

Evolution of Bloodless Surgery: A Case for Bloodless Suprapubic Prostatectomy

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Abstract

Allogeneic blood transfusion is commonly prescribed to patients undergoing suprapubic prostatectomy for benign prostatic hyperplasia as a treatment option to replace blood loss. Historically, suprapubic prostatectomy has been perceived as an extremely high hemorrhagic surgery, and this has led to the association of suprapubic prostatectomy with a high rate of allogeneic blood transfusion. However, the outcome of suprapubic prostatectomy has significantly improved over the years and has become less hemorrhagic in many hands – creating the opportunity to consistently avoid allogeneic blood transfusion. On the other hand, the efficacy of blood transfusion has come under more stringent scrutiny as many clinical studies have reported inconsistent effects of blood transfusion on patient outcome. In contemporary practice, a more conservative/bloodless approach in the perioperative management of anemia in surgical patients is strongly being advocated with convincing evidence that many surgical patients can be routinely and safely managed without allogeneic blood transfusion. There is no large-scale discussion on bloodless surgery in urology in the contemporary literature, especially in the area of suprapubic prostatectomy that has been historically associated with a high rate of blood transfusion. This review article will discuss the evolution of bloodless surgery including the ongoing controversies surrounding blood transfusion in general, and then the relatively small but ongoing penetration of bloodless surgical approach in the field of suprapubic prostatectomy. Furthermore, the authors' approach to bloodless suprapubic prostatectomy will be highlighted, and in doing so, it can be emphasized that suprapubic prostatectomy is no more as hemorrhagic as was historically perceived, but rather a routine bloodless suprapubic prostatectomy is now possible in many hands.

Keywords: Benign prostatic hyperplasia, blood transfusion, bloodless prostatectomy, bloodless surgery, patient blood management

INTRODUCTION

Suprapubic prostatectomy for benign prostatic hyperplasia (BPH) remains a viable option in the surgical treatment of BPH and is associated with a low re-treatment rate.¹ It is the predominant method of surgical treatment of BPH in the developing world, and the results of many contemporary and earlier studies do show that suprapubic prostatectomy remains a very effective surgical procedure for BPH with good short-term and long-term outcomes.²⁻⁹ A historical and discouraging aspect of suprapubic prostatectomy has been the significant hemorrhage that can be encountered. Fortunately, surgical advancement is multifaceted: as the technological aspect of surgery is improving through new discoveries/refining of older technologies and equipment – it is also important to note that the surgical technique of doing many types of surgery is also improving, making some types of

surgery, previously considered problematic, more attractive in this contemporary era.

The perception of suprapubic prostatectomy as an extremely high hemorrhagic surgery has consequently led to its association with a high rate of blood transfusion. Apparently, for this possibility of significant hemorrhage, some authors have reported the widespread viewpoint that allogeneic transfusion of blood during suprapubic prostatectomy is so common that it is a standard practice in many surgical centers across the world.¹⁰

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The reported blood transfusion rates for suprapubic prostatectomy have been variable,^{3,8-12} but can be as high as 57.1%.¹³ Furthermore, there are unpublished accounts of some surgeons that routinely transfuse all their patients undergoing open prostatectomy. However, of great encouragement is that some authors have significantly improved the surgical technique of doing open prostatectomy that they have been able to achieve 0.0% blood transfusion rate in their reported series.^{4,5,7,14,15}

Blood transfusion has for long been the mainstay of treatment of perioperative anemia in surgical patients with a widespread habit among many clinicians of transfusing allogeneic blood at the least hesitance. However, the practice of perioperative allogeneic blood transfusion in contemporary practice is significantly changing, with many authors advocating for an extremely conservative/bloodless approach in the perioperative management of anemia in surgical patients.¹⁶⁻²⁵

The term “bloodless surgery” denotes treating patients surgically without resorting to allogeneic blood transfusion. The research data and also active discussion in literature that have helped propel bloodless surgery to the present position of importance have been mostly in the subspecialty of cardiovascular surgery and critical care.^{17,18,26,27} Urologic surgery is presently not experiencing a large-scale discussion on the topic of bloodless surgery in literature. Many types of urologic surgery deal with significant hemorrhage; hence, it is necessary to review the evolution of bloodless surgery including the ongoing controversies surrounding blood transfusion in general and subsequently the penetration of bloodless surgery in urology, particularly in suprapubic prostatectomy that has traditionally been associated with a high rate of blood transfusion. This review article will thus bring to the knowledge of the wider urological community the fact that suprapubic prostatectomy is no more as hemorrhagic as historically perceived, but rather a routine bloodless suprapubic prostatectomy is now possible in many hands and that there are certainly many advantages to pursue this approach.

THE EVOLUTION OF BLOODLESS SURGERY

The use of blood in medical practice has undergone a full swing from a very early rigorous practice of “bloodletting or draining” as a means of curing diseases to the widespread practice of blood transfusion that became popular during the Second World War.^{28,29} The discovery of blood group, advances in grouping and crossmatching, establishment of blood banks, and advances in blood preservation all helped to make blood transfusion safer and attractive.²⁸ The Second World War further created extraordinary demand for blood transfusion and as such, provided enormous stimuli for the rapid development of transfusion services.^{28,29} It was during this period that blood banks were developed. These numerous roles that transfusion services played highlighted the lifesaving value of blood that after the war, blood banks continued to spread across the globe, leading to the development of a popular culture of transfusing

blood at the least hesitance, and this culture became eventually engraved in the medical practice.

However, some key factors significantly changed this overwhelming welcoming attitude of physicians toward allogeneic blood transfusion. Three of these factors that significantly raised doubt and changed the attitude of physicians toward blood transfusion will be briefly discussed in the following sections.

The Jehovah Witness factor

The origin of the term “bloodless medicine” can rightly be attributed to the insistence of the religious group “Jehovah witness” to avoid donor blood at any cost.^{16,30} This attitude of avoiding transfusion of donor blood certainly spurred research in the field of bloodless surgery. In 1945 when the Jehovah Witness religious group declared that it is not acceptable for their members to receive allogeneic blood or its product, it became difficult for this group to receive medical care in situations where the physicians felt that blood transfusion will be required. Few physicians, however, took interest to accommodate their belief. A significant breakthrough in this regard was that of the first open-heart surgery without blood transfusion in a Jehovah Witness patient done by Dr. Denton Cooley.¹⁷ Following this report, more cases of bloodless surgeries were reported and also many hospitals started promoting bloodless surgery programs across the globe.^{16,18,31-34} Many of these reports showed equivalent if not better outcome in cases done without blood transfusion compared to those done with blood transfusion.^{26,34-36}

Transfusion-transmissible infection factor

Blood transfusion remains a potential source of transmission of infection from the donor to the recipient.³⁷⁻⁴⁰ The struggle to prevent the transmission of infection through blood transfusion has been and continues to be an arduous task. The outbreak of human immunodeficiency virus (HIV) infection in the early 1980s and the subsequent confirmation of its transmission through blood and its products significantly eroded the confidence that people had in the safety of blood transfusion. In the immediate vicinity of this confirmation, physicians as well as patients became very cautious in the usage of donor blood, and this fear of transfusion-transmissible infection has remained high in the public eye. Despite the development of multiple tests for transfusion-transmissible diseases that have significantly reduced the risk of infectious transmission, the risk is still substantial, especially in developing countries.^{41,42} Many of these developing countries are deficient in infrastructure, organizational support, and skilled labor to ensure safe access to blood transfusion.⁴³ Hence, the benefits of blood transfusion in many environments of developing countries should always be carefully weighed against the risk. Furthermore, it is essential to always remember that blood screening is only effective for infectious factors that we are currently aware of and not for infectious agents yet to be discovered. Furthermore, for a feared infection like HIV, it is important to note that even the most sensitive screening technologies currently available

are not capable of identifying its presence during the first few days after infection.^{44,45} A key component of the strategy by the World Health Organization for blood safety is reducing unnecessary transfusions through the use of transfusion when medically indicated for patient survival and well-being, minimizing the loss of blood during surgery, and the use of suitable alternative treatment.⁴⁶ Hence, a more critical attitude to blood transfusion can go a long way in reducing the present high rate of blood transfusion and as such contribute toward minimizing the risk of transfusion-transmissible infections.

Economic cost

Many authors have reported that the transfusion of allogeneic blood has been underestimated in cost but overestimated in effectiveness.^{47,48} Blood transfusion service is complex in that it involves numerous hospital resources and personnel to run effectively. The cost of blood transfusion keeps increasing for many reasons but mostly through the ever-increasing tests and human services involved – all garnered to make the procedure safer.⁴⁰ Using the activity-based costing analysis to capture the cost of a complex service such as blood transfusion, it was shown that the mean total cost of administering a single unit of blood to a surgical patient in the USA was between \$726 and \$1183 and between \$522 and \$611 in Europe.⁴⁸ There are also enormous challenges in financing safe blood in many of the developing countries with the consequential result that international norms in transfusion safety are not implemented in many of these countries. Blood donors in many developing countries, especially in sub-Saharan Africa, are mostly family or replacement donors usually recruited from relatives or friends of the patients.⁴⁹ Furthermore, paid donors can be recruited when the family is unable to provide the needed blood. This approach in obtaining blood for transfusion adds additional organizational and financial burden on the involved families that are already under stressful circumstances. Hence, any blood transfusion that can be safely avoided reduces the financial and emotional burden on the involved families.

AVOIDING BLOOD TRANSFUSION

It is presently obvious that blood transfusion can be safely avoided during many surgical procedures. To eliminate or minimize the rate of blood transfusion, the concept of patient blood management (PBM) is currently being advocated – encompassing both surgical and nonsurgical patients.^{16,25,50} PBM can be defined as an approach to improve patient outcomes by integrating all available techniques to eliminate or reduce allogeneic blood transfusions.^{16,31} This concept for surgical patients has been described in the form of three strategies/approaches as discussed further below.^{20,31}

Preoperative strategies

The focus of the preoperative approach is garnered toward optimizing patient's red blood cell mass. This involves identifying the presence of anemia and its underlying cause with the aim to correct such factors before surgery. Abnormal bleeding disorders, if present, should also be identified and

taken into consideration. For patients noted to be anemic, the management options include treating the underlying cause and the use of hematinics and building up the hemoglobin (HB) level. Other options in the preoperative preparation of patients among many others include the use of erythropoietin to stimulate red blood cell production. Preoperative donation of blood by the patient for later re-infusion is also among the available options that could be considered.^{20,31}

Intraoperative strategies

The focus of the intraoperative approach is garnered toward minimizing blood loss during surgery. It also includes collecting and re-infusing blood lost during the surgery and improving the tolerance of anemia through optimal patient management throughout the course of the surgery. Apart from meticulous surgical approach to minimize blood loss, some of the factors that can be utilized in this approach include appropriate patient positioning and use of tourniquets, local vasoconstrictive agents, electrocautery, argon beam coagulation, and topical hemostatic agents. Other options include incorporation of acute normovolemic hemodilution which involves removing and keeping a portion of the patient's blood and replacing that with other fluids such as crystalloids or colloids. This is done with the aim to dilute the patient's blood, thereby minimizing the red blood cell mass lost during the surgery. The removed blood is later re-infused back to the patient at the end of the surgery or earlier if need be following re-infusion protocol.

Postoperative strategies

The focus of the postoperative approach is garnered toward minimizing any further blood loss after surgery and also early identification and intervention in cases of postoperative bleeding. Blood draws for laboratory investigations should not be done out of routine but appropriately justified and the lowest amount used. Hematinics should be continued if need be. Any consideration for blood transfusion should be critically evaluated based on patient's clinical condition and not aiming at achieving high HB values. In this line of management, lowering the transfusion trigger, otherwise known as restrictive approach to blood transfusion, also comes into play.

BLOODLESS SUPRAPUBIC PROSTATECTOMY

It is widely assumed that suprapubic prostatectomy is an extremely high hemorrhagic surgery and as such, there is little or no active discussion of bloodless suprapubic prostatectomy in the contemporary literature. The transfusion rate for suprapubic prostatectomy in recent years has remained variable and most likely reflects the technique and experience of the involved surgeon. In many hands, the transfusion rate has remained high with little or no difference from series reported many decades ago,^{11,12} whereas in others, the transfusion rate has significantly decreased^{3,8} and even reaching the 0% mark [Table 1].^{4,5,7,14,15} The few authors that have reported successful bloodless suprapubic prostatectomy seem to have achieved such results mainly through improved surgical hemostasis.^{4,5,7,14,15} Lezrek *et al.*⁷ in a series of 78 patients used

the modified Denis technique for hemostasis in suprapubic prostatectomy. The authors reported a mean intraoperative blood loss of 264 ml, with none of the patients receiving blood transfusion [Table 1]. Mireku-Boateng and Jackson¹⁴ in a series of 42 patients used the approach of prostate fossa packing. The authors reported an average intraoperative blood loss of 160 ml, with no patient receiving blood transfusion [Table 1]. However, it is still very likely that many other surgeons that may have achieved good surgical hemostasis are still offering their patients allogeneic blood transfusion, probably aiming to achieve high HB values, or are probably still using the long-standing but outdated recommendation to transfuse for an HB value below 10 g/dl.

THE AUTHORS' APPROACH IN ACHIEVING CONSECUTIVE BLOODLESS SUPRAPUBIC PROSTATECTOMY OVER MANY YEARS

The authors have intentionally pursued a bloodless suprapubic prostatectomy approach over many years in the absence of an organized PBM program. In general, to avoid or minimize blood transfusion, the three pillars/strategies of PBM as previously discussed have been shown to be of importance. Some elements of these strategies are more easily obtainable, whereas others need a significant investment and a well-organized PBM program. This is especially challenging in low-resource economies where the investment in health care by the government is still suboptimal. In the absence of an organized blood management program, the authors have focused on those areas of the program that are easily available and achievable. These include:

a. Preoperative workup that among others confirms the absence of any bleeding disorder and takes into consideration the patient's drug history that may affect blood coagulation and increase the risk of bleeding. Furthermore, the correction/improvement of detected low HB values is done with the aid of hematinics and improved dietary recommendation prior to the date of surgery. In our series of 100 consecutive suprapubic prostatectomies without blood transfusion,¹⁵ sixty patients (60%) were preoperatively anemic with an HB level of 9.8–12.9 mg/dl. Anemia is prevalent in many developing countries mostly due to poor nutrition and common compensation. These patients are started on hematinics and are encouraged to increase the intake of proteinous meal and green leafy vegetables prior to their date of surgery

- b. Intraoperative meticulous surgical technique that includes meticulous surgical hemostasis using the authors' modified suprapubic prostatectomy technique^{4,5} that has resulted in minimal blood loss for this surgery. In the author's reported series of 47 patients⁵ and 100 patients¹⁵ that underwent suprapubic prostatectomy [Table 1], the mean decrease in HB level was 1.06 and 1.15, respectively, with none of the patients receiving blood transfusion
- c. Postoperative management that specially highlights restrictive approach to blood transfusion through accepting low HB values in patients that are clinically stable. In the author's institution, the more prevalent transfusion protocol is transfusion for symptomatic anemia or for any critical HB level of 6–8 g regardless of symptoms. However, many other consultants still transfuse using a value of an HB level of 10 mg/dl and below.

The authors' bloodless prostatectomy approach has been described in other publications;^{4,5} however, some key elements of the surgery include:

- A very careful enucleation of the prostatic adenomatous lobes
- A modified bladder neck repair^{4,5}
- Use of size 22 or 24 two-way Foley catheter
- No suprapubic catheter
- No perivesical drain
- No continuous bladder irrigation.

Our results of using these modifications and adopting a restrictive approach to blood transfusion have been encouraging: in a series of 100 consecutive suprapubic prostatectomies without blood transfusion,¹⁵ the mean age of the patients was 71.2 years (range of 52–88 years). The mean prostate weight was 95.6 g– (range of 50–238 g). The mean HB difference was 1.15 mg/dl (range of 0.3–2.7 mg/dl) [Table 2]. There was no mortality. There was wound infection in four patients, whereas in three other patients, there was catheter blockage with clots that were easily flushed out. None of the authors' patients has received blood transfusion up to the time of this report with no mortality or significant morbidity.^{4,5,15,51}

THE ROLE OF RESTRICTIVE BLOOD TRANSFUSION APPROACH IN ACHIEVING ZERO TRANSFUSION RATE

Restrictive blood transfusion approach entails accepting low HB/hematocrit levels without resorting to blood transfusion for the treatment of the affected patients.

Table 1: Overview of reported studies on suprapubic prostatectomy without blood transfusion

References	Year of publication	Number of patients	Mean decrease in HB	Blood transfusion	CBI	Mortality (%)
Lezrek <i>et al.</i> ⁷	2003	78	NA*	None	Yes	2.6
Mireku-Boateng and Jackson ¹⁴	2005	42	NA*	None	Yes	None
Okorie and Pisters ⁵	2010	47	1.06	None	No	None
Okorie ¹⁵	2013	100	1.15	None	No	None

*Lazerek *et al.* and Mireku-Boateng *et al.* reported mean intraoperative blood loss of 264 ml and 160 ml, respectively. CBI: Continuous bladder irrigation, HB: Hemoglobin, NA: Not available

Table 2: Patients' age, prostate specimen weight, and hemoglobin findings¹⁵

Parameter	Findings		
	Mean	Median	Range
Age (years)	71.2	70	52–88
Prostate specimen weight (g)	95.6	83	50–238
HB preoperative (mg/dl)	12.6	12.53	9.8–14.6
HB postoperative (mg/dl)	11.45	11.47	8.6–13.7
HB difference	1.15	1.07	0.3–2.7

HB: Hemoglobin

Blood transfusion triggers and transfusion protocols are of significant importance in influencing the transfusion approach of surgeons and other physicians. Historically, it was commonly accepted to transfuse patients when the HB level dropped below 10 g/dl.^{52,53} However, several contemporary guidelines based on data from studies where blood transfusion was withheld have advised against a single HB value for deciding on the need for blood transfusion.⁵³⁻⁵⁵ These guidelines are recommending that an HB value range between 6 and 10 g/dl can be used depending on the presence of serious comorbidity.

Furthermore and of significant importance is the need to take into consideration some of the factors triggering intraoperative blood transfusion, of which a critical factor is the role of the anesthesiologists. Anesthesiologists commonly use blood loss estimates and physiological variables in deciding on the need to transfuse a patient with allogeneic blood intraoperatively. However, estimation of intraoperative blood loss and the use of physiological variables such as clinical pallor, capillary refill, and hypotension are very subjective, and using these factors to decide on blood transfusion can be very unreliable and commonly lead to a high rate of unnecessary blood transfusion.⁵⁶⁻⁵⁸ Hence it is necessary to work in agreement with the anesthesiologist in planning for bloodless surgeries if unnecessary blood transfusion will be avoided intra-operative.

A number of studies comparing restrictive transfusion triggers versus more liberal triggers in various patient populations have also reported comparable or improved patient outcomes for the restrictive group of patients.^{36,59,60} Hence, adopting a more tolerant approach to postoperative anemia in clinically stable patients can undoubtedly reduce the use of allogeneic blood.

The authors early enough embraced the restrictive approach to blood transfusion in managing surgical patients that ordinarily would have been subjected to blood transfusion.

CONCLUSION

Blood is still a precious commodity that should be judiciously used. However, the debate surrounding the contemporary role of allogeneic blood transfusion is persistently shifting toward avoiding/minimizing allogeneic blood transfusion in the management of surgical patients. The surgical technique of suprapubic prostatectomy has significantly improved, making this surgery less hemorrhagic, and as such, a consistent

bloodless suprapubic prostatectomy is presently very possible and safe. Careful preoperative evaluation and selection of patients, intraoperative incorporation of modern techniques that help minimize blood loss, and close postoperative monitoring of patients all garnered toward ensuring patient safety are highly encouraged. This bloodless option should be prioritized toward reducing cost and avoiding the possible side effects associated with allogeneic blood transfusion while at the same time opening up access to surgery for those patients who refuse blood transfusion.

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There are no conflicts of interest.

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