Weighing the Risks of Blood Transfusions and the Benefits of Bloodless Surgery

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Issue

Healthcare professionals view blood transfusions as life savers. This is evidenced in research that shows that from 1997 to 2007, patients who received blood transfusions more than doubled from 1.1 million to 2.7 million. Blood transfusions represent the medical procedure with the largest increase over the decade (2009 AHRQ). The Elliot Hospital in Manchester, NH reports having 325 blood transfusions on average per month over the past year (blood bank supervisor, personal communication, April 20, 2010). Records do not specify how many blood transfusions occurred in planned surgery, emergent situations, or labor and delivery. At Catholic Medical Center, also in Manchester, 5,194 total products were transfused in 2009 (L. Baryd, personal communication, April 20, 2010).

In the clinical setting, during an OR observation, a blood transfusion was not necessary due to blood conservation made possible with a tourniquet minimizing blood loss during a total knee replacement. In the outpatient setting during a clinical rotation at the Elliot Hospital, the routine visits to the outpatient branch of the Fitch Unit were largely for blood transfusions and the occasional monthly intravenous medication dosages.

Thus, the impression seems to be that blood transfusions are the norm, and that everyone undergoing surgery is blood typed and crossed just in case a blood transfusion will be needed. On a more personal level, through study and research, bloodless surgery is an amazing alternative that is not only more accommodating for patients with different opinions, fears, cultural and religious backgrounds, but it also has served as a breakthrough in modern medical practices—increasing the effectiveness of medical interventions, decreasing medical costs, infection, mortality and lengths of stay in the post-operative setting. Therefore, seeing blood
transfusions in regular practice during clinical rotations in the Southern New Hampshire region is cause to ask the question, “What about going bloodless?”

So, what are the risks and benefits, here? And in going bloodless, what are the alternatives and their respective risks and benefits? In undertaking this research assignment and literature review, it is suspected that the idea of going bloodless will be strongly supported and that this is a new trend in the healthcare field.

**Clinical Bottom Line**

It is important to know if the current practice of transfusing blood is supported by the best possible evidence based research because evidence based practice integrates research evidence with clinical expertise and patient values. Evidence based practice can be applied to something new such as new disease management or a new treatment method or it can be applied to something that is already in place that may need updating due to new technology, costs, or risks outweighing benefits of the current practice. “We too rarely question the evidence base for commonplace practices in our working lives, including the use of blood and blood products, and I am glad that we are reconsidering this” (Picton 2008).

With more and more talk about the risks that accompany blood transfusions, efforts have been made to achieve a safer blood supply. In turn, this has made healthcare costs skyrocket. Along those lines, compensation that has been paid to families of patients that experience complications of receiving tainted blood and adverse effects of blood transfusions has added to this cost increase.

The main driving force that has caused this move toward bloodless surgery are the Jehovah’s Witnesses. Due to religious beliefs, ABO incompatibility, viral infection, bacterial infection, immunosuppression, and screening limitations all contribute to the weighty risks and
negative factors that come with blood transfusions. According to Professor Donat Spahn from the Institute of Anesthesiology at the University Hospital in Zurich, Switzerland, “side effects include not only HIV and Hepatitis C, but also new viruses that are prevalent in a donor population” (Watchtower, 2002). Cogliano and Kisner (2002) suggested that even patients who do not have religious reasons for refusing blood transfusions are also looking for alternatives due to the risks of blood transfusions.

The World Health Organization calculates that, around the globe, unsafe transfusion and injection practices cause about five million hepatitis C infections each year. Yes, physicians and patients are faced with transfusion complications, supply shortages and concerns about blood product safety (Watchtower, 2002).

Professor Neil Blumberg, Director of the Transfusion Medicine Unit and Blood Bank at the University of Rochester, NY states that “There is a growing concern on the part of physicians that our approach to blood transfusions needs to be reevaluated… We’ve estimated that approximately in the United States we can expect that ten to fifty thousand patients a year maybe dying from transfusion immunomodulation related causes” (Watchtower, 2002). According to Taber’s Medical dictionary, immunomodulation is “The alteration of immune responses with… plasmapheresis” (Taber’s, 2010). Thus, the immune response can be altered in an undesirable and extreme way in response to a blood transfusion.

Nevertheless, it is possible that the current practice in place is not supported by evidence based research and the potential for harm it may bring upon the patient, family, or health facilities and personnel is present and large. By taking the best possible evidence based research into consideration, clinical uncertainty can be decreased while shedding light on and increasing confidence in newer interventions that will lead to desirable, patient-centered outcomes.
Case and Clinical Question

In patients undergoing planned surgery, would considering blood transfusion alternatives when compared with standard blood transfusion interventions lead to less infections, complications and mortality rates, shorter hospital stays, decreased costs and increased patients satisfaction?

This is a topic of interest due to personal preferences on the refusal of blood transfusions and the breakthroughs that have presented themselves in some light research that I have done.

Search and Studies

The databases that were searched were The Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus with Full Text, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, and MEDLINE.

CINAHL covers professional journal in nursing and allied health disciplines giving access to healthcare books, nursing dissertations, conferences, standards of practice, and other publications from 1937-present.

The Cochrane Central Register of Controlled Trials and the Database of Systematic Reviews is a collection of evidence-based medicine databases, including full text articles, systematic reviews from around the world, and a bibliography of controlled trials from 2004-present.

Medline includes over four million citations on research, clinical practice, administration, policy issues, and health care services from 1966-present.

Key words used in the search were “bloodless surgery”, “blood transfusions/blood transfusion risks”, and “blood transfusion alternatives”.

Many articles were discarded because they were not at a high level of evidence. These included a variety of case studies and journal articles. Due to the vast array of low-level
evidence that was coming up during the search, modifications had to be made. Limiters for each database were set (CINAHL was limited to systematic reviews, research, and clinical trials. Medline and The Cochrane Central Register of Controlled Trials were limited to meta-analyses, randomized controlled trials, clinical trials, and controlled clinical trials). Similarly, numerous references for meta-analysis were included but were not available in full text; therefore, limiting the search to studies available in full text proved to be very beneficial.

Articles used in this analysis:


Evidence

*Cochrane Database of Systematic Reviews*, (4), Retrieved from Cochrane Database of Systematic Reviews database.

In a systematic review entitled *Cell Salvage for Minimising Perioperative Allogeneic Blood Transfusion*, 75 randomized control trials with adult participants 18 years of age or older undergoing elective surgery were considered. The amount of patients and blood transfused, re-operation for bleeding prevalence, post-operative complications (i.e. thrombosis, infection, organ failure), mortality and length of hospital stay of patients using cell salvage were all considered. The procedures varied including orthopedic, cardiac, and vascular surgeries. Of 6025 patients, 3048 were randomized to cell salvage and the exposure to blood transfusion was decreased by 38%. The study also looked into whether or not the blood was washed, when and where the cell salvage machine was used and placed, and the volume of blood transfused via cell salvage. The cell salvage method showed no significant impact on mortality, hospital length of stay or re-operation for bleeding, but infection was significantly decreased (RR 0.88; 95% CI 0.37 to 2.07). The fact that mortality was not affected goes to show that going bloodless does not have any negative repercussions. At the same time, infection was decreased which indicates that going bloodless presents with some benefits.

Sources of bias included the size of each trial. The majority of the trials included less than 60 participants. The meta-analysis discussed the risks of using a cell-salvage machine. These included air embolism, nephrotoxicity, and coagulation disorders. While a meta-analysis is and level-one evidence and this meta-analysis was very thorough, the need for a larger comparative trial of the efficacy, safety and cost-effectiveness of cell salvage is huge.
In *Bringing Bloodless Surgery into the Mainstream*, a very strong case study done on November 29, 1999, a patient undergoing a liver transplant at a hospital in Pittsburgh, PA did not want to accept a blood transfusion. In this study, the benefits and success of bloodless surgery are nicely outlined based on this patient and the cell-salvage approach to bloodless surgery is strongly supported by a short postoperative hospital stay and stable lab values and patient status.

A number of alternatives to blood transfusions were used here including preoperative medical therapies such as iron sulfate, recombinant erythropoietin and vitamin K. Preoperative blood sampling was minimized and if necessary microsampling techniques were used and consolidated. The patient was on the transplant list and undergoing preoperative therapy for six months. When she finally was ready for her transplant her hematocrit had fallen to 31%, her platelet count had dropped to 103,000/mm$^3$, and her prothrombin time had increased to 17 seconds.

Often times when patients do not accept blood transfusion for religious or other reasons this indicates that they do not accept whole blood or the four main components of blood. The patient in this study was given individualized, patient-centered care and each component of blood was discussed. It was decided by the patient that she could accept plasma proteins albumin, globulins and fibrinogen and clotting factors, vitamins and hormones.

Along with these exceptions, a cell salvage machine was used—an incredible alternative to blood transfusions. Special care was taken not to disrupt the circuit or allow the blood to sit stagnant—both of which the patient was against.

With all of the measures taken to perform a successful bloodless surgery, the patients postoperative lab values were all comparable to—if not better than—her preoperative values. She was extubated on her second postoperative day, catheters were removed on the their
postoperative day, and by the fifth postoperative day the patient was transferred out of the ICU. On the eleventh postoperative day the patient was discharged with an iron supplement and continued on erythropoietin until her hematocrit level was 35%.

Other blood transfusion alternatives were considered in this study. Hypotensive anesthesia lowers the mean arterial pressure and decreases bleeding. Hemodilution reduces the number of red blood cells lost during surgical bleeding. Blood volume expansion with normal saline causes an increase in cardiac output but a decrease in hemoglobin concentration. Intraoperative blood salvage saves up to 60% of red blood cells usually lost during surgical bleeding. Monitoring of the body’s temperature can increase platelet release and aggregation. Also using products such as fibrin glue, gelatin foam or thrombin spray decreases blood loss. Lastly, electrocautery decreases bleeding at surgical sites.

A case study is one of the lowest level of evidence—a level 6.

In 2005, the American Journal of Transplantation published an article entitled *To Do or Not To Do Living Donor Hepatectomy in Jehovah's Witnesses: Single Institution Experience of the First 13 Resections*. From June 1999 to April of 2004 a study was conducted at the University of Southern California University Hospital. In this controlled study, thirteen consecutive bloodless living donor hepatectomies were performed on seven male and six female adult patients with an average age of 37 years. These hepatectomies were done using various blood transfusion alternatives such as cell salvaging techniques, acute normovolemic hemodilution and fractionated products. The study described acute normobolemic hemodilution as the removal of up to 10–20% of the blood volume at the beginning of the procedure while maintaining intra-vascular volume of the patient by replacing the blood that was removed with
either a crystalloid and/or colloid solution. The 10-20% of blood removed was maintained ‘in continuity’ (a closed, active circuit) and later reinfused when no further bleeding was anticipated.

In seven out of the thirteen donors, blood loss was so scanty that it did not even warrant a reinfusion of the blood removed. In the other six donors, an average of 190 ccs of blood was reinfused from the cell saver. There were no complications, the average hospital stay was 6.2 days and the mortality and morbidity rate was 0%.

The study also included a metaanalysis of a few other studies—comparing the results of these thirteen surgeries with the reported morbidity rate for liver donors as of the year 2000 at 10% (Gridelli 2000). In another study conducted in 1999, at least 5 kidney and 2 liver donors died as a direct consequence of surgery involving blood transfusions (Vastag, 2003).

In another report, the perioperative morbidity and mortality for 449 live donor liver transplants, sixty-five donors had one or more complications including the need for non-autologous blood transfusion in 22 donors (4.9%), major post-operative wound infection (1.1%) and 1 donor death (0.2%) (Brown & Russo, 2003).

Finally in 1852 living donor hepatectomies the rate of transfusion was 1.6% prior to 1999, and 0.6% thereafter. In addition, their experience also indicated 0% perioperative mortality despite the decrease in transfusions (Umeshita, Fujiwara & Kiyosawa, 2003). With further research it is likely that many of these patients could have gotten away without needin a transfusion This evidence shows that going bloodless is “at least as effective as and possibly superior to a liberal transfusion strategy in critically ill ICU patients” (Hebert, Wells & Blajchman et al, 1999).

A research study conducted from 2000 to 2005 by the Department of Surgery, Division of Cardiovascular and Thoracic Surgery from the University of Minnesota, Minneapolis along
with the School of Nursing, University of Minnesota, Minneapolis, provided a high evidence controlled trial. This was published in the Journal of Cardiac Surgery in 2007 and was entitled *Bloodless Cardiac Surgery is Associated With Decreased Morbidity and Mortality.*

All patients who underwent a coronary artery bypass graft (CABG), a cardiac valve replacement or repair, and those who underwent a combined CABG and valve procedure were included in the study.

While strongly supporting the benefits of bloodless surgery, this evidence had many strengths in that it considered a number of variables to avoid any biases that my present themselves. These included twenty-two preoperative risk factors for blood transfusion such as age, sex, race, type of procedure needed (CABG, valve replacement, and a combination), operative status (elective, emergent, and urgent), the extensiveness of the surgery needed, and the severity of the cardiac disease (analysis of cardiac function—ejection fraction, percent with left main coronary artery occlusion greater than 50%, and perfusion times). The greater the risks, the more likely the patient received a blood transfusion.

Various forms of measurement were included in this study including frequencies, means and standard deviations, medians and ranges, chi-square tests and independent t-tests.

Along with this data, other data was recorded including information on patient characteristics, preoperative comorbidities, operative details, any complications during that hospital admission and 30-day survival.

Post-operatively twenty-six complications were analyzed for their association with transfusion status.
It was hypothesized that “cardiac surgery with perioperative blood transfusions was associated with worse outcomes” (Whitson, Huddleston, Savik & Sumway 2007). The hypothesis was correct.

2691 patients met the inclusion criteria (69% male, 31% female, with a mean age of 63.8 years. In the analysis of all factors, two groups were formed—those who received blood transfusions and those who did not, 64% and 36%, respectively. Complications rates were significantly different between these two groups. In those who did not receive blood, the complication rate was only 30.5% while it was 53.6% for those who did receive blood. These transfusion-related complications included renal failure, prolonged ventilation time, pneumonia, cardiac arrest, gastrointestinal complications, atrial fibrillation, stroke, myocardial infarction, bleeding requiring reoperation, and various types of infections including sepsis.

30-day operative mortality associated with blood transfusions was 3.4% compared with a mortality rate of 1.7% for those who did not receive blood transfusions. Similarly, an increased length of hospital stay was seen in an average of six days for patients who received blood transfusions and an average of five for those who did not.

Thus, minimizing the need for blood transfusions and utilizing the alternatives available for blood transfusions is effective and is of great need in its ability to decrease complications, improve outcomes and decrease morbidity and mortality.

Comments

Considering the literature reviewed above, in patients undergoing planned surgery, would considering blood transfusion alternatives when compared with standard blood transfusion interventions lead to less infections, complications and mortality rates, shorter hospital stays, decreased costs and increased patients satisfaction? Yes. There are various types of alternatives
to be utilized. These include proper positioning of the patient, using cell salvage so that “blood lost by surgeon is not lost for patient” (Watchtower, 2002), hemodilution, electrocautery, less invasive surgery and normothermics. All of the above evidence is reliable, valid and reports decreased complications, mortality, morbidity, hospital stays, and costs. It can be safely assumed that this results in greater patient satisfaction and more patient-centered care due to the ability to take religious, cultural and personal preferences into consideration. According to Dr. Philippe van der Linden, “Blood conservation is not an option, it’s a must” (Watchtower, 2002).

Implications for future nursing practice are vast. Firstly, in considering the research done at the University of Minnesota it is crucial that nurse’s play a role in educating their patients and the community about good eating habits, exercise and overall health promotion. In this way the factors that increase the potential need for a blood transfusion can be minimized (severity of cardiac disease, past cardiac interventions, etc).

Secondly, nurses play a major role in advocating for their patients. They not only can they speak up when they are assigned a patient who refuses a blood transfusion, but collaborating with doctors and the surgical team to come up with blood transfusion alternatives and educating the patient and supporting them in their decisions is also a role the nurse can take on. It is important, too, the that nurse be well-versed in her knowledge on blood, blood components and the benefits and risk factors that come with transfusing blood or parts of blood. This may come into play when helping a patient consider if components, rather than whole blood or the main components of it, may be acceptable.

The movement toward bloodless surgery and bloodless hospitals is fairly new and very unique. It has really been recognized over the past decade in modern day healthcare. Thus, there is much research to be done. It seems that most professionals suspect that going bloodless will
be beneficial, but few have tried it. This is evidenced in the large number of journal articles found in this literature review that discussed the risks of blood transfusions and the need to explore alternatives and the very few controlled trials and research studies that were found.

Nursing students’ future practice will be greatly impacted by this. It is crucial to share this information with colleagues, professors, mentors, doctors and patients. Going bloodless is a new phenomenon that holds great potential in improving the healthcare system that is now in place.


*Cochrane Database of Systematic Reviews*. (4), Retrieved from Cochrane Database of Systematic Reviews database


*AORN Journal*, 76(5), 830-841.


Retrieved from CINAHL Plus with Full Text database.


