Comparison of SuperPATH Approach and Moore Approach for Total Hip Arthroplasty in Patients With Femoral Neck Fractures: A Retrospective Study

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AIMS: Femoral neck fractures require total hip arthroplasty for treatment; however, the efficacy comparison between the Moore approach and the SuperPATH approach remains unclear. This study aims to explore the clinical efficacy of the SuperPATH approach and the Moore approach in total hip arthroplasty for patients with femoral neck fractures.

METHODS: A retrospective analysis of the clinical data of 110 patients with femoral neck fractures treated at Changhai Hospital from September 2021 to September 2024. According to the different approaches used for total hip arthroplasty, patients were divided into a SuperPATH group (SuperPATH approach, n = 50) and a Moore group (Moore approach, n = 60). Baseline information, operative parameters, inflammatory response, visual analogue scale (VAS) scores, Harris scores, 10-meter walking time, and complication rates were compared between the two groups.

RESULTS: Compared with the Moore group, the SuperPATH group had shorter operative time and incision length ($p < 0.05$), less intraoperative blood loss ($p < 0.001$), earlier time to first ambulation ($p < 0.05$), and shorter hospital stay ($p < 0.001$). On postoperative day 7, the inflammatory level in the Moore group was significantly higher than that in the SuperPATH group ($p < 0.05$). Compared with the Moore group, the VAS score of the SuperPATH group was lower on the first day, 7 days, and 1 month after the operation ($p < 0.001$). In the first week, one month, and three months after the operation, the Harris score of the SuperPATH group was significantly higher than that of the Moore group ($p < 0.001$). Two and three months after the operation, the 10-meter walking time of the SuperPATH group was shorter than that of the Moore group ($p < 0.05$). The total incidence of complications in the SuperPATH group was lower than that in the Moore group ($\chi^2 = 4.685$, $p = 0.030$).

CONCLUSIONS: Compared with the Moore approach, the SuperPATH approach for total hip arthroplasty in the treatment of femoral neck fractures has more advantages. It can shorten the operation time, reduce surgical trauma and inflammatory reactions, alleviate postoperative pain, improve joint function and walking ability, and reduce the incidence of complications.

Keywords: SuperPATH approach; Moore approach; total hip arthroplasty; femoral neck fractures; joint function

Introduction

Femoral neck fracture is a common clinical bone injury and represents a major health concern among middle-aged and elderly individuals. Because of age-related decline in physiological functions and progressive osteoporosis, these individuals are particularly susceptible to fractures, which may occur even with minor falls or twisting injuries [1]. The mortality rate in the first year after a femoral neck fracture can be as high as 20–30% [2,3]. The main clinical manifestations after a femoral neck fracture are hip pain, limited mobility, and external rotation deformity [4]. Femoral neck fractures are prone to damaging these blood vessels, which can lead to osteonecrosis of the femoral head and non-union of the fracture [5,6].

Currently, surgery is an important therapeutic approach for femoral neck fractures, and total hip arthroplasty (THA) is one of the main treatment options. THA replaces the patient's acetabulum and femoral head with prosthetic implants; although the procedure can be technically demanding, it can significantly improve quality of life, restore function and range of motion, and relieve pain in patients with advanced hip disease [7,8]. There are multiple surgical approaches for THA, among which the Moore approach and the SuperPATH approach are commonly used. The Moore approach is a traditional and widely used technique, but it may cause considerable damage to the muscles and soft tissues around the hip, potentially affecting postoperative pain and functional recovery [9]. With advances in medical technology, minimally invasive techniques have become increasingly frequent in THA. The SuperPATH approach is a relatively novel minimally invasive surgical route and has been used in recent years as a minimally invasive THA technique. Dr. James Chow (USA) was the first to describe the super-capsular percutaneously assisted total hip (SuperPATH) approach, which integrates the advantages of the super-capsular method and the percutaneously assisted to-

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tal hip procedure [10]. By accessing the hip capsule through the intermuscular space located between the gluteus medius and the piriformis, the SuperPATH technique avoids any incision to muscles or tendons [11,12]. Previous studies have shown that SuperPATH can shorten time to first ambulation and length of hospital stay, reduce complication rates, and decrease hospitalization costs [13,14]. It overcomes drawbacks of conventional total hip arthroplasty, such as slow recovery and prolonged bed rest, and has shown good clinical utility, thereby gaining increasing attention. Although the SuperPATH method has been attracting increasing clinical interest and adoption, evidence on the clinical efficacy of THA via the SuperPATH versus the Moore approach remains insufficient. Therefore, we compared the clinical efficacy of THA performed via the SuperPATH and Moore approaches in patients with femoral neck fractures.

This study aims to retrospectively analyze the potential clinical efficacy of total hip arthroplasty performed via the SuperPATH and Moore approaches in patients with femoral neck fractures. We compared baseline characteristics, perioperative indicators, inflammatory response, joint function, and complications between the two approaches to provide a reference for selecting surgical methods for the clinical treatment of femoral neck fractures.

Methods

Data Collection

We retrospectively analyzed the clinical data of 110 patients with femoral neck fractures treated at Changhai Hospital between September 2021 and September 2024. Inclusion criteria included: (1) confirmed femoral neck fracture; (2) age >60 years; (3) complete clinical data. Exclusion criteria included: (1) concomitant cardiac defects or major organ dysfunction; (2) history of prior hip surgery; (3) concomitant hip infection, hip tuberculosis, rheumatoid arthritis involving the hip, or other related diseases; (4) coagulation disorders; (5) cognitive impairment or abnormal mental status. According to the surgical approach used for total hip arthroplasty, patients were assigned to the SuperPATH group (SuperPATH approach, n = 50) or the Moore group (Moore approach, n = 60). The outcome assessors were independent and unaware of the patients' treatment groupings during data extraction and assessment. Informed consent of the patients was obtained in this study. The study has been approved by the ethics committee of Changhai Hospital (CHEC2025-161) and has been conducted in strict accordance with the Declaration of Helsinki.

Operation Method

The surgical plan was determined based on the type of fracture and the characteristics of the patients. All operations were performed by three senior orthopedic surgeons with many years of experience in hip surgery. Prophylactic intravenous administration of antibiotics was performed 30 minutes prior to surgery. Fifteen minutes before the procedure, tranexamic acid injection (Jiangsu Langou Pharmaceutical Co., Ltd., National Drug Approval No. H32022142, specification: 2 mL: 0.2 g) was added to 100 mL of saline and administered intravenously over 15 minutes. All prosthetic implants were supplied by Beijing Chunli Zhengda Medical Devices Co., Ltd.

SuperPATH group: Patients were placed in the lateral decubitus position and received general or epidural anesthesia. A longitudinal incision of about 6–8 cm was made from the tip of the greater trochanter proximally, and the skin, subcutaneous tissue, and tensor fascia lata were incised in sequence. Blunt dissection was used to separate the intermuscular interval between the gluteus medius and the piriformis to fully expose the hip capsule. The capsule was opened above the femoral neck, and a femoral neck osteotomy was performed inside the capsule using specialized instruments to remove the femoral head. Acetabular preparation and prosthesis implantation were then performed with dedicated instruments, followed by preparation and implantation on the femoral side. Finally, the capsule and the various tissue layers were sutured.

Moore group: Patients were placed supine with the affected buttock elevated and received general or epidural anesthesia. A longitudinal incision of about 10–15 cm was made on the posterolateral aspect of the hip, and the skin, subcutaneous tissue, fascia lata, and gluteus maximus were incised in sequence. Blunt dissection was used between the gluteus medius and the piriformis to expose the posterior hip capsule. The capsule was opened to expose the femoral head and acetabulum; a femoral neck osteotomy was performed and the femoral head was removed. The remaining surgery procedures were identical to those performed in the SuperPATH group.

Post-Operation

Anti-inflammatory and pain-relief therapies were given within 24 to 48 hours post-surgery. Patients were advised to engage in both active and passive hip exercises after 48 hours. According to the doctor's advice, patients were encouraged to gradually increase activity levels to reduce the risk of complications induced by prolonged bed rest, such as thrombosis. Regular follow-up visits, including scheduled imaging examinations, were conducted following the doctor's instructions to monitor recovery and promptly identify any potential complications.

Observation Indicator

We collected clinical data for two groups of patients. (1) Baseline characteristics: age, gender, body mass index (BMI), smoking history, hypertension, fracture type, fracture location, fracture time, and fracture reasons. (2) Surgical parameters: operation time, intraoperative blood loss, incision length, first time to get out of bed for activity, and hospitalization time. (3) Inflammatory response: before surgery and 7 days after surgery, we collected the serum interleukin-6 (IL-6), creatine kinase (CK), and C-reactive protein (CRP) data of the patients. (4) Pain degree: the vi-

Table 1. The baseline information of the two groups of patients.

	SuperPATH group (n = 50)	Moore group (n = 60)	t/χ^2	p
Age (years)	66.30 ± 5.15	67.95 ± 4.81	1.735	0.086
Gender (n, %)			0.031	0.859
Male	30 (60.00)	35 (58.33)		
Female	20 (40.00)	25 (41.67)		
BMI	21.06 ± 0.72	21.12 ± 0.68	0.449	0.655
Smoking history			0.102	0.749
Yes	12 (24.00)	16 (26.67)		
No	38 (76.00)	44 (73.33)		
Hypertension			0.140	0.709
Yes	15 (30.00)	20 (33.33)		
No	35 (70.00)	40 (66.67)		
Fracture type			0.098	0.952
Basal type	10 (20.00)	13 (21.67)		
Transcervical type	18 (36.00)	20 (33.33)		
Sub-capital type	22 (44.00)	27 (45.00)		
Injury (n, %)			0.185	0.667
Left	32 (64.00)	36 (60.00)		
Right	18 (36.00)	24 (40.00)		
Fracture time (h)	5.31 ± 0.99	5.58 ± 1.28	1.217	0.226
Reason for fracture			0.103	0.950
Tumble	20 (40.00)	23 (38.33)		
Traffic accident	18 (36.00)	21 (35.00)		
Heavy object crushing	12 (24.00)	16 (26.67)		

BMI, body mass index.

sual analogue scale (VAS) scores were collected before the operation and at 1 day, 7 days, and 1 month after the operation (with a total score of 10 points); higher scores indicate greater pain [15]. Scoring criteria: no pain = 0; mild pain not affecting sleep = 1–3; moderate pain mildly affecting sleep but tolerable = 4–6; severe/unbearable pain causing inability to sleep or awakening from sleep = 7–10. (5) Joint function: before surgery and 7 days, 1 month, and 3 months after surgery, we collected the Harris score (total score 100 points), with higher scores indicating better joint function [15,16]; the scoring criteria are as follows: excellent: 90–100 points; good: 80–89 points; passable: 70–79 points; poor: <70 points. (6) Walking ability: 1 month, 2 months, and 3 months after surgery, we evaluated the walking ability of patients using the 10-meter walking test. Timing began when the patients' leading foot crossed the start line and stopped when the leading foot crossed the finish line, and the time to walk the 10-meter distance was recorded [17]. (7) Complications: after surgery, patients received a three-month follow-up in the outpatient department. We recorded the occurrence of complications, including: infection, prosthesis dislocation, deep venous thrombosis, periprosthetic femoral fracture, etc. Criteria for infection diagnosis: ① identification of local signs such as redness, swelling, fever, and sinus tracts through physical examination; ② evaluation of soft tissue infections via imaging assessments. Prosthesis dislocation was confirmed through imaging reassessment.

Statistical Analyses

Statistical analyses were performed using SPSS software (version 23.0, SPSS Inc., Chicago, IL, USA). Continuous variables were assessed for normality using the Shapiro–Wilk test. Data were expressed as mean ± SD or median (interquartile range (IQR)) as appropriate, and compared using the independent samples t-test or Mann–Whitney U test accordingly. For the comparison within the group, the paired t-test was employed for two time-point comparisons. Post-hoc multiple comparisons were conducted using the Bonferroni correction method. Repeated measures analysis of variance was used for comparisons among groups at three or more time points. Categorical data are presented as numbers (percentages), with group comparisons carried out using the χ^2 test. A p value of less than 0.05 was deemed statistically significant.

Results

Comparison of Baseline Information

A total of 110 patients were included in this study, among which 50 were in the SuperPATH group and 60 were in the Moore group. The age of patients in the SuperPATH group was 66.30 ± 5.15, with 30 males and 20 females; 32 had left fractures and 18 had right fractures. The age of patients in the Moore group was 67.95 ± 4.81, with 35 males and 25 females; 36 had left fractures and 24 had right frac-

Table 2. Comparison of perioperative-related indicators between the two groups of patients.

Group	Operation time (min)	Intraoperative blood loss (mL)	Incision length (cm)	First time to get out of bed for activity (h)	Hospitalization time (days)
SuperPATH group (n = 50)	95.32 ± 13.62	116.71 ± 15.62	7.15 ± 0.56	20.55 ± 3.02	14.27 ± 1.85
Moore group (n = 60)	104.10 ± 15.84	130.42 ± 18.95	11.20 ± 0.99	22.12 ± 2.14	16.35 ± 2.32
t	3.083	4.087	25.692	3.182	5.124
p	0.003	<0.001	<0.001	0.002	<0.001

Table 3. Comparison of inflammatory responses between the two groups of patients.

Group	IL-6 (pg/mL)		CK (U/L)		CRP (mg/L)	
	Pre-operation	7 days after surgery	Pre-operation	7 days after surgery	Pre-operation	7 days after surgery
SuperPATH group (n = 50)	17.81 ± 3.81	25.94 ± 3.61*	79.92 ± 31.97	93.88 ± 35.73*	18.84 ± 2.91	25.89 ± 3.57*
Moore group (n = 60)	17.06 ± 4.91	28.56 ± 2.98*	80.49 ± 33.09	108.84 ± 32.85*	18.12 ± 2.48	31.93 ± 2.16*
t	0.881	4.170	0.091	2.285	1.401	10.928
p	0.380	<0.001	0.927	<0.024	0.164	<0.001

Note: * $p < 0.05$ vs pre-operation. IL-6, interleukin-6; CK, creatine kinase; CRP, C-reactive protein.

Table 4. Comparison of perioperative VAS score changes at multiple time points between the SuperPATH and Moore groups.

Group	Pre-operation	1 day after surgery	7 days after surgery	1 month after surgery
SuperPATH group (n = 50)	7.86 ± 0.57	5.89 ± 0.70*	4.24 ± 0.65*	2.00 ± 0.70*
Moore group (n = 60)	7.89 ± 0.75	6.52 ± 0.60*	5.03 ± 0.41*	3.02 ± 0.75*
t	0.232	5.083	7.748	7.320
p	0.817	<0.001	<0.001	<0.001
F inter-group/*p* inter-group		102.447/<0.001		
F time/*p* time		1185.415/<0.001		
F interaction/*p* interaction		10.360/<0.001		

Note: * $p < 0.05$ vs pre-operation. VAS, visual analogue scale.

tures. There were no significant differences in gender, age, or fracture sites between the two groups ($p > 0.05$) (Table 1).

Comparison of Perioperative-Related Indicators

Compared with the Moore group, the SuperPATH group exhibited a reduced duration of surgery and a smaller incision length ($p < 0.05$). Additionally, patients in the SuperPATH group experienced lower blood loss during the operation ($p < 0.001$), achieved earlier post-surgery ambulation ($p < 0.05$), and had a decreased length of hospital stay ($p < 0.001$) (Table 2).

Comparison of Inflammatory Responses

Before the operation, there was no statistically significant difference in the levels of interleukin-6 (IL-6), creatine kinase (CK) or CRP in the serum of the two groups of patients ($p > 0.05$). Seven days after the operation, the inflammatory level in the Moore group was significantly higher than that in the SuperPATH group ($p < 0.05$). Compared with before the operation, the levels of IL-6, CK and CRP in the SuperPATH group significantly increased 7 days after the operation ($p < 0.05$). Compared with before the operation, the levels of IL-6, CK and CRP in the Moore group also significantly increased 7 days after the operation ($p < 0.05$) (Table 3).

Comparison of VAS Scores

The differences in VAS scores for between-group, time-point, and interaction were all statistically significant ($p < 0.001$). Before the operation, there was no statistically significant difference in the VAS scores between the SuperPATH group and the Moore group ($p > 0.05$). Compared with the Moore group, the VAS scores of the SuperPATH group were lower on the first day, the seventh day, and one month after the operation ($p < 0.001$). Compared with pre-operation, the VAS scores of the SuperPATH group significantly reduced at 1 day, 7 days and 1 month after the surgery ($p < 0.05$). Similarly, the VAS scores of the Moore group also significantly reduced at 1 day, 7 days and 1 month after the surgery ($p < 0.05$) (Table 4).

Comparison of Harris Scores

The differences in Harris scores for between-group, time-point, and interaction were all statistically significant ($p < 0.001$). Before the operation, there was no statistically significant difference in the Harris scores between the SuperPATH group and the Moore group ($p > 0.05$). Compared with the Moore group, the Harris score of the SuperPATH group was higher at one week, one month, and three months after the operation ($p < 0.001$). Compared with pre-operation, the Harris scores of the SuperPATH group significantly increased at 1 week, 1 month and 3 months af-

Table 5. Comparison of Harris scores between the two groups of patients.

Group	Pre-operation	1 week after surgery	1 month after surgery	3 months after surgery
SuperPATH group (n = 50)	35.87 ± 2.97	72.86 ± 2.10*	82.38 ± 2.58*	90.68 ± 5.28*
Moore group (n = 60)	35.98 ± 3.21	69.65 ± 3.48*	79.14 ± 2.15*	85.97 ± 6.84*
t	0.185	5.711	7.185	3.979
p	0.853	<0.001	<0.001	<0.001
F inter-group/*p* inter-group		9.799/<0.001		
F time/*p* time		5404.035/<0.001		
F interaction/*p* interaction		69.054/<0.001		

Note: * $p < 0.05$ vs pre-operation.

Table 6. Comparison of the 10-meter walking time after surgery between the two groups of patients.

Group	1 month after surgery	2 months after surgery	3 months after surgery
SuperPATH group (n = 50)	14.52 ± 2.85	11.24 ± 2.58*	9.00 ± 1.21*
Moore group (n = 60)	14.23 ± 2.42	12.12 ± 1.99*	10.58 ± 1.03*
t	0.577	2.019	7.398
p	0.565	0.046	<0.001
F inter-group/*p* inter-group		42.831/<0.005	
F time/*p* time		190.668/<0.001	
F interaction/*p* interaction		7.756/<0.001	

Note: * $p < 0.05$ vs 1 month after surgery.

Table 7. Comparison of postoperative complications between the two groups of patients.

Group	Infection	Prosthesis dislocation	Deep venous thrombosis	Periprosthetic femoral fracture	Total incidence
SuperPATH group (n = 50)	2 (4.00)	0 (0.00)	1 (2.00)	1 (2.00)	4 (8.00)
Moore group (n = 60)	5 (8.33)	4 (6.67)	2 (3.33)	3 (5.00)	14 (23.33)
χ^2					4.685
p					0.030

ter the surgery ($p < 0.05$). Similarly, the Harris scores of the Moore group also significantly increased at 1 week, 1 month and 3 months after the surgery ($p < 0.05$) (Table 5).

Comparison of the 10-Meter Walking Time After Surgery

The differences in 10-meter walking time for between-group, time-point, and interaction were all statistically significant ($p < 0.005$ or $p < 0.001$). One month after the surgery, there was no statistically significant difference in the 10-meter walking time between the two groups ($p > 0.05$). Two and three months after the surgery, the 10-meter walking time of the SuperPATH group was significantly shorter than that of the Moore group ($p < 0.05$). The SuperPATH group experienced a continuous reduction in the 10-meter walking time from 1 month to 3 months after the surgery ($p < 0.05$). The Moore group also exhibited a continuous decrease in the 10-meter walking time from 1 month to 3 months after the surgery ($p < 0.05$) (Table 6).

Comparison of Postoperative Complications

In terms of complications, 4 cases of complications (8.00%) were observed in the SuperPATH group after surgery, including 2 cases of infection, 1 case of deep vein thrombosis in the lower extremities, and 1 case of femoral fracture around the prosthesis; while in the Moore group, there were 14 cases of complications (23.33%), including 5 cases of infection, 4 cases of prosthesis dislocation, 2 cases of deep vein thrombosis in the lower extremities, and 3 cases of femoral fracture around the prosthesis. The difference in the total incidence of postoperative complications between the two groups was statistically significant ($\chi^2 = 4.685$, $p = 0.030$) (Table 7).

Discussion

Femoral neck fractures disrupt the normal structure and function of the hip joint, limiting joint mobility [18]. Total hip arthroplasty is a commonly used procedure for treating femoral neck fractures and is recognized as a mature and highly standardized technique. It primarily restores the overall hip joint functional system in patients with femoral neck fractures, improves hip function, relieves joint pain, promotes recovery, and effectively improves patient prognosis [7,8]. In THA, the choice of surgical approach is critical because it directly determines the extent of muscle and soft-tissue damage, which in turn affects postoperative hip stability and the risk of dislocation. Therefore, minimizing soft-tissue injury without compromising prosthesis implantation efficacy has become the primary principle for selecting a surgical approach and the fundamental basis for determining the ideal approach.

At present, the posterolateral approach is the most frequently employed technique in traditional total hip arthroplasty. However, this procedure involves the removal of the posterior external rotator muscles along with the joint capsule, which may lead to additional damage to surrounding muscles and soft tissues, thereby increasing surgical trauma and blood loss. At the same time, removing the hip external rotators can weaken the abduction strength of the affected limb, which is unfavorable for early functional recovery. In recent years, with improvements in minimally invasive THA techniques and accumulating experience, minimally invasive THA has been increasingly adopted by surgeons [19]. The core advantage of minimally invasive THA is that, while ensuring effective prosthesis implantation, it can maximize soft-tissue protection and reduce perioperative bleeding through a small incision and an intermuscular approach, thereby significantly accelerating recovery of hip function [20]. The SuperPATH technique combines the SuperCap method with the PATH technique [21,22]. This minimally invasive technique accesses the surgical site through the interval between the gluteus minimus and the piriformis muscles, enabling exposure of the surgical area using specialized tools. A percutaneous puncture channel is created for acetabular preparation, while the femoral handling is performed in its original position. No muscles need to be transected, which preserves the periarticular soft tissues and joint capsule, maintains hip stability, and reduces the risk of dislocation.

In this study, the results showed that compared with the Moore group, the SuperPATH group had shorter operative time and incision length, less intraoperative blood loss, earlier first ambulation, and shorter hospital stay. This suggests that total hip arthroplasty via the SuperPATH approach has a significant advantage in reducing surgical trauma. IL-6, CK, and CRP are important markers of systemic inflammatory response and soft-tissue injury [23,24]. The results showed that on postoperative day 7, serum IL-6, CK, and CRP levels in both groups were elevated compared with preoperative values, and levels in the Moore group were significantly higher than those in the SuperPATH group. This indicates that the SuperPATH approach causes less tissue injury, with reduced activation of inflammatory cells and release of inflammatory mediators, thereby attenuating the postoperative inflammatory response and facilitating recovery. The SuperPath approach preserves the periarticular muscles, such as the external rotator muscles and the piriformis muscle, ensuring the integrity of the anterior and posterior parts of the hip joint capsule [25]. This surgery involves the original removal of the femoral neck and femoral head without requiring hip dislocation, thus minimizing surgical trauma and improving safety [12].

After a femoral neck fracture, pain, local tissue damage, and activity limitation from the fracture cause a sharp decline in joint function and severely restrict walking ability [18]. SuperPATH improves joint function and walking capacity, promoting recovery [26]. Compared with traditional approaches, the SuperPATH approach reduces damage to muscles, tendons, and the joint capsule [25], thereby lowering VAS scores. In this study, the SuperPATH group had lower VAS scores than the Moore group on postoperative day 1, day 7, and at 1 month. The SuperPATH group also had higher Harris scores than the Moore group at 1 week, 1 month, and 3 months postoperatively. Additionally, at 2 and 3 months postoperatively, the SuperPATH group recorded shorter 10-meter walking time than the Moore group, with the differences being statistically significant. These findings were similar to those of Shen *et al*. [27]. Notably, Jianbo *et al*. [28] found that at 1-week follow-up the SuperPATH group had significantly lower VAS scores and HHS than the posterolateral approach group, but there were no significant differences at 3 months and 2 years. These results suggest that the SuperPATH method for THA facilitates early functional recovery, although its long-term effects require further investigation.

Total hip arthroplasty can significantly improve hip function and quality of life [29,30]. However, postoperative complications remain key factors affecting recovery and patient prognosis. These risk factors may delay postoperative recovery, increase patient discomfort, and affect the safety and effectiveness of treatment [31,32]. Regarding complication rates, our study showed that the overall complication rate in the SuperPATH group was significantly lower than in the conventional Moore group. The SuperPATH group had lower incidences of periprosthetic femoral fracture and prosthesis dislocation. This difference may be attributable to the different impacts of the two surgical approaches on soft tissues and neural structure [12,25,33].

Although this study provides valuable clinical comparative data to inform the choice of surgical methods for treating femoral neck fractures, it has several limitations. Firstly, the sample size is insufficient, which affects the generalizability and reliability of the research results. Secondly, given the retrospective design of this study, data on prefracture anticoagulation status and baseline functional condition were unavailable, and no multivariate regression or propensity score matching was performed, which may introduce potential confounding bias. Thirdly, the distribution rules of fracture types and patient characteristics cannot completely avoid clinical subjective judgment and be externally verified. Future research should focus on large-scale, multi-center, long-term, prospective randomized controlled trials, or at least adopt a clear stratified randomization scheme. The adoption of propensity score matching is also recommended to improve the generalizability, validity and robustness of the results.

Conclusions

This study compared the clinical efficacy of the SuperPATH approach and the conventional Moore approach in patients undergoing total hip arthroplasty. The SuperPATH approach significantly shortened operative time and incision length, reduced intraoperative blood loss, shortened

time to first ambulation and hospital stay, decreased inflammatory response, improved postoperative VAS and Harris scores, enhanced walking ability, and reduced the incidence of complications. The minimally invasive SuperPATH technique may be an option for THA in the treatment of femoral neck fractures and provides a reference for selecting surgical methods in clinical practice.

Availability of Data and Materials

The data analyzed are available from the corresponding author upon reasonable request.

Author Contributions

YMW had the original conception of the work. YMW and KQ collected the clinical data. YMW and KQ performed the research. YMW and KQ drafted the manuscript. Both authors have been involved in revising the manuscript critically for important intellectual content. Both authors gave final approval of the version to be published. Both authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Changhai Hospital (CHEC2025-161) and has been conducted in strict adherence to the Declaration of Helsinki. Informed consent was obtained from the patients.

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Conflict of Interest

The authors declare no conflict of interest.

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