

Efficiency of Blood Use in Orthopaedic Surgery

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Abstract : A retrospective study was performed to investigate the efficiency of blood used in twenty common orthopaedic procedures at Srinagarind Hospital between December 1985 and June 1992. Seven hundred and eighty five cases were studied. Preoperative blood ordering was excessive in most procedures. The average cross-match to transfusion ratio (CTR) was 2.9:1. Sixty-three per cent of the crossmatched blood was not used for the procedures. The CTR, the percentage of patients needing blood transfusions, the average amount of blood per transfused patient and the transfusion index for each procedure were analyzed. Three help identify the necessity and the appropriate amount of blood to be requested for each procedure. The information also helps identify the procedures in which the use of autologous blood transfusions will be useful.

INTRODUCTION

The supply of homologous blood in Thailand comes mainly from volunteer donors and is limited. The demand for blood and blood products, however is steadily increasing. Our previous study of blood ordering in lumbar spine surgery had shown an overordering of homologous blood in our orthopaedic practice¹. This caused blood wastage, as the usefulness of the blood gradually expired while being allocated to patients. In many institutions blood ordering practices for elective orthopaedic surgery have been governed by guesswork and resident apprehension. This study was undertaken to document contemporary blood ordering practices at Srinagarind Hospital so that strategies for the more efficient use of blood in orthopaedic surgery can be developed.

MATERIALS AND METHODS

Blood use in common orthopaedic surgical procedure in adults performed at Srinagarind Hospital, Khon Kaen, from December 1985 to June 1992 were examined. The efficiency of blood use was assessed by comparing the number of units

of blood cross-matched pre-operatively with the number of units of blood actually transfused intra-and post-operatively for each procedure. There were 785 cases in which full records could be followed and could be reviewed for this study. Cases excluded were cases in which records were incomplete, cases in which blood transfusions were necessary for the correction of preoperative anemia, cases receiving multiple operations and cases receiving posterior lumbar spinal surgery which were reported previously¹. For each operation the CTR was calculated. This is an indication of blood ordering efficiency, since regular over-crossmatching will lead to a high CTR; a figure in excess of 2.5 is generally taken to indicate excess blood ordering². The average number of units transfused per procedure, or transfusion index (Ti), was also calculated. A Ti <0.5 indicates that, on average, less than half the unit of blood is transfused each time a procedure is performed and therefore routine ordering of blood for a procedure is not indicated.

RESULTS

There were 785 cases that underwent twenty operative procedures in this study. Number of patients, the number of patients receiving a transfusion, the number of units of blood cross-matched and the number of units of blood transfused, were recorded for each procedure. The percentages of patients transfused, the CTR, the average number of units of blood per transfused patient and the transfusion index (Ti) for each procedure were calculated. The overall results were shown in Table I. The total number of blood crossmatches was 825 units, while the number of units of blood that were transfused was 257. The overall CTR was 2.9 :1.

DISCUSSION

This study is to assess the efficacy of blood use in common orthopaedic operation. The study did not consider in children because the patients weight and size are much different among age groups. The blood was often ordered in volume rather than by number of units and was difficult to compare for

Procedure	Number patients	Patient n	Transfused %	Units of blood cross-matched (u)	Units of blood transfused (u)	CTR	Average of blood transfused per transfused patients (u)	Transfusion index (Ti)
Corrective osteotomy of cubitus varus	28	0	(0)	3	0	NT	0	0
ORIF of elbow fractures	32	3	(9.4)	21	3	7:1	1	.09
ORIF of AC joint separation	21	0	(0)	17	0	NT	0	0
ORIF (plate) of forearm fractures	58	1	(1.7)	36	1	36:1	1	.17
ORIF (plate) of humeral fracture	24	4	(16.7)	29	4	7.3:1	1	.17
ORIF (plate) of tibial fracture	42	6	(14.3)	34	6	5.7:1	1	.14
Tibial nailing (closed and open)	37	4	(10.8)	21	4	5.3:1	1	.11
Closed femoral nailing (locked and unlocked)	149	14	(9.4)	162	16	10.1:1	1.14	.11
Open femoral nailing	42	19	(45.2)	54	22	2.5:1	1.2	.52
ORIF (Plate) femoral fracture	53	34	(64.2)	70	41	1.7:1	1.2	.77
ORIF (angle blade-plate) trochanteric fracture	31	24	(77.4)	39	28	1.4:1	1.2	.90
Dynamic hip screw of hip fracture	34	17	(50)	41	17	2.4:1	1	.5
Closed Gamma nailing of trochanteric fracture	25	1	(4)	25	1	25:1	1	.04
Hemiarthroplasty of femoral neck fracture	48	19	(39.6)	57	19	3:1	1	.40
Total hip replacement	25	24	(96)	56	41	1.4:1	1.7	1.64
Above knee amputation	29	8	(27.6)	31	10	3.1:1	1.3	.34
Below knee amputation	18	1	(5.6)	12	1	12:1	1	.06
Anterior cruciate reconstruction	47	0	(0)	5	0	NT	0	0
ORIF (Harrington rod) of T-L spinal fracture	25	23	(92)	56	29	1.9:1	1.3	1.16
Harrington rod instrumentation for scoliosis	17	17	(100)	56	44	1.3:1	2.6	2.6
TOTAL	785	219	(27.9)	825	287	2.9:1		

u = unit of blood, NT = no transfusion, ORIF = open reduction and internal fixation, AC = acromio-clavicular, T-L = thoraco-lumbar

this study.

It was evident that much of the blood cross-matched for patients undergoing these orthopaedic surgical procedures at Srinagarind Hospital during the period of this study was not transfused. A CTR of between 2:1 and 2.5:1 has generally been considered acceptable for elective surgery^{2,3}. Several procedures in the present study were shown to have CTR greater than 2.5:1 (ie. blood use of less than 40 percent of the amount ordered), and the overall CTR was 2.9:1. We also found that in some cases cross-matching occurred simply because blood had always been ordered for that procedure. Resident apprehension also played a part in the over-ordering, as did poor communication.

Over-ordering of blood has a number of important implications³. Such as there is an increase in the age of transfused blood, blood is wasted by outsideting, the overall cost of the blood bank service is greatly increased, and

unnecessary reservations or unavailability of blood for other patients may impose restriction upon elective and semi-elective surgery.

Although there are many factors which effect to the necessity of blood transfusion among procedures and cases, this study can provide informations as an overall evaluation of our practice. Table I helps indentify the necessity of blood transfusions and also the average amount of blood transfusion per procedure in various common orthopaedic operations. The Ti also helps indentify operations where transfusions are likely. Only those operation for which blood should be cross-matched routinely would be considered when $Ti > 0.54$. The guideline for maximum blood ordering was suggested by many authors to be that the crossmatch order should not exceed 1.5 times the mean number of units given per transfused patient for that procedure^{2,3}.

In conclusion, this study has shown that even in a

teaching hospital, an unnecessarily large amount of blood was cross-matched but not used for orthopaedic surgery during a six year study period. The necessity and the amount of blood

transfusion for each condition can be predicted from Table I. More efficient blood use by appropriate ordering and having a preoperative blood donor scheme were suggested.

REFERENCES

1. Sribunditkul S, Mahaisavariya B. Over-ordering of blood in lumbar spinal surgery. J ASEAN Orthop Assoc 1993;7(in press).
2. Roualt CJ, Gruenhagen J. Reorganization of blood ordering practices. Transfusion 1978;18:448-53.
3. Henry JB, Webb WC. Optimal blood ordering for elective surgery. JAMA 1977;237:45.
4. Jaffray B, King PN, Gillon J, Basheer MM. Efficiency of blood use and prospects for autologous transfusion in general surgery. Annals of Roy Col 1991;73:235-80.