BLOOD ORDERING PRACTICES IN THE MANAGEMENT OF ECTOPIC PREGNANCY AT GROOTE SCHUUR HOSPITAL

J Nevin, E van Wyk, L Denny, E Megevand, M James

Objective. To investigate transfusion practices in the management of patients with ectopic pregnancy and to use this information to establish guidelines.

Design. A prospective, longitudinal study.

Setting. Groote Schuur Hospital, Cape Town.

Subjects. All patients treated for ectopic pregnancy.

Methods. To prevent the Hawthorne effect, resident medical staff were not informed of the true nature of the study. The appropriateness of their transfusion practices was assessed by measuring postoperative haematocrits, and the influence of shock, transfusion volumes and admission haemoglobin concentrations was investigated.

Results. One hundred and five patients were analysed. Seven and 15 patients were over- and undertransfused respectively, giving an overall transfusion error rate of 21%. When transfused volumes were increased, rates of transfusion error increased insignificantly. No patients were administered single-unit transfusions. Shock ($P < 0.004$) and an admission haemoglobin concentration < 10g/dl ($P < 0.001$) were significantly associated with transfusion errors.

Conclusions. Transfusion errors are common and undertransfusions are more frequent than overtransfusions. After transfusing a patient with three units of blood the haematocrit should be checked before additional units are transfused. Shocked patients and patients with admission haemoglobin concentrations < 10 g/dl deserve special attention. Single-unit transfusions can be considered. Financial resources for blood transfusions are not being squandered.

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Department of Obstetrics and Gynaecology, University of Cape Town.
J Nevin, MB BCh, MMed (O&G), MRCOG, FCOG (SA)
E van Wyk, MB ChB, FCOG (SA)
L Denny, MB ChB, MMed (O&G), FCOG (SA)
E Megevand, MD
Department of Anaesthesia, University of Cape Town
M James, MB ChB, PhD, FFARCS

While the risk of haemolytic reactions and infectious complications have put the transfusion of blood and its products under the spotlight, financial implications are also important and at Groote Schuur Hospital (GSH) the pressure on clinicians to justify expenditure has increased dramatically. As a consequence the Department of Obstetrics and Gynaecology initiated formal assessment of transfusion practices.

Since emergency admission for the management of ectopic pregnancy is common and carries the possibility of transfusion, patients with this pathology were considered a meaningful group on which to commence this audit process. In attempting to measure the appropriateness of blood transfusion practices, we hoped to establish the extent and cause(s) of the problem, to design guidelines for better practice and to calculate transfusion budgets for this particular complication of pregnancy.

PATIENTS AND METHODS

The study design was prospective and longitudinal. Using the statistical package Statgraphics (Version 6), a binomial distribution and an assumption that 30% of patients were incorrectly transfused with a beta error probability of 10%, it was calculated that 24 transfused patients would be needed to show a statistically significant incidence of transfusion error. Since 34 of 117 patients with ectopic pregnancies had been transfused during a 22-week preliminary observation period, a study size of at least 100 patients was chosen.

Patients with newly diagnosed ectopic pregnancy were prospectively and consecutively recruited. In order to limit the Hawthorne effect,[1] the true nature of the study was concealed from the attendant medical staff.

Data on transfusions, the presence/absence of shock, and admission haemoglobins (determined using capillary blood and the Buffalo Medical Specialties (BMS) portable haemoglobinometer[2]) were collected from patient and blood bank records.

Postoperative haematocrits (Hcts) were measured on the second postoperative day using a Technicon H1 automated blood counter.

Using a post-transfusion haematocrit range of 0.24 - 0.32 as a marker of appropriate transfusion, transfusion errors were diagnosed if the postoperative Hct was < 0.24 (undertransfusion), or if the postoperative, post-transfusion Hct was > 0.32 (overtransfusion).

Results were stored and analysed on Microsoft Excel Version 5.

Standard statistical techniques were used to analyse the relationships between rates of transfusion error and transfusion volume, shock and admission haemoglobin. Calculations included the chi-square test (with Yates' correction where necessary) and Fisher's exact test. Statistical significance was accepted at $P < 0.05$.

Consent was obtained from each patient and approval for the study was granted by the Ethics and Research Committee of the University of Cape Town.

RESULTS

One hundred and ten patients with newly diagnosed ectopic pregnancy were consecutively recruited for this study from 1 August to 8 December 1996. Five patients were excluded as postoperative Hcts were unavailable for 4 and 1 had an autotransfusion; consequently the study group consisted of 105 patients.

Of these, 27 (26%) were transfused a total of 77 units of blood. Ninety-eight units of blood were cross-matched for a cross-match transfusion ratio of 1.3.

Of 27 transfused patients, 7 were over- and 2 undertransfused, giving a transfusion error rate of 33.3% with a 95% confidence interval (CI) (16%, 51%). Of the 78 patients who were not transfused, 13 (17%) should, by definition, have been transfused. The number of over- and undertransfusions was therefore 7 and 15 respectively for an overall transfusion error rate of 21% with CI (13%, 29%). Table I shows that the rates of transfusion errors did not depend on the volume of blood transfused ($P = 0.18$).

Table I. Number of units transfused v. rates of transfusion error

	Number of units transfused				
	0	1	2	3	> 3
Overtransfusions (*N*)	–	–	1	1	–
Undertransfusions (*N*)	13	–	2	2	3
Transfusion errors (*N*)	13	–	3	3	3
Patients (*N*)	78	–	12	9	6
Transfusion error rate (%)	17	–	25	33	50

The transfusion error rate was greater if shock was present (47% shocked patients) compared with 15% if shock was absent ($P = 0.004$, Fisher's exact test). Rates of over- and undertransfusion in shocked patients did not differ. In the absence of shock, undertransfusion was significantly more common than overtransfusion ($P = 0.008$, Fisher's exact test). These results are summarised in Table II. One patient was thought to have developed pulmonary oedema as a consequence of undertransfusion during resuscitation.

Transfusion errors occurred more often if admission haemoglobins (Hbs) were < 10 (chi-square with Yates' correction, $P < 0.0001$). Of 39 patients with admission Hbs > 11 g/dl, none were transfused and only 1 patient had a postoperative Hct < 0.24.

Table II. Relationship between shock and transfusion error

	Shock absent	Shock present
Overtransfusions (*N*)	2	5
Undertransfusions (*N*)	11	4
Transfusion errors (*N*)	13	9
Patients (*N*)	86	19
Transfusion error rate (%)	15	47
95% CI (%)	7 - 22	24 - 69

DISCUSSION

By using the definition of well-tolerated normovolaemic anaemia (Hb 7 - 10 g/dl) as set out in the American College of Physicians guidelines for transfusion,[3] and allowing for a margin of safety, a haematocrit between 0.24 and 0.32 was chosen as marker of appropriate transfusion practice. This methodology is predictably open to dispute since empirical, automatic transfusion thresholds are probably archaic. It is better to base blood administration on circulatory competence and symptomatology in a normovolaemic low-risk patient. However, since the study of symptom-driven physician practices might be biased by the Hawthorne effect, a compromise was essential. While the tool chosen in this study to identify transfusion errors may have been imperfect, it has been used previously[4,5] and the inconsistencies exposed in the management of ectopic pregnancies were probably genuine and improvements attainable. As transfusion medicine is currently in its infancy,[6] we had to work with the tools at our disposal.

This study showed that transfusion practices were inappropriate and could have been improved in 21% of women admitted to GSH for the management of ectopic pregnancy. However, comparisons with other audits were reassuring. Despite the emergency nature of ectopic pregnancy, the rate of overtransfusion (26%) was less than that reported during elective surgery. Tartter *et al.*[4] studied patients undergoing elective colorectal resections and labelled 69% of transfusions as excessive. Guavanetti *et al.*[5] looked at a much larger population of transfused patients undergoing a variety of elective procedures and found that 33% had Hcts > 36%. A previous report from Groote Schuur Hospital[7] looked at elective surgery and identified 27% of postoperative transfusions as being excessive.

What the current study did highlight was that errors applied not only to the excessive administration of blood. Mistakes were also made by withholding transfusions. The latter point is often ignored and deserves more attention.[8] It should not be forgotten that inadequate transfusions can result in silent myocardial ischaemia.[6]

This study found that transfusion of more than three units of blood was often excessive. We concluded that a repeat Hb/Hct estimation is necessary before additional blood is administered to a patient who has received a three-unit transfusion.

All patients in the present series who received blood transfusions received more than one unit of blood. This finding suggests an avoidance of single-unit transfusions. Despite an earlier warning about the effect of this practice on rates of overtransfusion in this country,[7] this traditional approach continues to be advocated in South Africa.[9] It is certainly at variance with North American practice. In a 1986 publication Tartter *et al.*[4] attributed increased blood usage to a 1970 editorial that resulted in 'the unfortunate practice of ordering blood transfusions in pairs of units'. The 1992 American College of Physicians Clinical Guidelines[3] state that 'one unit may be sufficient'. Finally, a recently published randomised, prospective

trial comparing 'restrictive' and 'liberal' transfusion practices in Canadian critical care units[10] used transfusions on a unit-by-unit basis, with Hb checks after each unit. It is therefore clear that single-unit transfusions are acceptable to many practitioners, and in the absence of any evidence to the contrary these should be utilised in the management of ectopic pregnancies.

All shocked patients who were not given transfusions were left very anaemic. It was concluded that all shocked patients with ectopic pregnancies deserved transfusions. However the presence of shock is a strong confounding variable because it renders the judgement of an appropriate transfusion volume much more difficult. One can easily give too much.

Admission Hb had limitations as a guide to transfusion practice. Although an admission Hb > 11 g/dl appeared to be a contraindication to blood transfusion and patients with admission Hbs < 10 g/dl were at greatest risk of transfusion error and undertransfusion in particular, to offer firm guidelines was impossible. Since the method of Hb estimation used in this study has been validated using venous rather than capillary samples,[2] further studies are justified.

From a financial point of view, the cost of overtransfusions was offset by the inadvertent savings that accrued as a result of the transfusions that were inappropriately withheld. The results were used to estimate what a South African gynaecological service requires for the transfusion of patients with ectopic pregnancies. Although 20% of patients were managed incorrectly, the overall study group justified at least 77 units of blood, and in the light of a low cross-match transfusion ratio (1.3), it appears from this study that the budget for each South African patient with an ectopic pregnancy will need to include the cost of one unit of blood.

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