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Efficacy of Proximal Femoral Nail Anti – Rotation (PFNA) In the Treatment of Intertrochanteric Fracture in the Elderly with Complex Coronary Artery Disease and Type Ii Diabetes: A Clinical Case Report

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Abstract:
Intertrochanteric hip fractures associating with high rates of morbidity and mortality,have become increasingly common, especially in older adults. Treatment is a huge challenge for manytrauma surgeons because many problems such osteoporosis, medical disorders… Therefore, choosing the optimal fixation method and instrumentation is essential for a positive therapeutic effect. Proximal femoral intramedullary nail brings many advantages in the treatment of elderly intertrochanteric fracture. This study reports a case of 79 – years old women who sustained an intertrochanteric fracture type 31-A2.1 based on the AO/OTA classification while walking. Her past medical history of coronary artery disease underwent a stent implantation five years ago. It is worth mentioning that she has given up the treatment of anticoagulants drug for along time. Besides, diabetes and hyperextension are also high risk medical history in this patient. An operation is performed by open reduction and fixation with a PFNA (proximal femur nail anti-rotation) under close coordination with the cardiologist and the anesthesiologist. After than three months follow up period, good functional outcome according to the Harris hip scoring system, no cardiovascular complications.
Conclusion:
This case emphasized that a thorough pre-operation planning for elderlyintertrochanteric fracture with complex background disease should be considerbefore managing those patients to avoid complications and achieve good treatmentresults. PFNA has the advantages of a simple operation, few complications, andclinical efficacy for the treatment of elderly intertrochanteric fractures.
Keywords: *Intertrochanteric fractures, coronary,diabete, elderly, PFNA, C-arm, proximal femur nail anti-rotation.*

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I. Introduction

Hip fractures are of intense interest globally, it represent an increasingly prevalent problem in an aging population all over the world[1]. The epidemiological data varies between countries, but it is globally estimated that hip fractures willaffect around 18% of women and 6% of men and the global number of hip fractures is expected to increase from 1.26 million in 1990 to 4.5 million by the year 2050[3].According to a report from the United Kingdom, about 10% of elderly patients who had hip fracture died within 1 month, and up to 30% died within 1 year. Furthermore, among those who survived, about 58% had difficulty walking without assistive devices in the first year after hip fracture surgery and around one-third eventually ended up completely dependent[14].

Intertrochanteric hip fractures have become increasingly common, most frequently occurring in older adults. Between 35–40% of these fractures are classified as unstable (AO/ASIF classification: 31-A2/31-A3) and are thus associated with high rates of morbidity and mortality[3].

Treatment of intertrochanteric fractures in elderly patients is a huge challenge for many trauma surgeons, mainly because many such a patient has severe osteoporosis and medical disorders that increase the risks associated with surgery and anesthesia. Therefore, choosing the optimal fixation method and instrumentation is essential for a positive therapeutic effect[2].

Using a proximal femoral intramedullary nail brings many advantages in the treatment of elderly intertrochanteric fracture such as: small incision with minimally invasive approach, less pain, reduce surgical time and blood loss, early mobilization.

In this article, we bring a patient with a complex medical history of coronary artery disease, type II diabetes and hyperextension who was admitted to our hospital with acute intertrochanteric fracture. This case is also the first report of the use of proximal femur nail anti-rotation (PFNA) in the treatment of intertrochanteric fracture in our area.

II. Case Report

The patient is 79 year old women who presented to emergency department after a fall down the entrance to her house and was found to have a left intertrochanteric fracture (OA/OTA 31-A2.1). She had history of coronary artery disease underwent a stent implantation five years ago. It is worth mentioning that she has given up the treatment of anticoagulants drug for along time. Besides, not only an unstable blood glucose level with type II diabetes but also high level of daily blood pressure are huge challenges for our surgeons.

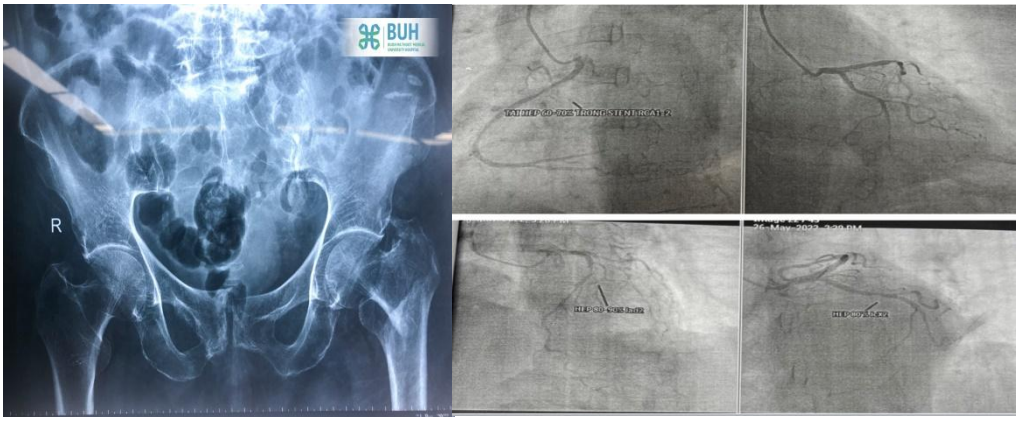

Figure1: X-ray and CAApreoperation

Preoperative planning

After admission to hospital, patient's limb was fixed by long anti-rotation brace and abducted. Elderly patients have various medical disorders and perioperative examination and treatment are thus very important. We performed ultrasound examination of the heart, lower extremity vasculature and assess cardiac function. Cardiac coronary artery angiography (CAA)was obtained and showed thatcoronary artery stenosis at left anterior descending (LAD) branch D2 and left circumflex artery (LCx)branch D2 were 80-90% and 80% in turn. Additionally, coronary in-stent restenosis at right coronary artery (RCA) branch D1 and D2 was 60-70%. We found that it is necessary to have a comprehensive evaluation to achieve the best treatment result. A consultation between orthopedists, the anesthesiologists and the cardiologists was immediately held. It led to a thorough perioperative strategy with controlling blood pressure, blood glucose level, cardiovascular disease and relative complications. In addition, we created a plan to prevent deep vein thrombosis, pressure ulcer, pneumonia and urine infection this patient during in hospital time.

The blood glucose level was monitored three times daily. Insulin therapy was administered and the daily fasting and postprandial glucose levels did not exceed 10 mmol/L. A dosing of 40mg/0.4 ml Lovenox (enoxaparin) daily to prophylaxis of deep vein thrombosis and stopped before operating at least 12 hoursand 2g of Cefazolin, one of first-generation cephalosporin antibiotic was administered to prevent infection 30 min before surgery and again to discharge. The patient's relatives were educated to take care to her and how to turn the patient, pat on the back every day.

Before surgery, the patient underwent lateral femoral X-rays, estimation of the size of the canal, and determination of the nail diameter and length. After finishing the preparation, the patient was taken to the operating room three days after hospitalized for open reduction and internal fixation with a PFNA. Our surgical team had the companion of interventional cardiologists to prepare for the worst circumstance.

Surgical technique

The patient was placed in the supine position on traction table. The hip and knee of the healthy limb were flexed and abducted to facilitate lateral C-arm, fluoroscopy. A single pad was placed under the hip to raise the limb by 5 cm, and the limb was adducted about 10°. The fracture was reset under C-arm, fluoroscopy. The incision about 4cm proximal and longitudinal, it was made through the fascia and gluteus to expose the tip of the greater trochanter. The proximal canal was then opened by evenly applied force to avoid breakage of the greater trochanter. After insertion of a reamed nail, fluoroscopy was performed to evaluate the fracture situation. By the anterior-posterior C-arm, fluoroscopy, the guide pin is located in 1/3 of the femoral neck and located

central of the femoral neck by lateral fluoroscopy. The second incision was made by extended 1.5 cm along head guide pin skin insertion to insert locking bolt.A 10mm diameter, 170mm length PFNA, 80mm blade and 8x30mm screw were inserted.The position of the nail and the fracture was confirmedfluoroscopically. The operation completed after thirty minutes without any accident. Epidural was also inserted for pain control extended to 48 hours after surgery.

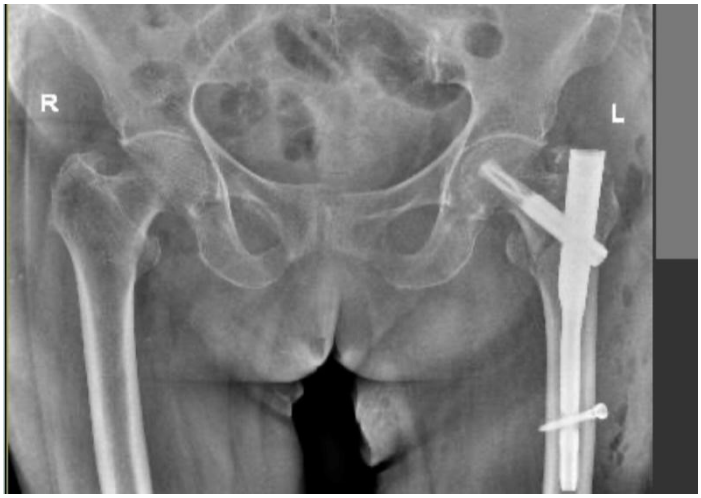

Figure 2: X-ray postoperation

Postoperative rehabilitation

The first day after, the isometric quadriceps and ankle pump exercises had been performed, the first 2 days of hip and knee flexion and extension exercises were initiated and the patients' X-rays were reviewed. Weight bearing and walking by a crutch(walker)at the third day. The patient had a satisfactory post operative course without complications and was discharged after 7 days.

Postoperative follow-up and treatment evaluation

The operative time, which was 30 minutes, was defined as the duration of time from the start of skin incising to completion of wound suturing. The amount of blood loss was not significant and the patient wasn't need a blood transfusion. The postoperative pain was well controlled with epidural and the VAS score was 3 at the first day postoperative and 1 at discharged time.

The patient was followed up and performed clinical and radiographic examination at 6 weeks,3 months postoperatively.At the first re-examination after 6 weeks,callus formation was noted at fracture site,thus the patient allowed to bear full weight and abled to walk without walking frame2 weeks later. Harris hip score was 80was considered good. At present, as of three months after surgery, the patient can walk by herself, do daily activities and exercises.

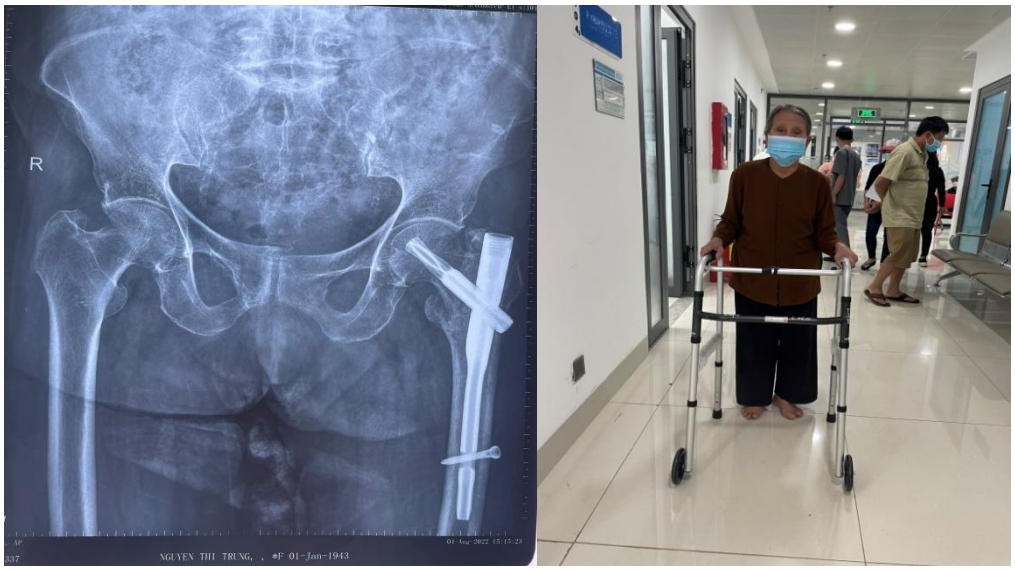

Figure 3: X-ray and patient after 6 weeks

III. Discussion

Intertrochanteric fractures often occur in older patients and remain challenging to any orthopedic surgeons, because of old age, poor bone quality and medical disorders. Furthermore, the ideal treatment method for intertrochanteric femoral fractures in elderly remains controversial. According to some orthopedists, stable intertrochanteric fractures can effectively treated with conservatively and that surgical treatment should be reversed for unstable fractures. However, we believe that as long as the patient is expected to tolerate surgery according to theirpreoperative examination results, surgery should be performed even for stable intertrochantericfractures as soon as possible after the patient stands orsits up to avoid pressure sores and hypostatic pneumonia while reducing the risk of nonunion.Studies have shown that surgical treatment of intertrochanteric fractures is associated with a significantly lower mortality rate and higher quality of life than achieved withconservative treatment. Conservative timing strategies should be avoided. Surgical delayis also associated with a significant increase in the risk of death and pressure sores. Orthopedic surgery services should ensure the majority of patients are operated within one or two days[9].Although, a wide variety of materials available for treatment of intertrochanteric fractures including dynamic hip screw, proximal femoral locking plate and nails, the ideal implant for treatmentis still a matter for discussion. For this case, the patient has a complex medical history with osteoporosis, diabetes and cardiovascular problems so theoperation need to performas fast as possible at the earliest. It is believed thatminimizing time of surgery brings many benefits such as lower the rate of intraoperative blood loss, reducing complications due to anesthesia as well as the rate of wound infection and have a postoperative period is easier.

The dynamic hip screw is the representative nail plate fixation system and is considered to be the gold standard treatment for intertrochanteric fractures. It has been widely used for this purpose, and years of clinical experience have demonstrated good clinical efficacy in stabilizing intertrochanteric fractures[5]. However, the dynamic hip screw does have some drawbacks,especially after application to unstable intertrochanteric fractures of the medial cortex because varus deformity and plate fracture easily occur in such cases [6]. Moreover, in elderly patients with osteoporosis, the hip screwholding force is weaker than that in intramedullaryfixation, which is more prone to rotation, hip screwcutting, and other complications [7]. Biomechanicalstudies have shown that because the mechanical axis ofthe intramedullary system is close to the center of thebody, its mechanical properties are better than those ofextra medullary fixation systems[8]. PFNA system was used in our case with its advantages. Firstly, the operation is simple and the operation time relatively short, surgical produces were completed in 30 minutes. Secondly, the incision is small with a total of 4.5cm skin incision and less bleedingoccurs during surgery. Thepatient did not require an intraoperative or postoperative blood transfusion.Finally, less pain and early mobilization.Postoperative pain was controlled by epidural supporting showed its clearly efficacy. The patient could seat at the first day and stand by walker at day 3. VAS score postoperative was significant low, 3 pointat day 1 and 1 point at day 7.

Another crucial factor relating to the successful of patient management iscontrollingcomorbid conditions. Theyhave a considerable impact on the prognosis of hipfracture patients and make perioperative management challenging and closely related topostoperative complications and mortality. Diabetes and cardiovascular disease were seenin our paper.

Diabetes is associated with a higher rate of perioperative complications such as needfor transfusion, pneumonia, delayeddischarge, surgical site infections, and in-hospital mortality.These poorer outcomes are in part due to higher rates ofcomorbid conditions such as ischemic heart disease, renalimpairment, andhypertension in patients with diabetes. To minimize the harms of diabetes theAmerican Association of Clinical Endocrinologists (AACE) and American Diabetes Association (ADA) guidelines, the Joint British Diabetes Society (JBDS)guidelines recommended the target glucose ranges of treatment hyperglycemia for hospitalized patients perioperative and are summarized on **table 1**[15].

Groups	Target (noncritically ill patients)	Publication year
Joint British Diabetes Societies For NHS Diabetes	6–10 mmol/L (108–180 mg/dL) target 4–12 mmol/L (72–216 mg/dL) acceptable	2012
AACE/ADA/Endocrine society	<140 mg/dL (7.8 mmol/L) and arandom BG of less than 180 mg/dL(10.0 mmol/L) Consider lower targets in those with previously tight control	2009
Canadian Diabetes Association	Fasting 5.0-8.0 mmol/L (90–144 mg/dL) Random <10 mmol/L (if safely achievable)	2013
The Association of Anaesthetists of Great Britain and Ireland	6–10 mmol/L (108–180 mg/dL) target (intra-operatively) 6–12 mmol/L (108–216 mg/dL) acceptable	2015

Table 1 *Perioperative glucose targets in national guidelines*

In a study by Y. Luo et al. 2021[4] aimed to examine the association between pre-existing cardiovascular disease and the risk of developing post-operativecardiovascular events in 3089 geriatric patients who receiving hip fracture surgery,authors concluded that patients with pre-existing cardiovascular disease

increased2.85 times risk of post- operative cardiovascular events, including myocardialinfarction, stroke, andcardiovascular-related death, compared to patients withoutpre-existingcardiovascular disease.
Regarding to comorbidities and complications, Jiang et al. 2021[10], in 2,805 geriatric hip fracture patientsaged 65 years old or older who received surgical treatmentconcluded that hypertension (51.8%), type 2 diabetes (23.6%), coronary heart disease (20.9%), stroke (18.7%), and arrhythmia (11.2%) were the most prevalent five comorbidities: Myocardial infarction, deep vein thrombosis, pulmonary embolism,pneumonia, and urinary tract infection were the major postoperative complications.The author believed that he reduced post-surgery complications could be achieved through a coordinated multidisciplinary team, including orthopedists, anesthesiologists, internists, and intensivists.Wei et al. 2019 showed that comorbid medical conditions remarkably extended patient's preoperative time and hospitalization time of patients[11]. Research by L. Mattisson et al. 2018 illustrated the percentage of 30-day mortality was 7.7% (811/10548) and the 1-year mortality was 26%[12]. According to P. Prommik et al .2019[13], unadjusted all-cause mortality rates for in-hospital, 1, 3, 6, and 12 months were: 3%, 9%, 18%, 24% and 31% respectively. The 12-month mortality rate for nonoperativemanagement was 58%.

Over the last two decades, high-quality evidence led to the implementation of many good clinical practices on hip fracture management, including antithrombotic prophylaxis, pain and emotion management, and enhanced recovery after surgery. Antithrombotic prophylaxis can significantly reduce the incidence of symptomatic deep vein thrombosis and pulmonary embolism. Nowadays, routine ultrasound tests, dynamic monitoring of D-dimer level,thrombosis risk evaluation, use of anticoagulants and nonpharmaceutical treatments, and early mobilization arerecommended for hip fracture patients. Due to trauma and concerns about surgical risks, a large proportion of patientsmay experience negative emotions such as anxiety, depression, and sleep disturbance. Adequate patient education, preoperative communication, postoperative rehabilitation guidance, and use of sedation and anti-anxiety medications can improve the mental and psychological state of these patients.All these good practices can benefit the patientsand contribute to a safe and quick recovery after surgery

IV. Conclusion

We experienced and reported a patient who had an intertrochanteric fracture with complex coronary artery disease and diabetes was treated by internal fixation using PFNA system. This study shows that use of the PFNA to treat intertrochanteric fractures in elderly patient with has the following advantages: a simple operation, few complications and good clinical efficacy and a comprehensive operation planning is necessary to get the best treatment result. However, the time of follow up was relatively short and only one clinical case,the long-term complications remain unclear.

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