International Journal of Research in Orthopaedics
Junior HP et al. Int J Res Orthop. 2024 Sep;10(5):1031-1035
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20242399

Case Series

Total knee arthroplasty stabilized with autologous bone graft for tibial bone defect correction

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Received: 06 May 2024
Revised: 08 July 2024
Accepted: 11 July 2024

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ABSTRACT

Evaluate the functional results obtained with total knee arthroplasty stabilized with autologous bone graft to correct axis deviation with tibial bone failure. A retrospective study with a convenience sample, consisting of fifteen patients operated between February 2015 and June 2019. Data were obtained through analysis of medical records: age, biological gender, affected side, pre- and postoperative radiographs, description of the surgical technique and The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire results preoperatively and 6 months after surgery. The average age of the patients was 67 years, majority male (53.3%) and varus deformity (80%). The mean time to release the load was 31 days and all patients were discharged two days after surgery, with no complaints of complications. In the preoperative period, pain and physical function had the highest scores in WOMAC questionnaire. After total knee arthroplasty, there was a significant improvement in the three dimensions of WOMAC, with a reduction of 78.6% in the total score. Total knee arthroplasty stabilized with autologous bone graft to correct axis deviation with tibial bone failure resulted in improvement of symptoms and physical function in most patients evaluated, reducing pain and functional disability due to gonarthrosis.

Keywords: Knee injuries, Total knee arthroplasty, Osteoarthritis of the knee, WOMAC questionnaire

INTRODUCTION

Morphological, functional, and structural changes can result in uni, bi, or tricompartmental degeneration of the knee, known as gonarthrosis. This joint involvement can cause pain, functional limitations, instability and, in the most advanced forms, angular deformities with local bone defects.[1] Total knee arthroplasty (TKA), considered a joint replacement procedure, is part of the therapeutic portfolio in the treatment of gonarthrosis and is capable of maintaining mechanical properties and mobility, in addition to relieving pain.[2] Bone defects can be found in patients undergoing TKA and must be corrected at the time of surgery to provide a stable platform for the tibial component, ensuring correct lower limb alignment and a successful outcome.[3,4] Such defects can be classified as contained or central and uncontained or peripheral. The contained ones are filled with morselized cancellous bone, while the peripheral ones will depend on the size and depth of the lesion. Defects smaller than 5 mm are normally filled with cement or reinforced cement. Defects between 5 and 10 mm and in size that exceed 50% of the tibial hemiplateau are filled by metallic augmentations – wedges and blocks, or autologous bone or allograft from distal and posterior femoral cuts. For defects greater than 10 mm, in addition to bone grafts, trabecular metals can be used.[3,5-7] The use of autogenous bone grafts in primary TKA presents good functional results, however, possible

complications include non-union, collapse or resorption of the graft.[8] Several techniques are used for bone graft implants, including the Insall and Sculco techniques.[9] In the first, a bone fragment is removed in a trapezoidal shape at the site of the bone defect and implanted, creating an autologous or homologous graft of the same shape, fixed with metal wires, resulting in a flat surface on the tibial condyle, ideal for cementing the prosthetic component. In the second, a smooth surface is created through an oblique cut at the site of bone loss with a pneumatic saw, the graft is placed in place and fixed with metal wires or screws.[1,9]

Due to the low availability of metal wedges and tibial rods in public health services in Brazil, an autologous graft from distal and posterior femoral cuts was used as an option for filling bone gaps, together with a stabilized posterior primary knee prosthesis with the aim of provide an adequate surface for supporting and fixing components.[10] The objective of the present study was to evaluate the functional results obtained with posterior total knee arthroplasty stabilized with autologous bone graft to correct axis deviation with tibial bone defect.

CASE SERIES

This was a retrospective study, through the analysis of medical records, using a convenience sample. The research was approved by the Research Ethics Committee of the Dr. Henrique Santillo State Center for Rehabilitation and Readaptation (CRER) with CAEE number: 34448820.4.0000.0023. All patients in the study signed the Free and Informed Consent Form (ICF).

The data were obtained from the Electronic Health Record (EHR) of an orthopedic outpatient clinic in the state of Goiás (Brazil) from February 2015 to June 2019, which presented for correction of marked angular deformity associated with bone failure in the proximal tibia with stabilized posterior total knee arthroplasty and autologous graft.

We included 15 medical records of patients of both biological genders (male and female), aged 50 years or over, who underwent the surgical procedure of posterior total knee arthroplasty stabilized with an autologous bone graft for correction of axis deviation with tibial bone defect in the orthopedics clinic, with bone defect in the proximal tibia between 5 and 20 mm, peripheral bone defect in the proximal tibia greater than 50% and diagnosis of primary gonarthrosis.

After selecting the medical records, frequencies were collected and estimated in relation to the variables: age, sex, affected side, pre- and post-operative radiographs, description of the surgical technique and results of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire in the pre-operative period already routinely applied to outpatient patients. To evaluate the postoperative functional result, the WOMAC questionnaire was applied in a version validated for the Portuguese language.[11,12] The collected data were tabulated in Microsoft Excel® software version 2007 and analyzed in the statistical software Statistical Package for the Social Sciences (SPSS®) version 17.0, at a significance level of 5%. For the data obtained in the WOMAC questionnaire, each item had a score that ranged from 0 (none) to 4 (very strong) and all items had the same weight.

Figure 1: (A) Preoperative and (B) postoperative panoramic radiographs of a 70-year-old female patient undergoing total knee arthroplasty on the right limb.

Figure 2: (A) Preoperative and (B) postoperative panoramic radiographs of a 61-year-old female patient undergoing total knee arthroplasty on the left limb.

The surgical technique used followed the following standardization: after exposing the proximal tibia, a standard cut was made perpendicular to the mechanical axis of the tibia, removing 8-10 mm from the side

contralateral to the existing defect. Then, it was measured to fit the parameters established for graft indication (failures involving up to 50% of the medial or lateral hemiplateau with 5-20 mm depth) and preparation of the donor area began, following the criteria of Dorr, with the exception of the fifth item, which was the non-use of the rod component due to the unavailability of the material in the hospital's medical service. Provisional fixation of the fragment was performed with Kirshner wires and definitive fixation with cortical screws for small fragments. Figures 1 to 3 show pre- and postoperative radiographic images of three patients who underwent TKA stabilized with autologous bone graft to correct axis deviation with tibial bone defect.

Figure 3: (A) Preoperative and (B) postoperative panoramic radiographs of a 78-year-old male patient undergoing total knee arthroplasty on the left limb.

From February 2015 to June 2019, 15 medical records were identified from patients who underwent correction of a marked angular deformity associated with bone failure in the proximal tibia with stabilized posterior total knee arthroplasty and autologous graft. The average age was 67 years (±8.25), ranging from 54 to 82 years. The majority of patients (53.3%) were male (Table 1), with a mean age of 70 years (±8.49). In the female biological gender, the age measurement was 64 years (±7.13).

The involvement was bilateral in one patient and unilateral in 14 patients (93.75%), as shown in Table 1, with the majority having varus deformity (80%), 50% on the right side. All patients were discharged two days after the surgical procedure and without reports of surgical complications. The average time for cargo release was 31 days (±8.49), ranging from 21 to 45 days, with no significant difference (p=0.24) between men (x=30.13±5.08) and women (x=32.14±5.67). Only 6 patients presented complaints on post-surgical return, 5 of which were pain and one patient presented edema and pain after 3 months, followed by signs of lysis at the bone/cement interface and reabsorption of the medial bone graft in the tibia. Table 2 presents the WOMAC scores for the total and subscales of pain, stiffness and physical function in the pre- and postoperative periods. Preoperatively, pain and physical function had the highest scores, followed by stiffness. As WOMAC is scored from 0 (best result) to 96 (worst result), after TKA there was a significant improvement in the three dimensions of WOMAC (mean difference between pre-operative and 6 months after surgery), with a reduction of 78.6% in total score.

Table 1: Demographic data of patients undergoing total knee arthroplasty.

	N	%
Biological gender		
Male	8	53.3
Female	7	46.7
Age (years)		
50 - 60	3	20.0
61 - 70	7	46.7
71 - 80	4	26.7
>80	1	6.6
Affected side		
Right	7	46.7
Left	7	46.7
Right/Left	1	6.6
Deformity		
Varus	12	80
Valgus	3	20

Table 2: Pre-operative and post-operative WOMAC scores for patients undergoing TKA.

Domain	Pre operative	Post operative	P value
Pain	3.44± 0.83	0.73±0.96	<0.001*
Stiffness	2.77±1.25	0.60±1.04	<0.001*
Physical Function	3.43±0.76	0.73±1.09	<0.001*
Total score	79.67±11.3	17.07±22.94	<0.001*

*Statistically significant difference using the t-test (P< 0.05).

DISCUSSION

The use of autologous bone graft to correct axis deviation with tibial bone defect is common during total knee arthroplasty.[13] Pain relief, correction of deformities, stability and recovery of knee function to perform daily activities are the main objectives of TKA.[14,15] For most patients, the ability to do simple stretching exercises, kneeling and gardening are the most important activities resumed after surgical correction.[16] When evaluating 89 patients undergoing TKA in two tertiary hospitals, Mahomed et al observed a mean age of 68 years, a figure close to that observed in the present study, but the sample had a higher prevalence of females (n=49, 55%).[17] Anderson et al followed 74 patients undergoing TKA and

observed a 90.8% improvement in quality of life after surgery.[18] Hawker et al evaluated 1,193 individuals undergoing TKA and observed persistent pain relief, improvement in physical function and satisfaction with the result in 80.2% of patients in a period of two to seven years postoperatively.[19] The WOMAC questionnaire is a multidimensional tool that allows the assessment of pain, stiffness and physical function in patients with hip or knee osteoarthritis.[20] When evaluating the pre-surgical score obtained in the WOMAC, Desmeules et al. reported that waiting time for surgery has a significantly negative impact on pain scores, physical function and quality of life of individuals undergoing TKA.[21]

In the present study, the success rate was 93% (n=14), with only one case reabsorption of the medial bone graft in the tibia. The use of autogenous bone graft promotes bone recovery, increasing fixation stability without the need for additional fixators, in addition to minimizing the risk of TKA infection when the surgical technique is performed with precision.[8] Watanabe, Sato e Itoi evaluated 30 knees with autologous bone grafts for tibial defects in TKA and followed the patients for an average period of 6 years and 10 months. In all knees except one, the grafted bone united and formed good continuity with the tibial floor, resulting in 96.6% survival of autogenous bone grafts. Although TKA presents a high rate of success and satisfaction, dissatisfaction in 30% of cases is directly related to the patients' quality of life, which depends on physical, behavioral, social and psychological factors.[22,23]

CONCLUSION

Total posterior knee arthroplasty stabilized with autologous bone graft to correct axis deviation with tibial bone defect resulted in improvement in symptoms and physical function in the majority of patients evaluated, reducing pain and functional disability resulting from gonarthrosis. In the case series evaluated, the results were consistent with the literature, reinforcing TKA as a reliable, established surgical procedure with substantial improvement in quality of life, even when physical function remains that of a healthy knee.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Junior HP, Torres MR, Araujo HRS, Filho UCS, Goulart RG, Santos MMB, Trindade AMV Total knee arthroplasty stabilized with autologous bone graft for tibial bone defect correction. Int J Res Orthop 2024;10:1031-5.