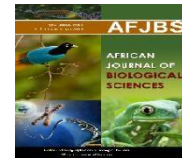


<https://doi.org/10.33472/AFJBS.6.4.2024.526-538>



African Journal of Biological Sciences



Research Paper

Open Access

Direct Anterior Approach Versus Lateral Approach in Total Hip Arthroplasty

Mohamed R.A. Saleh¹, Mahmoud A. Gohar²

1. Assistant Professor of Orthopedic Surgery, Faculty of Medicine, Helwan University, Egypt.
2. MB BSc., M.Sc., Orthopedic Surgery, Faculty of Medicine, Helwan University, Egypt.

E mail: Mahmoud_gohar_post@med.helwan.edu.eg

Corresponding author: Mahmood Ahmed Reda Gohar *³

Abstract

Background: Total hip arthroplasty (THA), an extensive clinical application for patients with painful hip disorders such as osteoarthritis (OA), osteonecrosis of the femoral head (ONFH) and femoral neck fracture, contributes to the excellent results in pain relief and function improvement of the hip joint. **Objectives:** Our results aimed to compare the outcomes of the direct anterior approach (DAA) with the lateral approach (LA) for total hip arthroplasty (THA) patients, to evaluate functional and clinical outcomes of direct anterior approach (DAA) to total hip arthroplasty. **Patients and methods:** This prospective cohort study involved 40 patients suffering from Hip osteoarthritis or dysplastic hip. All of them were managed by Total Hip Arthroplasty (THA) through either Direct Anterior Approach (20 patients) or Lateral Approach (20 patients) by convenience methods. They were done from the period from February 2020 to March 2021 at Helwan University Hospitals. **Results:** The current study showed that the distance ambulated in feet within the two groups increased significantly from preoperative to day 2 ($p < 0.001$). There were differences in distance ambulated in feet comparing the DAA group to the lateral group in day 1 ($p = 0.002$) and day 2 ($p = 0.001$). Rate of blood transfusion was found to be significantly higher in lateral approach group when compared to DAA group ($p = 0.049$). Regarding complications, lateral approach group showed significant increase in developing wound infection ($p = 0.048$). No significant differences were found when comparing groups regarding deep infection, instability, loosening, Femoral complications and Acetabular malposition ($p > 0.05$). **Conclusion:** Our study preliminary shows that although DAA may provide shorter hospitalization and faster recovery during the early postoperative period, the available evidence is still insufficient to conclude whether the DAA or lateral approach is superior for total hip arthroplasty.

Keywords: Direct Anterior, Lateral Approach, Total Hip Arthroplasty.

Article History

Volume 6, Issue 4, Feb 2024

Received: 17 Feb 2024

Accepted : 01 Mar 2024

doi:10.33472/AFJBS.6.4.2024.526-538

Introduction

Total hip arthroplasty (THA) is used widely around the world and considered one of the most successful orthopedic surgical procedures for restoring hip function, relieving pain, and improving quality of life in patients with debilitating arthritis of the hip. Some even going as far as calling it the surgery of the century. ^(1,2)

Enhancement in total hip arthroplasty procedures have led to shorter hospitalization, faster functional recovery, and higher patient satisfaction. ⁽³⁾

Except for perioperative managements, different surgical approaches can also affect clinical outcomes following THA. Total hip arthroplasty is often carried out by lateral approach and its modifications, which is the preferred procedure by approximately 42% of orthopedic surgeons worldwide. However, the requirement of muscle splitting in lateral approach may led to postoperative greater pain, longer hospitalization and rehabilitation. ^(4,5)

Direct anterior approach (DAA) to total hip arthroplasty, as an alternative procedure, has been developed in recent years. This shorter length of incision procedure involves muscle-sparing as well as less soft tissue and muscle dissection, qualifying it as a minimally invasive procedure. However, DAA is still evolving and its real clinical outcomes are controversial, especially when the approach is performed in learning curve. ^(6,7,8) our results aimed to compare the outcomes of the direct anterior approach (DAA) with the lateral approach (LA) for total hip arthroplasty (THA) patients. Evaluate functional and clinical outcomes of direct anterior approach (DAA) to total hip arthroplasty. Outline the indications and advantages of Direct Anterior Approach for Total Hip Arthroplasty.

Patients and Methods

This prospective cohort study involved 40 patients suffering from Hip osteoarthritis or dysplastic hip. All of them were managed by Total Hip Arthroplasty (THA) through either Direct Anterior Approach (20 patients) or Lateral Approach (20 patients) by convenience methods. They were done from the period from February 2020 to March 2021 at Helwan University Hospitals.

Inclusion criteria: Patients suffering from osteoarthritis hip or femoral head necrosis prepared for Total Hip Arthroplasty. Age: Adults from 36 to 70 years. Sex: Male or Female. Body Mass Index (BMI) less than 40. (Patients with BMI above 40 are very difficult to be operated with Direct Anterior Approach).

Exclusion criteria: Patients who are not fit for surgery, e.g. (uncontrolled D.M, uncontrolled epileptic patients). Previous hip surgery or retained instrumentations. Autoimmune diseases with multiple joint affection, e.g (Rheumatoid Arthritis). Local: hip infection or sepsis Remote: extra-articular active ongoing infection or bacteremia. Dysplastic hip e.g. (neglected DDH). Patients who met above criteria were randomized into 2 groups by closed envelope. **Group A:** 20 patients with arthritic hip treated by THA via lateral approach (LA). **Group B:** 20 patients with arthritic hip treated by THA via direct anterior approach (DAA). All patients in this study were subjected to the same investigations to confirm diagnosis and followed up prospectively for minimum 3 months post-operative.

Results

A total of 40 patients who underwent primary, elective THA were included in our study. There were 26 (65%) male and 14 (35%) females included. Demographic characteristics of the study population in both the groups were given in Table 1. Both the groups were comparable in terms of age, and gender. The male to female ratio in DAA group was 3:1 and in lateral approach group it

was 2.33:1 (p-value=0.507). The mean age in DAA group was 48.40 ± 13.64 years with range being 36 to 70 years and in lateral approach group mean age was 52.05 ± 12.40 years with range being 38 to 70 years.

Table (1): Demographic characteristics of the study group.

		DAA group (n=20)		Lateral approach group (n=20)		p- value
		n	%	n	%	
Age (years)	mean± SD	48.40± 13.64		52.05± 12.40		0.369 [‡]
	median	51.0		56.0		
	Range	36.0- 70.0		38.0- 70.0		
Gender	Male	15	75.0%	14	70.0%	0.507
	Female	5	25.0%	6	30.0%	

[‡] Mann- Whitney U test, [‡] Chi-square test

Table 2 presents preoperative diagnosis. Most of the patients in DAA group 15 (75%) and lateral approach group 14 (70%) were diagnosed as osteoarthritis with no statistically significant difference between both groups (p= 0.723).

Table (2): Comparison between groups regarding diagnosis.

		DAA group (n=20)		Lateral approach group (n=20)		p- value
		n	%	n	%	
Diagnosis	Femoral head osteonecrosis	5	25.0%	6	30.0%	0.723
	Osteoarthritis	15	75.0%	14	70.0%	

[‡] Mann- Whitney U test, [‡] Chi-square test

Table 3, There was no statistically significant difference between both groups as regard surgery time (p= 0.157). Lateral approach group showed significant increase in hospital stay compared to DAA group (p=0.001).

Table (3): Operative data characteristics in the two studied groups.

		DAA group (n=20)	Lateral approach group (n=20)	p- value
Surgery time (min.)	mean± SD	71.25± 9.44	66.50± 8.75	0.157
	median	70.0	67.5	
	Range	60.0- 90.0	50.0- 80.0	
Length of hospital stay (days)	mean± SD	2.15± 0.37	2.95± 0.76	0.001**
	median	2.0	2.0	
	Range	2.0- 3.0	2.0- 5.0	

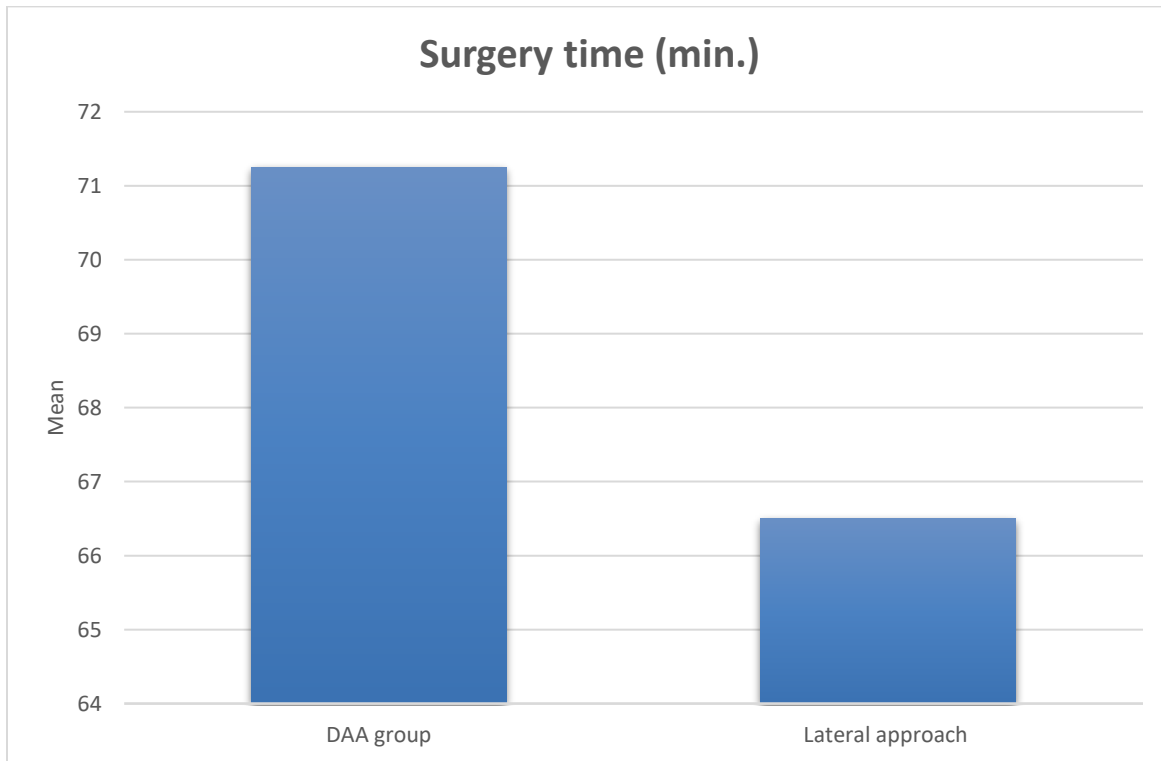


Figure 1: Comparison between groups as regard to Surgery time

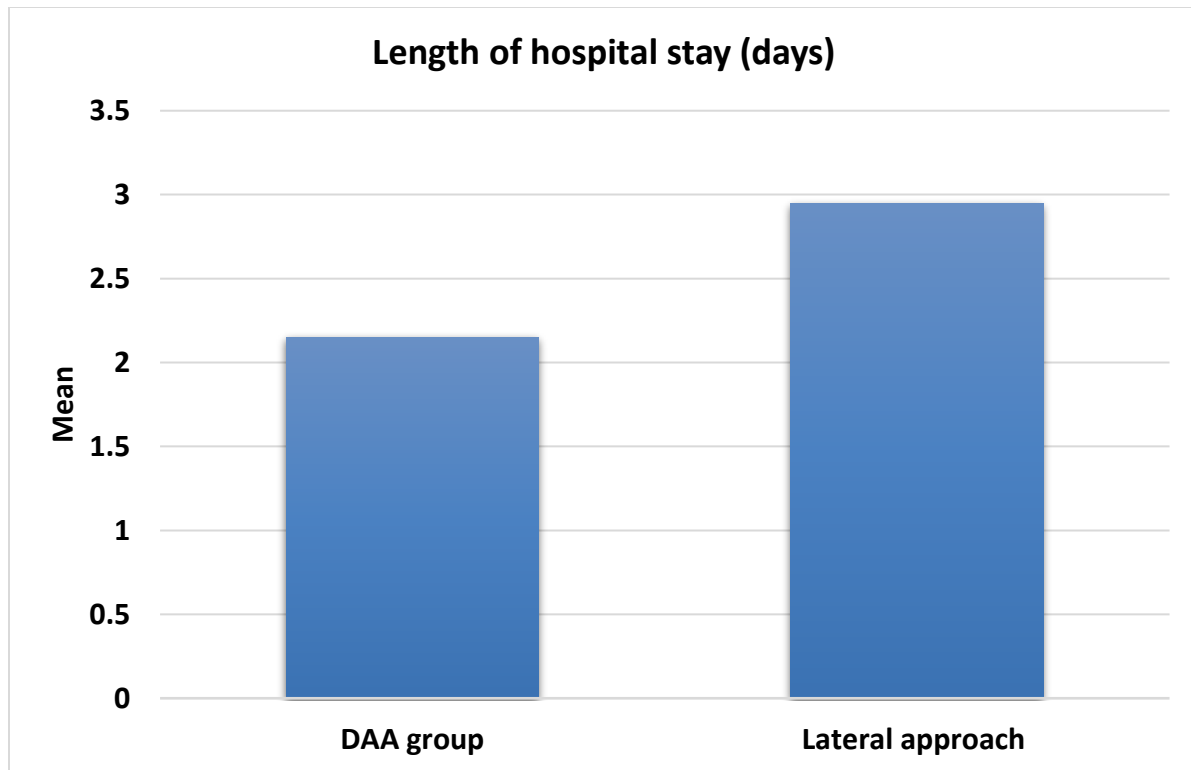


Figure 2: Comparison between groups as regard to Length of hospital stay.

Table (4): Analysis of pre-versus postoperative modified HHS in the two studied groups

		Preoperative	1month post.	3months post.	9months post.	p- value †
DAA group (n=20)	mean± SD	23.75± 2.05	50.40± 4.12	65.85± 6.91	88.65± 5.35	<0.001**
	median	23.0	50.0	65.0	89.5	
	Range	21.0- 28.0	40.0- 56.0	50.0- 80.0	78.0- 96.0	
Lateral approach group (n=20)	mean± SD	22.30± 0.98	39.55± 3.39	56.80± 6.65	81.40± 6.01	<0.001**
	median	23.0	40.0	55.0	80.0	
	Range	21.0- 23.0	35.0- 45.0	45.0- 70.0	67.0- 90.0	
p- value‡		0.015*	<0.001**	<0.001**	0.001**	

‡ Mann- Whitney U test, † Chi-square test, ‡: Friedman test

Regarding modified HHS, it showed statistically significant improvement postoperatively either in both DAA and lateral approach group ($p < 0.001$). A significant difference was found among the two groups regarding the respective change in the modified HHS value preoperative ($p = 0.015$), 1month ($p < 0.001$), 3months ($p < 0.001$) and 9 months ($p = 0.001$).

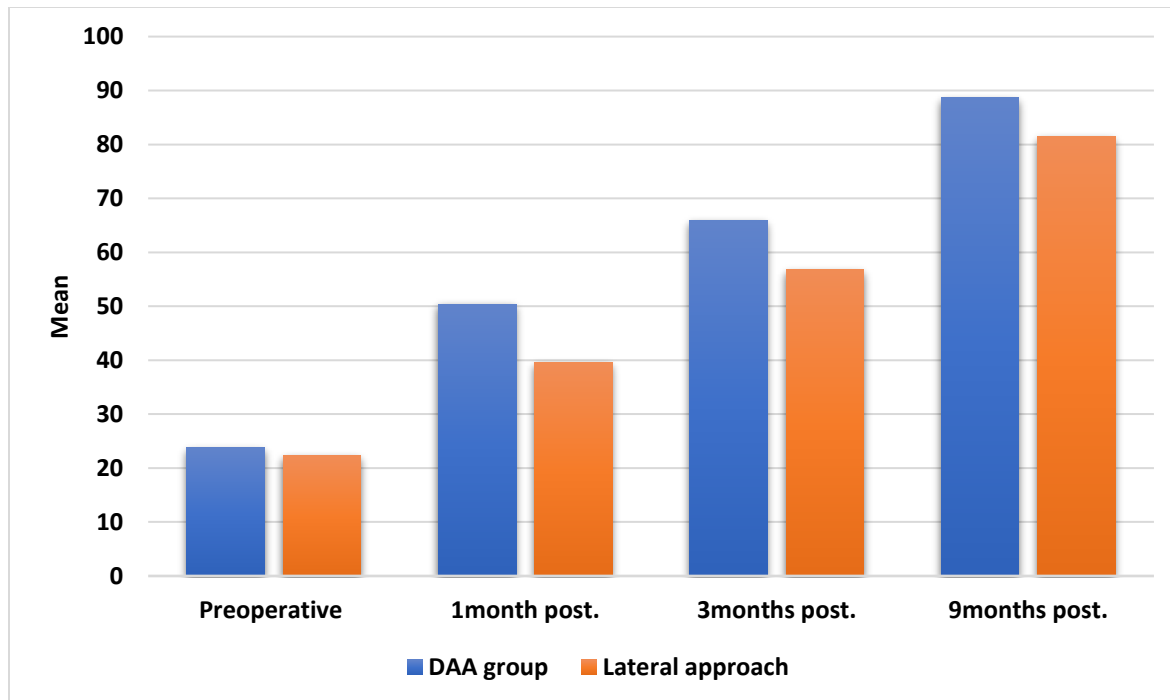


Figure 3: Analysis of pre-versus postoperative modified HHS in studied groups

Table (5): Visual analog pain score (VAS) in the two studied groups

		Preoperative	1 st day	2 nd day	3 rd day	p- value †
DAA group (n=20)	mean± SD	3.43± 0.47	3.53± 0.65	3.20± 0.58	3.32± 0.69	0.189
	median	3.35	3.30	3.0	3.15	
	Range	2.80- 4.0	2.50- 5.0	2.0- 4.20	2.50- 6.0	
Lateral approach group (n=20)	mean± SD	3.76± 0.49	3.60± 0.57	3.52± 0.44	3.45± 0.51	0.062
	median	4.0	3.50	3.50	3.50	
	Range	3.0- 4.5	3.0- 5.0	3.0- 4.0	3.0- 4.0	
p- value ‡		0.028*	0.820	0.056	0.583	

‡ Mann-Whitney U test, †: Friedman test

Pain was assessed preoperatively, as well as at day 1, 2& 3. DAA group reported significantly less pain postoperative than lateral approach group (p=0.028) with no significant difference between

them at day 1, 2 and 3 ($p>0.05$). There were no significant changes in pain level in VAS between pre and postoperative in both groups as illustrated in table (5).

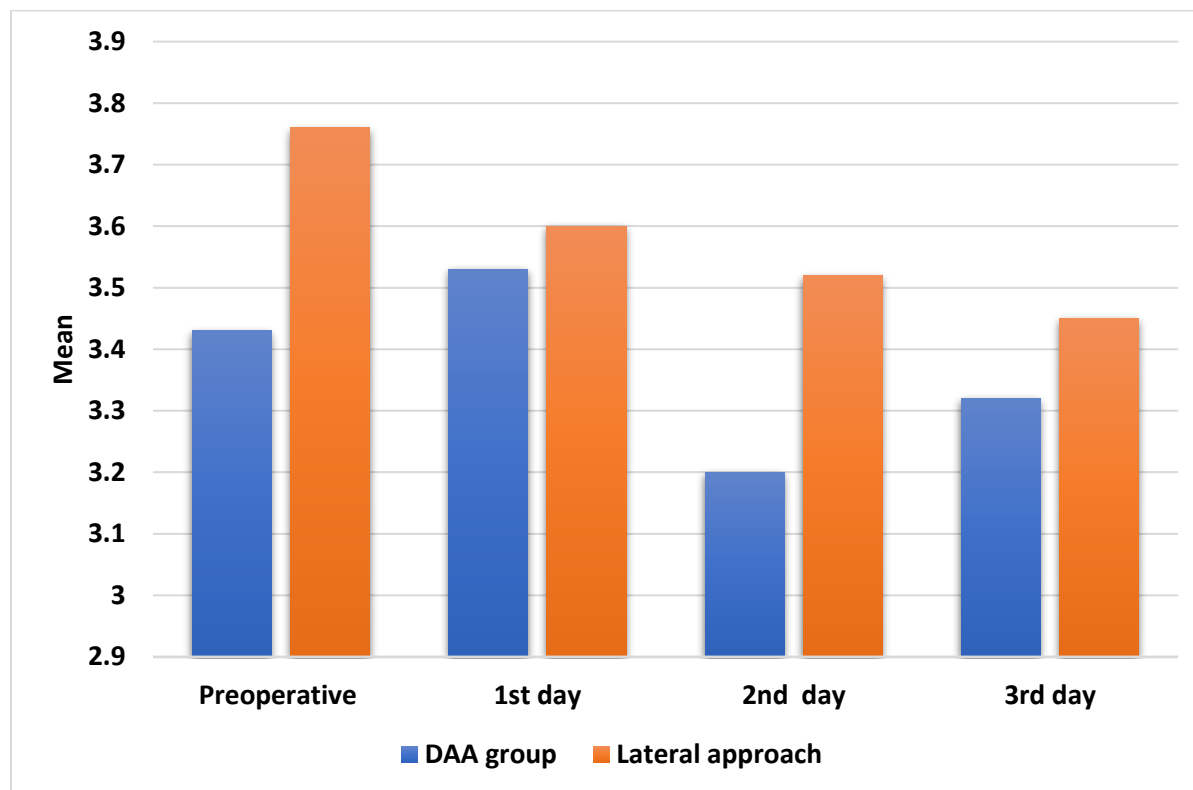


Figure 4: Visual analog pain score (VAS) in the two studied groups

Table (6): Distance ambulated in feet in the two studied groups

Distance ambulated in feet		Preoperative	1 st day	2 nd day	p- value †
DAA group (n=20)	mean± SD	31.50± 19.81	73.05± 14.68	126.0± 29.98	<0.001**
	median Range	27.50 10.0- 70.0	77.50 50.0- 100.0	120.0 70.0- 180.0	
Lateral approach group (n=20)	mean± SD	19.05± 7.69	54.50± 18.49	92.0± 28.58	<0.001**
	median Range	20.0 10.0- 30.0	60.0 10.0- 90.0	105.0 10.0- 120.0	
p- value		0.098	0.002**	0.001**	

‡ Mann- Whitney U test, †: Friedman test

The Distance ambulated in feet within the two groups increased significantly from preoperative to day 2 ($p<0.001$). There were differences in distance ambulated in feet comparing the DAA group to the lateral group in day 1 ($p=0.002$) and day2 ($p=0.001$).

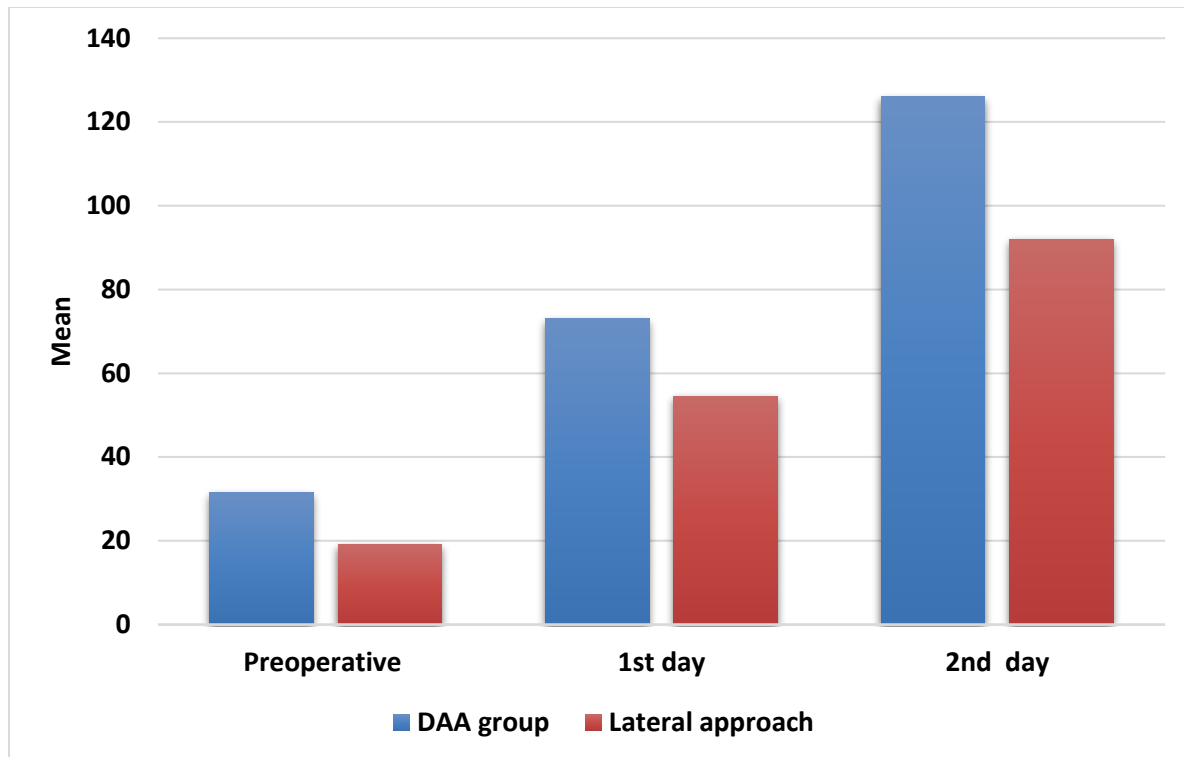


Figure 5: Comparison between both groups as regard to Distance ambulated in feet.

Table (7): Postoperative complications in the two studied groups

		DAA group (n=20)		Lateral approach group (n=20)		p- value ‡
		N	%	n	%	
Blood transfusion	0	15	55.0%	7	35.0%	0.049*
	1	4	40.0%	6	30.0%	
	2	1	5.0%	6	30.0%	
	3	0	0.0%	1	5.0%	
Wound contamination	No	19	95.0%	15	75.0%	0.048*
	Yes	1	5.0%	5	25.0%	
deep infection	No	20	100.0%	19	95.0%	0.317
	Yes	0	0.0%	1	5.0%	
Instability	No	19	95.0%	19	95.0%	0.487
	Yes	1	5.0%	1	5.0%	

Femoral complications	No	20	100.0%	17	85.0%	0.605
	Yes	0	0.0%	3	15.0%	
Acetabular malposition	No	19	95.0%	17	85.0%	0.251
	Yes	1	5.0%	3	15.0%	
Loosening	No	19	95.0%	18	90.0%	0.487
	Yes	1	5.0%	2	10.0%	

‡ Chi-square test or Fischer exact test

Rate of blood transfusion was found to be significantly higher in lateral approach group when compared to DAA group ($p= 0.049$). Regarding complications, lateral approach group showed significant increase in developing wound infection ($p= 0.048$). No significant differences were found when comparing groups regarding deep infection, instability, loosening, Femoral complications and Acetabular malposition ($p>0.05$) (table7).

Consequently, Lateral approach is associated with postoperative abductor muscle dysfunction as it is a transgluteal approach, this may cause a limp in patients with reduced abductor strength, as well as greater trochanteric pain or tenderness related to muscle injury. Anterior approach avoids this complication as it is a true intermuscular, internervous approach.

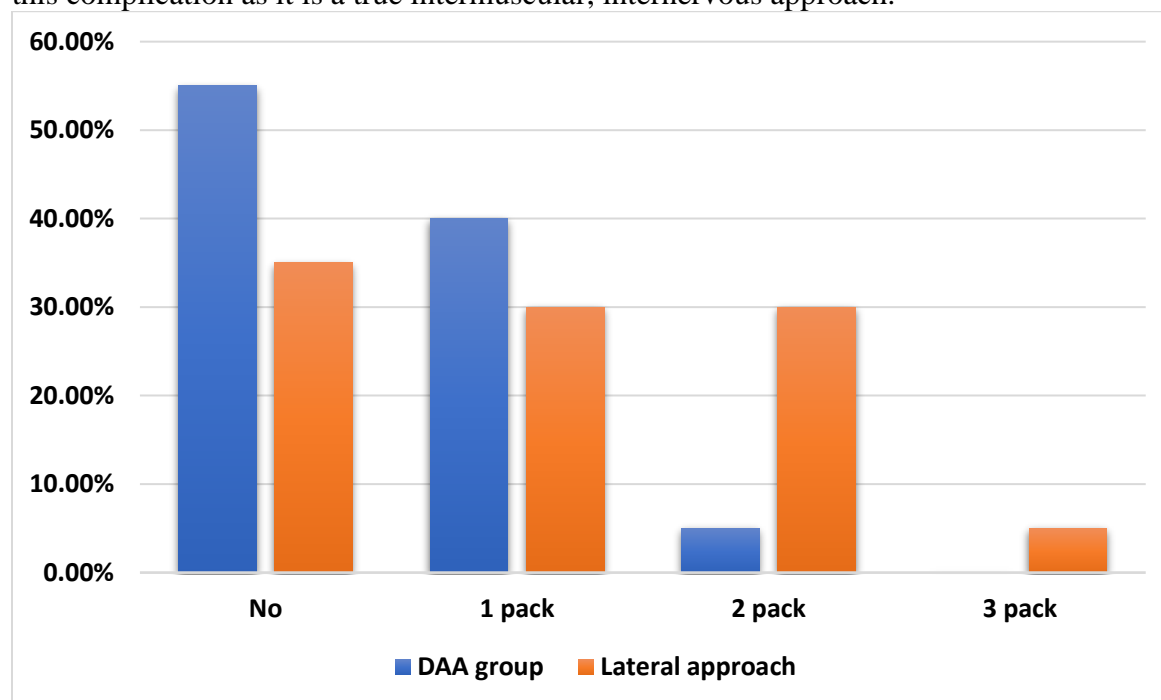


Figure 6: Comparison between groups as regard to Blood transfusion

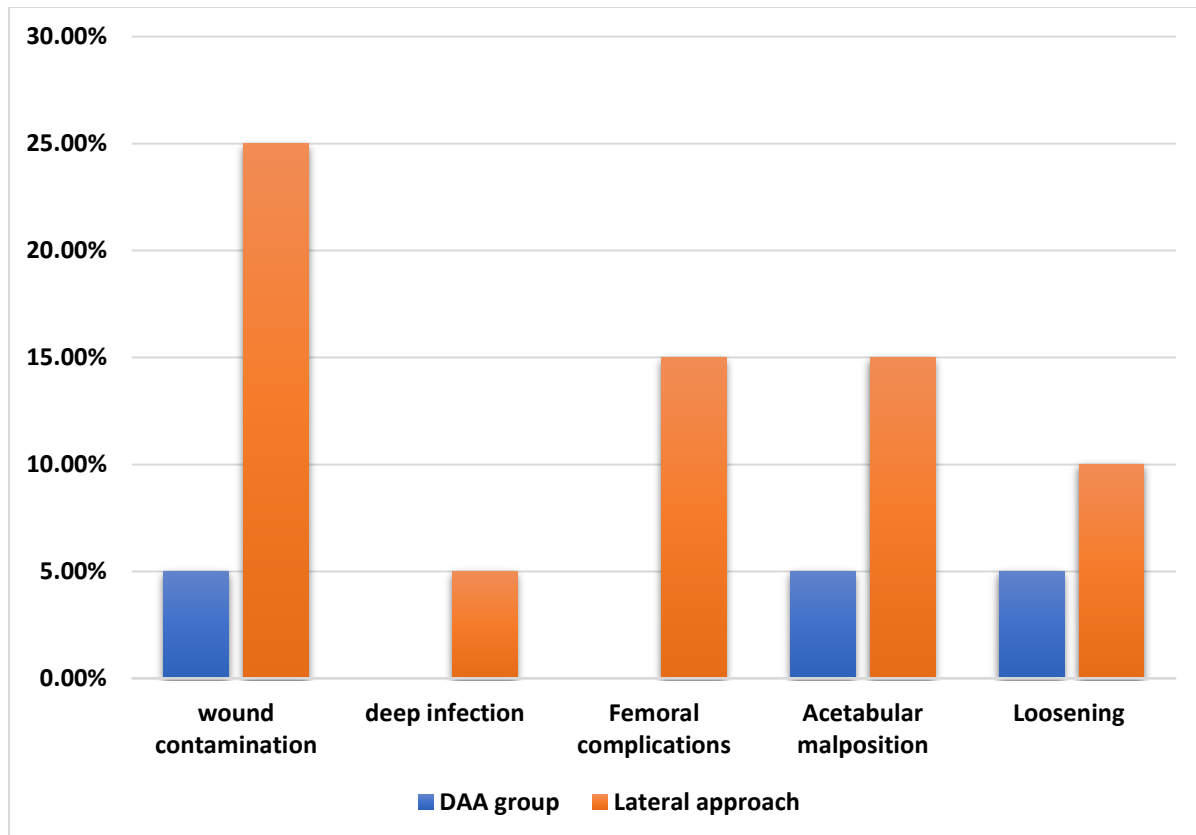


Figure7: Comparison between groups as regard to postoperative complications

Discussion

Both the groups were comparable in terms of age, and gender. The male to female ratio in DAA group was 3:1 and in lateral approach group it was 2.33:1 (p-value=0.507). The mean age in DAA group was 48.40 ± 13.64 years with range being 36 to 70 years and in lateral approach group mean age was 52.05 ± 12.40 years with range being 38 to 70 years.

Huang et al. ⁽⁹⁾ showed that a total of 13 articles were included in the meta-analysis, of which, five articles 16, 23–26 were RCTs and eight articles 15, 27–33 were case–control studies, including 24,853 hips (9575 hips in the DAA group and 15,278 hips in the LA group). The included articles were published between 2010 and 2019, and the longest period of follow-up was 3.72 years

Aggarwal et al. ⁽¹⁰⁾ showed that There were significant differences between groups in age (higher in lateral approach), hypertension (more frequent in lateral approach).

Fleischman et al. ⁽¹¹⁾ showed that of 16,186 primary THA, 5465 cases (33.8%) were performed using the DA approach, 8561 (52.9%) using DL, and 2160 (13.3%) using PL. Patients in the DA group were significantly younger and had a lower BMI than those in the DL and PL groups. However, there was no difference in gender between groups

There was no statistically significant difference between both groups as regard surgery time (p=0.157). Lateral approach group showed significant increase in hospital stay compared to DAA group (p=0.001).

Spina et al. ⁽¹²⁾ showed that the mean surgery time was 87.7 min (range 48–120 min) in group A and 82 min (range 40–131 min) in group B (P=0.25).

Regarding modified HHS, it showed statistically significant improvement postoperatively either in both DAA and lateral approach group ($p < 0.001$). A significant difference was found among the two groups regarding the respective change in the modified HHS value preoperative ($p = 0.015$), 1 month ($p < 0.001$), 3 months ($p < 0.001$) and 9 months ($p = 0.001$).

Mirza et al. ⁽¹³⁾ reported significantly higher 6-week Harris Hip Score (HHS) scores with DAA ($P < 0.0001$). **Restrepo et al.** ⁽¹⁴⁾ found that DAA led to significantly better scores on the HHS, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Short Form 36- Item Health Survey scale, Lower Extremity Functional Score, and Linear Analog Scale Assessment at 6 weeks, 6 months, and 1 year, although DAA and the lateral approach led to similar scores on these instruments at 2 years.

Similarly, **Ilchmann et al.** ⁽¹⁵⁾ found significantly higher HHS scores with DAA at 6 weeks, 12 weeks, and 1 year, but similar HHS scores for DAA and the lateral approach at 2 years.

Goebel et al. ⁽¹⁶⁾ found that mean time to achieve the therapeutic goal was shorter in the DAA group (6.4 vs 7.4 days).

Pain was assessed preoperatively, as well as at day 1, 2 & 3. DAA group reported significantly less pain postoperative than lateral approach group ($p = 0.028$) with no significant difference between them at day 1, 2 and 3 ($p > 0.05$). There were no significant changes in pain level in VAS between pre and postoperative in both groups

The Distance ambulated in feet within the two groups increased significantly from preoperative to day 2 ($p < 0.001$). There were differences in distance ambulated in feet comparing the DAA group to the lateral group in day 1 ($p = 0.002$) and day 2 ($p = 0.001$).

Spina et al. ⁽¹²⁾ reported that there were differences in distance ambulated in feet comparing the DAA group to the lateral group Recovery of ambulation at 6 months (%).

Rate of blood transfusion was found to be significantly higher in lateral approach group when compared to DAA group ($p = 0.049$). Regarding complications, lateral approach group showed significant increase in developing wound infection ($p = 0.048$). No significant differences were found when comparing groups regarding deep infection, instability, loosening, Femoral complications and Acetabular malposition ($p > 0.05$).

Spina et al. ⁽¹²⁾ showed that the mean number of blood units transfused was 1.7 U in group A and 1.9 U in group B ($P = 0.61$), while the percentage of patients transfused was 67.6% in group A and 71.1% in group B ($P = 0.74$), starting from similar haemoglobin mean values (11.8 gr/dl for group A and 11.9 gr/dl for group B). The incidence of perioperative complications was lower in group A (1 case/37 of hip dislocation) compared to group B (2 cases/38 of hip dislocations and 1 case/38 of infection). Residual pain was less present in group B than in group A both at 1 and 6 months ($P = 0.55$ and $P = 0.28$); recovery of ambulation with full or assisted weight-bearing at 6 months was also better in group B ($P = 0.78$). Mortality at 3 months post-operatively was significantly lower in group B ($P = 0.03$), while no difference was reported for the rate of mortality at 12 months between the two groups ($P = 0.57$)

In a meta-analysis by **Sun et al.** ⁽¹⁷⁾, Seven studies involving 566 patients provided data on the complications. There was a significantly greater proportion in the DAA group during the follow-up period (RR = 1.97; $P = 0.03$; 95% CI, 1.08–3.60).

Fleischman et al. ⁽¹¹⁾ identified 290 mechanical complications, the most common being periprosthetic fracture (39.7%), instability/ dislocation (34.5%), and aseptic loosening/failed osseointegration (25.5%). Failure of the femoral component ($n = 163$) was considerably more common than acetabular failure ($n = 22$), and prosthesis failure was uncommon ($n = 3$).

However, in the **Huang et al.** ⁽⁹⁾ meta-analysis, no significant difference was found in the rate of surgical site infection between the DAA and LA groups, which may be related to the BMI of less than 35 kg/m² in included patients.

A recent meta-analysis by **Miller et al.** ⁽¹⁸⁾ assessed perioperative complications between the direct anterior and posterior approaches, including randomized trials in addition to retrospective comparative studies and registry data. While the meta-analysis found there was a lower risk of reoperation, dislocation, and infection with the direct anterior approach, the authors justly caution that the majority of the data were retrospective, had heterogeneous reporting of complications, and were inherently prone to bias. In the present study, there are several factors that helped mitigate such bias. Patient baseline characteristics, operative variables, and complications were prospectively collected using NSQIP, where each variable is carefully defined and audited. All patients were treated in the same hospital, under the same standardized perioperative care pathway. Furthermore, all 3 approaches were being performed concurrently over the entire study period.

Conclusion

Our study preliminary shows that although DAA may provide shorter hospitalization and faster recovery during the early postoperative period, the available evidence is still insufficient to conclude whether the DAA or lateral approach is superior for total hip arthroplasty. Our results highlight the need for large, high-quality studies that investigate outcomes of DAA and that can be incorporated into future meta-analyses.

References

1. **Karlsen, A. P. H., Geisler, A., Petersen, P. L., Mathiesen, O., & Dahl, J. B. (2015).** Postoperative pain treatment after total hip arthroplasty: a systematic review. *Pain*, 156(1), 8-30.
2. **Marques, E. M., Jones, H. E., Elvers, K. T., Pyke, M., Blom, A. W., & Beswick, A. D. (2014).** Local anaesthetic infiltration for peri-operative pain control in total hip and knee replacement: systematic review and meta-analyses of short-and long-term effectiveness. *BMC musculoskeletal disorders*, 15(1), 1-20.
3. **Karunaratne, S., Duan, M., Pappas, E., Fritsch, B., Boyle, R., Gupta, S., ... & Steffens, D. (2019).** The effectiveness of robotic hip and knee arthroplasty on patient-reported outcomes: a systematic review and meta-analysis. *International Orthopaedics*, 43(6), 1283-1295.
4. **Post, Z. D., Orozco, F., Diaz-Ledezma, C., Hozack, W. J., & Ong, A. (2014).** Direct anterior approach for total hip arthroplasty: indications, technique, and results. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, 22(9), 595-603.
5. **Chechik, O., Khashan, M., Lador, R., Salai, M., & Amar, E. (2013).** Surgical approach and prosthesis fixation in hip arthroplasty world wide. *Archives of orthopaedic and trauma surgery*, 133(11), 1595-1600.
6. **Meermans, G., Konan, S., Das, R., Volpin, A., & Haddad, F. S. (2017).** The direct anterior approach in total hip arthroplasty: a systematic review of the literature. *The bone & joint journal*, 99(6), 732-740.
7. **Graves, S. C., Dropkin, B. M., Keeney, B. J., Lurie, J. D., & Tomek, I. M. (2016).** Does surgical approach affect patient-reported function after primary THA?. *Clinical Orthopaedics and Related Research*, 474(4), 971-981.

8. **Schünke, M., Schulte, E., Schumacher, U., & Lamperti, E. D. (2006).** Thieme atlas of anatomy: latin nomenclature: general anatomy and musculoskeletal system. Thieme.
9. **Huang, X. T., Liu, D. G., Jia, B., & Xu, Y. X. (2021).** Comparisons between Direct Anterior Approach and Lateral Approach for Primary Total Hip Arthroplasty in Postoperative Orthopaedic Complications: A Systematic Review and Meta-Analysis. *Orthopaedic Surgery*, 13(6),1707-1720.
10. **Agarwal, G., Sadacharan, D., Aggarwal, V., Chand, G., Mishra, A., Agarwal, A., ... & Mishra, S. K. (2019).** Surgical management of organ-contained unilateral pheochromocytoma: comparative outcomes of laparoscopic and conventional open surgical procedures in a large single-institution series. *Langenbeck's archives of surgery*, 397(7), 1109-1116.
11. **Fleischman, A. N., Tarabichi, M., Magner, Z., Parvizi, J., & Rothman, R. H. (2019).** Mechanical complications following total hip arthroplasty based on surgical approach: a large, single-institution cohort study. *The Journal of Arthroplasty*, 34(6), 1255-1260.
12. **Spina, M., Luppi, V., Chiappi, J., Bagnis, F., & Balsano, M. (2021).** Direct anterior approach versus direct lateral approach in total hip arthroplasty and bipolar hemiarthroplasty for femoral neck fractures: a retrospective comparative study. *Aging Clinical and Experimental Research*, 33(6), 1635-1644.
13. **Mirza, A. J., Lombardi Jr, A. V., Morris, M. J., & Berend, K. R. (2014).** A mini-anterior approach to the hip for total joint replacement: optimising results: improving hip joint replacement outcomes. *The Bone & Joint Journal*, 96(11_Supple_A), 32-35.
14. **Restrepo, C., Parvizi, J., Pour, A. E., & Hozack, W. J. (2010).** Prospective randomized study of two surgical approaches for total hip arthroplasty. *The Journal of arthroplasty*, 25(5), 671-679.
15. **Ilchmann, T., Gersbach, S., Zwicky, L., & Clauss, M. (2013).** Standard transgluteal versus minimal invasive anterior approach in hip arthroplasty: a prospective, consecutive cohort study. *Orthopedic reviews*, 5(4).
16. **Goebel, S., Steinert, A. F., Schillinger, J., Eulert, J., Broscheit, J., Rudert, M., & Nöth, U. (2012).** Reduced postoperative pain in total hip arthroplasty after minimal-invasive anterior approach. *International orthopaedics*, 36(3), 491-498.
17. **Sun, X., Zhao, X., Zhou, L., & Su, Z. (2021).** Direct anterior approach versus posterolateral approach in total hip arthroplasty: a meta-analysis of results on early post-operative period. *Journal of Orthopaedic Surgery and Research*, 16(1), 1-8.
18. **Miller, L. E., Gondusky, J. S., Bhattacharyya, S., Kamath, A. F., Boettner, F., & Wright, J. (2018).** Does surgical approach affect outcomes in total hip arthroplasty through 90 days of follow-up? A systematic review with meta-analysis. *The Journal of arthroplasty*, 33(4), 1296-1302.