A case-control study of the impact of WBC reduction on the cost of hospital care for patients undergoing coronary artery bypass graft surgery
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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
The health technology examined was the reduction of white blood cells (WBCs) for transfusions in patients undergoing coronary artery bypass graft (CABG) surgery.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised all patients undergoing CABG surgery.

Setting
The setting was tertiary care. The study was undertaken in the Cedars-Sinai Medical Center, Los Angeles (CA), USA.

Dates to which data relate
The clinical effectiveness and resource use data related to 1991 to 1994. No price year was reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The resource use data were collected retrospectively from the same patient sample that provided the clinical evidence data.

Study sample
All patients undergoing CABG surgery during the three study periods were included in the study. They were identified through a historical audit of hospital records. A total of 1,725 patients were included in the study. Of the 568 patients in the group before the use of WBC-reduced blood, 416 received a transfusion (mean age 70 years; men 69%) and 152 (mean age 63 years; men 92%) did not. Of the 666 patients who underwent CABG surgery when WBC-reduced blood was being used, 484 received a transfusion (mean age 71 years; men 69%) and 182 (mean age 63 years; men 87%) did not. Of the 491 patients in the group after the discontinuation of WBC-reduced blood, 317 received a transfusion (mean age 72 years; men 66%) and 174 (mean age 64 years; men 87%) did not. The authors did not compare their patient sample with the wider patient population undergoing CABG surgery. No sample size or power calculations
were reported.

**Study design**
The study was a retrospective case-control study that was conducted in a single centre. Three study periods were compared. More specifically, the 12 months before WBC reduction (period 1, 1991), the 24 months during WBC reduction (period 2, 1992 - 1993), and the 12 months following WBC reduction (period 3, 1994). The patients were followed up for the duration of their hospital stay. The retrospective nature of the study means that there was no loss to follow-up. There was no blinding in this study.

**Analysis of effectiveness**
The nature of the study means that the analysis of the clinical effectiveness data was conducted for treatment completers only. The incidence of postoperative infections and the length of hospital stay were used as the measures of effectiveness. The patients who did not receive a blood transfusion were more likely to be male and to be aged younger than those who received a transfusion. However, the analysis of the data considered whether there was a difference in trends over time between the two groups, and the only statistically significant difference in age and gender between the patient groups was that the mean age of the patients who received a transfusion increased slightly from 70 years in the first time period to 72 years in the final period.

**Effectiveness results**
Among patients who received a transfusion, the incidence of postoperative infection was 11% prior to the use of WBC-reduced blood, 13% during the use of WBC-reduced blood, and 7% after the discontinuation of WBC-reduced blood, (p=0.04).

Among patients who did not have a transfusion, the incidence of postoperative infection was 7% prior to the use of WBC-reduced blood, 7% during the use of WBC-reduced blood, and 2% after the discontinuation of WBC-reduced blood, (p=0.06).

The mean length of stay decreased significantly over time for patients who received transfusion, changing from 15.91 days before WBC reduction, to 14.12 days during WBC reduction and 12.14 days following WBC reduction, (p=0.001).

A similar trend was observed in the patients who did not receive transfusion. The mean length of stay changed from 11.01 days before WBC reduction, to 9.95 days during WBC reduction and to 8.27 days following WBC reduction, (p=0.001).

**Clinical conclusions**
The authors concluded that the use of WBC-reduced blood did not alter the length of hospital stay and the incidence of postoperative infection.

**Measure of benefits used in the economic analysis**
No summary measure of benefit was used in the economic analysis. In effect, a cost-consequences analysis was carried out.

**Direct costs**
The estimation of costs was derived from the patient sample. The authors only stated that the cost of hospital care was taken from the patients' hospital records. The cost components were not reported separately. The prices used related to the year in which the patient was treated. Consequently, no single price year was used. The costs were not discounted.
Statistical analysis of costs
The data on hospital costs were square root-transformed and the means and 95% confidence intervals (CIs) were calculated.

Indirect Costs
No indirect costs were included in this study.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
Among patients who received a transfusion, the mean costs were $38,478 (95% CI: 37,518 - 41,493) prior to WBC reduction, $40,836 (95% CI: 38,884 - 42,833) during WBC reduction, and $37,943 (95% CI: 36,111 - 39,820) after the discontinuation of WBC-reduced blood.

Among patients who did not have a transfusion, the mean costs were $26,734 (95% CI: 25,135 - 28,382) prior to WBC reduction, $26,012 (95% CI: 24,981 - 27,063) during WBC reduction, and $25,279 (95% CI: 24,239 - 26,340) after the discontinuation of WBC-reduced blood.

The mean total cost of hospital care did not change significantly over time for patients who either received a transfusion, (p=0.14), or did not receive a transfusion, (p=0.27).

There was no evidence that the cost of hospitalisation decreased during the years of WBC reduction for patients who received a transfusion.

Synthesis of costs and benefits
The health benefits and costs were not combined since the study was, in effect, a cost-consequences analysis.

Authors' conclusions
The study failed to demonstrated any significant impact of white blood cell (WBC)-reduced blood components on length of stay, total cost of hospital care, or incidence of postoperative infection during the 4-year period of investigation.

CRD COMMENTARY - Selection of comparators
The authors used historical comparators that illustrated the changing practices in their setting. You should consider how this relates to usual practice in your setting.

Validity of estimate of measure of effectiveness
The study used clinical effectiveness data from a retrospective case-control study. The authors acknowledged that uncontrolled, retrospective analyses could be misleading because of a general effort throughout the past decade to
reduce the length of hospital stay and cost of care for all patients. Thus, a randomised controlled trial would have provided a more robust study design. The study groups were not comparable at baseline. Hence, confounding factors may be high. The study sample was likely to have been representative of the patient population, although this was not discussed. A statistical analysis was performed to investigate whether the results were statistically significant. However, power calculations were not carried out, thus the sample size might have been too small to detect significant differences in outcomes between the groups.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. The analysis was, in effect, a cost-consequences analysis.

**Validity of estimate of costs**
The authors did not report the economic perspective of the study. However, it seems that the perspective adopted was that of the hospital. The total hospital costs were estimated for each group, although the cost components these costs included were not reported. The resource use data and the unit costs were not reported separately. No single price year was used. The cost estimates were derived from a single centre and were specific to the study setting. These facts limit the reproducibility of the study findings. The fact that the costs were calculated and analysed using prices at the time of treating, and no reflation exercise was undertaken, means that the internal validity of the cost results is limited. Statistical tests were performed when the cost estimates were compared. However, sensitivity analyses on the costs were not performed. This means that uncertainty surrounding the study results has not been assessed, thus the generalisability of the study is reduced. Discounting was appropriately not undertaken since the cost per case was incurred during less than 2 years.

**Other issues**
The authors did not compare their clinical results with other published papers. They reported that prospective studies, which were conducted to answer the same question, yielded conflicting results. The authors did not explicitly consider how their findings could be generalised to other settings. The conclusions of the study accurately represented the results and the data were not presented selectively. The authors reported that the study design (a retrospective case-control study) was a limitation of their study. Sensitivity analyses, to account for variability in the cost or effectiveness data, were not performed. Consequently, caution should be exercised when extrapolating the study results to different contexts.

**Implications of the study**
The authors did not make any recommendations for policy, practice or further research as a result of their study.

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