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Effects of Ice Application on Alopecia Produced by Adriamycin

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EFFECTS OF ICE APPLICATION ON ALOPECIA PRODUCED BY ADRIAMYCIN

by

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Each person whose signature appears below certifies that he has read this thesis and that in his opinion it is adequate, in scope and quality, as a thesis for the degree of Master of Science.

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CHAPTER I

INTRODUCTION FOR THE STUDY

I. NEED FOR THE STUDY

The cancer patient is often under considerable emotional stress and experiencing loss of his self-image from knowledge of his illness and disease process. The probability of baldness brought on by a chemotherapeutic drug, increases his threat of altered body image and may precipitate a severe depression. During the two months of this study, two male patients at Loma Linda University Medical Center (LLUMC) refused this treatment because of the probable scalp hair loss they would have as a result of adriamycin. One woman patient delayed treatment until this study was started and then consented to both the drug and the scalp ice application, a treatment used in an attempt to reduce the incidence of hair loss associated with this drug. These situations demonstrated the importance the patient placed on maintaining body image even at the expense of not undergoing treatment the physician had suggested.

Baldness or diminished hair growth whether generalized or localized is known as alopecia. Unfortunately there are no tested methods of preventing alopecia because of the broad spectrum of underlying contributing causes such as chemical poisons, hereditary abnormalities, nutritional deficiencies, trauma, aging process, neurological disorders, and a myriad of endocrine disorders (Ferriman, 1971, p. 45).

It is evident from this list of causes that in most instances, the individual has no choice as to whether he will be bald or not, but the cancer patient can say "no" to chemotherapy.

Everyone loses a certain number of hairs daily even under normal circumstances. The generally accepted opinion as to the average number of scalp hairs lost daily is between 50 and 100 (Kligman, 1961, p. 193). When laymen were asked to guess the number of hairs lost daily, they generally ventured figures between 10 and 25. Likewise, alopecia was often underestimated by observers due to the fact that such a large number of hairs had to be lost before the loss was noticeable to someone other than the patient. Baseline photographs might prove beneficial here (Kligman, 1961, p. 179).

Too often, alopecia is insidious and not even detected by the patient until he has already lost considerable hair. This type of alopecia is referred to as common baldness. Hamilton studied 526 subjects to determine the incidence of common baldness. On a scale of eight, he found women to have a maximum of stage four for common baldness. Observing subjects over fifty, he did not find a single woman with advanced alopecia as opposed to 58 percent of the men. Normally, women do not increase in baldness after the fifth decade, while men can lose hair up until the seventh decade (Hamilton, 1951, p. 724). Sabouraud suggested that if half the hair was not lost by thirty, the patient would never suffer from exaggerated alopecia (Sabouraud, 1929, p. 177), but this was not verified by Behrman. Some of the people with severe alopecia studied after the age of thirty, stated in retrospect that they had only minimal baldness at

age thirty (Behrman, 1952, p. 177). This conflict in opinions reflected the insidious nature of common baldness and pointed out the difficulty of not having a standardized, accurate guide to follow when making assessments of hair loss.

Alopecia ranging from partial to total baldness is a frequent complication of cancer chemotherapy. At M. D. Anderson Hospital in Houston, Texas, 100 percent of 71 patients receiving the drug, adriamycin, experienced alopecia to an observable degree starting by day 18 and becoming total within 2-3 days thereafter (Friedman, 1970, p. 18). The number of adriamycin doses does not seem to alter the amount of hair lost, since even one dose caused nearly total hair loss (Friedman, 1970, p. 18).

One of the recommended schedules of treatment with adriamycin for cancer and the one used both by M. D. Anderson Hospital and this medical center, LLUMC, is to give intravenously, 25 mg. of drug per square meter of body area each day for three days in succession, followed by an 18 day period of rest. No studies were found dealing with variance of hair loss on the various treatment routines. However, a study was done on the incidence of mucous membrane breakdown (stomatitis), a similar type of rapidly reproducing cell as are hair shaft cells. This time-dose schedule was found to markedly decrease the incidence of stomatitis which implied that stomatitis could be eliminated if the interval between doses was sufficiently long (Friedman, 1970, p. 17). Other side effects of this drug were "cardiotoxicity, bowel movement depression, and bone marrow depression." Bone marrow depression was the major determining factor as to whether the drug

was to be continued at three weeks or at a later time when the white blood cell count was sufficiently high to be safe (Friedman, 1970, p. 17). Bonadonna stated that patients who had received previous cancer chemotherapy were more susceptible to the toxic side-effects than those who had not (Bonadonna, 1969).

Adriamycin is a member of the antibiotic class which stops synthesis of certain proteins by inhibiting RNA production from DNA (Bonadonna, et al., 1969, p. 503; 1970, p. 478). In this manner, the most rapidly reproducing cells (those with the greatest metabolism) are attacked first or to the greatest degree, by not allowing them to reproduce themselves. The cells most affected are tumor cells, mucous membrane (linings of the gastro-intestinal tract), hair follicles, and white blood cells produced by the bone marrow. DiFronzo studied the distribution and excretion pattern of adriamycin in seven patients and found that the radioactive half-life was 30 minutes in plasma with a fairly constant concentration for 7 to 10 days. The drug is most effective on malignant effusions in peritoneal and pleural spaces. None was detectable in the cerebral spinal fluid which would indicate the drug would not be effective in inhibiting brain tumors. The excretion rate was about fifty percent of the administered dosage by about day seven (DiFronzo, 1970, p. 75). These findings were similar to those of Bonadonna and led him to conclude that adriamycin has a rapid plasma clearance and a slow rate of excretion (Bonadonna, 1970, p. 479). This implied that the drug becomes attached to surrounding tissues rapidly.

The drug carrying plasma has access to the scalp hair follicles only via superficial vessels located in the subcutaneous tissue. These

vessels get their supply from both the internal and external carotid arteries. These arteries connect frequently between each other as collateral channels (Behrman, 1952, p. 57).

Because of the superficial blood flow to the hair follicles and the rapid plasma clearance probability property of adriamycin, it seemed feasible to suggest that the blood flow to the scalp could be interrupted long enough to render adriamycin non-toxic to the scalp hair follicles, thus reducing alopecia associated with adriamycin. Use of a tourniquet around the margins of the scalp was used by O'Brien on 30 patients getting Vincristin, a similar-acting drug. Vincristin does not induce alopecia 100 percent of the time or to the same degree that adriamycin does. He reduced the incidence of obvious alopecia to just three out of thirty by using the tourniquet at 10 mm/Hg above systolic blood pressure during and for five minutes following the intravenous injection of the drug (O'Brien, 1970, p. 1469). There are no published studies on the use of ice packs to cause vasoconstriction of the scalp vessels in an attempt to keep toxic drugs from damaging the hair follicles. The vasoconstricting properties of cold or ice have been recognized for several centuries (Moor, 1964, p. 49; Bierman, 1952, p. 7; Wolff, 1949, p. 145; Wakim, 1959, p. 130).

This study was considered to be important for nursing because the nurse is concerned with the whole person, i. e. his emotional, physical, and spiritual well-being. The cancer patient is under physical and emotional stress from his disease. His body image is already threatened by his disease process. A treatment which may cause an obvious change in his appearance will be a further threat to his body image, and may be more than he can indure. Nurses aim to be supportive

of the patient's feelings and reactions to stress and illness. Nursing care is often designed to do those things which reduce or minimize the reactions to stress or illness. The application of an ice pack, being a non-invasive procedure, is a form of nursing therapy. Should this measure prevent or reduce a side effect of the drug, the supportive aspects of nursing care in showing concern for the "whole man" and his responses to illness, would be partially achieved.

II. THE PROBLEM

Statement of the Problem

The purpose of this study was to discover whether ice applied locally to the scalp of the patient 3 minutes before, during and for 7 minutes immediately after intravenous injection of adriamycin would reduce the alopecia associated with the administration of the drug.

Hypotheses

One main hypothesis was tested along with several sub-hypotheses: Patients receiving applications of ice packs directly to the scalp will have less alopecia than those who are not treated.

a. Alopecia will be greater in patients who have had radiation or other chemotherapy treatments within the last six months.

b. Alopecia will be more extensive among men than women.

c. Alopecia will be greater among those over fifty than below fifty years of age.

d. The patient will rate his alopecia as being greater than the average (mean) of the three nurse observers.

Assumptions

For this study, it was assumed (1) that hair loss would occur without the ice pack treatment to the scalp, and (2) that ice initially produced vasoconstriction of vessels in the area of skin to which the ice pack was applied.

Limitations

The study was limited to cancer patients at Loma Linda University Medical Center receiving adriamycin for the first time and having obvious scalp hair which could be evaluated. There was also a two month time limit set in which to collect study material.

Several important variables were not controlled in the group of patients studied.

1. Patients could be taking drugs other than chemotherapy concurrently. Prior chemotherapy with another agent or radiation treatments within six months of the first course of adriamycin were recorded to discover how they might affect alopecia.

2. Patients could care for their hair according to their habits of brushing or combing, shampooing, type of shampoo, etc. They were asked not to cut their hair however, until the end of the study period.

3. Patients had varying hair density, texture, and length, but these factors were considered as not changing scalp temperature significantly during the ice pack treatment.

4. The group of experimental patients was always in a reclining position, while the control patients were either sitting or reclining depending whether they were in the hospital or in the office of the doctor.

CHAPTER II

METHOD OF STUDY AND RATIONALE

This study was an effort to find out if ice packs applied to the scalp decreased blood flow to the hair follicles sufficiently well so as to reduce alopecia associated with the administration of intravenous adriamycin. A search of the literature did not reveal any published documentation of the use of ice to induce vasoconstriction locally in an attempt to protect hair follicles from the effects of toxic drugs. Therefore, a review of the literature was then used to develop a method for testing a possible solution to the problem of alopecia associated with adriamycin administration. This chapter presents the method used in this study and the rationale for the choice of method.

I. RATIONALE FOR METHOD OF STUDY

As there was no specific model for methodology, the procedure was formulated by study of the effects of the drug and effects of cold on various structures of the body as reported by other researchers. An attempt was made to choose the safest and most effective method for cold application, the distance of penetration and time necessary for accomplishing same, duration of cold, effects of the drug, adriamycin, and other attempts at trying to reduce drug induced alopecia.

Rationale for Selection of Ice

There are several methods by which the scalp could be cooled to cause vasoconstriction of blood vessels to the hair follicles, but ice was selected because of its ready availability at low temperature, ease of use, and relative comfort (not intrusive) for the patient (Dripps, 1956, p. 145). Ice also is capable of absorbing heat faster than the blowing of cold air and is thus able to cause vasoconstriction of skin vessels more rapidly (Bierman, 1940, p. 586). Alcohol poured over the skin only lowered the subcutaneous temperature about 3° F. as opposed to 24° F. for ice and 16° F. for cold air (Bierman, 1955, p. 1189). Dripps pointed out the disadvantage of not having effective temperature regulation in working with ice packs (Dripps, 1956, p. 415). Heat regulation of the skin is limited to the steady state in which heat delivery to the surface is equal to the heat loss to the environment (Lake, 1917, p. 588).

Effects of low temperature on skin. The interior temperature of an ice pack is 32° F. while the exterior is 40° F. (Seldon, 1936, p. 168). Keatinge and Cannon found that skin temperature could be as low as 31° to 35.4° F. without injury to the tissue (Keatinge, 1960, p. 13). Furthermore without the presence of moisture, skin temperature could be lowered to as low as 5° F. without injury (Bierman, 1955, p. 1189; Burton, 1955, p. 225). To protect the scalp from moisture from the ice pack, two paper surgical caps were placed over the patient's hair prior to the application of the disposable plastic ice pack.

Effects of low temperature on the blood supply of the skin. It is generally agreed that the initial response by the body to cold is for vasoconstriction which after a period of time changes to vaso-

dilation. The mechanisms causing this phenomenon are not well understood. In a study of blood flow by Barcroft, it was determined that blood flow was decreased in the forearm immersed in ice water. Also, the temperature of the blood flowing through the vessels was reduced, therefore increasing the viscosity of the blood which would in turn decrease blood flow even more. Primarily though, he found that the blood vessels did constrict to try to preserve the heat of the body (Barcroft, 1943, p. 19). Wakim agreed and brought in the physiological fact of the blood vessels of the skin being capable of monopolizing up to one fourth of the total blood volume, which increases or decreases in accordance with local and general needs (Wakim, 1959, p. 127).

Licht (1958) wrote that the mechanisms governing blood vessel diameter were mainly nervous, but that even in denervated limbs, there were still some local vasomotor responses. Skin blood flow was affected much more than muscle blood flow because of the closer proximity to the source of hot or cold stimulus (Licht, p. 133). In addition to the local affect of cold to the immediate area of application, there were remote reflex effects through the nervous system causing cooling elsewhere in the body (Moor, 1964, p. 9). In view of this last point, blankets were offered at the first signs of shivering or subjective statement by the patient that he felt chilled.

Considerable work has been done in trying to determine the effects of continued cold stimulus on blood flow. In observing reactions of the vessels of the human skin to cold, Lewis concluded that vasodilation following the initial vasoconstriction was usually, but not always periodic (occurring at regular intervals). He found that vasodilation could be prevented by severing nerves and allowing sufficient

time for degeneration to occur (Lewis, 1930, p. 188). Burton (1955) found that the vasodilation could be demonstrated even after denervation which is in disagreement with Lewis (p. 136). Spealman (1945) found that after the initial period of vasoconstriction, there was an increase in blood flow to the hands when they were chilled and the body temperature was normal (p. 220). Wolff (1949) found too that vasodilation continued after the finger was removed from the icy water indicating possible increased blood flow (p. 152). It was concluded that the increase in blood flow through the skin under hypothermia measures, was due to arteriovenous anastomoses or collateral blood systems (of which there are many in the scalp) (Lewis, 1930, p. 207; Forrester, 1969, p. 419; and Grant, 1931, p. 407).

Effect of low temperature on utilization of anti-tumor drugs. The effectiveness of any anti-tumor drug depends on how well the drug's action can be concentrated within the tumor and the minimizing of any toxic side-effects. Adriamycin is not tumor specific so it was necessary to try to minimize untoward effects if possible. Harrison studied 45 patients receiving another anti-tumor drug and used full body immersion in cold water (hypothermia) to try to reduce bone marrow depression. Bone marrow depression was not as severe. One man did develop cardiac complications, but was restored to normal rhythm after being defibrillated (Harrison, 1967, p. 1536). The principle behind this was to reduce the metabolism of the healthy bone marrow cells and force the unprotected vulnerable cells to have a greater uptake of the chemical because of a higher rate of metabolism. This principle was inferred from the proven theory that there is increased uptake of a drug at the cell level at elevated temperatures (Condon,

1967, p. 810). In addition to vasoconstriction and a slowdown of metabolism produced by hypothermia, there was less leukocytic migration through capillary walls, and a considerable slowing of the local circulation (Moor, 1964, p. 7).

Rationale for Length of Cold Application

Penetration of cold. Cold has the capacity to penetrate deeply into underlying tissues, but in this study, interest was primarily centered on the capacity of cold to penetrate the skin and subcutaneous tissue. The extent of the penetration in distance and temperature depends on (1) the nature of the substance applied, (2) its variation from thermal neutrality (i. e. difference between the ice pack temperature and temperature of tissue being influenced), (3) the duration of its application, and (4) the region upon which it is placed (Bierman, 1940, p. 585).

Bierman and Licht did extensive studies to determine length of time necessary to change skin, subcutaneous, and muscle temperature of the human calf muscle when exposed to either hot or cold stimulus. The time required for the fall in skin surface temperature from cold stimulus was 15 minutes; for subcutaneous temperature, about one hour; and for the intramuscular temperature, still falling after two hours (Bierman, 1952, p. 5; Wakim, 1959, p. 128). Macleod used two thermocouples to determine subcutaneous temperature changes incurred with local cold application; one thermocouple immediately under the applicator and the other at an unspecified distance. The difference between the temperature of the applicator and the skin was about 40° F. He noted a very sharp drop in temperature at first in all cases, taking about five minutes to reach to within 2.8° F. of the tempera-

ture finally attained (20° F. cooler than at the beginning). After removal of the cold, the temperature of the skin rose at about the same rate as it had fallen (Macleod, 1921, p. 70).

Duration of cold effects. In two separate studies on skin temperature of fingers immersed in ice water, it was found that vasoconstriction occurred immediately and could be so intense that local circulation could be occluded completely. Lewis found vasodilation occurring after 10 to 15 minutes had elapsed. He also found oscillation in blood vessel diameters and termed it the "hunting" phenomenon (i. e. the natural mechanism of the body which attempts to regulate heat control) but did not obtain an increase in skin temperature (Lewis, 1930, p. 206). Greenfield (1950) found that after only 5 minutes, there was a sudden increase of blood flow which could be sustained, but usually oscillated because of alternating vasoconstriction and vasodilation of blood vessels (p. 545). In a later study, Edwards concluded that neither vasoconstriction or dilation was abrupt. His other findings were similar to those of Lewis and Greenfield (Edwards, 1960, p. 208). The influence of this vasodilation factor on the duration of the application of the ice pack should depend on the degree and duration of this vasodilation in terms of normal blood flow. This relationship was not made clear by these researchers.

From the above discussion, it was evident that there was no set time at which vasodilation occurred and to what degree blood flow increased from the influence of cold application. An average between the two stated times of 5 and 15 minutes for vasodilation would be 10 minutes which was the time arbitrarily chosen to leave the ice pack

on the scalp of the patient. To produce initial vasoconstriction, the ice pack was applied for 3 minutes prior to the administration of the drug. An over-all period of 10 minutes was selected due to the reported success of the earlier mentioned study by O'Brien using a tourniquet which provided protection during and for five minutes following the intravenous injection, or not more than a total of 10 minutes.

The possibility that vasodilation occurs periodically when cold is applied to a body surface presented problems in determining the duration of application of the ice pack. The lack of specificity regarding this occurance caused the investigator to make an arbitrary choice in regard to the timing of the treatment. A need for additional research on the extent, nature and timing of vasoconstriction and vasodilation due to exposure to cold application was obvious.

Rationale for Selection of Patients

The cancer patient receiving the drug, adriamycin, was selected because of the possibility of a greater sample size than patients receiving other anti-tumor drugs. According to Friedman, these patients also had a 100 percent chance of hair loss following administration of the drug without any intervening treatment.

Rationale for Method of Hair Assessment

Assessment of hair growth depends on (1) the density of hair follicles, (2) the rate of growth of individual hair, (3) the state of the hair cycle, (4) the rate of shedding of club hairs (i. e. mature hairs), (5) the pattern of hair growth, (6) hair size, and (7) hair pigmentation (affecting subjective rather than objective

assessments) (Ferriman, 1971, p. 12). Ferriman goes on to state that although subjective assessment of hair growth is not adequate, particularly in disease states, there are very few objective methods now in use, and those which are in use are in a very early stage of development (Ferriman, 1971, p. 12). These objective methods of assessment required the assessor to pluck hairs, shave, cut, or make molds of the area being assessed and for the most part each had drawbacks when validity was considered (Ferriman, 1971, p. 12).

In determining density of hair follicles, one way was to take full thickness skin biopsies and examine them under a microscope, but for obvious reasons this would not be suitable for clinical application. Another way was to take an impression with a plastic material and then count the hair follicles, but there was really no way to differentiate hair follicles presently devoid of hair (Ferriman, 1971, p. 12). Rate of growth could be determined by shaving an area and observing subsequent growth over a period of time (Ferriman, 1971, p. 12). Plucking hair at random to gain a proportion of hair shafts at various phases of growth could be misleading if prior washing or vigorous brushing of the hair had been done (Kligman, 1961, p. 193; Braun-Falco, 1966, p. 142). In addition, the plucking technique could affect the appearance of the hair roots. Also the need to pluck a considerable number of hairs impaired the usefulness of the plucking method of hair loss assessment (Braun-Falco, 1966, p. 143).

The pattern of hair growth was found to be fairly consistent with age by Hamilton. He found that each successive generation of hair lessened in diameter and became finer in nature until the follicle

no longer produced the hair. This lack of production caused atrophy of the follicle. He noted that:

> the alopecia is never diffused; it has a specific locale and follows a well-known course until it achieves the typical patterns of male baldness. Although the hair becomes thinner in the marginal area, it is never completely lost, and extreme examples of hippocratic or classical baldness will still maintain a border fringe a few centimeters wide, festooned around the back of the head from ear to ear (Hamilton, 1951, p. 716).

This orderly progression of hair follicle atrophy is briefly interrupted when adriamycin is administered. The hair follicle is suddenly devoid of its hair shaft.

The hair follicle tended to respond in an all or none fashion except in its response to cancer chemotherapy. With this, the hair was lost from the follicles, but the follicles continued in their growing phase--there just were not any keratinized cells being made, thus no hair (Kligman, 1961, p. 197). Indications from this are that the hair follicles are still capable of growing hair if and when the drug is discontinued.

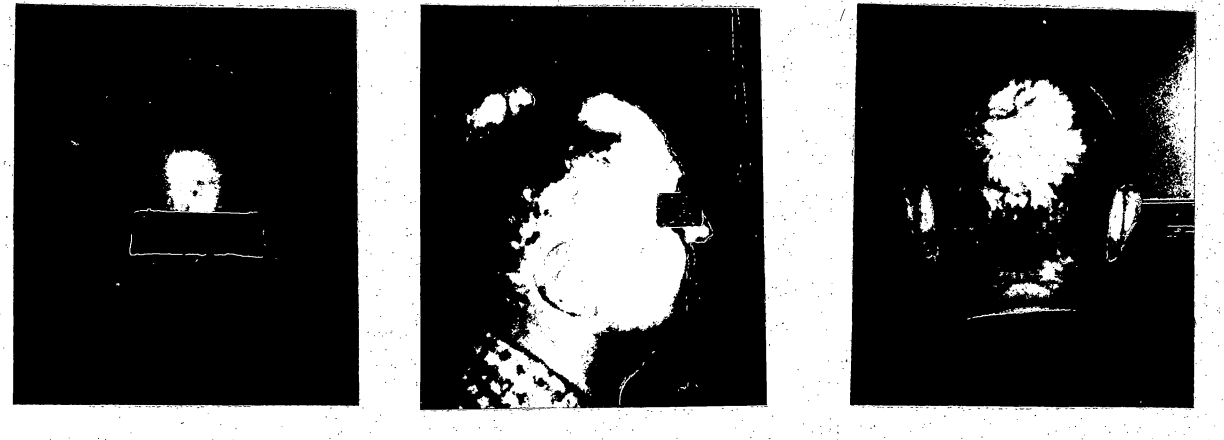
Since there does not appear to be an accurate, objective method of evaluating hair growth or loss at the present time suitable for clinical use, the subjective method of having three nurses assess hair loss at three week periods was selected. For reference to the original hair status of a patient, three pictures of different views of the patient's head were taken (See Figure I, for example). Evaluations were made from the pictures compared to the patient three and six weeks later. The patient was also asked to evaluate his own hair loss as none, mild, moderate, severe, or total.

FIGURE I

SAMPLE OF PICTURES USED
IN ASSESSMENT OF PATIENT ALOPECIA

Pre-treatment -

Post-treatment - Three Weeks



Post-treatment - Six Weeks

II. DESCRIPTION OF THE METHOD

Patients seen by the oncology specialists in both the office and on the hospital unit were selected for this study. The physician saw the patient first and decided what treatment would be best. If adriamycin was selected, the physician explained the possible side effects to the patient. Each patient was seen by the investigator prior to his first dose of adriamycin at which time consent for participation in the study was requested (See consent forms in Appendix B). Three black and white pictures (front, side, and back views of the patient's head) were taken to establish a base for comparison of pretreatment and posttreatment assessments of scalp hair loss. The following were noted: (See data collection sheet in Appendix C-1)

1. Dosage of adriamycin (based on square meter of body area which is derived from a person's weight and height).
2. History of any pre-existing hair loss from prior radiation or chemotherapy.

Pictures were taken of the same three views of the patient's head in three weeks and where time allowed, again in six weeks. The experimental and control groups met the same criteria. The application of the ice pack to the scalp was the only manipulated variable. The coincidental nurse-patient interaction between the investigator and control patient and the investigator and the experimental patient was handled as nearly alike as possible. The experimental patient received an explanation of the ice pack treatment and was asked to sign a consent form for the treatment which was in addition to the explanation received by the control group.

The experimental patient was supine while he received adriamycin while the control patient was usually sitting up. The control patients in the hospital were usually lying down.

The treatment for the experimental group consisted of (1) having the patient place two paper, surgery-type caps over his hair; (2) having the nurse investigator place a disposable ice pack over the two caps; and (3) having the nurse investigator secure the ice pack in place with the aid of an elastic bandage around the scalp margins and wrapped under the patient's chin. The ice pack consisted of a 22 inch by 24 inch plastic bag filled with about six pounds of finely crushed ice. Because of the weight, the patient was asked to lie down in a fully recumbent position while receiving the treatment. The ice pack was applied 3 minutes before drug administration and continued for a total of 10 minutes. This process was done each time the patient received the drug, usually daily for three days about every three weeks, depending upon the accompanying bone marrow depression. Both the experimental and control patients were asked to write down and report the day they noticed more hair falling out than usual because adriamycin reportedly causes a sudden and very noticeable loss (Friedman, 1970, p. 18).

The pictures taken of all patients before drug administration were used as references to evaluate the amount of alopecia at the three week period. Three nurse observers were asked to look at the pictures, go in and talk with the patient and assess his present status of hair loss. The observers were asked to separately write down whether hair loss was none, mild, moderate, severe, or total and also whether the loss was general, patchy, margins left (no hair

on top of head, but edges left), or margins gone (edges of scalp devoid of hair, but hair on the top of the head). The degree of alopecia was recorded as numbers based on the following scale: no loss = 0, mild = 1, moderate = 2, severe = 3, and total hair loss = 4. The type of alopecia was categorized by letters: A = generalized, B = patchy, C = margins left, and D = margins gone. Because all the patients in both groups experienced general alopecia by the sixth week, this categorizing of type of hair loss was not used. The process of hair loss assessment was repeated at six weeks on those patients who were observed for this long a period. The nurses doing the observing were not told if the patient was in the control or experimental group. The same nurses did not necessarily examine a given patient at three weeks and six weeks. This process served as a bias eliminator. The patient was asked the following questions by the nurse investigator: (See data collection sheet in Appendix C-2)

1. Have you had increased scalp hair loss? Yes No; Beard? Yes No or Not Applicable (NA).
2. What was the approximate date you noticed it? _____ _____ day.
3. What was the approximate amount of scalp hair loss?
4. What type of hair loss?

Responses were recorded on the data collection sheet.

III. DESCRIPTION AND SELECTION OF THE SAMPLE

All male and female patients who consented for and received their initial intravenous doses of adriamycin from three cooperating oncology specialists were eligible for the study group. Patients were included if they had sufficient hair which could be evaluated.

One male patient was arbitrarily selected to test and refine the method of ice pack application. The method was found to be acceptable for this study and was not changed in any way, so this patient was included as a part of the sample. This man had a hospital identification number ending with an odd digit so it was elected to take qualifying patients with odd ending hospital identification numbers for the experimental group and patients with even ending hospital identification numbers for the control group, regardless of sex, age, and/or diagnosis. A total sample of 14 patients between February 15 and April 21, 1972 met the criteria for the study. Nine patients were in the experimental group and five patients were in the control group.

This study was concerned with an observation of two groups of patients receiving the cancer chemotherapy agent, adriamycin. The independent variable was the application of an ice bag to the scalp of the experimental group while they received the drug. The method of study was experimental and was determined through a review of the literature to discover the time necessary for blood vessel constriction to occur, duration of the constriction, and the actual assessment of hair loss.

CHAPTER III

PRESENTATION AND ANALYSIS OF DATA

Data collected from the study of the effects of cold on alopecia associated with adriamycin administration are presented and analyzed in this chapter. These data, obtained from 14 patients were observed for significant differences between the experimental and control groups. Nine patients received the ice pack treatment while the other five patients did not receive the ice pack treatment. Otherwise, the patients were managed in as nearly the same manner as possible. Two patients in the experimental group expired before the three week assessment was possible so this limited to seven the experimental group that could be evaluated. Because the sample size was small, this study was considered as a pilot study and the data was interpreted as to their usefulness in a large sample.

Data were recorded on sex, age, whether the patient had radiation or other chemotherapy in the six months immediately prior to adriamycin administration, prior hair loss, assessment of hair loss made by three nurse observers and by the patient, and answers to two interview questions relating to that hair loss (i. e. date of onset and whether beard growth in men was less).

ANALYSIS OF VARIABLES

Extraneous Variables

Sex (Table I). Of the evaluated sample of twelve, nine patients were male and three were female. There were six males and one female in the experimental group and three males and two females in the control group. It was hypothesized that men would experience a greater degree of alopecia than would the women. This was based on a study by Hamilton in 1951 where he found women to have less alopecia than men. Appendix D shows that all three females experienced severe alopecia within the three week initial period while the men had varying degrees of alopecia, especially in the experimental group. The data do not indicate whether this difference was a result of the ice treatment or if this was due to the small female sample size. In a larger study, an effort should be made to achieve a better distribution of the sexes, or to confine a sample to men only or women only. For the small number of subjects in this study, the females lost more hair, more rapidly than the males. There are two major possible explanations for this. First, all three females had had prior chemotherapy or radiation within the past six months with one stating prior loss of hair from treatment, compared to only three out of nine of the males having prior treatment. And secondly, females tend to shampoo, brush and comb their longer hair more frequently thus causing more stress on the individual hair shafts.

Age (Table II). The combined age range was from 32 to 77 years, with a mean of 62 years in the experimental group and 61 years in the control group. The relationship between age and the degree of alopecia

TABLE I

DISTRIBUTION OF SEXES IN EVALUATED EXPERIMENTAL AND CONTROL GROUPS

SEX	EXPERIMENTAL	CONTROL
Male	6	3
Female	1	2

TABLE II

RANGES AND MEANS OF SELECTED VARIABLES
IN EVALUATED EXPERIMENTAL AND CONTROL GROUPS

Variable	EXPERIMENTAL		CONTROL	
	Range	Mean	Range	Mean
Age (years)	45-75	62	32-75	61
Onset Hair Loss (days)	12-22	16	14-17	15.2

experienced by the patient was not statistically significant either by individual (experimental or control) group or in total sample. This did not support the hypothesis which suggested that alopecia would be greater among those patients over fifty years. It was interesting to discover that there was a significant comparison ($P < .05$) between age and date of onset for hair loss. This means that when the experimental and control group were considered together, the older the patient, the later the date of onset for alopecia would occur. The two groups considered separately did not show a positive comparison between age and hair loss, probably due to the smallness in sample size. Clinically this was added verification of Hamilton's conclusion cited earlier that as a person ages, his hair becomes finer in structure and grows less rapidly. In the event of adriamycin administration, protein synthesis was stopped and the hair shaft no longer was produced. However, the root end of the hair shaft continued to grow out until there was no surrounding tissue keeping it attached to the scalp which caused shedding of that hair shaft. In the older patient, slower hair growth was demonstrated by a later date of onset for alopecia.

The mean date of onset of hair loss for the experimental group was 16 days after treatment while it was 15.2 days after treatment for the control group. The difference was not statistically significant. Those figures for day of onset were somewhat earlier than the stated 18th day cited by Friedman. With a larger group of subjects, sampling should include subjects above and below the age of 50, and data should be obtained which might confirm the findings of this pilot study regarding the relationship between age and date of onset for hair loss.

Prior treatment. It was hypothesized that individuals who had experienced other chemotherapy or radiation treatments within the previous six months would have a greater degree of alopecia. Using the t-test, there was no significant trend statistically when considering each group alone or as a total sample. Earlier, sex of the patient was mentioned as being a possible contributing factor in this regard. All three females had experienced prior chemotherapy and one stated prior hair loss from her treatment. All three females also experienced severe alopecia by the third week. Only three out of nine males had experienced prior treatment and there was no significant difference in alopecia between those who had or had not experienced prior treatment. The findings of this pilot study based on a small sample of males refuted the statement by Bonadonna (1969) that patients who had received previous cancer chemotherapy were more susceptible to the toxic side-effects than those who had not. The females agreed with Bonadonna, but the reason for agreement was not clearly due to prior treatment. Sex or the fact that females had longer hair and combed and brushed their hair more often than the males might also have been contributing factors as explained earlier.

Manipulated Variable (Table III)

The primary hypothesis for this study was that patients receiving applications of ice packs directly to the scalp would have less alopecia than those who were not treated in this manner. Using the t-test to compare alopecia assessments between the experimental and control group at both three weeks and at six weeks, it was found that the experimental group had significantly less alopecia assessed

than did the control group at three weeks. However, at the six week check, the t-test values were far below the level needed to be significant at the five percent level. Therefore, after six weeks, there was little difference between the two groups concerning the degree of assessed alopecia. Figure I pictorially portrays these differences of assessed alopecia between the experimental and control group.

As an additional check on the effects of the ice pack treatment, all the male patients were asked whether their beard growth was less. Since the beard was not exposed to the ice pack treatment, it was thought that if the beard growth was less while the scalp hair loss was minimal, the ice pack was possibly being effective in protecting the scalp hair follicles. At three weeks, all males in both groups expressed that they were shaving less indicating their beard growth was slower. Two men said they were not shaving. In the experimental group, four out of five males had only mild alopecia at three weeks, while the control group members had moderate to severe alopecia.

The time for the ice pack application in the experimental group was consistently a total of 10 minutes. The ice pack was applied 3 minutes before the injection of adriamycin. Because of occassional difficulty of venipuncture, the amount of time for the ice pack application after the injection varied some from patient to patient. In most patients, the time for venipuncture was less than one minute, leaving approximately six minutes of ice application after the injection. In a future study, the time required to locate an adequate vein for intravenous injection of the drug should be considered.

TABLE III

COMPARISON[1] OF MEAN ALOPECIA ASSESSED BY NURSES AND PATIENTS BETWEEN THE EXPERIMENTAL GROUP AND THE CONTROL GROUP AT THREE WEEKS AND SIX WEEKS

	3 Weeks			6 Weeks		
	Exp.	Con.	Level of Significance	Exp.	Con.	Level of Significance
Nurses-Assessed Alopecia	1.47	2.52	$P < .05$	2.7	2.9	$P > .05$
Patients-Assessed Alopecia	1.57	3.0	$P < .05$	2.57	3.0	$P > .05$

[1]Using t-test for uncorrelated data

TABLE IV

AGREEMENT[1] OF THE MEANS OF NURSE ASSESSMENTS OF ALOPECIA WITH THE MEAN OF PATIENT ASSESSMENTS BY EXPERIMENTAL AND CONTROL GROUPS AT THREE WEEKS AND SIX WEEKS

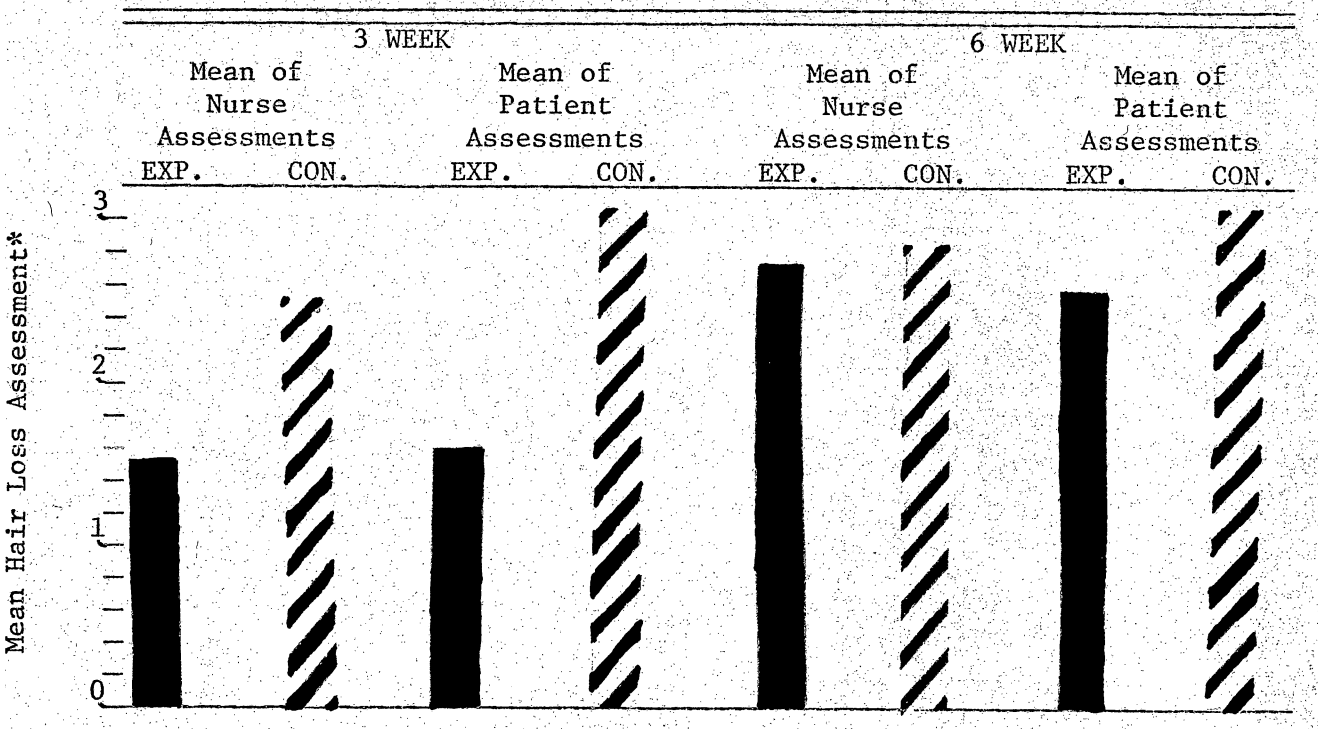
	3 Week			6 Week		
	Mean of Nurses	Mean of Patients	Level of Sig.	Mean of Nurses	Mean of Patients	Level of Sig.
Experimental	1.47	1.57	NS*	2.7	2.57	NS
Control	2.52	3.0	NS	2.9	3.0	NS

[1]Using a paired t-test

*NS = Not significant

FIGURE II

COMPARISON OF MEAN HAIR LOSS ASSESSMENT
OF EXPERIMENTAL AND CONTROL GROUPS
AT THREE AND SIX WEEKS



* Scale for mean hair loss

0 = no hair loss
1 = mild hair loss
2 = moderate hair loss
3 = severe hair loss
4 = total hair loss (no patient experienced absolute total alopecia)

Each experimental group patient was asked how he would rate the comfort or discomfort he experienced during each ice pack treatment. He was asked to respond by using suggested words, i. e. no discomfort, mild, moderate, or severe discomfort. Only one man and one woman expressed even mild discomfort as a result of the ice pack treatment which indicated this method might be satisfactory from the standpoint of the patient.

Agreement Among Assessors (Table IV)

It was hypothesized that the patient would assess his hair loss as being greater than the average of the three nurse observers. This hypothesis was not substantiated by this study group. The method of assessing the amount of hair loss by before/after photographs and nurse observers seemed to yield satisfactory results. Whether having the same three nurses assess any one patient at each stage of therapy would give more consistent results should be considered in future studies. By using the paired t-test for correlated data, it was found that the slight difference between how the patient rated his hair loss and how the nurses rated his hair loss was probably due to chance. There was a high correlation coefficient between the patient assessments and the nurse assessments in the experimental group. At three weeks, the correlation coefficient was .67 and at six weeks, .80 among the experimental group. A correlation coefficient of .50 is considered by statisticians to be a good correlation. The patient's knowledge of the study might have made him more conscious of his hair loss, but it might also have kept his objectivity high in regards to his own hair loss assessment.

The ice pack treatment did not significantly alter the date of onset for alopecia for the experimental group, but there was significantly less alopecia at three weeks when compared with the control group. The significant comparison of assessed alopecia between the experimental group and the control group was not maintained at the six week check. This indicated that the primary hypothesis that alopecia would be less in the experimental group was only partially supported. There was less at the end of three weeks, but the groups were about the same at the end of six weeks. The investigator does not have any concrete explanation as to why the difference between the two groups was minimal at the six week check. It is possible the application of ice only delayed the alopecia instead of reducing the degree of alopecia.

Other pilot studies should be undertaken to find a method of ice application which might prevent alopecia following adriamycin therapy.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

This pilot study was undertaken to evaluate the effectiveness of the ice pack treatment for protecting the scalp hair follicles from the alopecic effects of the drug adriamycin. Cold was thought to cause vasoconstriction of the superficial scalp circulation. It was thought that if vasoconstriction could be maintained for a short time before, during and following administration of the drug, the incidence of alopecia could be reduced.

No published documentation of cold used on the scalp to cause vasoconstriction of underlying vessels to reduce the amount of drug-contaminated blood flow getting to the hair follicles was found. References were studied to determine the effects of cold on the skin and surrounding tissues, the time necessary for penetration, duration of cold effects, effects of the drug adriamycin, and other attempts at trying to reduce drug-induced alopecia. The method of study was developed on this foundation of information.

The experimental method of research was used on a sample of 14 cancer patients meeting the criteria for the study, i. e. getting adriamycin for the first time and having sufficient hair on which to evaluate. The independent variable for the 9 patients in the experimental group (only 7 of whom were evaluated) was the application of

an ice pack over the scalp area. Two paper surgical caps were placed over the scalp area to collect moisture and then a plastic bag filled with ice chips secured in place by an ace bandage was the method used. The ice pack was applied 3 minutes before, during and for not more than an over-all period of 10 minutes following the intravenous injection of adriamycin.

In order to determine the effectiveness of the ice pack treatment, it was necessary to assess the degree of alopecia experienced by the patients. Because of the difficulties in assessing hair loss in an objective manner, a subjective plan was devised. The patient as well as three nurse observers assessed the patient's alopecia to obtain some degree of reliability as to how well the ice pack treatment had reduced alopecia. It was assumed that because the same three nurses were not used each time, that the assessments of alopecia would be less biased by the individual nurse who might assess the degree of alopecia too severely, or too mildly.

Data were also kept on patient age, sex, date of onset for alopecia, whether men had less beard growth as evidenced by fewer shaves a week than prior to treatment, and whether the ice pack treatment had caused discomfort.

The sample consisted of 14 patients who met the criteria of the study. Only twelve patients were evaluated because two patients in the experimental group expired before the first three week assessment period. There were seven patients in the experimental group who could be evaluated and five in the control group. Both groups were managed alike with the application of cold to the experimental group as the manipulated variable.

Comparisons between groups of numbers were considered statistically significant if P was less than five percent ($P < .05$). The variables of sex and age did not reveal any statistically significant comparisons with the test results. However the date of onset for alopecia was significant when compared with age for the entire study population (not control or experimental group alone). The older the patient, usually the later the date of onset for alopecia. The experimental group experienced significantly less alopecia than the control group at three weeks ($P < .05$). However, at six weeks both groups were essentially equal ($P = .40$). The men in both groups were needing to shave less due to diminished beard growth. Only two of the experimental group found the ice application to be even mildly uncomfortable, and these two expressed this only once of the six times they received the treatment.

II. CONCLUSIONS

The conclusions are based on the data obtained. In a sample of this small size the data were not conclusive and should not be generalized to patients outside this study group. Because the position of the patients was not controlled, it is possible that some of the findings may have been influenced by position as well as the ice pack treatment. The conclusions of this pilot study should be useful in designing a larger study of the effects of ice applications as a prevention for the alopecia associated with adriamycin therapy.

The hypothesis that patients receiving the applications of ice packs directly to the scalp will have less alopecia than those who are not treated cannot be accepted or rejected, because the findings

were inconclusive due to small sample size. The experimental group did have significantly less alopecia at three weeks than did the control group, but both groups were essentially the same at six weeks.

1. Prior chemotherapy or radiation treatments did not seem to have any influence on the degree of alopecia the patient would experience.

2. Sex was not conclusively demonstrated to be a factor in hair loss, due to the limited female sample in the experimental group. The female in the experimental group that could be evaluated experienced severe alopecia just like her two counterparts in the control group at three weeks. None of the males in the experimental group had severe alopecia at three weeks.

3. Age did not seem to alter the degree of alopecia experienced, but was significant when considering the date of onset. The older patients generally started losing their hair at a later date than their younger counterparts.

4. The patient assessment of his hair loss correlated closely with that of the three nurse observers.

III. RECOMMENDATIONS

Based on this pilot study, the following recommendations are made for a larger study.

1. The sample should contain a more equal distribution of the sexes and of age groups above and below 50 years.

2. The sample should be either limited to patients who have not received previous chemotherapy or radiation or should contain a

more equal distribution of those who have and have not received these therapies.

3. The same position should be used for both experimental and control groups of patients while they receive the adriamycin injection.

4. Unless some more objective measure of hair loss is available, the before/after photographs and a set of nurse-observers should provide a satisfactory evaluation of hair loss. Consideration should be given to using the same observers for each evaluation of any one patient.

5. Unless a better method is devised, the ice packs described in this study seemed acceptable. They were not judged too uncomfortable by the patients and were not difficult to manage. They were inexpensive and readily available. The two surgical caps for the scalp could be reduced to one to reduce the insulating effect of paper.

6. The needle for the intravenous injection of the drug should be placed before the application of the ice pack. This procedure would eliminate the variation in timing of the ice pack due to difficult venipuncture.

7. Before a larger study is done, animal studies or pilot studies with human subjects should be carried out to determine the ideal length of time for ice pack application. This could be done by using an ultrasonic flowmeter for detecting the amount of blood flow to the area. This meter is safe, non-invasive, and involves no pain for the patient, so there should be no objection in using this meter. This meter could be placed under the ice pack on the scalp and would emit varying sounds according to the amount of blood

flow immediately underneath it. This information could establish the length of ice application which would decrease blood flow for a period of time closer to the plasma half life of 30 minutes for adriamycin as determined by DiFronzo.

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BIBLIOGRAPHY

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APPENDIXES

APPENDIX A

LETTER TO THE DIRECTOR OF NURSES SEEKING PERMISSION TO DO STUDY AT LOMA LINDA UNIVERSITY HOSPITAL

16 North San Mateo
Redlands, Calif. 92373
February 8, 1972

Miss Gertrude Haussler
Director of Nursing Service
Loma Linda Univ. Med. Center

Dear Miss Haussler:

Many patients admitted to oncology service receive chemotherapeutic agents which produce alopecia among other side effects of the drug. One agent, namely adriamycin, causes varying degrees of alopecia in 97 to 100 percent of the patients treated with it. This is often embarrassing for the patient and sometimes startling for nursing and other paramedical personnel. I would like to use hypothermia measures to the scalp in an attempt to interrupt blood flow to the hair follicles until the majority of the drug has been chemically reduced or phased out of the blood serum (10 to 15 minutes). In this manner, I feel alopecia as a result of drug administration can be reduced if not prevented.

Nursing personnel will be asked to participate by notifying me when the drug is to be administered. I do not feel this will detract from the normal activity and time of the nursing staff. For the most part Dr. Godfrey will keep me informed as to whom gets the drug and when.

As I am a graduate student, this study is to meet in part, the requirements for a master's degree in nursing here at Loma Linda University. I will be working closely with my advisers in nursing and medicine; Miss Lucile Lewis, Miss Charleene Riffel, and Dr. Thomas Godfrey. May I have permission to conduct this study in your nursing service? I will be glad to make an appointment to talk with you further about the study. A stamped self-addressed card is enclosed for your convenience.

I look forward to hearing from you soon.

Yours sincerely,

Carol Frembling, RN, BS,
Graduate Student

Permission granted Feb. 15, 1972, by Miss Haussler.

APPENDIX B

CONSENT FOR EXPERIMENTAL GROUP

Consent for Participation in Study

After hearing reasons for and against use of hypothermia measures in prevention of hair loss as a result of my treatment for disease, I hereby consent for Carol Frembling RN to carry out this measure on me as a part of a study being done by her.

I also understand that pictures will be taken before, three weeks, and six weeks after treatment and agree that the negatives or prints prepared therefrom may be used for such purposes and in such manner as may be deemed necessary. I understand that my facial features will be blocked out so my identity will be protected.

Signed _____

Witness _____

Date _____ Hour _____

CONSENT FOR CONTROL GROUP

Consent for Participation in Study

I understand that hair loss is one side effect of the drug I am getting in the treatment of my disease. In order to determine degree of hair loss, I consent for Carol Frembling RN to take pictures before, at three weeks, and six weeks after treatment. I agree that the negatives or prints prepared therefrom may be used for such purposes and in such manner as may be deemed necessary. I understand that my facial features will be blocked out so my identity will be protected.

Signed _____

Witness _____

Date _____ Hour _____

APPENDIX C-1

Room #_____

DATA COLLECTION SHEET

Case #____C or E

Patient Name _____ Sex M F Birth Date _____

Diagnosis _____ Date Consent Signed _____

Course Number One Date	Dose	Time of Hypothermia Min. Before	Min. After	Discomfort Mild, Mod., Sev.
1. _____	_____mg.	_____	_____	_____
2. _____	_____mg.	_____	_____	_____
3. _____	_____mg.	_____	_____	_____

Previous Treatments (if any)

Radiation Therapy	Dates	Chemotherapy	Dates

Any pre-existing hair loss resulting from previous treatment? Yes No

Base line photographs for evaluation. Date _____ Day _____

Front Side Top and back of head

Course Number Two Date	Dose	Time of Hypothermia Min. Before	Min. After	Discomfort Mild, Mod., Sev.
1. _____	_____mg.	_____	_____	_____
2. _____	_____mg.	_____	_____	_____
3. _____	_____mg.	_____	_____	_____

APPENDIX C-2

Page 2 - Data Sheet

Patient Name _____

3 Week Pictures Date _____ Day _____
Front Side Back

Subjective Questions -

Have you had increased scalp hair loss? Yes No Beard? Yes No

What was the approximate date you noticed it? _____ day.

Approximate amount of all hair lost? None Mild Mod. Sev. Total
0% 25% 50% 75% 100%

Type of loss? Marginal Patchy Generalized

6 Week Pictures Date _____ Day _____
Front Side Back

EVALUATION OF HAIR LOSS

Nurse	Three Weeks		Six Weeks	
	Approx. Amt.	Type	Approx. Amt.	Type
1				
2				
3				
Total Av.	____	____	____	____

Patient

APPENDIX D

DATA COMPILATION SHEET WITH TOTAL INFORMATION*

Exp. Group No.	Sex	Age	Prior+ Treatment	Prior Hair Loss	Day of Onset	Degree of Hair Lost (X) 3 Week Assessment By Nurse	3 Week Assessment By Patient	6 Week Assessment By Nurse	6 Week Assessment By Patient	Type of Hair Loss	Loss of beard growth
1	M	75	Yes	No	22	1	1	2.3	1	A	Yes
2	F	69	Yes	No	NA#	On day 15 = none, expired			NA	NA	NA
3	M	77	No	No	NA	On day 10 = none, expired			NA	NA	NA
4	M	75	Yes	No	18	1	1	2.6	3	A	Yes
5	M	54	No	No	13	2	1	3	3	A	Yes
6	M	45	No	No	12	1	2	3	3	A	Yes
7	M	51	No	No	17	1	1	2	3	A	Yes
8	M	67	No	No	17	1.3	2	3	3	A	Yes
9	F	68	Yes	No	13	3	3	3	3	A	NA
Control Group											
1	F	52	Yes	Yes	14	3	3	3	3	A	NA
2	M	75	Yes	No	17	2	3	Expired		A	Yes
3	M	70	No	No	14	3	3	3	3	A	Yes
4	M	75	No	No	17	2	3	2.6	3	A	Yes
5	F	32	Yes	No	14	3	3	3	3	A	NA

* Dose of drug not relevant since it is based on square meter of body area.
\+ Prior Chemotherapy or radiation treatments in last six months resulting in hair loss.
(X) Scale: 0 = No increased hair loss, 1 = mild hair loss (25%), 2 = moderate hair loss (50%), 3 = severe hair loss (75%), and 4 = total hair loss (100%).
#NA = not applicable
0 Scale: A = generalized, B = patchy, C = margins left, and D = margins gone.

LOMA LINDA UNIVERSITY

Graduate School

EFFECTS OF ICE APPLICATION ON ALOPECIA PRODUCED BY ADRIAMYCIN

by

Carol Frembling

An Abstract of a Thesis

in Partial Fulfillment of the Requirements

for the Degree Master of Science

in the Field of Nursing

June 1972

ABSTRACT

This pilot study was concerned with discovering the effectiveness of the ice pack as an agent for reducing the blood flow through the scalp blood vessels thereby reducing the alopecia caused by the drug adriamycin. The use of cold is known as a vasoconstricting agent. It was thought that if vasoconstriction could be maintained for the first few minutes following the injection of adriamycin, the incidence of alopecia could be reduced.

Available references to the effects of cold on skin circulation and the effects of the drug adriamycin were studied to formulate a method of approach as no previous methodology suitable to this study was found in the literature.

The experimental method was used on a sample of 14 cancer patients meeting the criteria for the study. The independent variable for the 9 patients in the experimental group (only 7 of whom were evaluated) was the application of the ice pack over the scalp area. Two paper surgical caps were placed over the scalp area to collect condensed moisture from the ice pack and then a plastic bag filled with ice chips secured in place by an ace bandage was the method used. The ice pack was in place 3 minutes before, during and following the intravenous injection of adriamycin. The over-all time for the ice pack application was 10 minutes.

Because of the difficulty in measuring the amount of hair loss in an objective manner, a subjective approach was used. The patient as well as three nurses were asked to assess hair loss on a scale of none, mild, moderate, severe, or total hair loss. Pictures were taken before the treatment, at three weeks and again at six weeks where possible. These served as guidelines as to how much hair the patient had before treatment began. Data were also kept as to the date of onset for alopecia, whether men were needing to shave less, whether the patient had prior chemotherapy or radiation in the last six months, and the type of hair loss, i. e. general, patchy, margins gone, or margins left.

There were not enough females to determine whether sex had any relation on the amount of alopecia experienced with adriamycin. Age was not a factor except there was a positive correlation between age and date of onset for alopecia. The younger the patient, the earlier the date of onset for alopecia. There was close correlation between patient assessment of his alopecia and the assessment of his alopecia by the nurse observers. At three weeks there was significantly less alopecia among members of the experimental group than the control group, but at six weeks, both groups were almost equal. This would indicate alopecia was delayed in the experimental group but the degree was not reduced by the six weeks period.

There were several recommendations made from this pilot study that would be suitable for future studies.