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Efficiency of blood use and prospects for autologous transfusion in general surgery

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A 6-month retrospective audit of crossmatch and transfusion practice in a general surgical unit has been performed. Inefficiencies in blood ordering practices have been demonstrated and the value of performing a local audit to allow estimation of blood needs has been proven. Using criteria based on the suggested tariff for operations derived from this audit, only a small number of general surgical patients would be considered as potential autologous blood donors.

The perceived risks of heterologous blood transfusion have led to renewed interest in the possibilities of predeposit autologous blood donor schemes *(1–3)*. Prospective surgical patients may donate several units of blood in the weeks before surgery so that, if they should require transfusion in the perioperative and post-operative period, they may receive their own blood. The benefits to the patient include the elimination of blood-transmitted infection and allo-immunisation to white-cell and red-cell antigens. The patient also presents for surgery in a slightly haemodiluted state with a consequent reduction in blood viscosity. The benefits to the hospital are principally those of conserving the resources of the blood bank. In Scotland, unlike the United States of America and certain other transfusion services in the UK, it is the policy of the National Blood Transfusion Service that blood which is donated as part of an autologous donor scheme, but not used by its donor, is not added routinely to the general donor pool, nor is it used for protein fractionation. Thus, the collection of autologous donations which will not be transfused becomes extremely wasteful from the transfusion service point of view. However, identification of those operations in which transfusion routinely occurs may allow a predeposit scheme to run efficiently.

Previous studies have indicated that overordering of blood is widespread, and is a common cause of blood wastage, as blood gradually becomes time expired while allocated to patients *(4–6)*. Failure to crossmatch blood preoperatively need not be a source of concern to surgeons or anaesthetists, as it has been shown that a preoperative group and screen with an abbreviated crossmatch allows rapid provision of blood in cases of unexpected haemorrhage *(7)*.

In an attempt to identify those operations in which transfusion occurs routinely and which would be suitable for autologous donation, and to assess efficiency in blood ordering practices, we have carried out a 6-month retrospective audit of requests for crossmatched blood and subsequent transfusion in our surgical unit. In order to maximise the number of potential autologous donors, criteria for acceptance were based simply on the need to be crossmatched and the likelihood of transfusion; there was no exclusion on the grounds of age, malignancy, or antecedant medical condition. This is a general unit comprising three consultants offering a general surgery and urology service to a population of 140 000.

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Materials and methods

The records of the hospital transfusion laboratory from May to October 1988 inclusive were extracted, allowing the identification of all patients, both emergency and elective, for whom either a request for crossmatched blood or a request to group and screen was made. The case notes were then obtained to determine whether a procedure had been performed as an emergency or on an elective basis, or whether transfusion had been given to correct a preoperative anaemia or operative/post-operative blood loss.

For each operation the crossmatch to transfusion ratio (CTR) was calculated; this is an indication of blood ordering efficiency, since regularly over crossmatching will lead to a high CTR; a figure in excess of 2.5 is generally taken to indicate excess blood ordering *(8)*. In the elective group of patients, the average number of units transfused per procedure, or transfusion index (T_i) was calculated. A T_i of less than 0.5 indicates that, on average, less than half a unit of blood is transfused each time a procedure is performed, and therefore routine ordering of blood for a procedure is not indicated *(9)*. When considering crossmatch efficiency, we did not distinguish between transfusion to correct a preoperative anaemia and transfusion to correct operative and post-operative losses, as we were seeking to assess overall efficiency in blood use. When attempting to identify those operations which could be suitable for an autologous donor scheme, the CTR and the T_i were calculated after excluding crossmatch and transfusion which had been performed to correct preoperative anaemia, since it is a high probability of operative blood loss which will characterise these operations. We utilised these two criteria (T_i and CTR) to attempt to identify those patients in our sample who had undergone a procedure where it would have been cost-effective to have offered the patient the option of autologous donation. Obviously, only those operations for which blood should be crossmatched routinely would be considered; thus the operations had to have a T_i of >0.5. However, to run efficiently autologous donation should also only be offered where it is highly likely that blood will be transfused, thus excluding operations where the CTR was >2.5.

Results

Crossmatch practices (Tables I and II)

Requests for either a group and screen or crossmatch were received for 468 patients. Of these, 79 were for a group and screen, and 389 for crossmatch. There were 243 (62%) patients crossmatched for procedures where the CTR was >2.5, while 146 (38%) were crossmatched for a procedure with a CTR <2.5. Of the 468 patients, 284 underwent elective procedures, with 245 being crossmatched; of these, 227 (92%) were crossmatched for a procedure with a CTR>2.5. In the elective group, 148 (68%) patients were crossmatched for procedures with a T_i of <0.5.

Table I. Transfusion practices in elective admissions

	No. of patients		*No. of units of blood*			
Procedure	*Crossmatch*	*G&S*	*Crossmatch*	*Transfused*	*CTR*	T_i
TURP	120	0	271 (265)	39 (33)	6.9 (8)	0.3 (0.2)
Thyroid/parathyroid	8	0	16	0	—	0
Cholecystectomy	5	28	12	2	6	0.06
Mastectomy	8	2	20	4	5	0.44
Colon resection	27	0	90 (76)	29 (17)	3.1 (4.4)	1 (0.6)
TURT	32	1	92 (72)	32 (12)	2.8 (6)	1 (0.4)
Nephrectomy	16	0	72 (68)	27 (22)	2.6 (3)	1.6 (1.3)
APERectum	4	0	20	11	1.8	2.75
Gastrectomy	6	0	28 (2)	17 (10)	1.6 (2.1)	2.8 (1.6)
Oesoph/gastrectomy	2	0	6	4	1.5	2
Open prostatectomy	2	0	6	2	3	1
Reversal of Hartmann's	2	0	6 (24)	2 (0)	3 (—)	1 (0)
Haemorrhoidectomy	1	0	10 (4)	6 (0)	1.6 (—)	6 (0)
Pancreatic resection	2	0	6	3	2	1.5
Cystoscopy	2	0	13 (9)	8 (4)	1.6 (2.2)	4 (2)
Orchidectomy	1	0	6 (2)	4 (0)	1.5 (—)	4 (0)
Miscellaneous	7	8	17	0	—	0

1. Figures in brackets represent results excluding preoperative transfusion
2. Miscellaneous procedures included: Choledochoduodenostomy, urethral dilatation, ureterolithotomy, nephrolithotomy, polypectomy, nephrostomy, parietal cell vagotomy
TURT = Transurethral resection of tumour

Table II. Transfusion practices in emergency admissions

	No. of patients		*No. of units of blood*		
Diagnosis	*Crossmatch*	*G&S*	*Crossmatch*	*Transfused*	*CTR*
Trauma	9	8	38	0	4
Colonic resection	2	3	8	2	4
Perf DU	8	1	34	14	2.4
Embolectomy	2	0	8	4	2
Intes. obstruction	16	3	58	30	1.93
Ischaemic bowel	2	0	7	3	2.3
GI Haem.	76	13	510	291	1.75
Amputation	0	1	—	—	—
APERectum	1	0	4	4	1
Gast. bypass	1	1	2	0	—
Hernias	0	2	—	—	—
Diverticular disease	1	0	2	0	—
NSAP	0	2	—	—	—
Fundoplication	1	0	2	2	1
Drain collect	0	1	—	—	—
Second. haem.	1	2	4	4	1
Relaparotomy	2	0	4	4	1
Drain abscess	3	0	7	3	2.3
Splenectomy	1	1	6	2	3
Aortic aneurysm	2	0	8	0	—
Anaemia:					
Pharyngeal pouch	1	0	4	4	1
Uraemia	1	1	12	8	1.5
Inoperable Ca.	11	1	39	28	1.3
Menorrhagia	1	0	4	4	1
Gastr. surg.	2	0	7	7	1

NSAP = Non-specific abdominal pain

Possible autologous donors (Fig. 1)

Of the 468 patients identified for whom either a request to group and screen or crossmatch was made during the 6-month period studied, 284 underwent an elective procedure and 184 an emergency procedure; the emergency group could not be considered as potential autologous donors for obvious reasons. Of the 284 elective patients, 39 had a group and screen and 245 were crossmatched. Of the crossmatched patients 16 underwent a procedure with a CTR <2.5, and 61 a procedure with a T_i >0.5. Of these, respectively, 11 and 19 patients were subsequently transfused.

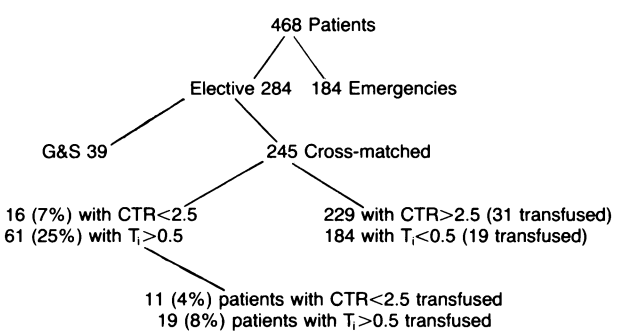

Figure 1. Possible predeposit donors and their transfusion history.

Discussion

If an autologous donor scheme is to operate efficiently, it is important that the offer of autologous donation is made only to patients who are to undergo an operation where the likelihood of transfusion is high. In addition, the operations should be carried out on an elective basis, allowing the necessary weeks in which to collect the blood, and the presenting condition must not be a cause of anaemia; because of these latter two points patients with advanced malignant disease would often be disqualified from autologous donation. Operations where transfusion is likely may be defined as those with a crossmatch to transfusion ratio of <2.5. However, some procedures for which transfusion is necessary have a CTR of >2.5 due to overordering; the use of a CTR of <2.5 as the criterion for the offer of autologous donation may then exclude some patients who are to undergo an operation for which autologous donation could be reasonably offered. The use of the transfusion index (T_i), derived from the average number of units transfused for a given procedure, overcomes this difficulty; it is generally conceded that procedures with a T_i of <0.5 merit only a group and screen rather than a crossmatch.

We identified 16 (7%) patients who underwent a procedure with a CTR <2.5 out of 245 elective patients. Of these 17 possible autologous donors, 11 (64%) were

subsequently transfused in the peri- and postoperative period. Using the T_i to identify operations where transfusion is likely, 93 of 245 patients undergoing elective surgery who were crossmatched had a $T_i > 0.5$. However, when the T_i was recalculated, excluding transfusions to correct a preoperative anaemia, only 61 (25%) patients were identified. Of these 61, only 19 (31%) were transfused. Thus, depending on the criteria used, we could identify 7% or 25% of our patients as undergoing a procedure where the likelihood of transfusion was sufficiently great to merit the offer of autologous donation, with 64% or 31% of these being transfused, respectively. This represented only 4% or 8% of all our elective patients who were crossmatched. In deciding which of the two criteria is more valid, although the T_i apparently identified more potential donors, a smaller proportion of these were subsequently transfused, suggesting that the CTR allows the identification of patients likely to be transfused with greater confidence. Furthermore we cannot say what proportion of these patients would actually have participated in an autologous donor scheme. In a recent American study, only 5% of eligible patients predeposited blood, although this may be exceptionally low *(10)*. Although there are attendant risks in the practice of heterologous transfusion, they are remarkably small in the UK *(11)*. In view of the small number of possible beneficiaries we were able to identify, it must be doubtful whether the risks of transfusion merit the expense and effort of setting up an autologous donor scheme to serve a general surgical population. However, certain operations within this group, such as abdominoperineal excision of rectum or gastrectomy, could be offered autologous donation if such a service were available locally. Other surgical specialties, notably orthopaedics, include procedures in which blood loss is both substantial and unavoidable, and here autologous transfusion has been successful *(12)*.

In common with previous audits *(4–6)*, we have found inefficiencies in blood ordering practices. Of all our patients who were crossmatched, 243 out of 389 (62%), were crossmatched for procedures where the CTR was >2.5. It may be thought that part of the difficulty lies in estimating the transfusion requirements of emergency cases. However, when elective cases alone were considered, the proportion with a CTR >2.5 is 227 out of 245 (93%). Further, 148 out of 245 (60%) have a T_i of <0.5 indicating that crossmatch was not required. Therefore, not only were we ordering too much blood, but in many instances we were ordering blood where none was required. Several operations for which we crossmatch blood routinely would appear to justify only a group and save policy, in particular prostatic surgery, transurethral resection of bladder tumours, thyroid surgery and mastectomy.

Although these figures are useful indices of transfusion practices, there are difficulties in comparing the figures from different audits. For example, from our audit we believe that the operation of transurethral resection of the prostate would merit only a group and screen, and this is in agreement with data from Southampton *(5)*. However, in Wales the appropriate figure would be 2 units and in Dundee 3 units *(4, 6)*. These differences are a reflection of differing surgical and anaesthetic policy and illustrate the dangers of applying suggested tariffs derived from other units. We believe that local audit, such as the one we have performed, is the best way of monitoring local transfusion practices and moderating the sort of inefficiencies we have demonstrated. Within our unit there is no place for an autologous donor scheme.

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