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الجمعية السعودية لجراحة العظام
Saudi Orthopedic Association

Journal of Musculoskeletal Surgery and Research

Original Article

Post-operative clinical outcomes and complications of posterior versus lateral approach for primary total hip arthroplasty: A retrospective cohort study

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Received: 07 October 2021
Accepted: 09 January 2022
EPub Ahead of Print: 04 February 2022
Published: 14 February 2022

DOI
10.25259/JMSR_128_2021

Quick Response Code:

ABSTRACT

Objectives: Total hip arthroplasty (THA) is considered one of the therapeutic procedures frequently performed in orthopedic surgery. It is believed that the surgical approach could influence the clinical outcomes following THA. We performed a retrospective cohort study to compare the postoperative clinical outcomes and complications between the posterior approach (PA) and the lateral approach (LA) for primary THA.

Methods: We enrolled patients who underwent primary THA through PA or LA. We sought to evaluate the postoperative complications including the need for intra- or postoperative blood transfusion, dislocation rate, and venous thromboembolism events, and the clinical outcomes, including length of hospital stay, operative time, and perioperative blood loss.

Results: A total of 211 patients (71 patients in PA vs. 140 patients in LA) were deemed eligible to be included in this study. There was no significant difference between PA and LA in post-operative clinical outcomes concerning operative time, and perioperative blood loss except for the length of hospital stay (PA median = 6.0 days vs. LA median = 9.0 days; $P < 0.001$) patients. After adjustment for the potential confounders, the length of hospital stay was found to be similar between the two groups ($P = 0.06$). Similarly, no difference was found between PA and LA in post-operative complications concerning the need for intra-operative blood transfusion, dislocation rate, and venous thromboembolism events except for the need for postoperative blood transfusion (RR = 1.82, 95% CI 1.16–2.87), which continued to be significantly higher in PA even after adjustment for the potential confounders ($P \leq 0.01$).

Conclusion: PA and LA herald similar outcomes for patients undergoing primary THA concerning the postoperative clinical outcomes and complications except for the need for post-operative blood transfusion.

Keywords: Hip osteoarthritis, Lateral approach, Posterior approach, Surgical approach, Total hip arthroplasty

INTRODUCTION

Total hip arthroplasty (THA) is considered one of the most practical and therapeutic procedures that are frequently performed in orthopedic surgery.[1,2] The inception of the THA procedure was in the 1960s and since then it has revolutionized to become one of the most curative

How to cite this article: Halawani AK, Ghaddaf AA, Alomari MS, Alaryani KH, Alibrahim AO, Alshehri MS. Post-operative clinical outcomes and complications of posterior versus lateral approach for primary total hip arthroplasty: A retrospective cohort study. J Musculoskelet Surg Res 2022;6:62-9.

procedures in treating patients with hip joint disorders, such as osteoarthritis.[2,3]

Despite the success rate and the satisfactory clinical outcomes it reflects on patients, THA is associated with several postoperative complications. The variability in the rate of these postoperative complications has been attributed to the use of different surgical approaches for THA procedures.[3] The most commonly used surgical approaches for THA are the posterior approach (PA), originally described by Moore, and the lateral approach (LA), originally described by Hardinge.[3] Nowadays, some modifications on the two surgical approaches are widely adopted, such as Gibson modification for PA, Mulliken's, Frndak's, and Watson Jones modifications for LA. PA is performed by orthopedic surgeons slightly more frequently than LA worldwide (45% and 42%, respectively).[4]

Studies comparing the two surgical approaches have shown conflicting results, leaving uncertainty about the choice of surgical approach for THA.[3,5-10] A recent systematic review concluded that PA was superior to LA in terms of dislocation rate, Trendelenburg gait, heterotopic ossification, and stem malposition following primary THA.[11] On the other hand, a more recent systematic review concluded that LA is more optimal concerning pain, functional outcomes, and complication rate following primary THA.[12]

To the best of our knowledge, evidence that could help determine the surgical approach that confers greater benefits and minimum risks for the Saudi population is lacking. Therefore, we performed this retrospective cohort study to compare the postoperative clinical outcomes and complications of the two most commonly used surgical approaches for THA.

MATERIALS AND METHODS

Study design and participants

This retrospective cohort study was performed at King Abdulaziz Medical City (KAMC), Jeddah, Saudi Arabia. The ethical approval was given by King Abdullah International Medical Research Center, Jeddah, Saudi Arabia. The study included patients who underwent primary THA through PA or LA at KAMC between January 2009 and December 2020. PA was performed according to the description of Moore and LA was performed according to the description of Hardinge.[13,14] The surgical approach used for each patient was based on the surgeon's preference. We excluded patients who underwent revision THA, bipolar hemiarthroplasty, or hip resurfacing from this study.

Outcome measures

Data collection sheet "Google sheet" was used to collect patients' data from their physical and electronic medical records using BestCare 2.0. The demographics and baseline characteristics were collected and compared between the two groups including patients' comorbidities, operative details, gender, age, body mass index (BMI), type of surgery (i.e., unilateral or bilateral), length of hospital stay, cause of surgery (i.e., finial diagnosis), and smoking status.

The desired outcomes of this study were the following: Post-operative international normalized ratio (INR), postoperative hemoglobin levels, post-operative serum creatinine levels, need for blood transfusion postoperatively, dislocation rate, peripheral nerve injury, deep venous thrombosis (DVT) in ≤30 days, pulmonary embolism (PE) in ≤30 days, surgical site infection, peri-prosthetic fracture, revision surgery, and follow-up period.

Data analysis

IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, N.Y., USA) was used for data analysis. We adopted 95% as a significance level and $P < 0.05$ as a threshold. Shapiro–Wilk test was used to test the normality of the continuous outcomes. The demographics and baseline characteristics were compared using an independent *t*-test for continuous variables and Chi-square for categorical variables. Categorical data were represented as frequencies and percentages while continuous data were represented as means (±SD). The desired outcomes of this study were compared using an independent *t*-test for the continuous outcomes and relative risk (RR) for the categorical outcomes. Median and interquartile range (IQR) were used to report the continuous outcomes that are not normally distributed on the Shapiro–Wilk test. We adjusted for the potential confounders of the desired outcomes using multiple linear regression for continuous outcomes and binary logistic regression for the categorical outcomes.

RESULTS

Demographics and baseline characteristics

A total of 211 patients who underwent THA from 2009 to 2020 were deemed eligible to be included in this study. Of them, 71 (33.65%) and 140 (66.35%) patients underwent THA through PA and LA, respectively. The number of male patients who underwent THA was 40 (56.34%) in PA and 79 (56.43%) in LA. The median age of the patients was 37 years (IQR 28–50) in PA and 44.50 years (IQR 30–60) in LA. The most common indications for surgery were degenerative osteoarthritis (35.21% in PA and 42.86% in LA) and avascular necrosis (AVN) of the hip joint (39.44% in PA and 29.29% in LA). The most used femoral head sizes in PA were 32 mm, 36 mm, and 28 mm (47.06%, 33.82%, and 17.65%, respectively) whereas the most used femoral head sizes in LA were 28 mm, 36 mm, and 32 mm (55.07%,

21.01%, and 16.67%, respectively). The patients included in this study mostly suffered from sickle cell anemia (22.54% in PA and 23.02% in LA), diabetes mellitus (9.86% in PA and 23.74% in LA), and hypertension (9.86% in PA and 28.99% in LA) [Table 1].

Post-operative clinical outcomes

PA showed a significantly shorter length of hospital stay compared to LA following THA (median=6.0, IQR: 6.0–8.0 days vs. median = 9.0, IQR 7.0–14.0 days; $P < 0.001$). No significant

Table 1: Baseline characteristics.

Parameters	Patients		*P*-value
	Posterior approach (*n*=71)	Lateral approach (*n*=140)	
Gender, *n* (%)			0.99
Male	40 (56.34%)	79 (56.34%)	
Age, median (IQR)	37.00 (28.00–50.00)	44.50 (30.00–60.00)	0.02
Body mass index, median (IQR)	29.22 (23.41–33.30)	28.09 (23.43–32.87)	0.72
Follow-up length in months, median (IQR)	12.00 (4.00–24.00)	32.0 (11.00–57.50)	<0.001
Type of surgery, *n* (%)			0.70
Unilateral	52 (73.24%)	99 (70.71%)	
Staged bilateral	19 (26.76%)	41 (29.29%)	
Affected side, *n* (%)			0.85
Right	36 (50.70%)	69 (49.29%)	
Current smoker, *n* (%)	18 (25.71%)	21 (15.56%)	0.08
Indication for surgery, *n* (%)			0.34
Degenerative osteoarthritis	25 (35.21%)	60 (42.86%)	
Avascular necrosis of the hip joint	28 (39.44%)	41 (29.29%)	
Developmental dysplasia of the hip	3 (4.23%)	10 (7.14%)	
Femoral neck fracture	6 (8.45%)	5 (3.57%)	
Inflammatory arthritis (Rheumatoid arthritis)	1 (1.41%)	4 (2.86%)	
Others	8 (11.27%)	20 (14.29%)	
ASA class, *n* (%)			0.19
1	15 (22.06%)	20 (14.39%)	
2	43 (63.24%)	83 (59.71%)	
3	10 (14.71%)	35 (25.18%)	
4	0 (0.00%)	1 (0.72%)	
Method of fixation, *n* (%)			0.41
Cementless THA	60 (95.24%)	123 (90.44%)	
Cemented THA	2 (3.17%)	5 (3.68%)	
Hybrid THA**	0 (0.00%)	6 (4.41%)	
Reverse hybrid THA***	1 (1.59%)	2 (1.47%)	
Type of anesthesia, *n* (%)			0.02
General anesthesia	47 (66.20%)	86 (61.43%)	
Spinal anesthesia	0 (0.00%)	20 (14.29%)	
Epidural anesthesia	2 (2.82%)	2 (1.43%)	
Combined general+epidural anesthesia	16 (22.54%)	21 (15.00%)	
Combined general+spinal anesthesia	4 (5.63%)	5 (3.57%)	
Combined spinal+epidural anesthesia	2 (2.82%)	6 (4.29%)	
Implant brand, *n* (%)			<0.001
Johnson & Johnson	58 (82.86%)	68 (49.28%)	
Smith and Nephew	8 (11.43%)	29 (21.01%)	
Biomet	1 (1.43%)	37 (26.81%)	
Others	3 (4.29%)	4 (2.90%)	
Bearing surface, *n* (%)			0.02
Metal-on-polyethylene	45 (71.43%)	110 (83.97%)	
Ceramic-on-polyethylene	18 (28.57%)	18 (13.7%)	
Metal-on-metal	0 (0.00%)	3 (2.29%)	

(Contd...)

Table 1: *(Continued)*

Parameters	Patients		*P*-value
	Posterior approach (*n*=71)	Lateral approach (*n*=140)	
Size of femoral head, *n* (%)			<0.001
20 mm	0 (0.00%)	1 (0.72%)	
22 mm	1 (1.47%)	9 (6.52%)	
28 mm	12 (17.65%)	76 (55.07%)	
32 mm	32 (47.06%)	23 (16.67%)	
36 mm	23 (33.82%)	29 (21.01%)	
Pre-operative creatinine, median (IQR)	64.00 (55.00–76.00)	67.00 (59.00–75.50)	0.35
Pre-operative Hemoglobin, mean (±SD)	12.79 (±2.35)	12.83 (±2.25)	0.89
Pre-operative INR, median (IQR)	1.00 (1.00–1.10)	1.00 (1.00–1.10)	0.62
Comorbidities, *n* (%)			
Sickle cell anemia	16 (22.54%)	32 (23.02%)	0.94
Diabetes mellitus	7 (9.86%)	33 (23.74%)	0.02
Hypertension	7 (9.86%)	40 (28.99%)	<0.001
COPD or asthma	1 (1.41%)	3 (2.19%)	0.70
Chronic renal failure	5 (7.14%)	4 (2.94%)	0.16
Hypothyroidism	5 (7.04%)	8 (5.84%)	0.73
Active infection	1 (1.41%)	4 (2.99%)	0.49
Cardiovascular comorbidities			1.00
Ischemic heart disease	1 (50.00%)	5 (35.71%)	
Dyslipidemia	1 (50.00%)	7 (50.00%)	
Others	0 (0.00%)	2 (14.29)	

*Fisher exact test, **Cementless acetabular component+cemented femoral component, ***Cemented acetabular component+cementless femoral component. SD: Standard deviation. IQR: Interquartile range, THA: Total hip arthroplasty, COPD: Chronic obstructive pulmonary disease, INR: International normalized ratio

difference was found between PA and LA in terms of operative time (median = 166.0, IQR 139.0–197.0 min vs. median = 162.0, IQR 131.0–218.0 min; P = 0.73) and perioperative blood loss (median=450, IQR 300–725 cc vs. median = 500, IQR 400–800 cc; P = 0.36). Likewise, no significant difference was found between PA and LA with respect to the post-operative laboratory findings creatinine (P = 0.53), hemoglobin (P = 0.20), and INR (P = 0.93) [Table 2].

Post-operative complications

No significant difference was found between PA and LA in terms of the need for intra-operative blood transfusion (RR = 1.39, 95% CI 0.86–2.23). However, the need for postoperative blood transfusion was significantly higher in PA compared to LA (RR = 1.82, 95% CI 1.16–2.87). The incidence of complications was 7.04% in PA and 12.95% in LA. The most common complications in our study were periprosthetic fracture (4.74%), revision THA (4.27%), and surgical site infection (2.37%). The causes of hip revision were aseptic loosening (55.56%), dislocation (22.22%), and limb length discrepancy (22.22%). The findings of our study revealed no significant difference between the PA and LA in terms of complication occurrence (RR=0.54, 95% CI 0.21 to 1.40). The incidence of venous thromboembolism was 1.42% (0% DVT and 1.42% PE). No significant difference was found between the two groups in the risk of developing DVT or PE in our study. Similarly, the risk of developing surgical site infection, periprosthetic fracture, peripheral nerve injury, dislocation, or revision THA was similar between the two groups [Table 3].

Regression analysis

We found that age, type of anesthesia, implant brand, bearing surface, femoral head size, diabetes mellitus, and hypertension were not normally distributed among the two groups, which are considered potential confounders for the desired outcomes. Therefore, we further adjusted for these potential confounders. The multiple linear regression analysis showed that the length of hospital stay is similar between PA and LA after adjustment for the potential confounders (P = 0.06). Similarly, no significant difference was found between the two groups in terms of operative time (P = 0.45), perioperative blood loss (P = 0.79), post-operative creatinine (P = 0.63), hemoglobin (P = 0.64), and INR (P = 0.95) [Table 4].

The multiple logistic regression analysis showed no significant difference between PA and LA in terms of the need for intra-operative blood transfusion (P = 0.06), complications (P = 0.68), periprosthetic fracture (P = 0.44),

and revision THA (P = 0.48) after adjustment. However, the need for postoperative blood transfusion continued to be significantly higher in PA after the adjustment for the potential confounders (P < 0.01) [Table 5].

DISCUSSION

We believe that this is the first study addressing the surgical approach's influence on the postoperative clinical outcomes following THA in Saudi Arabia. Our study showed no difference between PA and LA in the postoperative clinical outcomes except for the length of hospital stay, which was significantly shorter in PA. After adjusting for the potential confounders, the length of hospital stay did not show a significant difference between the two groups. Furthermore, both groups were similar in terms of postoperative complications except the need for postoperative blood transfusion, which was significantly higher in PA even after adjustment for the potential confounders.

The length of hospital stay was found to be similar between PA and LA by Buglak *et al.* (4.2 days vs. 4.56 days), Aggarwal *et al.* (3.2 days vs. 2.3 days), Ritter *et al.* (5.19 days vs. 5.25 days), and Hart *et al.* (2.7 days vs. 3.1 days), which is inconsistent to the original findings of our study.[15-18] The longer duration of hospital stay in LA reported in our study could be attributed to the higher median age and higher comorbidity rate for patients who received THA through LA.

Table 2: Post-operative clinical outcomes.

Parameters	Patients		*P*-value
	Posterior approach (*n*=71)	Lateral approach (*n*=140)	
Length of hospital stay (days), median (IQR)	6.00 (6.00–8.00)	9.00 (7.00–14.00)	<0.001
Operative time (minutes), median (IQR)	166.00 (139.00–197.00)	162.00 (131.00–218.00)	0.73
Peri-operative blood loss (cc), median (IQR)	450.00 (300.00–725.00)	500.00 (400.00–800.00)	0.36
Post-operative creatinine (mmol/L), median (IQR)	59.00 (48.00–71.00)	61.50 (52.00–72.25)	0.53
Post-operative hemoglobin (g/dL), mean (±SD)	11.00 (±1.70)	10.68 (±1.65)	0.20
Post-operative INR, median (IQR)	1.10 (1.00–1.20)	1.10 (1.00–1.20)	0.93

SD: Standard deviation, IQR: Interquartile range, INR: International normalized ratio

Table 3: Post-operative complications.

Parameters	Patients		Risk ratio (95% CI)
	Posterior approach (*n*=71) (%)	Lateral approach (*n*=140) (%)	
Need for intra-operative blood transfusion	21 (31.34)	30 (22.56)	1.39 (0.86–2.23)
Need for post-operative blood transfusion	25 (38.46)	27 (21.09)	1.82 (1.16–2.87)
Any complication	5 (7.04)	18 (12.95)	0.54 (0.21–1.40)
Deep venous thrombosis≤30 days	0 (0.00)	0 (0.00)	Not estimatable
Pulmonary embolism≤30 days	0 (0.00)	3 (2.40)	0.28 (0.01–5.34)
Surgical site infection	0 (0.00)	5 (3.97)	0.18 (0.01–3.18)
Periprosthetic fracture	3 (4.23)	7 (5.83)	0.72 (0.19–2.71)
Peripheral nerve injury	1 (1.41)	2 (1.67)	0.85 (0.08–9.15)
Dislocation	0 (0.00)	4 (3.25)	0.22 (0.01–3.99)
Revision THA	1 (1.85)	8 (6.78)	0.27 (0.04–2.13)

THA: Total hip arthroplasty, CI: Conflicts interest

Table 4: Adjusted post-operative clinical outcomes.

Parameters	Coefficient (B)	95% CI for B	*P*-value
Length of hospital stay	2.04	(−0.13–4.20)	0.06
Operative time	−7.56	(−27.08–11.95)	0.45
Perioperative blood loss	−20.51	(−174.61–133.59)	0.79
Post-operative creatinine	−12.13	(−61.74–37.48)	0.63
Post-operative hemoglobin	−0.13	(−0.71–0.44)	0.64
Post-operative INR	0.004	(−015–0.16)	0.95

Adjustment was made for age, type of anesthesia, implant brand, bearing surface, femoral head size, diabetes mellitus, and hypertension. Adjustment was made using binary linear regression. INR: International normalized ratio, CI: Conflicts interest

Table 5: Adjusted post-operative complications.

Parameters	Adjusted odds ratio (95% CI)	*P*-value
Need for intra-operative blood transfusion	2.56 (0.93–7.04)	0.06
Need to post-operative blood transfusion	4.30 (1.58–11.72)	<0.01
Any complication	0.75 (0.19–2.99)	0.68
Deep venous thrombosis≤30 days	Not estimatable	Not estimatable
Pulmonary embolism≤30 days	Not estimatable	Not estimatable
Surgical site infection	Not estimatable	Not estimatable
Periprosthetic fracture	0.50 (0.09–2.89)	0.44
Peripheral nerve injury	Not estimatable	Not estimatable
Revision THA	2.77 (0.17–46.01)	0.48

Adjustment was made for age, type of anesthesia, implant brand, bearing surface, femoral head size, diabetes mellitus, and hypertension. Adjustment was made using multiple logistic regression, THA: Total hip arthroplasty, CI: Conflicts interest

In addition, the other non-balanced factors such as type of anesthesia, implant brand, bearing surface, and femoral head size might have influenced the length of hospital stay as well. However, after adjusting for these confounding factors, the length of hospital stay was found to be similar between the two groups.

The findings of our study revealed no difference between PA and LA in median operative time. This is consistent with some of the published studies showing similar operative times between the two groups.[19,20] Conversely, some studies in the literature showed a significantly lower operative time in favor of PA.[18,21-23] Pooling these studies in a meta-analysis revealed no difference between LA and PA in mean operative time with a high heterogeneity rate. After removing the source of heterogeneity, PA was found to confer a significantly lower mean operative time.[24] The variation in mean operative time among the different studies have been related to the perceived influence of surgeon experience, including patient BMI, and the presence of trainees.[25,26]

No difference between PA and LA was perceived in our study concerning the amount of perioperative bleeding. Many of the previous studies reported similar perioperative bleeding volume between the two surgical approaches.[22-23,27,28] However, Weale *et al.* showed a significantly lower mean peri-operative blood loss in PA compared to LA (599 cc vs. 768 cc).[19] The overall perioperative bleeding volume following THA was found to be similar in both surgical approaches in a systematic review and meta-analysis.[24] In our study, the patients who underwent THA through PA needed a significantly higher postoperative blood transfusion. Initially, we thought that this difference could be attributed to confounding factors or linked to specific patients' parameters. However, we did not find the need for postoperative blood transfusion to be influenced by the potential confounders nor was it linked to any of the patients' parameters. Most of the studies in the literature found post-operative blood transfusion to be similar among PA and LA.[21,23,27,29] However, Hart *et al.* found that the proportion of patients requiring post-operative allogenic transfusion is significantly higher in LA than PA (11.55% vs. PA; 6.8%).[18]

Our study revealed a relatively low complication rate following THA through PA than LA (7.0% vs. 12.9%). Peri-prosthetic fracture, revision THA, and surgical site infection were the most common complications reported in our study. The most causes of hip revision in our study were aseptic loosening, dislocation, and limb length discrepancy. Hart *et al.* in a retrospective cohort study assessed the incidence of major and minor complications within the 30 days following THA through PA and LA. The study showed no significant difference between PA and LA in the incidence of any major complication (3.4% vs. 5.3%) or the incidence of any minor complication (8.3% PA vs. 13.5%). The most commonly reported major complications in their study were hospital readmission, hip revision, and deep infection (2.4%, 1.4%, and 0.4%, respectively) while the most commonly reported minor complications were allogeneic blood transfusion (and urinary tract infection (7.6% and 1.3%, respectively).[18] However, other studies showed that PA is associated with a higher hip revision rate compared to LA.[30,31] Dislocation and aseptic loosening have been perceived as the most common causes of revision following THA. The rate of hip revision ranges from 18.8% to 37% due to dislocation and from 9.6% to 49% due to aseptic loosening.[18,20,21,30,31] Furthermore, the incidence of venous thromboembolism following THA in Saudi Arabia was 1.3%, which is comparable to what has been reported by our study (1.42%).[31] None of the previous studies revealed a significant difference between PA and LA in terms of DVT, PE, or peripheral nerve injuries.[11,18,19,32,33]

The strengths of our study include providing an insight into the influence of the surgical approach on the postoperative clinical outcomes and complications in the Saudi population. Up to our knowledge, none of the previous studies about THA in Saudi Arabia discussed this issue. We believe that the sample size of our study is representative of the general Saudi population undergoing THA due to the relatively small number of THA cases in SA.[34,35] Moreover, our study

provided an insight into the prevalence of sickle cell anemia patients undergoing THA due to AVN of the hip joint.

We acknowledge that our study has several limitations. First, the data provided by our study was not normally distributed among the two groups and the analysis may not delineate the true effect of the surgical approach on the clinical outcomes and complications following THA. Second, our study could not determine the influence of the surgical approach on the patient-reported outcomes, such as patient satisfaction and health-related quality of life, limb length discrepancy, or the functional outcomes, such as abductor muscle strength, limping, or hip scores following THA. Finally, the number of patients in the LA group is nearly double those in the PA group which could be a potential confounder that our study did not adjust for.

CONCLUSION

Our study reveals no significant difference between PA and LA for individuals undergoing THA concerning the postoperative clinical outcomes and complications except for the length of hospital stay and the need for postoperative blood transfusion. After adjustment for the potential confounders, the length of hospital stay was found to be similar between the two groups whereas the need for postoperative blood transfusion continued to show a statistical significance.

RECOMMENDATIONS

Further studies are warranted to delineate the influence of the surgical approach on the Saudi population's functional and patient-reported outcomes.

AUTHORS' CONTRIBUTIONS

AKH contributed to the research idea, design of the study, data collection, statistical analysis and interpretation, and writing the final manuscript, AAG and MSAO contributed to the design of the study, data collection, statistical analysis and interpretation, and editing of the final manuscript, KHA and AOA contributed to the data collection, statistical analysis and interpretation, and editing of the final manuscript. MSAS contributed to the statistical analysis and interpretation and editing of the final manuscript. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

ETHICAL APPROVAL

The authors confirm that this study had been prepared following COPE roles and regulations. The ethical approval for the study was received from King Abdullah International Medical Research Center, Jeddah, Saudi Arabia on December 11, 2019 (reference SP19/538/J).

Declaration of patients consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest

There are no conflicts of interest.

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