Original Research Article

Preliminary outcomes of the introduction of computer assistance in total knee arthroplasty at the Basse-Terre hospital center in Guadeloupe

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ABSTRACT

Background: Computer-assisted total knee arthroplasty (TKA) is associated with significant precision during the surgical installation of prosthesis. We aimed to compare the radiological outcomes between the prostheses' positioning assisted by a passive computer system and with the conventional technique.
Methods: Participants included in this study were divided into two mixed groups based on the use of classical procedure and the computer navigated method during the positioning of implants during fractures. Clinical factors such as degrees of knee amplitude, knee IKS score and IKS function score and radiological features including the stage of osteoarthritis according to Ahlbäck classification, HKA and HKS angles, femoral and tibial mechanical axes, tibial slope prior and after the surgical procedure were measured in each group and then were compared.
Results: Of a total of 92 patients, there were 63 women and 29 men; among which 42 patients for were treated with conventional TKA and 50 patients benefited from navigated TKA. 76 patients had stage IV osteoarthritis, 15 patients were at stage III of Albäck classification, and one patient at stage V. The postoperative HKA angle was found to be better in the navigated cohort with a statistically significant difference. The IKS knee and function scores are significantly better in the navigated cohort.
Conclusions: Computer surgical navigation practiced during the total arthroplasty of the knee highlighted significant improvement in the positioning of the implants; and is associated with better functioning of the knees.

Keywords: Knee arthroplasty, Assisted surgery, Navigated prosthesis

INTRODUCTION

Total knee arthroplasty (TKA) is actually considered as classic surgical procedures in orthopedic settings with a constant increase in the number of implants placed over the world. Well performed. It is associated with positive outcomes.[1] The long-term survival of implants and prostheses influenced by the restoration of a femoro-tibial axis between 3° of valgus and 3° of varus reflecting the good quality of the positioning of the prosthesis whereas the poor correction of the mechanical axis of the lower limb may promote loosening.[2-4] Conventional mechanical ancillaries, which are visually checked by the surgeon do not allow to avoid false positioning of prostheses, which are usually linked to anatomical variations, lack of precision in visual estimates or technical limitations.[5-8] In order to overcome these shortcomings, computer-assisted surgery was developed as a gold standard able to increase the success during the positioning of the implants.[9] This study was aimed to compare the radiological outcomes between the prostheses' positioning assisted by a passive computer system and with the conventional technique.

METHODS

Current study was a retrospective study conducted from July 1, 2009 to June 30, 2010 in the Orthopaedic Department of the Basse-Terre hospital in Guadeloupe, France.

Inclusion and exclusion criteria

All patients who underwent total knee arthroplasty during the above-mentioned period were included in the study. Patients whose radiological work-up was incomplete and could not be completed because they were lost to follow-up, as well as patients who were not regularly followed up during the first year, either because they died or did not respond to requests, were excluded.

Procedure

Total 100 patients who had undergone total knee arthroplasty were selected in the study and were divided into two cohorts: the first grouping concerned 50 patients for whom the placement of total knee prosthesis was performed by conventional method (or classic) and the second consists of 50 patients with knee prostheses placed with surgical navigation. All patients benefited for the placement of the same implant model, a cemented postero-stabilized prosthesis with a rotary plate. The selected operating protocol concerns the following procedure: first tibial cut, ligament balancing in extension and flexion, control of the axis then femoral cut.

The patella was resurfaced in principle. The desired objective was to obtain a stable knee and an axis close to 180°. The internal parapatellar approach or midvastus for the axed or varus knees and the Keblish approach for the valgus were the approaches used in the case series. The rehabilitation protocol was identical for all patients with a resumption of full support protected by 2 crutches or a walker on the second postoperative day. Patients were reviewed at 6 months and 12 months. Bias was minimized by excluding eight (08) files were excluded from cohort 1 (conventional method) due to the fact either the radiological assessment was incomplete or patients were lost. of sight.

Clinical factors (degrees of knee amplitude, knee IKS score and IKS function score) and radiological characteristics (stage of osteoarthritis according to Ahlbäck classification, HKA and HKS angles, femoral and tibial mechanical axes, tibial slope) prior and in the aftermath of surgical procedures were compared among the two group. Prior permission was obtained from the patients to participate in this study, and the confidentiality of the data collected and the ethical rules were respected. A pre-established form was used to collect data from the patients' files and Statview software was used for statistical processing.

RESULTS

Socio-demographic characteristics

Conventional PTG cohort; age: the mean age of the patients at the time of the intervention was 72 years (ranging between 53 and 84 years). Gender: the sex ratio was 0.41. BMI: The mean height was 1.65m, for the mean weight of 71.55 kg (ranging from 38 kg to 112 kg). The mean Body Mass Index (BMI) was calculated to 26.28. Navigated PTG cohort: age: the mean age of the patients benefited of computed PTG was 67.4 years (ranging from 55 to 82 years). Gender: The sex ratio was 0.47. BMI: the mean height was 1.57m, the mean weight of 82.35 kg (extremes of 54 kg and 106 kg), and the mean BMI of 33.05.
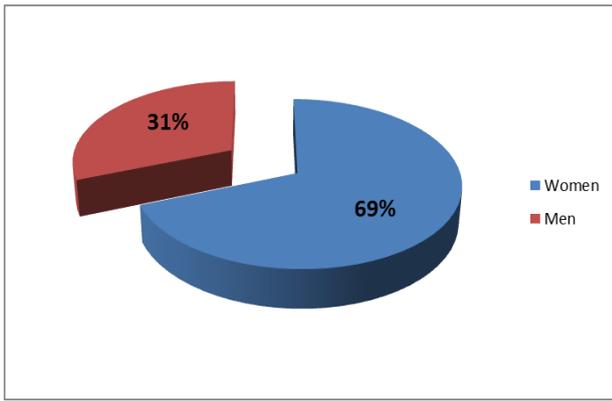
Postoperative clinical outcomes

The postoperative clinical outcomes are depicted in (Table 1). The IKS knee and function scores were significantly better for the navigated cohort. The mean postoperative flexion was 109°, i.e., 107° respectively for the mechanical conventional cohort and 111° for the navigated cohort, with no significant difference between the two.

**Table 1: Mean IKS score in post-operative period.**

Parameters	Mechanical	Navigation	Total	P value
IKS knee	82.6	89.8	87.5	DS
IKS fonction	68.8	79	75.9	DS
Flexion	107	111	109	DNS

Table 2: Mean ankle in post-operative period.

Parameters	Mécanical	Navigation	P value
HKA	175.3	177.8	0.0017
HKS	6.6	6.3	DNS
Alpha	89.3	89	DNS
Bêta	88.1	89.1	0.0392
Pente	2.8	2.3	DNS

Figure 1: Distribution of conventionnal PTG cohort by gender.
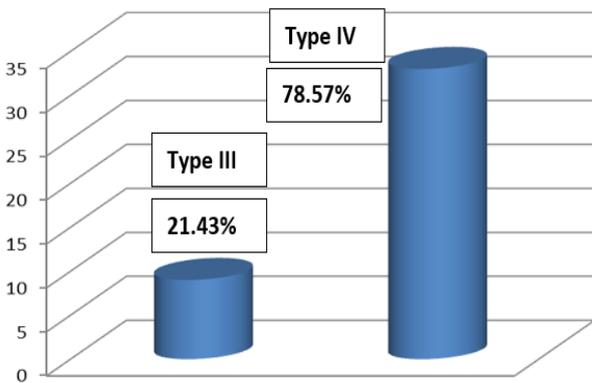
Figure 2: Stage of osteoarthritis.
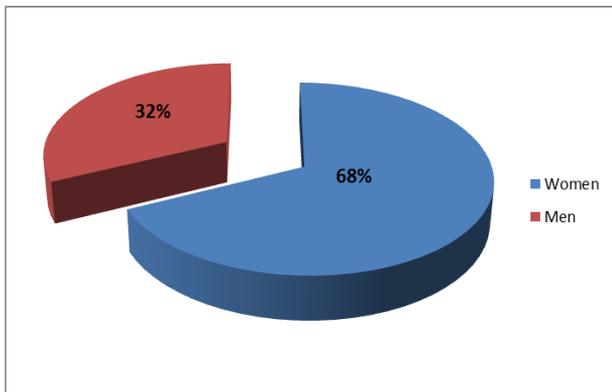
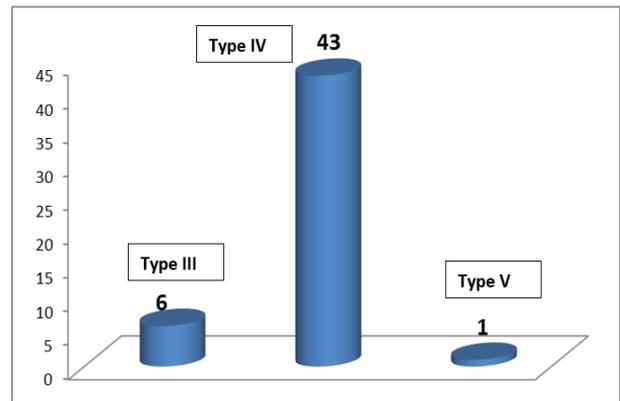**Figure 3: Distribution of navigated PTG cohort by gender.**

Postoperative radiological outcomes

The postoperative HKA angle is better in the navigated cohort (p=0.0017) due to a significant improvement in the mechanical tibial angle (beta) (p=0.0392) (Table 2).

DISCUSSION

The mean age in our study was 67.4 years (55 years to 82 years) and 72 years (55 years and 84 years) for

respectively the series of navigated TKAs and the series of unnavigated TKAs.

Figure 4: Distribution of navigated PTG by the stage of osteoarthritis according to Albäck classification.

These results are consistent with published evidence. In 2007, Saragaglia found a mean age of 74 years among participants included in his study.[10] In fact, the age of patients remains one of the determining factors affected the indication of knee arthroplasty. The majority of patients included in our study had stage 4 Ahlbäck osteoarthritis. This could be explained by the fact that these were often patients suffering from knee pain for several years and reserving surgery as a last resort after medical and/or rheumatological treatment. The mean value of the HKA angle was 175.27° for the series of non-navigated TKAs and 177.8° for navigated TKAs with a significant difference (p=0.0017). Surgical navigation has shown better alignment of the implants. These findings are similar to the study conducted by Jenny who revealed a significant improvement in the quality of TKA implantation with the navigation system compared to conventional instrumentation controlled by the surgeon's eye.[11] However, our results divergent from those found by Lino which showed a mean HKA angle of 177.5° and 179.2° respectively for the conventional implantation prostheses and those navigated.[9] Obtaining an absolute HKA angle of 180° during the surgical procedures was not essential in our practice; a stable knee in flexion-extension with good ligament balance and a correct aesthetic appearance seemed acceptable to us, especially in patients who are often overweight. The mechanical femoral angle was 89.51° and 89.04° for series of non-navigated PTN and series of navigated PTG, respectively, with a non-significant statistical difference. Our results are divergent from those of Saragaglia who demonstrated a significant difference (p=0.048) in the positioning of the femoral implant in favor of his series of computer-assisted prostheses.[12] Furthermore, in the positioning of the tibial component, there was a significant difference (p=0.0392); this findings are similar to the study of Lino who found a significant difference in favor of patients operated on by navigation.[9] The correct positioning of the tibial piece in our study could be explained by the fact that the first

bone cut was tibial, followed by the rescontruction of the surgical procedure was surrounding this tibial cut that the rest of the surgical intervention was constructed; this allows to have an acceptable mechanical axis of the member close to 180°. The values found for the mean posterior tibial slope showed no statistically significant difference in the two series. Lino and Saragaglia obtained similar results.[9,12]

The clinical outcomes of the operated knees were evaluated in our study using the IKS score and revealed an IKS-knee score of 82.64 points and 89.80 points respectively for series of non-navigated PTN and series of navigated PTG. The difference was statistically significant (p=0.008). Similar to the IKS-function score, it was 68.78 for series 1 and 79.00 for series 2 with a statistically significant difference (p=0.0118). These improvements in the various IKS scores observed for the series 2 knees could be explained by better positioning of the implants and therefore obtaining a better mechanical axis of the limb. There is no precise data in the literature to confirm or refute this hypothesis. The overall positioning of the implants was considered satisfactory for 60% of the cases in the series of navigated prostheses and for 37.83% in the series of non-navigated prostheses, considering a range of between 3° varus and 3° valgus. The difference is in favor of the computer-aided technique. Our results are different from those found by Jenny.[11] Similarly, El Masri reported good positioning of the implants with the use of a navigation system.[12] Better results were reported by Van Gaver with 91% of the navigated knees presenting an HKA angle between 177° and 183° compared to 59% for the unnavigated knees.[13]

Limitations

The main limitation of this study is the short time frame of the series and the results need to be confirmed by a longer-term follow-up.

CONCLUSION

The introduction of surgical navigation during total knee arthroplasty has allowed a significant improvement in the positioning of the implants but certainly also better clinical results of the knee with satisfactory IKS knee and function scores.

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