INTRODUCTION

Wound troubles after total knee arthroplasty (TKA) is one of the most often complications. During wound healing, blood supply and oxygenation are important. To date, however, few reports have been published concerning blood supply on the anterior skin of the knee.

According to our literature search, only Johnson reported transcutaneous oxygen tension (Tc PO2) measurement at 2 sites on the medial and lateral site of anterior knee, demonstrating that oxygenation was poorer on the lateral site than on the medial site. We anticipated that if Tc PO2 on the anterior knee were measured at multiple sites, it would enable more detailed evaluation of blood supply during wound healing processes. The present study was undertaken to analyze the relationship between blood supply and wound healing after TKA through measurement of Tc PO2 at multiple sites of anterior knee before and after TKA, and to lead to prevent wound troubles.

PATIENTS AND METHODS

The study involved 21 patients (21 knees) who underwent TKA at our facility from December 2009 to April 2010. The primary disease was OA for 17 knees and RA for 4 knees. Complications observed were diabetes mellitus (3 knees), deep venous thrombosis (2 knees) and congestive dermatitis of crus (1 knee).

Tc PO2 was measured at 4 sites, i.e., upper and lower medial sites and upper and lower lateral sites. In addition, a reference electrode was installed on the let subclavicular chest wall. Measurement was performed preoperatively, on postoperative day 1, and day 7. The ration of Tc Po2 at each time to reference TC PO2 was calculated as regional Tc PO2 index (RPI). Tc PO2 was evaluated on the basis of RPI. Subcutaneous tissue development was carried out under an investing layer. In all cases, the joint was incised with a medial parapatellar approach.

For evaluation of blood supply on anterior knee and the association between RPI and wound healing in patients undergoing TKA, we compared RPI among different sites. Patients were classified into delayed group or normal group according to the wound healing on postoperative day 14. RPI at each site was compared between the two groups. Statistical analysis was performed using two-way ANOVA. P < 0.05 was regarded statistically significant.

RESULTS

In analysis of RPI, the blood supply to the anterior skin of the knee decreased markedly after surgery. RPI at 2 inferior sites tended to be lower than those at 2 superior sites already before surgery. RPI at these 2 inferior sites on POD7 was significantly lower than at the 2 superior sites(Table 1). Normal group was composed of 18 knees (OA 14, RA 4). Delayed group was composed of 3 knees (OA 3). All delayed healing was noted at the inferior lateral edge of the wound. RIP on the only inferior lateral site was significantly lower in delayed group than in normal group(Table 2). No tendency for delayed healing was noted in cases complicated by diabetes mellitus or patients receiving oral steroid therapy.

<table>
<thead>
<tr>
<th>Site</th>
<th>Pre</th>
<th>POD1</th>
<th>POD7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior-medial</td>
<td>0.84±0.25</td>
<td>0.57±0.27</td>
<td>0.61±0.18</td>
</tr>
<tr>
<td>Superior-lateral</td>
<td>0.87±0.28</td>
<td>0.51±0.29</td>
<td>0.59±0.13</td>
</tr>
<tr>
<td>Inferior-medial</td>
<td>0.74±0.27</td>
<td>0.44±0.26</td>
<td>0.42±0.19 *</td>
</tr>
<tr>
<td>Inferior-lateral</td>
<td>0.77±0.19</td>
<td>0.38±0.37</td>
<td>0.42±0.22 *</td>
</tr>
</tbody>
</table>

Table 1. The time course of RPI at each site

* p<0.05 vs Superior-Medial and Superior-Lateral

DISCUSSION

In the present study, delayed wound healing was seen in patients showing reduction of RPI on the first postoperative day, while the history of diabetes mellitus and the use of steroid did not delay wound healing. Thus, disturbed blood supply due to operative manipulation seems to play a significant role as a factor inhibiting wound healing.

The skin on anterior knee is primarily nourished by the blood vessels branching from the saphenous artery and perforating through the deep fascia to enter subcutaneous tissue. These perforators form a meshwork of artery between subcutaneous tissues, and blood supply is likely to be poorer in the inferior areas of the knee with thinner subcutaneous tissue than in the superior areas.

The skin on anterior knee is primarily nourished by blood vessels leading from the medial site, because the perforators from the saphenous artery are abundant on the medial site of knee. For this reason, if an anterior straight midline incision is placed on the knee, it seems likely that blood supply in the lateral wound edge becomes poorer.