



Int. J. New. Chem., 2022, Vol. 9, Issue 2, pp. 243-249.

International Journal of New Chemistry

Published online in <http://www.ijnc.ir/>

Open Access

Print ISSN: 2645-7237

Online ISSN: 2383-188x



Original Research Article

An Investigation into Risk Factors for Knee Arthroplasty as a Knee Osteoarthritis (OA) Treatment

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Received: 2021-08-05

Accepted: 2021-10-21

Published: 2021-11-19

ABSTRACT

Abstract:

Introduction: Knee osteoarthritis (OA) is a chronic and multifactorial disease that may require knee arthroplasty if it is not treated early. It is hence necessary to identify the variables predicting knee arthroplasty in patients with knee OA. This study addressed the risk factors for knee arthroplasty as a knee OA treatment.

Methodology: This cross-sectional descriptive study was conducted on 378 patients at Imam Reza Hospital of Tabriz (affiliated with Tabriz University of Medical Sciences, TUOMS) in the period 2019-2020. The participants were selected based on the complete enumeration method. An author-made checklist was completed for all participants to evaluate the risk factors for knee arthroplasty. The participants were assigned to two groups of “knee arthroplasty” and “no knee arthroplasty” to be compared in terms of these variables.

Results: The results showed the effect of different factors on the necessity of knee arthroplasty: BMI (2.42 times), MAA (3.29 times), joint-line-JCA (2.83 times), VA (2.99 times), flexion contracture (3.15 times), total range of flexion (3.66 times), and alignment (varus and valgus) (2.27 times).

Conclusion: There are a variety of risk factors for knee arthroplasty that may affect patients differently. The study findings revealed that high BMI, abnormal MAA and VA, and restricted total range of flexion and alignment were the most important risk factors for knee arthroplasty in patients with knee OA.

Keywords: Osteoarthritis; Knee; Knee arthroplasty; Risk Factor

Introduction

Knee OA is a common chronic disease characterized by gradual fibrillation, destruction of articular cartilage, formation of osteophytes, and reduced intra-articular distances(1). If remain untreated, knee OA can lead to disabilities, difficulty in doing daily activities, and reduced quality of life in patients aged over 65 years. The latest reports of the World Health Organization (WHO) indicate that knee OA is the 10th leading cause of disabilities worldwide(2). The main clinical complications of this disease are pain and restricted range of motion(3). Although the exact cause of OA is still unknown, the most common risk factors for this disease are age, gender, heredity, articular traumas, infections, gout, and hemorrhagic diseases such as hemophilia. The most common strategies for managing this condition also include lifestyle changes, physiotherapy, taking non-steroidal anti-inflammatory drugs (NSAIDs), intra-articular injections, and orthopedic surgeries such as arthroscopic debridement, proximal tibial osteotomy, and arthroplasty(4, 5). The selection of orthopedic surgical procedures as a treatment option for such patients depends on factors such as the severity of pain, articular function, and the degree of osteoarthritis. Although NSAIDs and analgesics can somewhat control the symptoms, their long-term use can cause gastrointestinal, renal, and vascular complications. It has been recommended that intra-articular injections (hyaluronic acid, platelet-rich plasma, and stem cells) in the early stages of OA may prevent the progression of the disease(6, 7).

Evidence suggests that this therapeutic method is not much effective in the treatment of OA. Proximal tibial osteotomy is another option for treating internal or external compartments of knee OA, correcting varus deformities, and reliving continuous pain in young patients. Limb misalignment, knee ligaments imbalance, and morphological changes of bone can affect the results of this treatment and even necessitate arthroplasty(8). Arthroplasty, or complete joint replacement, is a surgical procedure in which the knee joint is replaced with a prosthesis made of metal alloys. As stated by the secretary of the Iranian Association of Orthopedic Surgeons, about 50,000 arthroplasty surgeries are annually performed in Iran(9). Considering the rapid growth of voluminous and complex data in the field of treatment and medical care, data mining is a powerful tool for the discovery of hidden patterns and the extraction of knowledge. Accordingly, a variety of algorithms can be employed to predict the necessity of knee arthroplasty. A review of the literature reveals that a few studies have dealt with proper treatments for this articular disease(10). Since an early knee arthroplasty surgery is of great importance in coping with disabilities, managing pain, improving knee function, and achieving desired therapeutic results, it is necessary to identify the factors influencing the choice of this method for treating patients with knee OA. Recent studies have shown that patients with knee OA should undergo knee arthroplasty as soon as possible once its indications are established, because the later the patients visit a physician for this

surgery, the more complicated surgical procedure they would experience. This study hence aims to identify the risk factors for knee arthroplasty as a treatment option for knee OA.

Methodology

In this cross-sectional descriptive study, the population consisted of 118 women and 70 1 men with knee OA visiting the orthopedic clinic of Imam Reza Hospital (affiliated with TUOMS) in the period 2019-2020. Of them, 378 patients who were prescribed to undergo a knee arthroplasty surgery were selected as the sample based on the complete enumeration method. Under the supervision of an orthopedic physician from TUOMS, preoperative radiographs, including the full-face standing radiograph and profile radiograph, and the Knee Society Score, approved by the Association of Orthopedic Surgeons, were reviewed to identify 20 effective variables in this regard. The inclusion criteria were being over 18 years old, having symptoms of knee OA, visiting the orthopedic clinic of Imam Reza Hospital, and willingness to participate in the study. The exclusion criteria were also a history of knee arthroplasty and affliction with knee deformities, endocrine disorders, and osteoporosis. Then a table containing the main risk factors for knee arthroplasty was prepared based on the review of similar studies and views of orthopedists specializing in knee arthroplasty. These variables were age, gender, PMH (past medical history), BMI (body mass index), LDFA (lateral distal femoral angle), MPTA (medial proximal tibial angle), MAA (mechanical axis angle), Joint-line-JCA, VA (varus angle), pain, flexion contracture, total range of flexion, alignment (varus and valgus), walking, the ability to going up the stairs, and walking aids used. All patients visiting the orthopedic clinical of Imam Reza Hospital were examined in terms of these variables and then they were assigned to two groups of patients who needed knee arthroplasty and those who did not need to undergo such surgical procedure. The data were inserted into SPSS-20 to be statistically analyzed using mean (standard deviation), frequency, and percentage for quantitative data and t-test and chi-square test for qualitative data. The significance level was determined to be $p < 0.05$. This research study was approved by the Ethics Committee of TUOMS (IR.TBZMED.REC.1398.858). After coordination with the officials of Imam Reza Hospital, the participants were briefed on the research objectives and procedures and an informed consent form was obtained from all of them to observe ethical considerations.

Results

A total of 158 patients visiting the studied clinic for knee arthroplasty participated in this study. The results showed that there was a significant difference between the two groups in terms of gender, BMI, MAA, Joint-line-JCA, VA, flexion contracture, pain, total range of flexion, and alignment (varus and

valgus) (Table 1), Therefore, these variables were analyzed by a multivariate regression model to determine the effect of each of them on the necessity of knee arthroplasty.

Table 1: A comparison between the two groups in the risk factors for knee arthroplasty

Variable		Groups		P Value
		Surgery(N=158)	Non-surgery(N=220)	
Age		52.83±6.49	41.52±5.64	0.012
Gender	Female	100 – 63.29%	85 – 38.63%	0.009
	Male	58 – 36.71%	135 – 61.37%	
PMH	Diabetes	35 – 22.15%	50 – 22.72%	0.251
	High Blood Pressure	53 – 33.54%	65 – 29.54%	
	None	80 – 50.31%	105 – 47.72%	
BMI	Normal	58 – 36.70%	103 – 46.81%	0.023
	High	100 – 63.30%	117 – 53.18%	
MAA	Normal	69 – 43.67%	129 – 58.63%	0.011
	Non-Normal	89 – 56.32%	91 – 41.36%	
Joint-line- JCA	Normal	55 – 34.81%	129 – 58.63%	0.005
	Non-Normal	103 – 65.18%	91 – 41.36%	
VA	Normal	9 – 5.69%	140 – 63.63%	0.003
	Mild	60 – 37.97%	52 – 23.63%	
	Sever	89 – 56.32%	28 – 12.72%	
Pain	Yes	158 – 100%	63 – 28.63%	0.001
	No	0 – 0%	157 – 71.37%	
Flexion Contracture	5-10°	6 – 3.79%	45 – 20.45%	0.001
	10-15°	25 – 18.35%	102 – 46.36%	
	15-20°	49 – 31.01%	59 – 26.81%	
	>20°	78 – 49.36%	14 – 6.36%	
Total range of flexion	0-25°	23 – 14.55%	100 – 45.45%	0.001
	25-50°	51 – 23.27%	50 – 22.72%	
	50-75°	70 – 44.30%	55 – 25%	
	>75°	14 – 8.86%	15 – 6.81%	
Alignment	Normal	9 – 5.69%	59 – 26.81%	0.001

(Varus & Valgus)	Mild	78 – 49.36%	131 – 59.54%	
	Sever	71 – 44.96%	40 – 18.18%	
Walking	Yes	103 – 65.18%	179 – 61.36%	0.319
	No	55 – 34.82%	41 – 18.63%	
Stare	Yes	135 – 85.44%	185 – 84.04%	0.419
	No	23 – 14.55%	35 – 15.96%	
Walking aids used	Yes	119 – 75.31%	189 – 85.90%	0.113
	No	39 – 24.68%	31 – 14.09%	

The results also indicated the effect of these risk factors on the necessity of knee arthroplasty: BMI (2.42 times), MAA (3.29 times), joint-line-JCA (2.83 times), VA (2.99 times), flexion contracture (3.15 times), total range of flexion (3.66 times), and alignment (varus and valgus) (2.27 times) (Table 2).

Table 2: The effect size of different risk factors for knee arthroplasty in patients with knee OA

Variable	OR	95% CI	P value
Gender	0.84	0.65-0.90	0.125
BMI	2.42	1.63-2.99	0.011
MAA	3.29	2.85-3.55	0.001
Joint-line-JCA	2.83	2.75-3.15	0.003
VA	2.99	2.85-3.41	0.001
Flexion Contracture	3.15	3.05-3.63	0.002
Pain	0.91	0.85-0.96	0.225
Total range of flexion	3.66	3.24-4.06	0.001
Alignment (Varus & Valgus)	2.27	2.06-2.41	0.011

Discussion

Knee OA is a debilitating condition whose prevalence is rapidly increasing. The prevalence of this disease increases with age, because it is assumed that cartilage destruction predisposes the knee to severe pain even under low pressure. Increased forces applied to the knee can be considered a risk factor for knee OA. Other risk factors for this disease reported by previous studies are gender, obesity, muscle weakness, articular weakness, and previous articular injuries. Therapeutic approaches to the treatment of knee OA can be divided into three groups: pharmacotherapy, surgery, and rehabilitation. NSAIDs, which have their own side effects, are the most common medicine now taken by patients with knee OA.

Surgical treatments for these patients also include gel injections and arthroplasty, which not only are very expensive but also may cause many complications for patients. This study addressed surgical treatments for knee OA and the factors affecting their necessity(1, 11, 12).

In this study, the number and mean age of men were more than those of women. The lower mean age of women with knee OA can be attributed to the higher frequency of secondary cases in this group of patients. However, primary OA was the reason for knee arthroplasty in most cases(13). The data showed that the frequency of surgeries on the right knee was more than those on the left knee. No clear reason was found for this finding in this study. Anesthesiologists preferred to use local anesthesia in most cases because of the old age of patients. The results revealed no significant difference between general and local anesthesia in cardiac and pulmonary complications. The most common preoperative deformities were varus and flexion contracture, which were secondarily caused by primary OA, whereas valgus was a less prevalent deformity, which was secondarily caused by RA in rare cases(14, 15).

Based on the findings of a study conducted by the Osteoarthritis Research Society International (OARSI) in 2010, poor articular functioning and articular cartilage destruction were among the most important factors influencing patients' decision about undergoing knee arthroplasty. Moreover, changes in the total range of flexion, flexion contracture, and alignment (varus and valgus) were greater in patients undergoing knee arthroplasty than in those who did need such a surgical procedure(16, 17).

Another study showed that increased BMI was among the effective risk factors for OA and the severity of its pain, as patients with a higher BMI are more likely to undergo knee arthroplasty. The results of this study also indicated that a higher BMI can increase the necessity of knee arthroplasty. It is noteworthy that such patients may experience different severities of pain such as mild/occasional, mild (only when going up the stairs), mild (when walking and going up the stairs), moderate/occasional, moderate/continuous, and severe. The above-mentioned study showed that severe pain was one of the main risk factors for knee arthroplasty, something which is not consistent with the results of the present study. Another study in 2018 reported that articular cartilage destruction, shown in knee radiographs, poor articular functioning, and restricted knee functioning were among the main risk factors for knee arthroplasty.

Conclusion

Patients with knee OA may experience a variety of risk factors for knee arthroplasty. This study suggested that high BMI, abnormal MAA and VA, and restricted total range of flexion and alignment were the most important risk factors for knee arthroplasty in such patients.

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How to Cite This Article

Parham Maroufi, Mohammadreza Moharrami, “**An Investigation into Risk Factors for Knee Arthroplasty as a Knee Osteoarthritis (OA) Treatment**”, *International Journal of New Chemistry.*, 2022; DOI: 10.22034/ijnc.2022.2.6.