Evaluation of Coagulation Profile in Patients Receiving Autologous Blood Transfusion

Nisha Rani Agrawal, Prithwis Bhattacharya, Devna Singh, Brahmanand Dube

Department of Obstetrics and Gynecology, Institute of Medical Sciences, Banaras Hindu University, Varanasi – 221 005

Summary

Autologous blood transfusion can be used in patients undergoing surgery and requiring blood. One of the modalities of autologous transfusion is pre-operative normovolemic haemodilution. We explored the feasibility of this procedure and its safety profile in 100 patients, undergoing major gynecological surgery, randomized either to receive autologous or homologous blood transfusions. Clinical monitoring of pulse, blood pressure, respiratory rate, electrocardiogram, central venous pressure SaO_2 etc. in two groups did not reveal any significant difference. Similarly hematocrit and coagulation profile consisting of bleeding time, clotting time, platelet count, prothrombin time, partial thromboplastin time and fibrinogen level did not show any remarkable change in the study group and the changes were comparable to the controls. Thus, autologous blood transfusion using preoperative haemodilution is a useful, safe and effective procedure, and can save already scarce and precious blood.

Blood transfusion needs a highly organized service round the clock. There has always been a tremendous demand for homologous blood in surgical specialties. In developing countries blood is often scarce and not always screened for infections especially for HIV. These considerations make autologous transfusion ideal in our settings. Safest blood, which a person can receive, is one's own blood (AABB, 1985). Three commonly used techniques are 1. Preoperative autologous blood donation, 2. Peri-operative blood salvage, and 3. Acute normovolemic haemodilution. These can be used alone or in combination to reduce the need of homologous blood transfusion (Matin et al 1987; NBREP Expert Panel, 1990).

This study was carried out to explore the safety profile of acute normovolemic haemodilution (ANH).

Material and Methods

Hundred patients aged between 30 – 60 year, undergoing major gynecological surgery and requiring blood transfusions, were recruited in this study. These patients were randomized into two groups – i) Group I –Fifty patients were given autologous transfusion by ANH and ii) Group II – Another 50 received homologous transfusions, and served as controls. Patients with cardiac diseases, obstructive pulmonary disease, gross renal impairment, coagulopathies, pregnancy and hemoglobin <8 gm / dl were excluded from the study.

The pulse rate, blood pressure, respiratory rate, ECG tracing and SaO_2 (by pulse oximetry) were routinely measured in all patients. General anaesthesia was given with ketamine and vecuronium bromide. After achieving a stable level of anaesthesia, central venous line was set up canulating the right internal jugular vein with a 16G canula in patients undergoing ANH (Group I). Bleeding time and clotting time was done, blood samples were collected for estimation of haemoglobin, haematocrit, coagulation profile and electrolytes.

Haemodilution was carried out by collecting blood through the central venous line and

simultaneously same volume of polygeline was infused through the peripheral venous line (Shah et al 1991). Depending on the pre-haemodilution hemoglobin level, body weight and requirement during surgery, the volume collected ranged from 500-1300 ml. Blood was collected in sterile serially numbered bottles containing acid-citrate dextrose solution and then stored at the room temperature inside the operation theatre. Normovolemia was maintained intra-operatively by crystalloids. Surgery was started after completion of haemodilution with stable vital parameters. Collected blood was reinfused after haemostasis or earlier depending on the blood loss. Reinfusion was done in the reverse order so that best unit, in terms of cellular elements and clotting factors, is given in the last. Blood samples were collected before and after haemodilution, before and after blood transfusion, and on post-operative day 1 and 7 for analysis. Simultaneously, bleeding and clotting times were also measured. Prothrombin time (Quick's one stage), partial thromboplastin time (kaolin-cephalin clotting time), thrombin time and fibrinogen level (heat precipitation method) were carried out by standard

Table 1 – Pre and Post transfusion hematological parameters in patients undergoing autologous and homologous transfusion

	Hemoglobin (Gm/dl)		Hematocrit		Platelet Count (x105/Cumm)	
	Group I	Group II	Group I	Group II	Group I	Group II
Pre-operative	11.1 + 2.3	11.2 ± 0.4	34.6 ± 0.8	33.8 ± 1.2	3.4 + 0.1	3.3 + 0.1
After hemodilution	9.2 ± 0.4	-	29.0 ± 0.9	-	2.1 ± 0.2	-
Intra-operative						
Before transfusion	9.1 ± 0.3	9.4 ± 0.2	28.1 ± 3.5	28.4 ± 4.0	2.8 ± 0.2	3.1 + 1.5
After transfusion	9.0 ± 0.3	9.3 ± 0.2	29.1 ± 1.2	28.1 ± 0.7	2.4 ± 0.2	2.8 + 1.6
1st Post-operative day	9.1 ± 0.2	9.5 ± 0.3	29.0 ± 1.2	28.5 ± 1.9	2.5 ± 0.1	2.5 + 0.1
7th Post-operative day	10.1 ± 0.2	10.1 ± 0.8	31.1 ± 0.8	32.2 ± 1.0	2.9 + 0.1	3.0 + 0.3

There was no statistically significant difference between values of Group I and II

Table II – Pre and Post transfusion hematological parameters in patients undergoing autologous and homologous transfusion

	Pre-Operative	After hemo-Dilution	Intra-operative transfusion Before	Intra-operative transfusion After	1st Post-operative day	7th Post-operative day
Bleeding Time (in secs)						
Group I	233 ±9	276 ±10	302 ±11	305 ± 9	275 ± 10	275 + 12
Group II	221 +15	-	266 ±18	284 ±15	284 ± 13	240 + 13
Clotting time (in secs)						
Group I	274 ±9	303 ±13	293 ±14	286 ±14	298 ± 12	298 + 12
Group II	290 +13	-	284 ±19	264 ±16	262 ± 19	260 + 12
Serum Fibrinogen						
(Gm/L)	3.6 ±0.2	3.4± 0.1	3.3± 0.1	3.1 ± 0.1	3.5 ± 0.2	3.6 + 0.1
Group I	3.5 ±0.2	-	3.4± 0.1	3.0 ± 0.2	209 ± 0.1	3.3 + 0.1
Group II						
Prothrombin Time*						
Group I	104 ±3	110 ± 3	112 ± 3	112 ± 5	276 ± 10	275 + 12
Group II	97 ±3	-	205 ± 9	284 ±16	284 ± 13	240 ± 13
Thrombin Time*						
Group I	103 ±1	106 ± 4	108 ± 4	108 ± 4	298 ± 4	298 + 12
298 + 12						
Group II	101 ±2	-	287 ±14	264 ±16	262 ± 18	160 + 12
Partial Thromboplastin Time*						
Group I	101 +4	102 ± 3	103 ± 5	98 ± 3	100 ± 4	99 + 4
Group II	95 ±3	-	97 ± 4	99 ± 2	107 ± 3	101 + 3

* Values are percent variations from controls. There was no statistically significant difference between values of Group I and II

laboratory techniques.

Observations

Both groups were matched for age, body weight, type of surgery and mean duration of surgery. Haemoglobin and haematocrit in both groups showed a fall intra-operatively which persisted on the first post-operative day but showed some improvement by seventh postoperative day. Similar trends were seen with platelet count (Table I).

Bleeding time showed prolongation in group I following haemodilution which further increased intra-operatively but started decreasing by first postoperative day. There was no evidence of impaired haemostasis or any tendency of bleeding from any site and the values remained within the normal range. There was no significant difference at any stage between the two groups. The clotting time also showed slight tendency towards prolongation in Group I but changes were statistically not significant

Prothrombin time, thrombin time and partial thromboplastin time were prolonged following haemodilution and declined following blood transfusion intra-operatively. There was a slight fall in serum fibrinogen level also but the two groups were comparable for all the parameters (Table II).

Discussion

Autologous blood transfusion helped to avoid complexities and expenses of arranging homologous blood especially of the rare blood groups (Matin et al, 1987). Haemodilution was achieved by isovolemic exchange of polygeline for blood. Red cell loss is better tolerated by body than volume loss. Body shows symptoms when red cells are reduced by 5% and becomes life-threatening when the loss is around 80%. Therefore, theoretically this procedure appears to be safe. Change, when studied serially in hemoglobin, hematocrit, platelets, bleeding time, clotting time, turned out to be within normal range and no different from patients receiving homologous blood transfusion. Other coagulation factors like thrombin time, prothrombin time, partial thromboplastin time showed a slight increase after haemodilution which returned back to normal in post-operative period and were comparable to controls (Laks et al; 1976).

Thus, ANH can be confidently used in major surgery thereby saving precious and scarce resource of human blood.

References

1. AABB : Autologous Transfusion : An American Association of Blood Banks Technical Manual, 9th Ed. Lippincott, Philadephia, 359 1985.
2. Laks H, Handin RI, Martin V, Pilon RN. J Surg Res 1976; 20; 225-30.
3. Matin E, Hansen E, Peter K. World J Surgery 11:59, 1987.
4. National Blood Resource Education Programme, Expert Panel. JAMA 263:414, 1990
5. Shah D, Shirolkar SP, Udwadia JF, Daftary M. Ind J Int Med 1:127-31,1991.