



Outcomes and complications of total hip arthroplasty and bipolar hemiarthroplasty with long and short stem prosthesis

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Article History

Received: 27 November 2019

Reviewed: 28/November/2019 to 19/January/2020

Accepted: 20 January 2020

E-publication: 27 January 2020

P-Publication: March - April 2020

Citation

Quang-Tri Lê, Minh-Hoang Nguyen. Outcomes and complications of total hip arthroplasty and bipolar hemiarthroplasty with long and short stem prosthesis. *Medical Science*, 2020, 24(102), 935-944

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General Note



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ABSTRACT

Aim: The study objective was the assessment of hip replacement outcomes with long-term monitor length over one year. **Materials and Methods:** Hip replacement was performed on 277 patients in 7A Military Hospital Ho Chi Minh City, Viet Nam, from Jun 2015 to Jun 2019. Total hip arthroplasty, short bipolar stem, and long stem hemiarthroplasty were performed on the patients, and specific damages of each patient served as the basis for chosen methods. This study made use of perspective and retrospective approaches. **Results:** "Good" functional outcome occurred in 90.0% of total hip arthroplasty, 92.0% of short stem bipolar hemiarthroplasty, and 71.7% of long stem hemiarthroplasty. The postoperative complication rate was 1.7 to 5.4% depends on the used techniques. Stem loosening occurred in 5.6% of old patients. Most patients were satisfied with the treatment outcome. **Discussions:** It could be considered that hip replacement meets the demands of promoting patient life quality, especially aged patients, enabled disabled patients to make a fast recovery and quickly resumed walking and daily activities, and mitigated care burden for the family and relatives. The mortality rate in the elderly was due to prolonged bedridden complications was also decreased.

Keywords: Hip Replacement, Femoral Neck, Femoral Head, Intertrochanteric, Long Stem Prosthesis.

1. INTRODUCTION

Joint and hip replacement were more and more common in developed countries in the treatment of hip injuries due to hip degeneration, femoral neck fractures, femoral neck avascular necrosis, trochanteric, or cervical tumors. In the U.S., there were about 150,000 hip replacement cases annually, and in France were 60,000 (Darrith et al., 2018). The hip replacement had a recent surge in Vietnam and gradually became conventional in large hospitals countrywide (Le, 2000; Nguyen, 200; Tran & Vu, 2006). The above mentioned hip injuries always lead to hip disfigurement, reduced range of motion, joint damages, pain, and disability. Internal treatment for such cases is mostly palliative. Arthrodesis relieves pain but does not meet patient walking demands. Meanwhile, a hip replacement can both remedy the pain and rehabilitate movement functions, increases patient life quality (Chan & Gill, 2000; Charnley, 2000; Gingras et al., 2000).

The first hip replacement was performed by Dr. Austin T. Moore in 1940, and today it is quite common in Vietnam (Le, 2000; Nguyen, 2000; Tran and Vu, 2006). Hip replacement has been done in 7A Military Hospital Ho Chi Minh City, Viet Nam, since 2013. We conducted this study to investigate hip injuries and made remarks on hip replacement operations for the conclusions for techniques and indications of this treatment.

2. METHODS

Experimental Participants

The study was performed on 277 hip replacement patients treated from Jun 2015 to Jun 2019 by the same surgeon team in 7A Military Hospital Ho Chi Minh City, Viet Nam.

Criteria for Selection

Total hip arthroplasty (THA)

- Femoral neck fractures in aged over 70 patients, Garden 3,4, good bone quality.
- Femoral head avascular necrosis due to earlier neck fracture or idiopathic diseases.
- Repeated dislocation.
- Patients with a history of the degenerative hip joint.
- Failure of earlier bone fusion with accompanying joint acetabular damages.
- Revision replacement due to acetabular loosening or dislocation due to improper socket position.

Bipolar short stem hemiarthroplasty

- Dislocated femoral neck fractures (Garden 3,4) in aged 70 - 85 patients.
- Slight dislocated in aged patients (Garden 1,2) with demands for the quick walking resumption and immediate hip replacement, this category was indicated for caution.

Long stem hemiarthroplasty

Unstable intertrochanteric fractures A2 and A3.3 types (AO classification), aged over 75 patients.

Prosthetic stem loosening in aged patients.

Femoral proximal tumors lead to damaged neck or head.

The failed bone fusion of intertrochanteric fractures.

Repeated femoral proximal fractures of replaced hip patients.

All patients must satisfy the criteria of the American Society of Anesthesiologists (ASA) ASA 1, 2, 3, had no Alzheimer's diseases, and had good pre-injury walking capability.

Criteria for Rejection

Infection at the hip or other organs.

Fragile patients or patients with accompanying diseases which did not meet ASA 4 or over criteria (American Society of Anaesthesiologist).

Patients with pre-fracture disability (paralysis, limb malformation, etc.)

Juvenile skeletal system.

Research methods

This study used descriptive, prospective, and retrospective approaches. Patients had to go through all conventional procedures: diagnosis, preoperative tests, radiography with CT-Scan imaging when needed, surgical operation, postoperative care, rehabilitation, scheduled re-examination with radiography. For the retrospective investigation, historical cases conventionally performed were reviewed for the required data.

Surgical techniques

Made an incision of 6-10cm. Lateral, posterior, and anterior approaches were all used. For THA, the non-damaged joint capsule should be conserved. Most THA surgeries used cementless prosthesis, and a few used Zimmer cement parts. Bipolar short stem hemiarthroplasty in all approaches should conserve the joint capsule and should not use the surgical drain. Long stem hemiarthroplasty main used Wagner cementless prosthesis, used the Hardinge approach for intertrochanteric fractures and old incisions for revision replacements.

All patients were administered with spinal anesthesia, preoperative preventive antibiotics of Cephalosporine 2 g and postoperative 1 g, then continued antibiotics administration for 5 – 7 days, anticoagulant of Lovenox 0.4 ml/day or Pradaxa for seven days. Drain tube (if any) was removed in postoperative day 3.

Postoperative rehabilitation

Crutch-assisted walking exercise around the bed began in postoperative day 3. The crutch was removed in week 3 or 4. Rehabilitation exercise without dislocation-risk movements was maintained for three months after surgery. Postoperative results were assessed based on the Charnley classification. The "very good" outcome was achieved with no pain, normal range of motion, and walking with no cane requirement. The "good" outcome was achieved with no pain, >50% range of motion, slightly limping, and walking with cane requirement. The "average" outcome included minor pain, a small range of motion, slightly limping, and the requirement of two canes. The "poor" outcome criteria were pain, limited range of motion, remarkable limping, and requirement of two canes assistance.

Data analysis

The data were processed using standard medical data analysis with SPSS 16.0 software and hypothesis tested using Chi-squared method.

Ethical declaration

The patients and relatives were well-informed about their conditions and equal treatment and were asked to take part in the study. The participation was strictly voluntary, verified by signed documents. Medicine Scientific Research Ethics Committee of the 7A Military Hospital approved this study (Number: 153/QĐ-HĐYD-BV7A, date: 29.06.2015). This study is original and is not published in other scientific journals.

3. RESULTS

General information

For bipolar short stem hemiarthroplasty, the lowest age was 70 years, and the highest was 98 years (Figure 1), averaged was 85.5 ± 11 years. The lowest age was 23 years, and the highest was 75 years, the average was 53 ± 5 years in THA cases, and in long stem hemiarthroplasty, the lowest, the highest, and the average age were 73, 97, and 82 ± 10 years respectively. Amongst the patients, 157 were females (56.7%), and 120 were males.

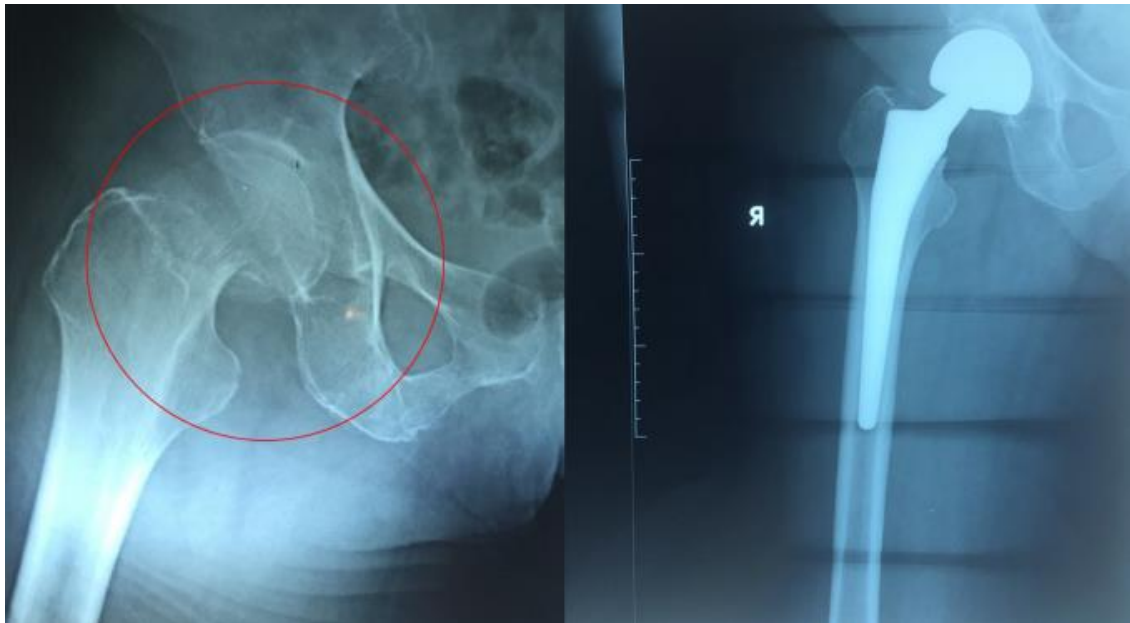


Figure 1 An old woman with intertrochanteric fracture (circle red - left) and after surgery (right).

Causes

The causes were presented in Table 1. Intertrochanteric fractures accounted for the majority (132/277 cases, 47.7%). Figure 2 presented a case of femoral neck necrosis after total hip replacement.

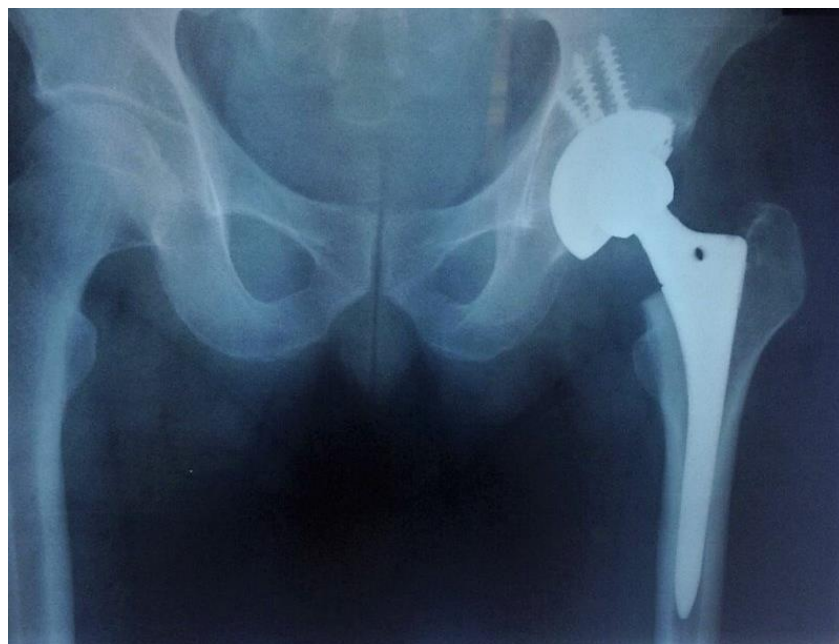


Figure 2 Total hip replacement due to femoral neck necrosis.

Table 1 Causes of hip replacement

Causes	THA		Hemiarthroplasty		Total	%
	Long stem	Short stem	Long stem	Short stem		
Femoral neck fractures	x	24	x	108	132	47.7
Intertrochanteric fractures	x	x	48	x	48	17.3
Femoral neck necrosis /degeneration	0	55	x	x	55	19.8
Repeated dislocation	1	3	x	x	4	1.4
Failed bone fusion	5	6	8	x	19	6.9
Revision replacement	4	13	2	x	19	6.9
Total	10	101	58	108	277	100.0

Blood Transfusion

Bipolar short stem arthroplasty required no blood transfusion if no blood loss occurred beforehand. Total hip arthroplasty usually required one blood unit, but it had better prepare 1 – 2 units as a precaution. Blood loss during long stem hemiarthroplasty was not remarkable as compensatory transfusion of one or two groups was performed preoperatively; still, preparation of 1 precautionary unit is necessary. Long stem THA required the same blood supply as short stem THA.

Types of Hip Prosthesis

The types of hip replacement were listed in Table 2. For THA, used the cup with size 28, socket with size 46-56 and fixed into the acetabulum with 1 – 3 screws. The stem was sized 10 – 14 and made by Zimmer. Bone grafting with acetabular screws took place in 18 cases, and the grafted bones were recycled from the removed head or the iliac crest. For bipolar short stem hemiarthroplasty, cementless Zimmer prosthesis was used with the stem size of 10 – 16. Long stem prosthesis had the size of 14 – 18 and length of 26.5 in males and 22.5 in females; a minority of them was cemented.

Table 2 Types of hip replacements

Type	Cementless	Cemented	Total
THA long & short stem	111	5	115
Bipolar short stem	100	6	106
Bipolar long stem	54	2	56
Total	265	12	277
Percentage	95.7%	4.3%	100%

Hospital Stay-in

The average in-hospital length was 8.9 days.

Positions of Hip Replacements

Arthroplasty of either left or right hip was performed on 92.4% cases. Nine cases had to head avascular necrosis of both left and right femurs, but the more severe one was treated first.

Operation Length

The operation length was measured from the first incision to the final skin suture. For THA, average operation length was 1h30' (longest 3 hours, shortest 1 hour). For long stem hemiarthroplasty, the average length was 77 ± 15 minutes, and short bipolar stem was 43 ± 10 minutes.

Postoperative Hip Movement

All cases had significant improvement in function, and all patients were satisfied with hip movement in comparison with preoperative conditions.

Accompanying Diseases

Cardiovascular occurred in 25 patients (9.0%) and endocrine (diabetic) diseases in 23 patients (8.3%). Renal diseases took place in 13 cases (4.33%) and lung disease in 22 cases (7.9%). Common cardiovascular illnesses were hypertension, coronary artery disease, and light valve regurgitation in the elderly. Pre- and postoperative psychosis was commonly seen in aged patients (22.4%) and treated with Dolargan, Dimedrol, and Aminazin. Psychosis usually occurred on the first postoperative day and stabilized later.

Complications

Two intertrochanteric patients suffered from femoral proximal cracks, but the issue was not severed as the bone was reinforced beforehand with steel cords. One case had pierced shaft by the stem, and one case had fractured bone, examined by C-Arm during surgery. The cases were treated by bone fusion using locking plates reinforced with steel cord winding around the superior parts of the bone with cortical screw (Figure 3). Union achieved after two months. Most patients had a well-healed surgical wound. Nine cases had slow heal (over three weeks) due to high blood sugar and unstable postoperative care. One hemiarthroplasty case had prolonged wound infection with mucus required debridement and antibiotics administration, which stabilized after four weeks; the overall infection rate was 0.7%.



Figure 3 Femoral fractures below the prosthetic stem

Four patients had limb shortening of less than 1.5 cm. There were cases of old dislocation, and femoral head necrosis resulted in the contraction of the thigh muscle, which pulled up the femur up to even 5 – 7 cm. The length discrepancy was compensated but not for more than 4 cm to avoid risks of nerve damage because of overstretching. The joint capsule and several related muscles were released. Nine percent of THA cases had sciatic nerve pain due to nerve stretching for re-lengthen of the limb. No superior gluteal nerve observed. Two cases with anterior approach incision had short pain and numbness in the thigh.

Dislocation took place in 2/115 cases of THA (1.7%). For bipolar short stem hemiarthroplasty, two postoperative dislocations were reported (2/106 cases, 1.9%); one was due to violation of cautionary protocol against dislocation and a slipping accident; one was due to postoperative seizures. Both were well treated with reduction, and proper treatment for the seizure was employed. For long stem hemiarthroplasty, dislocation took place in 3/56 cases (5.4%) due to postoperative rupture of reinforcing steel cord at the greater trochanter in the intertrochanteric fracture patients. These cases required surficial reduction and additional reinforcement of the greater trochanter using a fixation plate and ultra-tough suture.

Clogged blood vessels were not observed. Joint loosening occurred in 9/162 patients with bipolar hemiarthroplasty (5.6%). Aged patients underwent bipolar hemiarthroplasty over one year experienced limb shortening and gradual loosening in the femoral canal shown in radiographs. However, no significant complaint was recorded in these patients.

Short term and long term postoperative results

The shortest postoperative monitor time was six months, and the longest one was five years. Short term postoperative outcome (< 3 months) based on Charnley classification was "good" in both THA and hemiarthroplasty; the patients quickly resumed walking and felt satisfied with the results.

Long term postoperative outcome (>1 year) was only monitored in 80/115 THA patients, 72/106 bipolar short stem hemiarthroplasty cases, and 46/56 long stem hemiarthroplasty patients. The assessment was based on pain level, hip range of motion, walking conditions, and whether cane assistance was necessary. For THA, 72 patients (90.0%) had "good" and "very good" outcomes, and eight patients (10%) had "average" outcome. For bipolar short stem hemiarthroplasty, 66 patients (92.0%) had "good" and "very good" outcomes, and six patients (8.3%) had "average" outcome. For long stem hemiarthroplasty, 33 patients (71.7%) had "good" and "very good" outcomes and 13 patients (28.3%) had "average" outcomes. None had "poor" results. (see Chart 1)

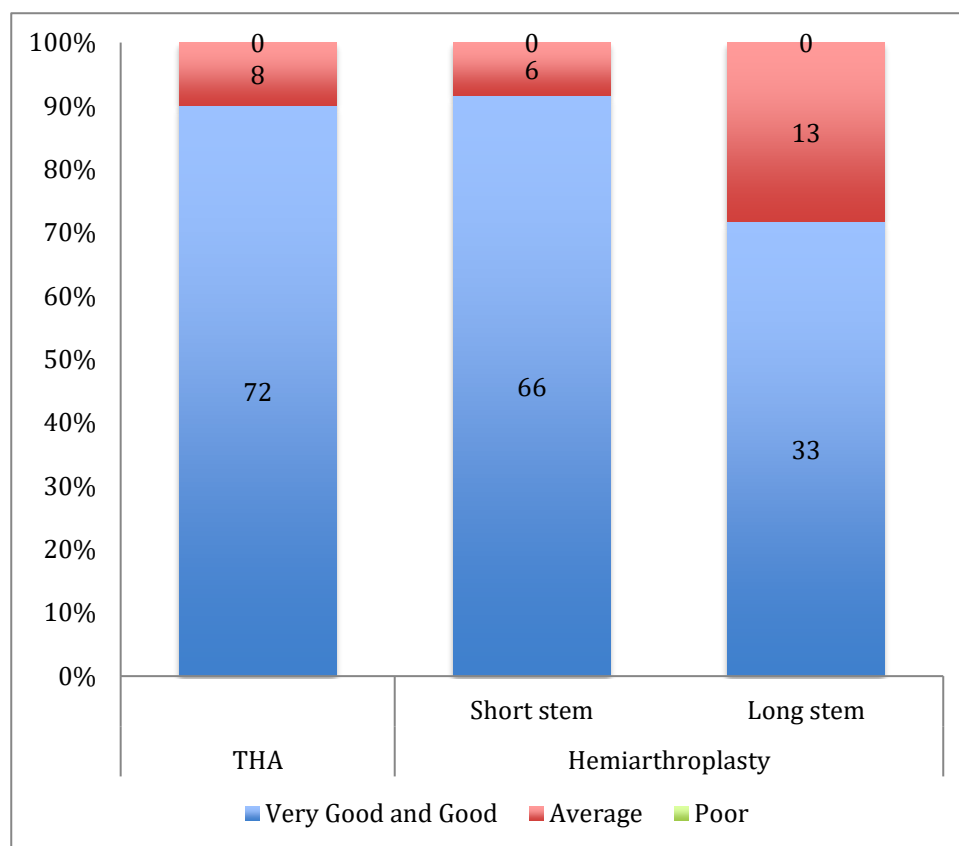


Chart 1 Long term evaluation of operative results

4. DISCUSSION

General information

Patient age in short bipolar stem (85.5 ± 11 years) and long stem hemiarthroplasty (82 ± 10 years) was significantly higher than in THA (53 ± 5 years), as the indications of the hemiarthroplasty groups were for femoral neck and intertrochanteric fractures in aged patients with osteoporosis; indeed hemiarthroplasty is seen as suitable treatment for the elderly in many cases (Hedbeck et al., 2011). The average age in other studies (Green et al., 1987; Chan & Gill, 2000; and Hedbeck et al., 2011) was from 82.2 years to 86 years, which was similar to the hemiarthroplasty patient age in our study. The average age for total hip replacement in the works of Waddell et al., (2004) was 72 years, and Berger et al., (2004) was 58 years, much higher than in our study. Probably the THA was indicated more commonly for the elderly in these works due to more advanced equipment and a higher level of anesthesia and resuscitation.

In our study, the female patient ratio was higher than males. Factors such as menopausal hormone changes are the risks for fractures in female patients (Cauley, 2015; El-Nahas et al., 2018).

Accompanying diseases

Accompanying disease rate rises with age, and this is a challenge for both surgery and anesthesia as hip replacement is usually indicated for femoral neck or intertrochanteric fractures in geriatric patients. As living standards and age increase, quick functional rehabilitation for daily life resumption is indeed in high demand. Developments in anesthesia and resuscitation enable more common indications for aged patients. All studied patients underwent sonography, the EF index must be at least 55%, and selection criteria strictly follow ASA classification.

Indications for surgery

Total hip arthroplasty was indicated based on symptoms of severe pain and impairment on walking and daily activities, which painkillers unable to remedy; the pain was directly related to the injuries. Hence for hip replacement indication and selection of materials and treatment methods, the injuries must be examined by radiography and CT Scanning if necessary. For degenerative hip based on Ficat classification, the diagnosis was mainly based on severe pain symptoms. Indication for long stem arthroplasty was based on an over-wide femoral canal, osteoporosis, unstable intertrochanteric fractures, and revision replacement of loosening hip. Bipolar hemiarthroplasty was indicated for intact acetabulum in senior patients, younger patients with femoral head necrosis – even with intact acetabula – were still indicated for THA.

Surgery time should be as soon as possible; performing the surgery within 48 hours after hospital admission leads to the best rehabilitation results, especially for the elderly. Researches showed that surgery later than three days triples the mortality rate. The choice of surgical methods and prosthesis types depended on fracture causes, remaining life expectancy, physical health, and financial conditions; but the highest priority must be surgical safety. Time from fracture occurrence to surgery was only investigated in aged patients, and 80% of these patients were treated within one week; treatment later than weeks was usually due to late admission or due to ASA level 3 conditions requiring internal treatment, blood, and electrolyte transfusion and stabilization of blood sugar.

Each type of incision approach has its own advantages; based on our experiences, the modified Hardinge approach is convenient for the treatment of intertrochanteric fractures and various kinds of arthroplasty. Anterior approach has the advantage of a small incision, less muscular invasive, and reduced joint dislocation. Several authors claimed that the posterior approach is prone to more dislocation (Bertin and Rottinger, 2004; Kwon et al., 2006) but such differences were not observed here. The most essential factors for incision selection are personal experiences, skills, and habits of each surgeon. There was no contraindication in ages as long as the patients fell into ASA 1,2,3 categories and had no preoperative disability; total hip arthroplasty could still be applied on aged over 80 patients with good physical health. Pain management was critical and enabled quick rehabilitation.

Postoperative complications

Cracks on proximal end occurred in two intertrochanteric fracture aged patients during stem installment, which was prone to happen due to the thin bone cortex. The issue was not severe as the bone was reinforced beforehand with steel cords. Damages on the femoral shaft tend to happen in older patients with osteoporosis; in this study, the damages were treated well, as mentioned in the Result section. The surgical stage of joint relocation should be paid attention.

Total hip replacement usually led to limb shortening. Length discrepancy can cause unequal loading of the limb, musculoskeletal stresses, may promote osteoarthritis in the limbs, and therefore, should be equalized (Swaminathan et al., 2014). Williamson & Reckling (1978) observed that 144/150 cases the treated limb was lengthened at 1.6 cm averagely. In our study, the limb shortening was moderate in many cases (less than 1.5cm), but there were more severe cases (up to 5 – 7 cm). Our surgical team managed to compensate for the length differences but not more than 4 cm to avoid overstretching, which may lead to nerve damages. Nerve pain due to re-lengthening the limb was indeed observed in our study.

Postoperative infection is a severe complication, especially deep infection since it can cause worse impairment than before the surgery or even lead to fatality. Deep infection is difficult to treat, and antibiotics yield little effect. Several authors proposed equipment removal, installment of an antibiotic bag, and treating the infection before a resumption of rehabilitation. In this study, most patients had a well-healed surgical wound, and the rate of infection was low (0.7%), and the infection cases were treated. Charnley (2000) showed a 3.8% rate of infection, including 1.6% in hospital and 2.2% at home several months after discharge. Do et al., (2000) showed 5/133 infection cases (0.04%) and Ngo (2000) showed 2/80 cases (0.025%), which were compatible to our study.

Hip dislocation is a severe postoperative issue. For THA, dislocation is probably due to improper socket position, and the safe zone should be a deviation of 6° from the anatomical location with the tilting of 39-45° and forward angle of 15-21°. There are many dislocation risk factors such as dislocation history, posterior approach, improper THA prosthesis positions, prosthetic neck and socket/cup impingement, the inadequate force generated by surrounding soft tissue (Do et al., 2000; Kwon et al., 2006; Merk et al., 2006; D'Angelo et al., 2008; Lu et al., 2019). Honl et al. (2003) reported 4% dislocation rate (3/80 cases) for the manual performance of THA, Woo, and Morrey (1982) reported dislocation 5.8% and 2.4% rate of the posterior and anterior approach, respectively, which were significantly higher than our study. Ngo (2000) reported 1/33 case (0.03%); and Do et al. (2000) reported 7/133 cases (0.05%), which were at a lower rate than our study. We considered the dislocation rate in this study as acceptable, but further researches are essential to evaluate the results better and optimize the process.

The clogged blood vessel is a rare but severe complication. Based on the literature, the fatality rate was from 3 to 20%. Therefore in this study, the anticoagulants Lovenox and Pradaxa were administered for all treated patients as precautionary. Fortunately, none was observed in our study. Joint loosening occurred in 9/162 patients (5.6%). Aged patients underwent bipolar hemiarthroplasty over one year experienced limb shortening and gradual loosening in the femoral canal shown in radiographs. However, no significant complaint was recorded in these patients.

Short term and long term postoperative results

Short term postoperative results were generally well, soon walking resumption and patient satisfaction was achieved. "Good" and "very good" long term postoperative results accounted for the majority of patient results, which were 90.0%, 92.0% and 71.7% in THA, bipolar short stem, and long stem hemiarthroplasty, respectively. Do et al. (2000) reported "good" and "very good" outcomes in 93.2% cases and "average" outcome in 3.4% cases. Nguyen et al. (2003) reported 92.5% "good" and "very good" cases, Nguyen et al. (2002) reported 256 "good" and "very good" cases (90%), and Tran et al. (2019) reported 92% "good" and "very good" cases. Authors in other countries, Darrith (2018) also reported 97.8% satisfactory results of THA; and Gashi (2018) 93.3% for hemiarthroplasty. The satisfactory results for THA and bipolar short stem hemiarthroplasty agreed well with the literature, but the long stem hemiarthroplasty outcome, although remained well, was significantly lower. We consider further researches with a large sample size are required to better assess the treatment effectiveness.

5. CONCLUSION

This study investigated hip replacement results of 277 patients and observed satisfaction in most cases. It can be considered that hip replacements can meet the increasing demands of life quality, especially in aged patients, enable quick walking resumption, fully recover preoperative muscular power, and prevent prolonged bedridden complications. Immediate rehabilitation is mentally meaningful for the patients and can bring down a care burden for the relatives. However, to guarantee surgical safety for aged patients, caution and careful judgment is a must. Besides correct surgery indications, good preparation both for the patients and in the arthroplasty selection, surgeons and professionals with good coordination and resuscitation skills, advance in surgical techniques is also essential. Further researches in a larger number of patients are also beneficial to make a more accurate remark and optimize the treatment protocol for these methods.

Declaration

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Funding

This research received no external funding.

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

Contribution

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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