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INJURY SEVERITY SCORES AND
NUTRITIONAL STATUS IN THE TRAUMA PATIENTS

by

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A RESEARCH PROJECT

Submitted in partial fulfillment of the requirements in the course NAH 592: Research Project Seminar: Adult Health Nursing in the School of Nursing, The University of Alabama at Birmingham.

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ABSTRACT

This study used a retrospective descriptive design using the Roy adaptation model to examine the relationship between trauma patients' Injury Severity Scores and nutritional needs. Nutritional needs were defined as protein requirement to achieve a positive nitrogen balance. The study examined data on 32 subjects age 20 to 50 years. The sample was comprised of 62.5 percent males and 37.5 percent females. All subjects were admitted to a single hospital over a six month period with diagnoses of traumatic injuries. All subjects received nutritional support while hospitalized. Data were gathered from the trauma registry and the patient records. Urinary nitrogen was utilized as an indicator of nitrogen balance. Protein received post-injury was correlated with the Injury Severity Score for each patient. Subjects' Injury Severity Scores ranged from 4 to 29.

Pearson correlations and descriptive data were used to examine the relationships. A statistically insignificant weak correlation (r= .0632, p= .731, alpha= .05) between the Injury Severity Score and the nutritional requirement to obtain a positive nitrogen balance was found. A positive correlation

(r= .0632, p= .731, alpha= .05) was identified between the Injury Severity Score, and the number of days required to achieve a positive nitrogen balance.

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CHAPTER I

Introduction

There were over 8,800,000 injuries and 94,000 deaths in the United States in 1987. The cost of these injuries exceeded $133.2 billion (National Safety Council, 1988). The nature of the injuries must be quantified to allow standardization of care and resource utilization. A number of scoring systems are in use in the clinical setting (Baker, O'Neill, Haddon, & Long, 1974; Gibson, 1981). The ability to compare injuries quantitatively allows the health care provider to identify trends and thus improve the quality of care provided. Trauma patients have been studied using various scales and scoring systens based on physiologic and anatomic injuries.

The nutritional needs of trauma patients have been studied for many years. The phenomena was investigated by Cuthbertson (1936, 1942) leading to the Ebb and Flow Theory of metabolic response to trauma which is used today (Bullock, 1988; Gann & Amaral, 1985). One metabolic sequela of trauma is the breakdown of protein as an energy source. Nutritional support of the trauma patient has been demonstrated to reduce complications and resource utilization (Bessey & Custer, 1987;

Morgan, 1984; Shaw & Wolfe, 1989; Weinsier, Bacon, & Butterworth, 1982). Robinson, Goldstein, and Levine, (1987) documented the cost of treating poorly nourished patients to be $7,000-$9,000 more than treating properly nourished patients with similar injuries. The poorly nourished patients also were noted to stay in the hospital 5.6 (+/- 2.2) days longer than their well nourished counterparts. The identification of a relationship between injury severity and nutritional needs of the trauma patient would allow for better utilization of resources and higher quality of care.

Statement of Purpose

The purpose of this study was to ascertain if there is a relationship between the Injury Severity Score and the nutritional needs of the trauma patient.

Conceptual Framework

Roy's Adaptation Theory

The conceptual framework for this study was the Roy Adaptation Model for nursing. In this model people are seen as an adaptive system in constant interaction with the environment (Roy, 1984). The person is seen as receiving input in the form of stimuli which can be focal, contextual, or residual. This input is then interpreted through an internal control system (cognator or regulator). The stimuli are then processed in one of four modes which act as effectors: a) physiologic, b) self-concept, c) role function, or d) interdependence. The person then reacts to the stimulus through adaptation. The goal of nursing is to promote effective adaptation in the patient (Roy, 1984).

Adaptation and Nursing in Trauma

Trauma patients often experience multiple system injuries necessitating major adaptive behaviors. The nurse can act to promote these adaptive behaviors through knowledge of existing relationships between severity of injury and nutritional needs. The adaptation theory provides the nurse guidance and direction in the multi-dimensional care of the trauma patient (Smith, Davis, Baba, Pierce, & Richardson, 1988). During the acute phase of the injury the nurse actively manipulates the environment to promote adaptation by the patient. The patient is seen as an open system with each adaptive behavior impacting other behaviors. The nurse must assess all of these interactions to be effectve (Giger, Bower, & Miller, *987).

Adaptation of a Physiologic Parameter

The relationship of the trauma patient's nutritional status to the severity of injury is a measure of the patients' adaptive process. The amount of catabolic activity following a traumatic injury is the patient's adaptive response to that injury. This response can be indirectly measured through monitoring nitrogen balance (Bessey & Custer, 1987). The body's reaction to the stimulus of tissue damage is primarily in the physiologic mode. The metabolic alterations are processed through the regulator function to maintain homeostasis. The areas of adaptation that were examined in this study occur in the nutritional requirements of the body following trauma and the severity of injury. The Injury Severity Score was used to quantify the injury and the nitrogen balance is used to quantify the body's adaptive process.

Problem

Is there a relationship between Injury Severity Score and nutritional status in the trauma patient? The null hypothesis for this study was that there is no relationship between Injury Severity Score and the nutritional status of the trauma patient.

Definition of Terms

Injury Severity Score - The Injury Severity Score (ISS) is a scalar device that is commonly used to assign a quantitative value to an individual's injuries at the time of discharge (Copes, Champion, Sacco, Lawnick, Keast, & Bain, 1988). This value is the sum of the square of the three highest Abbreviated Injury Scores. The scores can range from 3-75 with the higher score indicating more severe injury (Baker, et al. 1974;

Morgan, Civil, & Schwab, 1988).

Trauma Patient - Trauma patients are persons who sustained injuries as a result of the application of force or violence. Admission diagnosis numbers were used to identify persons having diagnosis numbers between 850 and 959.9 according to the International Classification of Diseases (Commission on Professional and Hospital Activities, 1978; Appendix A). Patients included were ages 20 to 50 years having no previously known metabolic problems.

Nutritional Status - This study defined nutritional status as the amount of protein required to achieve and maintain a positive nitrogen balance.

Nitrogen Balance - Nitrogen Balance was defined as a balance between nitrogen intake in the form of proteins compared with the urinary excretion of nitrogen. When grams of nitrogen taken in equals the nitrogen found in the urine over a 24-hour-period, then the patient was considered to be in balance.

Nitrogen in Grams - Nitrogen in grams was defined as the Grams of nitrogen received by the patient prior to achieving a positive nitrogen balance. This value was determined from the amount of nitrogen administered in the nutritional support solution.

Days Post-Injury - The number of days since admission to the hospital until a positive nitrogen balance was achieved. This value was determined by subtracting the date of admission from the date that a positive nitrogen balance was achieved.

Days on Treatment - The number of days between when nutritional support was initiated and when a positive nitrogen balance was achieved. This was determined by subtracting the date that nutritional support was begun from the date when a positive nitrogen balance was achieved.

Assumptions

1. The body's response to trauma was the primary cause of the increased protein metabolism.
2. Urinary nitrogen specimens reflected the patient's catabolism accurately.
3. All trauma patients were in comparable nutritional status prior to being injured (Maderazo, Woronick, Quercia, Hickingbotham, & Drezner, 1988).
4. All records accurately reflected the treatments that were received.

Significance of the Study

The findings of this study attempted to support or refute the concept of a relationship between degree of injury and the amount of nutritional support needed for trauma patients. The findings enabled the clinicians and managers to anticipate the amount of nutritional resources to be utilized by trauma patients. This study provided an additional use of information that was already collected. The end results should be increased efficiency and quality of care to the trauma patient.

Summary

Describing injuries quantitatively allowed for observations that might go undetected in single case reviews. The Injury Severity Score provided a method of comparing injuries objectively based on anatomic pathology (Wesson, Spence, Williams, & Armstrong, 1987). This scoring system is used primarily to predict mortality.

The catabolic response to trauma has been described for over 50 years. The relationship between the degree of injury and the amount of catabolism is not clear. Through using a standard scoring device and comparing it with an objective laboratory test a relationship could be identified if it existed. The information gained could then be utilized to better plan care and resource allocation.

This study's potential was to improve the quality of care through increased use of existing data to plan care. Financial savings to the hospital and the patient can be realized through more efficient utilization of resources.

CHAPTER II

Review of Research

A review of the literature yielded few articles that directly addressed a relationship between nutritional status and severity of injury. Areas of peripheral review included a) nutrition and illness, b) nitrogen loss, and c) scoring systems.

Nutritional Status

The study of nutrition and trauma is longstanding (Cuthbertson, 1936, 1942). The literature abounds with studies relating nutrition and illness or trauma. A study of 33 hospitals demonstrated that 75% of patients hospitalized more than two weeks were malnourished (Kamath, Lawler, Smith, Kalat, and Olson, 1986). In a study looking at patients at high-risk of being malnourished, patients with increased metabolic need were identified as being at a great risk (Weinseir et al. 1982). They identified trauma and burn patients as being at high-risk for hospital-induced malnutrition.

The trauma patient has been demonstrated to experience a period of hypermetabolism following injury (Anderson, 1987; Bessey & Custer, 1987; Shaw & Wolfe, 1987). Increased metabolic rates have been reported as high as 100%-150% above normal in burn patients (Morath, Miller, Finley, & Jones, 1983). Trauma patients without burns were shown to have metabolic rates 32%-36% above normal. Their metabolic rates increased to 60.8% if they recieved steroids and 79.2% if they developed sepsis (Anderson, 1987).

The adverse effects of not meeting this increased demand for energy was demonstrated by (Warnold & Lundom, 1984). In the study 215 postoperative patients were observed and an overall complication rate of 48% with 31% being major complications in the malnourished group of patients. This was in contrast to an overall complication rate of 23% of which 9% were noted to be major complications. Complications commonly seen in malnourished patients included a) sepsis, b) delayed wound healing, c) decreased immune functioning and increased mortality (Blazey, Brewer, Hudson, & Wilson, 1986). A study of 100 patients admitted to a general medical ward found a difference of 7.4 days longer stay in malnourished patients compared to normal nourished patients (Robinson, Goldstein, & Levine, 1987). The malnourished patients' hospital charges were $16,691 as compared to the $7,692 for the normally nourished patients.

Nutritional supplements were studied by Peterson et al. (1988) indicating a 32% septic complication rate for patients receiving total parenteral nutrition

(TPN) and a 10% r.̶ce for patients receiving total enteral nutrition (TEN). The findings were noted to be insignificant at p=0.08. In a study of the effect of TPN on neutrophils of trauma patients, it was reported that neutrophilic chemotaxis and chemokinetic activity were decreased for the first three days post-injury (Maderazo et al. 1988). After the three days the activity of the neutrophils in patients receiving TPN returned to normal.

Nitrogen Loss

The excess loss of nitrogen from the body as an end product of protein breakdown was described by Cuthbertson (1936; 1942) during his observations of trauma patients over 50 years ago. The loss of nitrogen in trauma patients has been noted to result from the breakdown of peripheral and visceral protein. In a study of nitrogen replacement Jeejeebhoy (1988) found that adequate nitrogen replacement had little or no effect on replenishing total body protein. The use of steroids post-injury has been demonstrated to increase the loss of nitrogen from the body. Trauma patients were observed to lose an average of 256 mg/kg/day when receiving steriods and 172 mg/kg/day without steroids (Ford, Jennings, & Andrassy, 1987).

There are various measures of nitrogen loss described in the literature. Among the studies noted most consistently are a) albumin, b) serum transferrin, c) total lymphocyte count, d) creatinine height index, and e) urine urea nitrogen (Anderson, 1987; Blazey et al., 1986; Curtas, Chapman, & Meguid, 1989; Morgan, 1984).

Scoring Systems

There are many scaling and scoring systems in use in the clinical setting. One of the most widely used in trauma is the Injury Severity Score (ISS) (Wesson, Spence, Williams, & Armstrong, 1987). This scale is based on the Abreviated Injury Scale. Injuries are scored from one to five. The three highest scores are squared and then added together (Baker et al., 1974). This produces a score that enables comparison of injuries based on severity of anatomic injuries. Scoring is done retrospectively after discharge.

The literature raised many questions regarding the use of this scoring system. Gibson (1981) noted that this system had only been validated based on outcome criteria done after the fact. The researcher stated that no evidence was presented to establish inter- and intra-rater reliability. Reliability and validity values of the ISS were reported in a study applying the scoring system to injured children (Wesson et al., 1987). They report a Cohens Kappa for multiple raters of 0.67 with a Z statistic of 19.82 with an alpha= .001.

The researcher stated that the scoring system has predictive validity. Morgan et al., (1988) observed an accuracy rate of 95% when comparing scoring by surgical residents and critical care nurses. Copes et al.(1988) demonstrated that the ISS has inconsistencies. The author noted that the ISS is based on subjective data. This raised questions about the data obtained being treated as interval data for statistical procedures. The system allows for one score from each anatomic area regardless of multiple severe injuries within the same area of the body. The author expressed concern over the scoring system assigning equal importance to all areas of the body.

Injury Severity Score and Nitrogen Loss

The literature was sparse in articles that directly related ISS to nitrogen loss. Shaw and Wolfe (1989) found that patients with ISS of 0-20 have slightly increased metabolic rate. Patients having ISS of 20 or more were found to have the same metabolic rate. This led to their conclusion that the increase in metabolic activity is an "all or none response" (Shaw & Wolfe, 1989, p. 70).

In a study of head injured children the Modified Injury Severity Score was used (Ford, Jennings, & Andrassy, 1987). The author noted that the children had extremely high catabolism rates but the findings were not able to be isolated to severity of injury or the use of steroid therapy. The researchers stated that the catabolic rate in adult trauma victims does relate to the severity of injury in a step-like progression.

Summary

There was a consensus in the literature about the need for nutritional support during prolonged hospitalizations. Trauma patients were noted to be properly nourished at the time of injury but soon their hypermetabolic state depleted their nutritional status (Maderazo et al. 1988). Due to the hypermetabolic state they were identified as being at high risk for malnutrition (Weinsier et al., 1982). The method for providing the needed nutrition was debated in the literature (Bessey & Custer, 1987: Maderazo, et al. 1988; Peterson et al. 1988; Souba, 1988). The body's immune response (neutrophils) was demonstrated to react more slowly after injury if total parenteral nutrition is initiated immediately (Maderazo, et al., 1988). Total enteral nutrition was advocated if not prohibited by injury or surgery. The distinction of type of nutrition was not differentiated in this study.

The ISS is a commonly used method for comparing severity of injuries despite its validity being debated in the literature (Copes et al., 1988; Gibson, 1981; Morgan et al., 1988).

The use of nitrogen excretion as an indicator of protein breakdown is a common practice (Kamath et al., 1986; Morath, Miller, Finley, & Jones, 1983; Morgan, 1984). Researchers have demonstrated that burn patients and head injury patients receiving steroids have an exceptionally high rate of protein breakdown (Anderson, 1987; Ford et al., 1987).

Only one study relating the ISS to nutritional status was located (Shaw & Wolfe, 1989). Many articles discussed severity of injury as an influencing factor in nutritional needs but no direct relationship was offered (Anderson, 1987; Bessey & Custer, 1987; Morgan, 1984). The lack of literature quantifying the relationship between injury severity and nutritional needs demonstrated the need for further study in this area.

CHAPTER III

Methodology

This study was conducted retrospectively using existing data. The aim was to identify a relationship between Injury Severity Scores and the nutritional needs of trauma patients. These data were already recorded in the patients' records and/or trauma registry. The results of this study would increase the usefulness of this data. This chapter described the methodology of the study.

Design of the Study

This study was of a descriptive design. Data were obtained from retrospective chart and trauma registry review. The variables examined were the a) ISS, b) urine urea nitrogen, c) days required to achieve a nitrogen balance, and d) number of grams of nitrogen required to achieve a nitrogen balance. Participation was restricted by age (20-50 years) to restrict variability of basal metabolic rates and incidence of chronic diseases. Patients with primary diagnoses of head injury or burns were excluded from this study. Patients not achieving a nitrogen balance during hospitalization were excluded from the study. Nitrogen balance was calculated using the formula: nitrogen intake - (urine urea nitrogen + 4 gm)= nitrogen balance. All lab values were from the same hospital laboratory.

Instrumentation

Data was collected and recorded on a data flow sheet (Appendix B). The data collection tool was developed by the researcher for this study. The ISS and age of the patient was obtained fron the Trauma registry. The ISS has a reported inter-rater reliability value of .67 using Cohen's kappa and a Z score of 19.82 with p = 0.001. The validity for the ISS is retrospectively 95% (Wesson et al., 1987).

The laboratory values for urine urea nitrogen was obtained from a review of the patient records. Data regarding days since injury was obtained from taking the difference between the date on the lab slips and the date of injury. The same procedure was used to get the number of days of nutritional therapy only using the date of the fist documented nutritional in the record. Total number of grams of nitrogen received prior to reaching a nitrogen balance was obtained by totaling the number of grams of nitrogen as recorded in the flow sheets and physician's order sheets in the record.

Subjects

This study was conducted at a moderate-sized teaching hospital in the Southeastern United States. Subjects were randomly selected using a table of random numbers and the last two digits of each subjects hospital identification number. A random sample of 32 patients hospitalized at least five days with diagnoses of trauma-related injuries was selected. Patients with primary diagnoses of burns or head injury were excluded due to the excess protein catabolism (Anderson, 1987; Bessey & Custer 1987; Morgan, 1984). Patients receiving steroids were also be excluded due to the effects of steroids on protein breakdown (Ford et al., 1987). Subjects were excluded if they have previously diagnosed metabolic diseases noted in the chart.

Procedure

Permission was obtained from the Trauma Services to access patient information using the trauma registry. Institutional premission and review was obtained (Appendix C) and the study conducted in accordance with all review board recommendations. All data was collected by the researcher over a one month period. Subjects were selected from patients who had been admitted to the trauma service over the past six months.

The use of the computerized trauma registry was limited to patient identification, ISS, and age. Only patients with trauma diagnoses were contained in the trauma registry. Inpatient records were manually reviewed and data was extracted by the researcher at the hospital. All data was recorded on the data flow sheet (Appendix D). All data was secured in a locked file cabinet and patients remained anonymous throughout the study.

Analysis

The data were analyzed using descriptive statistical methods and correlation studies. Frequencies, means, standard deviations, and Pearson correlation coefficients were calculated to test the null hypothesis. Calculations were conducted using the Statistical Package for the Social Sciences/PC+ (SPSS/PC+) computer program (Norusis, 1988).

Limitations

The limitations of this study are as follows:

1) There was no way to ensure that all patients in the study were of equal nutritional status at the time of injury.

2) This study was conducted at one hospital and that limits the ability of the findings to be generalized to a larger population.

3) The study was conducted on patients with an age of 20-50 years of age. This limits the ability to generalize the findings to older or younger patients.

4) There was no way to detect inaccuracy in information recorded in the record.

CHAPTER IV

Presentation and Analysis of Data

The purpose of this study was to identify a relationship between the nutritional needs of trauma patients and their respective Injury Severity Scores. Subjects were randomly selected from the trauma registry covering [illegible]1 trauma patients admitted to the hospital over a six month period. A sample of 32 patients that met the study criteria were selected after reviewing 79 records. These patients' records were reviewed and data was extracted for analysis.

Description of Subjects

The subjects were predominantly male (62.5%) with women comprising slightly more than one third (37.5%) of the sample. Subjects' ages ranged from 20 to 50 years, with a mean age of 32.8 years. All subjects achieved a positive nitrogen balance prior to discharge from the hospital. Any patients with diagnoses of burns or head injury were excluded from this study. Subjects receiving steroids or experiencing renal impairment were also excluded from this study.

Clinical Data

The Injury Severity Scores (ISS) were obtained from the computerized trauma registry. The scores were assigned retrospectively after the patients had been discharged from the hospital. The scores ranged from 4 to 29 with a mean score of 14.1 and a median of 14.0.

Information concerning the patients nitrogen status was obtained from a manual review of the inpatient records. The dates when a positive nitrogen balance was reflected in the record was noted. No difference was noted between patients receiving Total Parenteral Nutrition (TPN) and those receiving Total Enteral nutrition (TEN). The values covered a wide range from 64 Grams to 768 Grams, with a mean of 317.9 Grams. The variance in protein received daily was not examined.

The number of days of nutritional support received was calculated by taking the difference between the dates that nutritional support was initiated and the date that a positive nitrogen was achieved. The days of support ranged from 3 days to 21 days with a mean of 6.8 days. The days post-injury until a positive balance was noted had a range of 25 days (4 to 29 days) with a mean of 10.3 days.

<u>Analysis of Data</u>

The data was analyzed using the SSPS/PC+ computer program. Pearson r values were calculated using an alpha = .05. the results are contained in Table I.

Table I

Correlations of Clinical Data (n = 32)

	Sex	Age	ISS	Nitro	Rx	Days
Sex	1.0000 (0) p= .					
Age	.3258 (32) p= .069	1.0000 (0) p= .				
ISS	.0167 (32) p= .928	.0008 (32) p= .996	1.0000 (0) p= .			
Nitro	.1939 (32) p= .288	-.2796 (32) p= .121	.0632 (32) p= .731	1.0000 (0) p= .		
Rx	.0934 (32) p= .611	-.1127 (32) p= .539	.2699 (32) p= .135	.6335 (32) p= .000	1.0000 (0) p= .	
Days	.1985 (32) p= .283	.0494 (32) p= .788	.3597 (32) p= .043	.6292 (32) p=.000	.9074 (32) p= .000	1.0000 (0) p= .

ISS = Injury Severity Score.
Nitro = Grams of nitrogen recieved to achieve a positive nitrogen balance.
Rx = Days of nutritional support before achieving a positive nitrogen balance.
Days = Days post-injury before achieving a positive nitrogen balance.
. = Coefficient cannot be computed.

The null hypothesis was tested by the correlation of the ISS with the Grams of nitrogen (Nitro) received. There was a low positive correlation(r= .06316) that was determined to be insignificant (p= .7313).

Other Findings

The Injury Severity Score was calculated to have a moderate positive correlation (r= .3597, p= .043) with the number of days required to achieve a positive nitrogen balance. A highly positive correlation was found between days of nutritional support and the number of days required to achieve a positive nitrogen balance (r= .9074, p= .000). The number of grams of nitrogen received also was positively correlated to the number of days of nutritional support (r= .6335, p= .000) and the number of days post-injury until a positive balance was documented (r= .6292, p= .000).

Summary

The 32 subjects studied all achieved a positive nitrogen balance while hospitalized. The length of time and amount of nutritional support required to correct the nitrogen balance were subjected to statistical correlation procedures with the Injury Severity Score. There was determined to be an insignificant positive correlation between the Injury Severity Scores and the amount of nitrogen needed. Statistically significant positive correlations were found between the number of days of nutritional support and the number of days post-injury that a positive balance was documented. The number of grams of nitrogen received was also positively correlated to both a) the number of days post-injury til a positive balance was achieved, and b) the number of days of nutritional support received.

CHAPTER V

Discussion, Conclusion, and Recommendation

The purpose of this descriptive study was to ascertain if there was a relationship between Injury Severity Scores and the nutritional needs of the trauma patient. Nitrogen balance was utilized as the indicator of nutritional status. A statistically insignificant, weak positive correlation was identified using a Pearson correlation procedure. A sample of 32 subjects was used for this study.

Discussion

This study found that there is a statistically insignificant, weak correlation between patients' Injury Severity Score and their nurtitional requirement to atain a positive nitrogen balance. The findings of this study do not support rejection of the null hypothesis (i.e. there is no relationship between Injury Severity Score and the nutritional requirements of the trauma patient). This claim is made with the awareness of the possibility of committing a type II error.

The lack of support for rejection of the null hypothesis could arise from many sources. The Injury Severity Scores on these subjects were all from the lower end of the scale (4 - 29). Maderazo et al. (1987) excluded all subjects with ISS values below 20 in their study of the body's response to trauma. They stated that the lab changes that accompanied these lower ISS scores were very subtle. Subjects with ISS values below 20 account for 27 of the 32 subjects in this study. Therefore the results identified in this study reflect the relationship in only this part of the entire scale.

Data for this study was collected retrospectively from subjects' records. The lack of daily nutritional lab studies could have weakened the precision of the data. A subject could have achieved a positive nitrogen balance shortly after lab studies were drawn and it would not be documented for two or three days when the next labs were drawn. This imprecision could influence the detection of a significant relationship.

This study was conducted on a small group (n= 32) of trauma patients. Any individual differences in the nutritional requirements would have a greater effect than if the study were conducted on a larger group. There is no way to detect the presence any such individual deviations.

This study did not collect data on the specific trauma diagnosis or the type of nutritional support given (TPN versus TEN). The type of nutritional support provided often is dependent on the type of injury sustained. The type of nutritional support for optimal recovery is debated in the literature (Shaw & Wolf, 1988; Peterson et al., 1988). This data may have provided more strength to the relationship.

The use of ISS scores as interval data in statistical procedures is another possible source of contamination in this study. It has been noted in the literature that the ISS is based on subjective findings that are then given a nominal score (Copes et al., 1988). This score is then manipulated to result in the ISS. This is a common practice in the clinical setting but may not hold up to the scrutiny of statistical procedures.

One of the assumptions of this study was that all subjects were comparably nourished at the time of admission. There was no way to ensure that this assumption was met. The impact of a few subjects suffering from malnourishment would influence the results greatly.

Findings Related to Conceptual Framework

The Roy model of adaptation provided the conceptual framework for this study. This study examined the response of the body to trauma, in the physiologic mode in the area of nutrition. The prospect of using the ISS to indicate the amount of nutritional support (nitrogen) needed for optimal adaptation was not successful.

The ISS was found to correlate weakly (r= .3597, p= .043, alpha = .05) to the length of time the body required to adapt (achieve a positive nitrogen balance). Likewise there was a strong correlation between the number of days of nutritional support received and the number of days required to achieve adaptation (r= .9074, p= .000, alpha = .05).

These findings support the use of the Roy adaptation model in the assessment and intervention to promote effective adaptation to meet the nutritional needs in the trauma patient.

Findings Related to the Literature

The findings of this study support numerous former studies that document the hypermetabolic activity of the body in the immediate post-injury period (Shaw & Wolf, 1987; Bessey & Custer, 1987; Anderson, 1987). All of the subjects in this study experienced this hypermetabolic period as evidenced by the spillage of nitrogen in their urine.

The lack of a significant correlation between ISS and nutritional need could be indicative of the "all or none response" described by Shaw & Wolfe (1987, p.70).

The subjects' ISS scores were primarily less than 20 which was determined to be the maximum response value in the Shaw & Wolfe study. Ford, Jennings, and Andrassy (1987) were unable to identify a direct correlation of

ISS and the level of hypermetabolic response in the children they studied. This led to their proposal of a step-like progression in the catabolic response of the body to the severity of the injury.

Conclusions

The data collected and analyzed on this small group of patients failed to demonstrate a clear relationship between the ISS and nutritional requirements of these trauma patients. The findings of this study ($r=.0632$, $p=.731$, alpha= .05) are that there is a statistically insignificant, weakly positive relationship . The null hypothesis is not supported. There were many variables that were not controlled for despite the many restrictions that were in place.

Recommendations

The findings of this study are inconclusive as to the relationship of ISS to the trauma patients nutritional needs. Recommendations for further study include:

1. Repeat the study using a larger sample size and randomization by ISS across the entire range of possible scores.

2. Conduct the study prospectively utilizing daily lab studies.

3. Repeat this study collecting data on the type of nutritional support received and daily protein intake.

4. Conduct this study analyzing the data by grouping the ISS values into groups of five or ten points.

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APPENDIX A

Listing of Major Diagnoses and ICD-9 Codes

LISTING OF MAJOR DIAGNOSES AND ICD-9 CODES
(850-959)

850 Concussion
860 Traumatic Pneumothorax and Hemothorax
860-869 includes: Internal Injury of the Chest, Abdomen, and, Pelvis
870 Open Wound of Occular Adnexa
870-879 includes: Open Wound of Head, Neck, and Trunk
880 Open Wound of Shoulder and Upper Arm
880-887 Includes: Open Wound of Upper Limb
900 Injury to Blood Vessels of the Head and Neck
900-904 Injury to Blood Vessels
905 Late Effects of Muscuolskelatal and Connective Tissue Injuries
905-909 Late Effect of Injuries, Poisonings, Toxic Effects, and Other External Causes
910-919 Superficial Injury
920 Contusion ofFace, Scalp, and Neck Except Eye(s)
920-924 Contusion with Intact Skin Surface
930 Forgein Body on External Eye
930-939 Effects of Forgien Body Entering Through Orifice
949 Burn, unspecified
950-957 Injury To Nerves and Spinal Cord

958-959 Certain Traumatic Complications and Unspecified Injuries

* Taken from:
Comission on Professional and Hospital Activities (1978). The international classification of diseases (9th rev.): Clinical modification. Ann Arbor, MI: Author.

APPENDIX B

Data Collection Tool

INJURY SEVERITY SCORE / NUTRITION STUDY

Data Collection Tool

Case	Age/ Sex	ISS	Nitrogen (Gms.)	Days Post Injury	Days on RX
1	______	______	______	______	______
2	______	______	______	______	______
3	______	______	______	______	______
4	______	______	______	______	______
5	______	______	______	______	______
6	______	______	______	______	______
7	______	______	______	______	______
8	______	______	______	______	______
9	______	______	______	______	______
10	______	______	______	______	______
11	______	______	______	______	______
12	______	______	______	______	______
13	______	______	______	______	______
14	______	______	______	______	______
15	______	______	______	______	______
16	______	______	______	______	______
17	______	______	______	______	______
18	______	______	______	______	______
19	______	______	______	______	______
20	______	______	______	______	______

APPENDIX C

Institutional Review and Permission

DCH Regional Medical Center

INTERNAL CORRESPONDENCE

M E M O R A N D U M

TO: Karen Tidwell, R.N., Trauma Services Coordinator

FROM: Dr. Rufus C. Partlow, Jr. Chairman RCP
Medical Audit and Utilization Review Committee

SUBJECT: Data Request from James O. Milhollen

DATE: February 21, 1990

In its February 20 meeting, the Medical Audit and Utilization Review Committee approved the data request from James O. Milhollen for information on trauma patients, **with the stipulation that no identifying information is included in the report, including the name of the hospital.** Please notify Medical Records of the charts which need to be reviewed.

RCP,Jr.:vs

VS:E/10/#10

The University of Alabama at Birmingham
Institutional Review Board for Human Use
205/934-3789
Telex 888826 UAB BHM

FORM 4: IDENTIFICATION AND CERTIFICATION OF RESEARCH PROJECTS INVOLVING HUMAN SUBJECTS

THE INSTITUTIONAL REVIEW BOARD (IRB) MUST COMPLETE THIS FORM FOR ALL APPLICATIONS FOR RESEARCH AND TRAINING GRANTS, PROGRAM PROJECT AND CENTER GRANTS, DEMONSTRATION GRANTS, FELLOWSHIPS, TRAINEESHIPS, AWARDS, AND OTHER PROPOSALS WHICH MIGHT INVOLVE THE USE OF HUMAN RESEARCH SUBJECTS INDEPENDENT OF SOURCE OF FUNDING.

THIS FORM DOES NOT APPLY TO APPLICATIONS FOR GRANTS LIMITED TO THE SUPPORT OF CONSTRUCTION, ALTERATIONS AND RENOVATIONS, OR RESEARCH RESOURCES.

PRINCIPAL INVESTIGATOR: James D. Milhollen, R.N.

PROJECT TITLE: Injury Severity Scores and the Nutritional Needs of the Trauma Patient

---

_____1. THIS IS A TRAINING GRANT. EACH RESEARCH PROJECT INVOLVING HUMAN SUBJECTS PROPOSED BY TRAINEES MUST BE REVIEWED SEPARATELY BY THE INSTITUTIONAL REVIEW BOARD (IRB).

_____2. THIS APPLICATION INCLUDES RESEARCH INVOLVING HUMAN SUBJECTS. THE IRB HAS REVIEWED AND APPROVED THIS APPLICATION ON __________ IN ACCORDANCE WITH UAB'S ASSURANCE APPROVED BY THE UNITED STATES PUBLIC HEALTH SERVICE. THE PROJECT WILL BE SUBJECT TO ANNUAL CONTINUING REVIEW AS PROVIDED IN THAT ASSURANCE.

_____ THIS PROJECT RECEIVED EXPEDITED REVIEW.

_____ THIS PROJECT RECEIVED FULL BOARD REVIEW.

_____3. THIS APPLICATION MAY INCLUDE RESEARCH INVOLVING HUMAN SUBJECTS. REVIEW IS PENDING BY THE IRB AS PROVIDED BY UAB'S ASSURANCE. COMPLETION OF REVIEW WILL BE CERTIFIED BY ISSUANCE OF ANOTHER FORM 4 AS SOON AS POSSIBLE.

__X__4. EXEMPTION IS APPROVED BASED ON NUMBER(S) __5__.

DATE: 2-7-90

RUSSELL CUNNINGHAM, M.D.
INTERIM CHAIRMAN OF THE
INSTITUTIONAL REVIEW BOARD

FEB 15 REC'D

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-6583

REPLY TO ATTN OF: CIMI

15 Dec 89

SUBJECT: Thesis/Research Project Approval

TO: Major James Milhollen
2033 Longmeadow Lane
Hoover, AL 35216

Your research topic regarding the relationship between Injury Severity Scores and the body's nutritional need for protein is approved.

WILLIAM R. EDMONDSON, Capt, USAF, MSC
Program Manager, Health Care Education Division
Civilian Institution Programs

APPENDIX D

Data

INJURY SEVERITY SCORE / NUTRITION STUDY

Data

Case	Age/ Sex	ISS	Nitrogen (Gms.)	Days Post Injury	Days on RX
1	33/ M	22	501	19	16
2	21/ F	9	768	17	15
3	45/ M	10	144	10	3
4	39/ F	4	485	12	5
5	30/ M	8	388	7	4
6	22/ M	14	291	7	3
7	23/ M	20	164	7	4
8	36/ F	17	194	5	3
9	33/ F	12	232	7	3
10	37/ M	14	325	13	10
11	34/ M	17	761	14	11
12	40/ F	17	462	25	21
13	20/ M	24	428	16	14
14	47/ M	9	120	8	6
15	49/ F	17	485	11	3
16	28/ M	17	194	8	5
17	22/ M	4	180	5	3
18	38/ F	17	103	6	4
19	50/ M	21	144	11	4
20	20/ M	17	64	4	3

Data (Continued)

21	50/ F	14	54	5	3
22	21/ F	9	761	12	10
23	21/ M	9	107	10	6
24	49/ F	14	272	13	10
25	37/ F	29	315	15	7
26	22/ M	20	652	13	10
27	33/ M	4	154	5	3
28	50/ M	9	112	8	6
29	20/ M	17	212	10	5
30	20/ M	12	382	8	6
31	34/ F	12	298	10	5
32	27/ M	13	421	10	9