

Perceived Knowledge of the Registered Nurse in Managing Hyperglycemia According to Evidence-Based Practice in the Acute Care Setting

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Boca Raton

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Abstract

The purpose of this study was to examine the perception of the registered nurses' knowledge in managing the non-diabetic patient with hyperglycemia in the acute care setting. The evidence that has been identified to keep tight glycemic control has demonstrated better outcomes for this population of patients.

A non-experimental, quantitative approach was used in this study. Data was obtained based on a descriptive design, using a survey to collect information from an identified population. A convenience sample of 298 registered nurses, who worked as staff nurses at a small community hospital, was selected to obtain information for this study.

A questionnaire was the tool developed to collect the data for this research design. This questionnaire was developed from the research results found in the literature. The questionnaire had close-ended questions for the demographic information. Open-ended questions were used on a Likert scale to obtain data on perceived knowledge of evidence-based practice and knowledge on hyperglycemia.

One hundred and one questionnaires were returned yielding a 34% response rate. A normal fasting blood sugar was identified by 72% of the sample and 42% knew the goal of intensive insulin therapy. Certification in a specialty was obtained by 25% of the sample, 33% belonged to a professional organization and 42% subscribed to nursing journals. The questions on evidence-based practice and its place in clinical practice was identified by an

overall average of 13% of the sample. The responses on hyperglycemia in the non-diabetic patient showed an overall average of 21% of the sample with knowledge that is supported by research for best clinical practice.

The results of this descriptive study supported the literature that the number one barrier in managing hyperglycemia is lack of knowledge. Evidence-based practice needs to be imbedded in nursing culture. The delivery of nursing care needs to be benchmarked against research, put into clinical practice, and evaluated. Deliberate care with specific outcomes is the standard that will be required.

Identifying the knowledge of the staff in managing hyperglycemia will allow for educational programs to be developed to bring the knowledge base of the staff nurse forward to achieve best practice.

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CHAPTER ONE

INTRODUCTION

The delivery of nursing care within the hospital setting is an ongoing system of change. Research efforts by multidisciplinary teams are continuously demonstrating improvements in managing disease processes to improve outcomes for patients. Registered nurses are challenged everyday, as primary care givers, to keep abreast of hospital initiatives to deliver care that meets the best standards as identified through research.

One of the challenges that the registered nurse faces in caring for patients with hyperglycemia is keeping updated with the ongoing research. The challenge that the registered nurse faces is how to keep the knowledge of best practice at the forefront of patient care delivery. The generic nursing education that prepares one to take the board of nursing licensing examination addresses only the knowledge that the novice nurse begins her practice. As the nurse makes the journey from novice to expert, how does the assessment of the nurses' knowledge get evaluated? One's organizational skills and technical skills do not necessarily translate into expertise where critical thinking is needed to keep current with best practice.

Diabetes research is revealing the importance of tight glycemic controls for those with diabetes as well as those without diabetes who have an illness or disease. The American Diabetes Association is identifying, through research, how

imperative it is for homeostasis to occur in the presence of a normal glyceamic state. All bodily functions rely on normal blood sugars to keep it running efficiently (Clement et al., 2004).

Problem Statement

How does the registered nurse keep her knowledge current to effectively manage patients with hyperglycemia using evidence based practice?

Background Information

The United States Department of Health and Human Services has identified through evidence that controlling one's blood pressure, cholesterol, blood sugar and weight decreases the adverse effects on health (2000). Reducing health risks with a healthy lifestyle saves lives and reduces costs to the health care system (Hirsch, 2003). Recommendations for educating the public regarding achieving and maintaining health to increase the quality of life should also be part of the care received in the hospital setting.

The Consensus Development Conference on Inpatient Diabetes Control held in December of 2003 identified the need for tighter glyceamic controls in order to improve outcomes. The role of insulin in managing patients with and without diabetes provides metabolic control to achieve homeostasis minimizing the complications that can occur. Maintaining normal blood glucose levels during illness has been shown to reduce the length of hospital stay as well as the complications that may occur in the

presence of hyperglycemia. Decrease in hospital stay reduces cost as reduction in cost care incurred from decreased need for antibiotics, ventilators, dialysis, additional procedures as well as re-hospitalization (ACE, 2003). "Despite the establishment of standards of care published in numerous practice guidelines, optimal clinical outcomes are often not achieved" (Baumann, Chang, & Hoebeke, 2002).

Hospitals are guiding their delivery of quality care by developing standard orders, policies and protocols to keep their standards current with best practice which has been accepted by research. The barriers that exist with changing practice is to change the thinking of the practitioners delivering the care and keeping current with best practice. The data clearly identify that normal glucose levels in the hospitalized patients improves patient outcomes (Hirsch, I., 2005). Lack of knowledge has been identified as the greatest barrier to overcome when lowering the glyceimic goals to improve outcomes.

Purpose of the study

The purpose of this study was to examine the perception of the registered nurses' knowledge in managing the patient with hyperglycemia in the acute care setting. The evidence that has been identified to keep tight glyceimic control has demonstrated better outcomes for this population of patients and are the nurses managing these patients delivering the same standards in managing their blood glucose levels?

Importance of the Study

The knowledge that is being identified through research indicates the importance of managing hyperglycemia during illness in the non-diabetic patient. Evidence-based practice (EBP) allows for an organized, systematic approach in managing patients with specific disorders and conditions. The literature identify the lack of use of EBP in the clinical setting among nursing. Euglycemic patients have fewer complications and decreased length of stays which translates into cost savings. Nursing needs to evolve their practice so care may be delivered using the knowledge gained from EBP and allowing for more deliberate care with specific outcomes. In an environment of escalating health care costs EBP provides the best practice at the best price. If nursing doesn't engage in EBP then other disciplines, such as reimbursement agencies, will dictate nursing practice which will start an erosion of the nursing profession.

Nursing needs to assess EBP and identify how to bring this practice into the mainstream of delivering patient care by having a paradigm shift in its delivery of care. The barriers that exist and how to overcome these barriers need to be identified. Expanding knowledge of research and EBP and integrating this into practice at the bedside could be a valuable approach to offering patients the best outcomes.

Definitions

Best practice: The best approach to managing patients using evidence-based practice which is the standard.

Cytokines: Extracellular factors that are produced by a variety of cells which change or alter the cells which is important in the body's inflammatory response.

Evidence-based practice: Systematic approach to manage illness or disease based on the best results of research used by health care providers.

Euglycemia: Normal concentration of glucose in the blood.

Staff nurse: A registered nurse whose role is practicing in the delivery of direct patient care.

Chapter Two

Literature Review

There are 18.2 million people diagnosed with diabetes in the United States. There are 5.4 million people who have diabetes but have not been diagnosed. There are 20 million people with impaired glucose tolerance, a symptom of pre-diabetes. Diabetes is the 4th most common co-morbid condition with hospitalized patients. Diabetes is also the 5th leading cause of death in the United States (Leahy & Cefalu, 2002). Diabetes is the leading cause of acute myocardial infarctions, stroke, blindness, kidney failure and non-traumatic amputation. It is estimated that diabetes costs our health care system \$132 billion annually to manage this disease, and its complications, according to estimates from the Center for Disease Control (1998). Based on the evidence that adequate blood sugar control decreases the risk of adverse outcomes (U.S. Department of Health and Human Services, 2000), national guidelines that define clinical outcomes based on patient risk factors have been developed.

Diabetes

An understanding of the disease of diabetes mellitus is necessary to identify the associated pathophysiology that occurs as this disease progresses. A decrease in the secretion of insulin from the beta cells of the pancreas is the cause of this disease. The pancreas, a primary endocrine organ, is located behind the stomach which contain the beta cells that secrete the hormone insulin, these beta cells are also referred to as the

Islet of Langerhans. These beta cells which produce the insulin are located throughout the pancreas. A disturbance in the production of insulin interferes with carbohydrate metabolism which has an adverse effect on protein and fat metabolism.

Insulin promotes the utilization of glucose in the body's cells which is needed to maintain normal blood glucose levels. Insulin promotes fatty acid transport and fat deposits into the cells. Insulin promotes amino acid transport into the cells as well as facilitating protein utilization by the cells. Decrease in insulin production by the beta cells is the cause of diabetes mellitus. A lack of insulin prevents glucose from entering the cells allowing the glucose to accumulate in the blood causing a condition known as hyperglycemia (Lewis, Netkeeper & Dirksen, 2000). "Insulin is the key that unlocks the cells, allowing glucose to enter" (Diepenbrock, 2004, p. 257) when glucose is locked out of the cell it remains in the blood. When the cells are deprived of glucose, they starve and cause negative physiological processes since glucose is the fuel that supports the central nervous system. When blood glucose levels are allowed to remain elevated damage occurs to the blood vessels and nerves within the body. This damage is the cause of vascular disease, kidney failure, nerve damage and blindness (Lewis, Netkeeper & Dirksen, 2000).

There are two types of diabetes, Type 1 diabetes is when there is no insulin produced and Type 2 diabetes is when the production is decreased. The cause of Type 1 is still unclear, an autoimmune reaction caused by a virus or an environmental

factor, which destroys the beta cells, is one theory. Type 2 diabetes is related to beta cell exhaustion due to lifestyle and/or heredity factors. Risk factors such as being overweight, family history, Hispanic, Black or North American ethnicity, and gestational diabetes during pregnancy, are all felt to predispose one to Type 2 diabetes (Fong et al., 1993).

Type 1 diabetes is when there is no insulin secreted due to destruction of the beta cells requiring exogenous insulin to be taken to maintain homeostasis. These cells, once destroyed, do not regenerate. Type 2 diabetes results when there is exhaustion of the beta cells due to increasing need for insulin to move glucose into the cell (Fong et al., 1993).

Insulin deficiency causes glucose to build up in the bloodstream instead of being transported to the cells and used for energy. Eventually the blood sugar rises and the kidneys can not reabsorb the sugar and the excess glucose is excreted in the urine. When excess glucose is excreted the body has an increased need for water to excrete the glucose which causes excessive thirst to replace the water loss. This is the hallmark sign of diabetes. Since there is not enough glucose available for cellular oxidation the body burns protein and fat which produces ketones. These highly toxic ketones, the most common is acetoacetic acid, accumulates in the blood and acidosis develops. These acids are excreted through respirations and urine which cause the breath to be fruity and the urine to have a sweet odor. If the acidosis is severe, diabetic coma and death can occur (Smith et al., 2005).

Through diabetes research, the effects of hyperglycemia without diabetes has been identified as having significant adverse effects on health (Van de Berghe, 2004). Hyperglycemia increases the risks for cardiovascular disease. The patient will have larger myocardial infarctions and larger strokes (Ceriello et al., 2004). Hyperglycemia can be a marker of illness and will indicate a poor outcome (Krinsley, 2003). Keeping patients euglycemic, blood glucose levels within a normal range, during illness, allows for improved metabolic control (Van de Berghe, 2004).

The diabetic research has identified the role of hyperglycemia in the diabetic patient as well as those without diabetes. The American College of Endocrinology and the American Association of Clinical Endocrinologists identify early detection and aggressive management of hyperglycemia is needed to improve outcomes (ACE, 2004). Elevated blood sugars during illness have been identified as contributing to poor clinical outcomes associated with increased length of hospital stay, from 4.5 days to 9 days, leading to increase costs, as well as increased morbidity and mortality. The need for nursing home care after discharge is increased as a result of hyperglycemia (Clement et al., 2004).

Hyperglycemia in the acute myocardial infarction patient is a strong predictor of a poor outcome (Malmberg et al., 1999). Hyperglycemia in the acute myocardial infarction has a five time risk of serious complications and a four time risk of dying before discharge compared with the patient whose blood sugar is

kept within the normal range. Hyperglycemia alters the ischemia-reperfusion process and reduces the coronary collateral blood flow needed to minimize cellular myocardial death (Clement et al., 2004). Acute myocardial infarction patients whose blood sugars are allowed to remain elevated have an increased risk of developing congestive heart failure compared with those patients whose blood sugars were normal. Correcting hyperglycemia in the myocardial infarction patient has been identified through research to improve outcomes (Capes et al., 2000).

Hyperglycemia that is not corrected within the first 24-48 hours after surgery is the greatest predictor for post-operative infections resulting in serious complications. Cardiac surgery patients with hyperglycemia have an increased rate of deep wound infections and mortality (Furnary et al., 2004). Research has demonstrated that hyperglycemia depresses the immune system decreasing the process of phagocytosis to occur. (Bridges & Dukes, 2005). Hyperglycemia is a marker for systemic inflammation in response to infection since elevated blood sugars inhibits the body to fight infection. (Ahrens & Vollman, 2003).

Maintaining euglycemia during an acute stroke is vital in minimizing residual deficiencies (Bhalla, & Hargroves, 2004). Maintaining a normal blood sugar for the first 24 hours after a stroke decreases ischemia to the brain (Bhalla & Hargroves, 2004). Hyperglycemia contributes to abnormalities in the clotting cascade leading to thrombosis (Clement et al., 2004) which places the stroke patient at risk for further cerebral

damage. Maintaining a normal blood sugar during this period decreases sepsis, renal failure and mortality (Gray et al., 2004).

The damage done by being in a hyperglycemic state has been clearly documented. A crisis occurs when diabetes is not diagnosed or under treated when the body is undergoing stress (Lewis, Heitkemper & Durksen, 2000). Each time the body is insulted by illness or disease there is a physiological response that naturally occurs in everyone, and that is stress. Stress plays a very important role in illness. Stress increases hormones and cytokines, increasing the body's need for insulin. Therefore, during the stress that results from a pathophysiological condition, exogenous insulin may be needed to correct hyperglycemia (Bloomgarden, 2004). Stress hyperglycemia has been associated with increase in mortality and poor recovery after a stroke and myocardial infarction due to its effect on the vascular system (Capes et al., 2001). A common belief in health care is that stress-induced hyperglycemia is normal. Contrary to that belief, research clearly demonstrates poor clinical outcomes from stress-induced hyperglycemia (Olga et al., 2004).

Certain diseases, by their own pathophysiology, inherently induce altered glucose metabolism causing hyperglycemia, such as cancers, infection, myocardial infarction, Chronic Obstructive Pulmonary Disease, HIV, hyperthyroidism, hypothyroidism, malabsorption syndromes and depression. Patients having surgery who have suffered trauma are also at risk for developing

hyperglycemia (Furnary, 1999).

Certain medications can also cause an elevated blood glucose level. Patients that are on antiretroviral medications, beta-blockers, immunosuppressants, nicotinic acid, phenytoin, pseudoephedrine, steroids, thiazide diuretics are at risk for hyperglycemia and must be checked frequently so they are not living with elevated blood sugars (Furnary, 1999).

Activities within the hospital setting also induce hyperglycemia. Being placed on bedrest, limiting physical activity, causes an elevated blood sugar. Appetite changes that occur due to hospitalization can cause blood sugar fluctuations due to change in balance of foods and decrease intake due to decrease in appetite (Qing et al., 2004).

The landmark DIGAMI (Diabetes and Insulin-Glucose Infusion in Acute Myocardial Infarction) study provided the outcome data to support tight glycemic control in all patients, not just those patients with diabetes. This study looked at 600 patients with an acute myocardial infarction and managed them randomly with either traditional care (whatever care the primary care physician decided upon) or aggressive care using insulin to keep glucose levels normal. There was a 30% decrease in mortality in those patients who were kept euglycemic with insulin. Published in 1999, there were many critics and care was never standardized (Malmberg et al., 1999).

Dr. Greet Van den Berghe et al. published their one year study in 2001 involving insulin therapy on 1,548 surgical patients in an Intensive Care Unit and got the attention of the

whole medical field. This study looked at critically ill patients and hyperglycemia. These patients were randomly selected to receive intensive insulin therapy by infusion (maintaining blood glucose levels between 80 and 110 mg/dL) and conventional treatment (starting treatment if blood sugar level goes above 215 mg/dL and maintaining the blood sugar level between 180 and 200 mg/dL) with intravenous insulin. The data from this study were overwhelming to the medical world. The intensive insulin therapy groups' mortality decreased from 8% to 4.6%. These patients needed fewer days on mechanical ventilation, hemodialysis, and the need for blood transfusions was reduced by 50%. Length of stay in the Intensive Care Unit was reduced compared with those patients who received conventional treatment. Blood sepsis decreased by 46%, kidney failure by 41% and polyneuropathy by 44%. This therapy reduced in-hospital mortality by 34%.

The Van de Berghe study demonstrated the link between hyperglycemia and the adverse effects it causes in the presence of disease. Dr. Hirsch (Titus, 2004, p. 2). calls the Van de Berghe study "the biggest, most important randomized study to look at the importance of tight glycemetic control." This study will direct appropriate care of patients with hyperglycemia.

A study published in the journal *Circulation* (Chaudhuri et al., 2004) looked at patients who had an acute myocardial infarction and received the drug TPA which is used to dissolve the obstructing blood clot to open the coronary arteries to allow reperfusion. Patients who received intravenous insulin to

keep their blood sugars normal had a 30% reduction of dead heart muscle which demonstrated a smaller myocardial infarction.

Ongoing research is clearly defining how maintaining a normal physiological balance of plasma glucose is essential for well being. The American Diabetes Association (ADA) annually updates the guidelines for managing diabetes in clinical practice using the most current data available through research. Through the information learned through diabetes research, new knowledge is presented on how to manage non-diabetics who develop hyperglycemia as a result of pathological stress. The 2004 ADA recommendations for achieving a healthy state has become the standard for everyone by maintaining a blood pressure less than 130 mm Hg systolic and less than 80 mm Hg diastolic and keeping the A1c less than 7%. The A1c test measures the glucose attached to the hemoglobin which gives an index of glycemic control for the preceding 2-3 months since hemoglobin in the red blood cell has a half life of 60-90 days (Leahy & Cefalu, 2002). The Adult Treatment Panel III [ATP III] of the National Cholesterol Education Program supports the lowering of the lipid profile cholesterol less than 200 mg/dL, LDL less than 100 mg/dL, HDL greater than 40 mg/dL (men), greater than 50 mg/dL (women), and triglycerides less than 150 mg/dL. Blood sugar goals are 80-110 mg/dL for critical patients who are not eating and 110 mg/dL before a meal, for those less ill who can eat, and 180 mg/dL maximum glucose for these patients after they eat (Brinton, 2005) (see Table 1). Tight control of the blood glucose level causes a beneficial homeostatic effect (Colin,

2004).

Table 1

Glycemic Targets in Hospitalized Patients

Intensive Care Unit
110 mg/dl
Non-Critical Care Units
110 mg/dl preprandrial
180 mg/dl maximal glucose

Source: American Association of Clinical Endocrinologists

Microvascular and macrovascular complications that result from diabetes has been demonstrated through research that the non-diabetic patient can exhibit these same complications in the presence of illness. Evidence clearly supports the need for strict glucose control and that it can only be done through structured care (Renders et al., 2001).

In their position statement, the American College of Endocrinology identifies four effects of managing hyperglycemia with the use of exogenous insulin. Hyperglycemia elevates free fatty acids which contributes to poor outcomes, especially cardiac arrhythmias. Hyperglycemia stimulates inflammatory growth factors which hinder cellular recovery after an acute myocardial infarction. Hyperglycemia inhibits nitric oxide production resulting in vasoconstriction inhibiting oxidation and the body's response to inflammation. Finally, hyperglycemia has been linked to development of pro-inflammatory cytokines, which alter the cells ability to fight infection (ACE, 2004).

Prompt glucose control should begin once the patient enters the Emergency Room or is a direct admission from the physician's office. Stress hyperglycemia is associated with any acute illness (Sakharova, 2004). "It is clear that hyperglycemia in the hospital setting has been ignored for too long throughout the United States" (Moghissi, 2005, p. 1693). Elevated blood sugars are common yet rarely treated (Kosiborod et al., 2005). Initial patient assessment should include blood sugar levels, with appropriate insulin therapy, to minimize the adverse effects of hyperglycemia on their presenting illness (Funnell,

2005). Changes in the microvascular system develop during hyperglycemia and go undetected especially in the presence of other illnesses (Charkoudian et al., 2002). Hyperglycemia is often overlooked when other medical conditions exist (Moghissi, 2005), "glucose control takes a back seat to these seemingly more pressing concerns" (Inzucchi & Rosenstock, 2005, p. 978). Insulin therapy to normalize blood sugar levels provide the patient an improved recovery with fewer complications (Dow, 2005).

Evidence-based Practice

As a result of ongoing research in the area of diabetes, other patient populations are benefiting through the evidence of the adverse effects of hyperglycemia on the body. Managing hyperglycemia in the non-diabetic patient has resulted in improved outcomes with the management of tighter glycemic controls with intravenous insulin (Malmberg et al., 1999) Integrating research results into clinical practice provides for a solid approach for evidence-based practice (EBP) by incorporating concrete sources, research, scientific knowledge and clinical knowledge allowing nursing care to use EBP to improve outcomes (Hirsch, 2005). This evidence provides a framework for delivering care.

EBP results from research which demonstrates an approach to improve outcomes. "Best evidence contains only studies that have been pre-appraised for scientific validity and pre-screened for clinical relevance" (Marik, 2001, p. 48). Randomized controlled clinical trials (RCT) is the gold standard in

healthcare to evaluate the effect of an intervention on patient outcomes (Hackett et al., 2000). It is the strength, the highest level of evidence, from the RCT that is being implemented and evaluated. EBP identifies specific actions for an expected outcome, steps to deliver care that will be the standard for the given situation. Guidelines to standardize care are developed to minimize deviations in practice (Pearson, 2002). A framework to collect data on the outcomes are established assessing the delivery of care of identified conditions to many patients using the same approach. Unfortunately, only a small percentage of nursing divisions in the United States are basing their practice on EBP, indicating that research has failed to influence care (Melynk & Fineout-Overholt, 2000).

Before EBP was developed, the delivery of care was based upon clinical practice learned empirically and learned as apprentices from experienced clinicians (Hackett, 2000). Specific actions for specific outcomes were being evaluated by the patients' progress. With EBP, results from data collected from the outcome is benchmarked against the research as it translates into clinical practice. The data from the research comes from concrete sources which include the integrity of the research (evaluated by peers), clinical knowledge and scientific knowledge, which collectively is evidence-based practice. The evidence that results from the outcomes can support current practice or support a need to demonstrate a change in practice generating more research (Bonell, 1999).

It has been clearly documented through research that