

Research Article

Functional and Radiological Outcomes of Total Knee Arthroplasty in Patients with Advanced Osteoarthritis and Obesity

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ABSTRACT

Background: Advanced knee osteoarthritis is a common cause of chronic pain, reduced mobility, and functional disability, particularly in obese individuals. Obesity accelerates the progression of osteoarthritis through increased joint loading and metabolic-inflammatory mechanisms, potentially affecting surgical outcomes after total knee arthroplasty.

Objective: To evaluate the functional and radiological outcomes of total knee arthroplasty in obese patients with advanced knee osteoarthritis.

Methods: This prospective observational study was conducted in the Department of Orthopaedic Surgery, Ghurki Trust Teaching Hospital, Lahore, Pakistan, from June 2024 to October 2025. A total of 100 obese patients aged 45 years and above with advanced knee osteoarthritis undergoing primary total knee arthroplasty were included through non-probability consecutive sampling. Functional outcomes were assessed using pain score, knee function, range of motion, walking ability, stair climbing, and knee stability. Radiological outcomes included implant alignment, prosthesis positioning, deformity correction, and early postoperative complications. Data were analyzed using SPSS version 25.0.

Results: The mean age of the patients was 62.8 ± 8.4 years, and females constituted 64.0% of the study population. The mean body mass index was 33.7 ± 3.1 kg/m². Significant postoperative improvement was observed in all functional parameters. Pain score improved from 8.1 ± 1.0 preoperatively to 2.1 ± 0.9 postoperatively, while functional score increased from 39.6 ± 8.7 to 82.9 ± 9.4 . Knee flexion improved from $84.7 \pm 13.5^\circ$ to $112.8 \pm 10.6^\circ$. Satisfactory implant alignment was achieved in 89.0% of patients, and 90.0% of patients had good to excellent overall outcomes.

Conclusion: Total knee arthroplasty provides significant functional improvement and satisfactory radiological outcomes in obese patients with advanced knee osteoarthritis and remains an effective treatment option in this population.

Keywords: Total Knee Arthroplasty, Knee Osteoarthritis, Obesity, Functional Outcome, Radiological Outcome, Orthopaedic Surgery.

INTRODUCTION

Knee osteoarthritis is a chronic degenerative joint disorder and a major cause of pain, disability, and poor quality of life in the world¹. It is marked by gradual cartilage degeneration, subchondral bone remodelling, the development of osteophytes, and inflammation of the synovium, which finally leads to the

rigidity, deformity, and functional impairment of the joints. Knee osteoarthritis is a key issue in global public health as it is getting more prevalent with increasing life expectancy, inactive lifestyles, and rising incidences of metabolic disorders, especially in low and middle-income nations².

Out of the many risk factors, obesity has been one of the most important factors in the development and progression of knee osteoarthritis³. Besides amplifying the mechanical load on weight-bearing joints, excess body weight is also an implicated factor in systemic inflammation via adipokine-mediated mechanisms, thus hastening cartilage pathogenesis and joint destruction. Obese patients have an increased risk of developing severe types of osteoarthritis at a younger age and tend to manifest with more severe pain, decreased mobility, and worse functional status of the knee⁴.

Pharmacological therapy, physiotherapy, and lifestyle modification are the conservative management strategies that fail to offer the patient sufficient symptom relief, and total knee arthroplasty is the ultimate solution to the advanced knee osteoarthritis⁵. The total knee arthroplasty has been demonstrated to be effective in alleviating pain, reestablishing normal joint functioning, and increasing the quality of life. Nevertheless, the incidence of obesity presents special problems in the perioperative and postoperative process, such as a technical complication during surgery, a high risk of complications, and a possibility of affecting the functional recovery and implant survival⁶.

Even though the effectiveness of total knee arthroplasty has already been well established, the outcomes of this procedure in obese patients are still a subject of debate⁷. In some of the studies, it has been proposed that obesity correlates with poor functional outcomes, increased complication rates, and poor radiological alignment, whereas in some studies, they have found that obesity does not affect their pain relief and functional recovery. These contradictory results emphasize the necessity of additional clinical analysis, especially in the local populations where the patient features, medical facilities, and surgical procedures might vary⁸.

The current study aims to determine the functional and radiological results of total knee arthroplasty among patients with severe osteoarthritis and obesity. This study will also help provide full-scale evidence on the efficacy of total knee arthroplasty in this high-risk group of patients and will help in enhancing clinical decision-making and counselling patients⁹.

MATERIALS AND METHODS

The study was a prospective observational study carried out in the Department of

Orthopaedic Surgery, Ghurki Trust Teaching Hospital, Lahore, Pakistan, with a study period commencing in June 2024 and continuing until October 2025. The study aimed to measure the functional and radiological results of a total knee arthroplasty on patients who came with a high level of osteoarthritis of the knee when they were obese. One hundred patients were recruited based on non-probability consecutive sampling following the set eligibility criteria.

Patients aged 45 years and above of either gender, diagnosed clinically and radiologically with advanced osteoarthritis of the knee, and having obesity based on body mass index, were included in the study. Patients who had been planned to receive primary total knee arthroplasty, and were willing to participate by giving informed written consent, were recruited only. The study excluded patients who had undergone revision knee arthroplasty, had inflammatory arthropathy like rheumatoid arthritis, previous major knee trauma or fracture, malignancy around the knee joint, active infection, or severe systemic disease that might interfere with surgery or follow-up.

All potential patients were then evaluated in detail preoperatively, after obtaining the consent of the institutional ethical review committee. The demographic/clinical data were captured on a structured proforma and included age and gender, body mass index, symptoms duration, knee involvement laterality, and comorbidities. Clinical evaluation was done in terms of knee pain severity, walking restriction, stair climbing problems, and range of movement. Standard clinical parameters that assessed pain relief, ambulatory capacity, stair negotiation, joint stability, and knee mobility were used to conduct functional evaluation in preoperative and follow-up.

The orthopaedic surgical team conducted all the primary total knee arthroplasty operations under the usual aseptic conditions and the institutional operating procedures. Management and rehabilitation postoperatively were done as per the regular hospital guidelines. Clinical and radiological evaluation of patients occurred at scheduled visits after surgery. The outcome measures were functional and evaluated as improvement in pain, walking, climbing stairs, knee stability, and range of motion post-operatively.

The radiological assessment was conducted on both preoperative and postoperative anteroposterior and lateral knee radiographs. The severity of osteoarthritis and any deformity was determined using preoperative

radiographs, and postoperative radiographs were checked to determine the positioning of the prosthesis, the alignment of the implants, the correction of deformity, and any radiological evidence of complications like loosening, malalignment, or instability.

Statistical Package for the Social Sciences (SPSS) version 25.0 was used to enter all the collected data and analyze them. Quantitative variables such as age, body mass index, and duration of symptoms were expressed as mean \pm standard deviation, whereas qualitative variables such as gender, side involved, and outcome categories were presented as frequencies and percentages. Stratification was conducted where necessary so as to determine the impact of such variables as age, gender, and degree of obesity on postoperative functional and radiological outcomes. P-value of 0.05 and below was taken to be statistically significant. The entire process was performed according to the ethical criteria of conducting research with human subjects. Informed consent was also taken in writing before inclusion, and the confidentiality of the patient data was highly ensured in this study.

RESULTS

A total of 100 obese patients with advanced knee osteoarthritis who underwent primary total knee arthroplasty were included in the final analysis. Every patient went through the follow-up protocol and was accessible in terms

of functional and radiological evaluation. However, on the whole, the study showed significant improvement in clinical outcome, as well as a satisfactory radiological outcome after surgery.

The demographic and clinical profile of the patients at the baseline showed that the mean age was 62.8 ± 8.4 years, with most of the patients aged above 65 (old age). The ratio was found to be predominantly female (64.0% female vs 36.0% male) due to the established increased prevalence of osteoarthritis in women. The average body mass index was $33.7/3.1 \text{ kg/m}^2$, with the majority of the patients falling under Class I (58.0%) and Class II obesity (34.0), with a smaller fraction (8.0) falling under Class III obesity. The average symptom duration was 6.2 years, and the standard deviation was 2.7 years, which means that the disease was chronic and was operated on. The right knee was marginally more involved (56.0%) than the left (44.0%). In terms of comorbidity, the most common comorbidities were hypertension (48.0%) and diabetes mellitus (31.0%), with one-fifth of patients having both conditions at the same time (19.0%). The results indicate that the population sample was mostly old, metabolically impaired, and with long duration of the disease, which is a characteristic of a real-life cohort of patients who undergo total knee arthroplasty in tertiary care (Table 1).

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population

Variable	Findings
Total patients (n)	100
Age (years), mean \pm SD	62.8 ± 8.4
Age group 45–54 years, n (%)	18 (18.0%)
Age group 55–64 years, n (%)	39 (39.0%)
Age group ≥ 65 years, n (%)	43 (43.0%)
Gender (Male), n (%)	36 (36.0%)
Gender (Female), n (%)	64 (64.0%)
Body Mass Index (kg/m^2), mean \pm SD	33.7 ± 3.1
Obesity Class I, n (%)	58 (58.0%)
Obesity Class II, n (%)	34 (34.0%)
Obesity Class III, n (%)	8 (8.0%)
Duration of symptoms (years), mean \pm SD	6.2 ± 2.7
Right knee involvement, n (%)	56 (56.0%)
Left knee involvement, n (%)	44 (44.0%)
Hypertension, n (%)	48 (48.0%)
Diabetes mellitus, n (%)	31 (31.0%)
Both hypertension and diabetes, n (%)	19 (19.0%)

Preoperative functional assessment revealed that most of the patients were severely clinically impaired. The mean pain score (VAS) was 8.1

± 1.0 , indicating severe pain, while the Knee Society Functional Score was low (39.6 ± 8.7), reflecting poor functional ability. There was

limited joint mobility as the mean knee flexion was limited to 84.7 ± 13.5 degrees. There was severe walking limitation in 72.0% patients and moderate-severe stair climbing difficulty in 81.0% patients. Only 41.0% of patients were found to be stable in their knees in clinical terms before surgery. The high degree of functional parameters was significantly improved after total knee arthroplasty. The mean pain score decreased to 2.1 ± 0.9 , indicating substantial pain relief. Knee Society Functional Score increased to 82.9 ± 9.4 with a significant

improvement in functional ability. Knee flexion was enhanced by 112.8 ± 10.6 degrees, indicating better joint mobility. Severe walking limitation reduced drastically from 72.0% to 9.0%, and stair-climbing difficulty decreased from 81.0% to 17.0%. The level of clinical knee stability also increased significantly to 91.0% after surgery. These were all statistically highly significant ($p < 0.001$), which confirmed the high level of functional advantage of total knee arthroplasty among obese patients (Table 2).

Table 2. Preoperative and Postoperative Comparison of Functional Outcomes

Variable	Preoperative	Postoperative	p-value
Pain score (VAS), mean \pm SD	8.1 \pm 1.0	2.1 \pm 0.9	<0.001
Knee Society Functional Score, mean \pm SD	39.6 \pm 8.7	82.9 \pm 9.4	<0.001
Knee flexion range (degrees), mean \pm SD	84.7 \pm 13.5	112.8 \pm 10.6	<0.001
Severe walking limitation, n (%)	72 (72.0%)	9 (9.0%)	<0.001
Moderate-to-severe stair-climbing difficulty, n (%)	81 (81.0%)	17 (17.0%)	<0.001
Clinical knee stability present, n (%)	41 (41.0%)	91 (91.0%)	<0.001

Radiological assessment revealed positive postoperative results in most of the patients. Radiographs taken preoperatively revealed that the joints had advanced osteoarthritic changes with a narrowed joint space, presence of osteophytes, and deformity. The observation of satisfactory implant position in 89.0% of patients and correct position of the prosthesis in 91.0% in postoperative radiographs was evidence of a successful surgical method in most instances. Proper correction of deformity was attained in 86.0% of patients. Radiological complications were relatively uncommon, with

early signs of loosening observed in only 3.0% of cases, mild malalignment in 6.0%, and radiographic instability in 5.0%. As far as clinical complications are concerned, the most common were superficial wound infection (7.0%), knee stiffness (10.0%), persistent moderate pain (8.0%), and 75.0% of patients did not have significant early postoperative complications. These data suggest that even with the problems related to obesity, the positive radiological results and the tolerable complication rates are possible after the total knee arthroplasty (Table 3).

Table 3. Postoperative Radiological Outcomes and Early Complications

Variable	Findings
Satisfactory implant alignment, n (%)	89 (89.0%)
Proper prosthesis positioning, n (%)	91 (91.0%)
Adequate correction of deformity, n (%)	86 (86.0%)
Radiological signs of early loosening, n (%)	3 (3.0%)
Mild malalignment, n (%)	6 (6.0%)
Radiographic instability, n (%)	5 (5.0%)
Superficial wound infection, n (%)	7 (7.0%)
Postoperative knee stiffness, n (%)	10 (10.0%)
Persistent moderate pain, n (%)	8 (8.0%)
No major complications, n (%)	75 (75.0%)

General outcome analysis showed that 71.0% of the patients obtained an excellent outcome, 19.0% obtained a good outcome, 7.0% obtained a fair outcome, and only 3.0% obtained a poor outcome. This indicates that

90.0% of patients experienced favorable (good to excellent) outcomes, reflecting the overall success of total knee arthroplasty in obese patients with advanced osteoarthritis (Figure 1).

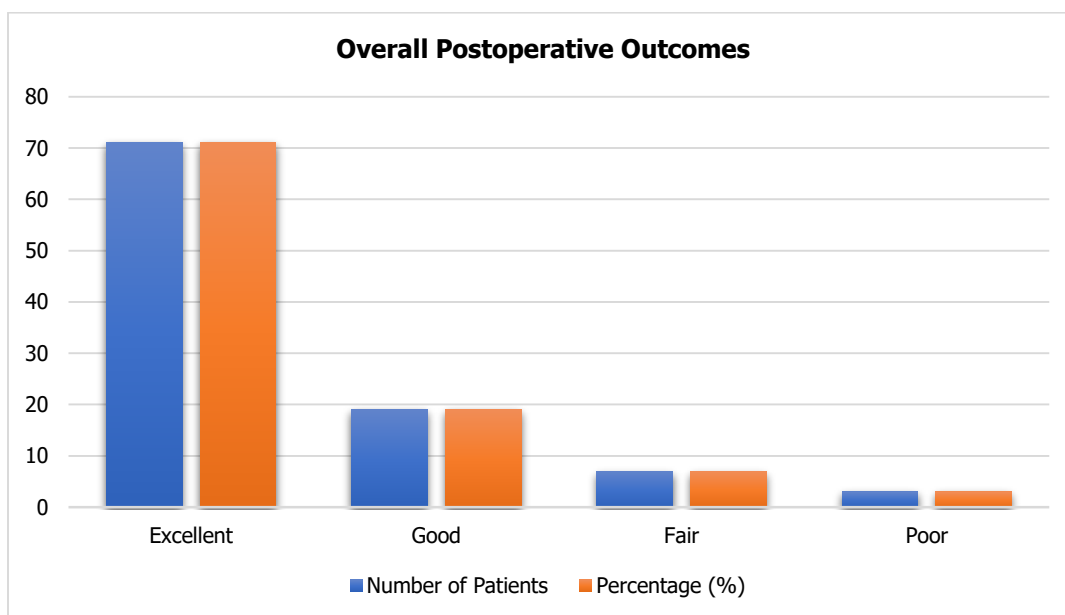


Figure 1. Overall Outcome Categories Following Total Knee Arthroplasty

Figure 1 clearly illustrates that most patients are in the excellent and good outcomes groups, which supports the effectiveness of total knee arthroplasty in enhancing both radiological and functional status in obese individuals.

On the whole, the paper has shown that total knee arthroplasty has led to significant functional benefits and satisfactory radiology in obese patients with advanced knee osteoarthritis. The majority of the patients reported significant pain reduction, improvement of mobility, increased knee stability, and satisfactory implant alignment, with 90.0% reporting good to excellent overall outcomes. Even though the percentage of patients who ended up with early postoperative complications is low, the overall results are highly encouraging as to the efficacy and clinical utility of total knee arthroplasty in this patient group.

DISCUSSION

The current research compared the results of functional and radiological outcomes of total knee arthroplasty (TKA) in obese patients with advanced knee osteoarthritis, and the results showed that the operation was related to significant postoperative pain relief, mobility, knee function, and radiological position¹. Regardless of the acknowledged technical and other perioperative difficulties related to obesity, the overall results of this cohort were positive, and a significant proportion of patients demonstrated good-to-excellent postoperative outcomes. These results indicate the usefulness of TKA as a possible treatment in obese patients

with end-stage osteoarthritis, when conservative treatment is ineffective^{2,3}.

Among the most significant results of this study was the significant functional outcomes improvement following surgery (Table 2). The current cohort of patients was severely disabled in the preoperative period, as indicated by the high baseline pain score, low functional score, limited range of motion, and significant walking and climbing stairs limitations^{3,4}. The pain significantly decreased, and the functional performance, including mobility and the stability of the knee, significantly improved following arthroplasty. These results are in line with the other previous literature that demonstrates that despite poor preoperative performance by the obese patients, they still tend to receive significant symptomatic and functional benefit of TKA. A recent prospective cohort study also found that obese patients have significant postoperative functional improvement after TKA, which supports the opinion that obesity does not preclude the possibility of successful recovery⁵⁻⁷.

The decrease in pain was especially significant in the current study. The average VAS pain score was reduced to 2.1 ± 0.9 after surgery, a significant and clinically significant reduction of the preoperative 8.1 ± 1.0 ^{8,9}. This level of analgesia is critical, particularly in patients with obesity, who tend to have severe preoperative pain, as a result of both mechanical loading and the inflammatory effects of obesity on the joint. Post-TKA pain reduction can thus be viewed as a successful surgical outcome as well as an enormous positive change in quality of life and

everyday functionality. The same tendencies have been observed in earlier systematic reviews, in which obese and even morbidly obese patients showed evident postoperative improvement in Knee Society scores and pain outcomes despite having a relatively increased perioperative risk burden¹⁰.

The other significant finding of the current study was the considerable enhancement of the range of motion and walking ability (Table 2). The increase in knee flexion from $84.7 \pm 13.5^\circ$ to $112.8 \pm 10.6^\circ$ suggests that surgery successfully restored a large proportion of lost joint mobility¹¹. Similarly, the decrease in extreme walking disability and difficulty with stair climbing is a validation that the positive effects of surgery were not limited to the alleviation of isolated pain but instead converted into the significant recovery of daily physical work. Such enhancements are clinically significant as patients with obesity are frequently admitted to surgery with a long time of inactivity, deconditioning, and fear of movement that may exacerbate disability even more. Thus, the postoperative improvements in ambulation and functional independence are greatly justified by the use of TKA in this group of patients¹².

One should also discuss the findings of this study at baseline. Most of the patients were older women with class I or class II obesity and several metabolic comorbidities (Table 1)¹³. This trend indicates the established epidemiological association between the sex of the female, obesity, increasing age, and the severity of osteoarthritis. Obesity is a cause of knee osteoarthritis because it raises biomechanical loading across the joint as well as via systemic inflammatory mechanisms involving adipokines and chronic low-grade inflammation. This dual burden is probably the reason why, in the current study, many patients were already symptomatic and radiographically diseased during surgery. Clinically, this justifies the necessity of earlier identification and formal control of osteoarthritis in obese patients prior to the disease attaining serious functional loss¹⁴.

The radiological results that were achieved in the current research were also promising (Table 3). More than 85% of patients demonstrated satisfactory implant alignment, appropriate prosthesis positioning, and adequate deformity correction¹⁵. The significance of these findings is that one of the conventional issues of the obese patients undergoing TKA is the technical impossibility to position the implant correctly

and in the correct alignment caused by the bulky soft tissue, distorted limb kinematics, and the difficulty of intraoperative exposure. Nevertheless, the current findings are that, even in the case of most obese patients, a good radiological outcome can still be obtained with good surgical technique and perioperative planning. Past studies assessing component positioning in obese patients have also indicated that reasonable postoperative positioning can be obtained, but that precision of technique is particularly crucial with this group¹⁶.

The incidence of radiological and early postoperative complications in this study was quite low and was at an acceptable level. Only 3.0% of patients showed signs of early loosening, mild malalignment in 6.0, and radiographic instability in 5.0¹⁷. The most frequent complications were knee stiffness (10.0%), persistent moderate pain (8.0%), and superficial wound infection (7.0%), and 75.0% of the patients did not have any major early postoperative complication (Table 3). The importance of these findings is that obesity has often been linked to the risk of wound complications, infection, thromboembolic events, and extended operative time. Meta-analytic and registry-based evidence have indicated that complication rates (particularly wound-related) are more likely to be elevated in patients with morbid obesity, even though functional improvements can still be significant¹⁸.

The infection of the superficial wound that was seen in the current study is worth particular attention. It is not too high, but still, it is clinically significant as obese patients are estimated to be at a high risk of wound-related complications owing to less effective soft tissue handling, lower tissue perfusion, and related maladaptation of metabolism like diabetes mellitus¹⁹. The co-occurrence of obesity with hypertension and diabetes, in the current cohort, was probably a risk factor. However, the total burden of complications was not too bad, and the positive outcomes of the surgery were evidently more than the negative events in most of the cases. This is an indication that, instead of the exclusion of obese patients during surgery due to the body mass index, a more balanced and individualized risk-benefit methodology needs to be taken²⁰.

The practical implication of this research is that obesity cannot be assumed as a contraindication to total knee arthroplasty^{11,12}. Although obesity is indeed a factor that

complicates the perioperative condition and may expose patients to increased risks of developing some complications, the current evidence shows that the majority of patients with obesity still receive significant clinical and satisfactory radiological results following surgery. This is especially relevant in real-world orthopedic practice in countries such as Pakistan, where patients often present late, have prolonged disease duration, and may have limited access to prolonged conservative rehabilitation or structured weight management programs. Not operating on such patients at all can, in fact, increase disability, immobility, cardiometabolic degradation, and quality of life^{7,13}.

This interpretation is further confirmed by the ultimate overall outcome distribution in this study. A total of 71.0% of patients achieved an excellent outcome and 19.0% achieved a good outcome (Figure 1), meaning that 90.0% of the study population experienced a favourable postoperative result^{15,16}. This large percentage of successful results is of clinical importance and indicates that the procedure is still highly effective in overweight patients, even with the extra technical and physiological load caused by obesity. The findings thus confirm the perception that patient selection, thorough surgical practice, and a well-organized postoperative rehabilitation may be of more significance as determinants of success rather than obesity¹⁰⁻¹².

The research has a number of strengths. It particularly targeted a relevant and growing orthopedic population, encompassed both functional and radiologic outcomes, and produced results that have direct implications for everyday tertiary care orthopedic practice^{5,6}. Certain shortcomings should also be noted, though. To begin with, it was a single-center observational study with a rather small sample that could limit the generalizability. Second, the follow-up period is largely an indicator of the early outcomes of the postoperative period, and as such, there was no ability to measure long-term implant survival, revision rates, and late complications. Third, the study reported a robust improvement of the postoperative results, but it lacked a non-obese control group, which would have provided a more direct measurement of the impact of obesity on the outcomes. Further multicenter research with a bigger sample size, duration of follow-up, and stratified according to the level of obesity would be more solid evidence in this field^{8,15}.

In general, the results of this research suggest that total knee arthroplasty offers significant functional recovery and good radiological correction of obese individuals with severe knee osteoarthritis, and has an acceptable early complication profile. These results add to the emerging literature indicating that, despite the fact that obesity may indeed raise the complexity of the operation, as well as the risk of complications, it does not eliminate the fact that TKA can potentially offer significant benefits in the right patients¹⁸⁻²⁰.

CONCLUSION

Total knee arthroplasty produced significant functional improvement and satisfactory radiological outcomes in obese patients with advanced knee osteoarthritis. Significant pain relief and an increase in joint mobility, better knee functioning, and acceptable implant positioning were reported in most patients, and a big proportion of the patients reported good to excellent overall outcomes. Despite the few cases of early postoperative complications encountered, the overall positive outcomes of surgery were still significant. These results indicate that obesity is not a contraindication to total knee arthroplasty and that the surgery is an effective medical intervention in patients who are selected adequately.

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Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this article.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' Contributions

MNS conceived and supervised the study. MH, AS, JIK, and HK contributed to data collection and manuscript drafting. HS, MSUH, MA, AS, AA, OJK, and MIK assisted in data entry, literature review, and manuscript revision. All authors read and approved the final manuscript.

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