Blood utilization in hip and knee arthroplasty: a cost-minimization study
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Routine pre-operative crossmatching of blood (Phase 1) was compared to a policy of grouping, screening and saving (G&S) (Phase 2) blood for patients having a primary total hip or total knee arthroplasty.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The population of interest comprised patients having primary elective total hip arthroplasty (THA) or primary elective total knee arthroplasty (TKA).

Setting
The setting was secondary care. The economic study was carried out in Northumberland, UK.

Dates to which data relate
Effectiveness and resource use data collection for phase 1 (crossmatched blood) of the study was carried out between 1 May 1995 and 31 July 1995 and between 1 January 1996 and 31 March 1996 for phase 2 (G&S policy). The price year was not reported explicitly.

Source of effectiveness data
The source of effectiveness data was a single study.

Link between effectiveness and cost data
The collection of resource use data was undertaken prospectively on the same patient sample as that used in the effectiveness study.

Study sample
The authors did not report any calculations to estimate sample size required to detect statistically significant differences in costs or effects. All patients listed for elective hip or knee arthroplasty were included in the study. No further inclusion or exclusion criteria were reported. The study sample was appropriate for the clinical study question. In phase 1 of the study (crossmatched blood), 73 patients (age range: 45 - 88 years) underwent surgery and 38 had a total hip arthroplasty and 35 had a total knee arthroplasty. In phase 2 (G&S policy), 67 patients (age range: 40 - 84 years) underwent surgery and 33 had a total hip arthroplasty and 34 had a total knee arthroplasty.
Study design
The study was a single centre, before-and-after study using two separate cohorts of patients. Patients were followed-up from the start of surgery until they were discharged from the ward. No loss to follow-up was reported. The authors did not report whether investigators or patients were masked to the method of blood transfusion policy for the study period or analysis of data.

Analysis of effectiveness
The analysis of the effectiveness study was based on treatment completers only.

The primary health outcomes were units of blood requested pre-operatively and the units of blood transfused on day 1 and days 2 to 7.

Pre- and post-operative haemoglobin levels were recorded.

The total units of blood not used within the first week post-operatively and the additional units of blood transfused between days 2 and 7 and total number of units of blood transfused, were also recorded.

The numbers of adverse reactions to the blood transfusion were recorded.

Patients were shown to be comparable between the two groups, crossmatch and G&S, for age and sex distribution, and for grade of operating surgeon.

Effectiveness results
Using routine pre-operative cross matching (phase 1), 213 units of blood were crossmatched pre-operatively and 112 of these were transfused (53%) on day 1 and a further 15 were used on days 2 to 7. A total of 86 units remained unused (40%). Twelve patients required additional crossmatch of 18 units, all of which were transfused within the first week.

Using the G&S policy (phase 2), no blood was crossmatched pre-operatively and 79 units of blood were requested and transfused on day 1 in response to peri-operative blood loss and haemodynamic status. A further 38 units were requested and transfused on days 2 to 7.

There was no significant difference between the crossmatch group (phase 1) and G&S policy group (phase 2) in terms of pre-operative haemoglobin levels: 129g per litre (+/-14) for the crossmatch group and 131g per litre (+/-13.7) for the G&S policy group (not significant).

The average 48-hour post-operative haemoglobin levels were: 113.6g per litre (+/-13.1, n=70) for the crossmatch group and 113.6g per litre (+/-16.6, n=59) for the G&S policy group (not significant).

No adverse reactions were reported.

Clinical conclusions
The authors concluded that the G&S policy for major joint replacement is a safe and acceptable practice.

Measure of benefits used in the economic analysis
The outcomes were reported in a disaggregated way and as such this was a cost-consequences analysis.

Direct costs
Costs and quantities were not analysed separately. The study reported the direct costs associated with the number of units of blood that were wasted as a result of the routine pre-operative crossmatch policy. These were hospital costs associated with labour, materials and blood handling charges from the Northern Region Blood Transfusion Centre.
There was no difference between the cost of a unit of blood ordered during or out of office hours because the Centre operates a 24-hour shift system and so the same unit cost was applied to all units of blood whenever they were ordered. The authors reported that the length of hospital admission for patients having crossmatched blood (12 days) was significantly longer (p<0.05) than the length of stay for the patients using the G&S policy (9.5 days). The cost of this difference in length of stay was not quantified. The authors reported cost savings as a result of using a G&S policy rather than routine crossmatching of blood using the unit cost to the orthopaedic directorate for 3 units of blood (115.75).

Discounting was not carried out due to the short time frame of the analysis. The price year was not reported.

Statistical analysis of costs
No statistical analysis of costs was reported.

Indirect Costs
No indirect costs were included in the analysis.

Currency
UK pounds sterling (£). No currency conversions were reported.

Sensitivity analysis
The authors did not carry out a sensitivity analysis.

Estimated benefits used in the economic analysis
See effectiveness results above.

Cost results
The authors reported that the adoption of a G&S policy resulted in an annual saving of over 8,000 per year, corresponding to a handling fee of 18 units of blood per month, for the hospital orthopaedic directorate.

Synthesis of costs and benefits
Costs and benefits were not combined.

Authors’ conclusions
The authors’ concluded that using a G&S policy rather than routine pre-operative blood crossmatching for primary elective hip and knee arthroplasty demonstrated significant cost savings. The authors recommended that G&S is a safe, practical option that improves the efficiency of blood ordering and produces a considerable financial saving.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used, namely that it represents an approach that has been validated and sanctioned by the British Blood Transfusion Society. You, as a user of this database, should decide if this is a widely used health technology in your own setting.

Validity of estimate of measure of effectiveness
The source of the effectiveness data was a single study. The study used a before-and-after design with two patient cohorts, which was appropriate for the aim of the study to determine the safety and practicality of using a G&S policy
rather than routine crossmatching of blood for joint arthroplasty. However, this study design was not appropriate to evaluate the clinical effectiveness of the G&S policy. The study sample was representative of the study population. Patients groups were shown to be comparable at analysis. The study did not report a power calculation and it is not clear if the study sample was large enough to detect a statistical difference between the selected outcome variables. Therefore, the lack of statistically significant differences could have been due to chance rather than equivalence.

**Validity of estimate of measure of benefit**
The authors did not derive a measure of health benefit. The analysis was therefore categorised as a cost-consequences study.

**Validity of estimate of costs**
The study perspective was not reported explicitly. The study only quantified the cost of handling wasted units of blood. Some relevant costs, such as the cost of length of stay, appear to have been omitted from the analysis. The authors reported that the cost of an antibody screen was £1.20 but did not attach this unit cost to resource use and compare it directly with the cost of crossmatching a unit of blood. The omission of these costs is unlikely to change the conclusion that G&S policy is less expensive than crossmatching. However, not all the relevant data were presented to give an accurate estimate of the cost of a G&S policy compared to crossmatching. Costs and quantities were not reported separately, no statistical analysis of costs or quantities was reported, and no sensitivity analysis of quantities or costs was conducted, which may limit the generalisability of the study's findings. Appropriate currency conversions were not performed. Since all costs were incurred over a short time frame (less than one year) discounting was unnecessary.

**Other issues**
Although the authors commented that their recommendations were in line with the BCSH blood transfusion service task force guidelines, and other authors, they did not report any supporting evidence and failed to make appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was not addressed due to the omission of a sensitivity analysis. The authors did not appear to present their results selectively. The study enrolled patients undergoing elective joint arthroplasty and this was reflected in the authors' conclusions. The authors did not report any limitations to the design of their study.

**Implications of the study**
The authors recommend the introduction of a G&S policy rather than routine crossmatching of blood for patients having a total hip or knee arthroplasty. They suggested that this recommendation is in line with the British Committee for Standards in Haematology blood transfusion task force guidelines.

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