

Doctoral dissertation abstract

Dissertation topic

“Assessment of implant symmetry and prognostic factors for two-stage bilateral total arthroplasties of the hip or knee and of the effects of the Covid-19 pandemic on the incidence of hip and knee arthroplasties”

LIST OF PUBLICATIONS CITED IN THE DISSERTATION

1. **Kazubski Krystian**, Tomczyk Łukasz, Kopczyński Bartosz, Morasiewicz Piotr. *The Epidemiology of Hip and Knee Primary and Revision Arthroplasties during the COVID-19 Pandemic*. Healthcare (Basel). 2021 Apr 29;9(5):519. doi: 10.3390/healthcare9050519. (IF 1.916, MNiSW points: 40)
2. **Kazubski K.** Tomczyk Ł, Ciszewski M, Witkowski J, Reichert P, Morasiewicz P. *The Symmetry and Predictive Factors in Two-Stage Bilateral Hip Replacement Procedures*. Symmetry 2021, 13(8), 1472; <https://doi.org/10.3390/sym13081472> (IF 2.713, MNiSW/KBN points: 70)
3. **Kazubski K.** Tomczyk Ł, Bobiński A, Morasiewicz P. *Prognostic Factors in Staged Bilateral Total Knee Arthroplasty—A Retrospective Case Series Analysis*. J. Clin. Med. 2023, 12(10),3547; <https://doi.org/10.3390/jcm12103547> (-IF 3.9, MNiSW/KBN points: 140)

Introduction

Degenerative joint disease, or osteoarthritis, is one of the most prevalent chronic conditions worldwide. Due to the associated pain and limited range of motion, the disease causes severe motor impairment in the elderly. As the population of obese and aging individuals grows, so does the proportion of people affected with osteoarthritis. Nearly half of the general population develops the disease by the age of 40. Radiographic evidence of osteoarthritis can be seen in 80% of 55-year-olds, and in approximately 90% of people over 70 years of age.

The aim of osteoarthritis management is to alleviate pain, increase joint range of motion, and make an active lifestyle possible. Surgical treatment, which is recommended in severe disease, considerably decreases pain severity and the number of medications needed. Surgical treatment should be considered in patients with advanced osteoarthritis that limits joint mobility and, consequently, the patient's physical activity. The treatment in advanced osteoarthritis involves total arthroplasty.

With approximately 1.5–2 million total hip or knee replacement procedures performed in the United States each year, patients with a history of the procedure constitute a large proportion of orthopedic patients.

Bilateral total arthroplasty is indicated in severe bilateral osteoarthritis that manifests with considerable pain and limited mobility. Approximately 10%–25% of patients who underwent total joint replacement have the endoprosthesis implants in both lower limbs. Approximately 19%–30% of patients with osteoarthritis of the knee require a bilateral total knee replacement surgery.

Orthopedic surgeons are divided in terms of the preferred number of stages to this procedure, with some advocating simultaneous bilateral implantation during a single procedure, whereas others, who constitute a majority, preferring a two-stage procedure.

International literature on the topic contains few reports on the prognostic factors (observed after the implantation of the first endoprosthesis) that might affect the subsequent implantation of the corresponding endoprosthesis in the contralateral limb.

Learning the effects of certain pre-selected parameters on the outcome of the first arthroplasty may considerably facilitate the planning of the second stage of treatment (arthroplasty in the contralateral limb). These data will also help prepare the surgeon for possible problems or complications that may arise during the second procedure.

The Covid-19 pandemic has altered health care worldwide. In 2020, the pandemic substantially limited patients' access to general health care and to specialists, which also altered surgical practice protocols and orthopedic ward admission criteria. Unsurprisingly, such pandemic-induced alterations in the indications for total hip and knee replacement procedures during the Covid-19 pandemic affected the number of total hip and knee replacement procedures.

This aims of this study were

- 1) to assess symmetry by analyzing pre-selected parameters of the two arthroplasty procedures;
- 2) to determine predictive factors at the second procedure for total hip or knee replacement;
- 3) to assess the effects of the Covid-19 pandemic on the incidence of both primary and revision arthroplasties of the hip or knee.

Material and methods

The evaluated two-stage bilateral total joint replacement procedures were performed at a clinical center in 86 patients in 2017–2021. Bilateral total hip replacements were performed in 42, and bilateral total knee replacements were performed in 44 of those patients. The indications for each of the procedures were bilateral osteoarthritis of the hip or knee, respectively, accompanied by severe pain. This study was conducted in accordance with the guidelines of the Opole University Ethics Committee (approval No. UO/0004/KB/2021) and those of the Declaration of Helsinki.

The parameters assessed in this study included the total number of performed bilateral hip and knee replacement surgeries, the total number of male and female patients who underwent bilateral hip replacement, the total number of male and female patients who underwent bilateral total knee replacement.

Moreover, the size of the femoral component used for the first stage of bilateral total knee replacement surgery was compared with the size used for the other knee during the second stage.

The size of the tibial component used for the first stage of bilateral total knee replacement surgery was compared with that used for the other knee during the second stage.

The size of the polyethylene insert used for the first stage of bilateral total knee replacement surgery was compared with that used for the other knee during the second stage.

The mean duration of anesthesia during the first stage of bilateral knee replacement was compared with that for the contralateral knee at the second stage.

The mean duration of hospital stay during the first stage of bilateral total knee replacement was compared with that during the second stage.

The number of complications (infections, dislocations, delayed wound healing, peri-implant fractures) following the first stage of bilateral total knee replacement was compared with that following the second stage of the surgery for the contralateral knee.

The size of the shaft used for the first stage of bilateral total hip replacement was compared with that used for the second stage of the procedure for the contralateral knee.

The size of the acetabular cup used for the first stage of bilateral total hip replacement was compared with that used for the second stage.

The size of the implant head used for the first stage of bilateral total hip replacement was compared with that used for the second stage.

The mean duration of anesthesia during the first stage of bilateral total hip replacement was compared with that during the second stage.

The mean duration of hospital stay for the first stage of bilateral total hip replacement was compared with that for the second stage.

The number of complications (infections, dislocations, delayed wound healing, peri-implant fractures) following the first stage of bilateral total hip replacement was compared with that following the second stage.

The impact of the Covid-19 pandemic on the number of primary and revision total hip and knee replacement surgeries, hospital stay duration, patient age, and the female-to-male ratio were evaluated.

Study inclusion criteria:

The criteria for inclusion to this study were a bilateral total hip replacement or a bilateral total knee replacement, complete medical records, and complete radiographic records.

The medical records of patients who underwent bilateral hip replacement or bilateral total knee replacement in the period between March 4 and October 15, 2019 (pre-pandemic data)

were compared with the medical records of patients who underwent these types of surgeries between March 4 and October 15, 2020 (data from the Covid-19 pandemic).

Study exclusion criteria:

The exclusion criteria for this study were one of the stages of bilateral total hip replacement performed at a different clinical center, one of the stages of bilateral total knee replacement performed at a different clinical center, total hip replacement surgery performed due to femoral neck fracture, incomplete radiographic records, or incomplete medical records.

Statistical analyses were conducted with Statistica 13.1 (StatSoft Inc., Tulsa, USA). The Wilcoxon test, Student t-test, chi-square test, and Mann–Whitney U test were used for statistical analyses. Analysis of variance was performed, and correlations were calculated with the Spearman rank correlation coefficient.

Study results and discussion

The goal of a total hip or knee arthroplasty is to improve the range of motion and relieve pain, which considerably improves mobility of the lower limb. A total hip or knee replacement surgery helps many patients resume their physical activity and serves to improve their quality of life and health status.

Approximately 20% of patients with bilateral degenerative hip lesions and 10%–25% of patients with bilateral degenerative knee lesions undergo a bilateral arthroplasty. The procedure can be performed as a simultaneous (i.e. one-stage) or staged (i.e. two-stage) surgery, with orthopedic surgeons having individual preferences.

I believe that staged surgical treatment for bilateral hip or knee osteoarthritis may have a considerable advantage over a simultaneous surgery, since evaluation of the first stage makes it possible to determine prognostic factors for the second surgery. This also includes determining and predicting risk factors for revision surgeries in bilateral arthroplasty patients. Those aspects of bilateral total hip or knee replacement have not been comprehensively evaluated, particularly in terms of the symmetry of implant sizes used for the first and second stages of the procedure.

Assessing certain aspects of bilateral total hip or knee arthroplasty will help determine risk factors, plan subsequent stages of treatment, and develop a rehabilitation protocol. The collected data will help the orthopedic surgeon prepare for possible complications during the second stage surgery, which will considerably improve the treatment process.

This study showed no significant differences in the duration of hospital stay for the first and second stages of total arthroplasty, either for total knee or hip replacements.

The study also showed no significant differences in the duration of anesthesia or the number of complications during the two stages of bilateral total arthroplasty, either for total knee or hip replacements.

The analysis showed a strong correlation between the implant size (hip shaft, acetabular cup) used during the first and second stages of bilateral total hip arthroplasty. There was also a strong correlation between the size of both the femoral and the tibial components used during

the two stages of the bilateral total knee replacement. The correlation of the implant sizes used during the first and second stages of bilateral arthroplasty plays an important role in preoperative planning.

Interestingly, in most cases the first procedure of a staged bilateral total arthroplasty, whether of the hip or knee joint, was performed in the right limb, which may suggest more rapid joint degeneration on the right side. Right lower limb dominance may produce more rapid development of degenerative changes in the right hip or knee. Most of the evaluated, now retired, patients had a history of physical labor and had a dominant right lower limb.

Moreover, the study demonstrated an effect of the Covid-19 pandemic on the incidence of both primary and revision arthroplasties of the hip or knee.

The study demonstrated the total number of primary and revision arthroplasty procedures of the hip or knee joint during the Covid-19 pandemic was lower than that during the corresponding pre-pandemic period. Analysis showed a lower female-to-male ratio among patients undergoing arthroplasty during the pandemic than during the corresponding pre-pandemic period.

The observed shorter mean duration of hospital stay following a total hip or knee replacement surgery during the Covid-19 pandemic may have been associated with a high risk of Covid-19 infection.