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Original Article

A Comparison of the Medium-Term Results of Total Knee Arthroplasty Using Computer-Assisted and Conventional Techniques to Treat Patients With Extraarticular Femoral Deformities

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ABSTRACT

Background: We compared the medium-term results of total knee arthroplasty (TKA) performed using computer-assisted surgery (CAS) and conventional techniques in patients with extraarticular femoral deformities.

Methods: The clinical and radiographic data of 40 knees (34 patients) with extraarticular femoral deformities that underwent consecutive CAS-TKA were compared with those of a control group that underwent conventional TKA (80 knees, 63 patients). No demographic data (in particular, the causes of the extraarticular deformities) differed between the two groups. The follow-up periods of the CAS and conventional TKA groups were 6.0 and 6.3 years, respectively.

Results: In the CAS group, the average knee score increased from 48.2 to 89.6 at the final follow-up ($P < .001$); the average function score increased from 51.4 to 91.4. The range of motion averaged 105.5° preoperatively and 123.3° postoperatively. No significant differences were found in the knee score, function score, or range of motion after TKA between the 2 groups. The average preoperative mechanical axes were 18.1° varus in both groups. The average postoperative mechanical axis was 1.4° varus in the CAS group and 3.3° varus in the conventional TKA group ($P = .001$). The proportion of postoperatively aligned knees was 77.5% in the CAS group and 32.5% in the conventional group ($P < .001$).

Conclusion: Although the medium-term clinical results of TKA in extraarticular femoral deformities were satisfactory in both the CAS and conventional TKA groups, the former group exhibited more accurate postoperative coronal alignment. It was useful to employ navigation in patients with extraarticular deformities of various etiologies.

Precise implant positioning and appropriate alignment correction are critical to ensure the long-term success of total knee arthroplasty (TKA) [1]. In conventional TKA, the mechanical axis (MA) is indirectly recreated by reference to the anatomical axis; alignment guides are employed to this end [2]. However, it can be difficult to use intramedullary guides in patients with extraarticular femoral deformities (coronal bowing, angular deformities, fracture malunions, sequelae after osteomyelitis, and/or multiple epiphyseal dysplasia). Three operative strategies are available: (1) corrective osteotomy at the site of the deformity, (2) supracondylar osteotomy performed at the time of TKA, and (3) intraarticular correction with modification of the distal femoral resection during TKA. Although the optimal procedure remains controversial, we prefer the third method because it is associated with a reduced incidence of complications caused by both anesthesia and the operation [3].

Computer-assisted navigation has been used to increase the accuracy of TKA. Such navigation allows direct measurement of the MA without breaching the medullary canal; this is potentially very useful when treating patients with extraarticular deformities. However, Bae et al [4] found that the extent of preoperative varus deformity influenced the postoperative alignment despite the use

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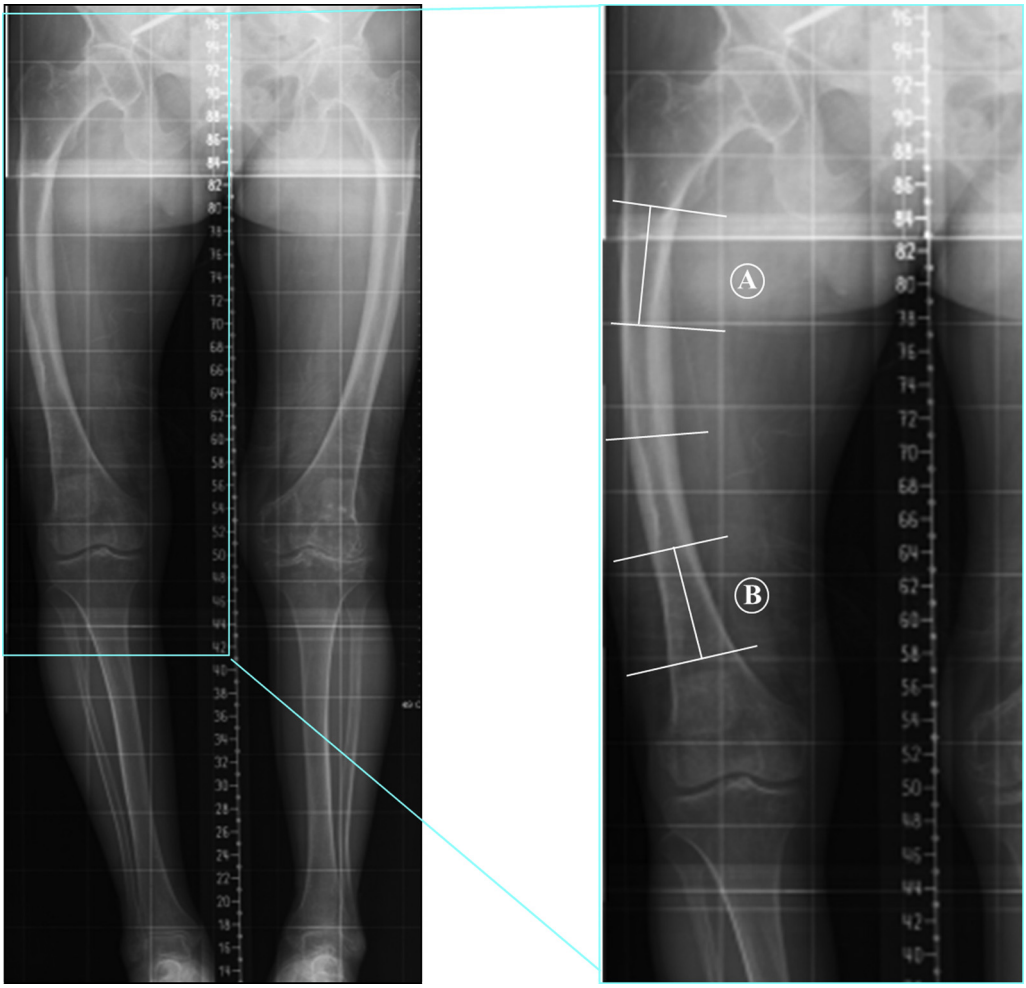

Fig. 1. Measurement of the femoral lateral bowing angle. The femoral coronal bowing angle was the angle between the proximal one-quarter of the intramedullary canal axis (A) and the distal one-quarter of the canal axis (B); thus, the femoral diaphysis was divided into 4 parts.

of computer-assisted surgery (CAS); more careful correction of alignment was required, especially when TKA was performed on patients with severe varus deformities.

Many reports have shown that navigation aids intraarticular correction when TKA is performed in patients with extraarticular deformities [2,5-9], but no study has yet compared the clinical and radiographic results afforded by CAS and conventional TKA in patients with such deformities. We were also concerned with the accuracy of navigation in such patients compared with those treated via the conventional technique.

The purpose of our present study was to compare the medium-term outcomes of TKA using CAS with those of the conventional technique in patients in whom it was difficult to employ intramedullary guide systems because of the presence of extraarticular femoral deformities. We hypothesized that CAS would be valuable in such patients and that the medium-term outcomes of CAS-TKA would be more satisfactory (no complications caused by navigation) than those of conventional TKA.

Patients and Methods

Patients

All consecutive patients in whom extraarticular femoral deformity CAS-TKAs were performed between 2003 and 2006 constituted the study group (CAS group). To facilitate matched-pair analysis, the control group (conventional group), in whom extraarticular femoral deformities were corrected using conventional TKA, was formed by reference to age, sex, body mass index, the cause and severity of the extraarticular femoral deformity, the type of prosthesis prescribed, and the period of operation. The inclusion criterion was an extraarticular femoral deformity with coronal or sagittal angulation of >10°. The exclusion criterion was that intraarticular correction with modification of distal femoral resection during TKA was predicted to make the injury of the collateral ligament because the preoperatively planned distal resection surface on the anteroposterior radiograph jeopardized the origin of the collateral ligament [10,11]. Patients with extraarticular tibial deformities or who underwent extraarticular corrective osteotomies were also excluded. The patients with small amount of femoral coronal bowing (<10°) were excluded, when the bowing angle was measured as indicated in Figure 1. The CAS group included 40 knees (34 patients), and the conventional group included 80 knees (63 patients). The study was approved by the institutional review board of our hospital. In the CAS group, the causes of extraarticular femoral deformities included femoral coronal bowing in 27 knees, fracture malunion in 8, deformed sequelae after osteomyelitis in 3, and multiple epiphyseal discrepancies in 2 (Figs. 2-4). The demographic features of the 2 groups, including the causes of extraarticular deformities, did not differ significantly (Table 1).