There were 22 patients with cerebral palsy aged six to 17 years who underwent an acetabuloplasty as part of an open reduction of the hip. In 11 patients a paediatric cell saver was used to collect autologous blood which was re-infused per-operatively. This group was compared to a cohort of 11 patients undergoing similar operations in whom only banked homologous blood was transfused.

On average, 432 ml of autologous blood was re-infused compared to 909 ml of homologous blood (p < 0.01), representing 19.6% and 47% of the total blood volume, respectively (p < 0.002). Two units of homologous blood were transfused in the cell saver group compared with 20 units in the control group (p < 0.001). When using a paediatric cell saver, homologous blood transfusion was avoided in 82% of patients and there were no complications.

Patients and Methods

Over a five-year period, 22 acetabuloplasties were undertaken as part of open reduction of the hip in children with cerebral palsy. In the majority of patients (17), an ipsilateral varus derotation osteotomy of the proximal femur was also carried out. Between 1999 and 2002, we used a paediatric cell saver during the operation in a consecutive series of 11 patients (autologous group). This group was compared with a cohort of 11 consecutive patients operated on between 1997 and 1999, in which a cell saver was not used (control group).

To collect and transfuse autologous blood, a BRAT 2® system from COBE® (Qedgeley, UK) was used. The process involves three stages. In the first stage, blood from suction and swabs is collected in a 2 L reservoir and mixed with anticoagulant citrate dextrose formula A. During the second stage the collected blood is centrifuged in a 135 ml bowl, thus concentrating the red blood cells. This concentrate is washed with 1000 to 1500 ml of normal saline to remove cellular stroma, plasma-free haemoglobin, clotting degradation products and anticoagulant. The packed and washed red cells are then pumped into a re-infusion bag. The blood is re-infused through a 20 µm filter at the end of the operation.

The autologous blood has a known haematocrit of 60%.

Autologous transfusion is well established as an option to deal with loss of blood in orthopaedic procedures. The reduced risk of transmission of diseases, such as hepatitis B and C, AIDS and possibly variant Creutzfeldt-Jakob disease outweighs the increased cost of some forms of autologous transfusion.1-3 Different techniques of autologous transfusion are available; pre-operative donation, peri-operative haemodilution, intra-operative salvage and post-operative collection. To our knowledge no comparative studies on the use of an intra-operative paediatric cell saver have been published. We have compared the transfusion requirements of 11 children who underwent an acetabuloplasty with the use of a cell saver, with those of a cohort of 11 children where a cell saver was not used.
the autologous and homologous blood allowed the calculation of the volume of the transfused blood (corrected volume), which was expressed as a percentage of the total blood volume. Statistical analysis between the groups included the unpaired Student’s t-test and the Mann-Whitney U test.

Results

The patient and operative details can be seen in Table I. Two anaesthetists were involved, one for all the patients in the autologous group and eight of 11 in the control group, and one for the remainder. The mean volume of transfused autologous blood was 432 ml, which represented 19.6% of the total blood volume (9% to 40%). In addition, two patients received one unit of homologous blood each on the first post-operative day. In the control group a mean 1.8 units (909 ml) of homologous blood were transfused (1 to 4 L). This represented on average 47% of the total blood volume (23% to 98%). The difference between the absolute amounts was statistically significant (p < 0.01), as was the difference between the percentages of total blood volume (p < 0.002). In total, only two units of homologous blood were transfused in the autologous group compared with 20 in the control group, which was highly significant (p < 0.001).

Homologous blood was avoided in nine of the 11 patients (82%) in the autologous transfusion group. All patients in the control group received homologous blood. There was no statistically significant difference between operations with and without a femoral osteotomy (p = 0.56). The mean post-operative haemoglobin and haematocrit was the same for both groups (Table II). There were no complications affecting blood requirements.

Discussion

Although the potential benefits of autologous transfusion are obvious, the technique is used only sporadically. Despite an increase in awareness of its potential benefits, its use has not increased over the last decade. In paediatric operations, where a relatively large percentage of the total blood volume can be lost, replacement with large quantities of homologous blood carries a risk of the transmission of disease.

Previous studies have shown that when using pre-operative donation alone between 63% and 90% of children had their transfusion needs met entirely with autologous blood. In our study, 82% of patients receiving salvaged autologous blood during the operation avoided additional transfusion of homologous blood. Pre-operative donation requires an understanding and co-operative patient. There are technical problems, with small needles increasing the risk of collecting unusable units of blood. It has been reported that pre-operative donation of blood is associated with dizziness, fainting, nausea and/or vomiting, apprehension and hypertension in 9.9% of patients. In addition to the general advantages of autologous transfusion, intra-operative salvage and re-infusion avoids the technical problems, complications and the issue of patient co-operation associated with pre-operative donation.

In a study by Simpson et al., 175 children who underwent elective orthopaedic operations and donated blood pre-operatively, 70 also had intra-operative salvage. Both this group and the remaining 105 patients received similar amounts of donated blood. In addition, the 70 patients received a mean of 210 ml of salvaged autologous blood during the operation avoided additional transfusion of homologous blood. Pre-operative donation requires an understanding and co-operative patient. There are technical problems, with small needles increasing the risk of collecting unusable units of blood. It has been reported that pre-operative donation of blood is associated with dizziness, fainting, nausea and/or vomiting, apprehension and hypertension in 9.9% of patients. In addition to the general advantages of autologous transfusion, intra-operative salvage and re-infusion avoids the technical problems, complications and the issue of patient co-operation associated with pre-operative donation.

Keverline and Sanders described three patients with transient haematuria associated with the use of intra-operative salvage and re-infusion in different paediatric orthopaedic operations. It was thought to be caused by a direct insult to the kidneys by the return of poorly washed blood. We washed the collected blood with 1000 to 1500 ml of normal saline and did not encounter any complications related to intra-operative blood salvage and re-infusion.
Pre-operative blood donation may not be cost-effective if collected blood is not used or used only because it is available. The cost of the use of the cell-saver in our study was £80 per patient (for the collecting and processing bowls), while the cost of one unit of banked blood was £99.77.

Our findings support the use of a cell saver in acetabuloplasty in children. It avoided transfusion of homologous blood in 82% of patients and there were no complications.

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References