PREOPERATIVE DEHYDRATION IN ELECTIVE SURGICAL PATIENTS

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This thesis is dedicated to David Danforth for his support, love, and encouragement.

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ABSTRACT

Because preoperative patients are kept NPO for various periods of time we do not know how many patients go to surgery in an early stage of dehydration. It is the purpose of this study to report on the fasting weight loss of elderly preoperative elective surgical patients 60 years of age or older.

The framework for the study was based on the physiological principles of water and electrolyte balance and the factors that operate to dehydrate preoperative patients.

The selected review of the literature indicated that few nursing studies have been done on the dehydrating effect of the enforced preoperative fast on elderly elective surgical patients or that documented the and stages of dehydration.

The sample consisted of ten newly admitted elderly elective surgical patients. All subjects followed the same protocol.

The findings of this study suggest that elderly elective surgical patients considered good surgical risks go to the operating room in a variety of stages of dehydration due to the enforced preoperative fast. The data also suggest that body size, time NPO, enematas, and frequency

of surgeries are variables that interact to provide these various stages of dehydration.

This study needs to be replicated using a larger sample so that suggested relationships may be clarified regarding factors contributing to fluid loss.

CHAPTER 1

INTRODUCTION

Of the compounds that compose the body, by weight rougly two-thirds or 65 per cent is water. The water is separated into two compartments, intracellular and extra-cellular, between which there is free exchange (Brobeck, 1973). Water is extremely important in metabolism because all of the chemical reactions of the body take place in an aqueous solution. Even the process of respiration involves water as the inspired air becomes 100 per cent water saturated, literally a liquid, before it reacts at the alveolar membrane (Brobeck, 1973).

Any change in body water composition can disrupt metabolism. The intracellular fluid volume is rather fixed so it is the extracellular fluid volume that shows the greatest changes. However, water is in a dynamic state and continually moving between compartments. Normally, intake of fluid equals output; however, when output exceeds intake, the body's water content is reduced, creating a negative water balance (Brobeck, 1973). The total amount of fluid lost from the fluid compartments will vary depending upon the cause of the negative water balance, but a loss of one-quarter of the body's water is usually fatal (Brobeck, 1973).

However, a water loss of much less magnitude is not without its consequences.

Statement of the Problem

The problem identified for study relating to body water balance involves the common practice ordered by medicine and enforced by nursing to prepare patients for surgery: all preoperative individuals are placed on fluid restriction, commonly called "nothing by mouth" (NPO). This routine is frequently initiated at a specific time on the night before surgery. "This deprives the patient of his right to respond to basic hunger and thirst regulatory stimuli" (Voda, 1977a, p. 2). Oral fluid restriction is continued for variable time periods after surgery during which time it becomes the responsibility of the nursing staff to monitor the patient in order to maintain and promote adequate hydration, fluid balance, and nutrition.

The question this study was designed to answer is: to what extent is the human body dehydrated by enforcement of the preoperative fasting routine as measured by weight loss?

Significance of the Problem

The problem is significant to nursing since it is nurses who enforce the NPO routine and monitor the hydration status of all NPO patients. Although the placement of preoperative patients on NPO occurs at similar times, the total length of time each individual is on NPO varies according to the time that surgery is scheduled. Routine enforcement does not take into account factors such as age and sex, body size, or eating, drinking, and elimination habits of persons, all of which determine one's requirements for water. Because of the way the NPO routine is enforced, it is conceivable that some patients go into surgery in an early stage of dehydration, pure water deficit, or approaching dehydration (Voda, 1977a).

The most common method used by nurses to monitor hydration status is the intake and output record. The accuracy of this method is highly questionable since it only measures sensible fluid gains and losses. Even if measured and tallied accurately, intake and output records could not be used exclusively as a source of data from which to order or not to order replacement fluids.

The detrimental effects of dehydration have been documented. Moran mapped the antidiuretic hormone response in surgery. Blood samples obtained were from eight surgical patients, sex not indicated, during the various phases of the operative procedure; preoperative recumbent phase, overnight fast to intubation of anesthesia, labile phase, and recovery. He found that the antidiuretic hormone levels ranged from one microunit (μU) preoperatively and rose as high as 50 μU during the operative procedure. The average secretion of antidiuretic hormone during the recumbent phase was 0.6 μU, but rose to 1.7 μU during the preoperative fasting phase (Moran and Zimmerman, 1967). High levels of antidiuretic hormone were measured in the intraoperative period and postoperative period suggesting that the antidiuretic hormone mechanism etiology of fluid retention begins in the period of preoperative dehydration (Moran and Zimmerman, 1967). This response was dissected into several factors which play an important role in antidiuretic hormone secretion after surgery. The osmoreceptor system in the supraoptic nucleus of the hypothalamus is thought to control plasma toxicity and is responsible for stimulating the secretion of the antidiuretic hormone levels between 0.05 and 6 μU due to the NPO state. Hemorrhage, however, is a potent stimulus for antidiuretic hormone secretion. It is postulated that a receptor located in the walls of large arteries is capable of stimulating antidiuretic hormone secretion due to a fall in central blood volume, producing antidiuretic hormone levels as high as 900 μU. Two other strong stimuli of antidiuretic hormone secretion are cutaneous and visceral pain, both of which accompany any surgical procedure (Moran and Zimmerman, 1967). The net result of activation of any one or all antidiuretic hormone receptor systems is a retention of water in the postoperative period. Administration of replacement fluids during this time is presumed to result in the accumulation of fluid with the resultant risk of the development of universal edema, cardiac stress, and possibly decompensation (Deding, Jorgensen, and Nielsen, 1971; Deutsch, Goldberg, and Dripps, 1966).

Nurses who understand the effects of preoperative dehydration on the patient are in a position to manipulate the time of onset of the NPO state of patients in order to minimize the antidiuretic hormone response to preoperative fasting.

The phenomena of preoperative fasting weight loss was a serendipitous outcome of a nursing study originally designed to investigate weight gain as an indirect indication of antidiuresis in the NPO preoperative patient (Voda, 1977a). Since the discovery of fasting weight loss was an unplanned outcome, no hypotheses were tested for statistical significance. However, the Voda (1977a, pp. 14-15) study generated certain hypotheses for testing by nurses:

1. A significant number of NPO preoperative patients lose more than two percent of their body weight over a 12-hour period of time and are in an early stage of dehydration.

2. a. Estimation of the percentage of weight loss is possible if body weights and intake and output records are reliable for patients on restricted intake.

   b. Changes in body water can be equated with changes in weight in patients on restricted fluid intake.

3. Persons 60 years of age and over on restricted fluid intake have a greater percentage of body weight loss than younger (15-29 years) and middle-aged (30-59 years) persons.

4. Persons being prepared for and anticipating abdominal surgery experience a greater weight loss than persons scheduled for other types of surgery.

5. a. Thirst is not a reliable indicator of early impending dehydration.

   b. A significant number of persons on restricted intake who experience more than two percent body weight loss are not thirsty.

6. There is no correlation between surface area and weight loss in preoperative patients on restricted intake.

Purpose of the Study

Purpose of this study is to determine the fasting weight loss of elderly elective surgical patients as suggested by Voda (1977a) in hypotheses 1, 2, 3, 4, and 6. If elderly elective surgical patients are subject to a greater fluid loss during their NPO period as a result of aging, they may be in need of closer monitoring by nurses. This may be done to prevent the postoperative effects of dehydration, that is, inappropriate ADH secretion, as documented by Moran and Zimmerman (1967), Deding et al. (1971), and Deutsch et al. (1966) as well as ensuring an adequate hydration state on entering the operating room.

Hypotheses

The hypotheses tested in this study were:

1. A majority of NPO patients in the age group studied will lose two per cent or more body weight.

2. There will be a positive relationship between water loss (total measured sensible intake minus measured sensible loss plus estimated insensible loss) and measured weight loss in patients on restricted intake.
3. There will be a positive relationship between the time (number of hours) on restricted intake and the amount of fluid lost.
4. There will be a positive relationship between the time (number of hours) on restricted intake and the the amount of weight lost.
5. There will be no relationship between body size and weight loss in patients on restricted intake.

CHAPTER 2

THEORETICAL FRAMEWORK

This chapter contains the theoretical framework defining the phenomena of preoperative dehydration and fasting weight loss. A selected review of the literature indicating the extent of the knowledge concerning the phenomena at this time is also presented.

Dehydration

Dehydration has been defined as extracellular fluid volume deficit which implies a decrease in both water and electrolytes (Vannetta and Fogelman, 1976). For the purpose of this study, it was defined as a pure water deficit.

Mechanisms of Water Loss

Water loss from the body can be divided into two groups, sensible and insensible loss. Sensible water losses are those that can be seen, felt, and measured, such as urine, feces, vomitus, gall bladder drainage, and sweating. Sweating, although seen and felt, can only be estimated and not measured. Insensible water losses are water vapor loss from the lungs and skin.

> Insensible perspiration is defined as a condition of discharge of water in the form of vapor only, so that it is insensible, invisible,

> intangible, but weighable. . . . In order to distinguish between insensible perspiration and sweating, therefore, attention must be paid to the atmospheric condition (Kuno, 1967, p. 26).

Sensible Losses

"As long as the organism is alive and meeting basic needs, metabolism goes on and water is simultaneously consumed, produced, and eliminated" (Voda, 1977a, p. 4). Some of the water consumed is excreted as an obligatory loss to eliminate waste products formed by the body. When water consumption is restricted, waste products from metabolism continue to be formed, and those that are obliged to be eliminated are done so via the smallest amount of urine solution possible. Normal urine volume excreted is between 600-2500 ml per 24 hours with an average of 1200 ml; night urine excretion usually does not exceed 500-70 ml (Harper 1975). Guyton (1976) stated that mean normal urine excretion is approximately 1400 ml per 24 hours.

The formation of urine and regulation of water is one function of the kidney. The functional unit of the kidney involved in these activities is the nephron of which each kidney has approximately one million. Each nephron consists of a glomerulus, a proximal convoluted tubule, a loop of Henle, and a distal convoluted tubule that empties into a collecting duct. The blood supply is from the renal artery that branches into smaller units until it becomes the afferent arteriole which supplies the glomerulus capillaries.

After leaving the glomerulus, the capillaries form the efferent arteriole which sends extensions (vasa recta) around the loop of Henle. The efferent arteriole also forms the peritubular capillary network that empties into the venous network. The glomerulus filters on an average approximately 125 ml per minute; the total quantity of the glomerular filtrate formed each day averages about 180 liters of which over 99 per cent is reabsorbed, with the remainder passing into the urine.

The normal mechanism for urine concentration is referred to as the counter-current mechanism. This involves two fluids, one in the tubules and the other in the vasa recta, flowing counter-current to each other. This mechanism is used because although water is passively reabsorbed from the tubule, solutes are actively reabsorbed; therefore, a dilute urine could be formed by simply reabsorbing the solutes and allowing the water to be excreted in the urine. There are times, however, when it is exceedingly important to concentrate the urine to excrete as many waste products as possible, while at the same time conserving water for the body (Guyton, 1976).

The mechanisms for excreting a highly concentrated urine involves large quantities of antidiuretic hormone being secreted into the body fluids. This hormone increases the permeability of the collecting tubules to water. As the tubular fluid passes down throught the medulla of the kidney to the pelvis and ureters, it is exposed to the hyper-osmolality of the medullary interstitial fluid. Therefore, large quantities of fluid are passively reabsorbed by osmosis into the medullary interstitium and the fluid leaving the collecting tubule is highly concentrated urine. The highest osmolality achieved in humans is approximately four times the osmolality of the plasma and glomerular filtrate which is 290 (Guyton, 1976). Urine volume has been known to fall to a mean of 432 ml per 24 hours in dehydrated subjects (Lapides, 1976). The normal fluid loss through stools is approximately 200 ml (Guyton, 1976). Gump et al. (1968) reported that the average water content of 30 human stools, well subjects, was approximately 273 ml.

Sweating, another avenue of sensible water loss, is a function of thermoregulation and is initiated when the environmental temperature exceeds 82.4 to 86°F, or when the body temperature reaches or exceeds 98.4°F, with a fever, and with autonomic nervous system stimulation. Though sweating can be seen and felt, it is extremely difficult to measure. The maximal rate of sweating is estimated at two liters per hour (Metheny and Snively, 1974).

Insensible Loss

"Insensible fluid losses are the losses that cannot be seen. They can be measured directly only with complex equipment" (Voda, 1977a, p. 4). However, they can be estimated through the use of body surface area nomograms (DuBois and DuBois, 1915). Insensible losses are also losses that are obliged to occur despite the lack of water input. Insensible water loss occurs from the skin surface in the form of perspiration and from the lungs in the hydration of expired gases. In assessing the hydration status of the patient, these losses are usually not considered.

Gump et al. (1968) measured the insensible water losses of 20 male and female patients, 305 measurements, using a sensitive bed scale and found that the body loses 23 ± 7.7 grams of water per square meter of surface area (gm/H_2O/m^2/hr). This agrees with the findings of Kuno (1967).

Hays (1968) estimated that insensible water loss was roughly the same for an individual who is injured as for the normal individual and was approximately 750 ml/m^2/24 hrs of surface area. Hays also measured water loss with an increase in temperature: water loss increases one per cent for every degree Centigrade (°C), seven per cent for every degree Fahrenheit (°F), the body temperature is above normothermic values. Thus, it is possible to estimate the insensible water loss of individuals. However, the estimation will vary depending on whether these are estimates using Gump's or Hays's values. For example, the insensible water loss of a 70 kilogram adult, with surface area estimation of 1.70 m^2 is 39.1 gm/hr or 938.4 gm/24 hrs using Gump et al.'s figures; 1275 ml/24 hrs using Hays's figures.

The result of continual water losses, through sensible and insensible means without intake culminates in clinical dehydration.

Body Weight and Body Water

A person who has lost two per cent of his body weight is in a state of primary water depletion or cellular dehydration (Marriott, 1950). Bland (1963) identifies three stages of dehydration: early, moderately severe, and very severe. Early stages of dehydration occur when an individual loses two per cent of his body weight. This stage is manifested by thirst, little salivary flow, a dry mouth, oliguria, and weakness. With moderately severe dehydration, "the patient appears seriously ill and there are early personality changes, but he is capable of average physical and mental efforts" (Bland, 1963, p. 171). With severe dehydration, there is a seven to 14 per cent loss of body weight. The aforementioned manifestations are present along with diminution of physical and mental capacities; hallucinations and delirium are known to occur (Bland, 1963).

Body Water and Body Shape and Age

As mentioned previously, 65 per cent of the human body's weight is water, roughly two-thirds. It is difficult to accurately calculate values for total body water as it is determined by lean tissue mass rather than weight. "In an obese person water is a lower percentage of body weight than in one who is lean" (Brobeck, 1973, pp. 4-113).

Total body water content is also known to decrease significantly with age. This is due to a decrease in intracellular water from 30.5 per cent to 25.1 per cent, associated with tissue loss due to age (Bertolini, 1969; Shock, 1961).

Methods Used to Measure Body Water

Because of the complexity of the various balance methods used to measure body water, clinicians must rely on methods developed to estimate body water gain and loss. One method used is the intake and output (I and O) record of sensible losses coupled with an estimate of the insensible water loss. Or, for NPO patients particularly, another method is to weigh the patient. Gump et al. (1968) showed a statistically significant relationship between the changes in weight and body water changes. Specifically, patients with unrestricted intake and output records showed that weight changes were detectable due to intake and output of solids, gases, and liquids and was expressed as: weight = (I-O) solids + (I-O) liquids + (I-O) gases (Gump et al., 1968).

Selected Review of the Literature

There are few clinical studies that document the stages of dehydration or correlate signs and symptoms with weight loss. One study of seven healthy male subjects showed that the first signs of dehydration (thirst, decreased skin turgor, and tongue folds) occurred after the subjects had lost three kilograms of body weight, or three liters of water (Lapides, Bourne, and MacLean, 1965).

A review of the nursing literature indicated there was only one clinical study on the effects of preoperative fluid restriction on the 60 year or older patient. Voda (1977a) found eight of 40 subjects (20%) had a two per cent or greater weight loss and of these six were in the age range of 60 years or older.

However, there were several articles that discussed the problems of the elderly surgical patient. Ellison (1975) speaks of the narrow margin of reserve in the elderly patient. Because of age related changes in certain organs, the elderly's ability to adapt to stress becomes smaller and smaller. A combination of organ changes, though adequate for a sedentary life, cannot cope with stress of surgery. Howels (1977) discusses the systematic dehydration of the elderly patient and the use of weight as a parameter for indicating the need for fluid replacement to prevent intraoperative and postoperative period complications. "Successful preoperative and intraoperative fluid management should make only maintenance fluids necessary in the later postoperative period" (Howels, 1977, p. 101).

CHAPTER 3

THE SAMPLE

In this chapter the methodology that was used to study the phenomena of preoperative dehydration and fasting weight loss is presented. There is also a description of the sample used and the type and location of the agency in which the study was performed. The method of data analysis used and the means for protection of the subjects' rights are discussed.

For the purpose of testing the stated hypotheses and answering the research question, a descriptive correlational design was used. All data were collected by the investigator. This was to provide variable control through the use of only one data collector.

The sample consisted of ten preoperative elective surgical patients, six men and four women, whose ages ranged from 63 to 71 years. The average age for the sample was 67.4 years. These data are shown in Table 1.

The subjects were admitted to the hospital for different surgeries including hernia repair, femoral-popliteal arterial bypass surgery, cholecystectomy, breast biopsy with radical mastectomy, and gastrectomy.

Table 1. Age Distribution of Subjects (N = 10)

Age	Frequency	Per cent of subjects
63	1	10.0
64	3	30.0
67	1	10.0
70	3	30.0
71	2	20.0
Total	10	100.0

The following criteria were used for subject selection:

1. The patient was determined to be a good surgical risk. This was determined by consulting with the patient's physician or reading the medical history.
2. Patients with pre-existing chronic illness of diabetes mellitus (drug dependent), adrenal, or liver disease were not considered fot the study, nor were those patients having complex cardiac or renal surgery, or those receiving diuretics
3. All patients were 60 years of age or older and able to read and speak English.

The sample population was drawn from the patient population of a private hospital in a southwestern city.

Protection of Human Rights

The human rights of all subjects were protected according to the National Institute of Health guidelines and written policies of The University of Arizona College of Nursing and the Arizona Health Sciences Center Ethical Review Committees, "Human Subjects Committee Manual of Procedures" (1977). Prior to admission to the study and the beginning of data collection, all subjects signed consent forms (see Appendix A). Data were coded so that the subject's identity was protected, and analysis was done through the use of a computer and again coded to maintain confidentiality.

Methodology

On admission to the study, the age, sex, and type of surgery were recorded, the height and weight were measured. An intake and output record was also started at that time.

Weight

Body weight was measured as follows: (1) at admission, (2) after the preoperative evening meal, (3) before the patient retired and/or was placed on NPO status, and (4) immediately prior to going to surgery. This was done to measure weight fluctuations due to intake and to estimate the weight gain due to the ingestion of food and fluid and all sensible losses during the preoperative period.

Weight was measured on an Acme Scale Company "In-Bed Scale," model #SM2M, that was checked weekly with 135 pounds of lead weight by the biomedical engineering department of the hospital, which is responsible for maintaining the precise medical life supporting and monitoring equipment of the hospital. The scale was found to be accurate to within ± one ounce; however, the precision was dependent upon the position of the subject being weighed. To ensure accuracy, certain protocols were followed when weighing subjects. The subjects wore the same clothing for all weight measurements; they emptied their bladders prior to each weight measurement; and because of the positional inaccuracy, they stood in the same spot for each measurement. This was accomplished by taping two cutouts of feet on the base of the scale and having the subject stand on these cutouts for each measurement. The scale was calibrated prior to each measurement to ensure accuracy.

Intake and Output

All sensible intake and output was measured, including output that was lost through enemas and stools. Insensible water loss was estimated through the use of body surface area nomograms. The intake and output were recorded from the time of admission to the study until the subject was taken to surgery (see Appendix B). Insensible water loss was estimated using the median value of insensible water loss per hour, calculated by Gump et al. (1968): 23 ± 7.7 grams of water per square meter of surface area per hour (gm/H_2O/m^2/hour). Two graduated cylinders, one 100 ml and one 1000 ml, were used for measuring all sensible output.

Surface Area

Body surface area was estimated with a modified Dubois nomogram (Snively, 1957). The height and weight for each subject were plotted on their appropriate lines of the nomogram. Where a line drawn between them crossed, the center surface area line was the estimated body surface area for that subject.

Statistical Analysis

Statistical analysis of internal data was done using Pearson r-correlation (Colton, 1974). Variables analyzed using Pearson r were height, baseline (admission) weight, finishing weight, total intake, total output (measured sensible plus estimated insensible), time NPO, total fluid loss (total intake minus total output), and total weight loss (baseline minus finishing weights) to determine the linearity of the relationship of these variables.

CHAPTER 4

ANALYSIS OF DATA

This chapter consists of a presentation of the statistical analysis of the data collected for this study. The raw data can be seen in Appendix C.

Weight

In this study all subjects lost weight. Table 2 shows the weight loss and percentage of body weight lost of each subject. The younger subjects weighed more than the older subjects, and men were heavier than women. (These age, weight, and height data are shown in Table 2.) The correlational matrix (Table 3) shows a positive correlation between height and weight, 0.8226. This also suggests that taller subjects also lost more weight than the shorter. Since the taller, heavier subjects were also the younger male subjects in the group, it was these individuals who lost the most weight.

Fluid Loss

The total measured intake for the subjects from the time of admission to the study until the onset of their NPO period ranged from 350 ml to 2300 ml. Total output (measured sensible output plus estimated insensible losses)

Table 2. Comparison of Age, Sex, Height, Weight Loss, Fluid Loss, Admission Weight, NPO Time, and Percentage of Body Weight Lost (N = 10)

Subject	Age	Sex	Height (Ft/In)	Admission Weight (Lbs)	Weight Loss (Lbs)	Percentage of Body Wt Lost	Fluid Loss (ml)	NPO Time (hrs)
A	71	M	5/8	138.0	2.0	1.40	1319	10.0
B	70	M	5/9	129.9	1.3	1.00	811	14.0
C	63	M	6/4	182.2	3.3	1.80	1044	8.0
D	67	F	5/4	144.0	0.8	0.50	564	8.0
E	64	M	6/0	184.0	1.8	1.00	1201	13.5
F	64	M	6/0	182.8	5.3	2.90	2197	14.0
G	70	F	5/5	119.5	0.9	0.01	523	12.0
H	64	F	5/5	124.5	0.3	0.20	901	8.7
I	70	M	5/11	154.5	2.5	1.60	1532	10.5
J	71	F	5/5	143.7	2.7	1.80	1329	10.5

Table 3. Correlational Matrix of Variables: Height, Baseline Weight, Intake, Output, NPO Time, Fluid Loss, and Weight Loss (N = 10)

	Height	Baseline Weight	NPO Time	Intake	Output	Fluid Loss	Weight Loss
Height	--	0.8355	0.8226	0.2014	0.0530	0.4933	0.6459
Baseline Weight		--	a	-0.1072	0.2929	0.5794	0.7294
NPO Time			--	a	a	0.2899	0.0884
Intake				--	0.7644	0.0180	-0.1507
Output					--	0.6584	0.4452
Fluid Loss						--	0.8663
Weight Loss							--

[a] Omitted due to error in computer calculation.

ranged from 1201 ml to 3832 ml. All subjects were in negative fluid balance with a total fluid loss (total intake minus total output) ranging from 523 ml to 2197 ml (see Table 4). The correlation between total intake and total output was 0.7644 and is shown in Table 3. This suggests that a meticulously kept intake and output record, one that incorporates the estimates of insensible fluid loss, can make the keeping of intake and output records a meaningful nursing activity in monitoring the biologically intact individual. Implied in this relationship is that as intake decreases, so does output, and continues to do so until a point is reached wherein waste products of metabolism are obliged to be excreted through the smallest amount of urine possible.

Fluid changes are also reflected in weight changes. The correlation between total weight loss (baseline minus finishing weight) and total fluid loss was 0.8663. This is also shown in Table 3.

Time NPO

Table 2 shows the amount of NPO time spent by each subject prior to surgery as compared to total fluid loss, weight loss, and percentage of body weight lost. The correlations between NPO time and fluid loss is 0.2899 and between weight loss and NPO time is 0.0884 (Table 3). These

Table 4. Total Intake, Output, and Fluid Loss for Each Subject (N = 10)

Subject	Total Intake (ml)	Total Output (ml)	Total Fluid Loss (ml)
A	800	2119	1319
B	390	1201	811
C	910	1954	1044
D	910	1474	564
E	407	1608	1201
F	350	2547	2197
G	720	1243	523
H	1155	2056	901
I	2300	3832	1532
J	450	1779	1329

correlations do not suggest a relationship between time NPO and weight and fluid loss in these subjects.

All the patients lost weight and were in a stage of negative fluid balance. This was not related to the amount of time each subject spent on NPO.

CHAPTER 5

DISCUSSION

In this chapter the data presented in Chapter 4 will be discussed in relation to the hypotheses tested, the theoretical framework, and the literature.

As mentioned earlier, "As long as the organism is alive and meeting basic needs, metabolism goes on and water is simultaneously consumed, produced, and eliminated" (Voda, 1977a, p. 4). The maintenance of optimum hydration status or a state of dynamic equilibrium implies that intake must equal output. In this study all patients lost weight which suggests that intake did not balance output and that the subjects were in a variety of stages of negative fluid balance when they reached the operating room. The results of this study do not support hypothesis 1, that a majority of NPO patients in the age group studied will lose two per cent or more body weight. This disagrees with the findings of Voda (1977a) in which eight of her 40 subjects lost two per cent or greater body weight; six of these were in the 60 or older age range.

An interesting seredipitous outcome of the weight measurement was related to the difference between pre-operative evening meal and hour of sleep. The weights taken at bedtime (no one was awake at midnight) showed that those subjects who had stopped drinking fluids shortly after their evening meal weighed in at values close to their admission weights (see Appendix C). For example subjects' A, B, F, and I weights on admission were 138.0, 129.9, 182.8, and 154.5 pounds, respectively. At bedtime they weighed 138.2, 129.7, 182.4, and 154.2 pounds, respectively.

All the subjects were scheduled by their physician to begin their NPO periods at twelve midnight, but started their periods at various times by ceasing to drink fluids. The subjects then remained NPO until the scheduled time for surgery, which for this sample, ranged from eight in the morning until twelve noon with a total time span of eight to fourteen hours. There was no correlation between the time on NPO and the total amount of fluid and weight loss ($r = 0.2899$, $r = 0.0884$). This suggests that the amount of measured fluid and weight loss was not related to time on NPO. This is inconsistent with the findings of Lapides et al. (1965) who found a more linear relationship between the variables. This could be explained by the quality and quantity of the sample or the hydration state of the subjects prior to admission to the study and starting the NPO period. Further, the correlation statistic is subject to sampling variation so that even though one calculates a high or low r (as in this example of fluid loss vs NPO time and weight loss vs NPO time), the r could vary from sample to sample according to the characteristics of the sample. Such things as state of hydration, response to stress of hospitalization and approaching surgery, sneaking drinks, ambient temperature, as well as undiagnosed renal or adrenal problems could be highly influencial if not controlled for.

Weight loss of NPO preoperative patients on enforced routine was associated with fluid loss (r = 0.8663), and both fluid loss and weight loss appeared to be related to the size of the patient (r = 0.6459 and 0.4933). This is consistent with hypothesis 2, that there will be a positive relationship between water loss (total measured sensible intake minus measured sensible loss plus estimated insensible loss) and measured weight loss in patients on restricted intake.

Body size was also found to be related to weight loss (r = 0.6459). These findings refute hypothesis 5: There will be no relationship between body size and weight loss in patients on restricted intake. The men in this study were taller and heavier than the women (Table 2). This can be explained by the fact that the greater the surface area the greater the corresponding increase in insensible water loss from the skin. Although the weight range was close, 68.7 pounds between the lightest and the heaviest, the heavier people lost more fluid and weight. Subject C was an example of this (Table 2). Subject C was six feet four inches tall, male, and 63 years of age.

Although he did not receive any preoperative bowel preparation for his scheduled hernia repair, he lost 3.3 pounds. Since a taller person has a greater surface area than a smaller compact person, one would expect the tall person to lose more body water even though he/she may have the same total body volume (Snively, 1957).

Another factor that could affect a greater weight loss among the taller, heavier subjects of this study was the frequency of surgeries in the last few months prior to the admission during which the study took place. Subject F, a 64 year old male (see Table 2) who lost the greatest amount of weight, was having his third major surgery in a year and the second in three weeks. He lost over two per cent of his body weight; however, on his previous surgery, three weeks prior to the present admission, as Subject E, he lost less than one per cent of his body weight. During both hospitalizations he spent almost the same amount of time NPO (14 hours vs. 13.5 hours).

Another factor that contributes to sensible fluid loss is the NPO routine of cleansing enemas for certain abdominal surgeries. Subject I, a 70 year old male, received saline enemas until clear as routine bowel preparation for hernia repair. He lost 1.6 per cent of his total body weight. The purpose of the cleansing enema is to evacuate feces. The enema increases peristalsis by enlarging the contents of the bowel, or through irritation to evacuate its contents. This increased peristalsis decreases the amount of time the feces is in contact with the absorptive surface of the bowel, thereby increasing the fluid content of the feces. Subject I lost 409 ml of fluid through the feces following saline enemas.

Of the four subjects who lost two or more pounds of weight (C, F, I, and J), only one subject, F, lost two per cent or greater of his total body weight and was considered to be in a state of early dehydration. Subject F lost 2.9 per cent of his body weight; however, the other three subjects (C, I, and J) lost 1.8 per cent, 1.6 per cent, and 1.8 per cent, respectively.

CHAPTER 6

SUMMARY AND CONCLUSIONS

This chapter contains a summary of the study, conclusions, and implications drawn from the study as well as suggestions for further study.

This descriptive study attempted to determine the fasting weight loss among NPO preoperative elective surgical patients 60 years of age or older. For this study subjects were chosen from newly admitted surgical patients and each followed the same research protocol.

The framework for the study was based on physiological principles of water and electrolyte balance and the factors that operate to dehydrate preoperative patients. These included mechanisms of water loss both insensible and sensible, the relationship of body weight to body water, and the relationship of body water to age and body shape. Included also was a discussion of ways used to measure body water.

The selected review of the literature indicated that few if any nursing studies have been done on the dehydrating effect of the preoperative NPO fast on elderly elective surgical patients or that document the signs and stages of dehydration.

The data supported Hypothesis 2, that there is a positive relationship between water loss (total measured intake minus measured sensible loss plus estimated insensible loss) and measured weight loss in patients on restricted intake; refuted Hypothesis 1, that a majority of NPO patients in the age group studied will lose two per cent or more body weight; Hypotheses 3 and 4 that there will be a positive relationship between time (number of hours) on restricted intake NPO and the amount of fluid lost, and there will be a positive relationship between time (hours) and the amount of weight lost were also not supported; nor was Hypothesis 5 that there will be no relationship between body size and weight loss in patients on restricted intake. A larger different sample might yield different results.

Although only one subject in this study lost two per cent or greater body weight, nine others lost a considerable amount of body weight during the overnight fast. This suggests the beginnings of a pattern; that is, that certain patients with specific body size and shape may lose more fluid in the preoperative period than others The data also suggest the total number and frequency of surgeries over the year (months) and preoperative bowel preparation associated with surgery tend to tax the older body's ability to compensate for these losses resulting in preoperative fluid loss that borders on an early stage of dehydration.

Implications

The major implications of this study are that elderly elective surgical patients who are considered good surgical risks and who do not receive preoperative fluid replacement therapy do lose a considerable volume of fluid during the enforced preoperative NPO) period. This fluid loss, which is clinically reflected as weight loss, can culminate in an early stage of dehydration triggering the compensatory antidiuretic hormone (ADH) response. Moran and Zimmerman (1967) found that high levels of ADH measured in the intraoperative and postoperative period suggest the ADH mechanism etiology of fluid retention begins in the period of preoperative fast. The excessive hormone response was dissected into several factors by Moran, the first stimulus being to the osmoreceptor system in the supraoptic nucleus of the hypothalamus which is responsible for stimulating the secretion of ADH due to the NPO induced hyperosmolal state. Other stimuli for secretion are hemorrhage, and both cutaneous and visceral pain which accompany any surgical procedure. Jenkins (1977) says that the goal of the anesthesiologist when the patient arrives in the operating room is to suppress the ADH response by infusing five per cent dextrose and water to minimize postoperatively the inappropriate ADH response.

Nurses are in a key position to monitor the hydration state of all preoperative patients to ensure that patients go to surgery in a safe, hydrated state. Particularly vulnerable due to aging and decreased ability to compensate physiologically are the elderly preoperative patients. Older patients who show any of the factors that may contribute to fluid loss outlined in this study need to be monitored closely so as to insure that they go to surgery in as optimum a hydration state as possible. Nurses can do this by weighing the patients on an accurate scale, by keeping of accurate intake and output records, to include the estimated insensible water loss, and by providing fluids up until the time they must be placed on absolute NPO.

Suggestions for Further Study

Originally, the variables under study were thought to be three: fluid loss, weight loss, and per cent of weight loss. However, these were found to be multiple and actually a total of ten distinct variables were operational. Therefore, before any definitive suggestions for further study are made, a sample size of at least 30 or more subjects is necessary.

As suggestions for further studies the following are recommended:

First, a replication of this descriptive study using trained research assistants to control for researcher bias needs to be done to determine if the findings of this study appear with similar regularity in older persons.

Second, does the preoperative fast affect subjects with the greatest surface area, those with impaired nutritional status, those with multiple surgeries, and those who have cleansing enema as part of their preoperative routine?

Third, an experimental design to follow suggestions postulated in this study to control for and manipulate the variables that are highly and significantly correlated.

Fourth, a descriptive study to determine the relationship between preoperative weight loss and the postoperative course of recovery in individual subjects who have elective surgery.

Fifth, an experimental study in which one group is loaded with fluids prior to the onset of the NPO period and a second group follows the regular preoperative routine and is not loaded with fluids.

APPENDIX A

SUBJECT'S CONSENT FORM

Principal Investigator: Victoria L. Danforth, R. N.

I am requesting your voluntary participation in a study entitled, "Preoperative Dehydration in Elective Surgical Patients." The purpose of this study is to determine the fasting weight loss of preoperative patients. Basic to the problem under study is the common practice of placing all preoperative surgical patients on fluid restriction regimen called nothing by mouth (NPO). Your physician has already given his consent for you to participate in this study, and he has determined, according to his usual preoperative routine, at what time your preoperative fluid restriction will begin. If you decide to participate, you will be weighed at admission, after your preoperative meal, upon retiring and/or at the start of the NPO period, and just prior to being taken for surgery. Also, from the time of admission until you are taken to surgery, all fluid intake and all urine and stool output will be measured along with all enemas or other irrigations. Basic information will be recorded at the time of your admission about you, including sex, age, height, and type of surgical procedure you are to have. There is no cost to you for participation in this study, and you are free to ask and receive answers to relevant questions at any time. This may not seem of benefit to you at this time; however, it will prepare you for the postoperative routine you may experience, and possibly help future preoperative patients.

To protect you and the confidentiality of the information gathered, all forms will be coded to protect anonymity. And when the data of the project are analyzed, the results will be submitted for publication and anonymity will also be maintained. You may withdraw from the study at any time; you need not state your reason for doing so, without affecting your medical care.

Investigator ______________________________

Date ______________________________

I have read and understand the above consent form and I agree to participate in this study. I also agree to the taking of the measurements mentioned above. I realize that participation in this study is voluntary and that I may withdraw at any time. I also realize that there is no monetary or other kind of benefit due me if I participate in this study; however, the findings of this study may be of benefit to future preoperative patients.

Subject____

Date____

APPENDIX B

DATA COLLECTION FORM

Admission time:

Admission date:

Age: Sex: Height: Body Surface Area:

Intake				Output			
Source	Amount	Source	Amount	Source	Amount	Source	Amount
TOTAL >		TOTAL >		TOTAL >		TOTAL >	

Type of Surgery: ______________

____

____

____

____

Weight

Admission: ______________

After evening meal: ______________

Bedtime: ______________

Start of NPO period: ______________

Just prior to surgery: ______________

APPENDIX C

RAW DATA

Subject	Age	Sex	Height (ft/in)	Total Intake	Total Output	Admission Weight (lbs)	Weight After Evening Meal (lbs)	Bedtime Weight[a] (lbs)	Weight Just Prior to Surgery (lbs)	NPO Time (hours)
A	71	M	5/8	800 ml	2119 ml	138.0	138.3	138.2	136.0	10.0
B	70	M	5/9	390 ml	1201 ml	129.9	130.7	129.7	128.6	14.0
C	63	M	6/4	910 ml	1954 ml	188.2	188.8	187.8	184.9	8.0
D	67	F	5/4	910 ml	1474 ml	144.0	145.4	145.0	143.2	8.0
E	64	M	6/0	407 ml	1608 ml	184.0	185.6	185.8	182.2	13.5
F	64	M	6/0	350 ml	2547 ml	182.8	183.6	182.4	177.5	14.0
G	70	F	5/5	720 ml	1243 ml	119.5	120.5	--	118.6	12.0
H	64	F	5/5	1155 ml	2056 ml	124.5	125.8	125.0	124.2	8.7
I	70	M	5/11	2300 ml	3832 ml	154.5	154.8	154.2	152.0	10.5
J	71	F	5/5	450 ml	1779 ml	143.7	144.1	144.4	141.0	10.5

[a]Weights at start of NPO period omitted as all subjects were asleep.

SELECTED BIBLIOGRAPHY

Bertolini, Alberto M. Gerontologic Metabolism. Springfield, Ill.: Charles C. Thomas, Publisher, 1969.

Bland, John H. Clinical Metabolism of Body Water and Electrolytes. Philadelphia: W. B. Saunders Co., 1963.

Brobeck, John R. Best and Taylor's Physiological Basis of Medical Practice. 9th ed. Baltimore: The William Wilkins Co., 1973.

Colton, Theodore. Statistics in Medicine. Boston: Little, Brown and Co., 1974.

Deding, A., S. Jorgensen, and F. Hassing Nielsen. "Pre-operative Sodium Balance," Acta Anaesth Psiologica Scandinavica, 15:33-43, 1971.

Deutsch, Stanley, Martin Goldberg, and Robert D. Dripps. "Postoperative Hyponatremia with Inappropriate Release of Antidiuretic Hormone," Anesthesiology, 27:250-256, May-June, 1966.

DuBois, D., and E. F. DuBois. "The Measurement of the Surface Area of Man," Archives of Internal Medicine, 15:868-881, May, 1915.

Ellison, Norig. "Problems in Geriatric Anesthesia," Surgical Clinics of North America, 55:929-945, August, 1975.

Gump, Frank E., John M. Kinney, Calvin L. Long, and Rene Gelber. "Measurement of Water Balance--A Guide to Surgical Care," Surgery, 64:154-164, July, 1968.

Guyton, Arthur C. Textbook of Medical Physiology. 5th ed. Philadelphia: W. B. Saunders Co., 1976.

Harper, Harold A. Physiological Chemistry. 15th ed. Los Altos, Ca.: Lange Medical Publications, 1975.

Hays, Mark A. "Water and Electrolyte Therapy after Operation," New England Journal of Medicine, 278:1054-1055, May 9, 1968.

Howels, Earl M. "Managing Fluids and Electrolytes in Surgical Patients," Geriatrics, 32:100-102, May, 1977.

"Human Subjects Committee Manual of Procedures." University of Arizona, Tucson, July, 1977.

Jenkins, Dalton. M.D., Tucson, Arizona, personal interview, 1977.

Kuno, Yas. Human Perspiration. Springfield, Ill.: Charles Thomas, Publisher, 1967.

Lapides, Jack. Fundamentals of Urology. Philadelphia: W. B. Saunders Co., 1976.

Lapides, Jack, Richard B. Bourne, and Loyd R. MacLean. "Clinical Signs of Dehydration and Extracellular Fluid Loss," Journal of the American Medical Association, 191:141-143, February 1, 1965.

Marriott, H. L. Water and Salt Depletion. Springfield, Ill.: Charles C. Thomas, Publisher, 1950.

Metheny, N. M., and W. D. Snively. Nurses' Handbook of Fluid Balance. 2nd ed. Philadelphia: J. B. Lippincott Co., 1974.

Moran, Walter H., and Bernard Zimmermann. "Mechanism of Antidiuretic Hormone (ADH) Control of Importance to the Surgical Patient," Surgery, 67:639-644, October, 1967.

Shock, N. W. "Physiological Aspects of Aging in Man," Annual Review of Physiology, 23:97, 1961.

Snively, W. D. "Body Surface Area as a Dosage Criterion in Fluid Therapy: Theory and Application," Metabolism, 6:70-87, January, 1957.

Vannetta, John C., and Morris J. Fogelman. Moyer's Fluid Balance: A Clinical Manual. Chicago: Yearbook Publishers, 1976.

Voda, Ann M. "Letter to the Editor," American Journal of Nursing, 71:1126-1127, June, 1971.

Voda, Ann M. "Fasting Weight Loss of Preoperative Patients," Proceedings of the 5th Annual Nursing Research Conference. Indianapolis: Sigma Theta Tau, September, 1977a.

Voda, Ann M. "Procedure for Departmental Review Process for Research Process." Tucson: College of Nursing, University of Arizona, 1977b.