Basics of Blood Management

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FIRST EDITION
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Preface to first edition

The benefit-to-risk ratio of blood products needs constant evaluation. Blood products, as therapeutic agents, have had the test of time but lack the evidence we expect from other medicinals. Blood, an organ, is used as a pharmaceutical agent by the medical profession, due to the achievements in collection, processing, banking, and distribution. The fact that the most common risk of blood transfusion is blood delivery error supports the notion that blood is handled as a pharmaceutical agent. Over the last few decades, the risk of blood transfusion and associated complications has raised concerns about safety of blood by both the public and health-care providers. At the same time, experience with patients refusing blood and data on blood conservation brought to light the real possibility of other modalities to treat perisurgical anemia and to avoid it with blood conservation methods. In addition to risks and complications, data became available demonstrating the behavioral aspect of transfusion practice versus an evidence-based practice. In this book, the authors address many aspects of modern transfusion medicine, known blood conservation modalities, and new approaches to the treatment of perisurgical anemia, as well as special clinical considerations. This approach, now termed “blood management” by the Society for the Advancement of Blood Management, incorporates appropriate transfusion practice and blood conservation to deliver the lowest risk and highest benefit to the patient. In addition, it brings all these modalities to the patient's bedside and above all is a patient-centered approach. Blood management is a multidisciplinary, multimodality concept that focuses on the patient by improving patient outcome, making it one of the most intriguing and rewarding fields in medicine.
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Introduction

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Blood management requires an understanding of all elements of blood and transfusions. It includes the philosophy, biology, physiology, and ethical considerations, as well as demonstrating the practical application of various techniques. This publication introduces the reader to blood management and explains how to improve medical outcomes by avoiding undue blood loss, enhancing the patient’s own blood, and improving tolerance of anemia and coagulopathy until any of these underlying conditions are successfully remedied.

This introduction to blood management is intended for the training and early practicing clinicians. It is meant to be both informative and practical and spans many of the medical specialties that encounter blood and transfusions as part of their daily practice. It will aid in tailoring individual care plans for the different patients. Finally, it addresses the structure and function of a blood management program, a novel approach to blood conservation, and improved patient outcome.

In this book, blood management is considered from an international perspective, so attention is paid to conditions encountered in developing as well as industrial countries. Techniques such as cell salvage are performed differently in economically deprived countries; HIV, hepatitis, and malaria may or may not be a threat to the blood supply, depending on geographic location; oxygen, intravenous fluids, and erythropoiesis-stimulating proteins may be readily available in some countries or inaccessible in others. The book is intended to broaden the readers’ horizons, discussing working conditions encountered by blood managers around the world. Many of the clinical scenarios and the exercise that follow are intended for the reader to adapt the information to the prevailing circumstances in their location.

This book is unique in the fact that it is the first dedicated in its entirety to the concept of blood management. The authors hope that this book will stimulate the readers to further advance blood management through shared experience and research. It is intended to be informative, practical, enjoyable and will stimulate debate and discussion as well as help patients in need.
With this introductory chapter the reader will be given a glimpse into the organization of blood management and its history—a history that is still extremely active and changes day to day.

**Objectives of this chapter**

1. Identify historical developments that led to today’s concept of blood management.
2. Demonstrate the benefits of blood management.
3. Identify blood management as “good clinical” practice.
4. Show that blood management and its techniques should be used in all cases that qualify.
5. Help understand how a blood management program works.

**Definitions**

*Bloodless medicine and surgery*: Bloodless medicine is a multimodality, multidisciplinary approach to safe and effective patient care without the use of allogeneic blood products. Bloodless medicine and surgery utilizes pharmacological and technological means as well as medical and surgical techniques to provide the best possible care without the use of donor blood.

*Transfusion-free medicine and surgery*: Since “bloodless medicine” is kind of a misnomer, the term “transfusion-free medicine” was coined and is used instead.

*Blood conservation*: “Blood conservation is a global concept engulfing all possible strategies aimed at reducing patient’s exposure to allogeneic blood products” [1]. This concept does not exclude the use of allogeneic blood entirely.

*Blood management*: Blood management is the philosophy to improve patient outcomes by integrating all available techniques to reduce or eliminate allogeneic blood transfusions. It is a patient-centered, multidisciplinary, multimodal, planned approach to patient care. Blood management is not an “alternative,” it is the standard of care.

**A brief look at history**

**History of bloodless medicine, transfusion-free medicine, blood conservation, and blood management**

The term “bloodless medicine” is often associated with the belief of Jehovah’s Witnesses to refrain from the use of blood, therefore ruling out the option of blood transfusion. The essence of bloodless medicine, and lately, blood management, however, is not restricted to the beliefs of a religious group. To get a better understanding as to what bloodless medicine and blood management means, let us go back to the roots of these disciplines.

One is not completely wrong to attribute the origin of the term “bloodless medicine” to the endeavor of Jehovah’s Witnesses to receive treatment without resorting to donor blood transfusion. Their attitude toward the sanctity of blood greatly influences their view of blood transfusion. This was published as early as 1927 in their journal *The Watchtower* (December 15, 1927). Although the decision to refuse blood transfusion is a completely religious one, the Witnesses frequently used scientific information about the side effects of donor blood transfusion. The booklet entitled *Blood, Medicine and the Law of God* (published in 1961) addressed issues such as transfusion reactions, transfusion-related syphilis, malaria, and hepatitis.

Refusing blood transfusions on religious grounds was not easy. Repeatedly, patients were physically forced to take donor blood, using such high-handed methods as
incapacitation by court order, strapping patients to the bed (even with the help of police officers), and secretly adding sedatives to a patient’s infusion. In the early 1960s, representatives of Jehovah’s Witnesses started visiting physicians to explain the reasons why transfusions were refused by the Witness population. Often, during the same visit, they offered literature which dealt with techniques that were acceptable to the Witness patients, informing physicians of the availability of the so-called transfusion alternatives. After a few years of work, the governing body of Jehovah’s Witnesses announced the formation of Hospital Liaison Committees (1979). These continued to “support Jehovah’s Witnesses in . . . their determination to prevent their being given blood transfusions, to clear away misunderstandings on the part of doctors and hospitals, . . . to establish a more cooperative spirit between medical institutions and Witness patients” and to “alert hospital staff to the fact that there are valid alternatives to the infusion of blood” (italics ours). Occasionally, the Witnesses even went to court to fight for their rights as patients. In a great number of cases, the Witnesses’ position was upheld by the courts.

Although many physicians had difficulty with the concept of bloodless medicine, there were some physicians who took up the challenge to provide the best possible medical care without the use of blood transfusions. These were in fact the earliest blood managers. As their experience in performing “bloodless” surgery increased, more complex procedures such as open heart surgery, orthopedic surgery, and cancer surgery could be performed. Even children and newborns could successfully be treated without transfusing blood. Not before long, those pioneering physicians published their results with Witness patients, thereby encouraging other doctors to adopt the methods used in performing such surgical interventions.

Among the first ones who rose to the challenge was the heart surgeon Denton Cooley of Texas. In the early 1960s, his team devised methods to treat Witness patients. Reporting on his early experiences, he published an article in a 1964 issue of The American Journal of Cardiology. In the article “Open heart surgery in Jehovah’s Witnesses” his team described the techniques used. In 1977, Cooley reported his experiences with more than 500 patients [2].

Cooley’s example was followed by many other courageous physicians. For instance, in 1970 Dr Pearce performed bloodless open heart surgery in New Orleans. His efforts did not go unnoticed. Newspapers reported on these spectacular cases. Perhaps out of curiosity or out of the earnest desire to learn, many colleagues visited Dr Pearce’s team in the operating room to learn how to do “bloodless hearts.” Dr Jerome Kay, from Los Angeles, also performed bloodless heart surgery. In 1973 he reported that he is now performing bloodless heart surgery on the majority of his patients. The call for bloodless treatments spread around the whole world. Dr Sharad Pandey of the KEM hospital in Mumbai, India, adopted bloodless techniques from Canada and tailored them to fit Indian conditions. Centers in Europe and the rest of the world started adopting those advances as well.

It is understandable that Witness patients preferred the treatment of physicians who had already proven their willingness and ability to treat them without using donor blood. The good reputation of such physicians spread and so patients from far away were transferred to their facilities. This laid the foundation for organized “bloodless programs.” One of the hospitals with such a program was the Esperanza Intercommunity Hospital in Yorba Linda, California, where a high percentage of patients were Witnesses. Dr Herk Hutchins, an experienced surgeon and a Witness himself, was known for his development of an iron-containing formula for blood-building. Among his team was the young surgeon Ron Lapin. Later, he was famed for his pioneering work in the area of bloodless therapies. Critics labeled him a quack. Nevertheless, he continued and was later honored for opening one of the first organized bloodless centers in the world, as well as for publishing the first journal on this topic, and for his efforts to teach his colleagues. During his career, he performed thousands of bloodless surgeries.

All of those pioneers of blood management had to rise to the challenge of using and refining available techniques, adjusting them to current needs, and individualizing patient care. They adopted new technologies as soon as this was reasonable. Much attention was paid to details of patient care, thus improving the quality of the whole therapy. They also fought for patients’ rights and upheld those rights. Many involved in the field of blood management confirm the good feeling of being a physician in the truest sense. There is no need to force a particular treatment. Such an attitude is a precious heritage from the pioneers of blood management. Now, at the beginning of the twenty-first century, this pioneer spirit can still be felt at some meetings dedicated to blood management.

**Military use of blood and blood management**

Over the centuries, the armies of different nations contributed to what is now available for blood management, but not on religious grounds. It can actually be said that
the military made many crucial contributions to blood management by taking care of the thousands of wounded operated on before transfusions became feasible. In fact, every surgery performed before the era of blood transfusion was, strictly speaking, a “bloodless surgery.” Surgeons were confronted with blood loss, but had no way to replace blood. This meant it was imperative to stop hemorrhage promptly and effectively and to avoid further blood loss. During the centuries, battlegrounds were the places where surgeons were massively confronted with blood loss and it was on the battlefield that hemorrhage was recognized as a cause of death. Hemorrhaging victims needed surgery. It was then that techniques of bloodless medicine and blood management were invented. The experience of the early surgeons serving near the battlefield is applicable in today’s blood management schemes. William Steward Halsted, a surgeon on the battlefield, described uncontrolled hemorrhage [3] and later taught his trainees at Johns Hopkins the technique of gentle tissue handling, surgery in anatomic ways, and meticulous hemostasis (Halstedian principles). His excellent work provides the basis of the surgical contribution to a blood management program.

As soon as transfusions became somewhat practical, the military used them for their purposes. Since war brought about a deluge of hemorrhaging victims, there was a need for a therapy. The First World War brought the advent of blood anticoagulation. This made it possible to transport blood to the wounded and reduced the use of living donors in the field. But there were other problems. Storage times and problems with logistics called for improvements in blood therapy. During the Second World War, the problem of storage of blood was partly overcome by the advent of blood banks. Another development was due to Cohn’s fractionation of blood, which led to the production of plasma as a volume expander for war victims. The United States extensively used plasma for volume expansion in World War II.

Although the World Wars propelled the development of transfusion medicine, these simultaneously propelled the development of alternative treatments. Tremendous problems with availability and logistics as well as with compatibility of blood made transfusions near the battlefield dangerous, difficult, and expensive. Those problems, as well as inherent risks of transfusions, led to the search for other ways of treatment. Intravenous fluids had been described in earlier medical literature [4, 5], but the pressing need to replace lost blood and the difficulties involved in transfusions provided a strong impetus for military medicine to change practice. In this connection, note the following report appearing in the Providence Sunday Journal of May 17, 1953: “The Army will henceforth use dextran, a substance made from sugar, instead of blood plasma, for all requirements at home and overseas, it was learned last night. An authoritative Army medical source, who asked not to be quoted by name, said ‘a complete switchover’ to the plasma substitute has been put into effect, after ‘utterly convincing’ tests of dextran in continental and combat area hospitals during the last few months. This official said a major factor in the switchover to dextran was that use of plasma entails a ‘high risk’ of causing a disease known as serum hepatitis—a jaundice-like ailment. Not all plasma carries this hazard, he emphasized, but he added that dextran is entirely free of the hazard. ‘We have begun to fill all orders from domestic and overseas theaters with dextran instead of plasma.’”

Efforts to develop another “blood substitute” were intensified by US military in 1985. Major investments supported research, either by contract laboratories or by military facilities themselves [6]. This time, not the search for a plasma expander but the search for an oxygen carrier was the driving force behind the army’s efforts.

Promising products in the sector of blood management were readily introduced to the military. One example is a cell-saving device. The surgeon Gerald Klebanoff, who served in the Vietnam War, introduced a device for autotransfusion in the military hospitals. Another example is the recombinant clotting factor VIIa. Although officially declared to be a product for use in hemophiliacs, the Israeli army discovered its potential to stop life-threatening hemorrhage and therefore included it in their treatment of injured victims.

Also, in recent times, the military showed a keen interest in blood management. After the attack on the World Trade Center in New York on September 11, 2001, physicians of the US military approached the Society for the Advancement of Blood Management and asked about blood management. They were aware that a war in a country like Afghanistan would also require preparation on the part of the physicians. The high costs of transfusions in war times (up to US $9000 must be calculated for one unit of red blood cells when transfused in countries like Afghanistan) and logistic difficulties called for blood-conserving approaches. Consequently, specialists in the field of blood management met together with representatives of the US military, the result of which was an initiative named STORMACT® (strategies to reduce military and civilian transfusion). The consensus of this initiative was a blood management concept to be used to treat victims of war and disaster as well as patients in a preclinical setting.