Autologous blood reinfusion in patients undergoing bilateral total hip arthroplasty

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ABSTRACT

Purpose. To compare the rate and unit of allogeneic blood transfusion in one-stage bilateral total hip arthroplasty (THA) in patients with and without autologous blood reinfusion.

Methods. Records of a consecutive series of 43 men and 33 women aged 25 to 83 (mean, 55) years who underwent one-stage sequential bilateral THA by a single surgeon were reviewed. Their risks of cardiopulmonary complications were minimal. At least 4 weeks prior to surgery, 38 of the patients donated 2 units of autologous blood in 2 stages (one to 2 weeks apart). The remaining 38 patients did not donate blood owing to personal preferences or logistical reasons. All pre-donated autologous blood was transfused back to the patients in the recovery room. Estimated blood loss volume, blood salvaged volume, and complications were recorded, as were pre- and post-operative haemoglobin levels. The 2 groups were compared with respect to the rate and unit of allogeneic blood transfusion.

Results. The mean estimated blood loss was 939 (SD, 448; range, 200–2500) ml. The mean volume of blood salvaged was 302 (SD, 196; range, 0–850) ml, representing a collection rate of 32%. In patients with and without autologous blood reinfusion, 16 (42%) and 33 (87%) patients received allogeneic blood transfusion of 0.9 and 2.4 units, respectively (p<0.0001). Four patients developed major cardiopulmonary complications. None had deep venous thrombosis or pulmonary embolism. No complications resulted from blood transfusion. The 2 groups were not significantly different in complication rate (13% vs. 18%, p=0.54) and discharge haemoglobin levels.

Conclusion. Autologous blood reinfusion was effective in reducing the rate and unit of allogeneic blood transfusion in patients undergoing one-stage bilateral THA.

Key words: arthroplasty, replacement, hip; blood transfusion, autologous; operative blood salvage

INTRODUCTION

Total hip arthroplasty (THA) relieves pain and
improves function in patients with osteoarthritis of the hip; 42% of whom have bilateral involvement. A one-stage sequential bilateral THA enables shorter total surgical and recovery times, less total blood loss, and is more cost-effective, compared to separate procedures. Transfusion rates for unilateral THA have been reported to be 5 to 39%, and are even higher in bilateral THA. Optimising preoperative haemoglobin concentrations and minimising intraoperative blood loss can help reduce postoperative complications. Blood management procedures such as preoperative autologous blood donation, intra- and post-operative blood salvage, and the use of haematopoietic agents (erythropoietin) have reported to decrease the rates of allogeneic transfusion, disease transmission, and transfusion reactions. Nonetheless, preoperative autologous blood donation is associated with increased costs and blood wastage. We compared the rate and unit of allogeneic blood transfusion in one-stage bilateral THA in patients with and without autologous blood reinfusion.

MATERIALS AND METHODS

Records of a consecutive series of 43 men and 33 women aged 25 to 83 (mean, 55) years who underwent one-stage sequential bilateral THA between 2002 and 2008 by a single surgeon were reviewed. The diagnoses were avascular necrosis (n=40), osteoarthritis (n=26), developmental dysplasia (n=6), and inflammatory arthritis (n=4). Patients were evaluated by a cardiologist, and their risks of cardiopulmonary complications were minimal. Patients were excluded if they had any pre-existing cardiac or pulmonary abnormalities (history of atrial fibrillation, valvular abnormalities, coronary artery disease, chronic obstructive pulmonary disease, deep vein thrombosis, and pulmonary embolism).

At least 4 weeks prior to surgery, 38 of the patients had donated 2 units of autologous blood in 2 stages (one to 2 weeks apart) and had sufficient time for erythropoiesis and recovery of haemoglobin levels. The remaining 38 patients did not donate blood owing to personal preferences or logistical reasons. THA was performed under general anaesthesia via the posterolateral approach. Each patient was placed in the lateral decubitus position. In some patients, an epidural catheter was placed for intra- and post-operative pain control. Intra-operative cell salvage was used and no drain was placed. Both acetabular and femoral components were uncemented and press-fit. Bearing surfaces were chosen based on the patient's age, expectations, and functional levels. After the first THA, the subsequent THA was carried out only if the patient remained haemodynamically stable. All pre-donated autologous blood was transfused back to the patients in the recovery room.

Postoperatively, patients were allowed full weight bearing. Based on the American Academy of Orthopaedic Surgeons guidelines, lower extremity compression devices and aspirin (325 mg twice a day for 6 weeks) were provided to prevent deep venous thrombosis. No warfarin or low-molecular-weight heparin was given as our patients were considered low risk for deep vein thrombosis and pulmonary embolism.

Operating time, estimated blood loss volume, blood salvaged volume, and complications in the first 90 days were recorded, as were pre- and post-operative haemoglobin levels. Allogeneic blood transfusion was performed when clinical symptoms of anaemia were noted (hypotension, low urinary output, lethargy, tachycardia, shortness of breath, and/or low oxygen levels in pulse oximetry or arterial blood gas) rather than by resorting to a predetermined transfusion threshold.

The 2 groups were compared with respect to the rate and unit of allogeneic blood transfusion using the Chi squared test and the unpaired t-test assuming unequal variance, respectively. A p value of <0.05 was considered statistically significant.

RESULTS

In the 76 patients, the mean operating time was 336 (standard deviation [SD], 55; range, 205–457) minutes. The mean estimated blood loss was 939 (SD, 448; range, 200–2500) ml. The mean volume of blood salvaged was 302 (SD, 196; range, 0–850) ml, representing a collection rate of 32%.

In patients with and without autologous blood reinfusion, 16 (42%) and 33 (87%) patients received allogeneic blood transfusion of 0.9±1.4 and 2.4±1.5 units, respectively (p<0.0001, Table 1).

Four patients developed major cardiopulmonary complications. Two patients had transient renal failure, which resolved without long-term sequelae. None had deep venous thrombosis or pulmonary embolism. No complications resulted from blood transfusion (Table 2). The 2 groups were not significantly different in complication rate (13% vs. 18%, p=0.54) and discharge haemoglobin levels.
Blood loss during total joint arthroplasty can be significant, especially during bilateral procedures. A study reported an allogeneic blood transfusion rate of 66% in 978 patients undergoing sequential bilateral THA under the same anaesthetic protocol; each patient received a mean of 4.3 (SD, 1.2) units of blood.\(^1\)\(^8\) In our study, the overall allogeneic blood transfusion rate was 65%, and a mean of 1.7 (range, 0–6) units of blood were transfused. Vigilance is required to prevent precipitous drops in haemoglobin concentrations in these patients.

Preoperative autologous blood donation has shown to decrease the need for allogeneic blood transfusions in patients undergoing elective orthopaedic procedures.\(^1\)\(^5\),\(^1\)\(^6\) Our results were consistent with these studies. Nonetheless, when the interval before surgery is insufficient to restore haemoglobin levels, blood transfusion rates may even increase. In a study of primary unilateral THA,\(^1\)\(^1\) patients who had preoperative autologous blood donation had significantly lower haemoglobin levels postoperatively than those who did not. 69% of the pre-donated patients received autologous blood reinfusion, but neither group received allogeneic blood transfusion. In another study, autologous blood transfusion rate of 91% was reported when the mean interval between preoperative autologous blood donation and surgery was 13 (SD, 3.3) days.\(^1\)\(^9\) Therefore, sufficient time is critical for preoperative autologous blood donation to be effective. In our series, patients were asked to donate blood at least 4 weeks prior to surgery in order to allow enough time for the body to recover.

Estimated blood loss is usually an underestimate of the actual blood loss. In a prospective, multicentre study of 3996 patients undergoing elective total hip or knee replacement,\(^2\)\(^1\) the respective median estimated and calculated blood losses were 750 and 1944 ml (p<0.001) for THA patients and 800 and 1934 ml (p<0.001) for total knee replacement patients. Blood requirements after arthroplasty are substantial, and surgeons should stay ahead of the transfusion curve and pay special attention to the availability of fluids and blood products.\(^2\)\(^2\)

Although there are drawbacks in autologous and allogeneic blood transfusions (microbial contamination, waste, increased costs, fluid overload, transfusion reactions, and clerical errors),\(^1\)\(^1\),\(^2\)\(^0\) all our patients who predonated blood prior to surgery received 2 units of autologous blood in the recovery room (zero waste) and anticipated a further drop in haemoglobin levels. Furthermore, most blood transfusions (autologous and allogeneic) were given on days 0 and 1, and haemoglobin levels were maintained above 8.0 g/dl. While current guidelines discourage blood transfusion for patients undergoing unilateral procedures when the haemoglobin level is >8.0 g/dl, bilateral procedures are subject to double blood loss and fluid shift volumes, and symptoms may develop earlier. Proactive management is therefore important in preventing complications from bilateral THA.

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Autologous blood reinfusion</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of units of pre-donated blood</td>
<td>1.89±0.56 (1–3)</td>
<td></td>
</tr>
<tr>
<td>Haemoglobin level (g/dl)</td>
<td>0.95±1.4 (0–6)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Preop</td>
<td>12.9±1.4</td>
<td>0.56</td>
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<tr>
<td>Day 0</td>
<td>10.1±1.1</td>
<td>0.03</td>
</tr>
<tr>
<td>Day 1</td>
<td>9.5±1.1</td>
<td>0.21</td>
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<tr>
<td>Day 2</td>
<td>8.7±1.0</td>
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</tr>
<tr>
<td>Day 3</td>
<td>8.6±0.7</td>
<td>0.22</td>
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<tr>
<td>Day 4</td>
<td>9.0±0.2</td>
<td>0.45</td>
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* Data are presented as mean±SD (range)

### Table 2

<table>
<thead>
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<th>Complication</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Hypotension requiring intensive care</td>
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</tr>
<tr>
<td>Aspiration pneumonia</td>
<td>1</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>2</td>
</tr>
<tr>
<td>Facial abrasion from endotracheal tube</td>
<td>1</td>
</tr>
<tr>
<td>Peroneal nerve palsy</td>
<td>1</td>
</tr>
<tr>
<td>Component loosening</td>
<td>1</td>
</tr>
<tr>
<td>Postop periprosthetic fracture</td>
<td>1</td>
</tr>
<tr>
<td>Sacral pressure ulcer</td>
<td>1</td>
</tr>
<tr>
<td>Superficial wound infection</td>
<td>1</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Blood loss during total joint arthroplasty can be significant, especially during bilateral procedures. A study reported an allogeneic blood transfusion rate of 66% in 978 patients undergoing sequential bilateral THA under the same anaesthetic protocol; each patient received a mean of 4.3 (SD, 1.2) units of blood.\(^1\)\(^8\) In our study, the overall allogeneic blood transfusion rate was 65%, and a mean of 1.7 (range, 0–6) units of blood were transfused. Vigilance is required to prevent precipitous drops in haemoglobin concentrations in these patients.

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CONCLUSION

Patients undergoing one-stage bilateral THA are at risk of severe blood loss. Preoperative autologous blood donation can minimise the need for allogeneic blood transfusion when all pre-donated autologous blood is re-transfused to the patients in the recovery room.

REFERENCES