represents a normotensive population.

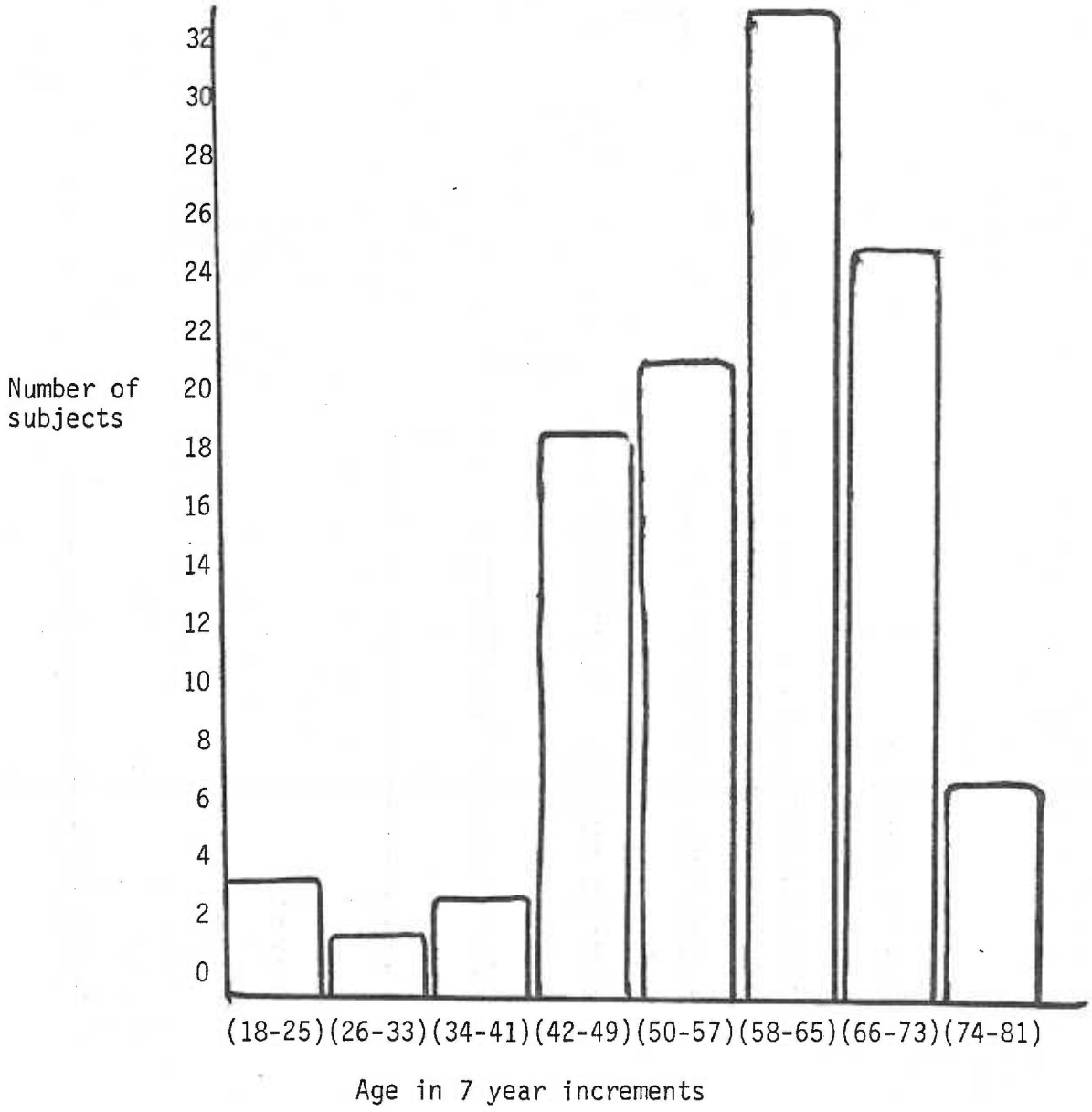

Figure 1. Distribution of sample subjects according to age.

Hypothesis I

The first hypothesis that this study was designed to explore was that post angiocardiographic patients with pressure dressings will have an increased incidence of alterations in skin integrity when compared to patients who do not have pressure dressings over the femoral site. Table 1 presents the relationship between pressure dressings and the incidence and degree of alterations in skin integrity of the individuals in this study.

The t test ($t = 5.80$, df = 56.0, $p < .001$), Pearson's r (.47, $p < .001$), Spearman's Correlation Coefficient (.54, $p < .001$), and Kendall's Correlation Coefficient (.53, $p < .001$) all confirm the hypothesis that post angiocardiographic patients with pressure dressings on the femoral site have an increased incidence of alterations in skin integrity when compared to those patients who do not have a pressure dressing over the femoral site. The hypothesis was accepted.

The individuals in the group without pressure dressings had 0% incidence of alterations in skin integrity while the individuals in the group with pressure dressings had a 47% incidence of alterations in skin integrity. The degree of alteration in skin integrity in the total sample (those individuals with and without pressure dressings) compared with individuals with pressure dressings (Figures 2 and 3) indicates 80 individuals (74.1% of the sample) without skin alteration in the total sample and 30 individuals (56.2% of the sample) in the group with pressure dressings. A total of 27 individuals (47.4% of the sample with pressure dressings and 25.2% of the total sample) had some degree of alteration in skin integrity.

Table 1

The Relationship Between Pressure Dressings and the Incidence and Degree of Alteration in Skin Integrity

	No skin injury	Skin erythematous	Skin erythematous with blister	Skin erythematous with some degree of loss of epidermis	Total
Pressure dressing	30 (52.6%)	23 (40.4%)	1 (1.8%)	3 (5.3%)	57 (53.3%)
No pressure dressing	50 (100%)	0 (0%)	0 (0%)	0 (0%)	50 (46.7%)
Total	80 (74.8%)	23 (21.5%)	1 (0.9%)	3 (2.8%)	107 (100%)

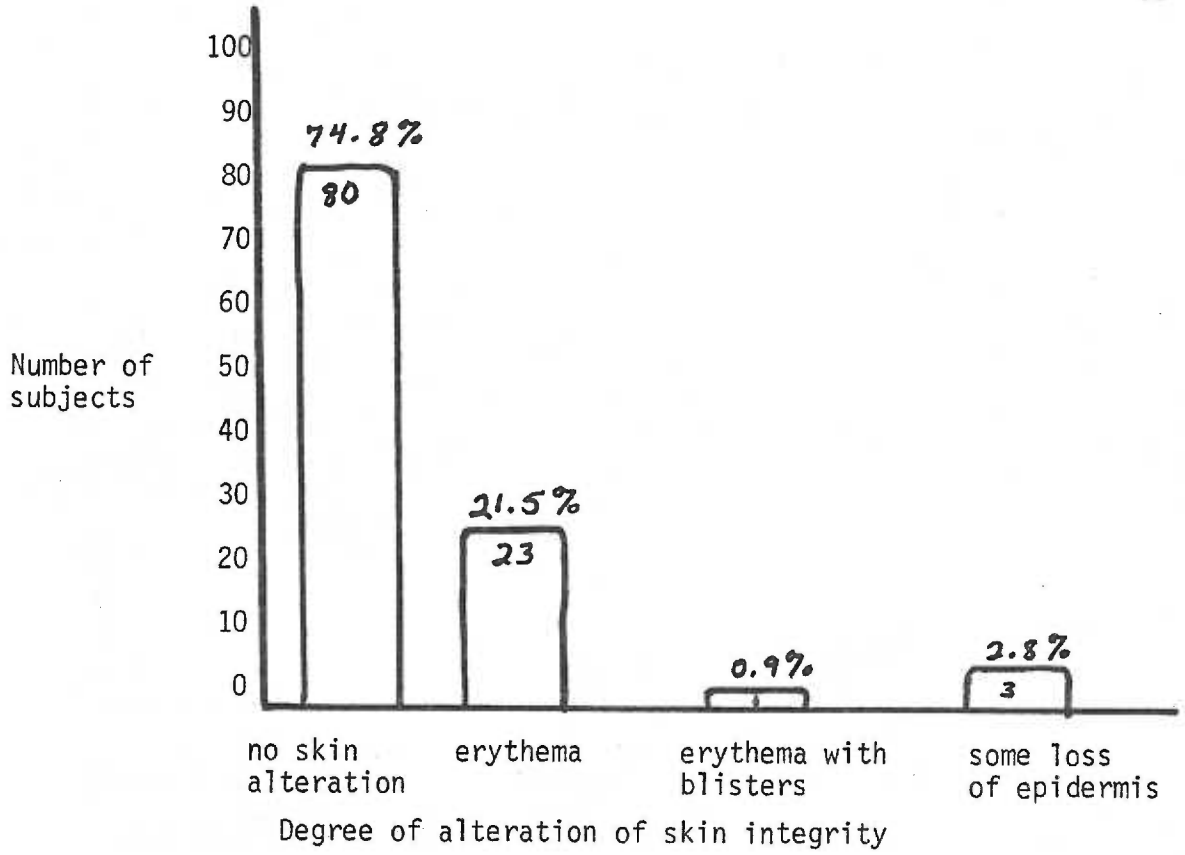

Figure 2. Degree of alteration in skin integrity in the total sample.

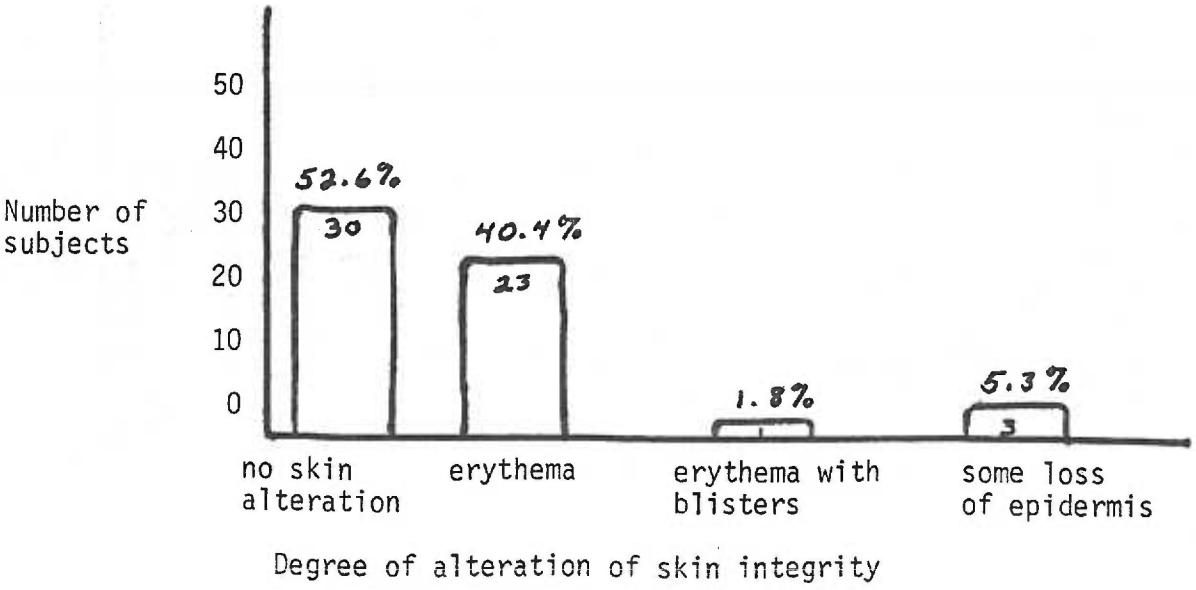

Figure 3. Degree of alteration in skin integrity in patients with pressure dressings.

Additional factors that could have affected the results of this study would be alterations in skin integrity due to the shaving process or the betadine preparation on the skin. All patients in the study had both shaving and the betadine preparation prior to the procedure. It appears that none of the patients without pressure dressings had any damage from the shaving process or the betadine preparation. Thus it is possible, but unlikely, that the shaving process or the betadine preparation could have resulted in or added to the degree of damage to the skin integrity in those patients with pressure dressings post angiocardiography.

Still other factors that may have influenced the results of this study could have been the age of the patient, the nutritional status of the patient, the hydration status of the patient, and certain disease processes and other factors that may affect skin integrity. None of these variables were controlled for in this study because it was a convenience sample.

However, the ages of the patients in the study were recorded to see if there was an increased incidence of alteration in skin integrity in the older population. Of the 23 patients in category 2, erythematous, the ages ranged from the youngest in the study (18 years) to the oldest in the study (81 years) with a mean in the 56-65 year range. In category 3, erythematous with blister, there was only one patient, age 73. The three individuals in category 4, some loss of epidermis, were all within the age range of the sample mean. Therefore it is unlikely that the skin alterations were related to age. The alterations in skin integrity according to age are depicted in Table 2.

Table 2

The Distribution of Subjects by Age According to Alterations in Skin Integrity

Age	No skin alteration	Erythema	Erythema with blisters	Some loss of epidermis	Total
17-25	0	3	0	0	3
26-33	1	0	0	0	1
34-41	1	1	0	0	2
42-49	15	4	0	0	19
50-57	19	2	0	0	21
58-65	22	6	0	3	31
66-73	17	6	1	0	24
74-81	5	1	0	0	6
Total	80	23	1	3	107

Hypothesis II

The second hypothesis that this study was designed to explore was that there would be a positive relationship between the length of time a pressure dressing remained on the femoral site post angiocardiography and the degree of alteration in skin integrity.

The Pearson's r (.04, $p < .38$) and the One Way Analysis of Variance (F ratio = .79, $p < .51$) indicate that there was no relationship between the number of hours a pressure dressing remained on the femoral site and the degree of alteration in skin integrity. Therefore, this hypothesis was rejected.

The mean hours of duration of the pressure dressing was 8.7 hours. As depicted in Figure 4, only 5.3% of the sample (3 patients) had the pressure dressing on for less than 6 hours, 77.2% of the sample (44

patients) had the pressure dressing on from 6 to 11.9 hours, 12.2% of the sample (7 patients) had the pressure dressing on from 12 to 17.9 hours and 5.3% of the sample (3 patients) had the pressure dressing on for over 18 hours.

The majority of the patients in this sample fall into one category (6-11.9 hours). There were too few numbers in the other three categories for valid analysis. Had the sample sizes in the other three categories been larger the results may have been different. Table 3 illustrates the relationship between the duration of the pressure dressing and the degree of alteration in skin integrity.

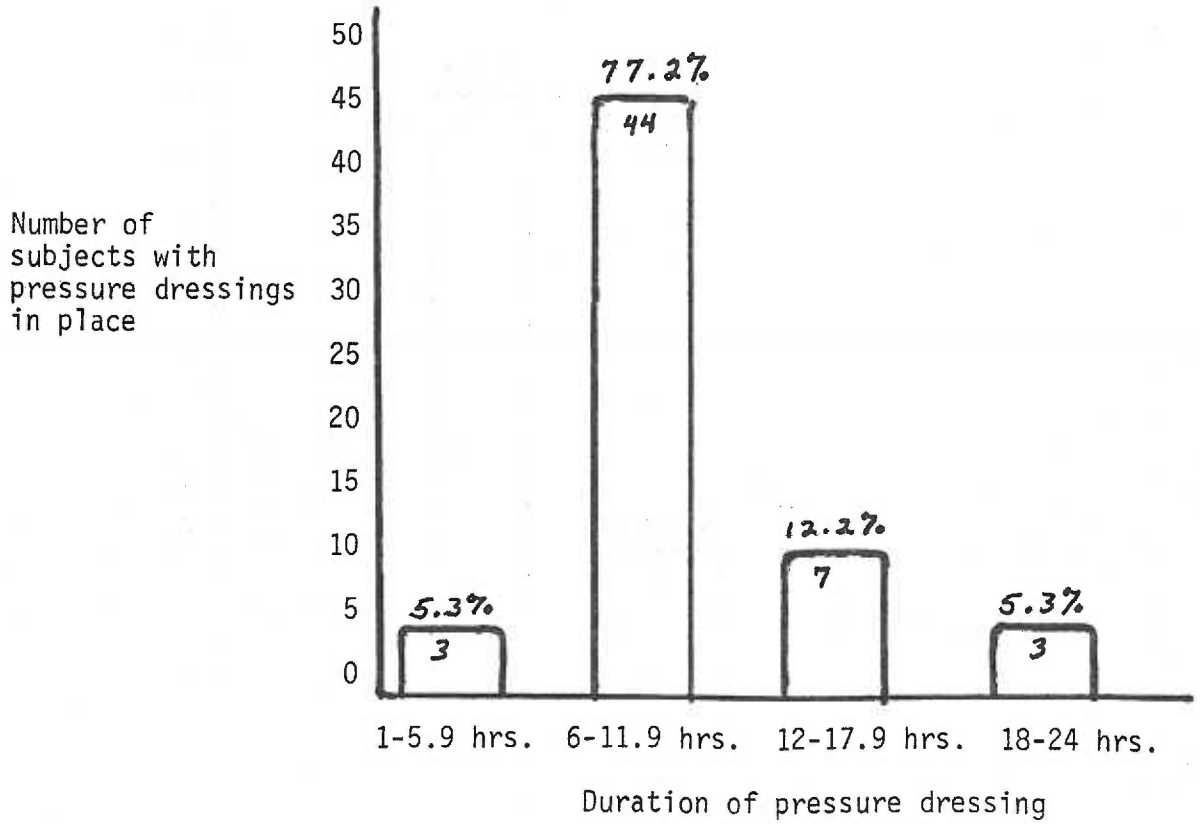

Figure 4. Length of time the pressure dressings remained on the femoral site in 57 patients with pressure dressings.

Table 3

The Relationship Between the Duration of the Pressure Dressing and the Degree of Alteration in Skin Integrity

Duration of pressure dressing	No erythema no injury	Skin erythematous	Skin erythematous with blisters	Skin erythematous with some degree of loss of epidermis	Total
On 1-5.9 hours	2 (66.7%)	1 (33.3%)	0 (0%)	0 (0%)	3 (5.3%)
6-11.9 hours	22 (50.0%)	19 (43.2%)	0 (0%)	3 (6.8%)	44 (77.2%)
12-17.9 hours	5 (71.4%)	2 (28.6%)	0 (0%)	0 (0%)	7 (12.3%)
Over 18 hours	1 (33.3%)	1 (33.3%)	1 (33.3%)	0 (0%)	3 (5.3%)
Total	30 (52.6%)	23 (40.4%)	1 (1.8%)	3 (5.3%)	57 (100%)

Hypothesis III

The third hypothesis that this study was designed to explore was that there would be no relationship between the complication of delayed bleeding and the use or non-use of a pressure dressing on the femoral site post angiocardiography.

The chi-square test (2.27, df = 1, $p < .13$) and the *t*-test ($t = -1.90$, df = 87.51, $p < .06$) indicate that there is no significant relationship between the variables. Pearson's r (.18, $p < .03$) indicates a very slight relationship between no pressure dressings and the incidence of delayed bleeding. This accounts for only about 3.2% of the variance. Therefore the hypothesis is accepted.

Table 4 illustrates that in 107 patients with and without pressure dressings, a total of 97 patients (90.7%) had no complication of delayed bleeding. A total of 10 patients (9.3%) had the complication of delayed bleeding. This complication rate exceeds any of those described in the literature. These 10 patients include those with slight oozing of blood to those with frank bleeding that had to have external pressure applied to stop the oozing or bleeding.

Two of the patients who bled were in the pressure dressing group. Eight of the patients who bled were in the group without pressure dressings. Six of the 8 patients who bled without a pressure dressing had a pressure dressing placed after pressure was applied. Two of the 8 patients who bled without pressure dressings did not have a pressure dressing put on after the pressure was applied.

Table 4

The Relationship Between the Presence or Absence of a Pressure Dressing and the Incidence of the Complication of Delayed Bleeding

	delayed bleeding	no delayed bleeding	row total
pressure dressing	2 (3.9%)	49 (96.1%)	51 (47.7%)
no pressure dressing	8 (14.3%)	48 (85.7%)	56 (52.3%)
column total	10 (9.3%)	97 (90.7%)	107 (100%)

CHAPTER IV

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

Interest in the subject of pressure dressings post angiocardiography was generated from a discrepancy noted between the current practice and the literature regarding the use of pressure dressings as a deterrent to bleeding post angiography. There is almost no information in the literature regarding the effects of pressure dressings on the skin. There was only one reference that suggested that some angiographers had found various degrees of skin reactions. No studies have been done regarding the effects of pressure dressings on skin integrity.

This descriptive study was conducted to determine the relationship between the use of pressure dressings post angiocardiography and the degree of alteration in skin integrity. The study also examined the length of time the pressure dressing remained on the femoral site and the degree of skin alteration to see if there was a correlation. The third aspect of this study dealt with the complication of delayed bleeding and the use or non-use of pressure dressings in the sample subjects.

The study sample was drawn from three hospitals in the Portland area that perform angiocardiographic procedures. Physicians in one of the three hospitals do not use pressure dressings and physicians in the other two hospitals do use pressure dressings.

The study sample included 107 subjects who met the criteria as outlined in the methods chapter. The age of the sample ranged from 18 years old to 81 years old with a mean of 58 years of age. Most of the patients in the study were late mid-life. Approximately 30% were female and 70% were male.

The data were gathered and recorded on a study specific data collection instrument by the nurses caring for the patients post angiocardiography. Other information was obtained from the chart and by direct observation by the nurses.

Overall, there was a high incidence (approximately 47%) of various degrees of alterations in skin integrity in the study sample with pressure dressings, when compared to no (0%) alterations in skin integrity in the study sample without pressure dressings. The vast majority of skin alterations were classified as erythema, which is a minor alteration in skin integrity. When both groups of subjects, patients with pressure dressings and patients without pressure dressings, were examined as an aggregate there still remained a strong correlation ($r = .47$) (approximately 25% of the sample) between the various degrees of alterations in skin integrity and the use of pressure dressings. The *t*-test, Spearman's Correlation Coefficient, and Kendall's Coefficient were all significant at the .001 level.

After analyzing the data concerning the length of time a pressure dressing remained on the femoral site and the severity of the degree of alteration in skin integrity, no correlation was found using the Pearson r ($.04$, $p < .38$) and the One-Way Analysis of Variance ($F = .789$, $p < .51$).

The incidence of the complication of delayed bleeding in this sample was found to be 10 patients (9.3%) out of the total sample of 107 patients. The chi-square test (2.27131, df = 1, $p < .13$) and the *t*-test ($t = -1.90$, df = 87.51, $p < .06$) indicated no correlation between the use or non-use of pressure dressings and the incidence of delayed bleeding. However, the Pearson r ($r = .18$, $p < .03$) indicated a very slight relationship between the complication of delayed bleeding and the non-use of pressure dressings.

Conclusions

While the results of this study cannot be generalized because of non-random sampling, this study does suggest that there is an increased risk of alterations in skin integrity in those patients who have pressure dressings placed on the femoral site post angiocardiography. There are no studies in the literature to verify or contradict these findings. The results should be viewed as a first step in the documentation process. Indeed, there could be other factors that could possibly cause alterations in skin integrity that were not addressed; for example, other disease processes, nutritional status, and hydration.

Because of non-random sampling and the few patients in three of the four categories of length of time, this study cannot predict any relationship between length of time a pressure dressing remains on the femoral site and the severity of the degree of alterations in skin integrity. There was no correlation between these two variables in this sample using the Pearson r and One-Way Analysis of Variance. There are

no studies in the literature to confirm or contradict these findings. Thus, again this must be viewed as an initial step in the documentation process.

Because of the various factors that could influence the complication of delayed bleeding, as stated in the literature, that were not controlled and non-random sampling, this study was not able to state whether or not a pressure dressing is a deterrent to the complication of delayed bleeding. However, the results of this study do suggest that the use or non-use of the pressure dressing has no correlation with the complication of delayed bleeding.

Limitations of the Study

Several weaknesses are inherent in this study due to the nonexperimental design. First, it was not feasible to do random sampling because of the structure of the post angiocardiographic procedures performed at the hospitals. It was impossible to manipulate the independent variable because the physicians in the hospital either used or did not use pressure dressings. The lack of manipulation of the independent variable and the non-random sampling prevents one from drawing strong causal conclusions. No cause and effect relationships can be drawn.

Second, the study was limited because of the low frequencies in some of the areas being studied. Third, there was no attempt made to control any other variables that may influence alterations in skin integrity. Fourth, there was no interrater reliability established even though there were many nurses assessing the sites.

Implications for Nursing

The results of this study suggest that patients with pressure dressings post angiocardiography do have increased alterations in skin integrity and that pressure dressings have no relationship to the complication of delayed bleeding. Therefore it may benefit the patient and the nurse if the pressure dressings were eliminated post angiocardiography.

If the pressure dressings were eliminated the nurse could visualize the femoral site with greater accuracy and in less time. Also any hematomas would be visualized sooner and the patient might suffer less discomfort requiring less pain medication. In addition, the patient would be spared the expense of the dressing, pain medication, and discomfort of the pressure dressing while it is on or when it is removed. Of greatest importance, of course, is that the patient would be spared the alterations in skin integrity that occur due to the pressure dressing.

Because of the high incidence of alterations in skin integrity with pressure dressings nurses should take great care when removing the pressure dressing from the patient to decrease the discomfort of removal and to try to decrease the skin alterations resulting from the removal of tape.

Recommendations

The following recommendations for further research are suggested as a result of this study.

1. A prospective study should be done incorporating random sampling and the manipulation of the independent variable. Physicians would need to consent to alternating pressure dressings and no pressure dressings in a randomly derived study sample. Information could then be gathered on the effects of the pressure dressing on skin integrity and delayed bleeding. A larger sample size might be of greater value so that it would be comparable to the other studies in the literature regarding delayed bleeding.

2. A prospective study with random sampling could be conducted with pressure dressings for 6 hours, 12 hours, 18 hours, and 24 hours with equal numbers of patients in each group to ascertain if there is a relationship between the length of time a pressure dressing remains over the femoral site and the degree of alteration in skin integrity.

3. A study should be conducted to ascertain and identify various risk factors related to the complication of delayed bleeding in order to identify the population at risk who might need to have pressure dressings applied post angiocardiography. At the present time the factors that are related to the complication of delayed bleeding are anecdotal.

4. A study of levels of discomfort experienced by the patient with and without a pressure dressing as measured by the amount of pain medication and voiced complaints of discomfort should be conducted.

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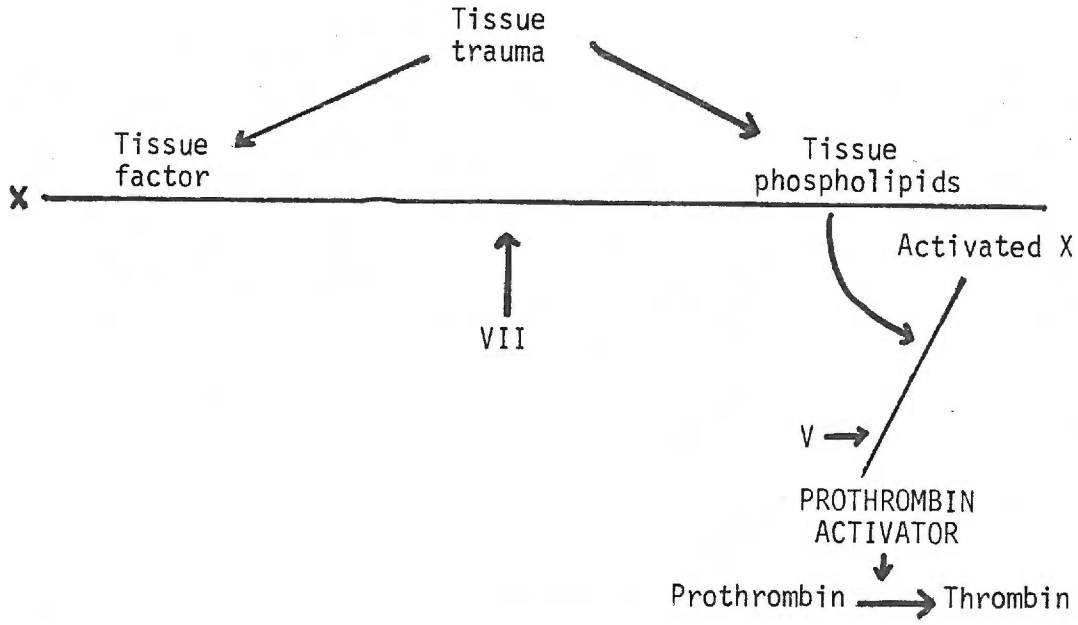
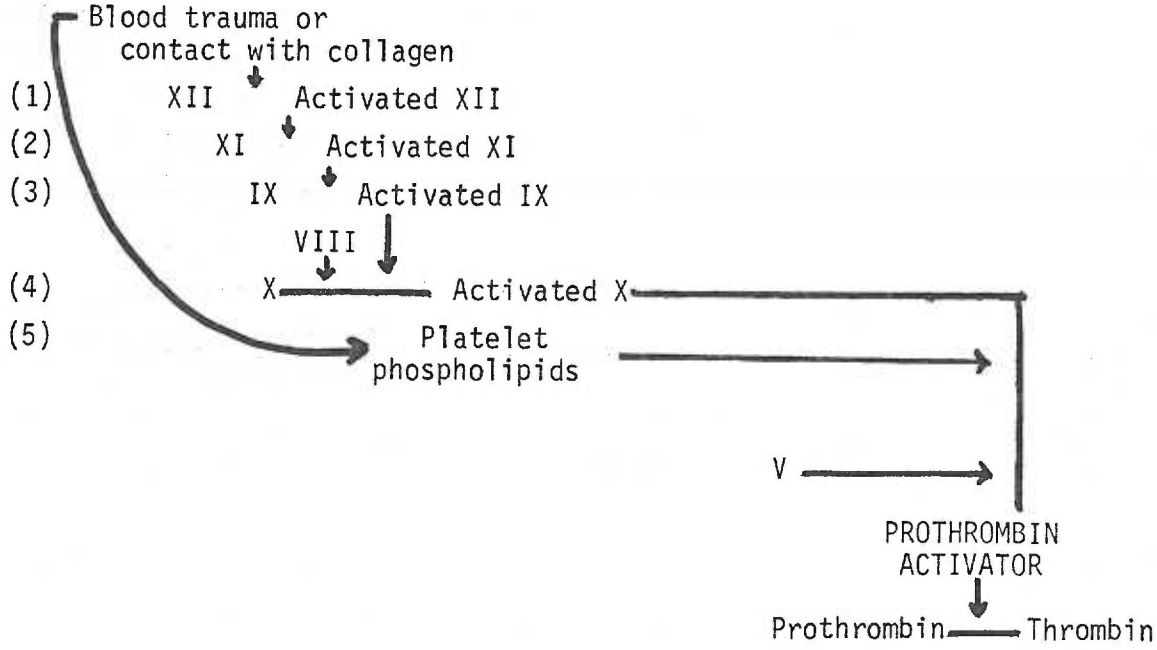
APPENDICES

APPENDIX A

A Schematic of the Chemical Events That Take Place in the Process of Blood Coagulation (by Arthur Guyton)*



The extrinsic pathway for initiating blood clotting.



The instrinsic pathway for initiating blood clotting.

* Arthur Guyton, Basic Human Physiology, 2nd ed., Philadelphia: W. B. Saunders, 1977, p. 95.

APPENDIX B

A Summary of the Local Complication Rates Following Angiographic Studies as Reported by Eisenberg and Mani

	Christianson et al.		Halpern	Eisenberg & Mani
	with pressure dressing	without pressure dressing	with pressure dressing	without pressure dressing
Hematoma - no therapy	2/382 (0.52%)	2/372 (0.54%)	12/1000 (1.2%)	2/900 (0.2%)
Hematoma or bleeding requiring therapy	2/382 (0.52%)	14/372 (3.76%)	4/1000 (0.4%)	1/900 (0.1%)
Complications requiring surgery, e.g. thrombosis	0/382 (0%)	1/372 (0.27%)	4/1000 (0.4%)	1/900 (0.1%)
Total local complication rates	4/382 (1.0%)	17/372 (4.53%)	20/1000 (2.0%)	4/900 (0.4%)

APPENDIX C

Data Gathering Instrument

Hospital Number	Age	Sex	BP	PD	No PD	# Hours PD on	1 No skin injury	2 erythematous	3 Erythematous with blister	3 Some degree loss of epidermis	Delayed bleeding	No delayed bleeding