THE EFFECTIVENESS OF PLASTER OF PARIS STRIPS AS A PROTECTANT FOR INTRAVENOUS SITES IN CHILDREN

A THESIS

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We hereby recommend that the Thesis prepared under our supervision by Jean Stuart Smith entitled "The Effectiveness of Plaster of Paris Strips as a Protectant for Intravenous Sites in Children"

be accepted as fulfilling this part of the requirements for the Degree of Master of Science.

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CHAPTER I

INTRODUCTION

The phenomenal technological advances of our times have been referred to as a revolution. Perhaps these advances could more properly be called an "evolution" characterized by a rate of change that is revolutionary. The climate these technological advances have produced requires sober and systematic appraisal at the interface between technology and the human being. Not only the technology itself and its staggering costs, but the ethical spirit to which nurses ascribe, force constant re-examination of patient care.

Countless numbers of children receive intravenous therapy each year and their numbers are growing. This study was intended to investigate a technique using strips of plaster of paris for protection to see if it improves the stability of an intravenous needle at the site of entry. Many factors comprise effective therapy; many items influence the desired outcome. Certain factors involve manual skills in the basic administration system. Patients present varying degrees of dependence on intravenous lines for infusion, medication, transfusions, and for meeting nutritional needs.

Pediatric fluid therapy has always presented a challenge to health care personnel for provision of safe fluid administration with minimal stress to the child. Nursing intervention involves assisting the child and his family to accept a procedure comprised of multiple stressors. All parenteral therapy in the initial stages is painful and frightening in varying degrees. Children may manifest a wide range of response to the procedure dependent upon their past experience, their stage of growth and development, and the present environmental situation. There is the phenomenon of emotional contagion between parent and child; stress that is relevant to one is reflected by the other. Since children's veins are usually small, and the venipuncture procedure is stressful, a well-placed needle is an artful procedure which requires careful maintenance.

Nurses consider both the child and his family's response to illness and hospitalization and strive for optimal means in treatment modalities. Because of the demands to manage sophisticated equipment, assess patient needs, deliver services, and evaluate effectiveness, nurses are committed to researching procedures which expedite efficient delivery of care to children.

Statement of Problem

The problem of this study was to determine the effectiveness of plaster of paris strips applied as a protective hood to needle entry sites in pediatric intravenous therapy as compared to the effectiveness of collodion protected needle entry sites in intravenous therapy of hospitalized children under the age of five years.

Purposes

The purposes of this study were to:

1. Determine the length of time an intravenous needle site remained functional when covered by plaster of paris strips

2. Determine the length of time an intravenous needle site remained functional when covered with collodion

3. Compare the length of time an intravenous needle site remained functional using plaster of paris with the time an intravenous needle remained functional using collodion

4. Identify the number of children requiring restraints during infusions when needle sites were covered with plaster of paris strips

5. Identify the number of children requiring restraints during infusions when needle sites were covered with collodion

6. Compare the number of children requiring restraints when needle sites were covered with collodion with the number of children requiring restraints when needle sites were covered with plaster of paris

Background and Significant

A primary clinical function of the nurse responsible for intravenous therapy is to maintain constant and accurate flow of the intravenous solution. In spite of common acceptance that intravenous infusions are stressful experiences for children, this modality is the treatment of choice in increasing numbers of situations (Torrance 1968). Each hospital establishes its own intravenous equipment standards and approves its own criteria for the procedure of administration of intravenous therapy.

Improvement in the quality and effectiveness of patient care is a moral obligation in the nursing process (Notter 1974). The technique of pediatric fluid administration must be based on systematic assessment of the child's particular needs and problems. Malfunctioning intravenous therapy may (1) lead to toxic or delayed patient response, (2) increase the possibility of either phlebitis or thrombophlebitis, (3) create metabolic problems, (4) heighten stress to the child, family, and/or

staff, (5) prolong the recuperative process, and/or (6) lengthen hospitalization (Turko 1976).

Veins that will accept and tolerate needles and indwelling catheters have earned profound respect. Intravenous therapy is an aspect of modern clinical care that has its own particular problems as well as rewards (Rosenfield 1974). There are many ingredients of effective intravenous therapy for children and most basic is the nurse's choice of needle and selection of the site. The choice of needle is dependent on the axiom: utilize the smallest gauge possible that will allow sufficient fluid flow and that will minimize needle-to-vein-wall contact. The needle must be placed within the venous flow and stabilized with maximum security (Waechter 1976). Factors that influence site selection are (1) the age and development of the child, (2) the condition of the veins, (3) the purpose of the infusion, (4) the expected duration of fluid therapy, and (5) the comfort of the child (Podratz 1976).

A review of the literature emphasized the need for adequately immobilizing the needle of an intravenous drip. A comfortable and effective means of stabilizing the intravenous needle is essential, yet there is a paucity of material to indicate methods. Waechter reflected the

unspoken approach of most authors describing parenteral techniques:

> The same method of immobilization that is used for the adult is satisfactory for the older child. With adequate taping, the child may not have to concentrate on maintaining a fixed position (1976, p. 806).

Leiffer (1977), in describing the use of a scalp-vein set, informed the reader that the needle unit may be firmly anchored to the patient's head with adhesive tape. In subsequent instructions, the author illustrated immobilizing the child's head with sandbags and suggested the use of clove hitch restraints for extremities.

Many pediatric nurses have seen restraints as an inevitable part of the treatment regime; others have chosen to take judicious chances by releasing children even though any movement may pose the threat of dislodging an intravenous line. To deprive a child of mobility is to take away his best avenue of coping with stress. Dowd, Novak, and Ray (1977) instituted a study to determine how nurses, in the best interest of the child, could deal effectively and realistically with the concept of restraints. The response of children being restrained revealed definite patterns of crying, struggling, and decreased activity levels when temporarily freed. This study cited both physiologic and psychologic research that was convincing

of a child's need for movement. Restraints are known to (1) affect physiologic function of all body systems, (2) delete the major form of a child's self-expression and protection, (3) inhibit sensory stimulation by which children develop body language, and (4) block all means of motor contact with the environment. Movement poses a threat to the efficacy of a parenteral fluid line; restraints pose complication to children (Dowd, Novak, and Ray 1977).

One day of immobilization can result in 3 percent loss of muscle strength (Dowd, Novak, and Ray 1977). The percentage of emotional stress of the hospitalized child is more difficult to measure. If a child is able to master stress he will gain optimism along with greater capacity for future mastery; he will experience growth rather than devastation (Spenner 1974).

Hospitalization places the child in unfamiliar surroundings where, in a state of increased dependency, he may feel small, powerless, and insecure. He experiences numerous threats to his body integrity from treatment and/or diagnostic procedures and must deal with his fears and expectations from his developmental phase. Nursing implications involve consideration of both the child's and his family's responses to stress (Marlowe 1977). Faust

(1973) reported that the most traumatic procedures for children in the hospital were those involving the use of needles. The findings reported the experiences as "stressful" and "fearful."

Descriptive studies of hospitalized children have pointed out the phenomena of parent-child emotional contagion (Campbell 1956). To facilitate constructive parent-child emotional contagion, stressful events in the child's treatment regime must be expertly managed. A malfunctioning infusion heightens the stress response of child, parent, and nurse.

In defining the pathological state of excessive stress, Hans Selye's (1956) research is the most comprehensive to date. Selye introduced the stress concept in 1936, and defined stress as "the rate of wear and tear in the body" as well as noting a particular pattern of physiological responses. Selye detailed this biological response pattern into the "general adaptation syndrome," GAS, consisting of three distinct phases. In the first stage, the "alarm reaction phase," defensive forces are mobilized. In the second phase, the "stage of resistance," maximum adaptation occurs, and in the third phase that of "exhaustion," adaptive mechanisms collapse and the stress is excessive and prolonged.

Selye (1956) also viewed the "body's adaptability" or "adaptation energy" as finite. Consequently, although adaptation is necessary for survival, the adaptive process in itself may be deleterious. The circumstances, situations, and stimuli which call forth adaptive energy may be of critical importance to individuals who are already coping with chronic stressful conditions. Repeated exposure to stress, even widely differing kinds of stressors, ultimately takes a toll. When the stage of exhaustion is reached, the ability to continue to adapt to the environmental demands is also exhausted (Selye 1956).

During stress, an individual is more prone to infection, his adrenal system is in full alarm status, and the hormonal changes result in catabolic events. Since countless stimuli can evoke the stress syndrome, the nurse must recognize the influence of stressors on the patient's therapeutic progress. A purely physical, localized stressor can bring the body's entire stress mechamism into action (Pelletier 1977).

In the interest of preventing needle dislodgment, pediatric staffs exercise great care when stabilizing a venipuncture. Adhesive tape in varying widths and designs is foundational. In addition to adhesive tape, collodion as a protectant is a common and effective additive at the

site to aid immobilization of the lumen. Collodion is a clear, viscous liquid that dries with sealing properties. It is flammable and requires the use of acetone for removal, yet it possesses protective capacities to immobilize the needle hub and cover it with a resistant shield (United States Pharmacopeia Committee of Revision 1975).

Another protectant which has indicated value is that created by the use of plaster of paris strips. The use of plaster in this manner has been a new concept to the local geographic area. Because the method is new, there is a dilemma among nurses concerning values and deterrents. Pediatricians order its use, but there is no literature available on which to base nursing judgments. Data were gathered on fifteen patients at a children's hospital in the southwestern part of the United States to document I.V. therapy situations occurring between October 22, 1977, and November 10, 1977. During this time a child had developed blisters on the palm of his hand when plaster was the I.V. site protectant. The study revealed that among the fifteen patients cited, two others had also acquired blistered skin during I.V. therapy although their needls sites were secured with adhesive tape and collodion rather than plaster. It was concluded that the blistered skin in

all three instances was caused by excessive perspiration from supportive padding and not by the collodion or the plaster.

In all pediatric I.V. therapy, adhesive tape is the means by which the needle is basically stabilized. Adhesive tape anchors the needle hub, the butterfly wings, or the intravenous catheter directly to the skin, initially securing the functional position. From this foundation, modes of skin puncture in children require further means of security. It is possible, in a minimal number of situations, to acquire adequate stabilization by increasing the amount and varying the position of ahesive tape alone. However, for the majority of children, the taping method is too maleable and its use results in infiltration even when combined with body restraints. Collodion application, over the site and directly to the skin, creates a clear seal or shield with a rigid surface increasing site immobilization and protection. Because of its chemical properties, it must be removed with acetone. Plaster of paris strips dipped in water and applied to the adhesive tape in the basic foundation provides a cast-like protectant. When moistened with water it can be removed entirely or its edges lifted to view the puncture site (Children's Hospital Report 1977).

The current study investigated the length of time intravenous (I.V.) sites were functional when needles were protected by plaster strips or by collodion and/or when restraints were an added necessity to maintain I.V. patency.

Hypothesis

To carry out the purpose of this study, the following hypothesis was tested: The use of plaster of paris strips applied to an intravenous needle site would increase the length of time the needle would remain in position to function properly as compared to collodion applied to a needle site.

Definition of Terms

Within the limits of this study, the following terms were used as defined below.

1. Plaster of paris--the commercially-prepared crystaline material of calcium sulfate dihydrate used to make casts and stiff bandages when mixed with water

2. Plaster of paris strips--3-by-1 inch pieces of fabric commercially-impregnated with calcium sulfate dihydrate powder

3. Adhesive tape--a fabric, one side of which is coated with an adhesive substance causing it to adhere to the material with which it is in contact

4. Collodion--a fiscous liquid containing pyroxylin that when dry forms a strong, thin transparent film useful in sealing a dressing

5. Intravenous (I.V.)--within or into a vein

6. I.V. infusion--administration of more than 100 cc of parenteral fluid into the venous system

7. Transfusion--administration of blood into the venous system

8. Hood--a covering to afford protection. Hood may have air-space between itself and needle or may lie flat on needle hub

9. Restraint--the process of confining from physical action by the use of immobilizing materials

10. Effective--producing the desired result and measured by whether or not I.V. is functional

11. Nurse--a graduate of a diploma, associate degree, or baccalaureate nursing school who is registered by the state in which he/she is practicing

12. Stress--any physical or psychological state of tension, strain, or pressure which results in a disturbance of equilibrium

13. Protectant--a fixed covering applied to immobilize an I.V. needle hub

14. Functional I.V.--needle operative with maximum benefit within vein allowing I.V. fluid to infuse within the blood stream

Limitations

Limitations for this study were as follows:

1. The sample size was small due to the seasonal reduction in hospital census

2. The degree of frustration and response to hospitalization of each child were unpredictable and not measured

3. Ths skill of the nurse starting the I.V. and immobilizing it would vary

4. The child's family support system would vary

5. The child's level of illness and level of consciousness would vary

6. Illness and a strange environment might precipitate regressive behavior in children

7. The choice of needls (butterfly, medicut, or angiocath) would be at the discretion of the nurse starting the I.V.

8. Hospital policy was that the intravenous site will be rotated every seventy-two hours "if feasible" (Children's Hospital 1978)

Delimitations

Delimitations for this study were the following:

1. Children from birth to age five years were involved in the study

2. Children requiring hospitalization on an in-patient basis were included

3. Children requiring intravenous infusion whose volume and/or rate of drip necessitated I.V. functioning over a period of hours and/or days were included

Assumptions

The following assumptions were made for this study:

1. A physician's written order proceeds the initiation of I.V. therapy

2. Registered nurses choosing to work in pediatric hospitals are responsive to the needs of children

3. A child five years of age and under is dependent on others for his safety

4. Registered nurses have the skill to initiate and monitor I.V. therapy

Summary

This study explored the usefulness of plaster of paris strips to stabilize I.V. needle sites in children and compared the effectiveness with that of collodion protected needle sites. Chapter II explores the impact of I.V. therapy on the current treatment of sick children, emphasizing the technical variables involved. The influence of child growth and development phases on the nursing management of infusion therapy is described as well as the resultant stress of an uncomfortable procedure. Chapter III describes how the study was conducted with the aid of the hospital staff. The results and the interpretation of the effectiveness of the two protectant methods are included in Chapter IV. Chapter V gives direction for future study based on the findings from this study.

CHAPTER II

REVIEW OF LITERATURE

The focus of this study was to evaluate the efficacy of two methods used to stabilize an intravenous needle in pediatric patients from birth to five years of age. Guidance for this task was researched in the literature pertinent to principles of intravenous therapy, theories of child development, and the theory and research concerning human stress. The review of literature was ultimately categorized into sections so as to provide information in response to the following questions: (1) What value does I.V. therapy have in current patient care? (2) What are the principles of human physiology that are pertinent to venipuncture and the maintenance of I.V. therapy? (3) What are the normal competencies of children from birth to age five years particularly those of motor development? and (4) What are the implications of restricted movement and ensuing stress to young children?

Historical Review

In the fall of 1974, a journal devoted to intravenous therapy joined the publication resources available to health care personnel. This journal was addressed to

physicians and nurses engaged in the intravenous aspects of medical care and justifies its publication on the consequence of burgeoning knowledge and technological proliferation (Rosenfield 1974). The journal is an indicator of the growth of a technique which demands consideration because of its complexity and its implications for nursing care. In sharp contrast Bergersen stated

> Intravenous therapy is such a common, everyday phenomenon in hospital patients that nurses are often less attentive to the problems and complications of I.V. therapy than is desirable . . . (1976, p. 76).

Sir Christopher Wren is said to have been the first person to inject drugs into the veins of living animals in about the year 1657, and six years later, J. D. Major made the first successful injection in man (Plumer 1975). From a very crude beginning, the technique for intravenous injection and a knowledge of its implications developed slowly over a century and a half. The latter half of the nineteenth century brought an increasing concern for safety in the administration of parenteral solution largely because of the work of Robert Koch and Louis Pasteur. In the middle 1920's Dr. Florence Seibert provided proof that chills and fever, which often followed intravenous infusion were caused by potent microbial growth which could be eliminated by distillation of water and by heating at elevated

temperatures all glassware involved with parenteral fluids (Martin 1965). The fifth edition of the National Formulary published in 1926 contained the first official standards for parenterals in the United States and listed only six injectable solutions. The current National Formulary (1975) contains 104 monographs and the United States Pharmacopia (1975) contains 191 monographs under the category of parenteral preparations. Thus, this rapidly growing number of I.V. fluids signifies their increasing importance among therapeutic treatment modes.

As with all treatment forms, there continue to be advantages and disadvantages to intravenous infusion. Immediate physiological action, the ability to circumvent the irregularity of intestinal absorption, provision of fluids and/or medications to patients in an unconscious or uncooperative state, and the required administration by a technically-knowledgeable person to implement accurate administration can be listed as advantages. Among the disadvantages of this treatment form are the requirement of asepsis, the real or psychological pain factor involved in its use, and the difficulty in correcting an error, should one be made. The need for the technically-trained personnel to initiate and monitor the procedure, is sometimes viewed as a disadvantage (Plumer 1975).

Technical Variables

Veins serve as conduits for transport of blood from the tissues back to the heart. Since the pressure in the venous system is very low, the venous walls are thin. Even so, they are muscular, a characteristic which allows them to contract or expand (Guyton 1971). By far the greatest amount of the blood in the circulation is contained in systemic veins, approximated at 59 percent of the total volume. The pressure at the beginning of the veins is about 10 mm Hg and decreases to about 0 mm Hg at the right atrium. This large decrease in pressure indicates the veins have far more resistance than might be expected for vessels of their size. Large veins have almost no resistance when they are distended and the pressure in the peripheral veins is usually 6-9 mm Hg greater than the right arterial pressure. The venous pressure can be estimated by simply observing the distention of the peripheral veins, especially the neck veins. In the sitting position, the neck veins are never distended in the normal person. However, if central venous pressure is increased as much as 10 mm Hg, the lower veins of the neck begin to protrude even in the sitting position. Raising or lowering an arm will also estimate venous pressure while observing the degree of distention in the antecubital fossa of hand veins (Guyton 1971).

Improvements and innovations in equipment have reduced hazards; sets and needles are now disposable, reducing risks of pyrogenic reactions and hepatitis. Prior to World War II, the metal needle was the method for infusing parenteral fluids. In 1945 the flexible plastic tubing known as the intravenous catheter was developed and introduced into the circulation by means of either a cut-down or a needle (Crossly 1972). In 1958 the Intracath, a plastic catheter lying within the lumen of the needle was introduced (Plumer 1975). The type of catheter lessened the need for the surgical procedure of the cut-down.

The first change in the steel needle appeared in 1957. McGaw Laboratories introduced what looked like an inverted rubber "T" or a small needle which was to be shortly followed by small vein sets with foldable wings replacing the metal hub. The traditional steel needle gave way to the winged infusion needle, since the latter provided more comfort and was less apt to infiltrate the surrounding tissue. Industry continues to provide equipment to increase the level of patient safety. Medications are commonly given intravenously, with 60 to 80 percent of infusion fluids containing additives. Proper handling and use of this equipment is vital to the patient's safety. I.V. therapy has come a long way since the 1940's when the sole

requisite of the intravenous nurse was the ability to perform a venipuncture skillfully. A new, exciting era has been reached in intravenous therapy, complicated by technical advances (Plumer 1975, Crossly 1972).

Modern intravenous infusion sets measure the amounts of fluid flow and maintain the flow at the prescribed rate. The flow rate can be determined by those sets whose calibration is established that 60 drops per minute is equal to 60 cc's per hour. One method is to reduce the size of the drop by the use of special sets which deliver 60 drops per milliliter. Because of the child's reduced heart size and smaller circulatory system, regulatory devices are essential to prevent fluid overloading (Pillitteri 1977). An additional contribution to patient care has been provided by an electrical monitor which controls the fluid flow at a predetermined rate. This device was created to eliminate the need to count drops by automatically adjusting the flow rate. The intent was that valuable nursing time would be saved and the risk of circulatory overload from a run-away infusion reduced. However,

> . . . volume control or interceptive measuring devices were developed specifically for use in very specialized intravenous therapy regimes. Through excessive and sometimes irrational use they have almost become the technique of choice in some hospitals. Many potential problems exist

> with these devices because of misuse, overuse and abuse (Henry and Harrison 1972, p. 69).

Familiarity with the principle underlying venous physiology is of prime value to the nurse. An understanding of the reaction of veins to the nervous stimulation of the vasoconstrictors and vasodialators enables the nurse to (1) increase the size and visibility of a vein before attempting venipuncture and (2) relieve venous spasm and assist in infusion maintenance. The systemic veins are divided into three classes: (1) superficial, (2) deep, and (3) venous sinues (Warwick 1973). The superficial or cutaneous veins are those used in venipuncture. They are located just beneath the skin in the superficial fascia. These veins and the deep veins sometimes units; in the lower extremities they unite freely (Kimber, Gray, and Stackpoles 1966). For example, the small saphenous vein, which is a superficial vein, drains the dorsum of the foot and the posterior section of the leg; it ascends the back of the leg and empties directly into the deep popliteal vein. Because of the deep connections, concern arises when it becomes necessary to use the veins of the lower extremities; thrombosis may occur and could extend to the deep veins and cause pulmonary embolis (Plumer 1975).

Deep veins are usually enclosed in the same sheath with the arteries. Occasionally an arteriovenous anastomosis may occur on a congenital basis or as the result of a past penetrating injury of the vein and adjacent artery. When such trauma occurs, the blood flows directly into the vein resulting in an arteriovenous fistula overburdened with high pressure arterial blood. Knowledge of the characteristics differentiating veins from arteries and the position of each is important in order to avoid the complications of inappropriate puncture (Plumer 1975).

Arteries and veins are similar in structure; both are composed of three layers of tissue. Care must be taken to avoid roughening the surface when puncturing or removing a needle from a vein; any trauma that roughens the endothelial lining encourages thrombosis. Vasoconstrictors and vasodialators contained in the middle layer keep the vessels in a state of tonus. Stimulation can occur by temperature, by mechanical means, or by chemical change with resulting spasms. Application of heat to the vein will relieve spasm, improve blood flow, and relieve pain. Awareness of these aspects of venous physiology both enhances safety to the child and promotes his comfort (Plumer 1975).

The major superficial veins of the scalp are the most common sites for intravenous therapy in the infant. The

largest and most easily accessible vein is located in the temporal skull region (King, Wieck, and Dyer 1977) and passes between the layers of the temporal fascia before it becomes superficial (Warwick 1973). Scalp veins are relatively easy to enter and scalp vein infusions are easier to manage (Broadribb 1973). As the term "easier to manage" occurs in reference to the use of scalp veins, the literature was consistent to follow with description of sandbags to immobilize the infant's head and clove-hitch restraints for the arms. This was in addition to shaving of the scalp in the needle insertion area and instructions for firm adhesive taping.

The selection of the vein is a deciding factor in the success of the infusion and in the preservation of veins for future therapy. The most prominent vein is not necessarily the most suitable for venipuncture (King, Wieck, and Dyer 1977). Scrutiny of all accessible veins is desirable before a choice is made. Four major factors must be considered: the pressure gradient of the fluid to be infused; the age, size, and development of the child; purpose of the infusion; and the expected duration of therapy. The preferred technique of venipuncture for small veins is known as the indirect method and consists of insertion of the needle through the skin during which the

needle enters the skin below the point where the vein is visible. Entering the skin above the vein, the bevel-up position of the needle facilitates venipuncture and produces less trauma; however, in small veins entering the vein with the bevel down may be necessary to prevent extravasation (Abbott 1965).

Intravenous therapy presents hazards of both local and systemic complications. The local complications occur most frequently and include skin irritations, fluid infiltrations, and thrombophlebitis. The systemic complications are the most serious and consist of pyrogenic reactions, pulmonary edema, and speed shock (Plumer 1975). Any irritation involving the wall of the vein predisposes the patient to thrombophlebitis. Inflammation is governed by the (1) duration of the infusion, (2) composition of the solution, (3) site of the infusion, (4) technique of the venipuncture, and (5) equipment employed. The risk of an inflammatory process is minimized if the nurse selects veins with ample blood volume, avoids veins in areas over joint flexion, and anchors needles securely. Periodic inspection of the needle site will detect developing complications before serious damage occurs (Bard 1970).

Dislodgment of the needle with consequent infiltration of fluid is not uncommon and is too frequently

considered of minor significance (Plumer 1975). Frequently the edema is allowed to increase because of misconception that backflow of blood into the adapter is significant proof that the infusion is functioning within the vein. This is not a reliable method for assessment. The point of the needle may puncture the posterior wall of the vein, leaving the bevel within the lumen of the vein. To confirm infiltration, a tourniquet should be applied proximal to the injection site. If the infusion continues regardless of this venous obstruction, extravastion is present (Plumer 1975). Safe, successful fluid therapy depends also on the role of the nurse in maintaining the infusion. The proper rate must be maintained, medications must be infused at their allotted time, and potential hazards prevented (Pillitteri 1977).

Procedural Guidelines

As the nurse expands her knowledge base of physiology, parenteral pharmacology, and child growth and development,more responsibility for total nursing care of the patient is assumed. It is easily documented that children's veins are fragile and that complications arise quickly when fluid therapy malfunctions. Literature that deals with the procedural techniques involved in starting and maintaining pediatric I.V. therapy is limited. Many pediatric textbooks

omit the actual methodology for selecting an intravenous site, preparing the skin, puncturing the vein, and immobilizing the needle. Those texts which do describe the procedure use performance step directives rather than performance description. A description in the American Journal of I.V. Therapy (1975) depicted a means to tape a butterfly catheter in a dorsal metacarpal vein of an adult hand. Suttin (1969) provided instructions and an illustration of looped I.V. tubing for anchoring an I.V. needle in the adult basilic vein along with suggestions for restraint of the extremity involved. This author's treatment of the subject of needle stabilization was found to be representative of other medical-surgical texts referring to adult care (Harmer and Nite 1978, Fuerst and Wolff 1974, King, Wieck, and Dyer 1977).

More pertinent guidelines for the care of a functioning pediatric infusion were reviewed from literature specific to pediatrics. Marlow (1977) wrote with outstanding detail concerning the nurse's role in I.V. therapy, even including a caution that regulation of the drip rate must be done when the infant is resting. Marlow (1977) incorporated information indicating appropriate veins to be used, types of restraints for body immobilization, and pictured realistic taping with several strips of 1-1/2-inch

adhesive. Folded gauze was suggested as a needle support following insertion. The literature of Waechter and Blake (1976) included the directive that the amount and type of tape needed should be cut in pre-procedural preparation. Reduced circulation from prolonged restraint at the needle site or to the body parts is stated as a preventable hazard. Both Plumer (1975) and Metheny (1974) described pediatric infusion equipment in their textbooks which are written to cover the single topic of I.V. therapy. Both authors mentioned adhesive taping and restraint of the child, but offered no detail for accomplishing the process.

Leiffer (1977) updated and expanded her 1972 publication of Principles and Techniques of Pediatric Nursing concerning intravenous therapy. In the current text, the author is more descriptive of each step involved in the infusion process from preparation to the terminating of an infusion. The introductory statement to this segment of methodology is "When intravenous fluids are ordered, it is entirely the responsibility of the nurse to insure the safety of the patient" ((Leiffer 1977, p. 194). Description of means to secure the I.V. needle remains the same as in the 1972 edition as does the statement "the child should be closely observed for symptoms of infiltration and the development of phlebitis at the site of venipuncture"

(Leiffer 1977, p. 195). Regarding security of the needle, Leiffer's updated text does not change the statement that "the tubing is looped and secured . . . to prevent dislodgment of the needle" and the reader is referred to the chapter entitled "Restraining and Positioning Infants and Children" (p. 197). The author also supplied an illustration of an infant with a scalp vein infusion in place which displays a single piece of tape holding the needle hub, sandbags to support the head in an upright dorsal recumbent position, and arms placed close to the infant's side (Leiffer 1977).

King, Wieck, and Dyer (1977), in their illustrated manual of nursing techniques, devoted a chapter in outline form for I.V. infusion in pediatrics. A similar pictorial illustration to that of Leiffer's (1977) is found of an infant with a temporal scalp-vein needle secured with a single strip of tape. The sandbags are omitted. These authors refer to the hazards of infiltration and caution the nurse to anchor the I.V. tubing well since its weight can accomplish needle dislodgment. Further cognizance of the need for needle security is referred to as ". . . movement of the child's extremities will cause tension on the vein and possibly discharge the needle" (King, Wieck, and Dyer 1977, p. 217). With instruction for proper removal

of the needle the directive is given to "gently remove the tape."

References in the literature concerning collodion as an I.V. site protectant were located as the product was listed among supplies necessary to begin intravenous therapy. No instructions for its application or removal nor descriptions of its properties were located in nursing literature. Remington's Pharmaceutical Sciences (Martin 1965) described collodion as a liquid preparation containing pyroxylin in a mixture of ethyl ether ethanol.

> They are applied . . . by means of a . . . suitable applicator and when the ether and ethanol have evaporated, leave a film of pyroxylin on the surface. Collodion and Flexible Collodion are protectives for minor cuts and scratches (Martin 1965, p. 447).

Both collodion and flexible collodion are listed under the category of "protective" by Remington's Pharmaceutical Sciences (Martin 1965, p. 447). Collodion is a clear, or slightly opalescent, viscous liquid which is colorless and has the odor of ether. Its alcohol content is from 22 to 26 percent and carries the caution of being highly inflammable. This means of protecting a site has two purposes: (1) to provide occlusive protection from the external environment and (2) to provide mechanical support. Although collodion is listed in several pediatric texts dealing with

supplies for intravenous therapy (Leiffer 1977; King, Wieck, and Dyer 1977), neither text did more than list it.

Reference to plaster of paris strips as an I.V. site protectant was located in a text written by an English pediatrician. In a section entitled "Practical Procedures" under the subtitle "Intravenous Infusion," both plaster of paris bandage and collodion are listed as equipment apparatus. A comment under the subtitle "Techniques" was"

> It is essential to immobilize the needle in the scalp: . . . this may be done with either thin strips of plaster of paris bandage, adhesive strapping, or strips of gauze soaked in collodion. The authors favor either plaster or strapping (MacKieth 1977 pp. 273-274).

A footnote at the end of the chapter read:

> We wish to acknowledge the help received in the preparation of this chapter from Mrs. B. A. Williams, S.R.N., R.S.C.N., formerly of the Bristol Royal Hospital for Sick Children (MacKeith 1976, p. 276).

In identifying the credentials of the nurse acknowledged, it was learned that the above initials indicated this nurse is a registered nurse with two additional years of work to achieve the status of a pediatric nursing specialist.

A 1971 edition of an English text concerning care of the critically-ill child, advocates securing the needle hub to the child's skin by ". . . a cone of wet plaster of

paris" (Jones 1971, p. 261). A manufacturer's booklet prepared in 1959 and entitled Technical Aspects of Plaster of Paris stated that although the product has widespread usage, "there is surprisingly little in current medical literature on the physical and chemical properties of plaster" (Johnson & Johnson 1959, p. 1). Plaster of paris is manufactured from a solid crystalline material known as gypsum or calcium sulphate dihydrate. Gypsum is pulverized to break up the crystals and subjected to intense heat which results in the creation of a fine powder. When water is added, the reaction is reversed and the plaster recrystallizes into solid gypsum. According to this source, during the past century plaster of paris has become the most universally-used material for immobilization (Johnson & Johnson 1959).

Pediatric hospitals in England had adapted plaster of paris to use in immobilizing intravenous sites and as English nurses have become employed in the United States, limited usage is found here. According to the report written at Cook's Children's Hospital (1977), plaster strips, approximately 3-by-1 inches, which are wet by dipping into water, form excellent immobilization for intravenous needles which have been taped in "normal fashion." When removal is necessary, it is easily

accomplished by dampening the edges of the plaster covering and lifting it off. Should there be any plaster on the skin, it can be washed off. The plaster is used as a protective covering for the needle; it allows more freedom of movement for the active child. Distractors to the method are named as (1) occlusion of the area from view because the material is opaque and (2) overuse of the amount of material at the site (Children's Hospital Report 1977).

The nursing management of pediatric infusion is also found in a portion of pediatric nutrition texts when oral or gastro-intestinal tube feeding is impossible, insufficient or potentially hazardous. Literature is readily available pertaining to hyperalimentation which shares the basic concepts of asepsis, long-range functioning, and infection control with subcutaneous I.V. therapy (Colley 1977). References dealing with Total Parenteral Nutrition address care of the wound site and stabilization of the catheter more specifically than do those dealing with cutaneous needle placement. Diagrams of plaster tape strips to secure dressings that will not limit the patient's movement are shown (Colley 1977, Fischer 1976). It is difficult for children to tolerate the long hours of infusion therapy. They should be provided

with bed activities and allowed out of bed as much as possible (Pillitteri 1977).

Growth and Development Competencies

Successful administration of intravenous therapy, whatever its scope of technical needs, must include nursing interventions which focus on both the child's developmental level and his individual needs. In addition, parents need to be included (Petrillo 1972). With nursing assistance, most parents quickly learn how to protect the intravenous system and are able to continue their parenting tasks (Colley 1977).

From the moment of birth, the newborn is acutely aware of his surroundings and has been found to distinguish between equally competent caretakers at ten days of age (Petrillo and Sanger 1972). Care of the neonate demands satisfaction of innate sucking and stimulation needs which function both to release tension and provide sensory pleasure. Intravenous therapy may be a necessary substitute for the normal feeding process. The use of a pacifier can make a significant contribution toward decreasing the frustration of an infant who must tolerate prolonged physical discomfort or food deprivation (Colley 1970). According to Montagu (1971), the infant will develop a sense of trust or mistrust depending upon his sensory

impressions which are received mainly through the skin. Since I.V. infusions not only penetrate the skin but utilize equipment which presents barriers to tactile stimulation, it is imperative that a nursing plan include intervals for the infant to be held, talked to, rocked, and touched (Petrillo and Sanger 1977, Marlow 1977, Leiffer 1977).

The well-developed neonate does not maintain a stationary position; even before birth he moved about in utero. In the second month of life, the infant who is active may roll over and by three months indicates a preference for the prone or supine position. Uncoordinated movements of the hand and arm begin in these early months and progress to definite reaching and grasping motions. Around the seventh month, increased strength and coordination of the infant's trunk and arms allows him to move about purposefully (Scipien et al. 1975, Piaget 1952). It is in this period of life that the scalp vein infusion site is most commonly used and unless the needle is securely anchored, normal movement may cause its dislodgment (Waechter and Blake 1976, Leiffer 1977). Although movement is desirable, an infant with a scalp vein infusion must never lie on the site of the needle insertion. Restraints may be avoided if the I.V. tubing and needle

are adequately taped and bandaged. Covering the hands with mittens may prevent effective grasping to pull at an infusion line (Fochtman 1976).

By the end of the first year, the infant applies previously-learned sensorimotor activities to new situations; this necessary state of development should not be curtailed by the use of harnesses or restrictive devices. Emotional withdrawal is not uncommon when a baby is sustained on parenteral therapy for a prolonged period of time. Hand-mouth-eye contact develops simultaneously in the infant and can be delayed or abnormal when infusion processes block the stimulation to normal development (Scipien et al. 1975, Piaget 1952).

The toddler period is defined as encompassing the ages one to three. While still emotionally dependent on his parents, he begins to actively move out to investigate other people and new places and things. He is constantly in motion, his developmental task being to increase neuro-motor coordination, including locomotion and manual dexterity (Chinn 1974). He is rapidly becoming more aware of his body. A measure of the toddler's pain is caused by psychologic stress (Petrillo and Sanger 1972). Separation from parents, lack of physical contact, and imposed immobility are all painful experiences to the toddler.

Restriction of fluids is also stressful, since it is difficult for him to understand why thirst cannot be alleviated with a drink (Brandt, Chinn, and Smith 1976). Immobility decreases the child's opportunity to learn from tactile and kinesthetic means. If restraint is necessary, it should be removed several times daily for exercise. Restraints on a toddler are often overused when other means of protection would be less traumatic and just as successful (Scipien et al. 1975; Petrillo and Sanger 1972; Dowdy, Novak, and Ray 1977).

Parents should be impressed with the importance of their visits and encouraged to hold and cuddle their children. Age appropriate substitutes for oral satisfaction such as pacifiers, whistles, and blowing activities should be part of the nursing plan. Physically the toddler period is one of accelerated maturation. His movements become mastered to the extent that reaching, holding, walking, and climbing are no longer random activities but the means for new endeavors. Newly improved and refined muscle control helps the child regulate his desired functions and he finds it increasingly difficult and undesirable to stay within a designated space (Maier 1977). Regression is a common coping mechanism in this age group. "Regression

may be increased by the type of illness" (Scipien et al. 1975, p. 370).

In caring for the toddler during any procedure, the approach must be individualized to his developmental level; I.V. therapy is known to be both an invasive and restrictive process. Very little is known about children's interpretations of intrusive procedures, and what is known has been learned in retrospect by analyzing hospitalized children's play and emotional reactions (Schwartz 1972). Treatment modalities that require restraint place an added burden on the child. The research of Anna Freud (1970) indicated that traumatic experiences may not be fully integrated at the time of trauma, leaving a residual to be dealt with in later experience.

The ill preschooler's major characteristics of development are those requiring security and stability of his environment which result in a need to protect his body intactness. The preschooler, struggling with his body image organization, reacts to any body defect, temporary or permanent. Erikson's theory of a child development stated that this age is struggline for a sense of initiative. As part of the child's quest, he conducts personal research through physical exploration (Scipien et al. 1975). There are certain limitations to a

preschooler's motor skills, mainly his quickness of movement with compromised opportunity to judge distance and strength. Muscular development is uneven and incomplete and hand-eye coordinations remain incomplete. Expression through noise and movement is necessary for growth. Active boisterous games with unrestrained running and jumping are the norm. Children of this age group have an urge to action and are still for only a short time. They are interested far more in the activity pursued than in its result (Armstrong and Browder 1970).

The ill preschooler experiences through diagnostic and treatment procedures a multitude of threats to his body integrity. When the body is repeatedly intruded by injection, the preschooler may interpret the treatment as punishment for his fantasies or his transgressions of parenteral authority. A child in this age category has increased value of his body; any procedure that requires entry into the body, such as intravenous needles and the adjunct equipment, violates their sense of body integrity. Preschool children have the capacity to cooperate (Waechter and Blake 1976). It is recognized that resignation and the feeling of helplessness which often plague a hospitalized child, consume energy that is necessary for healing. Mobility and interaction with his peers along with

expression through movement are normal needs for the preschool child (Armstrong and Browder 1970). Preschoolers often express some preference as to where they want an infusion needle inserted. If there is a choice, it should be given the child. A preschooler likes to feed himself and feels ashamed to have his hands restrained. Nursing intervention should attempt to respect a child's wishes although all infusions must be secured in place (Pillitteri 1977).

Stress and Intravenous Therapy

"The performance of few procedures is so easily affected by stress as is the execution of a difficult venipuncture" (Plumer 1975, p. 317). The measurement of anxiety states in children, their perception, duration, and causative factors form a significant segment of most modern libraries. Those disciplines involved in the care of children have produced literature replete with guidelines admonitions, and axioms for helping a child accept stressful procedures. Stress definitions are generally catalogued from the viewpoint of the observer. The anatomist, the physiologist, the psychologist, and the various clinicians delineate stress from their vantage point. Spiegel defined stress:

> What we commonly call stress is a process which threatens the individual with a loss of some significant aspect of his relationship with his environment. The adaptive process, whether at a somatic or psychological level, is concerned with maintaining the organism environment system at optimum equilibrium (1971, p. 340).

The hospital is a natural setting for stress arising from illness, from a foreign environment, and from exposure to various treatment procedures. Ventures to understand and ameliorate undue stress in pediatric patients require adaptation to the child's developmental stage (Petrillo and Sanger 1972).

The human personality evolves out of the interaction between the infant and his social and physical environment. The birth of the infant calls forth maximal adaptational responses (Schwartz 1972). During infancy, the world is experienced in a passive and dependent fashion. If adequate psychological and physical care is provided during these early months, the normal infant responds in predictable patterns (Papalia and Olds 1975). The needs of the infant assert themselves through the gradual mounting of tension. When tension becomes uncomfortable and/or painful, the child becomes restless and cries. If tension is not relieved, the frustration may lead to the infant's frantic, uncoordinated agitation with screaming and, in extreme cases, with exhaustion. The pattern will repeat itself until the

infant is satisfied or gives up attempts to find relief and becomes apathetic (Schwartz 1972). It is absolutely essential that the infant receiving intravenous infusions be closely assessed. The infant is frightened at the end of the procedure which initiates I.V. therapy because he has been hurt; he may be equally as frightened by the mummying procedure that held him firmly during the process. The infant should be comforted by cuddling, being talked to, touched, and stroked. This is an advantage of scalp vein insertion; if it is placed securely the infant can be allowed a great deal more body freedom. Having dependency needs met enables an infant to develop a sense of trust and eventually to develop a feeling of mastery over stressing situation (Schwartz 1972, Pillitteri 1977).

Regardless of what causes anxiety and stress to the toddler, his natural reaction will be to strike out at the frustration and to avoid it. The toddler has many fears; anything that is new may frighten him. He may be demanding and assertive at home, but he is generally shy with strangers. Any idea that comes from an adult is likely to be met with "no" in this age of negativism; his tolerance for frustration is extremely low (Armstrong and Browder 1970). The child's aggressive behavior in response to frustration may also consist of kicking or hitting.

Distracting the child during stressful periods has some value, but during a period of acute stress the child is consumed with what is happening to him. In order to decrease stress and possible psychological stress sequalae, the pediatric nurse is challenged to accurately assess pain in the toddler. Nonverbal behavior is of extreme importance. "For every indicant that may reflect pain there is probably an implication for nursing" (Brandt, Chinn, and Smith 1976, p. 208). Initiating I.V. therapy contains episodes of fear, pain, restraint, and, in most instances, separation from the parent or familiar caretaker. When a predictably painful experience is anticipated, the pain and subsequent stress can be minimized by restraining the child appropriately, administering the painful procedure skillfully, and giving appropriate emotional support throughout (Chinn 1974).

The ill preschooler experiences, through diagnostic and treatment procedures, a multitude of threats to his body integrity. A sense of vulnerability evolves in the child becuase of repeated subjection to the use of various clinical tools. The developing personality is ill-prepared to deal with intrusive procedures and restricted mobility. The preschool child struggles with his identification process and body image organization and with any bodily

defect, temporary or permanent. In response, some children try to hide their defects; others make a great display of them. Since cognition has not conquered adjustment to change during this period, the preschooler has difficulty understanding how and why he became ill. The nurse's first premise with an ill child of this age group should be that the child's interpretation of the events surrounding his hospitalization in no way correlates to the adult's. Inability to synthesize and analyze is normal to the child five years of age and under and attests to the need that his stress be recognized (Wolfer 1975, Waechter 1976, Schilder 1950).

The nurse interacts with a given patient for the purpose of aid during any one of several phases along the growth and development continuum. Effecting each approach in patient care requires a working knowledge of the child's and his family's coping behavior established in response to prior trauma, stress, or crisis. The importance of healthy coping resides in its enabling a person to emerge from difficulty with intact self-esteem. In pediatric literature, hospitalization of a child is described as stressful for everyone in the family unit, despite attempts to avoid adversity, neither child nor adult can realistically be protected from unfavorable stress. What can be avoided

is unnecessary pain and its sequelae when treatment procedures go awry and the child experiences repetitious stress. Intravenous infusions have great potential for problems which can only be remedied by restarting the malfunctioning delivery system. A very small child will attempt to protect himself with physical resistance and crying, an older child will add verbal pleas for help. When pleas are ignored and painful experiences imposed by more powerful beings, a child's feeling of abandonment and helplessness increases. Pain, then, is intimately involved with human relationships; the affective components of pain serve to increase the small child's stress. Preschoolers view all experiences from their perspective of how it relates to the present, not how the event will help them in the future (Brandt, Chinn, and Smith 1976).

Overall effectiveness of any child's coping is further determined by parental response. Parents and siblings suffer when illness and/or hospitalization interrupt normal family life. Whatever defenses are used, Anna Freud (1965) cautioned that they should be distinguished on a broad index. Defenses of both adult and child should be weighted according to age appropriateness, intensity of usage, and reversibility, e.g., the ability to cease defensive behavior on the threat to homeostasis ceases (Petrillo 1972, Fagin 1972).

To complete the circle of interrelationships, it is necessary that nurses also cope with stress. This necessitates self-awareness in sufficient quantity to be supportive of, and unthreatened by, patients and families who are coping with their stress. This requires assessing situations realistically and flexibly enough to modify potential reactions to illness and its accompaniments. This would presuppose maturity in the nurse (Petrillo 1972). Only a skilled person should perform venipuncture on a child both to prevent puncture injuries and to safeguard the child emotionally. Reactions to fear not only make therapy difficult but inhibit the healing process through the body's inappropriate release of hormones and changed metabolic rate (Plumer 1975, Selye 1956).

It was the intent of this study to further support the pediatric nurses responsibile for I.V. therapy by collecting data concerning means to stabilize a functioning I.V. needle. This study was based upon the philosophy that a positive clinical environment is essential to a child's well-being, a position supported by all pediatric literature reviewed. In the nursing care of children, means for improving treatment procedures is of high priority, thereby increasing the child's comfort and decreasing the accompanying stress. The time element involved in effective

intravenous therapy incorporates many interdependent variables. One of these is the procedure used to stabilize the needle within the vein. The following chapter is the analysis of the data collected from hospitalized children who received infusions, with emphasis of analyzing the data concerning two means of needle stabilization.

CHAPTER III

PROCEDURE FOR COLLECTION OF DATA

This study was conducted in two phases, the initial one being in-service staff education and the second the data collection phase. The purpose of in-service education was to inform nursing personnel of the structure of the study and enlist their assistance in data collection.

A quasi-experimental approach (Isaac and Michael 1976) was used in the investigational phase of this study. The independent variable was the use of plaster of paris strips and collodion as protectors for intravenous sites. The dependent variables were the length of time an infusion site remained functional and whether application of body restraints was required to further protect the stability of the infusion. Plaster of paris strips were not attached to the skin but were attached to adhesive tape that secured the needle to the skin. There was a comparison of an equal number of infusion sites protected by plaster of paris strips with an equal number of infusion sites protected by collodion. Data were collected from children hospitalized in only one agency. The total twenty-four-hour day was included in the study; data were collected from all three

shifts. Only registered nurses collected data. They also adhered to procedures in the hospital manual concerning I.V. therapy. The choice of intravenous needle sites was not restricted; scalp vein or extremity venous sites were used.

The human rights of patient, family, and staff were safeguarded. Both collodion and plaster of paris strips were used by the agency involved in this study. The thrust of the investigation concerned the comparison of the effectiveness of these two methods of securing I.V. needle sites.

In-service Education

Subsequent to appropriate introductory appointments, a planning meeting was held with the director of nursing, the assistant director, and the in-service educator of Cook Children's Hospital on August 1, 1978. The purpose was to collaborate the teaching objectives for presenting the study to the nursing staff. The in-service director had been aware of the problems the staff encountered with I.V. protectants over the past year and had encouraged the investigator to construct a study.

Plans for three in-service meetings were formulated, each approximately twenty minutes in duration, and were scheduled prior to the beginning of each shift. The

assistant director of nurses elected to contact the nurses in person and by telephone and decided one mid-afternoon in-service meeting was more feasible. Day shifts and afternoon shifts met conjointly; night shift people were approached individually by the investigator.

The in-service meeting was conducted by the investigator at 2:00 P.M. on August 7, 1978. Seven registered nurses were in attendance, representing 30 percent of the registered nursing staff. Head nurses from both medical and surgical floors were present along with the assistant director of nurses and the in-service educator. The nurses were given an abbreviated, overall view of the study verbally and then presented with a one-page written explanation (appendix D). They were also told of the application that had been approved by the Texas Woman's University Human Rights Committee and the permission given by their administration for the hospital name and location to be used in the thesis. Questions that related to appendix D were:

1. What is random sampling?

   Answer: A sampling technique in which everyone in a group has an equal chance of selection.

2. Question: How will you mark the sets?

Answer: With adhesive tape numbers on the front of each I.V. package and a folded, pre-numbered nurse's tool attached by a rubber band around the package.

3. Question: Will you want to start any of the I.V.'s?

Answer: No.

4. Question: What about I.V.'s started in the emergency room or the operating rooms?

Answer: They will not be included in the study, unless you for some reason restart the I.V. using a random numbered package from your stock. This would place the child in the study and I would begin timing the needle protectant from or at this time but marked "start #2."

5. Question: How long will you stay when you come?

Answer: I don't know--depends on how many I.V.'s are in progress, how many people I talk to, how much observation time I need. I am not working elsewhere during these two weeks so I can come and go as I need to.

Questions were terminated at this point because of the lack of time. Assurance was given to the nurses that further questions would be answered by the investigator, on an individual basis as the investigator encountered them during phases of the study.

Copies of the oral description of the study which would be given the parent or guardian of each child (appendix F) were then given to the nurses. Emphasis was placed on the fact that the use of the forms was the investigator's responsibility. However, as nurses assisting in the study, families/patient might ask them for pertinent information or they could be asked to serve as witnesses to the consent.

The final copies handed out were of the tool the nurses would be using to document relevant data (appendix A). This tool was discussed in detail. Nurses were encouraged to use the "comment" column. No questions were asked following the discussion and distribution of this sheet, but it is believed that the approaching time of change of shifts caused the elimination. At later times questions concerning appendix A were:

1. Question: Why do you call it a "tool?"

Answer: Simply a word which means equipment or an instrument on which we can record information.

2. Question: Why do you start the "Restarted" column with a (1)? If it's restarted, it is really start #2.

Answer: I agree. This column can be relabeled so that the initial successful start is #1 and restarted infusions will be numbered 2, 3, etc.

3. Question: If I change protectant methods, do I change tools?

Answer: Depends on whether or not you change tubing. If you use a new I.V. set, you will have a new sheet and a new number. If not, just use the comment column and I will make note of the change. Remember, I'll check these I.V. sites each shift and will be reading the nurses' notes as well, watching for changes.

4. Question: What do you mean by type of restraint?

Answer: I want to know if it's a sandbag, a clove hitch with a flannel strip or sheeting, a body restraint, rubber bands, safety pins, armboards, etc.

5. Question: Can I use the patient's addressograph stamp rather than fill out the age, sex, etc.?

Answer: Yes, if it's quicker. The addressograph carries information that will not be used for these will be destroyed when the study is completed.

6. Question: Why does the tool say "pt.#?" The I.V. sets are what is numbered, the patients are not.

Answer: True, but on my large data collection tool, they become one and the same. I have specified to parents I will not use their children's names.

Individual teaching to the 11:00 P.M. to 7:00 A.M. personnel was repetitious. Head nurses and assistant head

nurses shared their information during the report phases of contact, some of which preceded the investigator's contact.

Setting

The setting for this study was a seventy-five bed pediatric hospital located within the inner city area of Fort Worth, Texas. The agency is a private institution with both medical and surgical service. The agency has the only pediatric emergency room in the city and the only poison control center. There are two operating suites and a recovery room, one medical intensive care unit, and one surgical intensive care unit. The hospital has its own laboratory, pharmacy, x-ray, and respiratory therapy departments. The nursing department employs registered nurses, licensed vocational nurses, and nurse assistants. There is a full-time dietitian. A playroom is under the direction of a professional life director five days a week from 8:00 A.M. to 5:00 P.M.

The study was initiated on both the medical and surgical floors, but was curtailed to the medical floor after the first five days. Utilization of the combined floors presented an area too large and diversified for effective data collection. The medical floor occupies the second floor of the hospital and has a total patient bed capacity of forty-seven beds. Forty of these beds

share semi-private facilities. There is also a three-bed medical intensive care unit and a private isolation suite. There are four other units which may be converted to isolation units when necessary. Every patient unit has an adult-size rocking chair. Parents are encouraged to stay with their children full-time if possible, and adult in-the-room sleeping facilities are available with each patient unit. All rooms have a lavatory and running water; not all have private baths. Each room has a telephone and a color television. The floor has its own kitchen, a separate formula room, and a treatment room. Ambulatory children with non-infectious diseases are permitted to go to the playroom on the third floor, which is the space also occupied by the surgical floor. Other children are restricted to their rooms or a spacious second floor semi-circular lobby area. The treatment room contains the primary supply of I.V. equipment and children are transported there for I.V.'s to be started and, if necessary, restarted.

Population

The sample for this study were hospitalized children sixty months of age and under who required intravenous therapy. Data were collected on twenty-eight children and eight were omitted whose infusion were of less than seventy-two hours duration. Prior to collection of data,

the method of I.V. site protectant was randomly assigned by utilization of the random number table (appendix H). Each I.V. infusion set was tagged following the number table system and sets were placed in random order on the treatment room shelves. The number affixed to the infusion set determined its random order and was also utilized as the patient's identification number for data collection. The random order numbers were of two categories: odd numbers and even numbers. The plaster of paris method of I.V. site stabilizing was used when the infusion set number was an even number. The collodion method of I.V. site stabilizing was used when the infusion set was an odd-numbered set.

Tool

Two tools were used in this study:

1. The tool designated as Form A (appendix A) was a pre-printed, pre-numbered form designated by the investigator for the use by nurses who started, monitored, and/or discontinued an infusion. A form was attached to each of thirty stock supply I.V. tubing packages. The form was attached to the patient's chart and removed at completion of I.V. therapy. No two forms had the same number. The pre-numbered forms designated the type of I.V. needle site protection to be used with each patient. The

nurse involved was permitted to change to the alternate protectant method if her judgment dictated, by noting the change on the form.

2. The tool designated as Form 1B (appendix B) was used only by the investigator to summarize data from Form A that pertained to plaster of paris hoods. Form 1C (appendix C) was used only by the investigator to summarize data from Form A that pertained to collodion protectant seals of infusion sites. This summary form 1B documented the expected time of infusion with the actual time of completion and the comparison was noted in statement of hours and minutes in the column of comments.

Data Collection

Packages of infusion tubing in the nursing unit supply rooms were tagged in advance by the investigator. Any re-tagging or adjustment in the patient numbering system was done every day on each shift by the investigator. The investigator assessed all infusions in progress at least once each shift, every day at random times from the first day of the study, August 9, 1978, to its termination on August 25, 1978. By the end of the first five days, data collection vists were curtailed by the investigator to the 11:00 P.M. to 7:00 A.M. shift. These were hours when every effort was made for children and parents to rest. Changes

that occurred were well documented by staff on fluid record-keeping sheets required by the hospital as well as on nurses' notes. Except for one new admission which coincided with the investigator's visit, no attempt was made to talk to parents during the midnight to 7:00 A.M. periods. It was learned that charge nurses routinely made rounds with each other to see each patient with infusion therapy as the shifts changed. The investigator found that to join them was both permissible and advantageous. Questions were answered during this period and the interest of all persons concerned in the study seemed to increase. Because it was impossible to do this on more than one floor at the time, however, the third floor was omitted from the study on August 15, 1978. There were several reasons for this change:

1. Third floor surgical patients were requiring short-term infusion therapy. Two major surgeries that occurred as the study began were exceptions and were included until they terminated

2. A very high percentage of the I.V.'s were started in the operating room, an area that was not feasible to random number the I.V. sets

3. The random sample numbering system did not function appropriately from the stock supply area on the

floor; no plaster of paris strips were applied as protectants

It was learned that collodion was the preferred protectant and if plaster strips were to be used, the investigator would need to instruct and supervise the methodology. It was not felt that the situation warranted the teaching involvement since the sample size was achievable without patients from this area.

The hours between 2:00 P.M. and 6:00 P.M. were used daily to replenish the numbered tags and attach tools to new I.V. stock. It was the most productive time to explain the study to parents and obtain signed consent forms. The hours also permitted children to be observed during and following nap time, during a meal, and when activity was more entertainment-oriented. Visitors were present and approximately half of the private pediatricians visited patients during this time.

From August 9 through 14, 1978, the investigator spent six hours a day in routine duties connected with in-hospital data collection. When the study was limited to the medical floor beginning August 15, 1978, the hours were reduced but the study was half completed before a well-organized routine trimmed the time to three hours as

an absolute minimal possibility. The most productive sequence of the investigator's activity developed as follows:

1. Arrive at 2:00 P.M. and restock supply shelves. These supply shelves were located in three areas: treatment room, medical intensive care unit, and the isolation unit. Pre-numbered tools for staff use were fan-folded and placed on the I.V. tubing sets with the same rubber bands that attached the pharmacy charge slips. Adhesive tape squares which read "Research study #___" were attached to the face of each boxed tubing. The number on the box was identical to the number on the nurse's tool (appendix A)

2. Align shelf order of all stock with the random number sheet (appendix H). This was imperative at each shift visit

3. Join nurses making the change-of-shift rounds

4. Return to new patients and explain the study and obtain written consent form (appendix F) from the parent/guardian

5. Return to nurses' station and review charts and the attached tool (appendix A). Reading the nurses' notes and correlating this tool with the patient's fluid data sheet was necessary. Busy nurses tended to omit infiltrations and restarts on the attached tool (appendix A); if one was left out, the information became skewed

6. Collect those tools on which infusions had been completed. At times the tool was still on the chart. If the patient had been discharged, most of the time the discharging personnel put the tool in a designated drawer. On occasion, the ward clerk had the tool; on other occasions they were sent to the record room with the chart but were easily retrievable by the investigator

7. Transfer the appropriate information from the staff nurse's tool (appendix A) to the appropriate investigator's tool (appendix B or appendix C), depending on the type of I.V. site protectant

8. Approach staff nurses to answer questions or ask them for information, whichever the situation warranted. Interaction benefited both the investigator and the staff

On August 21 and 22, 1978, following pre-planning and in-depth communication, the investigator was out-of-town and data collection was totally in the care of the staff. During that forty-eight-hour period, two nurses supplied more written information than before on the tool used by staff nurses (appendix A). All tools that were operational continued to be kept but a reduced number were initiated although new patients were admitted and data collection tools were on the I.V. sets used. The forms were removed

and laid aside. Of the four that were added to the study, two were outside the sixty-month age limit.

Treatment of Data

Data were reported in writing to the statistician of the Computer Science Division of the Southwestern Medical School. The investigator combined the information from appendix B and appendix C onto one sheet supplied by the statistician to expedite the use of the Fisher Exact probability test (see table 13). Individual items were evaluated using a content analysis for illiciting the number of times criteria concepts occurred.

CHAPTER IV

ANALYSIS OF DATA

Data were analyzed using several methods. Frequency counts, percentages, and summary statistics are presented for independent categories of the data. Groups were compared using Chi-square analysis and Fisher's Exact Probability test. The .05 level was selected as the probability level denoting statistical significance.

Data were collected from the I.V. sites of twenty-eight subjects, eight of whom were deleted from the study prior to data analysis. The eight were eliminated because their individual infusions were discontinued in less than seventy hours. Twenty subjects remained in the study as their infusion time continued past seventy hours, a requirement for inclusion in the study. There were a total of fifty I.V. sites among the twenty subjects. Random assignment of two methods of protecting an intravenous needle site allocated the twenty subjects to one of two independent groups. The random assignment was made with the initial venipuncture process and the groups were evenly divided into ten each. Analysis was done at the completion of the two-week study based on the data in appendix I.

The subjects in the study ranged in age from three weeks (.75 months) to sixty months. Nine (45 percent) were male with an age range of 1.5 to 60 months and a mean age of 22.3 months. Eleven (55 percent) were female with ages ranging from .75 to 36.5 months and a mean of 11.6 months (table 1).

TABLE 1

DEMOGRAPHIC DATA ACCORDING TO SEX
(N = 20)

Sex	Number	Percent	Age Range in Months	Mean
Male	9	45	1.50 - 48.0	22.3
Female	11	55	.75 - 36.5	11.6

Seventeen (85 percent) of the subjects were patients of private pediatricians, and three (15 percent) were patients of general practitioners (table 2).

TABLE 2

PATIENT DISTRIBUTION ACCORDING TO PHYSICIAN CATEGORY
(N = 20)

	Number	Percent	Medical	Surgical
Pediatrician	17	85	12	5
General Practitioner	3	15	3	0

Among the fifteen medical patients, nurses started thirteen of the I.V.s and resident physicians started two. Among the surgical patients in the study, three children had I.V.s started in the operating room by physicians and two were started by nurses. Nurses restarted I.V.s on each site that malfunctioned during the study (table 3).

TABLE 3

PATIENT DISTRIBUTION ACCORDING TO PERSONNEL STARTING I.V. (N = 20)

	Number	Percent	Medical	Surgical
Nurse	15	75	13	2
Physician	5	25	2	3

The sample consisted of fifteen medical patients, eight of whom were admitted to the hospital and their I.V. therapy started during the 7:00 A.M. to 3:00 P.M. hours. Five patients in this sample were admitted and I.V.s started between 3:00 P.M. and 11:00 P.M. Two patients were admitted and their I.V.s started after 12:00 midnight (table 4).

The subjects' hospital stay ranged from 3.5 to 36 days. Intravenous therapy was successfully maintained in nineteen of the twenty subjects. The one I.V. considered unsuccessful was changed to I.M. injection after 103 hours

TABLE 4

PATIENT DISTRIBUTION ACCORDING TO TIME OF ADMISSION
(N = 20)

Time of Admission	Number	Percent	Medical	Surgical
7 A.M. - 3 P.M.	11	55	8	3
3 P.M. - 11 P.M.	7	35	5	2
11 P.M. - 7 A.M.	2	10	2	0

because of the parents' reaction to infiltration and non-productive attempts to restart the intravenous process. All twenty of the subjects recovered from their illness sufficiently to be discharged to their homes.

The twenty subjects required intravenous therapy beyond seventy consecutive hours. One subject completed the prescribed therapy via a single venipuncture site; the remaining nineteen subjects required site changes in order to maintain fluid delivery. Reasons for site changes among the subjects were (1) changes mandated by hospital policy to relocate a needle site that had been operative more than seventy-two hours, (2) changes because of infiltration, (3) changes because the needle had been pulled out prematurely, (4) changes because the volutrol had become empty, and (5) changes because the site displayed reddened streaks. Each time a subject required a site change, reapplication of

a site protectant was required. There were a total of thirty site changes among the twenty subjects.

The broad category of "infiltrated" was designated for any incidence of extravasation. Sites were changed on two occasions when sepsis or thrombophlebitis was suspected, twice when empty infusion lines occurred, and five times to comply with the policy of changing sites after seventy-two hours. Two of those five were changed to comply with hospital policy. These elective changes represented 40 percent of all changes. Two of the five I.V.s malfunctioned in the new sites and were restarted three times each representing another 40 percent of the subjects. The reason for change is illustrated in table 5 along with the needle site area and the protectant that was used.

The thirty site changes added to the twenty initial sites to establish intravenous flow resulting in a total of fifty sites for data analysis. Each needle site was randomly assigned collodion or plaster of paris as the protectant. Eleven of the subjects experienced both collodion and plaster of paris as needle protectants. Of the fifty separate I.V. sites, twenty-one were protected by plaster of paris strips and twenty-nine by collodion. There was no significant difference found between the effectiveness of the two methods when the number of times

TABLE 5

INTRAVENOUS SITE CHANGES
(N = 30)

Reason for Change	Total	Plaster of Paris	Collodion	Scalp	Right Hand	Left Hand	Right Leg	Left Leg	Right Foot	Left Foot
72-hour policy	5	1	4	3	1	-	-	-	1	-
Red streaks at site	2	-	2	-	1	1	-	-	-	-
Infiltration	15	7	8	4	4	4	1	1	1	-
Empty volutrol	1	-	1	-	1	-	-	-	-	-
Leaking at site	3	1	2	3	-	-	-	-	-	-
Needle pulled out by patient or family	4	1	3	1	2	1	-	-	-	-

the I.V. infiltrated from needle instability was the criteria for measurement. Table 6 depicts the number of times infiltration occurred for each method of protection for the total number of I.V. sites.

TABLE 6

COMPARISON OF NEEDLE SITE PROTECTANTS
(N = 50)

Protectant	Number of Sites	With Infiltrations		Without Infiltrations	
		Number	Percent	Number	Percent
Collodion	29	8	27.6	21	72.4
Plaster of Paris	21	7	33.3	14	66.7

Proportionately the plaster of paris strips had a higher incidence of infiltration but the difference was not large enough for statistical significance.

Among the fifty I.V. sites, 60 percent were functioning as the delivery method for an antibiotic treatment regime. Table 7 shows the number of infiltrations that occurred in I.V.s with antibiotic additives. Using Chi-square to compare the infiltration of those I.V.s with antibiotics to those I.V.s not containing antibiotics, no relationship was found.

TABLE 7

INTRAVENOUS FLUIDS WITH ANTIBIOTIC ADDITIVES

Antibiotic	Total Number I.V. sites	Number of Infiltrations	Percent
Yes	30	9	40
No	20	6	40

Each incident of site change influenced measuring the effectiveness of the needle site protectant. The influence of combined variables caused the needle sites to be changed in all but one subject as many as four times. Data were recorded regarding the effectiveness of the needle site when the site was the first, second, third, or fourth for a single subject. The separate intravenous sites assessed represents a range of functioning time from 4.5 to 84 hours. The total time of any one subject's prescribed therapy ranged from 70 to 194 hours. Table 8 shows the time range and mean number of hours that sites were functional in order to attain continuity, the number of site sequences involved, and the protectant material applied.

The veins used for the fifty I.V. sites were among four anatomical locations: scalp, hand, leg, or foot. All fifty infusions were implemented with Butterfly needles of 21, 23, or 24 gauge. The scalp vein sites were protected by

TABLE 8

DURATION OF TIME SITES EFFECTIVE ACCORDING TO SITE SEQUENCE
(N = 50)

Site	Number	Range of Number Hours Functional	Mean Hours	Protectant	
				Collodion	Plaster of Paris
1	20	6.0 - 84.0	44.56	14	6
2	19	4.5 - 62.0	34.15	10	9
3	9	5.5 - 61.0	42.06	5	5
4	2	38.0 - 59.0	43.50	1	1

plaster of paris strips 131.5 hours and by collodion 36.5 hours. This difference in effectiveness of plaster of paris over collodion was not supported in the study, as is shown in table 9.

TABLE 9

I.V. ANATOMICAL SITES, PROTECTANT, AND INFILTRATIONS (N = 50)

	Infusion Site				
	Scalp	Arm	Hand	Foot	Leg
Total number	16	0	22	5	7
Number collodion protectant	10	0	13	4	3
Number collodion infiltrations	4	0	6	1	1
Percent infiltrated	40	0	27.2	25	33
Number plaster of paris protectant	6	0	9	1	4
Number plaster of paris infiltrations	3	0	5	0	1
Percent infiltrated	50	0	55	0	25

Restraints were used for each child in the study except for two infants who had successful scalp vein infusions. Four of the twenty children were not restrained when their I.V.s were started. Two children completed I.V. therapy beyond seventy-two hours in scalp veins without use

of restraints. Not every child was restrained with the initial introduction of fluids; however, the longer the therapy continued, the more often restraints were employed. Data were insignificant to determine whether the more sturdy plaster of paris strips protected a site better than did collodion. Subjects under the age of one year needed less restraint than the older subjects. Table 10 depicts the age and sex of subjects who had restraints and with which site sequence.

Based on data analyzed, differences were not significant. The hypothesis that plaster of paris strips applied to form a protective hood increased the length of time an intravenous needle remained functional and reduced the number of filtrations was not supported. There was no significant difference in the effectiveness of plaster of paris and collodion as a needle site protectant.

TABLE 10

RESTRAINTS
(N = 20)

Sex	Age in Months	Restraint Used at			
		Site #1	Site #2	Site #3	Site #4
Male	48	x	x	x	
Female	11	x	x	x	
Male	6	x	x		
Male	60	x	x		
Male	1.5	x	x	x	x
Female	0.75	0	0		
Male	24	x	x	x	
Male	8	x	x		
Female	1	0	0		
Female	18	x	x		
Male	3	x			
Female	5	x	x		
Female	2	0	x	x	
Female	11	0	x	x	x
Female	17	x			
Female	12	x	Unknown		
Male	14	x	x		
Male	36	x	x	x	
Female	13	x	x		
Female	36.5	x	x		

x = Restraint used.

0 = Restraint not used.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This chapter summarizes the study and relates the conclusions. The implications of the study are primarily for pediatric nurses who are responsible for initiating and maintaining intravenous therapy in children. Recommendations are made for further study based on the analysis of data and the conclusions.

Summary

The quasi-experimental design used in this study enabled the investigator to compare two methods for stabilizing I.V. needle sites in children. Random selection of the method of needle stabilization was implemented by labeling intravenous equipment packages according to a random number table (appendix H). The packages were shelved according to the sequence indicated by the table and used in the order shelved. Collaboration with the hospital in-service education department provided the means to inform the registered nurse staff of the study, its intents and purposes, and involve the nurses in data collection.

Twenty-eight children were involved in the study; eight were eliminated prior to data analysis. The eight who were deleted completed therapy in less than seventy hours. A total of fifty intravenous sites were assessed among the twenty children. The children ranged in age from three weeks to five years. Parents or guardians received explanation of the study and signed consent forms allowing the data collected from their child's infusion to be a part of the study. The duration of function of each I.V. needle site was a criterion for measurement of the effectiveness of either plaster of paris strips or collodion, as was the number of times the site malfunctioned. Ancilliary data concerning the children's intravenous therapy were also collected. The total data were analyzed under the supervision of a statistician. The stress factor of repeated I.V. malfunction was recognized but no attempt was made to measure its degree or effect.

Conclusions

No significant differences were evident between the effectiveness of plaster of paris strips and collodion as I.V. site protectants in children. The reasons that no differences were demonstrated in this study could relate in part to the criteria for measuring efficacy. It was found that criteria could not be uniformly applied to all patients

because of the differences which exist among patients requiring intravenous fluid therapy. Among the differences were age, sex, size, pathological condition, level of consciousness, ambulatory capability, and current phase of growth and development. The criteria of time measurement and the number of times a site infiltrated were dependent on each of the above named variables. Many criteria measured were subjective on the part of the patient, the physician, and/or the nurses rather than being scientifically objective criteria amenable to measurement.

Because the sample size was small, the results of this study cannot be generalized. However, it is concluded that it was a reliable sample obtained in a realistic structure. The focus of this study was on the welfare of the patient which limited the controls that could be imposed. It is concluded that simulated clinical situations would provide data of less value than that experienced in this pediatric setting, i.e., controlled application of protectant to simulated sites in a laboratory setting would yield less reliable data.

The investigator was primarily interested in observing the efficacy of plaster of paris strips and the efficacy of collodion as means to protect the placement of an intravenous needle. Staff nurses were concerned with

providing a functional I.V. and applied both protectant collodion and plaster of paris strips in varying styles. Nurses were not equally adept in the application of both materials. It was concluded that nurses' skills and the implementation of randomized protectants influenced the effectiveness of the application.

The relationship of the composition of the intravenous fluid being administered to the frequency of infiltration was of no statistical difference. This is not compatible with information from the literature that phlebitis and vascular irritation are consequences of lowered fluid pH (Maddox et al. 1977). Venous irritation and inflammation may result from the infusion of hypertonic glucose solutions, certain drug additives, or from solutions with a pH significantly different from that of the plasma (Abbott 1977). When the solution is used as a vehicle for administering drugs, local complications occur more frequently and include thrombophlebitis and infiltrations (Plumer 1975). The local complications occur as the result of trauma to the wall of the vein. The conclusion emerges that needle site protection is of increased value when fluid being infused may influence site tolerance.

Only one patient experienced intravenous therapy during the study without requiring a site change. The

therapy was completed for the patient after seventy-three hours duration. A second site would have been implemented to comply with hospital policy if further I.V. therapy had been required. Five other children maintained functional needle sites for the first seventy-two hours but their disease/illness process required longer hours of intravenous treatment. Taking these six children into consideration, the number of times I.V.s had to be restarted among all twenty children was a total of fifty times. It was concluded that this was data pertinent to site selection as well as other variables. Selection of an I.V. site depended on three primary factors: availability of sites, size of needle to be used, and the skill of the operator. Veins in the dorsum of the foot and leg were used proportionately less than other sites and were only used after initial sites had malfunctioned. Hands and arms were the sites of choice in patients over six months of age. Collodion or plaster of paris was equally effective in all sites. According to the literature, scalp veins over the temporal area are chosen more often than other possible areas for children under two years of age (Pellitteri 1977, Scipien et al. 1975, Waechter and Blake 1976), but the theory was not borne out by this study.

Restraints are commonly used when intravenous lines are in use. The underlying purpose is to facilitate the function of I.V. therapy, but the necessity is often assumed prior to initiating an infusion. The physiological and psychological effects of immobilization are secondary to the primary purpose of preventing movement that may render an I.V. useless. Literature both supported the need of restraints to provide safety (Leiffer 1977, Waechter and Blake 1975) and provided warning about imposed immobilization (Dewd, Novak, and Ray 1977). Every child had parental support. When a parent did not stay with a child, a family friend took over the responsibility. The fact that all of these patients were in the care of private physicians made the sample unrepresentative of the general population, but representative of the clientele of the hospital in which this study was conducted.

Implications

The implications of this study are primarily directed toward pediatric nurses who initiate and monitor intravenous therapy in children. Statistically, the findings indicated there is no difference in the efficacy of plaster of paris strips in needle site protection compared to that of collodion used as a protectant. This indicated,

conversely, that both methods were effective and provide nurses with a choice of needle site stabilization methods.

There was an implication that nurses would benefit from more guidelines for stabilizing pediatric I.V.s. Literature was sparse in describing this procedure and hospital manuals are much the same. Ability to be proficient with more than one method could benefit both the patient and the nurse. Attitudes and values influence the response to challenge. Implications from this study also suggested a need for lowering the number of infiltration phenomena and thereby lowering the stress experienced by patient, family, and staff.

Nurses administering intravenous infusions must be completely familiar with pediatric patient care and with the fluids and drugs being administered. Each patient must be the recipient of special knowledge applicable to the dosage range, effects, precautions, and adverse reactions inherent in intravenous therapy regimes. Obligation for optimal function of the infusion has become a nursing responsibility. The technical skills of aseptic technique, venipuncture, and the provision of comfort and psychological support must be exercised.

Venipuncture is not the relatively simple act of injecting a needle but an exacting procedure of correlating

nursing skills with knowledge. As an accompaniment of progress, therapeutic procedures that are frequently done for patients tend to be taken for granted by nurses as common procedures. Skills that provide a basis for effective skills, such as means to stabilize and protect an I.V. needle site, lose recognition of impact. Advancement in health care is making bold demands upon the professional nurse.

Recommendations

This study should be replicated narrowing the scope of the population and increasing the sample size. Limiting the initial venipuncture procedure to be performed by one nurse throughout the study (preferably the investigator) would remove the highly influencing variable of different skill levels. Limiting the site of infusion to be studied, i.e., scalp veins or upper extremity veins, would eliminate another variable. An expanded length of time for data collection would provide better linear data.

A study to explore young children's perception of their I.V. therapy could improve the provision of psychological comfort. Some research has been done with the parents of children who have scalp vein I.V. sites. The overt reaction of the parent to the site brought recognition of the stress in response to the visual impact; it is

suggested from observing young children in this study that the child's inner reactions are also overt and are of value to nurses researching improved means of care.

A study is also recommended to ascertain how the nurse makes a judgment on what method of I.V. site protectant to use. Where did the nurse receive initial instruction? What does the nurse know of the properties of plaster of paris, its potential, and its detractions? What is the nurse's knowledge of collodion; how does the nurse apply the product and where do newcomers refer for guidelines? One of the functions assumed by nursing service is the administration of I.V. therapy. It is recommended that study of each of its facets be considered to increase awareness and provide data for its vastly important implications.

APPENDIX A

FORM A

TOOL FOR STAFF NURSE USE

Date_____

Pat. #	Age	Sex	Time Started	Infusion Site	Restarted	Comment
					(1) Date_____ Time_____	
					(2) Date_____ Time_____	
					(3) Date_____ Time_____	
					(4) Date_____ Time_____	

Restraint used_____
type_____
area_____

Dr.'s order reads:_____

_____

_____

*Note to Staff: If patient number is even, use collodion seal.

*If patient number is odd, use plaster of paris strips.

*If neither is used, state the material used instead.

APPENDIX B

TABLE 11

DATA FROM I.V. SITE PROTECTED WITH PLASTER OF PARIS HOODS

Patient	Age in Months	Sex	Restraints Used	Needle Site	Antibiotic Additive	Sequence of Times Started	Reason for Venipuncture	Infusion Hours at This Site	Medical or Surgical	Reason for Change
2	17.0	Female	Unknown	Left foot	Yes	#2	Remedy infiltration	57	Medical	Discontinued. Total I.V. therapy 104 hours
3	5.0	Female	Yes	Right hand	No	#1	Initiate I.V.	36	Medical	Infiltrated
5	60.0	Male	Yes	Right hand	Yes	#1	Initiate I.V.	84	Medical	Child fell from chair
7	1.5	Male	Yes	Scalp	Yes	#2	Continue therapy	43	Surgical	Infiltrated
7	1.5	Male	Yes	Right hand	Yes	#3	Continue therapy	41.5	Surgical	Infiltrated
7	1.5	Male	Yes	Right leg	Yes	#4	Continue therapy	38	Surgical	Discontinued. Total I.V. therapy 194.5 hours
9	8.0	Male	Yes	Left hand	No	#1	Initiate I.V.	21.5	Medical	Mother accidentally I.V.
9	8.0	Male	Yes	Scalp	No	#2	Continue I.V.	52	Medical	Discontinued. Total I.V. therapy 73.5 hours
11	48.0	Male	Yes	Left hand	Yes	#1	Initiate I.V.	73.5	Surgical	Elective site changes to comply with hospital policy
11	48.0	Male	Yes	Lef leg	Yes	#3	Infiltrated	79.0	Surgical	Discontinued. Total I.V. therapy 109.8 hours.

TABLE 11--Continued

Patient	Age in Months	Sex	Restraints Used	Needle Site	Antibiotic Additive	Sequence of Times Started	Reason for Venipuncture	Infusion Hours at This Site	Medical or Surgical	Reason for Change
13	11.0	Female	Yes	Scalp	Yes	#2	Site #1 leaking fluid	8	Surgical	Changed collodion to seal appendix
13	11.0	Female	Yes	Scalp	Yes	#3	Infiltration	35	Surgical	Discontinued. Total I.V. therapy 102 hours
14	36.0	Female	Yes	Right leg	No	#2	Continue therapy	26	Medical	Infiltrated
15	6.0	Male	Yes	Right hand	Yes	#1	Initiate I.V.	70	Medical	Elective change. Approaching 72 hours
15	6.0	Male	Yes	Left hand	Yes	#2	Continue therapy	33	Medical	Discontinued. Total I.V. therapy 103 hours
16	1.0	Female	No	Scalp	No	#2	Remedy infiltration	9.5	Medical	Infiltrated
16	1.0	Female	No	Scalp	No	#3	Remedy infiltration	61	Medical	Discontinued. Total I.V. therapy 83 hours
17	24.0	Male	Yes	Lef hand	Yes	#1	Initiate therapy	31	Medical	Infiltrated
17	24.0	Male	Yes	Right leg	Yes	#3	Remedy infiltration	41	Medical	Discontinued. Total I.V. therapy 109 hours
19	.75	Female	No	Scalp	Yes	#2	Remedy infiltration	61	Medical	Discontinued. Total I.V. therapy 82 hours
26	18.0	Female	Yes	Right hand	No	#2	Continue therapy	5	Medical	Discontinued. Total I.V. therapy 78 hours

APPENDIX C

TABLE 12

DATA FROM I.V. SITE PROTECTED WITH COLLODION

Patient	Age in Months	Sex	Restraints Used	Needle Site	Antibiotic Additive	Sequence of Times Started	Reason for Venipuncture	Infusion Hours at This Site	Medical or Surgical	Reason for Change
2	17.0	Female	Yes	Left hand	Yes	#1	Initiate I.V.	47	Medical	Infiltrated
3	5.0	Female	Yes	Right foot	No	#2	Remedy infiltration	42	Medical	Discontinued. Total I.V. therapy 78 hours
4	2.0	Female	No	Scalp	Yes	#1	Initiate I.V.	53	Medical	Leaking fluid
4	2.0	Female	Yes	Left hand	No	#2	Correct leaking at site	4.5	Medical	Red streak at site
4	2.0	Female	Yes	Scalp	No	#3	Move away from site with reddened streaks	38.5	Medical	Discontinued. Total I.V. therapy 96 hours
5	60.0	Male	Yes	Right hand	Yes	#2	Continue therapy	62	Medical	Discontinued. Total I.V. therapy 146 hours
6	12.0	Female	Yes	Left hand	Yes	#1	Initiate I.V.	22.5	Surgical	Infiltrated
6	12.0	Female	Yes	Right hand	No	#2	Remedy infiltration	50.5	Surgical	Discontinued. Total I.V. therapy 73 hours
7	1.5	Male	Yes	Scalp	Yes	#1	Initiate I.V.	72	Surgical	Elective site change after 72 hours

TABLE 12--Continued

Patient	Age in Months	Sex	Restraints Used	Needle Site	Antibiotic Additive	Sequence of Times Started	Reason for Venipuncture	Infusion Hours at This Site	Medical or Surgical	Reason for Change
8	14.0	Male	Yes	Right hand	No	#1	Initiate I.V.	22	Medical	Red streak at site
8	14.0	Male	Yes	Right foot	Yes	#2	Move away from site with reddened streaks	12	Medical	Infiltrated
8	14.0	Male	Yes	Right leg	Yes	#3	Remedy infiltration	36	Medical	Discontinued. Total I.V. therapy 70 hours
10	11.0	Female	No	Scalp	Yes	#1	Initiate I.V.	69	Medical	Approaching 72 hours. Elective change
10	11.0	Female	Yes	Scalp	Yes	#2	Continue therapy	8	Medical	Leaking at site
10	11.0	Female	Yes	Left hand	Yes	#3	Correct leaking	5.5	Medical	Patient pulled out
10	11.0	Female	Yes	Left Foot	Yes	#4	Continue therapy	59	Medical	Discontinued. Total I.V. therapy 121.5 hours
11	48.0	Male	Yes	Right hand	Yes	#2	Continue therapy	27	Medical	Infiltrated
12	3.0	Male	Yes	Scalp	No	#1	Initiate I.V.	73	Medical	Discontinued. Total I.V. therapy 73 hours
13	11.0	Female	Yes	Scalp	Yes	#1	Initiate I.V.	69	Surgical	Approaching 72 hours. Elective change
14	36.0	Male	Yes	Right hand	Yes	#1	Initiate I.V.	6	Medical	Patient pulled out
14	36.0	Male	Yes	Left hand	Yes	#3	Remedy infiltration	41	Medical	Discontinued. Total I.V. therapy 73 hours

TABLE 12--Continued

Patient	Age in Months	Sex	Restraints Used	Needle Site	Antibiotic Additive	Sequence of Times Started	Reason for Venipuncture	Infusion Hours at This Site	Medical or Surgical	Reason for Change
16	1.0	Female	No	Scalp	No	#1	Initiate I.V.	12.5	Medical	Infiltrated
16	1.0	Female	No	Scalp	No	#2	Remedy infiltration	9.5	Medical	Changed to plaster of paris
17	24.0	Male	Yes	Lef leg	Yes	#2	Remedy infiltration	37	Medical	Infiltrated
19	.75	Female	No	Scalp	Yes	#1	Initiate I.V.	21	Medical	Infiltrated
21	13.0	Female	Yes	Right hand	No	#1	Initiate I.V.	23	Surgical	Infiltrated
21	13.0	Female	Yes	Left hand	No	#2	Remedy infiltration	51	Surgical	Discontinued. Total I.V. therapy 74 hours
26	18.0	Female	Yes	Right foot	No	#1	Initiate I.V.	73	Medical	Elective site change after 72 hours at one site
29	36.5	Female	Yes	Right hand	Yes	#1	Initiate I.V.	12	Medical	Patient pulled out
29	36.5	Female	Yes	Right leg	Yes	#2	Continue therapy	61	Medical	Discontinued. Total I.V. therapy 73 hours

APPENDIX D

LETTER TO THE NURSE

July 1978

Dear Nurse:

I am a graduate study in nursing at Texas Woman's University. I would like to ask your participation in a survey to be conducted as part of my Master's thesis. The purpose of this study is to compare the effectiveness of plaster of paris strips with the effectiveness of collodion when used as an I.V. protectant.

In order to collect data impartially, numbered forms will be attached to the I.V. sets in the treatment room. If the number is an even number, please use collodion to secure the needle; if the number is odd, use plaster of paris strips. Your nursing judgment and your individual skills will be respected, knowing your first interest is optimal care of the patient. As an example, if the I.V. package form indicates using collodion and in your judgment plaster of paris or neither method is more beneficial to that situation, please use what is most appropriate and indicate the change in the column for comments. The random numbering system will be adjusted by the investigator.

I will be in the hospital at some time during all three shifts every day for observation, communication, and data summation. Manipulation of the child's I.V. or his environment will not be attempted by the investigator; his care and all judgments related to it will remain with the hospital nursing staff.

The study will be discussed with each parent or guardian and their written permission will be obtained to use their child's I.V. therapy experience in the study by the investigator.

In those instances where body restraints must be used with the child, please indicate this in the given space on the I.V. package forms. Any other comments you have are welcome.

Your willingness to explore the values and deterrents of I.V. site protectants for a two-week period is appreciated.

Sincerely,

Jean Smith

js

APPENDIX E

ORAL DESCRIPTION OF STUDY TO BE GIVEN THE PARENT OR GUARDIAN OF A CHILD RECEIVING I.V. THERAPY

I am Jean Smith, a graduate student in nursing at Texas Woman's University. I am collecting information about the best ways to keep a needle in place while a child is getting fluid in a vein. I would like to include your child's experience in this information, but first I want explain what I am doing.

I am looking at two ways that are used to hold a needle in place in a vein: one is called collodion and is a clear liquid that dries with a protecting surface; the other is plaster of paris strips from the same material used to make casts. Both ways are good ways, but I would like to gather information about whether or not an I.V. needle stays in place longer with collodion or with the plaster of paris. In order to do this, it is necessary to watch both methods closely and keep records on what happens. I have provided a numbering system so that your child's name will not be used in any way. I will want to come several times each day to look at the needle area and record what I see. I will not adjust or in any way change what the hospital nurses are doing to keep the needle in place. I will answer your questions at any time; if I am not here the nurses caring for your child are willing to answer your questions.

Each time nurses collect and share information we have better ways to care for our patients. By agreeing for your child to participate in this study, we hope to gain information which will be helpful to nurses and doctors in caring for other children in the future.

APPENDIX F

CONSENT FOR A CHILD TO PARTICIPATE AS A SUBJECT

IN A RESEARCH INVESTIGATION

I have been informed by Jean Smith, R.N., of her study of the effectiveness of different means of keeping I.V. needles in place in children under the age of five years. I understand the purpose of the study is to record information about how long a needle stays in place when it is protected by plaster of paris or when it is protected by the clear material called collodion. I give my permission for my child who is receiving intravenous therapy during this hospitalization to become part of the report by Ms. Smith. I understand only observations will be recorded and my child will receive his/her care from the nurses employed by the hospital according to their established procedure and according to the doctor's orders. I understand that neither my name nor my child's name will be used in this study.

Name of child (patient)_____

Parent or Guardian_____

Relationship_____

Address_____

Date_____

Witness_____

Date_____

APPENDIX G

TEXAS WOMAN'S UNIVERSITY
COLLEGE OF NURSING
DENTON, TEXAS

102

DALLAS CENTER
1810 Inwood Road
Dallas, Texas 75235

HOUSTON CENTER
1130 M.D. Anderson Blvd.
Houston, Texas 77025

AGENCY PERMISSION FOR CONDUCTING STUDY*

THE W. I. Cook Children's Hospital

GRANTS TO Jean Stuart Smith

a student enrolled in a program of nursing leading to a Master's Degree at Texas Woman's University, the privilege of its facilities in order to study the following problem: The effectiveness of plaster of paris strips as a protectant for intravenous sites in children.

The conditions mutually agreed upon are as follows:

1. The agency (may) (~~may not~~) be identified in the final report.
2. The names of consultative or administrative personnel in the agency (may) (~~may not~~) be identified in the final report.
3. The agency (wants) (~~does not want~~) a conference with the student when the report is completed.
4. The agency is (willing) (~~unwilling~~) to allow the completed report to be circulated through interlibrary loan.
5. Other: none

Date Aug 2 1978

Signature of Agency Personnel

Signature of student

Signature of Faculty Advisor

*Fill out and sign three copies to be distributed as follows: Original - Student; first copy - agency; second copy - T.W.U. College of Nursing.

APPENDIX I

RANDOM NUMBER ASSIGNMENT TABLE

Odd 1
Even 2
Odd 3
Odd 5
Even 4
Odd 7
Even 6
Even 8
Odd 9
Odd 11
Odd 13
Odd 15
Even 10
Odd 17
Even 12
Even 14
Even 16
Even 18
Even 20
Odd 19

*The above numbers will be affixed to the stock supply of infusion tubing packages as the packages are placed on the shelf. The purpose is to provide a means of random sampling assignment of patients to either the collodion protectant group or the patient to plaster of paris group.

APPENDIX H

TABLE 13

SUMMATION OF STUDY DATA

Patient	Age in Months	Sex	Method	Restraints Used	Needle Site	Antibiotic Additive	Times Started		Infusion Hours at This Site	Medical or Surgical	Type of Needle	Reason for Change
							Number	Sequence				
2	17.0	Female	Collodion	Yes	Left hand	Yes	2	1	47	Medical	BF23g	Infiltrated
2	17.0	Female	Plaster of paris	Unknown	Left foor	Yes	2	1	57	Medical	BF25g	Discontinued
					TOTAL INFUSION TIME ID #2				104 hours			
3	5.0	Female	Plaster of paris	Yes	Right hand	No	2	1	36	Medical	BF23g	Infiltrated
3	5.0	Female	Collodion	Yes	Right foot	No	2	2	42	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #3				78 hours			
4	2.0	Female	Collodion	No	Scalp	Yes	3	1	53	Medical	BF23g	Leaking
4	2.0	Female	Collodion	Yes	Left hand	Yes	3	2	4.5	Medical	BF23g	Red streaks
4	2.0	Female	Collodion	Yes	Scalp	No	3	3	38.5	Medical	BF25g	Discontinued
					TOTAL INFUSION TIME ID #4				96 hours			
5	60.0	Male	Plaster of paris	Yes	Right hand	Yes	2	1	84	Medical	BF21g	Fell from chair
5	60.0	Male	Collodion	Yes	Right hand	Yes	2	2	62	Medical	BF21g	Volutrol empty
					TOTAL INFUSION TIME ID #5				146 hours			
6	12.0	Female	Collodion	Yes	Left hand	Yes	2	1	22.5	Surgical	BF21g	Infiltrated
6	12.0	Female	Collodion	Yes	Right Hand	No	2	3	50.5	Surgical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #6				73 hours			
7	1.5	Male	Collodion	Yes	Scalp	Yes	4	1	72	Surgical	BF23g	Site change
7	1.5	Male	Plaster of paris	Yes	Scalp	Yes	4	2	43	Surgical	BF23g	Infiltrated
7	1.5	Male	Plaster of Paris	Yes	Right hand	Yes	4	3	41.5	Surgical	BF25g	Infiltrated
7	1.5	Male	Plaster of paris	Yes	Right leg	Yes	4	4	38	Surgical	BF25g	Discontinued
					TOTAL INFUSION TIME ID #7				194.5 hours			

TABLE 13--Continued

Patient	Age in Months	Sex	Method	Restraints Used	Needle Site	Antibiotic Additives	Times Started		Infusion Hours at This Site	Medical or Surgical	Type of Needle	Reason for Change
							Number	Sequence				
8	14.0	Male	Collodion	Yes	Right hand	No	3	1	22	Medical		Red streak
8	14.0	Male	Collodion	Yes	Right foot	No	3	2	12	Medical		Infiltrated
8	14.0	Male	Collodion	Yes	Right leg	No	3	3	36	Medical		Discontinued
					TOTAL INFUSION TIME ID #8				70 hours			
9	8.0	Male	Plaster of paris	Yes	Left hand	No	2	1	21.5	Medical	BF23g	Mother pulled out
9	8.0	Male	Plaster of paris	Yes	Scalp	No	2	2	52	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #9				73.5 hours			
10	11.0	Female	Collodion	No	Scalp	Yes	4	1	69	Medical	BF23g	Site change
10	11.0	Female	Collodion	Yes	Scalp	Yes	4	2	8	Medical	BF23g	Leaking
10	11.0	Female	Collodion	Yes	Left hand	Yes	4	3	5.5	Medical	BF25g	Pulled out by patient
10	11.0	Female	Collodion	Yes	Left foot	Yes	4	4	59	Medical	BF25g	Discontinued
					TOTAL INFUSION TIME ID #10				121.5 hours			
11	48.0	Male	Plaster of paris	Yes	Left hand	Yes	3	1	73.75	Medical	BF21g	Infiltrated
11	48.0	Male	Collodion	Yes	Right hand	Yes	3	2	27	Medical	BF21g	Infiltrated
11	48.0	Male	Plaster of paris	Yes	Left leg	Yes	3	3	79	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #11				109.8 hours			
12	3.0	Male	Collodion	Yes	Scalp	No	1	1	73	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #12				73 hours			
13	11.0	Female	Collodion	Yes	Scalp	Yes	3	1	69	Surgical	BF23g	Site changed
13	11.0	Female	Plaster of paris	Yes	Scalp	Yes	3	2	8	Surgical	BF23g	Leaking fluid
13	11.0	Female	Plaster of paris	Yes	Scalp	Yes	3	3	35	Surgical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #13				102 hours			

TABLE 13--Continued

Patient	Age in Months	Sex	Method	Restraints Used	Needle Site	Antibiotic Additive	Times Started		Infusion Hours at This Site	Medical or Surgical	Type of Needle	Reason for Change
							Number	Sequence				
14	36.0	Male	Collodion	Yes	Right hand	No	3	1	6	Medical		Pulled out by patient
14	36.0	Male	Plaster of paris	Yes	Right leg	No	3	2	26	Medical		Infiltrated
14	36.0	Male	Collodion	Yes	Left hand	No	3	3	41	Medical		Discontinued
					TOTAL INFUSION TIME ID #14				73 hours			
15	6.0	Male	Plaster of paris	Yes	Right hand	Yes	2	1	70	Medical	BF23g	Site changed
15	6.0	Male	Plaster of paris	Yes	Left hand	Yes	2	2	33	Medical		Removed from study
					TOTAL INFUSION TIME ID #15				103 hours			
16	1.0	Female	Collodion	No	Scalp	No	3	1	12.5	Medical	BF23g	Infiltrated
16	1.0	Female	Plaster of paris	No	Scalp	No	3	2	9.5	Medical	BF23g	Infiltrated
16	1.0	Female	Plaster of paris	No	Scalp	No	3	3	61	Medical	BF25g	Discontinued
					TOTAL INFUSION TIME ID #16				83 hours			
17	24.0	Male	Plaster of paris	Yes	Left hand	Yes	3	1	31	Medical	BF23g	Infiltrated
17	24.0	Male	Collodion	Yes	Left leg	Yes	3	2	37	Medical	BF23g	Infiltrated
17	24.0	Male	Plaster of paris	Yes	Right leg	Yes	3	3	41	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #17				109 hours			
19	.75	Female	Collodion	No	Scalp	Yes	2	1	21	Medical	BF23g	Infiltrated
19	.75	Female	Plaster of paris	No	Scalp	Yes	2	2	61	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #18				82 hours			
21	13.0	Female	Collodion	Yes	Right hand	No	2	1	23	Surgical		Infiltrated
21	13.0	Female	Collodion	Yes	Left hand	No	2	2	51	Surgical		Discontinued
					TOTAL INFUSION TIME ID #18				74 hours			
26	18.0	Female	Collodion	Yes	Right foot	No	2	1	73	Medical	BF23g	Site changed
26	18.0	Female	Plaster of paris	Yes	Right hand	No	2	2	5	Medical	BF23g	Discontinued
					TOTAL INFUSION TIME ID #26				78 hours			
29	36.5	Female	Collodion	Yes	Right hand	Yes	2	1	12	Medical		Pulled out by patient
29	36.5	Female	Collodion	Yes	Right leg	Yes	2	2	61	Medical		Discontinued
					TOTAL INFUSION TIME ID #29				73 hours			

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