Does salvage and tranexamic acid reduce the need for blood transfusion in revision hip surgery?

We carried out a retrospective case-control study in 80 patients who underwent a revision total hip replacement. Group A (40 patients) received tranexamic acid and intra-operative cell salvage. Group B (40 patients) was a matched control group and did not receive this management. Each group was divided into four subgroups: revision of both components, revision of both components with bone grafting, revision of the acetabular component with or without bone graft, and revision of the femoral component with or without bone graft.

In group A the total number of units transfused was 52, compared with 139 in group B, representing a reduction in blood usage of 62.5%. The mean amount of blood transfused from cell salvage in each group was 858 ml (113 to 2100), 477 ml (0 to 2680), 228 ml (75 to 315) and 464 ml (120 to 1125), respectively. There was a significant difference in the amount of blood returned between the groups (p < 0.0001).

In group A, 22 patients needed transfusion and in group B, 37 (p < 0.0001). A cost analysis calculation showed a total revenue saving of £70 000 and a potential saving throughout our facility of £318 288 per year.

Our results show that a significant reduction in blood transfusion can be made using combined cell salvage and tranexamic acid in revision surgery of the hip.

Problems that may be encountered as a result of blood transfusion include transmission of disease, anaphylaxis, haemolytic reactions, expense and constraints on availability. The British Orthopaedic Association has issued guidelines which state that in elective arthroplasty, blood should be returned to the patient where possible and that blood-conserving methods are employed. The use of cell salvage and tranexamic acid alone has been shown to substantially reduce the need for allogenic transfusion. Tranexamic acid works as a fibrinolytic inhibitor. This study examines this combination during revision surgery of the hip. Because cell salvage is performed during the procedure and tranexamic acid has an effect which lasts approximately three hours, it was felt that this combination would reduce the requirements for transfusion better than either alone. Consequently, we have not studied these treatments in isolation. The preparation of the patient before operation, good soft-tissue handling, adequate haemostasis and blood conservation are critical in revision surgery. Pre-operative blood donation has not been shown to be effective in the UK. Cost analyses of cell salvage and tranexamic acid have been studied and shown to be efficacious.

Patients and Methods
There were 40 patients in the study group (group A) and 40 in the control group (group B). The control group had revision surgery between 2003 and 2004 and the study group between 2004 and 2005. The patients in the groups were matched for age, gender, approach, not having rheumatoid disease and not having non steroidal anti-inflammatory drugs, aspirin or anticoagulants, with a normal clotting screen. Patients had pre-operative management to optimise their suitability for surgery. All had epidural anaesthesia and nerve blocks. Tranexamic acid was given provided that there was no contraindication. As the only real contraindication is a proven allergy, a rare complication which we did not observe, all patients received this drug. They were given 10 mg/kg at induction, 30 minutes before the incision. This was followed by 10 mg/kg over six hours, starting immediately after the induction dose. Cell salvage was performed using either haemonetics cells saver 5 (Haemonetics UK Ltd, Leeds, United Kingdom) or Dideco/electa (COBE Cardiovascular Inc., Arvada, Colorado) machines, which produce a concentrated haematocrit. Patients with infection and malignancy were excluded. Hydrogen peroxide solu-
tion was used initially during the operation, but the suction was changed and the wounds thoroughly irrigated with normal saline before cell salvage. Transfusion was used during the operation with a haemoglobin level of < 7 g/dl in patients with cardiac risk factors and < 8 g/dl in patients with no cardiac risk factors. Bellovac drains (Astra Tech Ltd., Stonehouse, United Kingdom) were inserted into the wound. All patients received clexane (Sanofi-aventis, Guildford, United Kingdom) 40 mg subcutaneously once daily. The haemoglobin concentrations were measured on days three and five.

Statistical analysis. Analysis of variance was used to analyse differences between the subgroups in terms of the number of units transfused and the amount of cell salvage returned. For the number receiving a transfusion in both the study and control groups, a chi-squared analysis was performed. A p value of 0.05 or less was considered significant. All data were provided with a 95% confidence interval (CI) when appropriate.

Results
Table I shows the total reduction in the number of units of blood (packed red blood cells) transfused in the two groups. We have broken this down into subgroups to illustrate that the amount of blood returned varied between the groups, depending on the complexity of the revision, which component was revised, and whether bone graft was used. The difference in the amount transfused between the subgroups was significant (p < 0.0001, 95% CI 1.16 to 2.74, power for 5% significance > 99.99%). There was a significant reduction in the post-operative haemoglobin levels (9.9 g/dl (7.4 to 12.6)) in the cell salvage/tranexamic acid group (p < 0.0001). This low haemoglobin level meant that post-operative transfusion was not required in the majority of cases. The amount of cell salvage returned was greatest in the patients who underwent revision of both components. They received a mean of 858 ml (113 to 2100), which is equivalent to four units of packed red cells (Table II). The total number of patients requiring transfusion in the study group was 22 and in the control group 37 (p < 0.0001). Complications in the control group included one deep-vein thrombosis and one wound haematoma which required drainage. Cellulitis, which resolved with antibiotics, was seen in one patient in the study group.

Discussion
The benefits of cell salvage and tranexamic acid used in isolation have been shown in elective joint replacement.5,6 This study evaluated the efficacy of cell salvage and tranexamic acid in combination on the basis of surgical complexity in matched groups. The mean cell salvage returned was highest in the group undergoing revision of both components (858 ml). This can be explained by the greater complexity and probably longer operating times. The amount of cell salvage returned significantly influenced the post-operative haemoglobin level. This indicates that cell salvage has a positive effect in reducing blood transfusion.

At our hospital, a report on the introduction of a blood conservation policy for the musculoskeletal division was carried out in July 2005 by forensic accountants. The total direct and indirect potential savings on the costs of blood and hospital stay were calculated at £3 188 288 per year. The total revenue saving was £70 000 per year. The savings attributable to the reduced length of stay by avoiding transfusion was £756 per patient, or 2.8 days at £270 per day. An audit conducted at our facility showed that a patient undergoing post-operative transfusion remained in hospital two days longer than a patient who was not transfused post-operatively. This could be attributed to slower rehabilitation.

In revision hip surgery, cell salvage and tranexamic acid in combination significantly reduces the need for blood transfusion. This has positive effects in terms of reduced risks to patients, cost effectiveness, quality of service, patient choice and reduced length of stay.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References