The appropriateness of blood transfusion following primary total hip replacement

PJ Joy, SJ Bennet

Gloucestershire Hospitals NHS Foundation Trust, UK

ABSTRACT

INTRODUCTION A significant proportion of all red cell transfusions are given to patients undergoing elective orthopaedic surgery. Concern over transfusion safety and cost, coupled with evidence showing that restrictive transfusion policies benefit patients, prompted us to audit our blood prescribing practice at Gloucestershire Hospitals NHS Foundation Trust in order to assess the appropriateness of every transfusion episode following elective primary total hip replacement.

METHODS All patients undergoing a primary total hip replacement in our department over a six-month period were included in the study. Data were collected retrospectively using case note examination and transfusion service data. Standards were dictated by the British Orthopaedic Association guidelines on blood conservation in elective orthopaedic surgery.

RESULTS Twenty-seven per cent of patients (39/143) were transfused. Forty-six per cent of these (18/39) were transfused inappropriately and twenty-three per cent (9/39) appropriately. Thirteen per cent (5/39) had a valid indication for transfusion but were over-transfused and in eighteen per cent (7/39) the quality of documentation did not allow an assessment to be made. Fifty-two per cent of patients who had surgical drains (29/56) were transfused. Reaudit following staff education and amendments to the local transfusion policy did not demonstrate a reduction in transfusion rates.

CONCLUSIONS This audit showed that significant potential exists for reducing transfusion rates based on optimising prescribing practice alone. It also demonstrated that changing local practice based on audit data can be challenging.

KEYWORDS

Arthroplasty – Hip – Anaemia – Blood transfusion

Accepted 4 December 2011

CORRESPONDENCE TO

Paula Joy, Department of Anaesthesia, Peterborough City Hospital, Edith Cavell Campus, Bretton Gate, Peterborough PE3 9GZ, UK
E: paula_joy@hotmail.co.uk

Transfusion following orthopaedic surgery accounts for 10% of all the red cell units issued by the transfusion service at Gloucestershire Hospitals NHS Foundation Trust. Their physiological aim is to increase the oxygen carrying capacity of the blood by raising the haemoglobin (Hb) concentration and allowing more oxygen to be delivered to the tissues. There is no consensus, however, on their precise clinical indications, which leads to significant variation in their use.

Concern regarding the safety of transfusions is highlighted by the Serious Hazards of Transfusion annual reports.¹ Complications relate to the transmission of blood borne infection and their immunomodulatory effects, including a possible increased susceptibility to wound infection. Furthermore, evidence over the last decade strongly suggests that a restrictive transfusion threshold of 7g/dl is safe and possibly superior to a threshold of 10g/dl.² A restrictive strategy of red cell transfusion is at least as effective as and possibly superior to a liberal transfusion strategy in critically ill patients.³ With concerns over safety, cost and the lack of availability of blood, every transfusion in orthopaedics should be carefully considered.

Two recent large regional audits examined the appropriateness of their local blood prescribing practice. The results

for orthopaedics showed that 47%⁴ and 50%⁵ of all red cells were transfused inappropriately, the highest level of all hospital specialties.

Many factors influence oxygen delivery and extraction by the tissues, and transfusion decisions should not be based on Hb concentration alone. Compensatory factors such as increased cardiac output, reduced blood viscosity, peripheral vasodilatation and an increase in 2,3-diphosphoglycerate all act to maintain adequate tissue oxygen delivery. Clinicians may underestimate the effectiveness of such adaptive mechanisms.

We aimed to assess the appropriateness of every transfusion episode following elective primary total hip replacements in our unit.

Methods

All patients undergoing a primary total hip replacement within a six-month period were identified retrospectively by hospital coding. Medical case notes were reviewed and the following information was noted: patient age, sex, past medical history, ASA (American Society of Anesthesiologists) grade, use of pre-operative antiplatelet therapy, surgeon,

use of surgical site drain, admission and post-operative Hb concentrations, documentation of indication for transfusion, number of units transfused, timing of transfusion, post-transfusion Hb level and length of hospital stay.

Each transfusion episode was classified as one of the following:

1. Transfusion appropriate and number of units transfused appropriate
2. Transfusion appropriate but number of units transfused inappropriate
3. Transfusion considered inappropriate
4. Quality of documentation did not allow an accurate decision regarding appropriateness

The classifications were based on the British Orthopaedic Association (BOA) guidelines (Table 1) and two further stipulations, namely that the transfusion trigger may be higher if there is documented ongoing significant bleeding at the time of the transfusion and that patients with Hb levels of between 7g/dl and 8g/dl were considered transfused appropriately if they were assessed as symptomatic from anaemia.

Following this data collection period, the results of the study were presented at a trust audit meeting. The issues of inappropriate transfusion were highlighted and several measures were introduced to the transfusion policy in the orthopaedic department. The anaesthetist would be responsible for setting a transfusion trigger for each patient. The indication for each transfusion episode had to be documented clearly in the medical notes and agreed by the orthopaedic registrar or consultant.

Results

The results are shown in Table 2. A total of 143 patients underwent primary total hip replacements during the study period. Twenty-seven per cent of patients (39/143) were transfused a mean number of 2.4 units.

Transfusion was appropriate in nine patients. Five patients had a valid indication for transfusion but were transfused excessively. Eighteen patients received blood transfusion inappropriately and in seven cases the quality of documentation was too poor to make an adequate assessment.

A single unit of blood at Gloucestershire Hospitals NHS Foundation Trust costs £139.70. Eighteen patients were deemed transfused inappropriately with a mean number of 2.4 units, at a cost of £6,055 (£12,070 annually). This figure underestimates the actual excess cost to the trust as it does not consider the five patients who were over-transfused or the seven patients whose transfusion episodes were not analysed due to poor documentation.

Fifty-six patients had surgical site drains placed at the time of surgery. Of these, 29 (52%) were transfused. The relative risk of blood transfusion for patients with a surgical drain was 3.99 (95% confidence interval: 3.35–4.63).

Six months following the presentation of the audit results and the change in departmental transfusion policy, data were collected retrospectively on 128 consecutive primary total hip replacements. Twenty-nine per cent of patients (37/128) received a mean number of 2.3 units of blood post-operatively, demonstrating that transfusion rates had not fallen following the change in transfusion policy.

Table 1 Summary of guidelines from the British Orthopaedic Association's *Blood Conservation in Elective Orthopaedic Surgery*⁶

- Patients should not normally be transfused if the haemoglobin concentration is >10g/dl.
- A strong indication for transfusion is a haemoglobin concentration <7g/dl.
- Transfusion will become essential when the haemoglobin concentration decreases to 5g/dl.
- A haemoglobin concentration of between 8g/dl and 10g/dl is a safe level, even for those patients with significant cardiorespiratory disease.*
- Symptomatic patients should be transfused.**
- It is appropriate to use a one-unit transfusion to exceed transfusion threshold if necessary.

*Over-transfusion was defined as a post-transfusion Hb level of 1.0g/dl above the defined safe level.

**Symptoms of dyspnoea, angina, tachycardia, orthostatic hypotension and syncope that can only be attributed to anaemia, not another pathophysiological process

Table 2 Appropriateness of blood transfusions

	Number of patients	Proportion of total transfused
Transfusion appropriate and number of units transfused appropriate	9	23%
Transfusion appropriate but number of units considered inappropriate	5	13%
Transfusion considered inappropriate	18	46%
Inadequate documentation	7	18%
Total	39	100%

Discussion

The Department of Health's *Better Blood Transfusion* recommends avoiding the unnecessary use of blood components and suggests regular audit and feedback of results of transfusion practice as well as the provision of regular documented training for all staff involved in the transfusion process.⁷

The BOA guidelines for blood transfusion in elective surgery were used to guide standards in this audit. It should be noted that had other professional body guidance been followed, the above results may have been slightly different. The main area of contention is regarding patients with Hb concentrations between 7g/dl and 10g/dl who may tolerate anaemia poorly. What is clear, however, is that doctors can be quick to attribute many symptoms to a patient's anaemia rather than other common conditions such as hypovolaemia, sepsis or even the fatigue associated with undergoing major surgery. Furthermore, the doctrine of treating something that can be treated (ie Hb level) should be avoided.

A total of 21,000 units of red blood cells are transfused annually in Gloucestershire Hospitals NHS Foundation Trust, with orthopaedic surgery accounting for 10% of this. If 46% of blood is inappropriately transfused across all orthopaedic patients, this would cost the trust £134,950 per year.

The use of a drain is also highlighted as a significant risk factor for requiring a transfusion. Drains are sited on the premise that they reduce the risk of post-operative wound infection and haematoma. The results from two randomised controlled trials from 2009 and 2010 suggested that no drain or autologous transfusion/reinfusion drains confer a reduced likelihood of requiring a post-operative blood transfusion and lead to a shorter inpatient stay.^{8,9} Furthermore, a meta-analysis of 18 randomised controlled trials, published in 2004, also indicated that closed suction drainage offers no significant benefit and increases the need for a blood transfusion after elective hip and knee replacements.¹⁰

Educating doctors with regards to the correct indications and potential adverse outcomes of transfusion has been shown to reduce inappropriate episodes by 40%.¹¹ In addition, it has been demonstrated that senior doctors prescribe inappropriate transfusions more often than their junior colleagues.¹²

Unfortunately, our reaudit showed that transfusion rates have not declined in this patient population. Despite effort

on the part of several clinicians, the policy changes have not been incorporated into everyone's practice. Perhaps further educational sessions for medical and nursing staff are required along with more regimented implementation of the changes by senior members of staff.

Conclusions

Our results demonstrate the over-prescription of red blood cells in elective orthopaedic patients as well as the significant potential to decrease transfusion rates based purely on optimising prescribing practice alone. The inappropriate prescription of blood exposes patients unnecessarily to the risks of transfusion and it also has significant cost implications. Furthermore, with chronic shortages of blood stocks nationally, any reduction in transfusion rates would be welcomed by both blood banks and donors.

References

1. Serious Hazards of Transfusion. *Annual Report 2010*. Manchester: SHOT; 2011.
2. Association of Anaesthetists of Great Britain and Ireland. *Blood Transfusion and the Anaesthetist: Red Cell Transfusion 2*. London: AAGBI; 2008.
3. Hébert PC, Wells G, Blajchman MA *et al*. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. *N Engl J Med* 1999; **340**: 409–417.
4. National Comparative Audit of Blood Transfusion. *Comparative Audit of Red Cell Use in the Hospitals in the South West and West Midlands Regions*. NCABT; 2008.
5. Northern Ireland Regional Transfusion Committee. *Regional Appropriateness of Blood Transfusion Audit – Summary Report*. NIRTC; 2006.
6. British Orthopaedic Association. *Blood Conservation in Elective Orthopaedic Surgery*. London: BOA; 2005.
7. Department of Health. *Better Blood Transfusion*. London: DH; 2007.
8. Cheung G, Oakley JE, Bing AJ *et al*. The effect of drains on transfusion requirements in primary total hip replacement: a prospective randomised trial. *J Bone Joint Surg Br* 2010; **92 Supp III**: 388.
9. Cheung G, Carmont MR, Bing AJ *et al*. No drain, autologous transfusion drain or suction drain? A randomised prospective study in total hip replacement surgery of 168 patients. *Acta Orthop Belg* 2010; **76**: 619–627.
10. Parker MJ, Roberts CP, Hay D. Closed suction drainage for hip and knee arthroplasty. A meta-analysis. *J Bone Joint Surg Am* 2004; **86**: 1,146–1,152.
11. Soumerai SB, Salem-Schatz S, Avorn J *et al*. A controlled trial of educational outreach to improve blood transfusion practice. *JAMA* 1993; **270**: 961–966.
12. Salem-Schatz SR, Avorn J, Soumerai SB. Influence of clinical knowledge, organizational context, and practice style on transfusion decision making. Implications for practice change strategies. *JAMA* 1990; **264**: 476–483.