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The Nurse's Knowledge of Blood Conservation as a Part of Blood Management

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THE NURSE'S KNOWLEDGE OF BLOOD CONSERVATION AS A PART OF BLOOD MANAGEMENT

by

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Abstract

Medicine has historically regarded blood transfusion as an integral component of major surgery or illness. However, clinical studies have shown that allogeneic blood transfusions are associated with increased morbidity and decreased survival. Knowledge of this research and the concepts of blood conservation so as to avoid unnecessary blood transfusions is needed in order to deliver holistic care and serve as patient advocate. This knowledge reaches every specialty of nursing care.

This study of the nurse's knowledge of blood conservation as a part of blood management utilizes The Conservation Model developed by Myra E. Levine in 1973. Levine's work is a conceptual model of nursing that focuses on conservation of the person's wholeness (Tomey & Alligood, 2002). It is defined as "keeping together" of the life systems and the integrity of the individual (Schaefer, 2006, p. 98). The Theory of Conservation is based on the assumption that all nursing actions are conservation principles (Schaefer, 2006). Conservation is further defined in the model as achieving a balance of energy supply and demand that is within the unique biological realities of the individual (Tomey & Alligood, 2002). The model proposes that the nurse participates actively in the patient's environment, and much of what the nurse does supports the patient's adaptations as he struggles in the predicament of illness. Maintaining or conserving a patient's viable resources such as skin integrity, immunity, oxygen demand and blood supply are essential in providing an environment in which the patient can heal.

Because knowledge of blood conservation as part of blood management is vital to providing appropriate care and avoidance of unnecessary blood transfusion, this research examines what knowledge practicing nurses in varying areas of expertise possess

regarding blood conservation. This study of the nurse's knowledge of blood conservation as a part of blood management was conducted using a convenience sample of registered nurses employed at a rural acute care hospital with no formal blood conservation program or bloodless medicine and surgery services. The study sample represented various areas of practice and all educational levels. A survey consisting of basic questions regarding blood conservation strategies and concepts was administered to practicing registered nurses. The survey was developed using current literature focusing on blood conservation techniques. The survey found that a minority of nurses gained education regarding blood conservation in their nursing programs. It also revealed a lack of knowledge related to appropriate indicator for blood transfusion and demonstrated that nurses discard an unnecessary amount of blood when drawing blood samples from central lines. The limitations of this study included small sample size and researcher developed questionnaire.

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CHAPTER I

Introduction

A growing appreciation exists for the accelerating risks involved in transfusing donated blood, the costs associated with transfusion, as well as refusal of some patients to accept blood transfusion. These concerns have recently gained much popularity and given rise to formal blood conservation and management programs and strategies to minimize blood transfusions. Current knowledge as well as the increasing desire of medical professionals to comply with ethical principles has encouraged researchers and clinicians to develop standards of care that aim to avoid unnecessary transfusions or allow transfusion-free medical and surgical care. These developments minimize transfusion for the benefit of all patients and the options range from simple practice changes to complex technology.

In recent years, the roles of blood transfusion as necessary and lifesaving have come into question. “Although conceptually attractive, evidence that transfusion augments oxygen delivery has been elusive to establish in ICU practice, and purported beneficial effects may in fact be considerably attenuated or even harmful” (Jackson & Shorr, 2005, p. 1421). Modern transfusion medicine resulted from the necessity to treat severely bleeding patients when relatively few resuscitation options were available (Thomson, Farmer, Hofmann, Isbister, & Shander, 2009). Because it was initially successful, transfusion was considered to be indispensable in modern therapies such as high dose chemotherapy, transplantation and complex surgeries. “Much of the use of blood associated with such treatments has not been based upon science, but on tradition and anecdotal experience” (Thomson et al., 2009, p. 425). However, focus was on

ensuring *safe administration* of the blood products used, with much less attention to the *clinical use* of the product and *resulting implications*. This can be seen in the curriculum content of medical and nursing programs that focus on safe administration of blood products, but include little content regarding appropriate clinical indication and effectiveness of blood transfusion therapy. This study of the nurse's knowledge of blood conservation as a part of blood management revealed that 64% of study participants were familiar with blood conservation/bloodless medicine and surgery. Twenty-eight percent had gained this familiarity from employers, forty-five percent from media or friends and coworkers, and only 9% from their nursing school program. A variety of factors are, however, now changing the previous paradigm such that modern medicine has begun to question the clinical benefits of blood transfusion. With the changing views regarding blood transfusion therapy, the medical, ethical, legal and economic evidence cannot be ignored and thus should become a part of an increasing number of nursing and medical programs. "Patient blood management needs to be implemented as the standard of care for all patients" (Thomson et al., 2009, p. 423).

Background and Significance of the Problem

Since the early 1980's, the potential health risks associated with blood treatment have raised concerns with consumers and the medical community. Diseases such as AIDS and hepatitis became topics of concern. Although extensive testing procedures have been established to safeguard blood supply against hepatitis B and C viruses, human immunodeficiency viruses 1 and 2, and human T-lymphotropic viruses I and II, transfusion is still associated with a limited risk of infection by these viruses as well as other pathogens. However, more threatening are bacterial infection risks, which are far

more frequent than viral infections. For example, it was estimated that for every 100 transfusions, 3-12 would be infected with cytomegalovirus in 2004 (Tokin et al., 2009). While screening for the most common known organisms does continue to improve, time as well as resources and yet undiscovered risks are mostly not considered. Despite improvements, infectious agents are expected to remain a threat. West Nile Virus, Severe Acute Respiratory Syndrome (SARS) virus, Chagas disease and variant Creutzfeldt Jakob disease show an ever changing profile of potential risk from transfusion (Thomson et al., 2009).

In addition to the threat of introducing infectious agents, allogeneic blood transfusions can also trigger changes in the recipient's immune system. Blood transfusion can be viewed as analogous to organ transplantation. It places the patient at risk for rejection, graft-versus-host disease in which the cells in donated blood attack the recipient's tissues and organs, and may also result in renal and hepatic complications. Current research suggests that transfusion-induced immunosuppression may reactivate latent viruses, increase the likelihood of postoperative infections, and trigger the recurrence of malignancies.

Blood transfusion can pose additional problems for critically ill patients, particularly those in need of rapidly improved oxygen delivery. Transfusion of stored blood greater than 2 weeks not only does not improve oxygen transport, but may contribute to the development of tissue ischemia in patients with sepsis due to the microcirculatory occlusion of some organs (Koch et al., 2008). Current studies are being conducted regarding transfusion of blood stored < 2 weeks (Clinicaltrials.gov, 2010).

In addition, bacteria are most often found in platelets, which are stored at room temperature. Some bacteria implicated in sepsis, including Yersinia enterocolitica and Pseudomonas flourescens, are known to grow at the blood-storage temperature of four degrees Celsius (Schlossburg, 2008).

The respiratory distress syndrome associated with transfusions, called TRALI (transfusion-related acute lung injury) constitutes a serious risk that may be presently underestimated, as it often goes unrecognized and under-treated. TRALI describes a particular form of acute respiratory distress syndrome (ARDS) that occurs after transfusion and which is caused by antibodies in plasma of a single donor unit reacting with leukocyte antigens in the recipient. By virtue of its morbidity and mortality, TRALI has become one of the most serious current complications of transfusion (Bux, 2005).

Further, the cost of transfusion has increased, due in part to the variety of tests to which the donor blood must be subjected. Although donors give their blood free of charge, the mean costs of recruiting donors and processing, storing, and shipping donated blood was about $495 per unit in 2003 (Pfeifer, 2003). Today that cost has risen to upwards of $1183 per unit (Shander, Hofmann, Ozawa, Theusinger, Gombotz, & Spahn, 2009).

As policies to decrease infectious contamination of donor blood are instituted, more and more potential donors are prohibited from donating. The donor pool continues to shrink, and the nation’s blood supply has been steadily declining (Zou, 2008). A major shortage is predicted in the US by the year 2030 due to the expectation of an unprecedented number of baby boomers undergoing orthopedic surgery (Cogliano & Kisner, 2002).

Historic and projected data show that the age segment of persons over the age of 65 will increase by as much as 146%, while the age range eligible to donate blood will only increase by 38% (Thomson et al., 2009). This is important because the over age 65 group receive significantly more blood transfusions than the younger group. Supply pressures are therefore only likely to increase. Adding to this, unnecessary blood transfusions help deplete the current and future available national blood supply (The Joint Commission, 2007). Therefore, blood conservation and management must become priorities in healthcare delivery, if not out of attention to quality care, then out of necessity.

Blood Conservation as a Part of Blood Management

"Blood management" or "Patient Blood Management" (PBM) is the term used to describe the appropriate provision and use of blood, its components and derivatives, and strategies to reduce or avoid the need for a blood transfusion (http://www.sabm.org, November 24, 2010). Patient blood management is based on three pillars: detecting and treating preoperative anemia, reducing the loss of red blood cells perioperatively, and optimizing the treatment of anemia (Spahn, Moch, Hofmann, & Isbister, 2009). The use of the term "blood management" recognizes that allogeneic blood transfusion is periodically necessary and is the most modern approach rather than the terms "bloodless" or "transfusion-free" medicine. The term "blood conservation" highlights the need to conserve blood, which is an aspect of PBM. The terms "bloodless" or "transfusion-free" which refer to clinical strategies for medical care without allogeneic or autologous blood transfusion is a well-defined area. In this type of care, the same range of techniques is

applied, but the option of allogeneic blood transfusion is not available either for religious reasons, personal preference, or some other clinical scenario.

From an administrative standpoint, the primary reason for patient blood conservation and management is cost. Allogeneic blood transfusion is very expensive and the more blood that is transfused directly impacts hospital expenditures. Consequently, the increasing cost of transfusions is the reason many hospital administrators are endeavoring to establish blood management programs. From the physician's viewpoint, the primary reason for blood management is to improve patient outcomes, which are achieved with the reduction or avoidance of exposure to allogeneic blood. Clinical studies have shown that allogeneic blood transfusions are associated with increased morbidity and decreased survival, while exposing the patient to viral, bacterial, or parasitic agents. And from the nurse’s standpoint, knowledge of these concepts is needed to understand the risks of transfusion and blood conservation strategies, as well implement nursing measures that reduce blood loss or increase tissue perfusion.

History of Bloodless Medicine and Surgery

In 1962, Dr. Denton Cooley made history by performing the first "bloodless" heart surgery. He reported this case in 1964. Dr. Cooley pioneered performing intricate heart and vascular surgery without blood on adults and children. Since then many specialties have been added to the growing list including trauma, hematology, critical care, internal medicine, and orthopedic surgery. Even surgical procedures traditionally associated with high blood loss are now performed without transfusion. Examples include prostate, cardiothoracic, cancer, brain, gastrointestinal, orthopedic, gynecologic, multiple valve replacements, and liver transplantation surgeries. Study results show that patients

are surviving complex procedures without the use of transfusion and that their outcomes are as good as, if not better than, similar patients who receive blood transfusion (Thomson et al., 2009).

The number of formal patient blood management (PBM) programs in the US alone increased from only a few in 1990 to more than 200 individual programs today with numbers aggressively increasing (Thomson et al., 2009). The number of programs is similar in Canada and countless other countries have programs implemented. Implementation of a PBM requires a cultural transformation and collaboration of all medical disciplines. A PBM program aims to identify patients at risk of transfusion and provide a management plan aimed at reducing or eliminating the need for transfusion. PBM comprises three main elements: (1) correction of a low preoperative erythrocyte mass or preoperative anemia, (2) minimizing perioperative erythrocyte loss, and (3) using low hemoglobin-based transfusion triggers (Spahn Moch, Hofmann, & Isbister, 2008). Even when the clinical situation is uncertain, historically, blood transfusion has been administered and this is not usually the case with other therapies. Blood transfusion is an inherently hazardous and costly therapy that should only be prescribed when there is evidence for patient benefit outweighing the potential for harm (Spahn et al., 2008).

Emerging Regulatory Standards for Blood Conservation

While there have been regulatory standards for blood utilization oversight and transfusion safety from a variety of agencies, elevation of these standards to performance measures changes the focus from "nice-to-know" information to actual patient care guidelines that will affect quality care delivery scores and reimbursement.

The Joint Commission is the acknowledged leader in developing standards for quality and safety for healthcare, and for evaluating performance within healthcare organizations based on these standards. Considering the fact that more than 18,000 health care providers use The Joint Commission standards to guide how they administer care and improve performance, the establishment of Blood Management Performance Measures will focus light on an important area of patient care that has been inadequately addressed in many hospitals (Gammon, 2010). The Joint Commission's Division of Quality Measurement and Research has been developing standardized performance measures for the past 20 years. Most hospitals are familiar with the measures sets that evaluate treatment of acute myocardial infarction, heart failure and pneumonia. There are currently ten different measures sets that hospitals can use to gauge quality of care. Due to the increased interest in the area of blood utilization and blood management, The Joint Commission initiated a project in 2008 to identify and test a set of standardized performance measures addressing blood management. The Blood Management Performance Measures project has completed the pilot testing phase. More than 75 hospitals across the country participated from February 2010 – July 2010. Listed below are the seven measures that were considered:

• Transfusion Consent

• RBC Transfusion Indication

• Plasma Transfusion Indication

• Platelet/Prophylactic Platelet Transfusion Indication

• Blood Administration Documentation

• Preoperative Anemia Screening

• Preoperative Blood Type Screening.

With an overall objective to evaluate blood transfusion necessity, the first measure evaluates transfusion informed consent including documentation of patient education of the risks, benefits and alternatives to blood transfusion. Three measures assess transfusion of blood products for inpatients > four months of age. To meet these measures, a documented clinical indication and pre-transfusion laboratory value are needed. One measure addresses nursing documentation of vital signs during transfusion administration. The last two measures evaluate patients > 18 years of age at high risk for transfusion. These measures assess whether the patient was screened preoperatively for anemia and blood type. The collective data will demonstrate blood transfusion necessity, demonstration of patient education regarding alternatives to transfusion and assessment and correction of preoperative anemia that would likely decrease the need for blood transfusion in the perioperative patient.

"The Blood Management Performance Measures project is a tremendous opportunity to develop a set of evidence-based, standardized blood management performance measures that will have a positive impact on patient care as well as focus on the appropriate utilization of the precious resource of blood", says Harriet Gammon of The Joint Commission's Division of Quality Measurement and Research. "Pilot participants have already noted that the data abstraction experience has revealed areas for improvement as they examine their current blood management processes" (Gammon, 2010, para. 5).

Theoretical Framework

This study of the nurse's knowledge of blood management and conservation utilizes The Conservation Model developed by Myra E. Levine in 1973. Levine's work is a conceptual model of nursing that focuses on conservation of the person's wholeness (Tomey & Alligood, 2002). It is defined as "keeping together" of the life systems and the integrity of the individual. Conservation is further defined in the model as achieving a balance of energy supply and demand that is within the unique biological realities of the individual (Tomey & Alligood, 2002).

Theory Overview

According to Levine, the process by which conservation is achieved is adaptation and the desired outcome is integrity or wholeness. Adaptation is the process by which people maintain their wholeness or integrity as they respond to environmental challenges. There are 21 major assumptions in the Conservation Model of which (1) will guide this research. It is that the nurse creates an environment in which healing could occur (Schaefer, 2006). According to Levine's model, nursing interventions are based on conservation of the patient's integrity (Tomey & Alligood, 2002). The nurse is seen as part of the environment and shares the repertoire of skill, knowledge, and compassion, assisting each patient to confront environmental challenges in resolving the problems encountered in the patient's own unique way. The effectiveness of interventions is measured by the maintenance of patient integrity. Nursing intervention is structured according to conservation principles and to promote adaptation (Tomey & Alligood, 2002). Levine describes the goal of nursing as to promote wholeness, realizing that every individual requires a unique and separate cluster of activities and that it is the nurse's

responsibility to assist the patient to defend and to seek the realization of his integrity (Tomey & Alligood, 2002).

Hypothesis

A major concept of the Conservation Model is energy conservation (McEwen & Willis, 2002/2007). Levine feels that nursing interventions are based on conserving of the patient's energy. She defines nursing as supportive and therapeutic interventions that are based upon scientific or therapeutic knowledge. As stated, a major assumption in the Conservation Model is that the nurse creates an environment in which healing can occur (Tomey & Alligood, 2002). If, however, knowledge is lacking about supportive or therapeutic interventions, it is not possible for the nurse to create this healing environment, therefore conservation of energy and conservation of integrity cannot occur.

Current nursing instruction regarding blood management is geared toward safe delivery of blood products. This is undeniably a very important nursing skill, but not all that needs to be considered when caring for an anemic patient or one experiencing trauma or undergoing surgery. While unable to disclose information about specific test content on the National Council Licensure Examination (NCLEX), the National Council of State Boards of Nursing acknowledges that content on the NCLEX is the result of practice analysis surveys which are a reflection of the practice of nursing in multiple major practice settings (National Council of, 2010). The 2010 Test Plan shows that 16-22% of the question content is dedicated to management of care, of which quality improvement is a part (National Council of, 2010). Blood management and conservation is far-reaching and is applicable to every nursing specialty. Due to current lack of education in nursing programs and practice settings regarding blood conservation and management, there is a

knowledge deficit among nurses. The hypothesis driving this research is that practicing nurses do not possess adequate knowledge about blood conservation measures. Utilizing a knowledge inventory questionnaire concerning concepts, goals and nursing measures regarding blood management and conservation, this research will answer the research question “What knowledge is lacking among nursing regarding blood conservation as a part of blood management?”

CHAPTER II

Review of Literature

A review of the literature was conducted in CINAHL, Google Scholar, OVID, PubMed and EBSCO Host using key words “blood transfusion risks”, “patient blood management”, “blood management”, blood conservation”, blood conservation strategies”, bloodless surgery and medicine”, “transfusion-free medical and surgical care”, “blood management performance measures” and “nursing measures in blood conservation”. “There’s an avalanche of data that supports bloodless medicine,” says Dr. Edwin A. Deitch, medical director of the University Center for Bloodless Surgery and Medicine and chairman of the Department of Surgery at New Jersey Medical School (Medicine in a Different, 2003). This statement proves true when one begins to research the topic of blood conservation. There amount of research studies, societies and organizations dedicated to this subject is overwhelming. Says Dr. Deitch, “We now know that receiving donated blood can suppress the immune system and that the risks of transfusions can be greater than that of anemia. Doctors have fewer reasons today to transfuse blood than in the past” (Medicine in a Different, 2003).

Risks Associated with Transfusions

Murphy et al. (2007) conducted a study of 8724 patients in a randomized control trial. They found that red blood cell (RBC) transfusion in patients having cardiac surgery is strongly associated with increased infection, ischemic postoperative morbidity, increased hospital length of stay, increased early and late mortality, and increased hospital costs. They concluded that it is difficult to identify patients in whom transfusion is truly necessary on the basis of hematocrit, age, or comorbidity, but that transfusion

appears to be harmful for almost all cardiac surgery patients and wastes a scarce commodity and other health service resources.

To determine the timing and incidence of postoperative infections associated with blood transfusion, Shander et al. (2009) observed 1489 patients undergoing orthopedic or cardiac surgery at 9 different hospitals. Infections included pneumonia, sepsis, urinary tract infection, surgical site infection, catheter-associated bacteremia, osteomyelitis, septic arthritis, and cardiovascular infection. A total of 455 patients underwent cardiac and 1034 orthopedic surgery. Results showed that the overall relative risk of postoperative infection was 3.6-fold greater for the patients given an autologous blood transfusion (ABT) compared with patients not having ABT in both the cardiac and orthopedic groups.

In an animal study using two tumor models, Atzil et. al (2008) found that blood transfusion was found to be an independent and significant risk factor for cancer progression in models, causing up to four-fold increase in lung tumor retention, and doubling mortality rates. Blood storage time was the critical determinant regardless of whether the transfused blood was allogeneic or autogenic.

Nursing Conservation Measures

Some strategies to decrease blood loss may be used throughout all phases of patient care. Micro-sampling techniques, for example, can be used consistently from preadmission through discharge thereby reducing blood loss due to phlebotomy. Critically ill patients lose clinically significant amounts of blood during routine phlebotomy for diagnostic tests.

Pabla, Watkins and Doughty (2009) conducted an observational study of 70 consecutive patients admitted to an acute renal medicine ward in a tertiary care hospital over a period of four months. Inclusion criteria included adult patients with acute or chronic renal failure. Patients actively bleeding were excluded. Blood loss due to phlebotomy was determined from the patient's computerized records. The total mean blood loss from phlebotomy during hospitalization was 215.8 ± 166 mL with a mean weekly blood loss of 55.7 ± 11.23 mL.

Further, it has been estimated that the volume of routine blood samples for standard tests can equal as much as 45 times the volume for required analysis (Pfeiffer, 2003). Arkin et al. (2009) found that the use of pediatric collection tubes resulted in a 37% reduction in blood loss from phlebotomy and was associated with a significant reduction in the proportion of patients requiring blood transfusions. There are many older studies demonstrating reduction in blood loss with blood conservation strategies. For example, Smoller, Kruskall & Horowitz (1989) demonstrated that the use of pediatric blood collection tubes reduced the volume of blood loss through phlebotomy by 47%. Amounts of discarded blood should be limited to only the necessary amount needed to clear the catheter when obtaining samples from arterial catheters. In an older study, discarded volumes accounted for 24% to 30% of the total daily blood loss in ICU patients (Dech & Szaflarski, 1996). The researcher was unable to find any more current studies related to phlebotomy blood loss because positive pressure and blood draw devices are readily available for use on central lines. Many facilities employ their use and thus minimize blood loss related to phlebotomy. If a facility, such as the one in this study,

adheres to older policies on discard amounts, it is reasonable to conclude that values found in these previous studies remain relevant.

Outlining strategies for blood management in critical care patients, Pfeifer and Vernon (2003) provide a framework for developing a blood conservation mentality in the critical care setting. They note that nurses at the bedside can play a key role in decreasing the need for transfusion by reducing oxygen demand by managing pain and anxiety and by preventing hypothermia. The article cites numerous sources for qualitative and quantitative studies performed to show the effectiveness of these and other blood salvaging and conservation strategies decreasing the need for transfusion. Blood conservation can be practiced in many ways, some of which are not even noticeable to the patient. Patient positioning is a simple measure that involves elevating the surgical site to reduce arterial pressure and facilitate venous drainage away from the surgical wound (Goodnough & Shander, 2007). Reductions in phlebotomy volumes can be made through the use of smaller test tubes and point-of-care micro-analyzers for blood gas, electrolyte, and hemoglobin analyses. Non- invasive monitoring, such as pulse oxymetry and capnography, can also reduce the number of samples required for blood gas analysis. Other simple nursing measures to decrease oxygen consumption by reducing stressors in critically ill patients can be employed, such as limiting mobility and turning and foot massage (Hayes & Cox, 1999).

Perioperative Conservation Measures

To minimize blood loss perioperatively, several conservation techniques are available. Intraoperative autotransfusion, plateletpheresis, cardiopulmonary bypass, hemodilution, hypotensive anesthesia, maintenance of normothermia, fibrin sealants and

the use of minimally invasive surgery whenever possible are some examples. Cautery is better today than in the past and includes argon beam plasma coagulators which use argon gas and high-frequency electrical current to keep bleeding under control. Some newer instrumentation includes a variety of tools that rapidly stop bleeding such as harmonic scalpels, which use ultrasound, and microwave-coagulating scalpels.

Rajagopalan et al. (2008) conducted a systematic search of published randomized trials that compared blood loss and/or transfusion requirements in normothermic and mildly hypothermic (34–36°C) surgical patients. Fourteen studies were included in analysis of blood loss, and 10 in the transfusion analysis. They concluded that even mild hypothermia (<1°C) significantly increases blood loss by approximately 16% and increases the relative risk for transfusion by approximately 22%. Thus, maintaining perioperative normothermia reduces blood loss and transfusion requirement by clinically important amounts.

Strategies to increase available oxygen supply include hyperoxic ventilation or the administration of 100% oxygen during surgery to quickly boost the concentration. Red blood cell production can be increased with epoetin alfa, or EPO, a genetically engineered form of erythropoietin. By binding to erythroid progenitor cells in the bone marrow, erythropoietin stimulates the production of mature erythrocytes, generating a reserve of red blood cells. EPO essentially allows patients to bank their blood in their own bodies. The efficacy of EPO has been demonstrated in a variety of elective surgical settings. Similarly, in critically ill patients with multiple organ failure, EPO therapy will also stimulate erythropoiesis. In a 2006 study, Alghamdi et al. reviewed the effectiveness of erythropoietin in reducing the risk of exposure to allogeneic blood transfusion during

or after cardiac surgery. A meta-analysis of 11 identified randomized controlled trials, reporting comparisons between erythropoietin and control, was undertaken. The primary outcome was the number of patients exposed to allogeneic blood transfusion during or after cardiac surgery. They reviewed eleven studies, involving 708 patients. In total, 471 patients were given erythropoietin, and 237 patients formed the control group. The results showed that the administration of erythropoietin with and without preoperative autologous blood transfusion prior to cardiac surgery is associated with a significant reduction in the risk of exposure to allogeneic blood transfusion (Alghamdi, Albanna, Guru, & Brister, 2006).

The anesthesiologist also has a pivotal role in blood conservation, with such options as hypotensive anesthesia, which lowers the patient's blood pressure and results in reduced blood loss. The surgeon can use surgical lasers and argon beam coagulators, practice careful cutting techniques, and clamp blood vessels to minimize bleeding. When there is excess bleeding, "cell saver" technology can collect the blood, cleanse it, and place it back in the patient's body. In addition, laparoscopic, or minimally invasive, surgeries significantly reduce the amount of bleeding.

Hemodilution is another useful technique where one or more units of blood are taken from a patient immediately before surgery and replaced with IV fluids to compensate for the missing blood. The patient's blood is diluted, so fewer red blood cells are lost. The blood that was drawn is slowly returned to the patient through a continuous circuit. Terada et al. (2001) conducted a study including 16 consecutive patients scheduled for radical prostatectomy. The first eight patients underwent conventional preoperative autologous blood (PAD) donation of 400 mL (1) week before the operation

and the second eight patients underwent acute normovolemic hemodilution (ANH) followed by immediate operation. Preoperative and postoperative hematocrit levels in the two groups were compared. The study found no differences in preoperative hematocrit or operative blood loss between the two groups. The postoperative hematocrit did not differ between the two groups. The two blood-conservation strategies resulted in similar postoperative hematologic outcomes. Terada et al. concluded that given its advantages, which include lower cost, lower risk and higher convenience, ANH is one of the procedures that may replace conventional PAD for use in radical prostatectomy.

From the review of literature it is apparent that the modern use of blood has not been based upon scientific evaluation of benefits, but mostly on anecdotal experience and a variety of factors are challenging current practice. Blood is a precious resource with an ever limiting supply due to the aging population. Costs have also continually increased due to complexities in collection, testing, processing and administration of transfusion. Risks of transfusions remain a major concern even with advances in screening. Accumulating literature demonstrates a strong association between transfusion and adverse outcomes. These include increased length of stay, increased postoperative infection, increased morbidity and increased mortality. To this end, the recent consensus concludes that there is little evidence that blood would improve most patients' outcomes in the vast majority of scenarios in which transfusions have been historically considered. From the literature, there are many nursing and perioperative blood conservation strategies that can be employed that minimize the risk of transfusion. Blood conservation options should be adopted and transfusion avoided wherever possible.

CHAPTER III

Method

Survey Development

The survey instrument, Nurse's Knowledge of Blood Conservation Survey, was developed by the researcher from literature focusing on blood conservation and patient blood management. Prior to administering, the instrument was pretested on a small group of practicing nurses and also reviewed by an experienced director and educator of a bloodless medicine and surgery program and revised based upon recommendations. It was designed to be completed within 15-20 minutes The instrument included (3) demographic questions, (2) Yes/No topic familiarity questions, (7) questions related to aspects of blood conservation strategies in multiple choice format and (1) opinion question.

Data Collection

The study was conducted using a convenience sample of acute care registered nurses at a rural acute care facility. The survey packet included a cover letter, a consent form outlining the study and the Blood Conservation Knowledge Questionnaire. The study subjects were informed their participation was voluntary and refusal to participate would not result in any penalty. The survey instrument was personally distributed in paper form by the researcher to registered nurses employed at an acute care facility. Instructions were included in the study instrument coversheet to return to the researcher through confidential interdepartmental mail. The completion and return of the survey implied consent. A total of 45 surveys were returned from a possible 88 for a return rate of 51%. Statistical relationships were determined using statistical package SPSS.

Survey Questions

The questions were randomly placed within the survey but were categorized by source of knowledge of blood conservation, known risks of blood transfusion, appropriate indicator for transfusion, strategies to minimize or avoid transfusion and nursing measures to reduce blood loss. Each of the questions had a research based source included in the reference list.

Ethical Considerations

The survey itself did not present any ethical considerations since there was no patient involvement or a change in practice by the study participants. Participants were informed in the cover letter that if they felt uncomfortable answering any questions, they were free to withdraw from the study. Anonymity was insured by asking the study participants to refrain from putting identifying remarks on the returned survey.

Chapter IV

Results

This study revealed that there was no significant difference in overall score related to level of education or by area of expertise although some areas were not well represented due to low number of survey participation. See below.

Knowledge Score by Level of Education

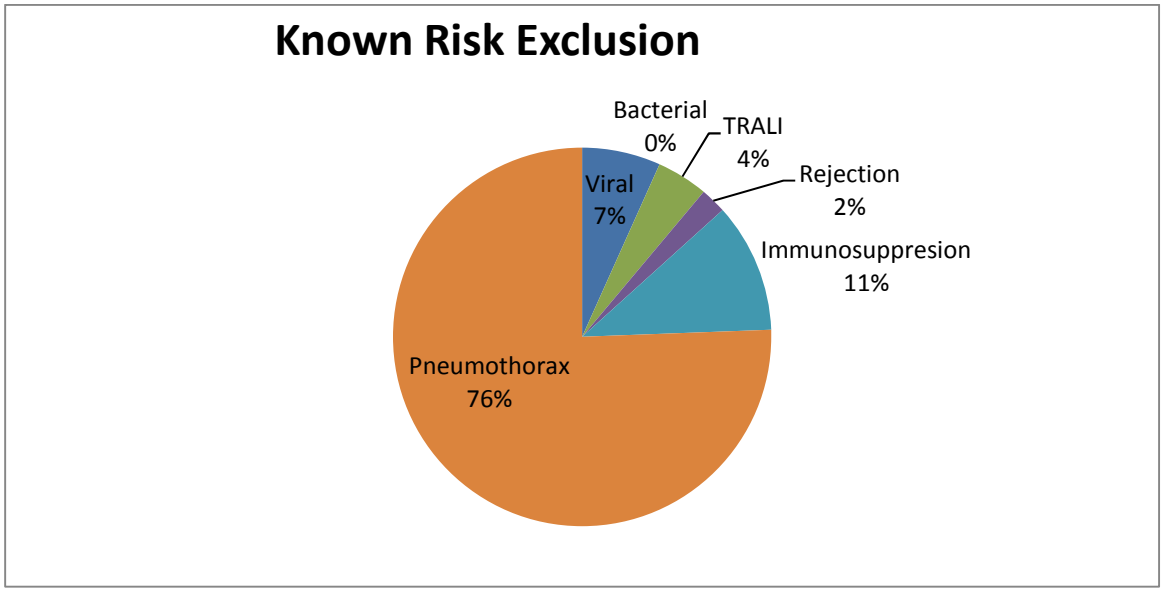
	N	**Mean ± sd**
Diploma	4	67.9 ± 13.68
Associate	17	63.0 ± 21.46
Bachelor	18	67.5 ± 15.34
Master	6	66.7 ± 14.75
(p=0.8878)		

Knowledge Score by Area of Experience or Expertise

	N	**Mean ± sd**
Emergency Room/Adult Intensive Care	11	70.1 ± 13.48
Adult Med-Surg/Orthopedics/Oncology	16	62.5 ± 21.43
Perioperative	9	61.9 ± 17.50
Pediatrics/Maternal/GYN	2	57.1 ± 20.20
Radiology/Nuclear Medicine	1	71.4
Quality Management/ Systems Mgt/ Administration/Education	6	73.8 ± 10.75
(p=0.6297)		

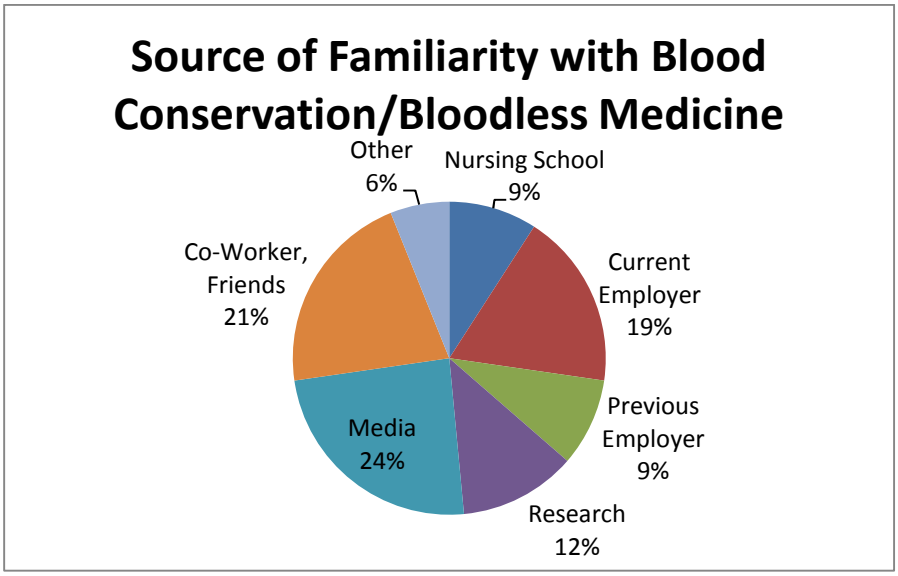
The study revealed that nurses were mostly familiar with known risks of blood transfusions with 76% of the study participants recognizing these risks. Question 3 was an exclusion question with pneumothorax being the exclusion answer. See Figure 1.

Figure 1. Known Risks Exclusion Question 3.



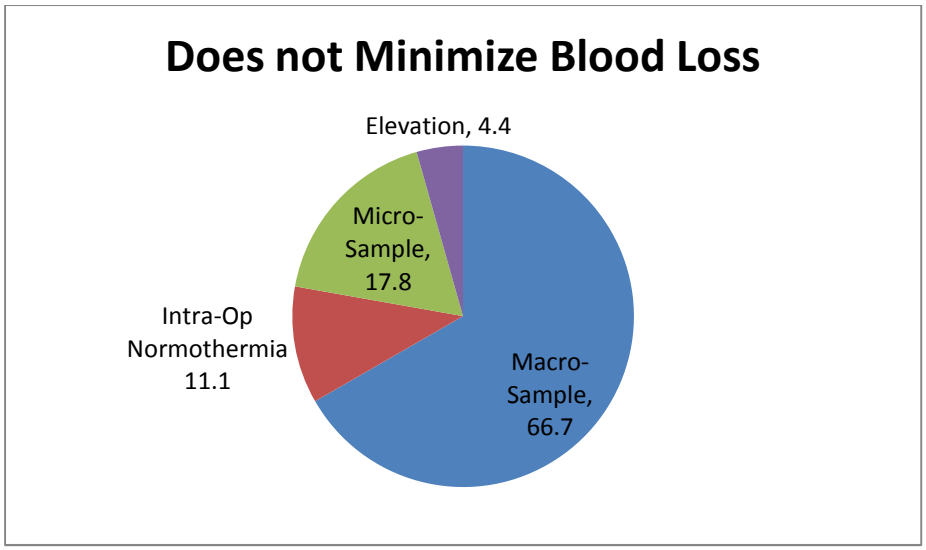
As mentioned, focus in education of blood management has traditionally been on ensuring the *safety* of the blood products used, with much less attention to the *clinical outcomes* of the product. This can be seen in the curriculum content of medical and nursing programs that focus on safe administration of blood products, but include little content regarding appropriate clinical indication and effectiveness of blood transfusion therapy. This study revealed that 64% of study participants were familiar with blood conservation/bloodless medicine and surgery. Twenty-eight percent of participants had gained familiarity from an employer, past or current; 45% had gained familiarity through media or friends and coworkers; but a mere 9% had gained this familiarity in their nursing school program. See Figure 2.

Figure 2. Source of Familiarity Question 6.



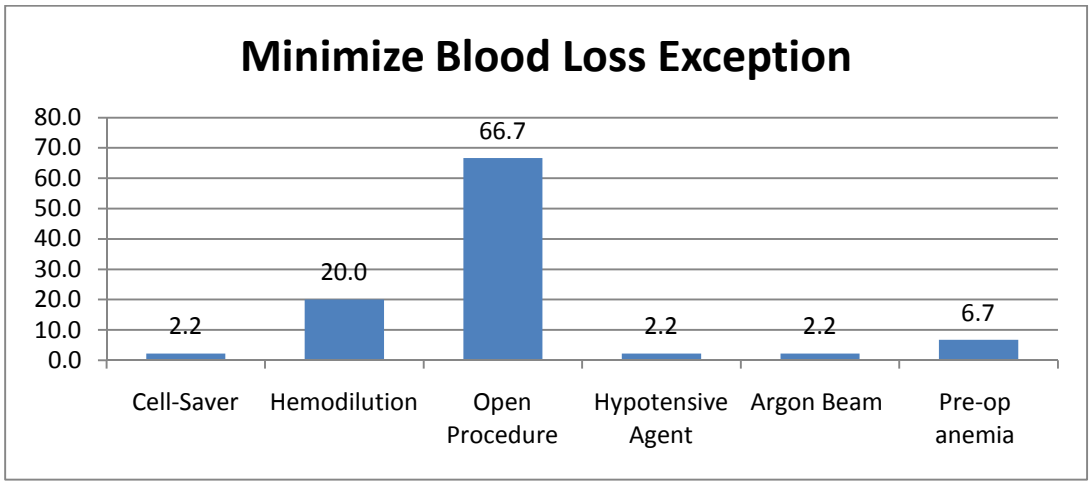
Although macro-sampling is standard practice at the study facility, 67% of the study participants recognized this as a practice that does not minimize blood loss. Further study would be needed to determine if nurses at this facility recognize their current practice as macro-sampling. See Figure 3.

Figure 3. Nursing Measures to Reduce Blood Loss Question 7.



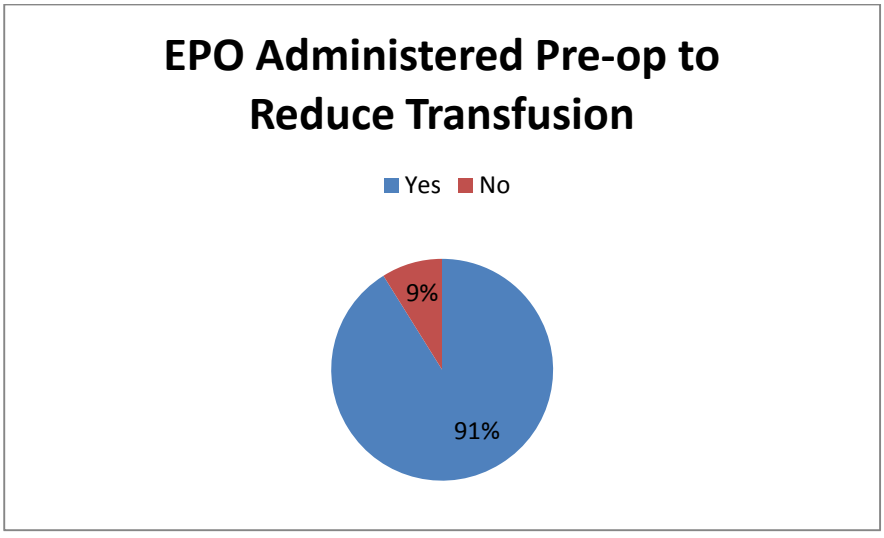
The study revealed that a majority of participants recognized measures to reduce blood loss. Question 8 was an exception question with open laparoscopic procedure being the correct exception. See Figure 4.

Figure 4. Strategies to Minimize Blood Loss Exception Question 8



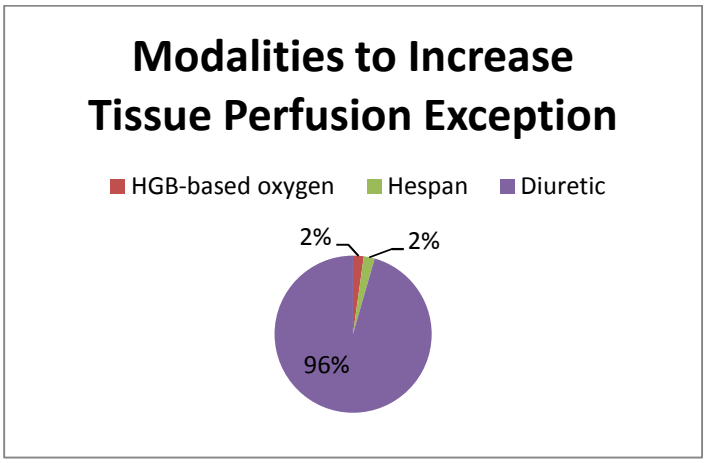
Among perioperative measures with the goal to increase RBC production and reduce risk for perioperative RBC transfusion is the administration of erythropoietin. Most study participants recognized erythropoietin as a therapy that can be administered with this goal. See Figure 5.

Figure 5. EPO Question 9.



Several modalities can be implemented for a patient that is hypovolemic from trauma or active bleeding to increase tissue oxygenation. Almost all nurses recognized these modalities and chose the appropriate exception answer. See Figure 6.

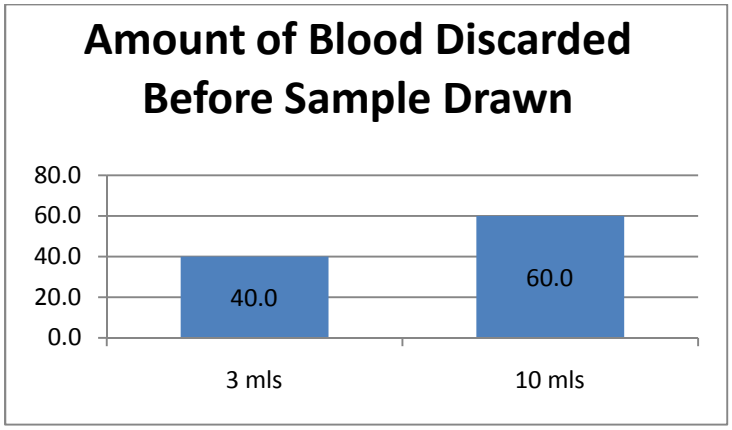
Figure 6. Modalities to Increase Tissue Perfusion Exception Question 10.



Reducing blood loss due to phlebotomy depends upon having critical care nurses implement conservation protocols and monitor levels of blood loss. Practice recommendations include periodically reviewing orders with patients' physicians to assess the frequency and types of routine diagnostic tests needed, questioning physicians about potentially repetitive or unnecessary tests, and suggesting noninvasive monitoring techniques when appropriate. Diagnostic tests can often be scheduled simultaneously so the same blood sample can be used for all of them. Recording blood loss due to phlebotomy on ICU flow sheets can decrease the amount of blood patients lose, presumably by heightening awareness among care providers and leading to discussion between nurses and other members of the critical care team about other blood conservation measures. Blood samples for diagnostic testing are commonly taken up to 24 times per day depending on patient illness acuity, ease of sampling and institutional

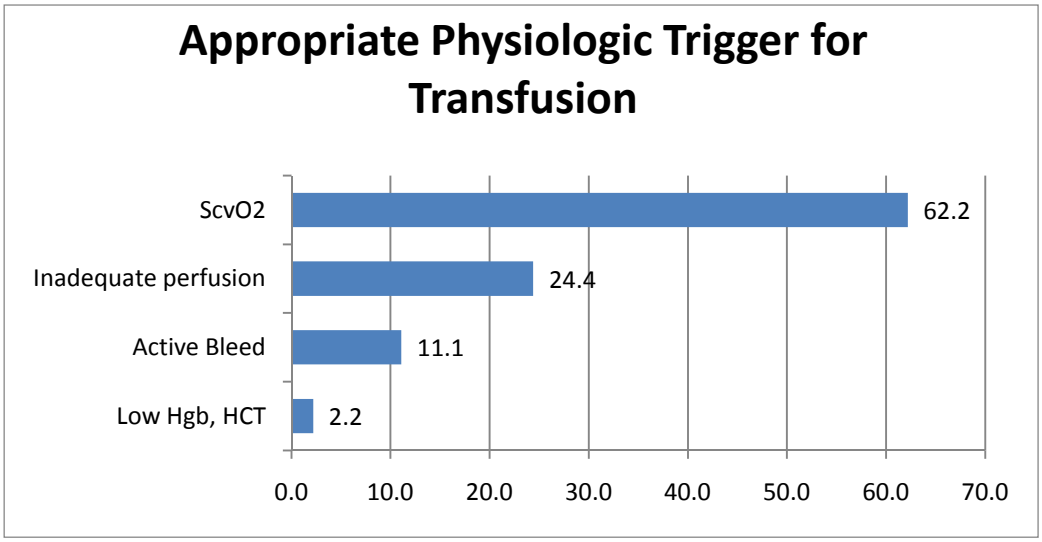
practice. In-dwelling central venous or arterial catheters contribute to increased sampling and blood loss because of the ease of sampling and because of the added requirement to discard the first few milliliters (mls) of infusate-blood mixture obtained when collecting blood from a fluid-infusing catheter. Policies dictating the amount of waste required differ among institutions, but the goal of the waste is only to clear the line of infusate. The Infusion Nurse's Society's guidelines suggest a *maximum* waste of 1.5 - 2 times the fill volume of the catheter (Infusion Nurse's Society, 2011). Most standard central venous catheters have ports with 3 ml lumens and thus the needed amount of waste required would be a maximum of 4.5 mls - 6 mls. In the study facility, the written protocol for waste is a liberal, but appropriate 5 mls. However, this study revealed that 60% of nurses waste 10 mls before withdrawing the needed sample, with one study participant even handwriting on the survey that the policy at the facility was 10 mls. See Figure 7.

Figure 7. Amount of Blood Discarded Question 11.



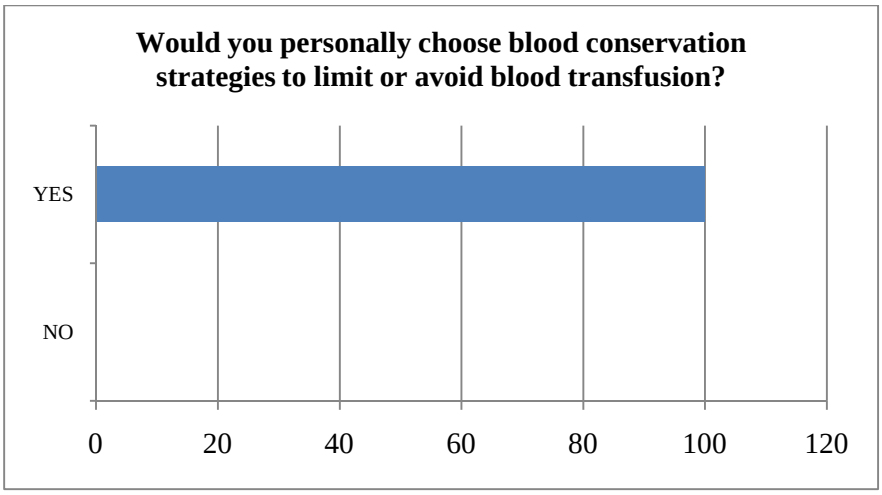
Because of lack of knowledge, nurses in the study answered Question 12 in a variety of ways. Only 24.4% recognized the appropriate answer. See Figure 8. Antiquated practice treated patients with blood transfusion following an untested “10/30” rule (Hgb 10, Hct 30). Common practice was to transfuse when levels dropped below these established “triggers”. Current research demonstrates that patients can tolerate much lower levels of anemia and that indication of transfusion should be based upon the overall clinical picture of the patient and that the trigger should be evidence of inadequate tissue perfusion.

Figure 8. Appropriate Trigger Question 12.



Question 13 on the knowledge survey requested an opinion from the study participants. When asked if they themselves would choose treatments and measures that encouraged blood conservation and limited or avoided the need to receive a blood transfusion, 100% of the study participants answered “yes”. See Figure 9.

Figure 9. . Choice of Blood Conservation Measures Question 13.



Because all nurses in the study answered yes to this question, it seems that there exists a desire to see a change in standard practice as it relates to blood transfusion. At the minimum, it demonstrates that nurses recognize the risks associated with blood transfusion therapy and see the benefits of blood conservation measures and alternatives. Therefore, it is necessary that nurses gain accurate knowledge of blood conservation as a part of overall blood management to provide better care for their patients and to make informed personal healthcare decisions.

CHAPTER V

Discussion

When most people hear the words ‘bloodless’ or ‘transfusion-free’, they immediately think of Jehovah’s Witnesses. Historically Jehovah’s Witnesses have been the largest users of bloodless and/or transfusion-free medicine and surgery. However, in recent years the objective of many individuals and organizations, both in the medical community and the lay public, has been to expand this approach to medicine to a much larger population. Religious, ethical and legal issues aside, one must take a hard look at whether or not blood avoidance offers benefits for the community at large. It is hoped that responsible patient blood management becomes the standard of care for any medical or surgical patient. One cannot deny that there are many modalities that have been heavily relied upon in the past, even as it relates to the use of blood, that are now considered archaic and unscientific. With current, available, proven techniques the future looks bright in providing safer and more effective care minimizing the need for blood transfusion.

Although bloodless medicine and surgery was created in response to the needs of Jehovah’s Witness patients, the interest in bloodless medicine has expanded to people outside this group. In 2002, non-Witnesses comprised 25% to 30% of patients undergoing bloodless surgery (Cogliano & Kisner, 2002). As research continues and alternatives are made more readily available and encouraged, it is reasonable to surmise that the percentage will increase and blood conservation will become standard of care for all patients. In the not too distant past, the divergence between medical necessity and personal beliefs might have resulted in a legal and ethical conflict. But today, options are

available that can turn confrontation to cooperation. Even with overwhelming research dedicated to the topic of conservation and the fact that technology is available, thought to conservation has been slow to become standard care, but it is inevitable.

This study hypothesized that practicing nurses do not possess adequate knowledge about blood conservation measures and aimed to answer the research question “What knowledge is lacking among nursing regarding blood conservation as a part of blood management”? The study demonstrated that nurses do possess knowledge of the risks associated with transfusion and recognize some options for minimizing risk for RBC transfusion. Also, the study revealed that nurses have knowledge of modalities that can be employed to increase tissue perfusion. However, the study revealed that nurses have minimal knowledge of appropriate blood transfusion “triggers”. Further, the study revealed that practice regarding blood waste amount before samples are taken from central lines vary at the study facility and the majority of nurses in the study do not follow current guidelines nor study facility protocol regarding waste amount. Of the nurses that were familiar with blood conservation strategies or bloodless medicine and surgery, the majority did not gain this knowledge in their nursing school program. This study demonstrates a need for education of nurses regarding blood conservation measures and patient blood management for reasons already stated. This education should be initiated in a nursing school program as it is essential information that is far-reaching to all nursing specialties and is part of emerging regulatory standards of care. Although nurses in the study recognized components of the overall goal to conserve blood, the “big picture” seems to be missing. This could be remedied if presented in a nursing school program. Nursing programs already include elements of PBM. Content reveals that

appropriate administration of blood products is included as well as blood transfusion consent and appropriate documentation of vital signs during transfusion, which are part of PBM. While considering these aspects of PBM, education should encompass all facets of PBM. Nurses need this knowledge to remain current with emerging practice changes and regulatory practice guidelines. According to Levine, nursing interventions are based on conservation of the patient's integrity (Tomey & Alligood, 2002). Therefore, knowledge of the conservation of a patient's most precious resource is significantly important.

Appendix A

Knowledge of Blood Conservation Survey

Your participation in this study is voluntary and confidential. Please do not put any identifying marks on the survey such as name or department. The results of this study will be used to determine general knowledge level in the identified topic. The results will in no way be used for penalization. Therefore, please do not research answers to the following questions, only answer the questions to the best of your ability. Once completed, place the survey in an interdepartmental envelope and return to Lindsey Austin, RN, BSN in the Quality Management Department of Cleveland Regional Medical Center.

Please circle the appropriate answer to the following questions.

1. What is the highest level of nursing education that you have completed?
   a. Diploma
   b. Associate's Degree
   c. Bachelor's Degree
   d. Master's Degree
   e. Doctoral Degree

2. In which area of nursing do you have the most experience or feel that is your area of expertise?
   a. Adult Intensive Care/ Emergency Room/Telemetry
   b. Adult Med-Surg/ Orthopedics
   c. Perioperative
   d. Pediatrics/Maternal/GYN
   e. Radiology/Nuclear Medicine
   f. Quality Management/ Systems Management/Administration/Education

3. Known risks of blood transfusion therapy include all but which of the following?
   a. viral infections
   b. bacterial infections
   c. TRALI (transfusion-related acute lung injury)
   d. rejection/graft-versus-host disease
   e. immunosuppression
   f. pneumothorax

4. Are you familiar with the term or concept of blood conservation?
   a. Yes
   b. No

5. Are you familiar with the term or concept of bloodless medicine and surgery?
   a. Yes
   b. No

6. If you answered yes to questions 4 or 5, where did you gain familiarity with these terms or concepts?
   a. nursing school program
   b. employment at current facility
   c. previous employment as a nurse at another facility
   d. personal research.
   e. media such as TV, newspaper, internet.
   f. coworker, friend, family member.
   g. other, please specify _____

7. Nursing measures that have the goal of diminishing blood loss thereby reducing the need for RBC transfusion include all but which of the following?
   a. macro-sampling of blood
   b. maintenance of intra-operative normothermia
   c. micro-sampling of blood
   d. elevating a surgical site to reduce arterial pressure and facilitate venous drainage away from the surgical wound

8. The following therapies that can be implemented perioperatively with the goal to reduce red blood cell loss or minimize need for RBC transfusion include all but which of the following?
   a. intra-operative autotransfusion (cell-saver)
   b. hemodilution
   c. preference to open versus laparoscopic procedures
   d. hypotensive anesthesia
   e. argon beam plasma coagulator
   f. preoperative anemia identification and correction

9. Epoetin alfa (erythropoietin or EPO) can be administered preoperatively to a patient with a planned surgery to increase red blood cell production so as to potentially diminish need for intra-operative or post-operative RBC transfusion.
   a. True
   b. False

10. The following modalities that can be implemented for a patient that is hypovolemic from trauma or active bleeding to increase tissue oxygenation include all but which of the following?
   a. hyperoxic ventilation
   b. hemoglobin-based oxygen carrier
   c. plasma expanders (i.e. Hespan)
   d. diuretics

11. When drawing blood samples from a *standard* triple lumen, central line, what is the correct amount of blood that should be drawn and discarded before drawing the amount needed for the sample?
    a. 3 mls or amount necessary to clear the line
    b. 10 mls
    c. 20 mls

12. Which physiologic "trigger" warrants RBC transfusion?
    a. Hgb<10, Hct<30
    b. active bleeding
    c. evidence of significantly inadequate tissue perfusion
    d. central venous oxygen saturation (ScvO2) <70%
    e. Hgb<8
    f. fatigue

13. If you were a patient, would you choose treatments and measures that encouraged blood conservation and limited or avoided the need for you to receive a blood transfusion?
    a. Yes
    b. No

Appendix B

Consent Form

REASEARCH PARTICIPANT CONSENT FORM

Nurse's knowledge of blood conservation as part of blood management.

Lindsey P Austin

Gardner-Webb University

School of Nursing

You are invited to participate in a study that will examine the nurse's knowledge of blood conservation as a part of blood management. This research will be used for a Master's Thesis and will be presented to the faculty of Gardner-Webb University Nursing Department. This is a voluntary study and refusal to participate will not result in any penalty. There will be no cost to you. Although there is no compensation, your participation in the study may benefit nursing in providing a basis for further education.

Methods of Research

You will be asked to complete a survey that asks questions about your knowledge of blood conservation and management. Completion of this survey will take approximately 15-20 minutes.

The answers to the knowledge survey will be analyzed by the researcher to identify current knowledge base of practicing nurses regarding blood conservation.

Risks and Benefits

There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. The results of the study may help to determine needed education for practicing nurses regarding blood conservation.

Confidentiality

Your participation in this study is completely voluntary and is anonymous. This information will be stored in a secure place, and not shared with anyone on an individual basis. Your survey responses will be strictly confidential. No one participant will be identified, rather data from this research will be reported only in the aggregate and will be shared with the Gardner-Webb School of Nursing.

Questions or Concerns

The researcher conducting this study is Lindsey P Austin, RN, BSN. Any questions or concerns should be directed to Lindsey P Austin, RN, BSN at (704) 477-8798, lindsey.austin@carolinashealthcare.org or Dr. Cindy Miller at Gardner-Webb University, (704) 406-4364, mlmiller@gardner-webb.edu.

Completion of the survey will constitute your voluntary consent to participate in this study.

Thank you very much for your support.

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