CLINICAL ARTICLE

Direct Anterior Approach *Versus* Posterolateral Approach in Total Hip Arthroplasty: A Systematic Review and Meta-analysis of Randomized Controlled Studies

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Objective: To compare the early rehabilitation effects of total hip arthroplasty (THA) with the direct anterior approach (DAA) *versus* the posterior approach (PA).

Methods: We searched PubMed, Embase, Web of Science, the Cochrane Library, and Google databases from inception to June 2019 to select studies that compared the DAA and PA for THA. Only randomized controlled trials (RCT) were included. Two researchers independently screened studies for inclusion, extracted data, and assessed the methodological quality. A meta-analysis was conducted using RevMan 5.3 software provided by Cochrane Assisted Network.

Results: A total of 932 patients underwent THA. There were 467 cases in group DAA and 465 cases in group PA. There was a significant difference in the incidence of lateral femoral cutaneous nerve injury between DAA and PA groups (RR = 38.97, 95% CI: 7.89–192.57, $P < 0.05$). DAA was associated with less pain compared with PA [WMD = −0.65, 95% CI (−0.91–0.38), $P < 0.05$]. There was no significant difference in operation time, hospitalization stay, and intraoperative bleeding volume. Moreover, in supplementary data, the number of acetabular prostheses in Lewinnek's safety zones in DAA was more than that in the PA group (RR = 1.20, 95% CI [1.04–1.39], $P < 0.05$), and the time of discontinuation of walking aids in the DAA group was earlier than that in the PA group (WMD = −11.05, 95% CI [−17.79–4.31], $P < 0.05$).

Conclusion: The DAA total hip arthroplasty has comparable results with PA, with earlier postoperative functional recovery, less postoperative pain scores, and higher incidence of lateral femoral cutaneous nerve injury. The results need to be validated by large-sample, high-quality RCT studies, and long-term follow-up of complications.

Key words: Anterior approach; Meta-analysis; Posterior approach; Total hip arthroplasty

Introduction

Total hip arthroplasty (THA), a mature and reliable treatment also known as artificial hip replacement, involves removing a diseased hip joint and replacing it with an artificial prosthesis that includes the femoral and acetabular parts. Using bone cement and screws, the prosthesis fixed to the bone and normal function of the patient's hip joint is reinstated[1–3]. THA can effectively relieve pain symptoms and improve the quality of life of patients with hip disease. THA can be performed using a variety of surgical approaches,

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such as the direct anterior approach (DAA), the anterolateral approach, the lateral approach, and the posterolateral approach (PA)[4–10]. PA is commonly used because it is relatively simple to operate and is conducive to intraoperative exposure. However, it has been reported that PA is associated with a relatively high rate of dislocation, great trauma, and slow recovery in the tissues around the joint[11]. With the increasing desire for rapid recovery, THA by DAA began to be favored by orthopaedists. It has been reported that DAA has the advantages of minimal trauma, rapid recovery, and low dislocation rate, but there are also reports of high blood loss and high incidence of complications (such as femoral fractures and incision complications)[12,13]. Whether DAA is superior to PA remains controversial. The present study aims to evaluate the clinical efficacy and safety of DAA *versus* PA in THA functional rehabilitation, complications, and imaging results.

Methods

The methods of literature search, inclusion and exclusion criteria, outcome measures, and methods of statistical analysis followed the *Cochrane Handbook for Systematic Reviews of Interventions*, and the protocol were defined according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement[14,15]. Patient consent and ethical approval were not mandatory, as all data available were based on previously published studies.

Search Strategy

Two independent authors searched PubMed, Web of Science, Embase, EBSCO, and Google databases for all related papers. The search time was from inception to June 2019. The search terms were as follows: ("total hip arthroplasty" OR "THA" OR "total hip replacement" OR "THR") combined with ("direct anterior approach" OR "anterolateral approach" OR "lateral approach" OR "posterolateral approach"). Wherever possible, we searched for references to relevant articles to identify potential information that had not already been retrieved. All enrolled studies were imported into the bibliographic citation management software of EndNote (Version X6, Thomson Corporation, Toronto, Canada). Authors of relevant abstracts were contacted to obtain any unpublished data (if available). When the results of a single study were reported in more than one publication, only the most recent and complete data were included.

Inclusion Criteria and Exclusion Criteria

Randomized controlled trials comparing the effects of DAA and PA in regard to postoperative functional evaluation, intraoperative and postoperative complications, and radiographic findings were selected. All of the studies included in the meta-analysis met the following criteria: (i) patients underwent THA; (ii) DAA as the experimental group; (iii) PA as the control group; (iv) Outcomes include operative time, blood loss, postoperative complications incision infection, postoperative blood loss, length of hospital stay, changes in the acetabular angles, and functional recovery; (v) study design RCT.

The following exclusion criteria were used: (i) animal studies; (ii) literature reviews or case reports; (iii) duplicate publication; (iv) non-DAA *versus* PA studies; (v) no available data about mean difference (MD) or risk ratio (RR), or no related data for calculating them; and (vi) studies involving navigation techniques and cases involving learning curves (fewer than 30 cases).

Methodology Quality Assessment and Outcome Measures

The quality of RCT was assessed by Jadad scale. The scale was composed of randomization, blindness, and follow up. It was divided into five points, 0–2 points for low-quality study and 3–5 points for high-quality study[16]. Data extracted from various studies include: (i) author, publication time, type of study, case characteristics etc.; and (ii) postoperative functional parameters, including intraoperative and postoperative complications, postoperative pain visual analogue scale (VAS), intraoperative bleeding volume, hospital stay, operative time, anteversion and abduction angle of acetabular prosthesis, number of acetabular prosthesis in Lewinnek safe area, muscle damage of wound markers (creatine kinase [CK] and inflammatory factor C reactive protein [CRP]), and gait.

Data Extraction and Synthesis

The literature was independently screened and cross-checked by two researchers according to the inclusion and exclusion criteria set beforehand. In case of disagreement, the literature was discussed and resolved and sent to a third researcher for decision if necessary. Data were extracted and entered by one researcher and checked by another according to a predesigned data extraction table. MD and RR were used as summary statistics for the pooled outcomes. Heterogeneity among the results was analyzed by Q-test; the test level was alpha = 0.1 and I^2 was used to measure the heterogeneity. If there was no statistical and clinical heterogeneity between the results of each study ($P > 0.1$, $I^2 < 50\%$), the fixed effect model was used for the meta-analysis; if there was moderate or higher statistical heterogeneity among the results but no clinical heterogeneity ($P < 0.1$, $I^2 < 50\%$), subgroup analysis or sensitivity analysis could be performed, if there were no obvious heterogeneity sources. A random effect model was used for the meta-analysis. A sensitivity analysis was performed by eliminating the impact of individual studies on the overall analysis results. Funnel plots were used to analyze whether publication bias exists in the included studies. Meta-analysis was conducted using Review Manager 5.1 software (Cochrane collaboration, Copenhagen, Denmark)[17]. The Quality in Prognostic Studies (QUIPS) tool was used for assessment of study reliability[18].

Results

Literature Retrieval

A total of 1433 papers were found, and 1084 papers were excluded because they were determined to be duplicates and unrelated papers. Then, 1010 papers were excluded because they were unrelated to this topic. A total of 74 papers were preliminarily screened, with 63 excluded from the retrospective case analysis and the non-contrast group after reading the title and abstract. Studies with incomplete data and other interventions and those of low quality were excluded after reading the full text. Finally, a total of 11 RCT qualified for inclusion in this systematic review and meta-analysis, with a total of 932 patients undergoing THA[19–29]. There were 467 cases in the DAA group and 465 cases in the PA group (Fig. 1).

Characteristics of the Included Studies

Table 1 listed the characteristics of the included RCT in patients who underwent THA surgery. There was no significant difference in age, body mass index (BMI), and sex ratio between the two groups. The publication period is from 2006 to 2018. The patients were 27–60 years old, with an average age of 59–65 years. The follow-up period ranged from 1 month to 1 year. The Jadad scores of the 11 RCT were all above three points, and the studies included were all of high quality. The random sequence generation process (selection bias) was low and unclear in 3 and 5 studies included, respectively. In 5 studies, allocation concealment was low, and it was very high in 2 studies. In all studies, participants' blindness had a higher bias risk. In the 7 studies, attrition bias is not yet clear. Other bias was higher in 1 study, the risk of two biases was not high, and the rest had a lower bias risk.

Results of Meta-Analyses

Postoperative Complications

Figure 2 presents a forest plot depicting the meta-analysis of the comparison between the DAA group and the PA group in postoperative complications. Intraoperative and postoperative complications were reported in 8 articles. There was no heterogeneity between the two groups. A fixed effect model was used to analyze the heterogeneity. Pooled results

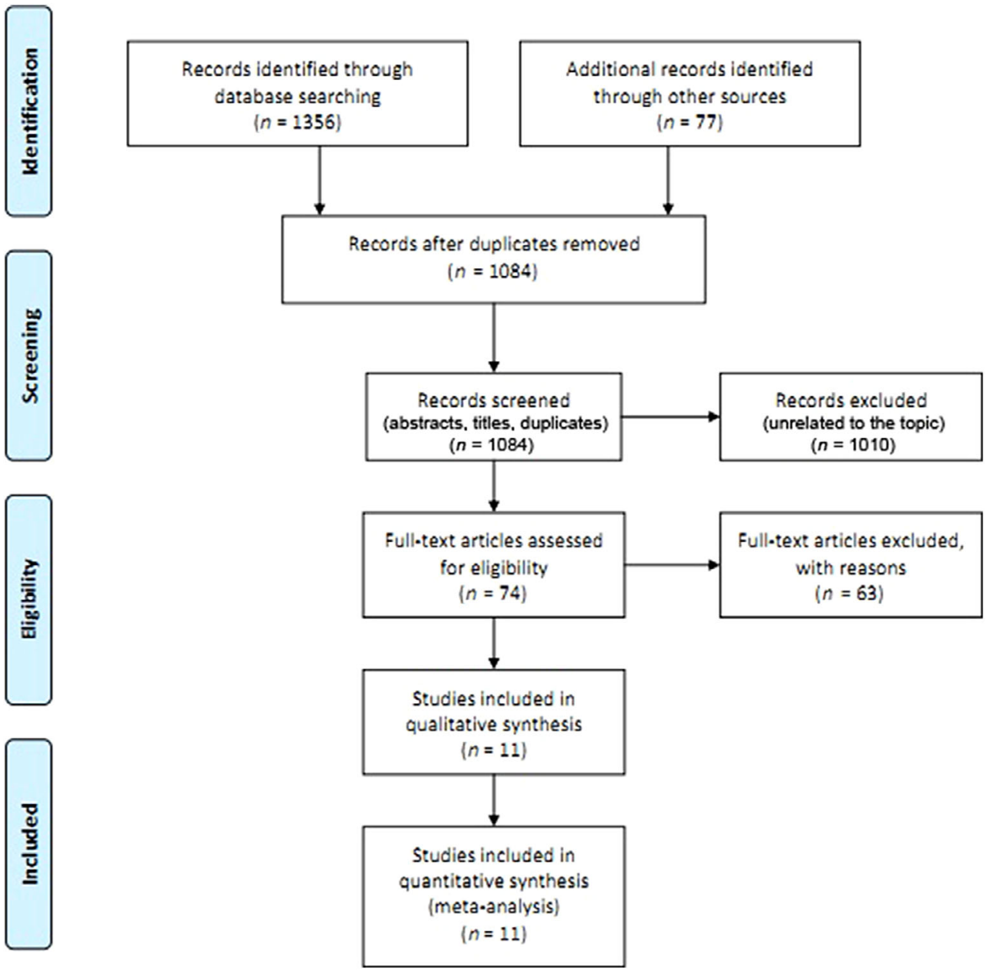


Fig. 1 Flow chart of publication search and selection.

TABLE 1 Characteristics of the included randomized controlled trials in patients who underwent total hip arthroplasty (THA) surgery

Authors	Comparisons	Number of patients	Mean age (year)	BMI (kg/m²)	Follow-up	Study quality
Cheng *et al.*[19]/Australia (2017)	DAA	35 (M/F: 15/20)	59	28	84 days	3
	PA	38 (M/F: 18/20)	63	28		
Poehling *et al.*[20]/USA (2017)	DAA	50 (M/F: 26/24)	63	31	8 weeks	4
	PA	50 (M/F: 22/28)	63	30		
Rykov *et al.*[21]/Netherlands (2017)	DAA	23 (M/F: 8/15)	63	29	6 weeks	3
	PA	23 (M/F: 11/12)	60	29		
Zhao *et al.*[22]/China (2017)	DAA	60 (M/F: 24/36)	65	24	3 months	4
	PA	60 (M/F: 26/34)	62	26		
Luo *et al.*[23]/China (2016)	DAA	52 (M/F: 17/35)	62	23	14 months	4
	PA	52 (M/F: 22/30)	64	24		
Christensen *et al.*[24]/USA (2015)	DAA	28 (M/F: 13/15)	64	31	42 days	3
	PA	23 (M/F: 11/12)	65	30		
Rodriguez *et al.*[25]/USA (2014)	DAA	60 (M/F: 28/32)	59	28	1 year	3
	PA	60 (M/F: 26/34)	60	24		
Taunton *et al.*[26]/USA (2014)	DAA	27 (M/F: 12/15)	62	28	42 days	3
	PA	27 (M/F: 13/14)	66	29		
Barrett *et al.*[27]/USA (2013)	DAA	43 (M/F: 29/14)	61	31	3 months	4
	PA	44 (M/F: 19/25)	63	29		
Bergin *et al.*[28]/USA (2011)	DAA	29 (M/F: 10/19)	69	26	1 months	4
	PA	28 (M/F: 14/14)	65	28		
Zhang *et al.*[29]/China (2006)	DAA	60 (M/F:2 5/35)	61	NA	3 months	3
	PA	60 (M/F: 28/32)	63	NA		

BMI, body mass index; DAA, direct anterior approach; F, female; M, male; NA, not available; PA, posterior approach; RCT, randomized controlled trial; THA, total hip arthroplasty.

indicated that there was a significant difference in the incidence of lateral femoral cutaneous nerve injury between DAA and PA groups (RR = 38.97, 95% CI: 7.89–192.57, $P < 0.05$). However, there were no significant differences in intraoperative fractures (RR = 1.71, 95% CI: 0.54–5.41, $P = 0.36$), postoperative dislocations (RR = 0.47, 95% CI: 0.11–2.05, $P = 0.31$), incision complications (RR = 1.18, 95% CI: 0.39–3.56, $P = 1.18$), and inguinal pain (RR = 2.62, 95% CI: 0.63–10.94, $P = 0.41$). There was no significant difference in the incidence of heterotopic ossification (RR = 1.68, 95% CI: 0.23–12.5, $P = 0.61$).

Postoperative Visual Analogue Scale

Two studies reported postoperative VAS scores (see Fig. 3). There was no heterogeneity in VAS scores on the first day after surgery. A fixed effect model was used to analyze the heterogeneity. The results showed that there was a significant difference between DAA and PA groups [WMD = − 0.65, 95% CI (−0.91– −0.38), $P < 0.05$]. The VAS score was heterogeneous on the second day after surgery. A random effect model was used to analyze the heterogeneity. The results showed that there was no significant difference between the DAA group and the PA group (WMD = − 0.67, 95% CI [− 1.34– −0.01], $P = 0.05$).

Operative Time

Among them, 8 reported operation time (Fig. 4). A random effect model was used to analyze the results. The results showed that the DAA group and the PA group had no significant difference in operation time (WMD = 6.69, 95% CI [− 2.08–15.45], $P = 0.13$), with significant between-study heterogeneity ($I^2 = 96\%$, $P_{for\ heterogeneity} < 0.01$).

Hospital Stay

Four studies reported hospital stays for DAA and PA groups. Results from our study suggested that there was no significant difference in hospitalization stay (WMD = − 0.19, 95% CI [− 0.58–0.21], $P = 0.36$) (Fig. 4). However, between-study heterogeneity was significant ($I^2 = 89\%$, $P_{for\ heterogeneity} < 0.01$).

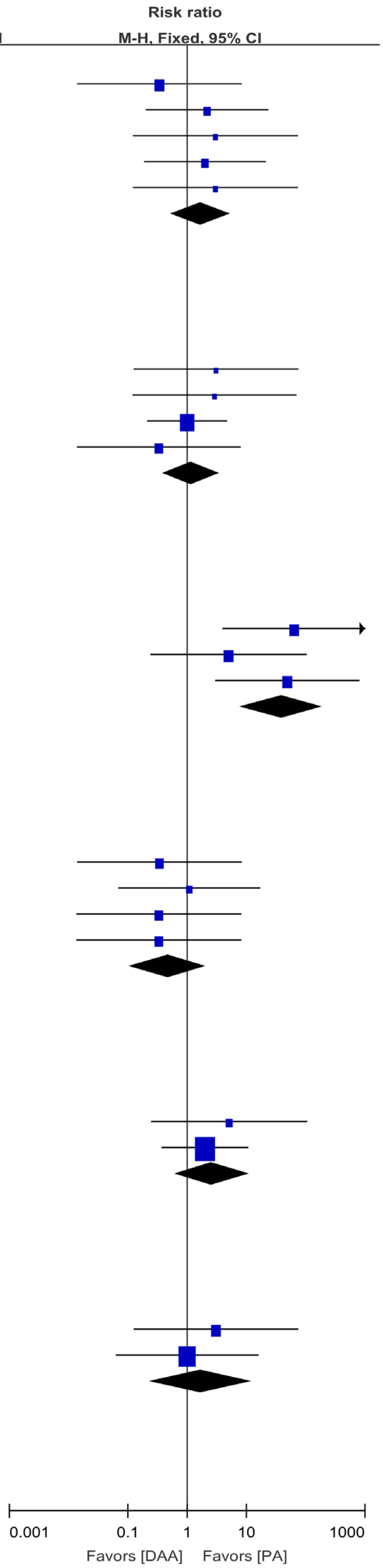
Blood Loss

Six studies reported intraoperative bleeding volume for DAA and PA groups. We found that there was no significant difference in intraoperative bleeding volume between these two groups (WMD = 5.63, 95% CI [− 67.12–78.38], $P = 0.88$) (Fig. 4). Significant between-study heterogeneity was also found ($I^2 = 98\%$, $P_{for\ heterogeneity} < 0.01$).

Changes in Acetabular Angle

Figure S1 shows the forest plot depicting the meta-analysis of the comparison between DAA and PA groups in acetabular angle after surgery. There was no significant difference in DAA *versus* PA both in anteversion angle (RR = −1.04, 95% CI [−4.09–2.01], $P > 0.05$] and abduction angle (RR = 0.59, 95% CI [−0.81–2.00], $P > 0.05$) of acetabular cup.

	DAA		PA			Risk ratio
Study or subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
1.1.1 Intraoperative fracture						
Barrett (2013)	0	43	1	44	33.4%	0.34 [0.01, 8.14]
Cheng (2017)	2	35	1	38	21.6%	2.17 [0.21, 22.91]
Rodriguez (2014)	1	60	0	60	11.3%	3.00 [0.12, 72.20]
Taunton (2014)	2	27	1	27	22.5%	2.00 [0.19, 20.77]
Zhao (2017)	1	60	0	60	11.3%	3.00 [0.12, 72.20]
Subtotal (95% CI)		**225**		**229**	**100.0%**	**1.71 [0.54, 5.41]**
Total events	6		3			
Heterogeneity: χ^2 = 1.29, df = 4 (p = 0.86); i^2 = 0%						
Test for overall effect: z = 0.91 (p = 0.36)						
1.1.2 Incision complications						
Barrett (2013)	1	43	0	44	9.0%	3.07 [0.13, 73.30]
Bergin (2011)	1	29	0	28	9.2%	2.90 [0.12, 68.33]
Cheng (2017)	3	35	3	35	54.5%	1.00 [0.22, 4.62]
Taunton (2014)	0	27	1	27	27.3%	0.33 [0.01, 7.84]
Subtotal (95% CI)		**134**		**134**	**100.0%**	**1.18 [0.39, 3.56]**
Total events	5		4			
Heterogeneity: χ^2 = 1.32, df = 3 (p = 0.72); i^2 = 0%						
Test for overall effect: z = 0.29 (p = 0.77)						
1.1.3 Lateral femoral cutaneous nerve injury						
Cheng (2017)	29	35	0	38	32.4%	63.92 [4.05, 1008.11]
Luo (2016)	2	52	0	52	33.8%	5.00 [0.25, 101.68]
Rodriguez (2014)	24	60	0	60	33.8%	49.00 [3.05, 787.75]
Subtotal (95% CI)		**147**		**150**	**100.0%**	**38.97 [7.89, 192.57]**
Total events	55		0			
Heterogeneity: χ^2 = 1.93, df = 2 (p = 0.38); i^2 = 0%						
Test for overall effect: z = 4.49 (p < 0.00001)						
1.1.4 Postoperative dislocation						
Barrett (2013)	0	43	1	44	27.3%	0.34 [0.01, 8.14]
Cheng (2017)	1	35	1	38	17.6%	1.09 [0.07, 16.71]
Luo (2016)	0	52	1	52	27.6%	0.33 [0.01, 8.00]
Rodriguez (2014)	0	60	1	60	27.6%	0.33 [0.01, 8.02]
Subtotal (95% CI)		**190**		**194**	**100.0%**	**0.47 [0.11, 2.05]**
Total events	1		4			
Heterogeneity: χ^2 = 0.49, df = 3 (p = 0.92); i^2 = 0%						
Test for overall effect: z = 1.01 (p = 0.31)						
1.1.5 Groin pain						
Barrett (2013)	2	43	0	44	19.8%	5.11 [0.25, 103.51]
Rodriguez (2014)	4	60	2	60	80.2%	2.00 [0.38, 10.51]
Subtotal (95% CI)		**103**		**104**	**100.0%**	**2.62 [0.63, 10.94]**
Total events	6		2			
Heterogeneity: χ^2 = 0.29, df = 1 (p = 0.59); i^2 = 0%						
Test for overall effect: z = 1.32 (p = 0.19)						
1.1.6 Heterotopic ossification						
Barrett (2013)	1	43	0	44	33.1%	3.07 [0.13, 73.30]
Rodriguez (2014)	1	60	1	60	66.9%	1.00 [0.06, 15.62]
Subtotal (95% CI)		**103**		**104**	**100.0%**	**1.68 [0.23, 12.50]**
Total events	2		1			
Heterogeneity: χ^2 = 0.28, df = 1 (p = 0.60); i^2 = 0%						
Test for overall effect: z = 0.51 (p = 0.61)						



Test for subgroup differences: χ^2 = 18.11. df = 5 (p = 0.003), i^2 = 72.4%

Fig. 2 Forest plot depicting the meta-analysis of the comparison between the direct anterior approach (DAA) group and the posterior approach (PA) group in postoperative complications.

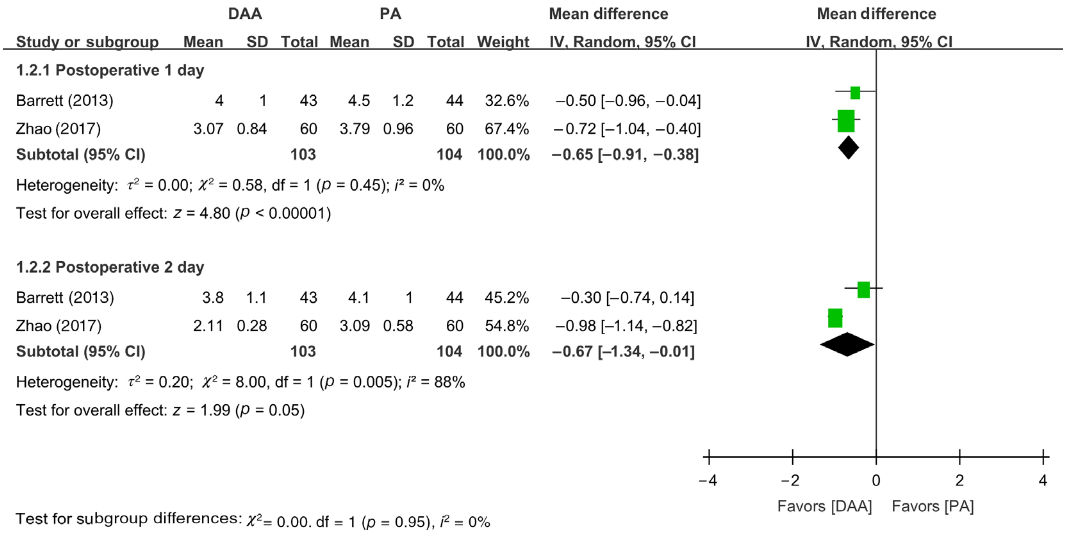


Fig. 3 Forest plot depicting the meta-analysis of the comparison between the direct anterior approach (DAA) group and the posterior approach (PA) group in postoperative visual analogue scale pain score.

Acetabular Component Number in Lewinnek Safety Zone

Three papers reported the number of acetabular prostheses in the Lewinnek's safe area (see Fig. S2). A heterogeneity test showed that there was no heterogeneity between the studies. A fixed effect model was used for analysis. The results showed that there was significant difference in the number of acetabular prostheses in Lewinnek's safety zones between DAA and PA groups (RR = 1.20, 95% CI [1.04–1.39], $P < 0.05$).

Time to Discontinuation of Use of Walking Aids

Two papers reported the time of discontinuation of use of walking aids after operation. The time of discontinuation of walking aids in the DAA group was earlier than that in the PA group (WMD = − 11.05, 95% CI [− 17.79– −4.31], $P < 0.05$) (see Fig. S3).

Discussion

Determining which artificial approaches to THA can achieve the most satisfactory curative effect and reduce the occurrence of trauma and postoperative complications has been a hot issue for scholars at home and abroad. At present, minimally invasive THA approaches include anterior, anterolateral, posterolateral, and double incision approaches. However, the length of the incision is not an important basis for judging minimally invasive THA. The core idea is that the implant will not cause damage to the muscles around the joint to achieve the best surgical results. DAA-THA is a minimally invasive procedure performed directly from the muscle gap. With the continuous improvement of surgical techniques and related surgical instruments, the effect of surgery is improving[7,30,31]. Compared with the posterolateral approach, DAA involves less trauma, faster recovery, and better and early curative effect.

Eleven high quality RCT were included in this study. Based on clinical and imaging analysis and surgical complications, the functional recovery, the walking ability, the and gait of the THA patients in the DAA group were better than those in the PA group. The VAS score of the DAA group was lower than that of the PA group and hips were lower than in the PA group. The number of acetabular prostheses in the Lewinnek safe area was more than that in the PA group. Soft tissue injury was worse in the PA group than in the DAA group, but the incidence of lateral femoral cutaneous nerve injury in the DAA group was higher than that in the PA group. There was no significant difference in the incidence of intraoperative fractures, postoperative dislocation, incision complications, heterotopic ossification, and pain in the inguinal region between the two groups; there was no significant difference in operative time, hospitalization time, and intraoperative bleeding volume between the two groups; and for acetabular anteversion and abduction, there was no significant difference in angle comparison.

The current study showed that in terms of early postoperative functional recovery, gait, and postoperative pain, the DAA group were better than the PA group. The reason is that the DAA causes little damage to the soft tissues. DAA is undertaken through the interspace of the sartorius, the rectus femoris, and the tensor fasciae latae, without cutting off the muscles, damaging the posterior capsule, or reducing external rotation. PA requires blunt separation of the gluteus maximus and transection of the lateral rotation muscle group, which can cause serious damage to the surrounding tissues. Both cadaveric study and MRI examination showed that soft tissue injury with the DAA was small. In this study, the presence of serum markers of muscle injury (CK) also confirmed that DAA caused little effect on peripheral soft

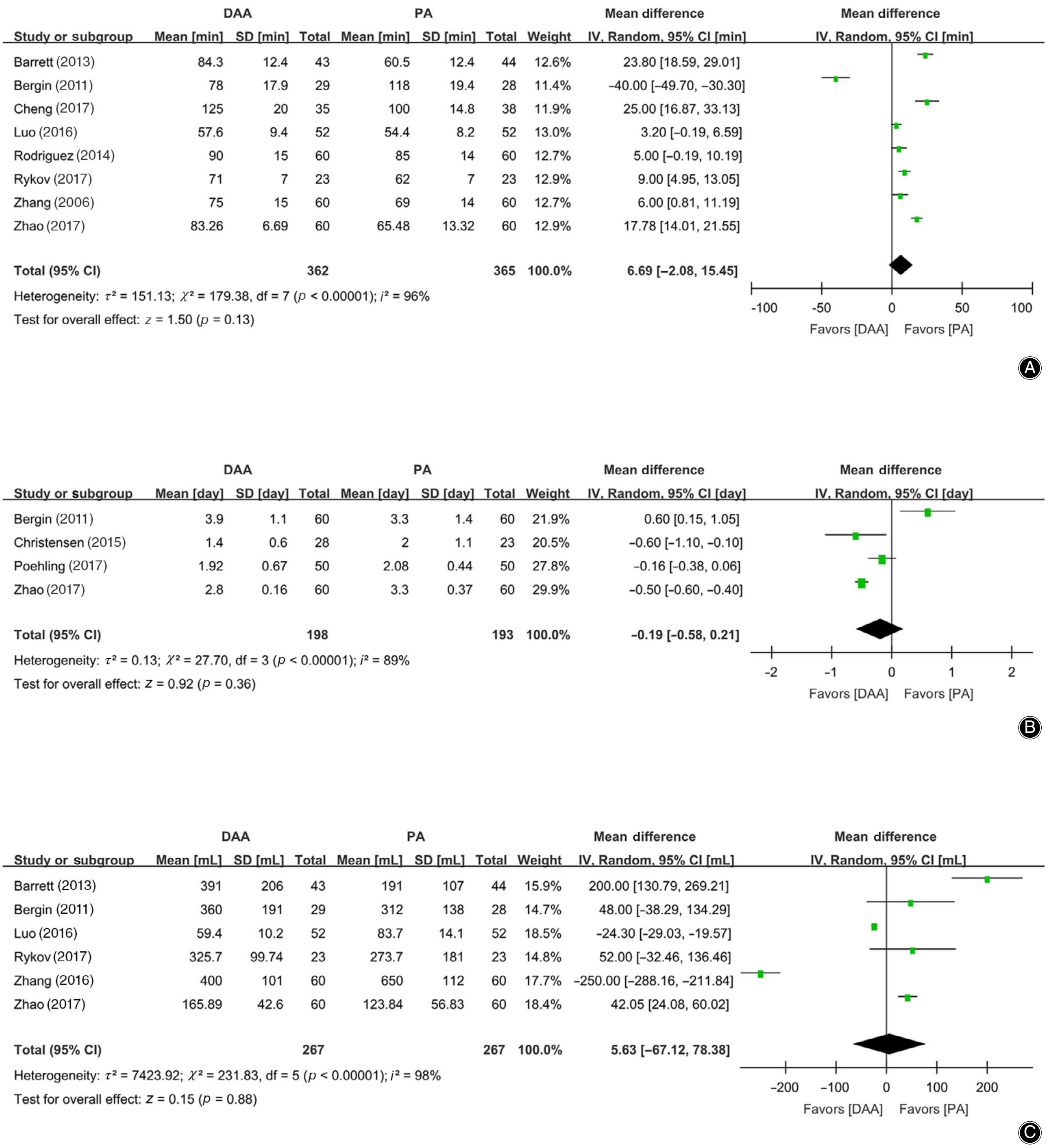


Fig. 4 Forest plot depicting the meta-analysis of the comparison between the direct anterior approach (DAA) group and the posterior approach (PA) group in (A) operative time, (B) hospital stay, and (C) blood loss.

tissue injury. In addition, compared with PA patients, DAA patients were not as restricted in movement after surgery.

The results of this study showed that the incidence of lateral femoral cutaneous nerve injury in the DAA group was significantly increased. It was reported that incision position, traction position, ligament and soft tissue treatment, and surgeon experience may increase the incidence of nerve injury. Injury of the lateral femoral cutaneous nerve can be manifested as numbness and discomfort in the lateral thigh area and numbness in the distal part of the incision. The symptoms of discomfort disappeared with time in the rehabilitation patients. There was no significant effect on the early functional recovery of the patients. Only 3 articles reported this complication in this study. Further studies are needed to confirm this. The results of this study showed that there was no significant difference in the incidence of postoperative dislocation, but the incidence of postoperative dislocation in the DAA group was lower than that in the PA group. Several studies have reported that the rate of dislocation after DAA is low, the group of circumflexors and the posterior capsule are intact, the surrounding soft tissue injury is minimal, and joint stability is maintained. In addition, DAA can obtain relatively good acetabular prosthesis placement. Theoretically, it can reduce the rate of dislocation, but long-term follow-up is needed to further verify the results.

The position of the acetabular prosthesis can affect joint function and the lifespan of the prosthesis. Poor positioning of the prosthesis can lead to dislocation, polyethylene wear, impact, and early revision. The ideal position of the acetabular prosthesis was Lewinnek safe area of anteversion $15^\circ \pm 10^\circ$ and abduction angle $40^\circ \pm 10^\circ$, respectively. There was no significant difference in acetabular anteversion and abduction angle between operative approaches. The reason why DAA can obtain an ideal prosthesis position is that DAA is mostly applied in the supine position, and the pelvis in the supine position is stable, not easy to rotate and tilt, and has little influence on acetabular prosthesis placement. In supine position, the surgeon can be more confident about the position of the pelvis. When the position of the acetabulum is not good, it can be found and adjusted in time. In lateral position, the variation of the pelvic inclination direction is great, which may affect the placement of the acetabular prosthesis. Therefore, DAA has more advantages in regard to inserting the acetabulum prosthesis into the Lewinnek safety zone.

One limitation of this system evaluation and meta-analysis was that the studies included have different functional evaluation indicators, which can only be used for descriptive analysis. In addition, the follow-up time was short, and the incidence of long-term complications cannot be compared. Moreover, this study only analyzed the effect of the surgical approach on the acetabular prosthesis and not the position of the femoral prosthesis. Finally, different primary diseases, surgical techniques, and measurement techniques for postoperative indicators in the literature included in this study may be heterogeneous and cannot be controlled. However, following careful selection of studies, the quality of the included literature in this study was high. All 11 RCT have passed the learning curve, increasing the reliability of the results.

In conclusion, DAA is superior to PA in providing early postoperative functional recovery, with mild postoperative pain and high incidence of lateral femoral cutaneous nerve injury. The results need to be validated by large-sample, high-quality RCT studies with long-term follow up of complications.

Supporting Information

Additional Supporting Information may be found in the online version of this article on the publisher's web-site:

Fig. S1 Forest plot depicting the meta-analysis of the comparison between the direct anterior approach (DAA) group and the posterior approach (PA) group in acetabular angle after operation. (A) Anteversion angle of acetabular cup and (B) abduction angle of acetabular cup.
Fig. S2. Forest plot depicting the meta-analysis of the comparison between the direct anterior approach (DAA) group and the posterior approach (PA) group in acetabular component number in Lewinnek safety zone.
Fig. S3. Forest plot depicting the meta-analysis of the comparison between the direct anterior approach (DAA) group and the posterior approach (PA) group in time to stop the use of walking aids.

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