

A METHOD TO IDENTIFY UNDERSTANDINGS AND SKILLS NEEDED BY
THE NURSE TO CARE FOR PATIENTS WITH NEUROLOGICAL
CONDITIONS TREATED BY INDUCED HYPOTHERMIA

by

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A Method to Identify Understandings and Skills Needed by
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Thesis directed by Assistant Professor Margaret L. Pluckhan

The descriptive case study was used to develop a method which could be used to identify the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia. From a survey of the related literature and from observation of selected patients, a checklist was developed for recording of the data. Sources for supplementary data were unstructured interviews with the physicians and nurses caring for the patient and the patient's medical records.

Data were collected over an eight week period. During this time, three patients were admitted to the hospital, who met requirements for the study. From the data collected, the nurse's understandings were inferred by means of documentary frequency from the related literature. These ninety-two inferences were submitted to a resident physician in neurosurgery, and eighty-four were validated. Fifty-seven nurse's skills were then inferred on the basis of the understandings, the signs and symptoms presented, the action taken by the nursing staff in response to a

sign or symptom, and related literature. These skills were all validated by a jury of five experts in the area of medical-surgical nursing. A final listing of the understandings and skills was then formulated.

It was concluded, due to the limited number of patients available for study, that the findings cannot be generalized. The method developed did prove to be one by which the nurse's understandings and skills could be identified.

This abstract of about 250 words is approved as to form and content. I recommend its publication.

Signed Margaret L. Pluckhan
Instructor in charge of thesis

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CHAPTER I

INTRODUCTION

The primary aim of professional nursing is to provide therapeutic nursing care to patients. To achieve this aim, the nurse must be familiar with the physiological norms and any deviations from these norms. These deviations may be brought about by a disease entity or by induced medical or surgical treatment. One method of treatment which brings about changes in these physiological norms is that of induced hypothermia. Hypothermia is being used for various types of medical and surgical conditions today.

Lewis stated that this method of treatment with the cooling blanket is relatively new.¹ As with any innovation in patient care, the nurse needs to understand her role in caring for this patient. Due to the fact that the patient with a neurological condition undergoing treatment by means of induced hypothermia exhibits various changes in physiological processes which result from both the neurological condition and the induced hypo-

¹F. John Lewis, "The Treatment of Fever with Surface Cooling," The Surgical Clinics of North America, 39:181, February, 1959.

thermia, it is important that the nurse be aware of and possess the understandings and skills which are necessary to care for this patient. It was the purpose of this study to develop a method by which these understandings and skills could be identified.

Statement of the Problem

The problem of the study was to develop a method which could be used to identify the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia.

Purposes of the Study

To develop this method, the purposes of the study were: (1) to study a selected group of patients with neurological conditions undergoing treatment by means of induced hypothermia with the Therm-o-Rite blanket; (2) to develop a tool by which data pertaining to the physical needs presented by these patients could be elicited; (3) to test the effectiveness of the tool in gathering these data; (4) to analyze the data obtained as a means of identifying the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia; and (5) to have these

understandings and skills validated by a jury of experts. Ultimately, the purpose of the study was to make recommendations as to the usefulness of this method.

Need for the Study

As a member of the health team, the nurse should realize that all medical treatment has nursing implications. With any innovation in medical practice, the nurse needs to understand and be able to implement her knowledge in a therapeutic manner for the welfare of the patient being treated. Graves stated that in caring for the patient undergoing therapy with hypothermia, experienced nurses must be available to give constant care.² If the nurse is to give intelligent care, it is necessary that she understand the underlying factors involved in the patient's condition and the physiological changes resulting from the instituted treatment. In addition to understanding, skills are necessary to accomplish the desired outcome of treatment.

A review of literature in medical journals, nursing journals, and other related publications revealed the need for the nurse's awareness of her role in caring for the patient undergoing treatment with induced hypothermia.

²Nancy Graves, "Nursing During Prolonged Hypothermia," The American Journal of Nursing, 60:969, July, 1960.

However, a well defined role in caring for these patients could not be identified from the literature. With the increased use of hypothermia today, the need for this study is clearly evidenced. Thus, it was the purpose of this study to develop a method by which the nurse's understandings and skills could be identified, so that ultimately they could be utilized in giving patient care.

Scope and Limitations

To test the method developed in this study, a clinical investigation was conducted in a three hundred and twenty bed general hospital in the Rocky Mountain region. All patients with neurological manifestations being treated with the hypothermic blanket who were admitted to this hospital during an eight week period were included in the study. Each patient was studied from the day of induction of hypothermia until either the day of termination by order of the physician or until death, if that should be the case.

It was recognized that the study had some limitations. These limitations were: (1) the population used to develop the method and test the tool was limited to the patients admitted to one hospital in the Rocky Mountain region; (2) the number of patients in the population was determined by availability and the limitations of time; (3) the patients included were only those in the

neurological diagnostic category, therefore, conclusions were limited to only this diagnostic category; (4) the patients included were only those who were treated by hypothermia for therapeutic purposes, so that hypothermia for purposes of anesthesia was excluded; (5) patients being treated by only one hypothermic technique--the Therm-o-Rite blanket--were utilized in testing the tool; (6) the method developed in this study was tested with the physical signs and symptoms only; (7) understandings and skills were the only two levels of behavior identified in the study; and (8) the conclusions derived cannot be generalized due to the limited number of patients available for study.

Assumptions

The assumptions underlying this study are: (1) the nurse has a definite role in caring for the patient with a neurological condition being treated by means of induced hypothermia; (2) certain understandings and skills are needed by the nurse in caring for this patient; and (3) a method can be developed which could be utilized in identifying these understandings and skills on the basis of the physical signs and symptoms presented by the patient.

Methodology

The descriptive case study was used to develop the method by which the patients could be studied. Best stated that,

Descriptive research describes what is. It involves the description, recording, analysis, and interpretation of the present nature, composition, or processes of phenomena. The focus is on prevailing conditions, or on how a person, group, or thing behaves or functions in the present.³

It was further stated by Best that the case study provides intensive data from a single case or from a limited number of typical cases.⁴ Intensity and depth of concentration in observing and recording was of greater value than would have been a more superficial study of a greater number of patients.

A checklist was used to record the physical signs and symptoms and other pertinent data presented by the patient during the time that he was treated by means of induced hypothermia. To supplement observational data, periodic unstructured interviews were held with the physicians and nurses responsible for the care of the patient. The patient's medical records were another source of information.

³ John W. Best, Research in Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959), p. 12.

⁴ Ibid., pp. 122-23.

The data were then tabulated and analyzed, and the nurse's understandings and skills were identified. These understandings and skills were then evaluated and validated by a jury of experts. On this basis, conclusions were drawn as to the usefulness of the method.

Definitions of Terms Used

Understanding. Comprehension and intellectual rationalization of a given phenomenon or concept.

Skill. An act or function performed proficiently, in response to a need presented, which requires both physical and mental activity. This is based on understanding.

Physical sign. Any objective evidence of an abnormal nature in the body or its organs.

Physical symptom. Any subjective evidence of an abnormal nature in the body or its organs.

Patient with a neurological condition. Any individual admitted for treatment involving the central or peripheral nervous system. This treatment may be medical or surgical.

Induced. Brought about by artificial means.

Hypothermia. A lowering of the body temperature.

Organization of Remainder of Thesis

Chapter II contains a review of literature from medical journals, nursing journals, and other related publications from 1943 to 1962. This literature related to research, neurology, hypothermia, and the nursing care of the patient being treated by means of hypothermic induction. In Chapter III is included the methodology and the techniques of data collection used in this study. The presentation, analysis, and interpretation of data is included in Chapter IV. The understandings and skills, needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia, are also identified. A brief case study is presented for each patient included in the study. The results of the evaluations by the jury are also included. Chapter V contains a summary of the study, the conclusions drawn, and the recommendations made.

CHAPTER II

SURVEY OF LITERATURE

Introduction

A review of literature was made for the following purposes: (1) to gain knowledge of induced hypothermia as a therapeutic procedure in medical practice; (2) to ascertain the medical and nursing points of view regarding hypothermia; (3) to determine to what extent the role of the nurse in caring for the patient being treated by means of induced hypothermia was defined in the literature; and (4) to determine the need for the development of methods that could be used in clinical research.

To accomplish the purposes set forth, a survey was made of nursing periodicals, medical periodicals, research literature, educational journals, physiology textbooks, and textbooks relating to hypothermia. For purposes of clarity, this chapter is organized and presented under the following headings: (1) hypothermia, (2) the nurse's role in hypothermia, and (3) need for development of methods for clinical study.

Hypothermia

Several authors presented definitions of hypothermia; some of these definitions varied considerably. Hypo-

thermia was defined by Edholm as,

. . . a state in which the body-temperature is lowered substantially below the normal, perhaps a minimum of 2-3° C. below the lowest temperature generally encountered in the particular species.¹

Ballantine and Jackson stated that the underlying principle in the use of hypothermia is to reduce, temporarily, the oxygen requirements of the vital tissues, particularly those of the central nervous system.² This is especially true in treating the patient with a neurological condition, since the nervous system is already affected.

It was stated by Lewis that hypothermia first had its beginning with Hippocrates. He indicated that during and since that time, hypothermia has had its advocates and opponents. He further stated that the advocates are succeeding over the opponents, as hypothermia is coming to be more acceptable in the present era.³

¹O. G. Edholm, "Hypothermia and the Effects of Cold: Introduction," British Medical Bulletin, 17:2, January, 1961. [Throughout the study the symbol (°) refers to degrees, and the symbol (C.) refers to temperature as expressed on the Centigrade scale. That means the freezing point of water is zero and the boiling point 100°.]

²Robert I. W. Ballantine and Ian Jackson, A Practice of General Anaesthesia for Neurosurgery (Boston: Little, Brown and Company, 1960), p. 78.

³F. John Lewis, "The Treatment of Fever with Surface Cooling," The Surgical Clinics of North America, 39:177, February, 1959.

Dundee and others, cited instances as early as 1812 and 1851 in which hypothermia was used for a variety of purposes such as relief of pain and the treatment of carcinoma. They also stated that it was not until 1936 that induced generalized hypothermia was used as a treatment for neoplasm by G. W. Smith and Temple Fay.⁴ According to Uihlein and others, during the 1930's, Smith and Fay maintained the human body at temperatures between 25° and 30° C. for days to allay the pain associated with inoperable carcinoma.⁵ Edholm stated that the modern investigation of induced hypothermia in man can be said to date from this work of Smith and Fay. He further stated that their clinical work was complemented by the physiological studies of Dill and Forbes on patients being treated by means of induced hypothermia.⁶ Dundee and others, stated that it was at this time that Smith and Fay appreciated the necessity of abolishing the body's normal reactions to cold--namely, shivering and vasoconstriction--to facilitate the cooling.⁷

⁴ John W. Dundee and others, "Hypothermia with Autonomic Block in Man," British Medical Journal, 2:1237, December, 1953.

⁵ Alfred Uihlein, Howard R. Terry, and John T. Martin, "Induced Hypothermia in Neurological Conditions," Medical Clinics of North America, 44:1079, July, 1960.

⁶ Edholm, op. cit., p. 1.

⁷ Dundee and others, loc. cit.

Edholm indicated that during and following World War II interest in hypothermia was stimulated in a most unusual way. Shipwrecks were frequent, and often the survivors of these shipwrecks were rescued, but they later died due to prolonged exposure to cold water immersion. Their body temperatures had been accidentally lowered during this exposure to the cold water. Thus, interest in hypothermia was stimulated by emphasis on treatment of hypothermic individuals, rather than by its clinical use. These incidents also stimulated interest in the physiology of hypothermia and its effects on man. Many studies have been done since that time to reveal new facts regarding hypothermia.⁸

Dundee and others, stated that in 1948 the possibility of applying hypothermia in cardiac surgery was pointed out. Since that time, cardiac surgeons have benefited immensely from using hypothermia in conjunction with premedication and anesthesia.⁹ According to Edholm, the use of hypothermia in surgical practice had greatly stimulated advances in this area, thus since 1950, the practice has advanced very rapidly.¹⁰

Hypothermia for both medical and surgical therapy

⁸ Edholm, loc. cit.

⁹ Dundee and others, loc. cit.

¹⁰ Edholm, loc. cit.

is being used more widely today. Ballantine and Jackson wrote that certain patient conditions indicate the need for hypothermia but that these are limited to very selected cases.¹¹

Several writers identified different types of hypothermic induction.¹² The types of induction could be divided into three major categories. These categories were: (1) external skin cooling, (2) internal surface cooling, and (3) extracorporeal circulation.

External Skin Cooling

The techniques used to induce hypothermia through external skin cooling were by means of ice water immersion, ice bags or plastic bags containing cooled fluid, cooling blankets, suspension of body in a deep freeze unit, cold water spray, air cooling, refrigeration mattresses, and forced air units.

Internal Surface Cooling

The various techniques used to induce cooling

¹¹ Ballantine and Jackson, loc. cit.

¹² James E. Eckenhoff, "The Physiology of Hypothermia," Bulletin New York Academy of Medicine, 34:298-99, May, 1958; I. K. R. McMillan and E. S. Machell, "The Technique of Induced Hypothermia," British Medical Bulletin, 17:32, January, 1961; William H. Sweet and Richard A. Koons, "Hypothermia and Hibernation in Neurosurgery," Clinical Neurosurgery (Baltimore: The Williams and Wilkins Company, 1957), pp. 235-36; and Uihlein, op. cit., pp. 1081-82.

through internal surface cooling were the introduction of cold saline solution into the chest following thoracotomy, the circulation of cold fluid through an intragastric balloon, the application of cold sponges or the pouring of cold solutions about the aorta, the administration of ice water enemas, and intraperitoneal cooling.

Extracorporeal Circulation

Cooling by means of extracorporeal circulation can be accomplished by means of various arterio-venous shunts. In this method the blood is cooled in some manner outside the body, then returned to the body.

Smith and Fairer stated that no matter which of these techniques is used, the defense mechanisms of the body which work toward the preservation of the internal milieu must be overcome. This internal milieu, as once described by Claude Bernard, attempts to protect the body against stress, aggression, or changes in the internal environment.¹³ Induced hypothermia, in a sense, must then combat these natural body forces in order to lower the temperature effectively. Uihlien, Terry, and Martin listed anesthesia and relaxant drugs as adjuncts to cool-

¹³ Angus Smith and J. G. Fairer, "Hibernation Anaesthesia in Major Surgery," British Medical Journal, 2:1247, December, 1953.

ing.¹⁴

The Nurse's Role in Hypothermia

The actual procedure for reducing the patient's temperature may be relatively simple, depending, of course, upon the method chosen for induction. Rosomoff stated that,

Hypothermia is an uncomplicated, practical method of treatment which is as easily applied in the small community hospital as in the medical center. It requires only a patient, some ice, and a thermometer. It has been the opinion of those who have utilized reduction of temperature as a therapeutic agent in the treatment of the seriously ill patient that hypothermia has proved beneficial and, in some instances, life-saving.¹⁵

Even though induced hypothermia may be a relatively uncomplicated procedure, certain changes occur in physiological processes which indicate the need for the nurse to possess certain understandings and skills in caring for these patients. The understandings and skills which the nurse should possess in caring for these patients could not be identified from the literature. However, several authors stated the nurse should be cognizant of the signs and symptoms which did occur during treatment. Nugent indicated that it was also important that the nurse under-

¹⁴Uihlien, Terry, and Martin, op. cit., p. 1081.

¹⁵Hubert L. Rosomoff, "Hypothermia in Management of Cerebrovascular Lesions," Southern Medical Journal, 54: 504, May, 1951.

stand her role in caring for these patients since hypothermia is being increasingly employed in patients with neurological conditions.¹⁶

Due to the dangers which could occur as a result of hypothermia, Graves believed that the patient required constant vigilance by a professional nurse experienced in the procedure. She further stated that some of the signs and symptoms for which the nurse should be alert were depressed corneal reflexes, pressure areas, and skin discolorations.¹⁷ Adler and Hale emphasized the dangers associated with cardiac irregularities, temperature control, and skin changes, which could result in frostbite.¹⁸ Nugent described several signs and symptoms for which the nurse should be alert; these were shivering, edema, convulsions, and drug reactions. He further stated that patients being treated by means of induced hypothermia required careful nursing care because of the dangers associated with its use.¹⁹

The review made of the literature relating to the nurse's role in caring for the patient being treated by means of induced hypothermia indicated that there was no

¹⁶ Nugent, op. cit., p. 967.

¹⁷ Graves, op. cit., pp. 969 et seq.

¹⁸ Adler and Hale, op. cit., p. 14.

¹⁹ Nugent, op. cit., pp. 968-69.

evidence that scientific inquiry has been done on this subject. In order to further establish the body of knowledge specific to nursing, scientific inquiry must be done on the problems relating to care which are dealt with each day. Abdellah stated that,

. . . the identification of common health problems faced by patients and the identification of the skills to be used by nurses constitute a first step in building a scientific body of knowledge on which nursing practice can be based.²⁰

It appeared that although the actual procedure of inducing hypothermia may be relatively uncomplicated, there are certain physiological changes which occur and indicate the need for intelligent care to be given by the nurse.

Need for Development of Methods for Clinical Study

The review of literature did not reveal any information which had been written on the development of specific methods for research in clinical nursing per se. However, Bunge said that nurses as a whole tend to be too dependent on tradition and authority to solve their problems, when a systematic study of the problem might lead

²⁰Faye G. Abdellah, Patient-centered Approaches to Nursing (New York: The Macmillan Company, 1960), p. 188.

to more justifiable and wiser conclusions.²¹ From this statement, it could be realized that the responsibility for nursing research and its application to nursing practice, resulting in improved methods in patient care, actually rests with the individual nurse. Bunge further stated that it is being recognized more and more that studies are needed in the direct care of patients and in the present and future functions of the professional nurse, as to what these functions should be. Therefore, nurses play a very strategic part in guiding the development of research in nursing.²²

It was further stated by Bunge that very few nurses are engaged in the actual designing and conducting of research in nursing. In designing methods for study, some tools suitable for collecting the data may already be developed; but, in other studies, tools must be developed before the data can be collected.²³

Therefore, as background for this study, information was found which related to the descriptive case study method of research, the techniques of interview and observation, and the data collection tool--the checklist.

²¹Helen L. Bunge, "Research Is Every Professional Nurse's Business," The American Journal of Nursing, 58: 817, June, 1958.

²²Ibid., p. 818.

²³Ibid., pp. 816 et seqq.

From the information gained in these areas of research, application was made to the development of a method which could be used in a clinical study of a selected group of patients being treated by means of induced hypothermia.

Thus, it can be said that there is a definite need in nursing for the development of methods which can be used in clinical research. No specific methods could be identified from the literature; however, from the related literature a method could be developed for the purposes of this study.

Summary

From a survey of literature in nursing periodicals, medical periodicals, research literature, educational journals, physiology textbooks, and textbooks relating to hypothermia, the following information was gained. Interest in the physiological changes brought about by hypothermia has been on the increase, especially during the last two decades. Clinical use of hypothermia for both medical and surgical treatment is also on the increase; however, the patients on whom hypothermia is used are very carefully selected.

Three major types of hypothermic induction are being used today. They are: (1) external skin cooling, (2) internal surface cooling, and (3) extracorporeal circulation. In addition to the cooling procedure, two

adjuncts to cooling have been listed as anesthesia and relaxant drugs.

Even though the actual cooling procedure may be relatively uncomplicated, certain changes occur in physiological processes which indicate the need for the nurse to possess certain understandings and skills in caring for these patients. These understandings and skills could not be identified from the literature. No evidence was found that scientific inquiry had been done on the problems relating to the nursing care of these patients.

From the review of literature, information could not be found which related to the development of a method of research in clinical nursing per se. However, the information gained from the research literature did provide the means by which a method could be developed and utilized in studying a selected group of patients being treated by means of induced hypothermia.

CHAPTER III

METHODOLOGY

Introduction

To develop this method, the purposes of the study were: (1) to study a selected group of patients with neurological conditions undergoing treatment by means of induced hypothermia with the Therm-o-Rite blanket; (2) to develop a tool by which data pertaining to the physical needs presented by these patients could be elicited; (3) to test the effectiveness of the tool in gathering these data; (4) to analyze the data obtained as a means of identifying the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia; and (5) to have these understandings and skills validated by a jury of experts. Ultimately, the purpose of the study was to make recommendations as to the usefulness of this method.

For the purpose of clarity, the chapter has been divided into the following sections: (1) the method, (2) techniques for collection of data, (3) setting of the study, (4) development of the checklist, (5) use of the checklist, (6) pretesting of the data collection

tool, (7) techniques for analysis of data, and (8) summary.

The Method

The descriptive method of research was used in this study. This method was selected because it could be used to more accurately gather the information needed, in order to test the method developed in this study. By using the descriptive method of research the patients could be studied and the prevailing conditions of the patient could be described. However, this method of research does not end with only a description. In discussing this point, Best indicated,

Although the gathering of data and the description of prevailing conditions or practices are necessary steps, the research process is not completed until the data are organized and analyzed, and significant conclusions are derived.¹

Descriptive research involves an element of interpretation of the meaning or significance of what is described.² To test the method developed in this study, the prevailing conditions of the patient were described and recorded; this data was analyzed, and conclusions were drawn.

To enhance depth in the descriptive method, the

¹ John W. Best, Research in Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959), p. 103.

² Ibid., p. 102.

case study was used. The case study is intensive and longitudinal, analyzing a single case or a limited number of cases very carefully. The analysis identified change, development, or progress in the case under consideration.³ The case study included day-to-day development. It usually represents direct observation at intervals, the gaps being filled in by appeal to memory or records.⁴

Techniques for Collection of Data

In the development of this method, observation and recording were the techniques of choice. To increase the validity of observing, the signs and symptoms to be observed were carefully defined. Good and Scates stated that the purpose, in defining the activities to be observed, was to include those signs and symptoms truly representative of the general category under study.⁵ In this way the validity of the data recorded was enhanced.

To supplement the techniques of observation and recording, unstructured interviews were held with the physicians and nurses caring for the patient. In addition

³ Ibid., p. 106.

⁴ John C. Almack, Research and Thesis Writing (Boston: Houghton Mifflin Company, 1930), p. 205.

⁵ Carter V. Good and Douglas E. Scates, Methods of Research (New York: Appleton-Century-Crofts, Inc., 1954), p. 657.

to this supplementary data, information was obtained from the patient's medical records. From the data recorded and the supplementary data, the case study report of each patient evolved.

It was decided that these techniques used in the collection of the data would provide the basis for the identification of the nurse's understandings and skills. If the nurse is to give intelligent nursing care, she must be capable of drawing conclusions from the prevailing conditions of the patient.

Setting of the Study

The study conducted in the development of this method was done in a three hundred and twenty bed general hospital in the Rocky Mountain region. All patients admitted with a neurological condition who were treated by means of induced hypothermia during an eight week period were included in the study. Verbal permission was granted by the Director of Nursing Service to use the hospital facilities for this study. This permission was then confirmed by letter. A copy of this letter is found in Appendix A.

It was arbitrarily decided to collect data on the first ten patients with neurological conditions being treated by induced hypothermia available during the time of the study. In the event that less than ten patients

were available during the eight week period allowed for the collection of the data, conclusions were to be drawn from the study of the patients available. During the eight week period, three patients were admitted who met requirements for the study.

All three patients being treated by means of induced hypothermia were placed in the surgical intensive care unit. This unit consisted of six cubicles divided by drawn curtains. The patients selected for placement in this unit were those requiring constant and intensive nursing care. It was necessary that these patients be carefully observed and that they receive skilled and effective care.

The patient being treated by means of induced hypothermia was placed on the Therm-o-Rite blanket. This was a rubberized blanket with longitudinal coils through which water and an antifreeze solution of denatured ethyl alcohol circulated. A machine was attached to this blanket which contained the following: (1) a control which determines the temperature of the fluid circulating in the blanket coils; (2) gauges which record the pressure at which the fluid is circulating; (3) gauges which record the temperature of fluid in the coils; (4) controls to determine the pressure of the circulating fluid; and (5) controls to turn the machine on and off. This machine constantly pumps the circulating fluid

through the blanket coils. Both a top and a bottom blanket are available for use as needed.

The neurological signs and vital signs (including blood pressure, pulse, respirations, and temperature) were checked frequently. The level of consciousness was continuously noted; and the patient's position was changed frequently. The nursing staff was constantly on the alert for any change in condition or any variance in the signs and symptoms presented by the patient. The patient remained on the cooling blankets as long as his condition warranted which was at the discretion of the physician.

Development of the Checklist

In the development of the method utilized in this study, a checklist was the tool of choice for the recording of the data obtained through the techniques of observation and unstructured interview. It was decided to develop a checklist which listed signs and symptoms frequently presented by the patient with a neurological condition being treated by means of induced hypothermia. This checklist was developed in the following manner.

After completing a survey of the literature, a list was compiled of signs and symptoms frequently presented by the patient being treated by means of induced hypothermia. The charts of three patients who had previously been on hypothermia were carefully reviewed, and

additional physical signs and symptoms which they presented were added to those listed from the review of the literature. Two patients being treated by means of induced hypothermia were then directly observed by the writer. Any additional signs and symptoms presented by these patients were also recorded. On the basis of these three sources of information (the related literature, the patient's records, and the direct observation of patients) a checklist was compiled which listed signs and symptoms to be observed in each patient. Each patient was identified by alphabetical letter only.

For purposes of organization, the physical signs and symptoms were organized under four bodily systems: (1) cardio-vascular system, (2) integumentary system, (3) respiratory system, and (4) nervous system. A blank line was provided at the end of each system so that any significant sign or symptom that occurred, but was not listed, could be added. "Other Recorded Data" included: (1) blood pressure, (2) pulse rate, (3) desired temperature, (4) actual temperature, (5) maximum "drift" in temperature, (6) blankets applied, and (7) medications related to this study. From the "Other Recorded Data" the nurse's understandings and skills were inferred as related to: (1) blood pressure, (2) pulse rate, (3) temperature, (4) Therm-o-Rite Blanket, and (5) medications. A copy of the checklist and the definitions of

terms used in the checklist is found in Appendix B.

Use of the Checklist

The checklist was then used on three selected patients. The discussion of its use is presented according to the selection of the method of conduct and the method of recording.

Selection of the Method of Conduct

After development of the tool, the question was raised as to the frequency of recording necessary in order to make valid conclusions from the data recorded. The data from the first patient included in the study were presented to a professor of research for evaluation of the trends in the signs and symptoms presented. It was agreed that the signs and symptoms did not present variability great enough to necessitate recording more than one time during a twenty-four hour interval. It was further recommended by this professor of research that a research physiologist and a neurosurgical resident physician be consulted regarding this question. Both the research physiologist and the neurosurgical resident physician presented written statements to the effect that one observation during a twenty-four hour interval was sufficient due to the fact that, in general, any observed features in these patients tend to change only slowly and

gradually. It was also stated that the definite consistency of the observable data collected during the course of the first study would suggest the likelihood of this consistency continuing. Thus, on the basis of this information, it was decided by the writer's committee that one recorded set of data at twenty-four hour intervals was sufficient.

Method of Recording

Recordings were made by placing a check mark to indicate the presence of a sign or symptom. A recording was made daily, starting with the day of hypothermic induction. Direct observations by the writer were recorded in red ink, and those from other sources were recorded in blue ink for purposes of identification. Supplementary sources to the writer's observations were the patient's medical records and unstructured interviews with the physicians and nurses caring for the patient. Recording for each patient was terminated at the time the physician ordered hypothermia discontinued, or at the time of death of the patient.

Each day a recording was also made of the action taken by the nursing staff in response to a sign or symptom presented by the patient. On some days, no new action was taken, so no recording was necessary.

Pretesting of the Data Collection Tool

Selltiz and others, justified the need for pretesting by stating that, "Once the data-collection instruments have been constructed, they must be pretested before they are used in the study proper."⁶ The tool was then pretested before using it in the study. This was done to determine if the tool elicited the desired data and if these data could be analyzed. Selltiz and others, stated that pretesting is necessary because a developed tool may actually be awkward or inappropriate to the material being studied.⁷

To pretest the tool, the checklist was tested on one patient who had a craniotomy performed and remained on the Therm-o-Rite blanket for three days, after which he was transferred to another institution. This testing indicated need for some revision. The checklist was then presented to the resident physician in neurosurgery who was directly responsible for all patients with neurological conditions being treated by means of induced hypothermia at this hospital. At this time, suggestions were made for further revision of the tool to facilitate greater accu-

⁶Claire Selltiz and others, Research Methods in Social Relations (revised one-volume edition; New York: Henry Holt and Company, Inc., 1959), p. 70.

⁷Ibid., pp. 70-71.

acy of recording, as well as greater ease in tabulation of the data. Following this revision, the tool was used on the next patient being treated with the Therm-o-Rite blanket. Its use elicited the desired data and required no further revision. Therefore, this patient was included in the population of the study.

Techniques for Analysis of Data

The data were then tabulated for all patients, presenting the signs and symptoms which had occurred according to each bodily system with which they were identified. These data were analyzed as to the physical signs and symptoms presented by the patients which indicated needs common to all, as well as individual needs.

Utilizing documentary frequency from the related literature, the understandings needed by the nurse were inferred. These understandings were inferred for each sign and symptom presented from each of the four bodily systems, and for each of the five items, with which the nurse is directly associated in caring for these patients, listed from the "Other Recorded Data." These understandings were categorized according to bodily systems and other items and were presented to a neurosurgical resident physician for evaluation and validation. This physician responded to the understandings inferred by indicating his agreement or disagreement as to whether the understanding was needed

by the nurse in giving intelligent physical care to the patient. In instances of disagreement with the understanding, the reason for disagreement was also stated. Appendix C contains a copy of the cover letter to the physician, the directions, and the understandings inferred with their corresponding footnotes.

Following validation of the understandings by the physician, the nurse's skills were inferred. These inferences were based on the signs and symptoms presented by the patient, the action taken by the nursing staff in response to the sign or symptom presented, and the related literature. These skills were categorized in the same manner as were the understandings. The skills were submitted to a jury of five experts in the area of medical-surgical nursing. These experts indicated their agreement or disagreement with the skills inferred by the writer, and in instances of disagreement with the skill, the reason for disagreement was stated. In this manner, the skills were validated. Appendix D contains a copy of the cover letter to the five jurors, the directions, and the skills inferred.

On the basis of the decisions from the physician and the five jurors, the understandings and skills inferred by the writer were validated. A final list was then formulated.

Summary

The descriptive case study method of research used in this investigation provided information regarding each patient. The techniques used to obtain information for data collection were observation and unstructured interview. To collect and organize the desired data, a checklist was used. This checklist was developed from signs and symptoms identified from the related literature, by direct patient observation, and from records of patients who were previously treated with the Therm-o-Rite blanket. Daily visits were made to each patient at twenty-four hour intervals, at which time recordings were made by a check mark indicating the presence of a sign or symptom. Action taken by the nursing staff in response to a sign or symptom presented was also recorded. The tool was pretested, and following revision, it was used to collect data for the study. During the eight week period allowed for the collection of the data, a total of three patients, who met the requirements, were admitted to the hospital.

The data were tabulated and analyzed. Inferences were drawn by the writer as to the understandings and skills the nurse must possess in giving intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia. These inferences were based upon related literature, the signs and symptoms

presented by the patients studied, and the action taken by the nursing staff. A jury of experts then validated the understandings and skills inferred. The jury responses were analyzed, and a final list of understandings and skills was formulated.

CHAPTER IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Introduction

The problem of the study was to develop a method which could be used to identify the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia. To accomplish the problem and the purposes set forth in the study, a checklist was developed as the tool of choice for collection of the data on a group of selected patients. To supplement the checklist data, information was also obtained from unstructured interviews with physicians and nurses caring for the patient and from the patient's medical records. These data were tabulated and analyzed, and the nurse's understandings were inferred by means of documentary frequency from the related literature. The understandings were presented to a neurosurgical resident physician, who was responsible for the care of these patients, for his evaluation and validation of the writer's inferences. After validation of the understandings, the nurse's skills were inferred, using as a basis the signs and symptoms presented by the patient, the action taken by

the nursing staff in response to the sign or symptom presented, and the related literature. The skills were presented to a jury of five experts in the area of medical-surgical nursing for evaluation and validation.

For the purpose of clarity, the chapter was organized and is presented under the following headings: (1) description of the population, (2) presentation of checklist data, (3) procedure for jury evaluation and validation, (4) understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia, (5) interpretation of findings, and (6) summary.

Description of the Population

During the eight week period allowed for collection of the data, three patients, who met requirements for the study, were admitted to the hospital. The patients were identified by alphabetical letter only. Each patient was observed at twenty-four hour intervals each day he remained on the Therm-o-Rite blanket. The first patient, Patient A, remained on the blanket for seven days. During this time, eight hours were spent by the investigator observing the patient and recording data. Patient B, the second patient, remained on the hypothermic blanket a

total of eleven days, and a total of fifteen hours was spent observing and recording by the investigator. The last patient, Patient C, remained on the Therm-o-Rite blanket for seven days, and the investigator spent a total of ten hours with this patient. Thus, a total of thirty-three hours was spent observing these three patients for the purpose of collection of data. Following is a brief case study report of each patient included in the population of the study.

Patient A

Patient A, a 19 year-old white male, was admitted to Hospital X following an automobile accident in which the truck he was driving overturned three times. Immediately following the accident, this 170 pound male was found comatose and apneic, but responded to artificial respiration. His admission blood pressure was 180/90, and his pulse rate was 52. The physicians' impression was that intracranial bleeding was present, and plans were made for an emergency operation. A burr hole craniotomy was performed and 100 cubic centimeters of blood were removed from a subdural hematoma. Following surgery, the blood pressure and pulse returned to normal, but intermittent periods of apnea continued, and the patient was placed on the lower hypothermic blanket. The first day postoperatively a tracheostomy was performed.

The clinical course during the next seven days was uneventful. Decerebrate rigidity and respiratory depression persisted; the patient remained comatose; the prognosis remained poor. The patient was treated by means of induced hypothermia during the entire time. His temperature was maintained at 32° C. quite easily through use of the lower Therm-o-Rite blanket. On occasion, his temperature did have a tendency to drift. However, despite medical management, in addition to hypothermia, the patient's condition was irreversible, and he expired on the seventh day following admission.

Patient B

Patient B, an 18 year-old white female, was transferred to this hospital from another hospital in the state, eight hours after she was involved in an automobile accident. At the time of admission she was deeply comatose and had decerebrate rigidity of her lower extremities. The blood pressure of this 125 pound girl was 120/80, and her pulse rate was 165. The admission diagnosis was established as a cerebral and brain stem contusion. A cerebral arteriogram indicated the presence of intracranial swelling, and the proposed medical regime for treatment was hypothermia and supportive management. She was placed on the lower Therm-o-Rite blanket the day of admission and remained on it for the ten days that

followed. Her temperature was maintained, with relative ease, at the desired level of 33° C. Occasionally, the temperature had a slight tendency to drift. A tracheostomy was performed on the day of admission.

Slight improvement was noted during the time the hypothermia was continued as she became more responsive to painful stimuli. However, on the thirteenth day following admission, her electrolytes were in a state of marked imbalance. Consultation with renal specialists established the fact that this electrolyte imbalance was due to a cerebral salt wasting syndrome which was a result of the head injury. Her condition became gradually worse as her blood pressure fell, her respirations became markedly depressed, and her urinary output was 6,700 cubic centimeters in one twenty-four hour period. No improvement was noted in her condition, and she expired on the fifteenth day following admission.

Patient C

Patient C, a 40 year-old white male, was admitted following an accident with the truck which he was driving. He was unconscious for an undetermined amount of time following the accident, and on admission to the hospital was listed as semi-comatose. However, he could be aroused to answer some questions, and at intervals he was apparently alert. The admitting diagnosis was cerebral concussion.

His admission blood pressure was 162/90 and his pulse rate was 99.

This 225 pound male was taken to surgery for a right carotid arteriogram which revealed a carotid obstruction. A right carotid thrombectomy and endarterectomy with a Tylon patch graft was performed. The question was raised by the physicians as to whether the carotid thrombosis was post-traumatic, resulting from the accident, or whether it had actually been the cause of a cerebral vascular accident, as the patient reported having had numbness of his left arm prior to the accident. A tracheostomy was performed the second day following admission.

The patient was placed between the upper and lower Therm-o-Rite blankets on the first day following admission for the purpose of reducing cerebral edema which resulted from the cerebral concussion. His temperature was very difficult to reduce and keep at the desired level of 35° to 36° C. He remained between the upper and lower blankets for four days, after which the upper blanket was removed. For the remaining three days of hypothermic therapy, he was continued only on the lower Therm-o-Rite blanket. His temperature had no tendency to drift.

He remained in a semi-comatose state during the course of treatment with hypothermia. However, on several occasions, he could be aroused sufficiently to take oral fluids, to respond to verbal commands, and to attempt

verbal response to questions.

He was last visited by the writer fifteen days after admission, after he had been off the hypothermic blanket for nine days. He remained confused and disoriented at this time. His improvement was very slow, and the physicians had indicated that some residual deficit to the brain could be evidenced.

Presentation of Checklist Data

Four tables were prepared which present the signs and symptoms identified with each system. These systems were: (1) cardio-vascular, (2) integumentary, (3) respiratory, and (4) nervous.

Cardio-vascular System Signs and Symptoms

Only one sign and symptom was identified for the cardio-vascular system. In Table I on page 42 is listed this cardio-vascular sign and symptom presented by three patients with neurological conditions being treated by means of induced hypothermia and the days on which this sign and symptom was noted. In addition, the day of termination of the patient study is also presented. The sign and symptom recorded for these patients was:

Pulse irregularity. Pulse irregularity occurred in Patient A during the entire seven days of treatment. It was noted in Patient B from the third through the ninth

TABLE I
CARDIO-VASCULAR PHYSICAL SIGNS AND SYMPTOMS PRESENTED BY THREE PATIENTS
WITH NEUROLOGICAL CONDITIONS BEING TREATED BY MEANS OF INDUCED
HYPOTHERMIA, INCLUDING THE DAYS ON WHICH NOTED

CARDIO-VASCULAR SIGN OR SYMPTOM	1	2	3	4	5	DAYS ON WHICH NOTED			8	9	10	11**
						6	7***					
Pulse irregular- ity	A	A	A,B	A,B	A,B	A,B	A,B	A,B	B	B		

*Indicates termination of study of Patient A.
**Indicates termination of study of Patient B.
***Indicates termination of study of Patient C.

<u>PATIENT</u>	<u>DIAGNOSIS</u>
A	Subdural hematoma
B	Cerebral and brain stem contusion
C	Cerebral concussion

days of treatment. It did not occur in Patient C.

Integumentary System Signs and Symptoms

Table II, page 44, shows the integumentary system signs and symptoms presented by three patients with neurological conditions being treated by means of induced hypothermia and the days on which these signs and symptoms were noted. This table also indicates the day of termination of the patient study. These signs and symptoms were:

Edema. Edema did not occur in any of the three patients.

Pressure areas. A slight area of pressure was observed in Patient A on the fifth day, then disappeared. Patient C developed an area of pressure on the seventh day of treatment. No pressure areas occurred in Patient B.

Skin color--pink. Both Patients B and C had pink skin color on only the first day of treatment. This was never observed in Patient A.

Skin color--reddened. Patient A had reddened skin on the first through the fourth days of treatment. Patient B's skin color was reddened on the second and third days, then recurred on the eleventh day. Patient C

TABLE II
INTEGUMENTARY PHYSICAL SIGNS AND SYMPTOMS PRESENTED BY THREE PATIENTS WITH
NEUROLOGICAL CONDITIONS BEING TREATED BY MEANS OF INDUCED
HYPOTHERMIA, INCLUDING THE DAYS ON WHICH NOTED

INTEGUMENTARY SIGN OR SYMPTOM	1	DAYS ON WHICH NOTED					8	9	10	11**
		2	3	4	5	6	7***			
Edema							*			
Pressure areas					A		C			
Skin color: pink	B,C									
reddened	A	A,B,C	A,B,C	A,C	C	C	C			B
discolored				B	A,B	A,B	A,B	B	B	

*Indicates termination of study of Patient A.
**Indicates termination of study of Patient B.
***Indicates termination of study of Patient C.

PATIENT	DIAGNOSIS
A	Subdural hematoma
B	Cerebral and brain stem contusion
C	Cerebral concussion

exhibited reddened skin color on the second through the seventh days.

Skin color--discolored. The skin became discolored on Patient A on the fifth day and remained until death on the seventh day. Patient B exhibited discoloration on the fourth through the tenth days. This was not observed in Patient C.

Respiratory System Signs and Symptoms

The respiratory physical signs and symptoms presented by three patients with neurological conditions being treated by means of induced hypothermia, including the days on which noted, are presented in Table III on page 46. This table also presents the day of termination of the study of each patient. These signs and symptoms were:

Depressed respirations. Patient A's respirations were depressed during his entire course of treatment (days one through seven). Patient C had depressed respirations on only the second through the fourth days. Patient B's respirations were at no time depressed.

Hyperventilation. Hyperventilation was noted in Patient A each day of treatment, including days one through seven. Patient B hyperventilated on the first through the third days, then began again on the eleventh day when hypothermia was discontinued. No hyperventilation was noted

TABLE III

RESPIRATORY PHYSICAL SIGNS AND SYMPTOMS PRESENTED BY THREE PATIENTS WITH
NEUROLOGICAL CONDITIONS BEING TREATED BY MEANS OF INDUCED
HYPOTHERMIA, INCLUDING THE DAYS ON WHICH NOTED

RESPIRATORY SIGN OR SYMPTOM	1	2	3	DAYS ON WHICH NOTED				8	9	10	
				4	5	6	7***				
Depressed respirations	A	A, C	A, C	A, C	A	A	A				
Hyperventila- tion	A,B	A,B	A,B	A	A	A	A				B
Respiratory obstruction	A,B,C	A,B,C	A, C	A,B,C	A,B,C	A,B,C	A,B,C	B	B	B	B

*Indicates termination of study of Patient A.
**Indicates termination of study of Patient B.
***Indicates termination of study of Patient C.

PATIENT	DIAGNOSIS
A	Subdural hematoma
B	Cerebral and brain stem contusion
C	Cerebral concussion

in Patient C.

Respiratory obstruction. All three patients had obstruction which interfered with respiration. Patient A had this each day of treatment, including days one through seven. Patient B had respiratory obstruction on each day of treatment from the first through the eleventh days, with the exception of the third day. Patient C had respiratory obstruction each day he was treated, including days one through seven.

Nervous System Signs and Symptoms

The neurological physical signs and symptoms presented by three patients with neurological conditions being treated by means of induced hypothermia, indicating the days on which noted, are presented in Table IV on page 48. This table also presents the day of termination of the study of each patient. These signs and symptoms were:

Pupillary reflexes. Patient A had pupillary reflexes from the first through the seventh days. Patient B's pupils reacted each day of treatment, including the first through the eleventh days. Pupillary reflexes were also observed in Patient C during each day of treatment, including the first through the seventh days.

Depressed corneal reflexes. Depressed corneal reflexes were noted in Patient A each day, from the first

TABLE IV

NEUROLOGICAL PHYSICAL SIGNS AND SYMPTOMS PRESENTED BY THREE PATIENTS WITH
NEUROLOGICAL CONDITIONS BEING TREATED BY MEANS OF INDUCED HYPOTHERMIA,
INCLUDING THE DAYS ON WHICH NOTED

NEUROLOGICAL SIGN OR SYMPTOM	1	DAYS ON WHICH NOTED							10	11**
		2	3	4	5	6	7***	8		
Pupillary reflexes	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	A,B,C	B	B	B
Depressed corneal reflexes	A,B,C	A,B,C	A,B	A,B	A,B	A,B	A,B	B	B	B
Mental clarity										
Semi-comatose	C	C	C	C	C	C	C			
Comatose	A,B	A,B	A,B	A,B	A,B	A,B	A,B	B	B	B
Restlessness	C	C	C	C	C	C	C			
"Goose pimples"				B					B	
Shivering	B	A, C		A,B,C	A, C	C				
Decerebrate rigidity	A,B	A,B	A,B	A,B	A,B	A,B	A,B	B	B	B
Convulsions	A									

*Indicates termination of study of Patient A.

**Indicates termination of study of Patient B.

***Indicates termination of study of Patient C.

PATIENT

A

B

C

DIAGNOSIS

Subdural hematoma

Cerebral and brain stem contusion

Cerebral concussion

through the seventh. Patient B presented this on each day of treatment also, from the first through the eleventh days. This was noted in Patient C only on days one and two.

Mental clarity. Mental clarity was not noted in any of the three patients.

Semi-comatose. Patient C remained semi-comatose from the first through the seventh days. Neither Patient A nor Patient B were semi-comatose at any time.

Comatose. Patient A remained comatose during the entire course of his treatment, from the first through the seventh days. Patient B remained comatose from the first through the eleventh days. Patient C was not comatose at any time.

Restlessness. Patient C was restless each day of treatment, including the first through the seventh days. Restlessness was not observed in either Patient A nor Patient B.

"Goose pimples". "Goose pimples" occurred in Patient B on the fourth and ninth days. This was not observed in either Patient A nor Patient C.

Shivering. Shivering occurred in each patient. In Patient A, it occurred on the second, fourth, and fifth

days. In Patient B, it was observed on the first and fourth days. In Patient C, it occurred on the second, fourth, fifth, and sixth days of treatment.

Decerebrate rigidity. Patient A presented decerebrate rigidity each day of treatment, from the first through the seventh days. Patient B remained rigid from the first through the eleventh days. This was not present in Patient C.

Convulsions. Patient A convulsed on the first day, prior to his surgery. Neither Patient B nor Patient C convulsed.

In addition to the data recorded, indicating the presence of a sign or symptom during each twenty-four hour interval, data were also recorded for seven other items listed as "Other Recorded Data" on the checklist in Appendix B. Inferences were drawn from five of the seven items listed. These supplementary data were not tabulated. However, they were used to assist the writer in making inferences as to the understandings and skills needed by the nurse as related to the following five items: (1) blood pressure, (2) pulse rate, (3) temperature, (4) Therm-o-Rite Blanket, and (5) medications.

Procedure for Jury Evaluation and Validation

Due to the fact that nursing practice should be

predicated upon a scientific body of knowledge, the understandings needed by the nurse in caring for this patient were inferred first. These understandings were established for each sign and symptom presented and for each of the five items established in the "Other Recorded Data" by means of documentary frequency from the related literature. A list of the sources utilized for the documentation are found in Appendix C. The signs and symptoms and the five items, along with the understandings inferred and their corresponding footnotes, were then presented to a neurosurgical resident physician for his evaluation as to whether he agreed or disagreed that these were valid understandings which were needed by the nurse in order to give intelligent physical care to these patients. An analysis of the responses indicated that of the ninety-two understandings presented to this physician, he agreed that eighty-four could be included in this category; he disagreed with eight, indicating that they should not be included.

Following this validation of the understandings inferred, they were again formulated, omitting those understandings receiving disagreement. Thus, there were a total of eighty-four understandings which had been validated.

Using these eighty-four understandings as a basis, in addition to other related literature and the

action taken by the nursing staff in response to a sign or symptom presented, the nurse's skills were inferred by the writer. A total of fifty-seven skills were formulated. Since these were nursing skills, they were submitted to a jury of five experts in the area of medical-surgical nursing for the indication of their agreement or disagreement with the skills inferred. Also given to the jury were the corresponding signs and symptoms and the eighty-four understandings previously inferred and now validated. It was arbitrarily decided that if eighty per cent, or four of the five jury members, agreed with a skill, for purposes of the study, the skill would be validated.

Analysis of the jury responses revealed that four of the five jurors indicated that each of the fifty-seven inferred skills was necessary. One juror indicated agreement with forty-two skills and disagreement with fifteen skills. Most of these disagreements related to her opinion that the skill would never be performed without specific order from the physician; a common comment in this instance was in response to the nurse's skill in keeping the family informed of the comatose patient's condition which said, "Interpretation of observations to family is the doctor's area of responsibility." Also, in the skill relating to the nurse's ability to control shivering, this juror stated, "Choice of action taken to be determined by M. D." Other reasons for indicating disagreement with the

inferred skill by this juror were either due to the fact that she felt additional information should have been included in the statement of the skill or that she felt the identified skill was not necessary. An example of a comment in this area of disagreement was in relation to the nurse exercising skill in preventing contractures or deformities as a result of the decerebrate rigidity; the related comment was, "Skill not a primary concern of symptoms elicited."

However, despite this disagreement from the one juror, each skill received at least eighty per cent agreement from the jury. Therefore, each of the fifty-seven skills inferred were considered validated for purposes of the study. Following validation of the understandings and skills by the experts, a final listing was formulated.

Understandings and Skills Needed by the Nurse to Give
Intelligent Physical Care to the Patient with a
Neurological Condition being Treated by means
of Induced Hypothermia

Following is a presentation of the final listing of all the understandings and skills identified by the writer, according to each bodily system or item with which they were identified. To the right of each listing is placed either "A", indicating agreement and validation of the understanding or skill, or "D", indicating disagreement. For each "D" presented, in relation to an under-

standing listed, the stated reason for disagreement by the physician immediately follows the understanding. Due to the fact that all the skills were validated by majority agreement, there are no reasons for disagreement to be listed. The corresponding footnotes for each of the understandings found in Appendix C are omitted in this listing, as also are examples for certain skills in Appendix D, which were included for the purpose of clarity to the jurors.

Understandings and Skills According to Signs and Symptoms of the Cardio-vascular System Presented by Patients with a Neurological Condition being Treated by means of Induced Hypothermia, Indicating Jury Agreement (A) or Disagreement (D) and the Reason for Disagreement

Sign or Symptom: Pulse irregularity

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that pulse irregularities may indicate cardiac arrhythmias which could be precursors to fibrillation.	A	<u>Skill</u> in counting and recording the pulse rate, with special attention to any deviations in rate or force of the beat.	A
<u>Understanding</u> that cardiac irregularities are sometimes noted prior to cardiac arrest.	A	<u>Skill</u> in reporting any pulse irregularities to the physician.	A
<u>Understanding</u> that alterations of rhythm are more common, and the incidence of ventricular fibrillation or cardiac arrest is much higher, when the temperature is reduced to levels below 28° to 30° C.	A	<u>Skill</u> in preparing emergency equipment for use should fibrillation or cardiac arrest occur.	A

Sign or Symptom: Pulse irregularity (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that bradycardia during hypothermia is a normal response of the heart to cold, but tachycardia or irregularities are dangerous and may predispose to fibrillation.	A	<u>Skill</u> in assisting the physician with emergency treatments which may be indicated.	A
<u>Understanding</u> that if irregularities should precede to fibrillation, the hypothermic heart does not respond to efforts directed to restoration of a regular beat as does the normal heart.	A	<u>Skill</u> in checking the pulse from the time of induction of hypothermia until after the patient's temperature has returned to normal and has stabilized.	A

Understandings and Skills According to Signs and Symptoms of the Integumentary System Presented by Patients with a Neurological Condition being Treated by means of Induced Hypothermia, Indicating Jury Agreement (A) or Disagreement (D) and the Reason for Disagreement

Sign or Symptom: Edema

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that edema may occur if the patient has been exposed to cooling over a considerable period of time.	A	<u>Skill</u> in observing and recording any signs of edema on the patient's trunk or extremities.	A

Sign or Symptom: Pressure areas

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that circulation has a tendency to stagnate in areas of pressure.	A	<u>Skill</u> in preventing areas of pressure on the patient by change of position.	A
<u>Understanding</u> that the cold skin is highly susceptible to damage produced by pressure, thus the patient may develop areas of pressure when remaining on the hypothermic blanket for a considerable period of time.	A	<u>Skill</u> in preventing areas of pressure, by padding any areas on the patient's body which would tend to be susceptible to cold pressure points.	A
		<u>Skill</u> in observing and recording any sign or symptom which might be indicative of a developing area of pressure.	A
		<u>Skill</u> in massaging the tissues to condition the skin against the development of pressure areas.	A
		<u>Skill</u> in positioning the patient so that any areas of pressure which have developed will not be exposed to further pressure, in order to promote restoration of healthy tissue to the affected areas.	A

Sign or Symptom: Skin color

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that vasoconstriction results from application of cold to the body.	A		

Sign or Symptom: Skin color (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that the rate of blood flow and the distribution of the blood vessels in the various parts of the body largely determine the degree of cooling and development of temperature gradients on exposure to cold.	A	<u>Skill</u> in observing the skin for any changes in color or any indications of impaired circulation, with particular scrutiny of the extremities.	A
<u>Understanding</u> that the blood vessels tend to conserve the loss of heat from the body as a whole at the expense of peripheral cooling and accentuate the temperature gradients along the length of the extremities.	A	<u>Skill</u> in preventing frostbite, which may follow skin changes resulting in profound discoloration.	A
<u>Understanding</u> that as a result of prolonged exposure to cold, skin changes do occur during the time the patient is on the hypothermic blanket.	A	<u>Skill</u> in promoting adequate circulatory flow and uniform heat exchange to the tissues.	A
<u>Understanding</u> that prolonged exposure to cold could result in frostbite.	A	<u>Skill</u> in preventing direct contact of the patient's skin with the cooling blanket by placing two layers of cotton bath blanket between the patient and the top and/or bottom cooling blanket.	A
<u>Understanding</u> that occasionally local areas of skin and subcutaneous tissue damage may occur following surface cooling.	A	<u>Skill</u> in placing additional covering over any areas with reddening or discoloration to the skin.	A

Sign or Symptom: Skin color (Continued)

<u>Understandings</u>		<u>Skills</u>
<u>Understanding</u> that uniform heat exchange is very important, so that any cold pressure points are avoided.	A	
<u>Understanding</u> that the skin in contact with the cooling blanket should look pink.	A	
<u>Understandings and Skills According to Signs and Symptoms of the Respiratory System Presented by Patients with a Neurological Condition being Treated by means of Induced Hypothermia, Indicating Jury Agreement (A) or Disagreement (D) and the Reason for Disagreement</u>		

Sign or Symptom: Depressed respirations

<u>Understandings</u>		<u>Skills</u>
<u>Understanding</u> that the effects of hypothermia upon respiration are difficult to determine, however it seems that reasonably normal respirations can persist to well below 28° C.	A	<u>Skill</u> in observing any alterations in breathing which may be characterized either by marked decreased rate or depth, or both. A
<u>Understanding</u> that depressed respirations may ensue in the patient with a head injury if edema of the brain stem or edema above the brain stem is present causing herniation into the foramen magnum and pressure on the respiratory center.	A	<u>Skill</u> in positioning the patient so as to promote optimum aeration of the lungs, with as little muscular exertion as possible for the patient. A

Sign or Symptom: Hyperventilation

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that the stimulus of cold may give rise to spontaneous hyperventilation, and this in turn will cause increased muscular effort which may increase the need for oxygen.	A	<u>Skill</u> in preventing hyperventilation, if possible, by avoiding sudden exposure of the patient's body to cold.	A
<u>Understanding</u> that it is most important to prevent the occurrence of respiratory acidosis during hypothermia by pulmonary hyperventilation.	D	<u>Skill</u> in observing and reporting hyperventilation.	A
<u>Reason for disagreement:</u> Hyperventilation does not produce acidosis, but rather alkalosis. This may occur to compensate for metabolic acidosis.			

Sign or Symptom: Respiratory obstruction

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that respiratory obstruction occurs quite frequently in these patients.	A	<u>Skill</u> in observing the patient to determine patency of the airway.	A
<u>Understanding</u> that increased difficulty in getting air is a tiring and unpleasant sensation and may lead to apprehension and even panic in the patient.	A	<u>Skill</u> in suctioning the patient, with a catheter, if secretions are interfering with the exchange of gases in the upper respiratory tree.	A

Sign or Symptom: Respiratory obstruction (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that in order to maintain a patent airway and adequate ventilation, a tracheostomy may be indicated.	A	<u>Skill</u> in preventing apprehension in the conscious patient, if secretions are interfering with the respiratory process.	A
		<u>Skill</u> in preparing equipment necessary to perform a tracheostomy, if there is a possibility that it might be indicated.	A
		<u>Skill</u> in assisting with the care of the tracheostomy to ensure a patent airway and to prevent aspiration of secretions.	A

Understandings and Skills According to Signs and Symptoms of the Nervous System Presented by Patients with a Neurological Condition being Treated by means of Induced Hypothermia, Indicating Jury Agreement (A) or Disagreement (D) and the Reason for Disagreement

Sign or Symptom: Pupillary reflexes

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that the evaluation of the pupillary reflexes is one of the most important parts of the neurologic examination.	A	<u>Skill</u> in testing the pupillary reactions to light by means of passing a light over the retina of the eye.	A

Sign or Symptom: Pupillary reflexes (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that the normal pupil contracts promptly when light is focused on the retina and dilates when the light is withdrawn.	A	<u>Skill</u> in observing each pupil, individually, as to the degree and character of the pupillary reaction.	A
<u>Understanding</u> that each eye should be tested individually as to whether the pupillary responses are prompt, sluggish, or absent.	A	<u>Skill</u> in observing and recording the size, shape, position, and equality of the pupils.	A
<u>Understanding</u> that it is significant as to the size, shape, position, equality, and reaction of the pupils.	A		

Sign or Symptom: Depressed corneal reflexes

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that these patients frequently have depressed corneal reflexes, accompanied by diminished secretions of the eye.	A	<u>Skill</u> in preventing corneal ulceration.	A
<u>Understanding</u> that the corneal reflexes should be frequently tested.	D	<u>Skill</u> in observing for blinking, tremor, or closing of the lids in response to light, sudden movement toward the eye, or a loud noise.	A
<u>Reason for disagreement:</u> This probably does not add much to following the patient's course and may cause corneal abrasion.			

Sign or Symptom: Depressed corneal reflexes (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that in deep coma these reflexes are absent, and the eyes may be open with a glassy stare.	A		

Sign or Symptom: Mental clarity

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that if the patient is conscious, he may exhibit fear and anxieties related to the continuous cold to which he is being exposed.	A	<u>Skill</u> in alleviating fears and anxieties which the patient may have, resulting from his condition and the instituted therapy.	A
<u>Understanding</u> that increase in the viscosity of the fluids and tissues of the joints and tendons, resulting from the cooling, may cause the alert patient to experience loss of manual dexterity.	A		

Sign or Symptom: Semi-comatose and Comatose

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that in various degrees of coma, the pupils may be either dilated or contracted.	A	<u>Skill</u> in observing the level of consciousness.	A
		<u>Skill</u> in maintaining good anatomical position of the patient at all times, with frequent change of position.	A

Sign or Symptom: Semi-comatose and Comatose (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that deep reflexes may be diminished or lost in the presence of increased intracranial pressure, and they are absent in deep coma.	A	<u>Skill</u> in keeping the family informed of the patient's condition.	A
<u>Understanding</u> that in deep coma the patient has no gag reflex. <u>Reason for disagreement:</u> Not necessarily.	D	<u>Skill</u> in instituting protective measures for the patient.	A
<u>Understanding</u> that unconsciousness may result from head injuries with primary damage to the brain, from pressure on the brain from swelling, or from drugs.	A		
<u>Understanding</u> that there is no rigid temperature level at which a physiological response will cease or reappear, but the precise level at which these changes take place is not as important as gaining understanding of the mechanisms involved in their disappearance.	A		
<u>Understanding</u> that amnesia usually occurs at about 34° C., dysarthria ensues at about 30° to 34° C., and close to 27° C. spontaneous movement and response to verbal commands are lost.	A		

Sign or Symptom: Semi-comatose and Comatose (Continued)

UnderstandingsSkills

Understanding that
temperatures of 27° C.
produce an almost com-
plete narcotic effect. A

Understanding that at a
body temperature of 28°
to 30° C. metabolism is
reduced by about 50 per
cent, resulting in de-
creased physiologic pro-
cesses with a resultant
fall in the level of
consciousness. A

Sign or Symptom: Restlessness

UnderstandingsSkills

Understanding that in-
creased muscular activ-
ity may cause an in-
crease in oxygen con-
sumption. A

Skill in providing
measures to allevi-
ate or prevent
restlessness. A

Sign or Symptom: "Goose pimples"

UnderstandingsSkills

Understanding that ex-
cessive "goose pimples"
in the absence of a
falling temperature
could be indicative of
impending or undetected
shivering. A

Skill in observing
and correlating the
presence of "goose
pimples" with the
absence of a falling
temperature. A

Sign or Symptom: Shivering

Understandings

Understanding that hypothermia is employed to reduce the body's metabolic activity (to the brain or any other injured organ) so that it can better tolerate this state of vascular insufficiency and to reduce the cerebral edema.

Understanding that shivering causes an increase in metabolic needs with an increase in oxygen consumption, which counteracts and defeats the purpose of the therapy.

Understanding that the temperature-regulating centers of the hypothalamus normally maintain a constant body temperature, and exposure to cold leads to increased heat conservation in the body by such mechanisms as shivering.

Understanding that two adjuncts to cooling which help alleviate shivering are anesthesia and drugs.

A

A

A

A

Skills

Skill in observing for shivering in the patient and in taking immediate action to alleviate it by either controlling the rate of cooling or by medication.

Skill in observing for symptoms of hypoglycemia, which might occur if shivering continues to persist.

Skill in observing for cyanosis, resulting from an oxygen deficit to the tissues.

A

A

A

Sign or Symptom: Shivering (Continued)

UnderstandingsSkills

Understanding that when shivering occurs, in moderate hypothermia, there is movement of water out of the circulation, and both the interstitial and intracellular compartments gain water which may result in edema. A

Understanding that shivering may increase metabolism and demands of circulation on the heart, for which the heart must compensate at lowered metabolism, which may produce an oxygen deficit resulting in cardiac irregularities and ventricular fibrillation. A

Understanding that shivering must be prevented and may be detected only by quivering of an E. C. G. stylus. A

Understanding that shivering may increase the metabolic activity of the brain as much as 100 per cent, causing an increase in cerebrospinal fluid pressure and increased brain volume, which counteracts the attempt to reduce cerebral edema or promote tissue healing. A

Sign or Symptom: Shivering (Continued)

<u>Understandings</u>	<u>Skills</u>
<u>Understanding</u> that when shivering occurs, in moderate hypothermia, there is movement of water out of the circulation, and both the interstitial and intracellular compartments gain water which may result in edema.	A
<u>Understanding</u> that shivering may increase metabolism and demands of circulation on the heart, for which the heart must compensate at lowered metabolism, which may produce an oxygen deficit resulting in cardiac irregularities and ventricular fibrillation.	A
<u>Understanding</u> that shivering must be prevented and may be detected only by quivering of an E. C. G. stylus.	A
<u>Understanding</u> that shivering may increase the metabolic activity of the brain as much as 100 per cent, causing an increase in cerebrospinal fluid pressure and increased brain volume, which counteracts the attempt to reduce cerebral edema or promote tissue healing.	A

Sign or Symptom: Shivering (Continued)

<u>Understandings</u>	<u>Skills</u>
<p><u>Understanding</u> that shivering may be difficult to control below 33° C.</p> <p><u>Reason for disagreement:</u> With proper use of adjunctive drugs, shivering should not be difficult to control.</p>	D
<p><u>Understanding</u> that if shivering continues, there is exhaustion of liver glycogen with resultant hypoglycemia, and with the breakdown of liver glycogen, the serum potassium may become elevated.</p>	A
<p><u>Understanding</u> that under normothermic conditions, cerebral ischemia produces a rapid and profound insult to the brain, but with hypothermia the cerebral metabolic rate must decrease with a fall in temperature.</p>	A

Sign or Symptom: Decerebrate rigidity

Understandings

Understanding that decerebrate rigidity is characterized by marked rigidity and sustained contraction of all the extensor (antigravity) muscles in which the limbs are stiffly extended, the head is erect, and the jaws are closed.

Understanding that this may follow injury to or transection of the brain stem at a level between the superior colliculi (anterior quadrigeminal bodies) and the vestibular nuclei.

Understanding that this is characterized by the arms being internally rotated at the shoulders, extended at the elbows, and hyperpronated, with the fingers extended at the metacarpophalangeal joints and flexed at the interphalangeal joints while the legs are extended at the hips, knees, and ankles, and the toes are plantar flexed.

Understanding that if only one half of the brain stem is severed, the rigidity is homolateral.

Reason for disagreement:
Contralateral.

Skills

A Skill in observing and recording position of all body parts, noting amount of rigidity present and any increase or decrease in tonicity.

A Skill in preventing contractures or deformities as a result of the rigidity.

Sign or Symptom: Convulsions

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that during the state of hypothermia, the nervous system shows a hypoexcitability but also a hyper-reactivity, thus there is a lowering of the threshold for convulsions, and if they occur, they may be difficult to control.	A	<u>Skill</u> in preventing convulsions, if possible.	A
		<u>Skill</u> in protecting the patient, if a seizure should occur.	A
<u>Understanding</u> that convulsions would raise the metabolic rate and the oxygen requirements to the tissues, thus the purposes for which the hypothermia was induced would be defeated.	A		

Understandings and Skills According to Five Items with which the Nurse is Directly Concerned in Caring for the Patient with a Neurological Condition being Treated by means of Induced Hypothermia, Indicating Jury Agreement (A) or Disagreement (D) and the Reason for Disagreement

Item: Blood pressure

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that great individual variations occur in the physiological reactions to cold, and changes in the blood pressure cannot be said to take place at predictable temperatures.	A	<u>Skill</u> in taking the blood pressure with the sphygmomanometer and stethoscope, with particular attention to any rise or fall.	A

Item: Blood pressure (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that the depressant effects of drugs increases the variability in blood pressure fall. <u>Reason for disagreement:</u> Needs to be reworded.	D	<u>Skill</u> in obtaining the blood pressure by palpation of the brachial artery, if it cannot be obtained by auscultation with the stethoscope.	A
<u>Understanding</u> that the change in blood pressure is not clear-cut, but if it drops this usually occurs below 30° C.	A		
<u>Understanding</u> that a sudden rise in blood pressure may be indicative of undetected or impending shivering.	A		
<u>Understanding</u> that shivering will cause considerable rise in the blood pressure.	A		
<u>Understanding</u> that when the temperature is at 30° to 31° C., the diastolic blood pressure cannot always be obtained and sometimes may only be obtained by palpation.	A		

Item: Blood pressure (Continued)

Understandings

Skills

Understanding that one A
of the main difficulties
during prolonged cooling
of the deeply comatose
patient is that the blood
pressure may fall fairly
soon after the induction
of hypothermia and may be
difficult to raise with
the usual vasopressor
drugs.

Item: Pulse rate

Understandings

Skills

Understanding that as A
the temperature lowers,
it is accompanied by a
progressive brady-
cardia.

Skill in counting the A
pulse, with special
concern for signifi-
cant changes in rate.

Understanding that at A
30° C. the pulse is al-
most always slow and may
be between 40 and 50
beats per minute.

Understanding that the A
pulse rate is increased
by shivering.

Item: Temperature

Understandings

Skills

Understanding that lowering the body temperature will not make tissue destruction or inflammatory reactions disappear, but will only modify the body's reaction to it.

A Skill in taking and interpreting the temperature rectally. A

Skill in permitting heat loss from the patient's body. A

Skill in preventing the patient's temperature from falling to dangerous levels. A

Understanding that the length of time required for a patient to reach the desired temperature depends on his initial basal temperature, his metabolic rate, his size, and how completely he is covered with the cooling surface.

A Skill in allowing the patient's body to rewarm at its own rate after the cooling blankets are removed. A

Understanding that the efficiency of this surface heat exchange will vary from subject to subject, depending on the extent of the superficial heat insulation by fat and hair.

A Skill in checking the temperature very closely until it has returned to normal and has stabilized. A

Understanding that the influence of drugs which reduce the metabolic rate will affect the rate of cooling.

A

Understanding that one of the greatest problems in reducing a patient's temperature to the desired level is the tendency for the temperature to drift downwards after the blanket is removed.

A

Item: Temperature (Continued)

UnderstandingsSkills

Understanding that the amount of drift varies with the rate the temperature is falling and the size of the patient, thus large patients cool slowly and show a greater tendency to drift. D
Reason for disagreement:
 Large patients show a less tendency to drift.

Understanding that the drift is usually one-half to two-thirds the number of degrees by which the temperature has been lowered when the cooling agent has been discontinued. D
Reason for disagreement:
 One-third to one-half.

Understanding that an after-rise in temperature may be seen following the return to normal temperature but does not usually persist, and it may be controlled by routine measures. A

Understanding that the patient's general condition may deteriorate during the later stages of rewarming, particularly during the first twenty-four hours, which may be due to rapid restoration of body temperature before circulation is able to supply sufficient oxygen for normothermic tissues. A

Item: Temperature (Continued)

<u>Understandings</u>		<u>Skills</u>
<u>Understanding</u> that the caloric output increases by 8 per cent for each 1° F. rise in temperature.	A	

Item: Therm-o-Rite Blanket

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that cooling with the Therm-o-Rite blanket should take three to four hours to reach the desired temperature.	A	<u>Skill</u> in adjusting the blanket controls, in accordance with the existing and desired body temperatures of the patient, to maintain complete control over the patient's present and impending temperature.	A
<u>Understanding</u> that after the temperature has fallen, it may be kept down with little difficulty, by using the Therm-o-Rite blanket or blankets, for as long as one desires.	A	<u>Skill</u> in turning the cooling blanket off in time to allow for downward drift, when reducing the patient's temperature.	A
<u>Understanding</u> that the blanket temperature may be lowered at any time the temperature begins to go up.	A		
<u>Understanding</u> that when the temperature falls below the desired level, the pump which circulates fluid through the blanket is simply turned off.	A		

Item: Therm-o-Rite Blanket (Continued)

<u>Understandings</u>		<u>Skills</u>
<u>Understanding</u> that the temperature of the water in the blanket coils must never exceed 42° C. in rewarming, as burns of the cold skin may be caused very easily.	A	
<u>Understanding</u> that rewarming with the blanket may cause a fever, unless observed very closely.	A	
<u>Understanding</u> that there is no information as to the degree of warmth that can be used safely, but apparently the cold skin is very sensitive to temperatures only a few degrees higher than normal.	A	
Item: Medications		
<u>Understandings</u>		<u>Skills</u>
<u>Understanding</u> that due to prolonged circulation time resulting from decreased cardiac output, plus vasoconstriction and increased viscosity of the blood, time after injecting intravenous drugs is prolonged until it takes effect.	A	<u>Skill</u> in assisting with administration of intravenous solutions and medications, with special attention to the body's ability to absorb the solution. A <u>Skill</u> in observing and reporting any symptoms of drug toxicity or sensitivity. A

Item: Medications (Continued)

<u>Understandings</u>		<u>Skills</u>	
<u>Understanding</u> that because of the decrease in metabolism, drugs may be slowly detoxified and excreted.	A	<u>Skill</u> in determining when prescribed p. r. n. medications should be given to enhance cooling, to prevent restlessness, and to prevent or control shivering.	A
<u>Understanding</u> that since the action of a drug usually involves one or more chemical processes, it is to be expected that the action will be modified by temperatures, being less when the temperature is low.	A		
<u>Understanding</u> that hypertonic solutions may be given intravenously to reduce intracranial pressure.	A		
<u>Understanding</u> that blood should be given with care during hypothermia, due to the decrease in vascular capacity and the known congestion of the liver and lungs.	A		
<u>Understanding</u> that drugs may be given to reduce metabolism and inhibit shivering in the patient.	A		

Interpretation of Findings

Following utilization of this method as a means of identifying the nurse's understandings and skills, an interpretation could be made as to the adequacy of the

method developed in relation to the findings of the study. First of all, it was interpreted that by applying this method to clinical research of the patient with a neurological condition being treated by means of induced hypothermia, the factors of cause and effect, relating to either the neurological condition or to the induced hypothermia, could not be delineated. An example of this would be in relation to the sign or symptom, pulse irregularity, in which Patient C was the only one of the three patients in whom this was not observed. The factors relating to cause or effect could not be deduced. In addition to this, it could be interpreted that the nurse must be cognizant of the clinical variance presented by each individual patient. For example, in this study some signs and symptoms had a relationship to the clinical condition of the patient with a neurological condition being treated by means of induced hypothermia which would not apply to patients in other diagnostic categories.

In relation to the method developed, it was deduced that each step taken in this method was necessary. A review of the related literature, clinical study of selected patients, and consultation with a physician in this area all proved to be necessary steps in the development of the tool for collection of the data. However, a more refined checklist would need to be developed if more specific signs and symptoms were to be recorded, such as to the specific

areas of either pressure or decerebrate rigidity, or as to the specific peculiarities of each pupillary reaction. It was also interpreted that the tool would need additions if other signs and symptoms, besides the physical, were to be included.

Documentary frequency was an adequate means of drawing valid inferences as to the nurse's understandings. By using these as a scientific basis, in addition to the sign and symptom, the checklist data obtained by observation and unstructured interviews with the physicians and nurses caring for the patient, and the patient's medical records, valid inferences could be made in relation to the nurse's skills. This was substantiated by the high agreement with the writer's inferences by the experts. In this manner, validity of the method was established. However, no interpretations could be made as to the reliability of the method.

From the findings obtained in the study, it could be interpreted that the method developed was consistently adequate as applied to each bodily system and to each item listed. It could not be determined that the method indicated any variance with any of the four bodily systems or any of the five items in which it was utilized.

Summary

In this study, a method was developed which could

be utilized in identifying the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia. A checklist was used to collect data on a group of three selected patients. A case study report was presented on each of these three patients. A total of thirty-three hours was spent observing and recording data on these patients.

The signs and symptoms presented by the three patients were tabulated and discussed. The procedure for jury evaluation and validation of the understandings was then presented. Of the ninety-two understandings established by means of documentary frequency from related literature and presented to a neurosurgical resident physician, eighty-four received agreement which indicated they were understandings needed by the nurse, and eight received disagreement.

Following validation of the understandings, fifty-seven skills were inferred and presented to a jury of five experts in the area of medical-surgical nursing for the purpose of validation. It had been established that eighty per cent agreement, or agreement from four of the five jurors, would validate the skill. All fifty-seven skills were validated. A final list was then formulated of those understandings and skills identified by the writer. In instances where there was disagreement, the reason for dis-

agreement was stated.

On the basis of the data obtained in the study, it was interpreted that the method was consistently adequate. This consistency prevailed with each bodily system and each item in which this method was utilized. No steps utilized in developing the method could be eliminated.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The descriptive case study was used to develop a method which could be used to identify the understandings and skills needed by the nurse to give intelligent physical care to the patient with a neurological condition being treated by means of induced hypothermia. The review of literature made indicated that induced hypothermia was being increasingly employed in the treatment of patients. While the literature indicated that the nurse had a role in the care of these patients, the role was poorly defined. The literature further indicated that nursing practice must be based upon a scientific body of knowledge. No evidence of scientific inquiry was found.

Following a survey of nursing periodicals, medical periodicals, research literature, educational journals, physiology textbooks, and textbooks relating to hypothermia, certain selected patients were observed. From these sources, a checklist was developed as the tool of choice for collection of the data. This checklist included signs and symptoms commonly manifested by these patients, according to four bodily systems, and seven

other related items listed as "Other Recorded Data". Following pretesting of this tool, data were collected on three patients, meeting requirements for the study, who were admitted to the hospital during the eight week period allowed for the collection of data. These three patients were included in the population of the study. To supplement the data recorded on the checklist, unstructured interviews were held with physicians and nurses caring for the patients, and the patients' medical records were utilized.

Following tabulation and analysis of these data, a total of ninety-two understandings needed by the nurse were inferred by means of documentary frequency from the related literature. These were presented to a neuro-surgical resident physician for his agreement or disagreement with the inferred understandings. Eighty-four received his agreement, and were therefore validated.

Fifty-seven nurse's skills were then inferred using as a basis the eighty-four understandings identified, the sign or symptom presented, the action taken by the nursing staff in response to a sign or symptom, and the related literature. In addition to these skills the signs and symptoms and the validated understandings were presented to a jury of five experts in the area of medical-surgical nursing. All fifty-seven skills were validated by at least eighty per cent agreement by the jurors. A final

listing was formulated according to each of the four bodily systems and each of the five items from "Other Recorded Data" with which they were identified.

It was interpreted that the method developed was consistently adequate. It could not be determined that the method indicated any variance with any of the bodily systems or the five items with which it was utilized.

Conclusions

Based upon data obtained in this study, the following conclusions were drawn:

1. The patients presented no specific pattern of needs according to either the presence of signs and symptoms or the degrees of severity of the signs and symptoms noted.

2. The signs and symptoms recorded and the understandings and skills identified in relation to them indicate that much of the patient's care lies within the scope of nursing.

3. The findings obtained in this study can be applied only to the patient with a neurological condition being treated by means of induced hypothermia.

4. The findings cannot be generalized due to the limited number of patients included in the population of the study.

5. The method developed and utilized in studying

these patients was one by which the nurse's understandings and skills could be identified.

Recommendations

On the basis of the data obtained in this study, the following recommendations are made:

1. The study be repeated with a larger patient population to ascertain the reliability of the method developed.
2. The method be utilized to study patients in other diagnostic categories.
3. The method be utilized in studying needs, other than physical, presented by the patient.
4. The understandings and skills identified in the study be used as a guide for planning individualized care for the patient with a neurological condition being treated by means of induced hypothermia.

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APPENDIX A

Letter to Director of Nursing Service

1270 Colorado Boulevard
Apt. 10
Denver 6, Colorado
May 22, 1962

Mrs. Louverta Brunkow
Director of Nursing Service

Dear Mrs. Brunkow:

This letter is to confirm our discussion of April 27, 1962, in which you gave me permission to conduct a research study at Colorado General Hospital.

As I indicated in our conversation, the study will involve daily observations of the patients undergoing therapy with the hypothermia blanket. Information will also be obtained from the patient's medical records and from the medical and nursing personnel caring for the patients. All patients and the hospital will remain anonymous. The study will be terminated by the end of July, 1962.

The purposes of the study are: (1) to study the patients with a neurological diagnosis undergoing therapy by means of induced hypothermia with the Therm-o-Rite blanket; (2) to compile data concerning the signs and symptoms presented by the patients; (3) to record the action taken by the nursing staff in response to the signs and symptoms presented; (4) to obtain facts regarding the body's response to hypothermia; (5) to analyze the collected data and identify the nurses' understandings and skills related to the care of this patient; and (6) to serve as the basis for the development of a plan of nursing care for the patient with a neurological diagnosis being treated by means of induced hypothermia.

Thank you for your cooperation. If you would like a summary of the findings, I would be happy to make them available to you.

Very sincerely,

Loris Foley

APPENDIX B

Checklist

Definitions of Checklist Signs and Symptoms

Patient's Name _____ Age _____ Diagnosis _____
(coded)

[illegible][illegible][illegible]

Patient's Name _____ Age _____ Diagnosis _____
(coded)

[illegible][illegible]

Patient's Name _____ Age _____ Diagnosis _____
(coded)

[illegible]

ACTION TAKEN BY NURSING STAFF IN RESPONSE TO
SIGN OR SYMPTOM PRESENTED:

DATE	SIGN OR SYMPTOM	ACTION TAKEN

DEFINITIONS OF CHECKLIST SIGNS AND SYMPTOMS

Pulse irregularity: any deviation from the regular rhythm of the pulse beat; may be a variation in "force" or "frequency."¹

Edema: a condition of body tissues containing grossly abnormal amounts of fluid, usually intercellular, and distending tissue spaces which normally are collapsed.² Edema in this study would be related to the integumentary system, only.

Pressure area: condition of the skin brought about by prolonged exposure of a part to compression or stress.

Skin color (pink): evidenced by no discoloration with adequate circulation.

Skin color (reddened): evidenced by diffused erythema over the skin.³

Skin color (discolored): evidenced by a darkened hue to the skin.

Depressed respirations: breathing characterized either by lessened frequency or depth, or both.⁴

¹ Clarence Wilbur Taber, Taber's Cyclopedic Medical Dictionary (sixth edition; Philadelphia: F. A. Davis Company, 1955), p. P-124.

² Ibid., p. E-7.

³ Ibid., E-43.

⁴ Ibid., D-13.

Hyperventilation: hyperpnea or forced respiration; an increase in the quantity of air breathed as a result of an increase in the rate or depth of respiration, or both.⁵

Respiratory obstruction: occlusion of the respiratory tree which interferes with the exchange of gases.

Pupillary reflexes: reaction by the pupil concerning passage of light through or dilatation or contraction of pupil.⁶

Depressed corneal reflexes: decreased ability to close the eyelids.⁷

Mental clarity: clearness of mental processes.

Semi-comatose: a state of unconsciousness from which one can be aroused.⁸

Comatose: a state of profound unconsciousness from which one cannot be roused.⁹

Restlessness: inability to lie or rest quietly; never quiet.

⁵Harold Wellington Jones, Normand L. Hoerr, and Arthur Osol (ed.), Blakiston's New Gould Medical Dictionary (first edition; Philadelphia: The Blakiston Company, 1949), p. 484.

⁶Taber, op. cit., p. P-126.

⁷Ibid., p. C-87.

⁸Norman Burke Taylor (ed.), Stedman's Medical Dictionary (eighteenth edition; Baltimore: The Williams and Wilkens Company, 1953), p. 1237.

⁹Ibid., p. 308.

"Goose pimples": a skin reaction caused by erection of skin papillae.¹⁰

Shivering: a trembling or shaking of the body, as from cold.¹¹

Decerebrate rigidity: a condition characterized by rigid contraction of the extensor and other muscles in which the upper limbs are internally rotated, extended at the elbow and hyperpronated with the fingers extended at the metacarpophalangeal joints and flexed at the interphalangeal joints; the lower limbs are extended at the hip and knee with the ankles and toes plantar flexed.¹²

Convulsion: paroxysms of involuntary muscular contractions and relaxations.¹³

"Drift": the amount of drop in the body temperature after the cooling blankets have been turned off or removed.

Blankets: the rubber coverings, below and/or above the patient, through which a refrigerant solution is pumped for purposes of cooling the patient.

¹⁰Taber, op. cit., p. G-27.

¹¹Ibid., p. S-37.

¹²Taylor, op. cit., p. 1195.

¹³Taber, op. cit., p. C-84.

Medications related to this study: any drugs administered to the patient which either alleviate or enhance the signs and symptoms recorded.

APPENDIX C

Cover Letter to Resident Physician in Neurosurgery

Directions

Understandings Inferred

1270 Colorado Boulevard
Apt. 10
Denver 6, Colorado
July 2, 1962

O. H. Reichman, M. D.
Intermediate Resident in Surgery
Colorado General Hospital
4200 East Ninth Avenue
Denver 6, Colorado

Dear Dr. Reichman:

Thank you for consenting to participate in my study. You have been chosen because you are considered an expert in the specialty of neurology, as well as in the area of treatment by means of induced hypothermia.

As you know, the purpose of the study is to develop a method which could be used to identify the understandings and skills, as related to the physical signs and symptoms presented, needed by the nurse to give intelligent care to the patient with a neurological condition being treated by means of induced hypothermia. These understandings were established by means of documentary frequency from the related literature.

Your participation in the study is elicited for the purpose of further validating these understandings. I estimate that your help will take a maximum of two hours of your time.

Thank you for your interest and assistance.

Sincerely,

Loris Foley

Miss Loris Foley is a student at the University of Colorado Graduate School, Department of Nursing. Your help and assistance will be greatly appreciated.

Chairman, Thesis Committee

DIRECTIONS

Section I

The signs and symptoms were categorized and are presented according to the bodily system with which they were identified. In the left-hand column is listed the sign or symptom presented by the patient. In the right-hand column are listed the understandings identified by the writer. The definition of understanding used in the study was "comprehension and intellectual rationalization of a given phenomena or concept."

You are to read the understanding identified and simply circle "A" if you agree with the identified understanding, or circle "D" if you disagree with the identified understanding. If you circle "D", indicating disagreement, please write very briefly your reason for disagreement on the blank line immediately below the understanding. The writer is not concerned with any understandings which you might feel should be added, but rather with only those listed herein.

Section II

In the left-hand column are listed five items with which the nurse is directly associated in giving care to the patient. In the right-hand column are listed the under-

standings identified by the writer, as related to these items. Please proceed exactly as you did in Section I.

SECTION I

Cardio-Vascular System

Signs and Symptoms

Pulse irregularity

Understandings

Understanding that pulse A D
irregularities may indi-
cate cardiac arrhythmias
which could be precursors
to fibrillation.¹

Understanding that cardi- A D
ac irregularities are
sometimes noted prior to
cardiac arrest.²

Understanding that alter- A D
ations of rhythm are more
common, and the incidence
of ventricular fibrilla-
tion or cardiac arrest is
much higher, when the
temperature is reduced to
levels below 28° to 30°
C.³

Understanding that A D
bradycardia during hypo-
thermia is a normal re-
sponse of the heart to
cold, but tachycardia or
irregularities are
dangerous and may predis-
pose to fibrillation.⁴

Signs and SymptomsUnderstandings

Pulse irregularity
(Continued)

Understanding that if irregularities should preceed to fibrillation, the hypothermic heart does not respond to efforts directed to restoration of a regular beat as does the normal heart.⁵

A D

Integumentary SystemSigns and SymptomsUnderstandings

Edema

Understanding that edema may occur if the patient has been exposed to cooling over a considerable period of time.⁶

A D

Pressure area

Understanding that circulation has a tendency to stagnate in areas of pressure.⁷

A D

Understanding that the cold skin is highly susceptible to damage produced by pressure, thus the patient may develop areas of pressure when remaining on the hypothermic blanket for a considerable period of time.⁸

A D

Signs and SymptomsUnderstandings

Skin color

Understanding that vasoconstriction results from application of cold to the body.⁹

A D

Understanding that the rate of blood flow and the distribution of the blood vessels in the various parts of the body largely determine the degree of cooling and development of temperature gradients on exposure to cold.¹⁰

A D

Understanding that the blood vessels tend to conserve the loss of heat from the body as a whole at the expense of peripheral cooling and accentuate the temperature gradients along the length of the extremities.¹¹

A D

Understanding that as a result of prolonged exposure to cold, skin changes do occur during the time the patient is on the hypothermic blanket.¹²

A D

Signs and SymptomsUnderstandings

Skin color (Continued)

Understanding that prolonged exposure to cold could result in frost-bite.¹³

A D

Understanding that occasionally local areas of skin and subcutaneous tissue damage may occur following surface cooling.¹⁴

A D

Understanding that uniform heat exchange is very important, so that any cold pressure points are avoided.¹⁵

A D

Understanding that the skin in contact with the cooling blanket should look pink.¹⁶

A D

Respiratory SystemSigns and SymptomsUnderstandings

Depressed respirations

Understanding that the effects of hypothermia upon respiration are difficult to determine, however it seems that reasonably normal respirations can persist to well below 28° C.¹⁷

A D

Signs and SymptomsUnderstandings

Depressed respirations
(Continued)

Understanding that depressed respirations may ensue in the patient with a head injury if edema of the brain stem or edema above the brain stem is present causing herniation into the foramen magnum and pressure on the respiratory center.¹⁸

A D

Hyperventilation

Understanding that the stimulus of cold may give rise to spontaneous hyperventilation, and this in turn will cause increased muscular effort which may increase the need for oxygen.¹⁹

A D

Understanding that it is most important to prevent the occurrence of respiratory acidosis during hypothermia by pulmonary hyperventilation.²⁰

A D

Respiratory obstruction

Understanding that respiratory obstruction occurs quite frequently in these patients.²¹

A D

Signs and SymptomsUnderstandings

Respiratory obstruction
(Continued)

Understanding that increased difficulty in getting air is a tiring and unpleasant sensation and may lead to apprehension and even panic in the patient.²²

A D

Understanding that in order to maintain a patent airway and adequate ventilation, a tracheostomy may be indicated.²³

A D

Nervous SystemSigns and SymptomsUnderstandings

Pupillary reflexes

Understanding that the evaluation of the pupillary reflexes is one of the most important parts of the neurologic examination.²⁴

A D

Understanding that the normal pupil contracts promptly when light is focused on the retina and dilates when the light is withdrawn.²⁵

A D

Signs and SymptomsUnderstandings

Pupillary reflexes
(Continued)

Understanding that each eye should be tested individually as to whether the pupillary responses are prompt, sluggish, or absent.²⁶

A D

Understanding that it is significant as to the size, shape, position, equality, and reaction of the pupils.²⁷

A D

Depressed corneal
reflexes

Understanding that these patients frequently have depressed corneal reflexes, accompanied by diminished secretions of the eye.²⁸

A D

Understanding that the corneal reflexes should be frequently tested.²⁹

A D

Understanding that in deep coma these reflexes are absent, and the eyes may be open with a glassy stare.³⁰

A D

Signs and SymptomsUnderstandings

Mental clarity

Understanding that if the patient is conscious, he may exhibit fear and anxieties related to the continuous cold to which he is being exposed.³¹

A D

Understanding that increase in the viscosity of the fluids and tissues of the joints and tendons, resulting from the cooling, may cause the alert patient to experience loss of manual dexterity.³²

A D

Semi-comatose and
Comatose

Understanding that in various degrees of coma, the pupils may be either dilated or contracted.³³

A D

Understanding that deep reflexes may be diminished or lost in the presence of increased intracranial pressure, and they are absent in deep coma.³⁴

A D

Understanding that in deep coma the patient has no gag reflex.³⁵

A D

Signs and Symptoms

Semi-comatose and
Comatose (Continued)

Understandings

Understanding that unconsciousness may result from head injuries with primary damage to the brain, from pressure on the brain from swelling, or from drugs.³⁶

A D

Understanding that there is no rigid temperature level at which a physiological response will cease or reappear, but the precise level at which these changes take place is not as important as gaining understanding of the mechanisms involved in their disappearance.³⁷

A D

Understanding that amnesia usually occurs at about 34° C., dysarthria ensues at about 30° to 34° C., and close to 27° C. spontaneous movement and response to verbal commands are lost.³⁸

A D

Understanding that temperatures of 27° C. produce an almost complete narcotic effect.³⁹

A D

Signs and SymptomsUnderstandings

Semi-comatose and
Comatose (Continued)

Understanding that at a body temperature of 28° to 30° C. metabolism is reduced by about 50 per cent, resulting in decreased physiologic processes with a resultant fall in the level of consciousness.⁴⁰

A D

Restlessness

Understanding that increased muscular activity may cause an increase in oxygen consumption.⁴¹

A D

"Goose pimples"

Understanding that excessive "goose pimples" in the absence of a falling temperature could be indicative of impending or undetected shivering.⁴²

A D

Shivering

Understanding that hypothermia is employed to reduce the body's metabolic activity (to the brain or any other injured organ) so that it can better tolerate this state of vascular insufficiency and to reduce the cerebral edema.⁴³

A D

Signs and SymptomsUnderstandings

Shivering (Continued)

Understanding that shivering causes an increase in metabolic needs with an increase in oxygen consumption, which counteracts and defeats the purpose of the therapy.⁴⁴

A D

Understanding that the temperature-regulating centers of the hypothalamus normally maintain a constant body temperature, and exposure to cold leads to increased heat conservation in the body by such mechanisms as shivering.⁴⁵

A D

Understanding that two adjuncts to cooling which help alleviate shivering are anesthesia and drugs.⁴⁶

A D

Understanding that when shivering occurs, in moderate hypothermia, there is movement of water out of the circulation, and both the interstitial and intracellular compartments gain water which may result in edema.⁴⁷

A D

Signs and SymptomsUnderstandings

Shivering (Continued)

Understanding that shivering may increase metabolism and demands of circulation on the heart, for which the heart must compensate at lowered metabolism, which may produce an oxygen deficit resulting in cardiac irregularities and ventricular fibrillation.⁴⁸

A D

Understanding that shivering must be prevented and may be detected only by quivering of an E. C. G. stylus.⁴⁹

A D

Understanding that shivering may increase the metabolic activity of the brain as much as 100 per cent, causing an increase in cerebrospinal fluid pressure and increased brain volume, which counteracts the attempt to reduce cerebral edema or promote tissue healing.⁵⁰

A D

Understanding that shivering may be difficult to control below 33° C.⁵¹

A D

Signs and SymptomsUnderstandings

Shivering (Continued)

Understanding that if shivering continues, there is exhaustion of liver glycogen with resultant hypoglycemia, and with the breakdown of liver glycogen, the serum potassium may become elevated.⁵²

A D

Understanding that under normothermic conditions, cerebral ischemia produces a rapid and profound insult to the brain, but with hypothermia the cerebral metabolic rate must decrease with a fall in temperature.⁵³

A D

Decerebrate rigidity

Understanding that decerebrate rigidity is characterized by marked rigidity and sustained contraction of all the extensor (antigravity) muscles in which the limbs are stiffly extended, the head is erect, and the jaws are closed.⁵⁴

A D

Signs and Symptoms

Decerebrate rigidity
(Continued)

Understandings

Understanding that this may follow injury to or transection of the brain stem at a level between the superior colliculi (anterior quadrigeminal bodies) and the vestibular nuclei.⁵⁵

A D

Understanding that this is characterized by the arms being internally rotated at the shoulders, extended at the elbows, and hyperpronated, with the fingers extended at the metacarpophalangeal joints and flexed at the interphalangeal joints while the legs are extended at the hips, knees, and ankles, and the toes are plantar flexed.⁵⁶

A D

Understanding that if only one half of the brain stem is severed, the rigidity is homolateral.⁵⁷

A D

Signs and SymptomsUnderstandings

Convulsions

Understanding that during the state of hypothermia, the nervous system shows a hypoexcitability but also a hyper-reactivity, thus there is a lowering of the threshold for convulsions, and if they occur, they may be difficult to control.⁵⁸

A D

Understanding that convulsions would raise the metabolic rate and the oxygen requirements to the tissues, thus the purposes for which the hypothermia was induced would be defeated.⁵⁹

A D

SECTION II

Understandings

Blood pressure

Understanding that great individual variations occur in the physiological reactions to cold, and changes in the blood pressure cannot be said to take place at predictable temperatures.⁶⁰

A D

Understanding that the depressant effects of drugs increases the variability in blood pressure fall.⁶¹

A D

Understanding that the change in blood pressure is not clear-cut, but if it drops this usually occurs below 30° C.⁶²

A D

Understanding that a sudden rise in blood pressure may be indicative of undetected or impending shivering.⁶³

A D

Understanding that shivering will cause considerable rise in the blood pressure.⁶⁴

A D

Understandings

Blood pressure
(Continued)

Understanding that when the temperature is at 30° to 31° C., the diastolic blood pressure cannot always be obtained and sometimes may only be obtained by palpation.⁶⁵

A D

Understanding that one of the main difficulties during prolonged cooling of the deeply comatose patient is that the blood pressure may fall fairly soon after the induction of hypothermia and may be difficult to raise with the usual vasopressor drugs.⁶⁶

A D

Pulse rate

Understanding that as the temperature lowers, it is accompanied by a progressive bradycardia.⁶⁷

A D

Understanding that at 30° C. the pulse is almost always slow and may be between 40 and 50 beats per minute.⁶⁸

A D

Understanding that the pulse rate is increased by shivering.⁶⁹

A D

Understandings

Temperature

Understanding that lowering the body temperature will not make tissue destruction or inflammatory reactions disappear, but will only modify the body's reaction to it.⁷⁰

A D

Understanding that the length of time required for a patient to reach the desired temperature depends on his initial basal temperature, his metabolic rate, his size, and how completely he is covered with the cooling surface.⁷¹

A D

Understanding that the efficiency of this surface heat exchange will vary from subject to subject, depending on the extent of the superficial heat insulation by fat and hair.⁷²

A D

Understanding that the influence of drugs which reduce the metabolic rate will affect the rate of cooling.⁷³

A D

Understandings

Temperature
(Continued)

Understanding that one of the greatest problems in reducing a patient's temperature to the desired level is the tendency for the temperature to drift downwards after the blanket is removed.⁷⁴

A D

Understanding that the amount of drift varies with the rate the temperature is falling and the size of the patient, thus large patients cool slowly and show a greater tendency to drift.⁷⁵

A D

Understanding that the drift is usually one-half to two-thirds the number of degrees by which the temperature has been lowered when the cooling agent has been discontinued.⁷⁶

A D

Understanding that an after-rise in temperature may be seen following the return to normal temperature but does not usually persist, and it may be controlled by routine measures.⁷⁷

A D

Understandings

Medications

Understanding that due to prolonged circulation time resulting from decreased cardiac output, plus vasoconstriction and increased viscosity of the blood, time after injecting intravenous drugs is prolonged until it takes effect.⁸⁷ A D

Understanding that because of the decrease in metabolism, drugs may be slowly detoxified and excreted.⁸⁸ A D

Understanding that since the action of a drug usually involves one or more chemical processes, it is to be expected that the action will be modified by temperatures, being less when the temperature is low.⁸⁹ A D

Understanding that hypertonic solutions may be given intravenously to reduce intracranial pressure.⁹⁰ A D

Understanding that blood should be given with care during hypothermia, due to the decrease in vascular capacity and the known congestion of the liver and lungs.⁹¹ A D

Understandings

Temperature
(Continued)

Understanding that the patient's general condition may deteriorate during the later stages of rewarming, particularly during the first twenty-four hours, which may be due to rapid restoration of body temperature before circulation is able to supply sufficient oxygen for normothermic tissues.⁷⁸

A D

Understanding that the caloric output increases by 8 per cent for each 1° F. rise in temperature.⁷⁹

A D

Therm-o-Rite Blanket

Understanding that cooling with the Therm-o-Rite blanket should take three to four hours to reach the desired temperature.⁸⁰

A D

Understanding that after the temperature has fallen, it may be kept down with little difficulty, by using the Therm-o-Rite blanket or blankets, for as long as one desires.⁸¹

A D

Understandings

Therm-o-Rite Blanket
(Continued)

Understanding that the blanket temperature may be lowered at any time the temperature begins to go up.⁸²

A D

Understanding that when the temperature falls below the desired level, the pump which circulates fluid through the blanket is simply turned off.⁸³

A D

Understanding that the temperature of the water in the blanket coils must never exceed 42° C. in rewarming, as burns of the cold skin may be caused very easily.⁸⁴

A D

Understanding that rewarming with the blanket may cause a fever, unless observed very closely.⁸⁵

A D

Understanding that there is no information as to the degree of warmth that can be used safely, but apparently the cold skin is very sensitive to temperatures only a few degrees higher than normal.⁸⁶

A D

Understandings

Medications
(Continued)

Understanding that drugs
may be given to reduce
metabolism and inhibit
shivering in the patient.⁹²

A D

FOOTNOTES

FOOTNOTES

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²²Shafer and others, op. cit., p. 501.

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²⁵Ibid., and John Marshall, Clinical Neurophysiology (Springfield, Illinois: Charles C. Thomas, 1959), p. 265.

²⁶DeJong, loc. cit.

²⁷Ibid., p. 904 and A. Theodore Steegmann, Examination of the Nervous System (second edition; Chicago: Year Book Medical Publishers, Inc., 1962), p. 41.

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²⁹DeJong, op. cit., p. 903.

³⁰Ibid., and Shafer and others, op. cit., p. 99.

³¹Graves, op. cit., p. 969.

³²Fox, op. cit., p. 16.

³³DeJong, op. cit., p. 904.

³⁴Ibid., p. 572 and Shafer and others, op. cit., p. 99.

³⁵Shafer and others, op. cit., p. 99.

³⁶Ibid., p. 100.

³⁷W. M. Lougheed, "The Central Nervous System in Hypothermia," British Medical Bulletin, 17:61, January, 1961 and Nugent, op. cit., p. 967.

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⁴²Ballantine and Jackson, op. cit., p. 81.

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- ⁵⁴ DeJong, op. cit., p. 478.
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- ⁵⁹ Fairley, op. cit., p. 52 and Nugent, op. cit., p. 967.
- ⁶⁰ Lougheed, op. cit., p. 63.
- ⁶¹ Ibid.
- ⁶² Ballantine and Jackson, op. cit., p. 82; Eckenhoff, op. cit., p. 300; and Uihlein, Terry, and Martin, op. cit., p. 1079.
- ⁶³ Ballantine and Jackson, op. cit., p. 81.
- ⁶⁴ Lougheed, op. cit., p. 63; Sweet and Koons, op. cit., p. 232; and Uihlein, Terry, and Martin, op. cit., p. 1079.
- ⁶⁵ Nugent, op. cit., p. 967.
- ⁶⁶ Ballantine and Jackson, op. cit., p. 90.
- ⁶⁷ Cooper, loc. cit.; Eckenhoff, op. cit., p. 300; and Sweet and Koons, op. cit., p. 231.
- ⁶⁸ Ballantine and Jackson, op. cit., p. 82.
- ⁶⁹ Dundee and others, op. cit., p. 1239 and Uihlein, Terry, and Martin, op. cit., p. 1079.
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- ⁷¹ Graves, op. cit., p. 970 and McMillan and Machell, op. cit., p. 32.
- ⁷² McMillan and Machell, op. cit., p. 32.

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⁷⁴Ballantine and Jackson, op. cit., p. 82; K. E. Cooper, "Physiology of Hypothermia," British Journal of Anaesthesia, 31:96, March, 1959; and Nugent, op. cit., p. 968.

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⁷⁹Lewis, op. cit., p. 178.

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⁸¹Ibid.

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⁸³Ibid., p. 180.

⁸⁴Ballantine and Jackson, op. cit., p. 81.

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⁸⁶Nugent, op. cit., p. 968.

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⁹⁰Harvey C. Slocum and Herman R. Hansen, "Anesthesia in Infants and Children," Clinical Neurosurgery, 5:155, 1958.

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APPENDIX D

Cover Letter to Five Jurors

Directions

Skills Inferred

1270 Colorado Boulevard
Apt. 10
Denver 6, Colorado
July 9, 1962

Dear _____:

Thank you for consenting to serve as a member of the jury for my research study. You were selected because of your background and experience in the specialty of medical-surgical nursing. I consider it most fortunate that you are willing to participate in the study.

As we discussed previously, the purpose of the study is to develop a method which could be used to identify the understandings and skills, as related to the physical signs and symptoms presented, needed by the nurse to give intelligent care to the patient with a neurological condition being treated by means of induced hypothermia. The signs and symptoms presented by the selected patients studied, the action taken by the nursing staff in response to a sign or symptom, and related literature were the basis upon which the understandings and skills were identified. The understandings were established and validated by means of documentary frequency. They were further evaluated and validated by the neurosurgical resident physician who has assisted me with the study.

Your participation in the study is elicited for the purpose of evaluating the nurse's skills which the writer has identified. I estimate that your help will take a maximum of two hours of your time.

Thank you for your interest and assistance.

Sincerely,

Loris Foley

Miss Loris Foley is a student at the University of Colorado Graduate School, Department of Nursing. Your help and assistance will be greatly appreciated.

Chairman, Thesis Committee

DIRECTIONS

Section I

The signs and symptoms were categorized and are presented according to the bodily system with which they were identified. First, is listed the sign or symptom presented by the patient. In the left-hand column are listed the understandings, which have already been validated. Following the understandings, but in the right-hand column, are listed the corresponding skill or skills. For the purpose of this study, a skill was defined as "an act or function performed proficiently, in response to a need presented, which requires both physical and mental activity. This is based on understanding."

After reading the understandings related to the sign or symptom, read the corresponding skills and simply circle "A" if you agree with the identified skill, or circle "D" if you disagree with the identified skill. If you circle "D", indicating disagreement, please write very briefly your reason for disagreement on the blank line immediately below the skill. The writer is not concerned with any skills which you might believe should be added, but rather with only those listed herein.

Section II

In this section are listed five items with which the nurse is directly associated in giving care to the patient. First, the item is listed. Then in the left-hand column are listed the understandings and in the right-hand column are listed the corresponding skills, as in the preceeding section. Please proceed exactly as you did in Section I, by indicating your agreement or disagreement with the skills identified and the reason for disagreement on the blank line immediately below the skill.

SECTION I

CARDIO-VASCULAR SYSTEM

Sign or Symptom: Pulse irregularity

Understandings

Skills

Understanding that pulse irregularities may indicate cardiac arrhythmias which could be precursors to fibrillation.

Understanding that cardiac irregularities are sometimes noted prior to cardiac arrest.

Understanding that alterations of rhythm are more common, and the incidence of ventricular fibrillation or cardiac arrest is much higher, when the temperature is reduced to levels below 28° to 30° C.

Understanding that bradycardia during hypothermia is a normal response of the heart to cold, but tachycardia or irregularities are dangerous and may predispose to fibrillation.

Understanding that if irregularities should precede to fibrillation, the hypothermic heart does not respond to efforts directed to restoration of a regular beat as does the normal heart.

Sign or Symptom: Pulse irregularity (Continued)UnderstandingsSkills

Skill in counting and recording the pulse rate, with special attention to any deviations in rate or force of the beat.

A D

Skill in reporting any pulse irregularities to the physician.

A D

Skill in preparing emergency equipment for use should fibrillation or cardiac arrest occur (e.g. facilities for thoracotomy, cardiac massage, electric defibrillation, oxygen administration).

A D

Skill in assisting the physician with emergency treatments which may be indicated (e.g. thoracotomy, cardiac massage, electric defibrillation).

A D

Sign or Symptom: Pulse irregularity (Continued)UnderstandingsSkills

Skill in checking the pulse from the time of induction of hypothermia until after the patient's temperature has returned to normal and has stabilized.

A D

INTEGUMENTARY SYSTEM

Sign or Symptom: Edema

Understandings

Skills

Understanding that edema may occur if the patient has been exposed to cooling over a considerable period of time.

Skill in observing and recording any signs of edema on the patient's trunk or extremities.

A D

Sign or Symptom: Pressure areas

Understandings

Skills

Understanding that circulation has a tendency to stagnate in areas of pressure.

Understanding that the cold skin is highly susceptible to damage produced by pressure, thus the patient may develop areas of pressure when remaining on the hypothermic blanket for a considerable period of time.

Skill in preventing areas of pressure on the patient by change of position.

A D

Sign or Symptom: Pressure areas (Continued)UnderstandingsSkills

Skill in preventing areas of pressure, by padding any areas on the patient's body which would tend to be susceptible to cold pressure points (e.g. under the scapulae, buttocks, and heels).

A D

Skill in observing and recording any sign or symptom which might be indicative of a developing area of pressure (e.g. reddened or broken areas on the skin).

A D

Skill in massaging the tissues to condition the skin against the development of pressure areas (e.g. massage every two hours with 7% tannic acid in ethyl alcohol).

A D

Skill in positioning the patient so that any areas of pressure which have developed will not be exposed to further pressure, in order to promote restoration of healthy tissue to the affected areas (e.g. if pressure area

A D

Sign or Symptom: Pressure areas (Continued)UnderstandingsSkills

has developed on coccyx, position patient so that this area will be pressure-free).

Sign or Symptom: Skin colorUnderstandingsSkills

Understanding that vasoconstriction results from application of cold to the body.

Understanding that the rate of blood flow and the distribution of the blood vessels in the various parts of the body largely determine the degree of cooling and development of temperature gradients on exposure to cold.

Understanding that the blood vessels tend to conserve the loss of heat from the body as a whole at the expense of peripheral cooling and accentuate the temperature gradients along the length of the extremities.

Understanding that as a result of prolonged exposure to cold, skin changes do occur during the time the patient is on the hypothermic blanket.

Understanding that prolonged exposure to cold could result in frostbite.

Sign or Symptom: Skin color (Continued)Understandings

Understanding that occasionally local areas of skin and subcutaneous tissue damage may occur following surface cooling.

Understanding that uniform heat exchange is very important, so that any cold pressure points are avoided.

Understanding that the skin in contact with the cooling blanket should look pink.

Skills

Skill in observing the skin for any changes in color or any indications of impaired circulation, with particular scrutiny of the extremities.

A D

Skill in preventing frostbite, which may follow skin changes resulting in profound discoloration.

A D

Skill in promoting adequate circulatory flow and uniform heat exchange to the tissues (e.g. by frequent turning of the patient and by the giving of good skin care).

A D

Sign or Symptom: Skin color (Continued)UnderstandingsSkills

Skill in preventing direct contact of the patient's skin with the cooling blanket by placing two layers of cotton bath blanket between the patient and the top and/or bottom cooling blanket.

A D

Skill in placing additional covering over any areas with reddening or discoloration to the skin (e.g. place cotton coverings over the feet).

A D

RESPIRATORY SYSTEM

Sign or Symptom: Depressed respirations

Understandings

Skills

Understanding that the effects of hypothermia upon respiration are difficult to determine, however it seems that reasonably normal respirations can persist to well below 28° C.

Understanding that depressed respirations may ensue in the patient with a head injury if edema of the brain stem or edema above the brain stem is present causing herniation into the foramen magnum and pressure on the respiratory center.

Skill in observing any alterations in breathing which may be characterized either by marked decreased rate or depth, or both.

A D

Skill in positioning the patient so as to promote optimum aeration of the lungs, with as little muscular exertion as possible for the patient (e.g. with head slightly elevated).

A D

Sign or Symptom: HyperventilationUnderstandingsSkills

Understanding that the stimulus of cold may give rise to spontaneous hyperventilation, and this in turn will cause increased muscular effort which may increase the need for oxygen.

Skill in preventing hyperventilation, if possible, by avoiding sudden exposure of the patient's body to cold.

A D

Skill in observing and reporting hyperventilation (e.g. when the quantity of air breathed is increased, resulting from an increase in the rate or depth of respiration, or both).

A D

Sign or Symptom: Respiratory obstructionUnderstandingsSkills

Understanding that respiratory obstruction occurs quite frequently in these patients.

Understanding that increased difficulty in getting air is a tiring and unpleasant sensation and may lead to apprehension and even panic in the patient.

Sign or Symptom: Respiratory obstruction (Continued)UnderstandingsSkills

Understanding that in order to maintain a patent airway and adequate ventilation, a tracheostomy may be indicated.

Skill in observing the patient to determine patency of the airway (e.g. note character of respirations, and listen for presence of secretions as the patient breathes).

A D

Skill in suctioning the patient, with a catheter, if secretions are interfering with the exchange of gases in the upper respiratory tree.

A D

Skill in preventing apprehension in the conscious patient, if secretions are interfering with the respiratory process (e.g. encourage him to cough up secretions and explain why suctioning is necessary).

A D

Sign or Symptom: Respiratory obstruction (Continued)UnderstandingsSkills

Skill in preparing equipment necessary to perform a tracheostomy, if there is a possibility that it might be indicated.

A D

Skill in assisting with the care of the tracheostomy to ensure a patent airway and to prevent aspiration of secretions (e.g. frequent suctioning and cleaning of the tracheostomy tube).

A D

NERVOUS SYSTEM

Sign or Symptom: Pupillary reflexes

Understandings

Skills

Understanding that the evaluation of the pupillary reflexes is one of the most important parts of the neurologic examination.

Understanding that the normal pupil contracts promptly when light is focused on the retina and dilates when the light is withdrawn.

Understanding that each eye should be tested individually as to whether the pupillary responses are prompt, sluggish, or absent.

Understanding that it is significant as to the size, shape, position, equality, and reaction of the pupils.

Skill in testing the pupillary reactions to light by means of passing a light over the retina of the eye. A D

Skill in observing each pupil, individually, as to the degree and character of the pupillary reaction (e.g. whether the reaction is prompt or sluggish). A D

Sign or Symptom: Pupillary reflexes (Continued)UnderstandingsSkills

Skill in observing and recording the size, shape, position, and equality of the pupils.

A D

Sign or Symptom: Depressed corneal reflexesUnderstandingsSkills

Understanding that these patients frequently have depressed corneal reflexes, accompanied by diminished secretions of the eye.

Understanding that in deep coma these reflexes are absent, and the eyes may be open with a glassy stare.

Skill in preventing corneal ulceration (e.g. apply prescribed eye medication or saline eye irrigations).

A D

Skill in observing for blinking, tremor, or closing of the lids in response to light, sudden movement toward the eye, or a loud noise.

A D

Sign or Symptom: Mental clarity

Understandings

Skills

Understanding that if the patient is conscious, he may exhibit fear and anxieties related to the continuous cold to which he is being exposed.

Understanding that increase in the viscosity of the fluids and tissues of the joints and tendons, resulting from the cooling, may cause the alert patient to experience loss of manual dexterity.

Skill in alleviating fears and anxieties which the patient may have, resulting from his condition and the instituted therapy (e.g. explain procedures to the patient, such as testing pupillary reflexes).

A D

Sign or Symptom: Semi-comatose and Comatose

Understandings

Skills

Understanding that in various degrees of coma, the pupils may be either dilated or contracted.

Understanding that deep reflexes may be diminished or lost in the presence of increased intracranial pressure, and they are absent in deep coma.

Sign or Symptom: Semi-comatose and Comatose (Continued)UnderstandingsSkills

Understanding that unconsciousness may result from head injuries with primary damage to the brain, from pressure on the brain from swelling, or from drugs.

Understanding that there is no rigid temperature level at which a physiological response will cease or reappear, but the precise level at which these changes take place is not as important as gaining understanding of the mechanisms involved in their disappearance.

Understanding that amnesia usually occurs at about 34° C., dysarthria ensues at about 30° to 34° C., and close to 27° C. spontaneous movement and response to verbal commands are lost.

Understanding that temperatures of 27° C. produce an almost complete narcotic effect.

Understanding that at a body temperature of 28° to 30° C. metabolism is reduced by about 50 per cent, resulting in decreased physiologic processes with a resultant fall in the level of consciousness.

Sign or Symptom: Semi-comatose and Comatose (Continued)UnderstandingsSkills

Skill in observing the level of consciousness (e.g. attempt to arouse patient or note whether or not he responds to pain or noise).

A D

Skill in maintaining good anatomical position of the patient at all times, with frequent change of position.

A D

Skill in keeping the family informed of the patient's condition (e.g. inform them of presence or lack of improvement).

A D

Skill in instituting protective measures for the patient (e.g. application of side-rails to bed).

A D

Sign or Symptom: RestlessnessUnderstandingsSkills

Understanding that increased muscular activity may cause an increase in oxygen consumption.

Sign or Symptom: Restlessness (Continued)UnderstandingsSkills

Skill in providing measures to alleviate or prevent restlessness (e.g. comfort measures, such as positioning of pillows).

A D

Sign or Symptom: "Goose pimples"UnderstandingsSkills

Understanding that excessive "goose pimples" in the absence of a falling temperature could be indicative of impending or undetected shivering.

Skill in observing and correlating the presence of "goose pimples" with the absence of a falling temperature.

A D

Sign or Symptom: ShiveringUnderstandingsSkills

Understanding that hypothermia is employed to reduce the body's metabolic activity (to the brain or any other injured organ) so that it can better tolerate this state of vascular insufficiency and to reduce the cerebral edema.

Sign or Symptom: Shivering (Continued)UnderstandingsSkills

Understanding that shivering causes an increase in metabolic needs with an increase in oxygen consumption, which counteracts and defeats the purpose of the therapy.

Understanding that the temperature-regulating centers of the hypothalamus normally maintain a constant body temperature, and exposure to cold leads to increased heat conservation in the body by such mechanisms as shivering.

Understanding that two adjuncts to cooling which help alleviate shivering are anesthesia and drugs.

Understanding that when shivering occurs, in moderate hypothermia, there is movement of water out of the circulation, and both the interstitial and intracellular compartments gain water which may result in edema.

Understanding that shivering may increase metabolism and demands of circulation on the heart, for which the heart must compensate at lowered metabolism, which may produce an oxygen deficit resulting in cardiac irregularities and ventricular fibrillation.

Understanding that shivering must be prevented and may be detected only by quivering of an E. C. G. stylus.

Sign or Symptom: Shivering (Continued)UnderstandingsSkills

Understanding that shivering may increase the metabolic activity of the brain as much as 100 per cent, causing an increase in cerebrospinal fluid pressure and increased brain volume, which counteracts the attempt to reduce cerebral edema or promote tissue healing.

Understanding that if shivering continues, there is exhaustion of liver glycogen with resultant hypoglycemia, and with the breakdown of liver glycogen, the serum potassium may become elevated.

Understanding that under normothermic conditions, cerebral ischemia produces a rapid and profound insult to the brain, but with hypothermia the cerebral metabolic rate must decrease with a fall in temperature.

Skill in observing for A D shivering in the patient and in taking immediate action to alleviate it by either controlling the rate of cooling or by medication.

Sign or Symptom: Shivering (Continued)UnderstandingsSkills

Skill in observing for symptoms of hypoglycemia, which might occur if shivering continues to persist (e.g. note for nervousness, blurring of vision, hunger, headache, palpitations, or diaphoresis).

A D

Skill in observing for cyanosis, resulting from an oxygen deficit to the tissues (e.g. may detect dusky or bluish appearance of nailbeds or lips).

A D

Sign or Symptom: Decerebrate rigidityUnderstandingsSkills

Understanding that decerebrate rigidity is characterized by marked rigidity and sustained contraction of all the extensor (anti-gravity) muscles in which the limbs are stiffly extended, the head is erect, and the jaws are closed.

Understanding that this may follow injury to or transection of the brain stem at a level between the superior colliculi (anterior quadrigeminal bodies) and the vestibular nuclei.

Sign or Symptom: Decerebrate rigidity (Continued)UnderstandingsSkills

Understanding that this is characterized by the arms being internally rotated at the shoulders, extended at the elbows, and hyperpronated, with the fingers extended at the metacarpophalangeal joints and flexed at the interphalangeal joints while the legs are extended at the hips, knees, and ankles, and the toes are plantar flexed.

Skill in observing and recording position of all body parts, noting amount of rigidity present and any increase or decrease in tonicity.

A D

Skill in preventing contractures or deformities as a result of the rigidity (e.g. use of footboard and maintenance of good body alignment with extremities in as near functional position as possible).

A D

Sign or Symptom: ConvulsionsUnderstandingsSkills

Understanding that during the state of hypothermia, the nervous system shows a hypoexcitability but also a hyper-reactivity, thus there is a lowering of the threshold for convulsions, and if they occur, they may be difficult to control.

Understanding that convulsions would raise the metabolic rate and the oxygen requirements to the tissues, thus the purposes for which the hypothermia was induced would be defeated.

Skill in preventing convulsions, if possible (e.g. reduce external stimulating noise).

A D

Skill in protecting the patient, if a seizure should occur (e.g. use of padded tongue-blade, protection of extremities, and use of side-rails).

A D

SECTION II

Item: Blood pressure

Understandings

Skills

Understanding that great individual variations occur in the physiological reactions to cold, and changes in the blood pressure cannot be said to take place at predictable temperatures.

Understanding that the change in blood pressure is not clear-cut, but if it drops this usually occurs below 30° C.

Understanding that a sudden rise in blood pressure may be indicative of undetected or impending shivering.

Understanding that shivering will cause considerable rise in the blood pressure.

Understanding that when the temperature is at 30° to 31° C., the diastolic blood pressure cannot always be obtained and sometimes may only be obtained by palpation.

Understanding that one of the main difficulties during prolonged cooling of the deeply comatose patient is that the blood pressure may fall fairly soon after the induction of hypothermia and may be difficult to raise with the usual vasopressor drugs.

Item: Blood pressure (Continued)UnderstandingsSkills

Skill in taking the blood pressure with the sphygmomanometer and stethoscope, with particular attention to any rise or fall.

A D

Skill in obtaining the blood pressure by palpation of the brachial artery, if it cannot be obtained by auscultation with the stethoscope.

A D

Item: Pulse rateUnderstandingsSkills

Understanding that as the temperature lowers, it is accompanied by a progressive bradycardia.

Understanding that at 30° C. the pulse is almost always slow and may be between 40 and 50 beats per minute.

Understanding that the pulse rate is increased by shivering.

Skill in counting the pulse, with special concern for significant changes in rate.

A D

Item: TemperatureUnderstandingsSkills

Understanding that lowering the body temperature will not make tissue destruction or inflammatory reactions disappear, but will only modify the body's reaction to it.

Understanding that the length of time required for a patient to reach the desired temperature depends on his initial basal temperature, his metabolic rate, his size, and how completely he is covered with the cooling surface.

Understanding that the efficiency of this surface heat exchange will vary from subject to subject, depending on the extent of the superficial heat insulation by fat and hair.

Understanding that the influence of drugs which reduce the metabolic rate will affect the rate of cooling.

Understanding that one of the greatest problems in reducing a patient's temperature to the desired level is the tendency for the temperature to drift downwards after the blanket is removed.

Understanding that an after-rise in temperature may be seen following the return to normal temperature but does not usually persist, and it may be controlled by routine measures.

Item: Temperature (Continued)UnderstandingsSkills

Understanding that the patient's general condition may deteriorate during the later stages of rewarming, particularly during the first twenty-four hours, which may be due to rapid restoration of body temperature before circulation is able to supply sufficient oxygen for normothermic tissues.

Understanding that the caloric output increases by 8 per cent for each 1° F. rise in temperature.

Skill in taking and interpreting the temperature rectally (e.g. hold the thermometer to make certain that it stays in place).

A D

Skill in permitting heat loss from the patient's body (e.g. removing all covering except one sheet from over the patient).

A D

Skill in preventing the patient's temperature from falling to dangerous levels (e.g. checking it every 30 minutes).

A D

Item: Temperature (Continued)UnderstandingsSkills

Skill in allowing the patient's body to re-warm at its own rate after the cooling blankets are removed (e.g. not applying any external heat such as heat cradles, hot water bottles, or heating pads to enhance the warming process, unless they are ordered by the physician).

A D

Skill in checking the temperature very closely until it has returned to normal and has stabilized.

A D

Item: Therm-o-Rite BlanketUnderstandingsSkills

Understanding that cooling with the Therm-o-Rite blanket should take three to four hours to reach the desired temperature.

Understanding that after the temperature has fallen, it may be kept down with little difficulty, by using the Therm-o-Rite blanket or blankets, for as long as one desires.

Item: Therm-o-Rite Blanket (Continued)UnderstandingsSkills

Understanding that the blanket temperature may be lowered at any time the temperature begins to go up.

Understanding that when the temperature falls below the desired level, the pump which circulates fluid through the blanket is simply turned off.

Understanding that the temperature of the water in the blanket coils must never exceed 42° C. in re-warming, as burns of the cold skin may be caused very easily.

Understanding that rewarming with the blanket may cause a fever, unless observed very closely.

Understanding that there is no information as to the degree of warmth that can be used safely, but apparently the cold skin is very sensitive to temperatures only a few degrees higher than normal.

Skill in adjusting the blanket controls, in accordance with the existing and desired body temperatures of the patient, to maintain complete control over the patient's present and impending temperature.

A D

Item: Therm-o-Rite Blanket (Continued)UnderstandingsSkills

Skill in turning the cooling blanket off in time to allow for downward drift, when reducing the patient's temperature (e.g. turn the blanket off when the existing body temperature is 34° C. and the desired body temperature is 33° C.).

A D

Item: MedicationsUnderstandingsSkills

Understanding that due to prolonged circulation time resulting from decreased cardiac output, plus vasoconstriction and increased viscosity of the blood, time after injecting intravenous drugs is prolonged until it takes effect.

Understanding that because of the decrease in metabolism, drugs may be slowly detoxified and excreted.

Understanding that since the action of a drug usually involves one or more chemical processes, it is to be expected that the action will be modified by temperatures, being less when the temperature is low.

Item: Medications (Continued)UnderstandingsSkills

Understanding that hypertonic solutions may be given intravenously to reduce intracranial pressure.

Understanding that blood should be given with care during hypothermia, due to the decrease in vascular capacity and the known congestion of the liver and lungs.

Understanding that drugs may be given to reduce metabolism and inhibit shivering in the patient.

Skill in assisting with administration of intravenous solutions and medications, with special attention to the body's ability to absorb the solution (e.g. note for slow rate of absorption or for infiltration of the solution into the surrounding tissues).

A D

Skill in observing and reporting any symptoms of drug toxicity or sensitivity (e.g. nausea, diarrhea, headache).

A D

Item: Medications (Continued)UnderstandingsSkills

Skill in determining when prescribed p. r. n. medications should be given to enhance cooling, to prevent restlessness, and to prevent or control shivering (e.g. Thorazine).

A D