



Hip hemiarthroplasty for senile femoral neck fractures: Minimally invasive SuperPath approach versus traditional posterior approach



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ABSTRACT

Background: The supercapsular percutaneously-assisted total hip (SuperPATH[®]) approach was created by combining the percutaneous preparation of the acetabulum using the percutaneously-assisted total hip (PATH), femoral reaming, and broaching of superior capsulotomy (SuperCap) approach. This technique reported a low complication rate, excellent gait kinematics, low transfusion rate, a shorter length of hospital stay, and a high proportion of discharge from the hospital. As minimally invasive SuperPath approach is designed for both trauma and end-stage degenerative joint disease, we investigated if this technique and standard surgical tools can replace artificial femoral head in elderly patients with femoral neck fracture. We also tested if it has advantages over the traditional posterior approach.

Methods: A prospective study was performed in 100 cases of eligible femoral neck fractures from May 01, 2015 to October 31, 2016. They were randomly divided into SuperPath and traditional group. The outcomes were evaluated using preoperative index, intraoperative data, and postoperative function data.

Results: No significant difference was detected in the operation time between the two groups. Compared with the traditional group, SuperPath group had smaller incision length, less intraoperative bleeding, lower transfusion rate, and a shorter starting time of weight-bearing activity. Harris Hip Score, Barthel Index, and VAS for pain-level scores in the SuperPath group at 1-week follow-up intervals were significantly lower than the conventional group, but not significantly different at 3-month and 2-year follow-up post-operation.

Conclusions: SuperPath approach for artificial femoral head replacement can reduce surgical injury due to smaller size of incision and accelerate weight-bearing activities post-operation to treat senile femoral neck fractures compared with traditional posterior approach surgeries.

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Background

The incidence of femoral neck fracture in the elderly has been gradually increasing. Artificial femoral head replacement is regarded as one of the most successful orthopedic reconstructive procedures to improve life quality in patients suffering from femoral neck fractures. Over the past 18 years, several tissue-sparing minimally invasive approaches for hip arthroplasty have been described [1–4]. These techniques encourage early mobilization, preserve gait kinematics, decrease pain, and

reduce the need for postoperative narcotic analgesia. It also promotes unrestricted range of hip motion and facilitates expedited discharge from the hospital. Chow et al. [5] argued that these minimally invasive techniques have their own shortcomings, such as long learning curve, high incidence of overall surgical complications, prolonged operation time, and increased intraoperative bleeding, etc. [6–13]. To solve these problems in minimally invasive hip arthroplasty, a novel tissue sparing surgical technique (SuperCap[®], MicroPort Orthopedics Inc., Arlington, TN, USA) was described by Murphy in 2004 [14]. Another technique, PATH[®] (MicroPort Orthopedics Inc., Arlington, TN, USA), was developed by Penenberg et al. in the same year [15]. In 2011, the surgical technique and initial experience of the supercapsular percutaneously assisted total hip (PATH[®]) (SuperPath[®], MicroPort Orthopedics Inc., Arlington, TN, USA) was published [5]. This technique combined the percutaneous preparation of the acetabulum through a portal of the PATH

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approach and the femoral reaming and broaching of the SuperCap approach. This method had a low complication rate, excellent gait kinematics, low transfusion rate, shortened length of hospital stay, and high proportion of discharge from the hospital.

In 2014, the supercapsular percutaneously assisted total hip arthroplasty (SuperPath) was introduced in China. Shanghai Pudong Hospital, China was one of the earliest institutions to carry out this surgical technique. As this method was designed for both trauma and end-stage degenerative joint disease, we investigated if this technique and standard surgical tools can be used to replace artificial femoral head in elderly patients with femoral neck fracture, and if there are advantages over traditional posterior approach.

Methods

Study design

This was a prospective randomized controlled trial of patients with femoral neck fractures. The study was conducted according to the “CONSORT statement” guidelines for randomized control trials [8]. The trial strictly follows the guidelines of the ethical censorship of Fudan University and has been also approved by the Ethics Committee of Shanghai Pudong Hospital Affiliated to Fudan University.

Inclusion and exclusion criteria

Inclusion criteria were the following: (1) patients of age > 75 years old; (2) patients with fresh femoral neck fracture (type Garden III and IV); (3) patients who are able to go to the ground before trauma; (4) patients with unconscious disorders who can endure surgery.

Exclusion criteria were the following: (1) patients with Sciatic nerve injury; (2) patients with pathological fracture, femoral head necrosis, and arthritis of the affected hip joint; (3) patients with trauma and fracture history of other parts; (4) patients who were followed up for less than 24 months and those who were lost in the follow-up period.

Patients

Between May 01, 2015, and October 31, 2016, a total of 100 consecutive senile patients who suffered from fresh femoral neck fracture and met the inclusion criteria were recruited and randomly assigned to two groups at the Shanghai Pudong Hospital, China. Group one included 50 patients who were operated using the SuperPath Approach, while group two included 50 patients who were operated using the conventional posterior approach. The patients' demographics are shown in Table 1. All the patients had hip pain and limited movement before the surgery. Before the surgery, the X-ray films of the pelvis were improved and plain CT scan and three-dimensional reconstruction of the hip were performed. All the patients in both the groups received surgery within seven days (3.5 ± 2.6) after the injury. All the surgeries were performed by one senior orthopedic chief surgeon. Fifty patients in the SuperPath group received minimally invasive SuperPath approach for femoral head replacement, including the SuperPath artificial femoral head, femoral neck, femoral stalk prosthesis, and related supporting surgical tools produced by Wright Medical Technology. Fifty patients in the traditional group received traditional posterior approach for femoral head replacement. Functional outcomes were evaluated using the following measures: Harris Hip Score (HHS), Barthel Index (BI), visual analog scale (VAS) for pain level.

Table 1

Preoperative patients' demographic characteristics in SuperPath group and conventional group.

	SuperPath group	Conventional group	P value
No. of patients	50	50	–
Age (years)	78.1 ± 2.3	79.5 ± 2.6	0.520
Gender(F/M)	19/31	21/29	0.152
BMI (kg/m ²)	23.82 ± 1.53	24.06 ± 1.72	0.321
VAS	7.62 ± 1.53	7.46 ± 1.52	0.732
Harris Hip Score	15.4 ± 2.8	15.6 ± 2.4	0.399
Barthel Index	67.9 ± 4.35	65.4 ± 5.62	0.151
Side (L/R)	21/29	23/27	0.611
Bedsore	1	0	0.315
Hypertension	32	31	0.836
Cardiopathy	6	8	0.564
Diabetes	15	17	0.668
Cerebrovascular accident	8	5	0.372
Chronic bronchitis	5	4	0.727

Preoperative preparation

The preoperative preparation included internal medicine preparation, such as control of blood pressure, blood sugar, correct anemia, hypoalbuminemia, treatment of bedsore, etc. Infections, such as control respiratory tract infection, urinary tract infection and gingivitis, oral ulcer and other diseases were assessed. X-ray examination of pelvis and hip joint were performed before operation, and template measurements were carefully performed to determine the center of rotation, setover, acetabular and femoral prosthesis size, neck length, and osteotomy position of the hip joint. All patients underwent 3D CT reconstruction before surgery to assess the presence of fractures and bone defects with lesser trochanter of femur. They also underwent color Doppler ultrasonography of lower extremity arteries, veins, and D-dimer examination before surgery to visualize if deep vein thrombosis was present. Both professional surgical tools for SuperPath minimally invasive approach before surgery and conventional surgical tools were prepared. The operative leg was cleaned one day before the surgery, and antibiotics were applied 30 min before surgery.

SuperPath approach

This approach included the use of general anesthesia (Fig. 1). The patient was positioned in standard lateral decubitus and baffle bracket was placed at the front and rear of the symphysis pubis and sacrum. This position does not affect the intraoperative X-ray examination, and provides stability of patient body operative leg such that enough flexion, adduction, and internal rotation angle is maintained (bend is not less than 90°, the contralateral lower limbs in straight, to ensure that the injured side limb has enough adduction perspective). Following standard aseptic preparation and draping of the operative site, a skin incision was made from the tip of the greater trochanter to a length ranging from 6 to 8 cm proximally in line with the operative leg at approximately 45° of flexion and 20–30° of adduction. The gluteal fascia was incised, and the gluteus maximus was separated in line with fibers. The interval between the gluteus minimus and piriformis was exposed using a Zelpi retractor. A Cobb elevator pushed the posterior part of the gluteus minimus muscle anteriorly and exposed the hip joint capsule.

The capsule was then incised along the path of the skin incision using electrocautery with an attention to the trochanteric fossa to ensure hemostasis at the base of the femoral neck. The capsular incision was extended from the saddle of the femoral neck to 1 cm proximal to the acetabular rim. The assistant lifted the knee to neutral and a Cobb elevator was placed between the posterior

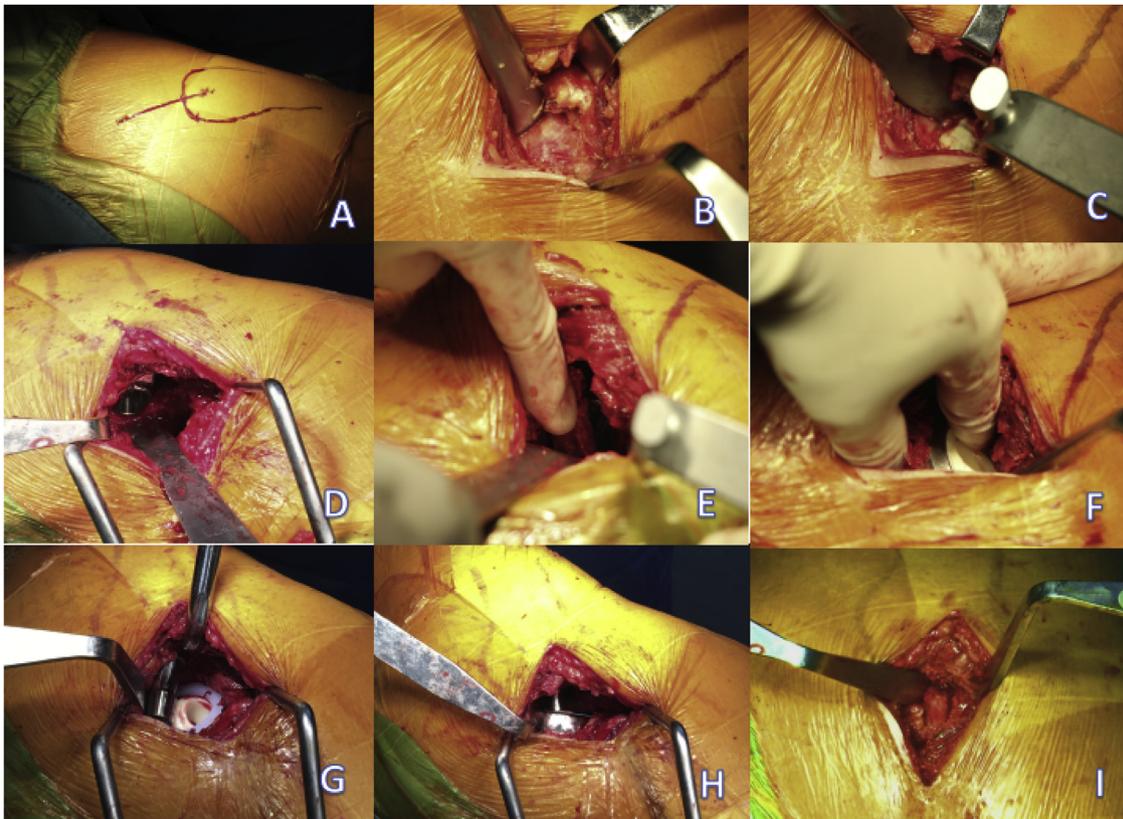


Fig. 1. Minimally invasive SuperPath approach for artificial femoral head replacement: marked surgical incision approach (A); Retract and expose the joint capsule from the gluteus minimus and piriformis Spaces (B); Expose the femoral neck, osteotomy of the femoral neck, and remove the femoral head (C); The proximal femur was firmly fixed and medullated, and the femoral stalk prosthesis was implanted (D); Bone grafting at the defect of the opening of the greater trochanter of femur (E); Implant appropriate bipolar head prosthesis(F); Implant Appropriate femoral neck prosthesis (G); Reduction of hip joint by manipulation (H); Complete suture of joint capsule (I).

capsule and posterior femoral neck. This was then replaced with a blunt Hohmann retractor to protect the surrounding soft tissue. The leg was adjusted to buckling 45° and adduction 15°. The femoral neck was cut off about 0.5 cm away from the femoral neck fracture line. After removing the femoral head and trimming the acetabulum, the self-designed femoral neck retractor was placed at each side of the proximal femur and below the femoral calcar (Fig. 3). Three hooks held the proximal femur firmly in place like claws (Fig. 4) where they fully exposed the intertrochanteric fossa, proximal femur, and provided a perfect surgical view. Hip joint adduction 15°, buckling 50°, intorsion 90°, reaming of the medulla along the axis of the femur. The femoral canal was entered 0.5 cm outside away from the Vertex of intertrochanteric fossa.

The cancellous bone was removed from the neck groove of the femur with a spatula and exposed to the cortical bone of femoral calcar to prevent undersizing of the implant and subsequent subsidence. With the ream and broach system, the femoral metaphysis was sequentially reamed until it met with resistance due to the isthmus of the femoral canal. Intramedullary reaming and cancellous resistance were confirmed with a cortical feeler gauge beyond the reamed level. The broach handle was then removed at the final size, leaving the broach in place to act as a femoral component trial. Broach trial position was compared to the preoperative template by measuring offset and distance from the tip of the greater trochanter to the shoulder of the broach trial. Meanwhile, the depth of broach was determined by direct vision where the standard is 1 cm above the femoral calcar. Finally, intraoperative X-ray examination was performed to determine the final size of broach. The excess cortical bone close to the end of broach of femoral neck was cut off using a narrow saw blade.

A trial modular neck-sized region was preoperatively selected from the template and placed into the femoral broach. The trial modular femoral head was placed in the acetabular component. The surgeon then used the T-handle to bring the head, neck together, and the assistant controlled the rotation by raising or lowering the foot or knee. The stability and range of motion were tested, and an intraoperative AP radiograph was taken to compare restoration of leg length, femoral shaft offset, and trial component position. The definitive femoral head was inserted, and a femoral prosthesis and stem were implanted and reduced again. Final stability testing was again performed. The hip joint capsule was perfectly preserved and closed with a suture. Then, a negative pressure drainage tube was placed in the wound, and the gluteal fascia and skin were closed with sutures. The self-designed femoral neck retractor was used throughout the operation to provide proximal femur stability and a good surgical field of view.

Posterior approach technique

The patient was placed in a lateral position; the incision was started 10 cm distal to the posterior superior iliac spine and extended to the posterior margin of the greater trochanter. Length of the incision was 12–13 cm, exposure and division of the deep fascia was in line with the skin incision. The fibers of the gluteus maximus were dissected bluntly and separated, exposing the greater trochanter. Divisions of the distal fibers were exposed, and the external rotators were released. The muscles were retracted medially, and the capsule was exposed and split distally to the proximal along the line of the femoral neck to detach the distal part of the capsule from the femur the rim of the acetabulum. The

standard posterior technique was followed to perform the femoral neck osteotomy, the hip was dislocated posteriorly, and the prosthesis was implanted. The joint capsule was repaired as much as possible, and the external rotator cuff was sutured and fixed to the great trochanter.

Postoperative management

All patients were treated with antibiotics for 24 h after surgery, and parecoxib sodium (50 mg of sodium intravenous drip) was regularly applied twice a day for three days. Immediately after recovery from anesthesia, if the patients could tolerate the pain, passive and active leg raising and hip bending exercises were performed. Based on the muscle strength conditions of the operated leg, patients were also encouraged to gradually carry out partial weight training as early as possible. On the second day after surgery, blood routine and CRP were reexamined, white blood cell count and neutrophil percentage were understood, hemoglobin concentration and erythrocyte specific volume were determined, infection and anemia were assessed, d-dimer was reexamined, deep vein thrombosis was observed, and b-ultrasonography of both lower limbs was performed if necessary. Blood routine and CRP were re-examined on the second day after surgery to determine whether there was infection and anemia. D-dimer was also re-examined to observe the presence of deep vein thrombosis, and ultrasound examination of lower extremity vessels was performed when necessary.

Follow-up

All patients were followed up in the rehabilitation unit of Shanghai Pudong Hospital, China. The operation time, intraoperative blood loss, length of incision, postoperative 48 h drainage, time to weight bearing, and complications were evaluated between the two groups. The postoperative outcomes were assessed at 1-week, 6-month, and 2-year follow-up intervals after the operation.

Statistics

All statistical analyses were performed using SPSS 12.0 (SPSS, Inc., Chicago, IL, USA). The clinical data and radiographic parameters were expressed as mean \pm standard deviation. Differences between the two groups were detected using Student's *t*-test and χ^2 test. The Shapiro-Wilk and Levene's tests showed normal data distribution and variance. P value less than 0.05 was considered statistically significant.

Results

All the 100 patients successfully completed the operation and were followed up. In the 2-year follow-up, no prosthesis loosened or subsided. All patients were assessed according to their weight-bearing ability on the first postoperative day. It was observed that 100% of the patients in the SuperPath group could mobilize without restriction. Both groups showed substantial overall improvement in mobility and function compared with preoperative status (Fig. 2). Compared with the traditional group, the SuperPath group had a smaller incision length, less intraoperative bleeding, little transfusion rate, and a shorter starting time of weight-bearing activity. There was no significant difference in operation time between the two groups (Table 2). Harris Hip Score, Barthel Index, and VAS for pain-level scores in the SuperPath group at 1-week follow-up intervals were significantly lower than conventional group, but not significantly different at 3-month and 2-year follow-up post-operation (Table 3). During the perioperative period, none of the patients had fractures, deep venous thrombosis, postoperative infection, sciatic nerve injury paralysis, or heterotopic ossification. In the SuperPath group, an 80-year-old female suffered dislocation after 40 days of operation (Fig. 5). No significant postoperative complications were observed in either of the two groups.

Fig. 5 Image showing the dislocation of hip joint in female (80 years old), fracture of right femur neck which occurred 40 days after operation using the SuperPath approach.



Fig. 2. Female patient, 84 years old, suffering from left hip pain and activity restriction for 3 h after accidental fall, preoperative pelvic X-ray showed fracture of left femoral neck (A); Minimally invasive SuperPath approach left artificial femoral head replacement 2 d after pelvic X-ray (B); The incision length was about 8 cm (C); Weight bearing activities can be assisted 2 days after surgery (d); Follow-up of affected limb function at 6 months after surgery (E).

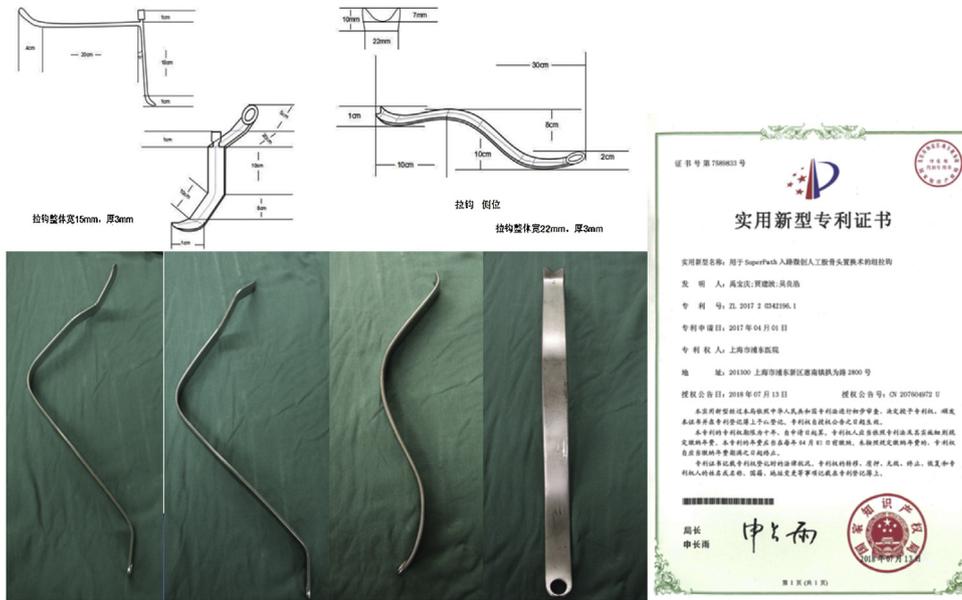


Fig. 3. The self-designed femoral neck retractor for artificial femoral head replacement was used in the SuperPATH approach for patients with femoral neck fractures.

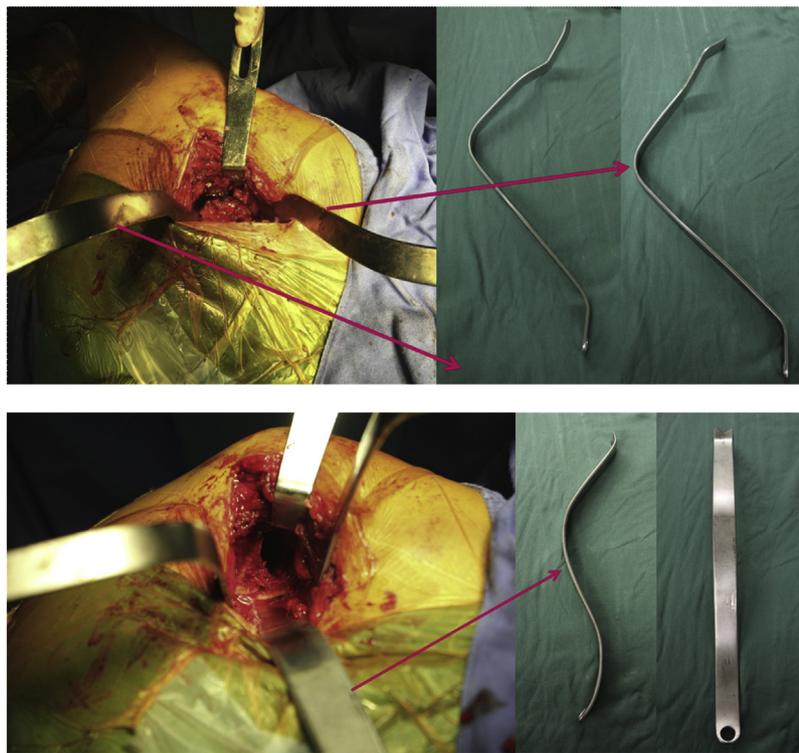


Fig. 4. Femoral neck retractor were Used in surgery.

Table 2
Perioperative patients' data.

	SuperPath group	Traditional group	P value
Operation time (m)	56 ± 7	53 ± 6	0.326
Blood loss (ml)	132 ± 29	156 ± 28	0.001
Transfusion rate	4.0% (2/50)	18% (9/50)	0.025
Incision length (cm)	7.1 ± 0.6	17.1 ± 1.9	0.000
weight-bearing(days)	1.6 ± 1.0	5.5 ± 1.6	0.000

Discussion

Femoral head replacement, total hip arthroplasty, and internal fixation with compression screws are commonly used to surgically treat femoral neck fractures in the elderly. Compared with internal fixation, artificial femoral head replacement can not only solve the problems of nonunion of fracture and ischemic necrosis of femoral head after femoral neck surgery, but also provide early postoperative activities and avoid complications caused by long-term bed rest [16]. Although closed reduction and internal fixation for stable

Table 3

Comparison of values for postoperative outcomes between SuperPath group and conventional group.

	Follow-up time	SuperPath group	Traditional group	P value
VAS	1 week	4.76 ± 0.73	6.63 ± 0.52	0.000
	3 month	1.2 ± 0.53	1.37 ± 0.44	0.238
	2 year	0.77 ± 0.21	0.87 ± 0.34	0.181
Harris Hip Score	1 week	80.2 ± 2.6	67.7 ± 5.1	0.026
	3 month	93.3 ± 1.52	92.6 ± 2.11	0.261
	2 year	95.4 ± 2.22	92.7 ± 2.51	0.391
Barthel Index	1 week	71.67 ± 9.37	62.46 ± 7.20	0.000
	3 month	91.26 ± 5.12	82.07 ± 9.62	0.010
	2 year	93.43 ± 5.90	92.69 ± 5.74	0.354



Fig. 5. Female, 80 years old, fracture of right femur neck, dislocation of hip joint occurred 40 days after operation with SuperPath approach, and was admitted to the hospital for emergency manipulative reduction treatment.

type of femoral neck fracture has good curative effect, there is a high incidence for complications, such as postoperative fracture nonunion, femoral head ischemic necrosis, etc for unstable patients with femoral neck fracture. This leads to difficulties in the early recovery of hip function and a high rate of reoperation rate.

Hip arthroplasty is one of the most successful surgical procedures for femoral neck fractures. Although most orthopedics are familiar with the posterior approach, this technique has certain disadvantages, such as long incision, large trauma, large intraoperative blood loss, part of the functional muscles of the hip (quadratus femoris, piriformis, obturator internus, and superior and inferior gemellus) usually needs be cut due to the weak posterior hip joint. Also, there is high tendency for posterior dislocation during early functional exercise, long postoperative recovery time, heavy psychological burden of the patient, and other problems [17]. Despite these disadvantages, the traditional posterior approach is still the most commonly used approach for artificial femoral head arthroplasty [17].

With continuous improvements in medical technology and innovation of new medical devices, the popularity of minimally invasive hip arthroplasty, aimed at reducing soft tissue injury and accelerating postoperative rehabilitation, has been gradually rising. Minimally invasive hip arthroplasty currently includes the anterior approach, anterolateral approach, lateral approach, posterolateral approach, and double-incision approach [1–4]. Due to equipment and technical improvements, anterior approach, lateral approach, and posterolateral approach now require smaller incisions. However, in some cases, it is necessary to partially or completely cut off the external rotator cuff (quadratus femoris, piriformis, obturator internus, and superior and inferior gemellus) and remove the posterior capsule of the joint. This can increase the possibility of postoperative dislocation of the hip joint to some extent [6–13]. This method, however, does not strictly belong to the category of minimally invasive, as the concept of minimally invasive technology requires small skin incisions, protection and maintenance of normal anatomical morphology, structure and

function of human tissues to substantially reduce surgical trauma and accelerate postoperative functional recovery.

SuperPath was primarily designed by Dr. James Chow for hip osteoarthritis patients with intact femoral neck. SuperPat has certain advantages, such as small skin incisions [5,16], less surgical trauma, intraoperative show more clearly, less intraoperative blood loss, faster postoperative recovery and weight-bearing time, and shorter hospital stay duration [18–20]. The learning curve for SuperPath is relatively short for orthopedic surgeons familiar with the traditional approach [5]. Due to the integrity of the femoral neck, the position of femoral opening, the direction of femoral reaming is easy to recognize during the operation, and the stability of the proximal femur should not be affected while preparing the femoral cavity. After femoral preparation, femoral neck osteotomy, femoral head removal, acetabular preparation. Before performing the operation, it needs to be determined if this technique can be applied to hip replacement patients with femoral neck fractures. Additionally, if a femoral neck fracture occurs, how is the position of femoral opening and the direction of femoral reaming determined? It also needs to be assessed if the proximal femur can be fixed firmly, and would the acetabulum wear out during femoral reaming. The length of femoral neck prosthesis also has to be determined. Currently, many of these questions remain unanswered.

The incision length in surgical techniques is usually about 6–8 cm, and the best flexion angle is 30° to 45°. When making the incision in the skin, if the flexion angle of the operation leg is small, the incision will be tilted forward. Thus, it is conducive to the exposure of surgical field when reaming and broaching the femoral. However, due to insufficient space in the rear, it is difficult to assemble the prosthesis. In case of larger flexion angle, although it is easy to assemble the prosthesis, the gluteus medius and gluteus minimus will obstruct the surgical field of view. The self-designed femoral neck retractors are very important. The three hooks were placed at each side of the proximal femur and below the femoral calcar (Fig. 3) where they hold the proximal femur firmly in place like claws. When reaming and broaching the

femoral, they protect the acetabulum from wear and tear. The three hooks were used all through the operation to provide stability to the proximal femur and a good surgical field of view. Once the prosthesis is installed and reset, it is relatively difficult to replace it. Thus, X-ray examination of pelvis and hip joint, and template measurements were carefully performed before the operation to determine the center of rotation, setover, acetabular and femoral prosthesis size, neck length, and osteotomy position of the hip joint. The replacement of the prosthesis was avoided to the best extent possible.

Complication

In this study, one patient in the SuperPath group developed posterior dislocation of hip 40 days after surgery. After detailed enquiry regarding the medical history, the patient mentioned that he was satisfied with the recovery of hip joint function after surgery. Posterior dislocation of the hip joint was caused by excessive hip flexion ($>110^\circ$) and adduction ($>45^\circ$) during agricultural work. Suh KT [21] reviewed the medical history of 190 patients with femoral neck fractures from 1996 to 2008, all of whom were treated with artificial bipolar head replacement. During the follow-up period of 13 months, five patients (2.6%) showed dislocation of the hip joint on the affected side during the follow-up. Salem KM [22] prospective reviewed the data of 8631 patients with femoral neck fracture for 11 years. Forty-one per cent of patients treated with artificial femoral head replacement had a postoperative hip dislocation rate of 0.76%. The authors suggested that if the time interval between fracture and surgery is greater than 24 h, the risk of hip dislocation on the affected side is four times higher than that of patients undergoing surgery within 24 h. Most patients (81%) had dislocation during the first six weeks after surgery. In general, the age of patients using bipolar head prosthesis is relatively lower, and the functional requirements of the joint are high. There is a high probability of excessive flexion and adduction of the hip joint on the affected side. Dislocation is caused once the critical point of the maximum mobility of the prosthesis is exceeded. The authors found that the incidence of postoperative dislocation was lower in patients with cement-type prosthesis than in patients with bipolar head prosthesis. Pala E [23] reported that four (7.4%) of the 54 patients who underwent posterior approach artificial femoral head replacement had postoperative dislocation, while 1 (1.8%) of the 54 patients who underwent minimally invasive direct anterior approach artificial femoral head replacement (MDAA) had postoperative dislocation. This patient had Parkinson's disease and joint dislocation was caused by involuntary activities. The SuperPath approach for artificial femoral head replacement preserves piriformis muscle and external rotation muscle group, ensuring sufficient muscle strength of the affected limb in the early stage, and rapid recovery of the affected limb function after surgery. However, due to excessive flexion and adduction of the affected limb 40 days after surgery, the prosthesis exceeded the critical point of maximum mobility, resulting in dislocation in one patient from the SuperPath group. This complication can be reduced or even avoided by strengthening postoperative education and follow-up.

Limitations and prospects

There are several limitations to our investigation, including the small number of cases and the shorter follow-up time. A short follow-up time could result in the missing of complications or patient information. Another limitation is that patients could not be blinded for this approach. Thus, positive preconceptions that they will have less pain and a faster recovery could impact short-term rehabilitation. Comprehensive evaluation of large sample

cases by evidence-based medical methods, and objective analysis of its feasibility, safety, short-term and long-term effects need to be conducted to assess if the minimally invasive hip arthroplasty can truly achieve the similar or better efficacy as traditional hip arthroplasty.

At present, with the accumulation of experience and the emergence of new technologies and materials, minimally invasive hip replacement surgery is becoming more mature, accurate, safer, and effective. However, as a new technology, minimally invasive hip arthroplasty is still in its infancy in the field of orthopedics. With the rise of minimally invasive surgery, further research and advancement of minimally invasive hip replacement surgery is expected in the near future.

Conclusions

SuperPath approach for artificial femoral head replacement for elderly patients with femoral neck fractures involves smaller incision length, less intraoperative bleeding, little transfusion rate, and a shorter starting time of weight-bearing activity. These factors have short-term effects on hip function recovery after the surgery. However, future analysis based on large-scale study is required to provide more authoritative assessment of the efficacy of this method.

Conflict of interest statement

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled.

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