FACTORS ASSOCIATED WITH PHLEBITIS FROM POLYETHYLENE CATHETERS DURING INTRAVEOUS THERAPY

Submitted by

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CHAPTER I

INTRODUCTION

STATEMENT OF THE PROBLEM

Because of the increasing complexity of medical and surgical procedures more hospitalized patients are receiving long term intravenous therapy. It has been estimated that one out of four patients will have an infusion and that one out of fifty patients will receive an admixture to the infusion.[20]

The pressures of day to day work make it desirable on the part of physicians for the infusion to run for several days before it needs changing. This has led to the increasing popularity of the polyethylene indwelling catheter or intracatheter. The term intracatheter will be used throughout this study in place of polyethylene indwelling catheter. The most commonly used intracatheters in the hospital where this study was done are the Bard 18 gauge, 8 inch and the Jelco 17 gauge, 3 inch. The sterile disposable intracatheter is inserted perceutaneously, preceded by an alcohol or virac skin preparation and is threaded into the vein of the patient. Neosporin ointment is placed over the puncture site which is then covered with sterile gauze and the

intracatheter taped securely in place. Most of the intracatheters are inserted in the basilic or cephalic veins of the patient's forearm. Other sites include the dorsal venous plexes in the hand, veins in the radial area of the wrist, and the anticubital fossa of the arm.

Many of these patients receive potent antibiotics every four to six hours. These drugs can be administered safely in a diluted form in the infusion in the volutrol, which is a special chamber of the secondary intravenous set. It takes approximately thirty minutes to complete the administration of the medication in the volutrol. Then the nurse opens the primary intravenous, or IV set. The medicine nurse is responsible for checking the IV frequently and inspecting the site of insertion of the intracatheter. This is not always feasible, however, because the nurse, in addition to her other duties, may have to check several volutrols. Since the volutrols will run empty before she is able to open the primary IV sets, the intracatheters may become plugged and the infusion stopped. In order to keep the infusion on time, the nurse disconnects the IV tubing near the intracatheter and with a 2cc syringe or a 1cc tuberculin syringe with sterile normal saline irrigates the IV tubing to reestablish flow through the intracatheter. When the intracatheter cannot be unplugged, the nurse withdraws the intracatheter. A trained IV nurse or a house physician inserts either a Bard or a Jelco intracatheter, or a scalp-vein needle in another site. The choice of devices depends upon the available vein

sites. Thus the main responsibility for maintaining the intracatheters is left to the medicine nurse. Other nurses may be asked to assume the responsibility, but often they are unaware of the need for close observation of the infusion site. Therefore, early phlebitis is not detected by the nurses, and the patient complains of soreness and discomfort at the site of insertion of the intracatheter.

Fonkalsrud[15] describes the postinfusion phlebitis as characterized by "inflammation of the vein with disruption of the endothelium in the vein, and eventual thrombosis." Such inflammation begins at the site where the fluids enter the vein, and then progresses proximally until a large vein with a higher flow is reached. Although phlebitis usually persists for less than a week after infusion has been discontinued, it may remain as an unpleasant complication for several months.

Other factors which may contribute to phlebitis from intracatheters are poor skin preparation, unclean or wet dressing, and the increased freedom of those patients during IV therapy. When those patients bend their arms or wrists, the result is often loosened tape which may cause back and forth motion of the intracatheter, thus causing irritation of the cannulated vein. If the intracatheter stretches the vein and blocks the flow past it, the concentration of the infusion is not immediately diluted and is therefore more irritating.

The clinical literature of Cheney[6] and Fonkalsrud[15] suggests

other factors related to phlebitis. Cheney found that the incidence of phlebitis was nine percent in patients whose intracatheters were in place for less than 24 hours, 58 percent in patients whose intracatheters were withdrawn after 25-48 hours, and 74 percent in those withdrawn after 49-72 hours. Fonkalsrud states that "the major principle in the management of infusion phlebitis is prompt recognition and discontinuance of the infusion." Both studies suggest that the major factor causing phlebitis is mechanical rather than bacterial. Both also concluded that the adverse reaction was directly related to the length of time the intracatheter was in place.

A study done by nurses[21] involving a team of trained nurses indicates that intracatheters produced a type of sensitivity reaction, particularly when an antibiotic or potassium chloride was mixed in the infusion. In this study, one out of five patients receiving infusions developed phlebitis. Of those patients who developed phlebitis, 77 percent had received these infusions by way of intracatheter.

Such a special trained team of nurses in a private hospital in Portland has shown that infection rates can be reduced. This was accomplished by frequent daily observation of the intracatheters and immediate removal of the intracatheters at the first sign of patient distress or intracatheter dysfunction.[16]

Research, however, has suggested that there are other factors which relate to the incidence of phlebitis.

PURPOSE OF THE STUDY

The purpose of this study was to identify factors which were related to phlebitis when a patient has an intracatheter for intravenous therapy. The variables which were tested included the following: preparation of the skin, infusion site, type of intracatheter, duration of infusion by intracatheter, and admixture of medication.

Specifically, the study tested the following hypotheses:

1. The incidence of phlebitis from intracatheter is no greater when the skin is prepared with iodophore (Virac 1:750) than when it is prepared with 70 percent ethanol.

2. Intracatheters inserted in the hand and wrist will produce a greater incidence of phlebitis than those inserted in the forearm.

3. The Jelco 17 gauge, 3 inch intracatheter will produce a greater incidence of phlebitis than the Bard 18 gauge, 8 inch intracatheter.

4. The incidence of phlebitis will be greater when intracatheters are left in place 48-96 hours, than when they are left in place less than 48 hours.

5. Intracatheters that have been irrigated with produce a greater incidence of phlebitis than intracatheters that have not been irrigated.

6. Infusions with medications will produce a greater incidence of phlebitis than infusions without medication.

METHODOLOGY

The population consisted of 65 medical, surgical patients from four wards in a general, county hospital. The criteria for the selection of the sample were (1) the patients were adults under 65 years of age, (2) mentally alert, (3) not critically ill, and (4) were currently receiving infusions by way of the intracatheters. The 65 patients who met the criteria were selected during daily visits to four wards. Data were collected by visiting the patients, at least twice daily for fourteen days, during the time the infusion was given.

The form on which data were collected was revised from the form developed by Dr. P. C. Fuchs.[16] He studied the effect of a team of trained nurses on the frequency of complications of intravenous therapy by way of the intracatheter. Although he demonstrated that data could be collected by the use of his form, additional information was desirable because continuous and intermittent infusions were used in the present study. The following information was obtained on each patient: sex, age, type and size of intracatheter, insertion site, insertion time, by whom inserted, continuous or intermittent infusion, complications, incidence of phlebitis, time of removal of intracatheter and the total hours of intracatheter use. (Appendix A). Since the researcher was with each patient for a limited time only to observe the site of the intracatheter, each patient was asked: did anything

happen to your infusion over the last 12 hours, and did the nurse irrigate your intracatheter. (This procedure was explained to the patient). If the patient did not seem to understand the questions, probing questions were used. Information obtained from the patient's chart included: the type of intracatheter used, the date and time it was inserted, and the antibiotics, which were added to the infusion.

Neosporin, an antibiotic ointment used at the site of insertion of all intracatheters was not mentioned in this study as it was used routinely by the trained IV nurse and the house physicians.

The findings of this study were tabulated and interpreted. Tables then were constructed from the data, and the findings were summarized.

METHOD OF ANALYSIS

The data were analyzed on frequency tables utilizing the simplified method of the 2x2 table. The hypotheses were tested using chi-square. The data were discrete and independent. Yates' correction beta factor was incorporated because of the small numbers in the cells of the tables. The level of significance used was .05 to accept the hypotheses.

CHAPTER II

REVIEW OF THE LITERATURE

REVIEW OF RELATED LITERATURE

The polyethylene indwelling catheter or intracatheter was first introduced by Dr. H. Meyers in 1945. This device has greatly facilitated long-term intravenous therapy. It involves leaving the intracatheter in place for no less than twenty-four hours.[11] Since then, it has become a common means of giving intravenous fluids and medication in many hospitals; for example, in 1967 Boston City Hospital dispensed 25,000 intracatheters to medical and surgical wards.[7] Half of those intracatheters were used for long-term intravenous therapy. Physicians, on the whole, have favored the intracatheter over the scalp-vein needle because it provides a more stable infusion site. The technique, however, of threading an intracatheter into the vein through a large bore needle requires close examination since the intracatheter can cause local and systemic infection in patients receiving long-term intravenous therapy.[2, 4] Various studies have indicated that this complication can be reduced by maintenance of the intracatheter by a trained team of nurses.

A study by Fonkalsrud described specifically the pathogenesis of phlebitis.[15] Previous studies have alluded to phlebitis as an important sign of impending complication due to the use of the intracatheter[5, 9] and will therefore be discussed in relation to the part the intracatheter can play in local and systemic infection in patients receiving intravenous therapy.

The exact pathogenesis of intracatheter-induced bacteremia remains unclear. There has been some speculation, however, that septic phlebitis may occur since the plastic intracatheter does not fit tightly in the skin puncture, thereby making it possible for microorganisms to enter the wound when the movements of the arm cause the intracatheter to slide back and forth.[13, 24]

The association of infection at the site of the skin puncture with infection in the intracatheter suggests that it is important to keep this area of skin as clean as possible. A team of nurses who had inserted 89 percent of the intracatheters in an intensive care unit demonstrated that the incidence of clinical phlebitis in the 48 hour or less group was reduced from 50 percent to 17 percent when iodine and 70 percent alcohol were used to cleanse the skin.[3] Another study indicated that all intracatheter-related septicemias occurred after the intracatheter had been in place a minimum of 48 hours.[4] Most authors have considered phlebitis a complication of skin contamination depending on the injury to the endothelium of the vein, inoculum size of the skin site,

and various host factors. Systemic antibiotics do not seem to prevent this complication.[17]

How the disease state of the patient is related to infection was elucidated by Koening.[22] He revealed that those most susceptible to infection are the very young and the very old; patients with influenza, exfoliative skin diseases, neoplasms, diabetes, liver disease, and renal failure; and patients receiving broad-spectrum antimicrobials, antineoplastic agents, and corticosteroids. In other words, the conditions under which serious infections occur may play a critical role in determining the outcome of the infection. Since the virulent staphylococci organism has been identified in most of the intracatheter-related septicemia, it is worth noting how this organism is able to evade the action of the potent antibiotics.

> The coagulase-positive staphylococci may survive within the patients' phagocytic cells. The cell walls of all coagulase-positive staphlococci contain "teichoic acids" which may be antiphagocytic. Thus the intraleukocytic residence may protect staphylococci from antimicrobial drugs and other antibacterial substances in serum or surrounding tissues and may aid in the spread of staphylococci to distant foci within the body.[22]

Druskin, in particular, has studied the role the intracatheter has played in causing local and systemic infection.[10] He reports two cases in which contamination of organism occurred via the blood from sites remote to the intracatheter. In each case, Klebsiella grew from urine cultures, and although repeated blood cultures were sterile, both Klebsiella and Enterococcus were obtained from the intracatheter

tip. It has been suggested that the thrombus, frequently found at the intracatheter tip, probably serves as a trap for bacteria carried by the blood and as a site for subsequent multiplication.[23]

Similar findings were reported by Smits and Freedman, who at the Yale New-Haven Hospital in 1967, related prolonged venous catheterization and septicemias.[25] Nine percent of those infections were attributed to intracatheters. In their opinion, the intracatheter was the main cause of septicemia at that hospital during that particular time period. It was also their feeling that the chance of such a complication was much higher if the intracatheter remained in the vein more than 48 hours. There appears to be no other method of reducing this complication other than early removal of the intracatheter.

During the same year, venous intracatheters were identified by Barrett as contributing to a group of nosocomial wound infection at Boston City Hospital.[3] In this study, Staphylococcus Aureus and Klebsiella-Enterobacter group were the most common organisms isolated from the blood and/or wound. In order to reduce this complication, Barrett felt that the intracatheter should be removed at the first sign of clinical phlebitis.

Other studies, one by Bogen[5] and one by Indar[19] reported clinical phlebitis as a sign that thrombotic or septic complications were likely to follow. Bogen, in 1960, stated that the incidence of phlebitis was greatly increased after the 48 hour period. Because

possible causes of phlebitis include irritation by the intracatheter as well as the acidity of the infused solution, Bogen suggests that the tip of the intracatheter should lie freely within a large vein so that the infusion may be diluted with the blood. In his study of 243 cutdowns, which were followed up for two weeks, there were 34 complications. Among these complications were ten cases of minor wound infection and ten cases of phlebitis.

In 1970, Banks investigated the incidence of infection by positive intracatheter and blood cultures in 118 patients who had been given infusion by intracatheter or angiocath in Kings Hospital, London.[2] Forty-five percent of the intracatheter tips were infected and four patients had bacteremia from the same organism as that cultured from the intracatheter and skin. His findings, however, were not in accord with those of Bentley or Smits, since his study showed no definite association between the incidence of infection and the length of time the intracatheter had been functioning.

Various studies have indicated that infection associated with the intracatheter can be reduced by maintenance of the intracatheter by a team of nurses. An example of how maintenance of intracatheter can reduce the rate of infection has been reported in separate studies made by Corso[8] at Rochester General Hospital, and Collins[7] at the Boston City Hospital. Corso specified strict techniques for insertion and maintenance of 505 intracatheters by a team of nurses. This included

the following all intracatheters were inserted in arm veins, unless otherwise specified by the physician; the skin was shaved, when necessary, and prepared with 99 percent alcohol blotted dry with sterile gauze, and painted with betadine, which was allowed to dry before insertion of intracatheter; all intracatheters sites were inspected four times a day and intracatheters were removed if there were any signs of phlebitis or dysfunction, or if the patient complained of local discomfort; all intracatheters were redressed and the skin scrubbed with alcohol every 24 hours; all intracatheters were removed after being in use for 72 hours unless otherwise ordered by the physician. A record was kept of all intracatheters. This record included the date and time of insertion and of removal, the reason for removal, and the condition of the intravenous site. The result of this study indicated that 26 (5.2 percent) of 505 of the intracatheters produced positive cultures. Two cases (0.4 percent) of intracatheter-induced bacteremia occurred, both with Staphylococcus Aureus. Corso contributed the low infection rate to the strict adherence of specific techniques of insertion and to maintenance of the intracatheter.

In contrast to Corso's study, Collins did not specify techniques for insertion and maintenance of 213 intracatheters. He reported that 39 percent of the patients who were receiving infusions by intracatheters developed phlebitis (marked erythema, induration and palpable venous cord) by the time of removal. The mean duration that the

intracatheter was in the vein was two and six-tenth days with a range of one to fourteen days for the group. The occurrence of phlebitis was not considered a reliable sign of local infection. Less than half (43 percent) of the intracatheters removed from the phlebitic patients produced positive cultures. Collins noted that out of 213 intracatheter tips, 73 (34.3 percent) yielded organisms. Included were the common skin contaminants. Local infection due to pathogens was 17.4 percent. This increased with the duration of intracatheterization. Collins felt strongly that the most effective singular means of reducing the overall morbidity associated with intracatheters is the restriction of their use, and that stainless-steel needles, particularly the scalp-vein type, should be used as an alternative mode of therapy in many patients.

In 1969, Fuchs[16] also examined the nature and extent of complications secondary to the use of the intracatheter. He stated that the major factor influencing the frequency of intracatheter colonization was the presence of other intracatheter complications, such as subcutaneous infiltration and phlebitis. According to Fuchs, the low infection rate (3.8 percent of 500 cultured intracatheter tips) was due to a trained team of nurses whose policy it was to observe the intracatheter site frequently and to remove intracatheters at the first sign of dysfunction. To him, the maintenance of the intracatheters was the most important factor in reducing the infection rate associated with its use.

Fonkalsrud's study described the incidence of phlebitis in terms of factors known to contribute to its pathogenesis.[15] One of the factors mentioned was that the acidity of the infusate seemed to be directly related to the incidence of phlebitis. Fonkalsrud demonstrated that when the infusate was neutralized with sodium bicarbonate just before the intravenous was administered to the patient the incidence of phlebitis was reduced threefold.[14] Another factor which influenced phlebitis was the infused agents. Concentrated sugar solutions, antibiotics and tumorcidal drugs are known to be sclerogenic. The relationship of the size of the needle or intracatheter to the size of the vein also is significant in causing phlebitis. The obstruction to flow caused by the infusing intracatheter prevents hemodilution of the solution and the sclerosing agent exerts directly upon the endothelium of the vein. Phlebitis is more likely to follow if the fluid is infused in the back of the hand than if the fluid is infused in the lower forearm.

In conclusion, Fonkalsrud suggested that when long-term intravenous infusion was anticipated, a cutdown intracatheter should be placed in a large central vein. Such intracatheter may be left in place for weeks without inducing phlebitis, since the infusate is promptly diluted and buffered by the blood in these large veins. He also stressed that daily dressing change, recleansing of the wound with an iodinated solution, and local antibiotic ointment help keep wound infection to a minimum.

Other factors which seem to contribute to the incidence of phlebitis included venous injury during insertion of a sharply beveled needle or intracatheter;[11] improper fixation of the needle in relation to the skin which produces intraluminal movement and resultant injury;[1] and material of the intracatheter such as polyethylene which appears to be more reactive than teflon.[18]

To determine factors associated with phlebitis from intracatheters a study was done by nurses at the Joseph Brant Memorial Hospital, Burlington, Ontario, Canada. Kay and Roberts[21] conducted a survey for four and one-half months in a 230 bed hospital where 974 infusions were administered by a team of nurses. Phlebitis was defined as being present when a nurse observed an area of inflammation in the affected vein or when the patient complained of pain in the area. The result showed that one out of every five patients receiving intravenous fluids developed phlebitis, and that 77 percent of these patients had received their infusions by way of intracatheters. The incidence of phlebitis was nine percent in patients whose intracatheters were left in place for less than 24 hours, 58 percent in patients whose intracatheters were withdrawn between 24-48 hours, and 74 percent in patients whose intracatheters were withdrawn between 49-72 hours. Although there was no change in procedures or equipment after the survey was completed, the members of the intravenous team were more aware of the need for close observation of the infusion site;

consequently, any untoward reactions were noted earlier, and the infusion site was changed before a severe case of phlebitis occurred.

SUMMARY

Research studies have shown that phlebitis is a common sequel to IV therapy with intracatheters. The study by Fonkalsrud dealt specifically with factors associated with phlebitis. Local and systemic infection rate associated with the intracatheter has been well documented by many authors. Numerous researchers emphasize restriction of use of the intracatheter and early removal of the intracatheter as the only way to reduce phlebitis. Various studies, however, indicated that infection rate could be reduced when a team of IV nurses inserted and maintained the intracatheters in patients receiving intravenous therapy. The IV team of nurses[16] also detected early phlebitis and discontinued the infusions thus reducing discomfort in patients who were receiving infusions by way of intracatheters.

CHAPTER III

REPORT OF THE STUDY

FINDINGS AND DISCUSSION

The researcher visited each ward three hours daily for fourteen consecutive days. The number of patients who were receiving infusions was recorded on the hospital's standardized form. The form was kept at the nurse's station and was reviewed at each visit. Patients who met the criteria of the study were visited and selected to be part of the sample. Each patient was visited twice a day as long as the intravenous remained in place. The data were recorded on the form devised for that purpose.

The sample consisted of 65 medical and surgical patients, 26 men and 39 women who were on four wards in a large county hospital. They ranged in age from 15 to 65. The mean age was 48.7 for the men and 40.5 for the women. The mean age of the total group was 43.8. See Table 1.

Twenty-four (24) patients were on the clean surgical wards and 41 patients were on the medical ward. Those patients who were classified as medical had been admitted with an infection; moreover, they were quite debilitated although their nutritional status was not

determined. It was recognized that one of the limitations of the study is that the specific diagnoses of the patients were not recorded.

TABLE 1

Distribution of Patients
by Age

Age	N
- 20	3
20 - 29	15
30 - 39	8
40 - 49	7
50 - 59	19
60 - +	13
TOTAL	65
$\bar{X}$	43.8

Of the 65 patients in the study 46 or 70.8 percent developed phlebitis; 19 or 29.2 percent did not develop phlebitis. See Table 2. There have been classifications of phlebitis[14] but it was not done in this study. This is another limitation of the data.

TABLE 2

Distribution of Patients
With and Without Phlebitis

Phlebitis	N	Percent
With phlebitis	46	70.8
Without phlebitis	19	29.2
Total	65	100.0

Of the 65 patients, 54 of them had a skin preparation with ethanol 70 percent, and eleven patients had a skin preparation with ethanol and virac. The physicians who started the intravenous prepared the skin with ethanol, and the intravenous nurse prepared the skin with ethanol and virac. See Table 3.

TABLE 3

Distribution of
Kind of Skin Preparation

Skin Preparation	N	Percent
Virac (1:750) and Ethanol	11	19.5
Ethanol (70 percent)	54	80.5
Total	65	100.0

A larger number of patients whose skin was prepared with ethanol (80.5 percent, N=37) developed phlebitis than those patients whose skin was prepared with virac (19.5 percent, N=9). See Table 4.

Statistical analysis resulted in the acceptance of the first hypothesis.

> The incidence of phlebitis from the intracatheter is no greater when the skin is prepared with iodophore (Virac 1:750) than when it is prepared with 70 percent ethanol.

TABLE 4

Patients With and Without Phlebitis
and Kind of Skin Preparation

Skin Preparation	Phlebitis	Non-Phlebitis	Total
Virac (1:750) and Ethanol	9	2	11
Ethanol (70 percent)	37	17	54
Total	46	19	65

$X^2 = 0.270$ $p > .05$

These data did not support the findings of Barrett[3] who found that when a team of trained IV nurses changed the skin preparation from ethanol to ethanol and virac the incidence of clinical phlebitis decreased from 50 percent to 17 percent.

The veins in the forearm are larger and therefore the infusate would be more diluted here than in the smaller veins of the hand or wrist. It was assumed that there would be a greater incidence of phlebitis in the veins of the hand or wrist than in the veins of the forearm. It has been suggested by Bogan[5] that cut downs in larger veins be used to reduce phlebitis because of the hemodilution of the solution. Of the 24 patients who had infusions in the hand or wrist 83.4 percent developed phlebitis. Of the 41 patients who had infusions in the forearm 63.4 percent developed phlebitis. See Table 5.

TABLE 5

Distribution of Phlebitis
by Site of Intracatheter

Hand - Wrist			Forearm		
	N	Percent		N	Percent
Phlebitis	20	83.4	Phlebitis	26	63.4
Non-Phlebitis	4	16.6	Non-Phlebitis	15	36.6
Total	24	100.0	Total	41	100.0

There was a significant difference in the number of patients with phlebitis who received infusions in the forearm and those who had infusions in the hand or wrist. Hypothesis two was accepted. See Table 6.

> Intracatheters inserted in the hand and wrist will produce a greater incidence of phlebitis than those inserted in the forearm.

TABLE 6

Patients With and Without Phlebitis
and Site of Intracatheter

Site of Intracatheter	Phlebitis	Non-Phlebitis	Total
Hand or wrist	20	4	24
Forearm	26	15	41
Total	46	19	65

$X^2 = 2.90$ $p < .05$

The size and kind of intracatheter was noted on the chart. The Jelco catheter #17 is shorter than the Bard #18. The farther the intracatheter tip is inserted into the vein the more stable the infusion site and the less chance of irritating the vein. As predicted in hypothesis three, the Jelco #17 produced greater incidence of phlebitis (72.5 percent, N=29) than the Bard #18 (68.0 percent, N=17). See Table 7.

TABLE 7

Distribution of Phlebitis
and Type of Intracatheters

Bard #18			Jelco #17		
	N	Percent		N	Percent
Phlebitis	17	68.0	Phlebitis	29	72.5
Non-Phlebitis	8	32.0	Non-Phlebitis	11	27.5
Total	25	100.0	Total	40	100.0

There was no significant relationship between the type of intracatheter and phlebitis. Hypothesis three was rejected. See Table 8.

> The Jelco 17 gauge, 3 inch intracatheter will produce a greater incidence of phlebitis than the Bard 18 gauge, 8 inch intracatheter.

The length of time the intracatheter was left in place was noted on the chart. There was a lower incidence of phlebitis in those patients who had intracatheters in less than 48 hours than in patients

who had intracatheters in more than 48 hours.

TABLE 8

Patients With and Without Phlebitis
and Type of Intracatheters

Type of Intracatheters	Phlebitis	Non-Phlebitis	Total
Bard #18	17	8	25
Jelco #17	29	11	40
Total	46	19	65

$X^2 = 0.116$ $p > 0.05$

TABLE 9

Length of Time Intracatheter
Was in the Vein

Less Than 48 Hours			More Than 48 Hours		
	N	Percent		N	Percent
Phlebitis	13	65.0	Phlebitis	33	74.0
Non-Phlebitis	7	35.0	Non-Phlebitis	12	26.0
Total	20	100.0	Total	45	100.0

Seventy-four percent (N=33) of the 45 patients who developed phlebitis had intracatheters in more than 48 hours. These findings supported the studies and opinions of others, that the length of time the intracatheter is left in place is related to incidence of

phlebitis.[2, 4] The literature stated that all intracatheters should be replaced after a 48 hour period in order to reduce the incidence of phlebitis.

TABLE 10

Distribution of Patients With Phlebitis by Length of Time Intracatheter was Left in Place

	N	Percent
Intracatheter < 48 hrs.	13	29.0
Intracatheter > 48 hrs.	33	71.0
Total	46	100.0

TABLE 11

Patients With and Without Phlebitis by Length of Time of Intracatheter Was in the Vein

Length of Time Intracatheter was in vein	Phlebitis	Non-Phlebitis	Total
Less than 48 hours	13	7	20
More than 48 hours	33	12	45
Total	46	19	65

$X^2 = 0.1492$ $p > 0.05$

The data in this study did not support this assumption as the difference was not statistically significant. Hypothesis 4 was rejected. See Table 10.

> The incidence of phlebitis will be greater when intracatheters are left in place 48-96 hours, than when they are left in place less than 48 hours.

This hypothesis was rejected as is shown in Table 10. These data are different from that reported by Banks[2] or Bentley[4]. They both reported that phlebitis was related to the length of time the intracatheters were left in place over 48 hours.

In the large county hospital where this study was conducted, it was the common practice for nurses to irrigate the intracatheters when they became plugged or when they stopped. Source of information as to whether or not the intracatheters were irrigated came from the nurse or the patient. If the information could not be obtained from the nurse, the patient was asked. If the patient did not understand the question, the procedure of irrigation of intracatheter was explained. Although this was a subjective method of obtaining data it seemed appropriate for this descriptive study. Studies which supported this procedure could not be found. However, it was assumed that patients who had their intracatheters irrigated would more likely develop phlebitis, than those who did not have their intracatheters irrigated.

TABLE 12

Distribution of Phlebitis
by Irrigation of Intracatheters

Irrigated			Non-Irrigated		
	N	Percent		N	Percent
Phlebitis	28	87.0	Phlebitis	18	55.0
Non-Phlebitis	4	13.0	Non-Phlebitis	15	45.0
Total	32	100.0	Total	33	100.0

TABLE 13

Patients With and Without Phlebitis
and Irrigation of Intracatheters

Irrigation of Intracatheter	Phlebitis	Non-Phlebitis	Total
Irrigated	28	4	32
Non-Irrigated	18	15	33
Total	46	19	65

$X^2 = 7.010$ $p < .001$

Of the 46 patients who developed phlebitis 28 (60 percent) had their intracatheters irrigated. These data revealed a highly significant difference between intracatheters which were irrigated and the incidence of phlebitis. See Table 13.

Hypothesis 5 stated:

> Intracatheters that have been irrigated will produce a greater incidence of phlebitis than intracatheters that have not been irrigated.

It was accepted.

The patients on the medical ward who had an infection were receiving an antibiotic every two hours intravenously. The most common antibiotic given was Keflin. The Physicians-Desk-Reference does not indicate that a relationship exists between Keflin and phlebitis. In this hospital the antibiotics are diluted and added through a volutrol every two to four hours. The patients were instructed to watch their own volutrol and summon the nurse when the solution in the volutrol was low. It takes approximately thirty minutes for the solution to run through the volutrol. It was observed, that the volutrols frequently were dry and consequently, the backflow of venous blood caused plugging of the intravenous tubing.

Thirty-three of the 46 patients who received an antibiotic developed phlebitis, as compared with 15 patients who did not receive an antibiotic. See Table 14.

More patients who received a medication in their intravenous (N=33, 74 percent) had a phlebitis than patients who did not have medication in their intravenous (N=13, 65 percent).

TABLE 14

Distribution of Phlebitis by Infusion
With and Without Medication

With Medication			Without Medication		
	N	Percent		N	Percent
Phlebitis	33	74.0	Phlebitis	13	65.0
Non-Phlebitis	12	26.0	Non-Phlebitis	7	35.0
Total	45	100.0	Total	20	100.0

TABLE 15

Patients With Phlebitis and Without Phlebitis
and Infusions With Medications

	Phlebitis	Non-Phlebitis	Total
With Medication	33	12	45
Without Medication	13	7	20
Total	46	19	65

$X^2 = 0.1492$ $p > .05$

Hypothesis 6 stated that:

> Infusions with medications will produce a greater incidence of phlebitis than infusions without medication.

This was not supported. See Table 15. The relationship between phlebitis and medications was not significant.

Collins[7] in his sample of 213 general medical surgical patients did report a significant correlation between the administration of sodium nafcillin and penicillin, and phlebitis.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The review of literature has indicated that phlebitis is a common occurrence in patients receiving infusions by way of the intracatheter. Complications such as local and systemic infections associated with the intracatheter can be reduced when a team of nurses maintain the infusions and remove the intracatheters at the first sign of phlebitis.

The purpose of this descriptive study was to identify factors associated with phlebitis from intracatheters in patients who were receiving infusions by way of the intracatheters. The particular factors studied included preparation of the skin, insertion site, type of intracatheter, duration of infusion, maintenance by irrigation of intracatheter, and admixture of medication. Hypotheses were formulated to indicate the relationship of the variables and the incidence of phlebitis.

The population consisted of 65 medical and surgical patients from four wards in a large county hospital. These patients were less than 65 years of age, mentally alert, and not critically ill. The mean

age of the total group was 43.8. The patients received infusions by way of Jelco or Bard intracatheters, most of which were started by house physicians.

The researcher visited each patient who met the criteria for the study twice a day during the time he was receiving intravenous therapy. Data were collected on a checklist consisting of the factors which the literature indicated as contributing to phlebitis.

Of the 65 patients in the study 46 (70.8 percent) developed phlebitis. When the data were analyzed on distribution tables, it was found that there was more phlebitis in patients who had: 1) an ethanol 70 percent skin preparation, 2) had their intracatheter in a vein in the forearm, 3) had a Jelco #17 needle, 4) had an intravenous running for more than 48 hours, 5) had the intravenous irrigated, and 6) had a medication in the intravenous. However, when the relationship between phlebitis and the factors were tested statistically, using chi-square with Yates' Correction factor, $p < .05$, few significant relationships were found. Hypothesis 2: Intracatheters inserted in the hand and wrist will produce a greater degree of phlebitis than those inserted in the forearm, was significant $p < 0.05$. Hypothesis 5: Intracatheters that have been irrigated will produce a greater incidence of phlebitis than intracatheters that have not been irrigated, was also significant $p < .001$. Hypothesis 1 was stated in the null. The incidence of phlebitis from the intracatheter is the same when the skin is prepared

with virac (1:750) and when the skin is prepared with ethanol, 70 percent. By rejecting the null hypothesis this indicates that there is a significant relationship between phlebitis and skin preparation. Hypotheses 3, 4, 6 were rejected. They were respectively: the Jelco 17 gauge, 3 inch intracatheter will produce a greater incidence of phlebitis than the Bard 18 gauge, 8 inch intracatheter; the incidence of phlebitis will be greater when the intracatheter is left in place more than 48 hours, than when they are left in place less than 48 hours; and infusions with medication will produce a greater incidence of phlebitis than infusions without medication.

Background variables identified in this study had little influence on the incidence of phlebitis associated with intracatheters during intravenous therapy. Irrigation of the intracatheters and site of insertion in hand, wrist, or lower forearm and the incidence of phlebitis was statistically significant for the patients in this study.

CONCLUSIONS

The amount of phlebitis which occurs in patients with infusions by intracatheter is high. It is a problem for the patient because it lengthens his hospitalization and it increases his risk for additional illnesses. Phlebitis is also a problem for the professional staff. The patients who comprised the population in this study were debilitated and many of them had infections. It would have been valuable to

know whether the patients who developed phlebitis were in nitrogen balance or to have had some measure of the patient's nutritional status. Not knowing the patient's diagnosis was a limitation.

The nurse has some responsibility for three of the factors that were significantly related to phlebitis: site of infusion, skin preparation, and irrigation of infusions. She can select a site only if she starts the infusion. She can assist the physician in starting an intravenous and prepare the skin with ethanol and virac. Hospital policy about irrigating intracatheters should be investigated and hopefully changed.

RECOMMENDATIONS FOR FUTURE STUDIES

1. The patients in this study were in a county hospital, a similar study should be done in a private hospital where patients from a wider socio-economic background can be identified.

2. The study should be repeated with a larger sample in which the patient's nutritional status and various diagnosis could be determined.

3. Experimental studies should be done in which all factors in the patients with phlebitis were controlled - type of needle, type of skin preparation, irrigation of intracatheters, site of insertion and admixture of medication.

4. A study should be done by a team of nurses who inserted and maintained scalp-vein needles and the incidence of phlebitis.

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