Audit on the efficient use of cross-matched blood in elective total hip and total knee replacement

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ABSTRACT

INTRODUCTION This prospective audit studies the use of cross-matched blood in 301 patients over a 1-year period undergoing total knee (TKR) and total hip replacement (THR) surgery in an orthopaedic unit.

PATIENTS AND METHODS Analysis over the first 6 months revealed a high level of unnecessary cross-matched blood. The following interventions were introduced: (i) to cease routine cross-matching for THR; (ii) all patients to have a check full blood count on day 2 after surgery; and (iii) Hb < 8 g/dl to be considered as the trigger for transfusion in patients over 65 years and free from significant co-morbidity. These changes are in accordance with published national guidelines [Anon. Guidelines for the clinical use of red cell transfusions. *Br J Haematol* 2001; **113**: 24–31].

RESULTS In the next 6 months, the number of units cross-matched but not transfused fell by 96% for THR, and the cross-match transfusion (C:T) ratio reduced from 3.21 to 1.62. Reductions were also observed for the TKR cohort. These results provide evidence of a substantial risk and cost benefit in the use of this limited resource. A telephone survey of 44 hospitals revealed that 20 hospitals routinely cross-matched blood for THR and 11 do so for TKR.

CONCLUSIONS Changes can be made to the Maximum Surgical Blood Ordering Schedules (MSBOS) in other orthopaedic units according to national guidelines.

KEYWORDS

Total hip replacement – Total knee replacement – Cross-match transfusion ratio (C/T) – Maximum Surgical Blood Ordering Schedule (MSBOS)

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Patients undergoing total knee (TKR) and total hip replacement (THR) surgery frequently require blood transfusions with evidence showing significant variation in the use of transfusions, related more to the attitude of the clinician than patient parameters.¹

Although 1.7 million people regularly donate blood in the UK, blood is a scarce clinical resource presently costing £110 per unit. Recent safety requirements for leukocyte depletion, nucleic acid testing and blood donation increase the cost and complexity of cross-matching.² Recent events relating to transfusions reinforce concerns regarding both infectious and non-infectious complications, combined with the on-going theoretical risks of the transmission of variant Creutzfeldt-Jakob disease (vCJD).^{3–5}

No randomised, controlled trials have yet been performed to develop evidence-based protocols for the use of blood, and thus 'pragmatic' guidelines were introduced by the British Society for Haematology following the recommendations of the Chief Medical Officer's *Better Blood Transfusion* initiative

(NHS Executive, 1998).^{6,7} It states that 'compatible blood should not generally be made available for surgery where the usage is < 50% of units provided'. These guidelines, aimed to modify clinicians' use of transfusions as an example of clinical governance, provide the basis for this audit.

This study compares blood transfusion use in THR and TKR surgery at a district general hospital to national guidelines and practices in other UK hospitals.

Patients and Methods

A total of 68 elective primary THRs and 89 TKRs at Stoke Mandeville Hospital were assessed over an initial 6-month period (1 February to 21 July 2003). Two units of blood were routinely cross-matched for elective THR and blood group and saved for elective TKR. The overall mean pre-operative haemoglobin was 14.4 g/dl (range, 12.9–16.3 g/dl). A variety of cemented and uncemented prostheses were used, with all patients having TED stockings and calf pumps.

The following parameters were recorded: (i) numbers of cross-matched units of blood requested/used (*i.e.* cross-match transfusion C:T ratio); (ii) the pre-operative and postoperative haemoglobin; and (iii) when the postoperative haemoglobin was taken.

The results from this initial survey were presented at a departmental audit meeting and the following protocol implemented:

1. Group-and-save serum only for elective THR and TKR.
2. All patients should have a FBC on second postoperative day.
3. Hb < 8 g/dl should be considered the indication for transfusion in patients over 65 years and free from significant co-morbidity.

A follow-up analysis performed during the subsequent 6-month period (1 August 2003 to 31 January 2004) included 64 primary THR and 80 primary TKR cases.

Further, for comparison a telephone survey was carried out of blood ordering schedules at both local and national orthopaedic units.

Results

Primary THR

The mean postoperative haemoglobin for patients that received a transfusion fell from 9.1 g/dl (range, 7.2–10.9 g/dl; $n = 68$) to 8.5 g/dl (range, 7.1–9.9 g/dl; $n = 64$). There was a 77% reduction in the number of patients cross-matched (75 to 17) with a corresponding reduction in the C:T ratio from 3.21 to 1.62 (49.5% reduction).

A 96% reduction (53 to 2) in the number of patients cross-matched but subsequently not requiring a transfusion was achieved. Seven patients in the first 6-month period had their surgery cancelled after blood cross-matching, thus needlessly cross-matching 14 units (cost of £1540). There were no similar cases in the second 6-month period.

Primary TKR

The mean postoperative haemoglobin in transfused patients fell from 8.8 g/dl (range, 6.8–9.1 g/dl; $n = 89$) to 7.9 g/dl (range, 7.1–9.9 g/dl; $n = 80$). There was no reduction in the number of patients cross-matched though the C:T ratio dropped from 1.86 to 1.58.

Telephone survey

A telephone survey of maximum surgical blood ordering schedules (MSBOS) for primary THR and TKR in 44 hospitals that undertook elective orthopaedic surgery was conducted.

Regarding primary THR, 24 hospitals (54.5%) group-and-save serum pre-operatively, whereas 19 hospitals

(43.1%) cross-match 2 units of blood pre-operatively – one hospital routinely cross-matched three units of blood.

For TKR surgery, 33 hospitals (75%) group-and-save serum pre-operatively, and 11 hospitals (25%) cross-match 2 units routinely.

Discussion

Total hip and total knee arthroplasty surgery make up a significant proportion of elective orthopaedic surgery in the UK. The peri-operative management for these operations should aim to optimise risk-benefit and cost-benefit ratios. Blood transfusion, as well as obvious benefits, is associated with risks and costs, both in general and specifically for the total hip and knee arthroplasty patient populations.^{8,9}

This audit demonstrates a significant improvement in the efficient use of cross-matched blood for THR surgery as evidenced by a reduction in the C:T ratio to 1.62, comparing favourably with a recent regional audit (average C:T ratio, 2.96).¹⁰ Concurrently, no significant changes in pre- and postoperative haemoglobin levels suggest these improvements were not a consequence of reduced operative losses.

The intervention to routine group-and-save blood pre-operatively was the principal factor responsible for the improved C:T ratio in THR surgery. However, the pre-existing protocol to group-and-save TKR patients explains the smaller reduction in C:T ratio compared with THR. With the cross-matching of blood from group-and-save serum taking only 20 min, there is no evidence to suggest that patients were at greater risk with the change in policy.

Although the selection of 8 g/dl as a transfusion trigger remains controversial, its use in patients free from other significant co-morbidities (especially cardiovascular disease) is beneficial.⁶ However, these recommendations change if the clinical scenario warrants.

Conclusions

These results provide evidence of improved cost-benefit ratio for patients undergoing THR and TKR surgery at Stoke Mandeville Hospital through the efficiency of the use of red cell transfusions.

Our telephone survey showed 44% of hospitals routinely cross-match blood for THR while 25% do so for TKR. This suggests other hospitals may benefit from reviewing their maximum surgical blood ordering schedules for elective THR and TKR surgery in line with current national guidelines.⁶

References

1. The Sanguis Study Group. Use of blood products for elective surgery in 43 European hospitals. *Transfusion Med* 1994; **4**: 251–68.

2. Department of Health. *Further Precautions to Protect Blood Supply*. Press Release, 16 March 2004.
3. Anon. Transfusion patients banned from giving blood. *The Times*, 16 March 2004.
4. Williamson LM, Lowe S, Love EM, Cohen H, Soldan K, McClelland DBL *et al*. Serious hazards of transfusion (SHOT) initiative: analysis of the first two annual reports. *BMJ* 1999; **319**: 16–9.
5. Murphy MF. New variant Creutzfeldt-Jakob disease: the risk of transmission by blood transfusion and the potential benefit of leukocyte reduction of blood components. *Transfusion Med Rev* 1999; **13**: 1–5.
6. Anon. Guidelines for the clinical use of red cell transfusions. *Br J Haematol* 2001; **113**: 24–31.
7. Mehra A, Murray J, deAlwis C. A safe, simple and cost-effective protocol for blood transfusion in primary total knee replacement. *Ann R Coll Surg Engl* 2004; **86**: 260–2.
8. Goodnough LT, Brecher M, Kanter MH, Aubuchon JP. Transfusion medicine: second of two parts – blood conservation. *N Engl J Med* 1999; **340**: 525–33.
9. Bierbaum BE, Callaghan JJ, Galante JO, Rubash HE, Tooms RE, Welch RB. Analysis of blood management in patients having a total hip or knee arthroplasty. *J Bone Joint Surg Am* 1999; **81**: 2–10.
10. Anon. *Comparative Re-Audit of the Use of Red Cell Transfusion in Patients Undergoing Primary Total Hip Replacement in hospitals served by the Oxford Blood Centre*. July 2003.