NEW TECHNIQUE FOR REDUCING BLOOD LOSS IN TOTAL KNEE ARTHROPLASTY

Anan Malairungsakul, M.D.

Department of Orthopaedics, Phayao Hospital, Phayao

Abstract A prospective randomised study was carried out to evaluate the blood loss in 30 total knee arthropasty patients, who were divided randomly into two equal groups; one having new technique bone plug and bone wax, while the other used a bone plug only. The surgery was carried out by a single surgeon at one institution using the uniform approach and standard operation.

The mean drainage of blood was lower in the bone plug and bone wax group. This difference was statistically significant ($p=0.001$). There was a highly significant reduction in blood drainage in the bone plug and bone wax group when compared to the bone plug only group. This finding allows for the order of less blood before an operation, reduces the risks of transfusion and gives financial saving. This new technique of surgery may also be useful for patients in whom blood products are not acceptable. Chiang Mai Medical Journal 2007; 46(4):147-152.
groups from sealed envelopes. There were 15 patients in each group. In group I, both bone plug and bone wax were used, whereas, bone plug only was used in group II.

A standardized technique of TKA was used in all patients with the same instruments (Johnson and Johnson Cemented fixed bearing type). Intra-operative and post-operative blood lost were recorded by the surgeon from the volume of blood in the suction bottle and the estimated blood loss in the gauze. All patients received spinal anesthesia, and none received thromboprophylaxis. Blood transfusion was given only in patients who had a post-operative hematocrit of less than 30 vol%.

Operative technique and prosthesis

The operations were performed using the same surgical approach, instrumentation and technique. The operations were carried out with blood loss fluid using a pneumatic tourniquet at a pressure of 400 mmHg after exsanguinations.

The new technique applied a bone plug in the distal femoral hole (to guide the femoral out) and bone wax on the cutting surface outside the femoral and tibia implants. Whereas, the standard technique applied the bone plug only.

New technique for bone plug and bone wax

The bone plug was harvested from the cutting part of the distal femur (as shown in Fig. 1, 2, and 5) to seal the femoral hole site of the intra-medullary alignment guides, and the second piece (as shown in Fig. 3 and 4) was sealed on top of the first one (as shown in Fig. 6) before the prosthesis was applied. Bone wax was used on the cut cancellous bone surface around the prosthesis in both the femoral and tibial part (as shown in Fig. 7 and 8).

The bone only plug group

The bone plug was harvested from the cutting part of the distal femur (as shown in Fig. 1, 2 and 5) to seal the femoral hole site of the intra-medullary alignment guides, and the second piece (as shown in Fig. 3 and 4) was sealed on top of the first one (as shown in Fig. 6) before the prosthesis was applied.

Figure 1. Bone from cutting part of distal femur (piece 1).

Figure 2. After re-cut to bone plug (piece 1).
Figure 3. Bone from cutting part of distal femur (piece 2).

Figure 4. After recut to bone plug (piece 2).

Figure 5. Bone plug piece 1 sealed femoral hole.

Figure 6. Bone plug piece 2 sealed on top of piece 1.

Figure 7. Bone wax was used in cut cancellous bone surface in femoral part.

Figure 8. Bone wax was used in cut cancellous bone surface in tibial part.
Statistical analysis
Continuous variables were presented as mean ± standard deviation (SD). Categorical variables were presented in percent. Student’s t-test was used for statistical analysis. A two-tailed p value of < 0.05 was considered a statistically significant difference.

Results
Of the 30 patients studied, 6 males and 24 females had a mean age of 59.2 years (range 53-72). All patients were matched for age, gender, and preoperative hematocrit level (Table 1). The mean total blood loss during the operation was 80.0 ± 26.3 ml. (range 50-150) in group I, and 147.0± 98.2 mL (range 50-200) in group II (= 0.095). However, the mean total blood loss in the drainage bottle was 326.0±125.3 ml. (180-440) in group I and 757.0±248.8 mL. (500-1200) in group II (p < 0.001). The mean total blood loss during the operation and in the drainage bottle was 406.0 + 186.3 ml. (500-1,200) in group I, and 904±125.8 mL. (180–440) in group II (p < 0.001). One patient in group II received 1 unit of blood transfusion (blood loss 1200 ml, Hct 28%).

Discussion
The amount of blood loss during cemented total knee arthroplasty varied among different reported studies. In this study, we tried to minimize blood loss during surgery by applying a tourniquet, using minimal invasive surgery (MIS), giving transamic acid and using computer assisted surgery. However, the major site of bleeding generally came from the distal femoral hole and sinusoids at the cut cancellous bone surfaces.(10,11) In this study, we found that the new technique of using bone plug and bone wax significantly reduced blood loss when compared with the conventional technique, which used a bone plug only when applying cemented implant suction drains for 24 hours and immediate continuous passive movement.

The mean blood loss in the drains in this study was lower than that of 1,500 mL in a previous report.(9) However, the mean blood loss during the operation was no different between the two groups, because of the tourniquet effect. Bleeding from sinusoids at the cut cancellous bone surfaces had significant volume. No patients in group I required blood transfusion, but one patient in group II did.

Conclusion
The new technique of using a bone plug in the femoral hole and bone wax on the cut cancellous bone surfaces in cemented TKA significantly reduced blood loss when compared with the group that used a bone plug only.

Table 1. Details (mean; SD; range) in both groups

<table>
<thead>
<tr>
<th></th>
<th>Bone plug and bone wax</th>
<th>Bone plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age in yrs</td>
<td>60.1 (53-72)</td>
<td>58.8 (53-67)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Patients received spinal anesthesia (%)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Mean pre-operative Hct (%)</td>
<td>38.5 (31-43)</td>
<td>37.5 (31-44)</td>
</tr>
<tr>
<td>SD pre-operative Hct</td>
<td>2.928</td>
<td>2.774</td>
</tr>
</tbody>
</table>
References

เทคนิคใหม่สำหรับลดการสูญเสียเลือดในการผ่าตัดเปลี่ยนข้อเข่าเทียม

อนันต์ มาลัยรุ่งสกุล, พ.บ.
กลุ่มงานศัลยกรรมออร์โธปิดิกร โรงพยาบาลพะเยา

บทคัดย่อ การศึกษาแบบไปข้างหน้าของการสูญเสียเลือดในผู้ป่วยจำนวน 30 คนที่ผ่าตัดเปลี่ยนข้อเข่าเทียม โดยศัลยแพทย์ผู้เชี่ยวชาญ 2 คน จำนวนเหตุการณ์ทั้งหมด 2 กลุ่ม กลุ่มแรกใช้เทคนิคใหม่ bone plug และ bone wax อีกกลุ่มใช้ bone plug การผ่าตัดทำโดยเดียวกันทั้งสองกลุ่ม โดยผู้ที่ช่วยผ่าตัดเป็นคนเดียว ในกรณีที่มีการเปลี่ยนแปลงทางเทคนิคการผ่าตัด จะได้ผลการผ่าตัดที่แตกต่างกัน และผลการศึกษาพบว่าการใช้เทคนิคใหม่ ซึ่งประกอบด้วย bone plug และ bone wax มีผลในการลดการสูญเสียเลือดในผู้ป่วยที่ใช้ทั้งสองกลุ่ม ซึ่งมีนัยสำคัญ (p=0.001) ทั้งนี้การลดการสูญเสียเลือดในผู้ป่วยช่วยลดความเครียดในการให้เลือด ลดค่าใช้จ่ายและเป็นประโยชน์อย่างมากในผู้ป่วยที่ไม่ต้องการเลือด เชิงทางวิชาการ 2550;47(4):147-152.

Anan Malairungsakul