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CHARACTERISTICS OF KNEE OSTEOARTHRITIS PATIENTS WHO UNDERWENT TOTAL KNEE REPLACEMENT AT PROF. DR. I.G.N.G. NGOERAH CENTRAL GENERAL HOSPITAL IN 2022-2023

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ABSTRACT

Background: Knee osteoarthritis cases are expected to increase because of many risk factors and increasing life expectancy. However, data about the characteristics of knee osteoarthritis patients are limited, even though this data can help clinicians know the management and are expected to be sources of information about risk factors, allowing them to educate the public about preventive measures. **Methods**: This research was accomplished at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital using a cross-sectional method. It utilizes medical records (2022-2023) and data interviews based on the WOMAC questionnaire, which is processed using SPSS version 26. This research has a sample size of thirty. **Results**: The results of this research indicate that the highest number of characteristics of patients with knee osteoarthritis who underwent total knee replacement based on gender is female (90%), based on body mass index is obesity class I (33.3%), based on age is elderly (46.7%), based on occupation is housewife (36.7%), and based on the functional degree of the knee joint after surgery using the WOMAC score is a mild classification (73.3%). **Conclusion:** The characteristics of patients with knee osteoarthritis who underwent total knee replacement were mostly female, obesity class I, elderly, housewife, with WOMAC scores included in the mild classification.

Keywords: knee osteoarthritis, total knee replacement, gender, body mass index, age, occupation, WOMAC score

INTRODUCTION

Knee osteoarthritis is often experienced by the elderly or adults. Early intervention plays a crucial role in preventing complications that can exacerbate the severity of this disease. The prevalence of knee osteoarthritis has steadily increased in recent years, leading to a notable rise in total knee replacement surgeries. These procedures are considered one of the most effective management options for knee osteoarthritis. However, data related to the characteristics of knee osteoarthritis patients who underwent total knee replacement, especially at Prof. Dr I.G.N.G. Ngoerah Central General Hospital, is minimal, even though this data can be used to determine the proper management. In the future, this data is expected to be a source of information about risk factors and appropriate preventive measures to reduce the number of cases of knee osteoarthritis that ultimately require total knee replacement surgery.

Osteoarthritis (OA) is a degenerative and progressive joint disease that can destroy the cartilage structure. OA attacks joints, such as the knee, shoulders, hips, and ankles.[1,2] According to new studies, OA is an inflammatory condition affecting all synovial joints, altering their structure and functionality.[3,4]

There are approximately 250 million cases of osteoarthritis worldwide.[5,6] In Indonesia, the prevalence of knee osteoarthritis based on data from the Indonesian Rheumatology Association in 2021 reached 15.5% in males and 12.7% in females.[7] The prevalence of knee OA in Indonesia is predicted to increase, given the various risk factors and increasing life expectancy. This is supported by data from the United States Bureau of Census, which states that the elderly population in Indonesia increased by 283.3% in 2020 compared to 1994.[7] Therefore, preventive measures, diagnosis, and management of knee OA must be carried out optimally to reduce the number of cases and prevent poor prognosis for patients.

Total knee replacement is one form of treatment for knee OA. Total knee replacement is a surgical reconstruction or replacement of knee joint surfaces due to defects or degeneration of the knee joint.[8] This surgical procedure is also the best therapeutic option for patients who are already suffering from end-stage knee OA,

particularly when the pain becomes intolerable.[9] Total knee replacement is also performed if there is a failure or complication due to previous knee joint replacement surgery, often called a revision total knee replacement.[8] In the United States, total knee replacement procedures are predicted to increase by 143% in 2050 compared to 2012, and by 2050, there will be an estimated 1.5 million total knee replacements performed annually.[10] Although total knee replacement is the reference method for knee OA patients, several factors must be considered before this procedure. This is closely related to the patient's condition, such as age and body mass index. Interestingly, a study found an association between increased total knee replacement and increased BMI, especially obesity, a contributing factor to causing knee osteoarthritis.[11,12] The study by Clement and Deehan (2020) also reported that knee osteoarthritis (OA) patients who were overweight or obese underwent total knee replacement procedures at significantly higher rates compared to those with a normal BMI. Obese patients are advised to lower their BMI before undergoing total knee replacement so that the rate of perioperative complications and the possibility of revision total knee replacement are lower.[13] However, other studies have stated no significant difference in patients with knee OA who are obese or not after total knee replacement.[14] On the other hand, there is also a widespread assumption that patients with knee OA aged >65 years are not allowed to undergo total knee replacement because of the high complication rate and low post-operative functional level. However, other studies have stated that age is not a contraindication for total knee joint replacement.[15]

Based on the problems above, this study aims to explore the characteristics of knee osteoarthritis patients who underwent total knee replacement at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital between 2022 and 2023. Specifically, the research will investigate the patient's gender, age, occupation, BMI, and the functional degree of their knee joint after total knee replacement using the Western Ontario and McMaster Universities Arthritis Index (WOMAC) score.

LITERATURE REVIEW

Knee osteoarthritis is a degenerative joint disease that damages the cartilage, particularly in the knee joint, due to wear and tear or progressive loss of articular cartilage.[16,17]

Osteoarthritis has become the second most common musculoskeletal disease in terms of Disability-Adjusted Life Years, particularly affecting the elderly.[18] In the United States, the prevalence of knee osteoarthritis in the age range of 65 or older is higher in females (41,1%) than in males (31,2%).[17] This is similar to the Riset Kesehatan Dasar (Riskesdas) results in 2018, revealing that the prevalence of joint disease was higher in females at 8.5%, compared to 6.1% in males.[19] These results, however, contrast with data from the Indonesian Rheumatology Association in 2021, which reported that, radiologically, knee OA was more frequent in males (15.5%) than in females (12.7%) within the age group of 40 to 60 years.[7]

The pathogenesis of knee osteoarthritis begins with the erosion of articular cartilage. This initial process is followed by the calcification of the cartilage, which contributes to forming fissures within the tissue. Due to this event, the body's immune system response is that chondrocytes are in a hypertrophic condition, which is also a sign of increased synthesis activity. Increased synthesis activity will increase the production of degradation results of matrix cells and proinflammatory mediators, thereby triggering a decrease in chondrocyte function, increased proliferation and proinflammatory responses in the synovium, and increased vascularization. On the other hand, in the subchondral bone, there will be an increase in the intensity of replacing damaged cartilage followed by vascular invasion from the subchondral bone to the inner part of the subchondral. This mechanism causes the formation of subchondral lesions and the formation of osteophytes.[20]

Risk factors contributing to the development of knee osteoarthritis cases are divided into two risk factors: non-modifiable and modifiable risk factors. Genetic, congenital bone disease, age, and gender are factors that can not be modified. On the other hand, modifiable risk factors include joint trauma, intensity of body activity or certain jobs, instability and weak muscle strength, metabolic syndrome, and body mass index (BMI).[4,16,17]

The diagnosis of knee OA is made based on the anamnesis, physical examination, and, if necessary, laboratory tests and radiological evaluations. In radiographic evaluation, knee OA is often categorized into four degrees of severity using the Kellgren and Lawrence grading approach.[17] Besides that, the Ahlbäck classification and the Knee Osteoarthritis Grading System are also used for radiological assessment. These classifications can evaluate cartilage degeneration and structural changes in the joint.[21] On the other hand, the American College of Rheumatology has released clinical classification criteria to help diagnose patients who may have knee OA. These criteria include: clinical, clinical and radiographic, and clinical and laboratory.[17]

The management of knee OA is divided into non-operative and operative.[3,8,22] One of the most successful orthopaedics surgical is total knee replacement. The procedure can reduce pain, help the knee joint return to its functional level, and improve quality of life.[15,23] Total knee replacement is a procedure for implanting an implant (prosthesis) in the patient's body, especially in the knee joint.[8] Four main implant designs are used in total knee replacement: cruciate-retaining, posterior stabilized, constrained nonhinged, and constrained hinged.[23,24]

The WOMAC questionnaire commonly assesses the effectiveness of operative and non-operative management in knee osteoarthritis.[1,25] This tool is specifically designed to

assess the functional status of the knee joint, particularly in patients having total knee replacement surgery.[1]

OBJECT AND METHOD

This descriptive observational research was conducted at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital using a cross-sectional method. The study utilized medical records from 2022 to 2023 and interviews based on the WOMAC questionnaire.

The study's target population is all knee osteoarthritis patients with total knee replacements at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital. The accessible population includes those with knee OA who had complete knee replacements at Prof. Dr I.G.N.G. Ngoerah Central General Hospital in January 2022-December 2023. The study's sample size was 30 knee osteoarthritis patients who had a total knee replacement at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital in 2022-2023 and met the inclusion criteria. The inclusion criteria in this study were patients with osteoarthritis in their knee who had a total knee replacement at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital between January 2022 and December 2023 and agreed to be interviewed. Patients with osteoarthritis in their knees who had total knee replacements between January 2022 and December 2023 and whose gender, height, weight, age, and occupation were not fully documented in their medical records at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital were excluded from this research. The Udayana University Faculty of Medicine Ethics Commission has accepted this research, with permission number 0028/UN14.2.2.VII.14/LT/2024.

The research sample was taken using the total sampling method, a sample selection technique that takes all population members as research samples. As a result, this study did not require a minimum sample size formula, but the sample was required to meet the inclusion criteria established by the researcher. The study's independent variables were gender, occupation, BMI, age, and WOMAC score, which measures the functional degree of the knee joint after total knee replacement. The dependent variable was the characteristics of patients with osteoarthritis in their knees who had total knee replacements at Prof. Dr. I.G.N.G. Ngoerah Central General.

In this research, descriptive techniques were used to analyze the data, facilitated by SPSS version 26. The research results obtained were presented in five frequency distribution tables: characteristics based on gender, BMI, age, occupation, and the knee joint's functional status after total knee replacement WOMAC score. The results of the data obtained were also presented in narrative form.

RESULT

The total number of patients with osteoarthritis in their knee who had a total knee replacement at Prof. Dr I.G.N.G. Ngoerah Central General Hospital in January 2022-December 2023 was 172; researchers obtained 30 patients to be used as research samples. Information characteristics of patients who had total knee replacement surgery due to osteoarthritis in their knees at Prof. Dr. I.G.N.G. Ngoerah General Hospital in 2022–2023 are provided below.

Characteristics of Knee Osteoarthritis Patients Who Underwent Total Knee Replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 Based on Gender

Table 1 shows that the majority of knee osteoarthritis patients who had total knee joint replacement are female (90%) compared to males (10%).

Table 1. Characteristics of knee osteoarthritis patients who underwent total knee replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 based on gender

Gender	Frequency (n)	Percentage (%)
Female	27	90
Male	3	10
Total	30	100

Characteristics of Knee Osteoarthritis Patients Who Underwent Total Knee Replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 Based on Body Mass Index (BMI)

Table 2 demonstrates that total knee replacement is highest in knee osteoarthritis patients with obesity class I (33.3%). The second highest is in patients with obesity class II (30.0%), followed by overweight patients (20.0%) and normal-weight patients (16.7%).

Table 2. Characteristics of knee osteoarthritis patients who underwent total knee replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 based on body mass index (BMI)

Classification	BMI (kg/m^2)	Frequency (n)	Percentage (%)
Underweight	<18.5	0	0
Normal	18.5-22.9	5	16.7
Overweight	23.0-24.9	6	20.0
Obesity class I	25.0-29.9	10	33.3
Obesity class II	>30.0	9	30.0
Total		30	100

Characteristics of Knee Osteoarthritis Patients Who Underwent Total Knee Replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 Based on Aged

Table 3 shows that knee osteoarthritis patients who underwent total knee replacement are more elderly (46,7%) than young old patients (30,0%) and middle-aged patients (23,3%).

Table 3. Characteristics of knee osteoarthritis patients who underwent total knee replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 based on aged

Classification	Age Range	Frequency (n)	Percentage (%)
Middle age	45-54	7	23.3
Elderly	55-65	14	46.7
Young old	66-74	9	30.0
Old	75-90	0	0
Very old	>90	0	0
Total		30	100

Characteristics of Knee Osteoarthritis Patients Who Underwent Total Knee Replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 Based on Occupation

Table 4 shows that knee osteoarthritis patients with jobs as housewives are the most dominant (36.7%) who underwent total knee replacement compared to other jobs, such as employees (26.7%), retirees (23.3%), and traders (13.3%).

Table 4. Characteristics of knee osteoarthritis patients who underwent total knee replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 based on occupation

Occupation	Frequency (n)	Percentage (%)
Employees	8	26.7
Retirees	7	23.3
Housewives	11	36.7
Traders	4	13.3
Total	30	100

Characteristics of Knee Osteoarthritis Patients Who Underwent Total Knee Replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 Based on the Functional Degree of the Knee Joint After Total Knee Replacement Using the Western Ontario And Mcmaster Universities Arthritis Index (WOMAC) Score

Table 5 demonstrates the results of evaluating the functional degree of the knee joint in patients with osteoarthritis after total knee replacement using the WOMAC questionnaire. The majority (73.3%) are classified as mild, followed by moderate (23.3%) and severe (3.3%).

Table 5. Characteristics of knee osteoarthritis patients who underwent total knee replacement at Prof. Dr. I.G.N.G Ngoerah Central General Hospital in 2022-2023 based on the functional degree of the knee joint after total knee replacement using the Western Ontario And Mcmaster Universities Arthritis Index (WOMAC) score.

Classification	Total WOMAC Score	Frequency (n)	Percentage (%)
Mild	0-24	22	73.3
Moderate	25-48	7	23.3
Severe	49-72	1	3.3
Very severe	73-96	0	0
Total		30	100

DISCUSSION

This study found that 90% of patients (27 samples) with osteoarthritis in their knee who received total knee replacement were female, while only 10% (3 samples) were male. The results of this investigation align with other studies accomplished at Prof. Dr. I.G.N.G. Ngoerah Central General Hospital in 2020–2022, which reported that 84.2% (48 samples) of total knee replacement were performed on female patients and 15.8% (9 samples) were male.[26] The result previously described also aligns with the research of Jamie et al., which revealed that 135 out of 223 or equivalent to 60.5% of patients with osteoarthritis in their knee who had total knee replacement were female patients, while males were only 88 out of 223 patients or equivalent to 22.3%. A study conducted in Brazil in 2007-2008 also concluded that 79.3% of patients diagnosed with knee osteoarthritis who received total knee replacement were dominated by females compared to males.[28] The high proportion of this surgery in female patients diagnosed with osteoarthritis in their knee is likely due to the higher prevalence of this disease in females.[29] Various factors can cause this: the rate of degenerative cartilage processes in the patella area in females is three times higher, and the rate of degenerative cartilage processes, especially in the tibia area, is four times higher than in males[30]; movements of the musculoskeletal system in females also result in higher friction, extension, and valgus forces than in male[31]; the volume of the tibia and patella bones in female is lower than in male[32,33]; and there are hormonal, neurological, immunomodulatory, and genetic influences that occur specifically in female.[34]

Based on BMI, this research proves that total knee replacement is more common in knee osteoarthritis patients with obesity class I than patients with obesity class II (30.0%), overweight (20.0%), and normal weight (16.7%). This is likely due to the highest proportion of knee osteoarthritis occurring in patients with obesity class I. Research by Claudia et al. at Prof. Dr. I.G.N.G Ngoerah Central General Hospital revealed that the proportion of knee osteoarthritis in January-June 2018 was highest in patients with obesity class I (38.3%). The study by Ahmad et al. at the Dr. Soetomo Regional General Hospital also found that patients with obesity class I (37%) experienced the most knee osteoarthritis. In addition, the escalation of total knee replacement procedure in knee osteoarthritis patients with obesity can be caused by several factors: based on microscopic examination, pathological conditions were found in the form of horizontal fissures in the osteochondral unit[36]; disruption of body mechanisms both biomechanically and physiologically so that the body becomes susceptible to osteoarthritis; and a high body mass index results in an increase in the load that the cartilage in the knee joint area must support. This has implications for tissue damage and stimulates adipose tissue to release adipokines (pro-inflammatory proteins in cartilage), which ultimately contribute significantly to the increase in the rate of osteoarthritis cases and ultimately increase the number of patients receiving total knee replacement intervention.[37–39]

The highest total knee replacement is performed on knee osteoarthritis patients who are classified as elderly (55-65 years), which is 46.7% (14 samples), followed by young old patients (66-74 years) at 30.0% (9 samples), and middle age group (45-54 years) at 23.3% (7 samples). This is likely linked to the ageing process, which causes changes in the chondrocyte response. Ageing experienced by chondrocytes in the knee joint causes an elevate production of inflammatory cytokines, tissue-destroying enzymes, growth factors, and advanced glycation end-products (AGE). AGE binding to its receptor on the knee joint cartilage induces degradation of the extracellular matrix and chondrocyte apoptosis while inhibiting the chondrocyte autophagy mechanism, making the cartilage more fragile and susceptible to damage.[40–42]

Based on the type of occupation, this study found that housewives were the type of occupation that received the highest intervention for total knee replacement due to knee osteoarthritis, which was 36.7% (11 samples). In second place were employees at 26.7% (8 samples), followed by retirees at 23.3% (7 samples), and traders at 13.3% (4 samples). The results of the above characteristic data are estimated to occur because the proportion of knee osteoarthritis is highest in housewives. This is supported by previous research at Prof. Dr. I.G.N.G Ngoerah Central General Hospital, which reported that the proportion of knee osteoarthritis in January-June 2018 was experienced mainly by housewives, which was 31.7%.[2] Studies conducted by Ernanto & Hermawan, Srilekha & Kumar, and Ogbu et al. also reported that the highest proportion of knee osteoarthritis was experienced by patients who worked as housewives, namely 53.7%; 24.5%; and 25.4%, respectively. The reasons behind the high proportion of knee osteoarthritis in housewives remain unclear, as no established guidelines accurately measure the impact of physical activity or work-related stress on housewives or women in general, so further research is needed. However, some studies have suggested that the role of a housewife involves repetitive movements that require significant knee joint flexion, causing the knee to bear excessive weight.[45–47]

WOMAC questionnaire is a tool for evaluating the functional status and therapeutic outcomes of patients with osteoarthritis in their knee, including those who have undergone total knee replacement. In this study, 73.3% of patients (22 samples) had a postoperative WOMAC score categorized as mild (0-24), while 23.3% (7 samples) were classified as moderate, and 3.3% (1 sample) were classified as severe. The researcher's study results are similar with the study of Al Thaher et al., which proved a significant decrease in the WOMAC score in all patients who received total knee replacement. The total WOMAC score of patients before surgery was included in the severe classification, while the total WOMAC score after surgery was included in the mild classification. The results of a previous study in 2013 also concluded similar results.[49] This is because total knee replacement has been proven to be the only intervention capable of improving the quality of life of patients with severe osteoarthritis, particularly in their knees.[48,49] During the interview process, the researcher discovered that 1 out of 30 patients was still classified as severe. The patient reported that the total knee replacement surgery had been performed only one month prior. This finding can be associated with several studies explaining a significant decrease in pain, stiffness, physical activity limitations, and psychological disorders in patients 6-12 months after surgery.[48,50]

CONCLUSION AND SUGGESTION

The study's findings indicate that females represent the largest group among knee osteoarthritis patients who underwent total knee replacement. Based on BMI, the highest is experienced by patients with obesity class I, while patients with normal body weight experience the lowest cases. Based on age, the highest cases occur in the elderly and the lowest in the middle age group. Based on occupation, housewives with knee osteoarthritis are the highest type of occupation that underwent total knee replacement, while the lowest cases occur in traders. Based on the functional degree of the knee joint after surgery using the WOMAC score, the highest knee osteoarthritis patients are included in the mild classification.

The researcher acknowledges the limitations of this study and suggests that future research should add research variables, such as history of trauma, knee joint deformity,

and localization of pain in patients with osteoarthritis in their knee who underwent total knee replacement by involving a more significant sample size to represent the population. Furthermore, an analytical study was conducted to see the association between each of the following variables such as gender, age, occupation, history of trauma, deformity of the knee joint, and localization of pain in patients with osteoarthritis in their knee with total knee replacement.

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