

The Use of Technologies to Decrease Peri-operative Allogenic Blood Transfusion: Results of Practice Variation in Israel

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Abstract

Background: Concern about the side effects of allogeneic blood transfusion has led to increased interest in methods of minimizing peri-operative transfusion. Technologies to minimize allogeneic transfusion include drugs such as aprotinin, desmopressin, tranexamic acid and erythropoietin, and techniques such as acute normovolemic hemodilution, cell salvage and autologous pre-donation.

Objective: To survey the current use in Israel of these seven technologies to minimize allogeneic blood transfusion.

Methods: Our survey was conducted in 1996–97 in all hospitals in Israel with more than 50 beds and at least one of the following departments: cardiac or vascular surgery, orthopedics, or urology. All departments surveyed were asked: a) whether the technologies were currently being used or not, b) the degree of use, and c) the factors influencing their use and non-use. The survey was targeted at the heads of these departments.

Results: Pharmaceuticals to reduce allogeneic blood transfusion were used in a much higher proportion in cardiac surgery departments than in the other three departments. Pre-operative blood donation was used in few of the cardiac, urologic and vascular surgery departments compared to its moderate use in orthopedic departments. The use of acute normovolemic hemodilution was reported in a majority of the cardiac departments only. Moderate use of cell salvage was reported in all departments except urology where it was not used at all.

Conclusion: There is considerable practice variation in the use of technologies to minimize exposure to peri-operative allogeneic blood transfusion in Israel.

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reaction, hypersensitivity to plasma proteins, sensitization to leukocyte and platelet antigens or to minor blood group antigens, as well as the risk of immediate and delayed hemolytic reactions have stimulated much interest in methods to decrease the use of allogeneic blood transfusion. This interest has continued despite efforts in the last decade to reduce the likelihood of viral transmission such as deferral of high risk donors and better methods of testing for the infecting viruses [1]. Peri-operative use of blood in elective surgery accounts for a substantial proportion of all blood used. The various technologies that are available to minimize peri-operative allogeneic transfusion include hemostatic agents that promote clotting (aprotinin, tranexamic, epsilon-aminocaproic acid, and desmopressin) [2–9], erythropoietin that stimulates red blood cell production [10–12], cell salvage devices that recover blood from the operative field and then return it to the patient [13,14], the technique of acute normovolemic hemodilution that entails the removal of blood immediately before surgery with simultaneous replacement by another fluid to maintain blood volume [15,16], and pre-operative autologous donation whereby patients can donate up to four units of their own blood [17,18].

The primary objective of this study was to investigate the availability and/or use of these technologies in Israel.

Materials and Methods

All hospitals in Israel with more than 50 beds and at least one department of cardiac surgery, vascular surgery, orthopedics, or urology, were surveyed between 1996 and 1997. The study consisted of two phases: a short questionnaire was sent to the chiefs of each of these departments to determine the use (yes/no) of technologies in their departments, and the second survey was sent to determine the degree of use. If the respondent indicated on the first questionnaire that their department used a particular technology they were then asked on the second questionnaire how often it was used on a scale ranging from routinely (> 80%), most of the time (50–80%), some of the time (10–50%), to almost never (< 10%). Additionally, they were asked whether use of the technology

The use of allogeneic blood transfusion carries with it a variety of possible side effects. The risk of transmitting infectious agents such as human immunodeficiency virus and hepatitis B and C, or of other adverse effects such as febrile

was “too much,” “about right,” or “inadequate.” Potential factors acting as obstacles to the use of a technology or factors influencing its use were also solicited by a personal interview. Data collection, collation, quality assurances, and analyses were performed at the Bnai Zion Medical Center, Haifa, Israel. Data were analyzed using qualitative data analysis software (QSR NUDIST) and simple descriptive statistics.

Results

Data were collected from 31 hospitals. The response rate was 100% from cardiac surgery departments, 77% from orthopedic departments, 60% from urology departments, and 83% from vascular surgery departments. The use of the various technologies according to the four surgical departments is shown in Tables 1–4.

Cardiac surgery [Table 1]

The proportion of these departments using drug technologies was considerably higher than in the other three specialties. Of the hospitals that reported aprotinin use, 100% used aprotinin but only 30% used it routinely. Tranexamic acid use was reported in 88% of hospitals but it was only used routinely in

one. Erythropoietin was not used in any of the hospitals for cardiac surgery. Of the non-drug technologies, ANH was used the most frequently while PAD was used in only 20% of the responding hospitals. All the cardiac surgery department heads (10/10) indicated that the use of aprotinin is “about right,” while 50% and 28% indicated the same for tranexamic acid and desmopressin respectively. For the non-drug technologies, 100% of the users of PAD felt that its current use was “inadequate” compared to 40% of the users of cell salvage and 30% of the users of ANH.

Orthopedic surgery [Table 2]

Pharmaceuticals were rarely used in orthopedic surgery except for tranexamic acid, which was used in 26% of the departments. Non-drug technologies were used more often with approximately 37% using cell salvage, ANH or PAD. Among the heads of orthopedic departments, 80% of those reporting tranexamic acid use stated that their use was “about right.” For the non-drug technologies, 75% of the users of PAD felt its use was “inadequate.”

ANH = acute normovolemic hemodilution

PAD = pre-operative autologous donation

Table 1. Use of technologies in cardiac surgery (n = 14)

Technology	Degree of use			Opinion of use					
	Hospitals responding	Do not use technology	Use technology	Routinely	Most of the time	Some of the time	Almost never	“Inadequate”	“About right”
APROTININ	10	0	10	3		7			10
TXA	8	1	7	1		4	2		7
DDAVP	10	6	4			1	3		4
EPO	10	10	0						
CS	10	6	4			2	2	2	2
ANH	13	3	10	5	1	2	2	4	6
PAD	10	8	2				2	2	

TXA = tranexamic acid, DDAVP = desmopressin, EPO = erythropoietin, CS = cell salvage, ANH = acute normovolemic hemodilution, PAD = pre-operative autologous donation

Table 2. Use of technologies in orthopedic surgery (n = 23)

Technology	Degree of use			Opinion of use					
	Hospitals responding	Do not use technology	Use technology	Routinely	Most of the time	Some of the time	Almost never	“Inadequate”	“About right”
APROTININ	17	17	0						
TXA	19	14	5		1	4		1	4
DDAVP	18	17	1				1		1
EPO	17	15	2				2		2
CS	16	10	6	1	1		4	3	3
ANH	21	15	6	1		2	3	4	2
PAD	21	13	8			2	5	6	2

Table 3. Use of technologies in urologic surgery (n = 18)

Technology	Degree of use			Opinion of use					
	Hospitals responding	Do not use technology	Use technology	Routinely	Most of the time	Some of the time	Almost never	"Inadequate"	"About right"
APROTININ	15	15	0						
TXA	18	7	11	1		10		2	9
DDAVP	16	14	2			1	1		
EPO	14	14	0						
CS	9	9	0						
ANH	17	14	3			1	1	3	
PAD	15	13	2				2	2	

Table 4. Use of technologies in vascular surgery (n = 25)

Technology	Degree of use			Opinion of use					
	Hospitals responding	Do not use technology	Use technology	Routinely	Most of the time	Some of the time	Almost never	"Inadequate"	"About right"
APROTININ	7	6	1				1		1
TXA	8	6	2		2				
DDAVP	7	7	0						
EPO	7	6	1						
CS	7	3	4	1	1		2	3	1
ANH	11	7	4			2		3	1
PAD	14	13	1				1		1

Urologic surgery [Table 3]

Tranexamic acid was used more frequently than any other technology in urologic surgery. All other technologies were rarely used, and three technologies (aprotinin, erythropoietin, and cell salvage) were not used at all. Almost all the users of tranexamic acid (82%) indicated that its current use was "about right." All the users of ANH and PAD reported that their use was "inadequate."

Vascular surgery [Table 4]

Drugs and PAD were used in very few departments, while ANH and cell salvage were used in 36% and 57% of the departments respectively. Of the four departments that use ANH, three indicated that its use was "inadequate," and two of the four departments using cell salvage indicated the same.

Obstacles to greater use

The most often reported obstacles to greater use of the drug technologies were: a) that clinicians were not familiar with this use of the drugs, b) that clinicians who were familiar with the technology were not necessarily fully convinced of the technology's success, and c) concern about side effects. Obstacles to greater use of cell salvage were reported to be: a) lack of clinical experience on the part of the staff, b) unavailability of an autotransfusion device, and c) high cost. The limited use of ANH was attributed to: a) lack of clinical experience, b) clinicians not being fully convinced of its

effectiveness, and c) concern about side effects. Obstacles to PAD were: a) lack of awareness of the procedure, b) technical problems, c) lack of manpower, and d) need for cooperation between departments.

Discussion

The results of this survey indicate a considerable practice variation in Israel with regard to the use of technologies to minimize exposure to peri-operative allogeneic transfusion, the use of the various technologies, and the type of surgery. There are many possible reasons for the amount of variation in practice. Since many technologies are effective at reducing the need for peri-operative allogeneic transfusion, clinicians can use a number of technologies to achieve the same goal and should involve the patients in the decision-making process. However, some of the clinicians were unaware of these possibilities and did not use any of the technologies. Economic factors such as the higher costs of cell salvage and erythropoietin and the low cost of blood relative to these technologies may also affect their use in the peri-operative period.

Each of the technologies is associated with side effects, the frequency and seriousness of which are not always clear to the physicians. At the same time the likelihood of contracting HIV or hepatitis from allogeneic blood transfusion has decreased considerably in the last decade [19], although the possibility

HIV = human immunodeficiency virus

of transmitting new agents such as prions still theoretically exists. Thus patients and physicians in one hospital may come to very different conclusions about the risk/benefit ratios of these technologies.

As part of the International Study of Perioperative Transfusion (ISPOT), systemic reviews of published reports of alternatives to allogeneic blood transfusion have been published [3,15,20]. The results show that autologous donation and normovolemic hemodilution do reduce the need for allogeneic blood, although moderately in the case of the latter [15,20]. However, this resulted statistically in an overall increase in transfusion rates. A review of the anti-fibrinolytic drugs used in cardiac surgery confirmed the efficacy of aprotinin and tranexamic acid but found desmopressin to be ineffective [3]. The cost-effectiveness of aprotinin can be questioned since it is more expensive than tranexamic acid, although randomized trials suggest a similar efficacy. It is interesting to note that cardiac surgery departments reported a fairly high use of aprotinin and a low reported use of tranexamic acid.

It is important to note that the present study was a survey of reported use of these technologies by surgical departments, and not an audit of actual use. Detailed interviews with clinicians and policy makers are currently being conducted to determine the reasons for the practice variation.

In the field of transfusion, it is important that physicians be aware of new information and developments in these technologies so that they can introduce and include them in routine hospital use.

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