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Management of Calcar-Femoral Destruction, Lesser Trochanteric Avulsion Fracture and Total Hip Arthroplasty: Rare Complex Intertrochanteric Fracture Treated at Kilimanjaro Christian Medical Centre, Northern Zonal Referral Hospital

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Abstract

Purpose: Our current case study aims to report and explain in depth the complexity of rare traumatic hip injury, mechanism of injury, clinical presentation, current gold-standard treatment option and expected long-term functional outcome.

Methodology: A convenience sampling method was used whereby 1 male patient aged 75 years was approached with a complete displaced femoral neck fracture, calcar distraction and lesser trochanter avulsion fracture. The patient underwent a total hip replacement procedure (Total Hip Arthroplasty). The patient enrolled in the study was ambulant without assistance before injury and the study was conducted in the orthopedics department at Kilimanjaro Christian Medical University College [KCMC], Moshi, Kilimanjaro, Tanzania.

Findings: We found a complete disruption of the calcar femoral component, a complete lesser trochanteric avulsion fracture, and displacement with 360-degree rotation of the femoral head. We also found the femoral head with no sign of bone-to-bone union. Findings from the case study concluded that the preferred management of a neglected severe comminuted fracture around the femoral neck involving complete calcar destruction with rotation of the head and possible avascular femoral head in a 75-year-old patient was emergent open surgical removal of the head, lesser trochanter reconstruction, and total hip replacement [THR]. However, children and young adults pays a significant attention that may need hip preservation or same procedure depending on the severity of the injury.

Unique Contribution to Theory, Practice and Policy: It was recommended to orthopedic and trauma emergence surgeon to careful take a history from the patient with a hip injury, especially an elderly patient, examine and order radiological investigation to immediately diagnose the fracture and determine whether it involve calcar femoral distraction or a complex intertrochanteric fracture. An emergency surgical posterior lateral [Kocher-Langenbeck] or anterior [Watson-Jones] approach, etc. must be immediately adopted without delay to remove the head and replace it with an artificial hip component [THR- total hip replacement/ arthroplasty] by an advanced and experienced orthopaedic hip surgeon to restore hip function, hip biomechanics, and pain management.

Keywords: *Calcar-Femoral Destruction, Hip mechanics, Lesser Trochanteric Avulsion, Intertrochanteric fracture, Total Hip Replacement*

Introduction

The calcar femoral [CF] is anatomically a thickened, dense ridge or plate of bone located inside proximal femur to the posteromedial extending from the region of the lesser trochanter. It acts as a septum-like internal partition between the femoral neck and shaft. (Garofalo et al., 2025), (Hammer, 2019b), (Choudhary et al., 2024), (Hammer, 2019a).

Biomechanically, the calcar femoral is considered as a primary internal compressive strut of the proximal femur, distributing of load from the femoral head to the femoral shaft. It also believed to maintain mechanical stability of femur during weight-bearing activities such as jumping or working as illustrated by Figures A, B, C below. (Garofalo et al., 2025) (Hammer, 2019a)

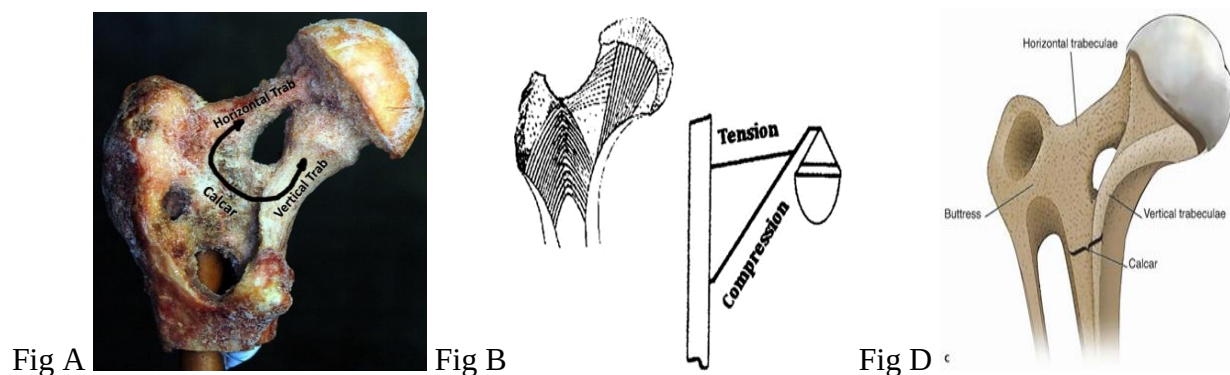
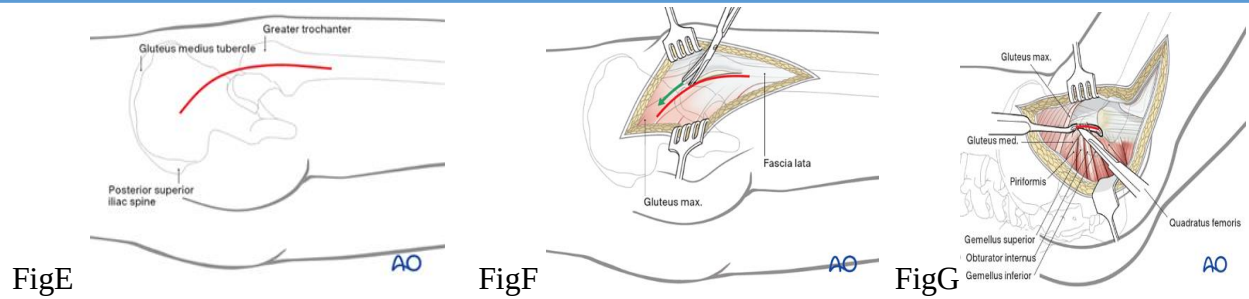


Figure A, above photograph showing a schematic anatomy of a dissected proximal femur extending to the neck. The calcar femoral component is situated between the proximal part of the femur, oblique and upward-directed. The horizontal and vertical trabecular columns connect calcar to the femoral shaft. The double-headed line shows the course of the hypothesized compression force through the calcar generated during hip flexion and extending under load. (Choudhary et al., 2024), (Hammer, 2019a).

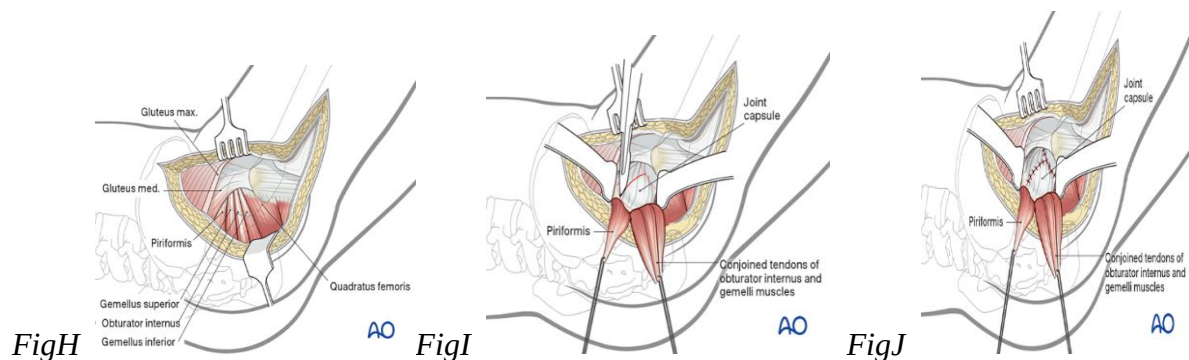
Figure B, above illustrate a schematic of Ward's diagrams showing mechanical configuration of the bone within the upper femur resembles supports of an old-fashioned gas lamp, both having struts to carry the resultant tension and compression forces.

Figure C, Above. show schematic configuration of the distribution two trabecular columns which are situated within femoral neck. Both vertical column and the horizontal column are believed to convey a compression force and a tension force, respectively.

The figures bellow illustrates patient in the posterolateral approach to the hip, which is performed with the patient positioned in a lateral decubitus.



Source: <https://surgeryreference.aofoundation.org/orthopedic-trauma/adult-trauma/proximal-femur/approach/posterolateral-posterior-approach>



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Total Hip Arthroplasty (THA) or Total Hip Replacement (THR) in patients with complex intertrochanteric fracture is a widely used and accepted surgical procedure nowadays, as it restores hip mobility, provides pain relief and improves quality of life. Implant success and longevity are influenced by the selection of appropriate materials (*Total Hip Replacement Surgery Guide*, n.d.), (Garofalo et al., 2025).

Total hip replacement or hip arthroplasty with an intact calcar is common orthopedic life-improving procedure, but total hip replacement for a patient with an intertrochanteric fracture involving to the calcar and complete avulsion of the lesser trochanter is a rare traumatic injury that calls for emergency lesser trochanteric fracture reconstruction and total hip joint replacement for extreme elderly patient. (Hammer, 2019b), (Journal et al., 2026).

As explained, when the calcar is destroyed, there will be an unequal distribution of force transferred to the hip. An intertrochanteric fracture can be defined as an extracapsular fracture through the base of the femoral neck at its junction with the intertrochanteric region, corresponding to the AO classification type B2. (Karakus et al., 2018).

This requires an urgent intervention; any delay may result in difficulty in total hip replacement because of distortion of anatomy around the hip, including fibrosis and callus formation (Hammer,

2019b). Intertrochanteric fracture in older people is usually a result of low -energy injury, most frequently caused by a weakened bone due to reduced bone density (osteoporosis).

A simple fall may result in this injury, but this patient was involved in a motor vehicle accident, and their condition worsens when associated with a calcar fracture. A fall from a significant height, such as from a ladder, tree or an industrial accident, can also generate enough force to cause the fracture. (Hammer, 2019b).

CASE REPORT

We are reporting a case of 75yrs old male patient admitted on April 11, 2022, from the emergency department (EMD) who sustained a left hip injury after being involved in a motor vehicle crash while crossing the road as a pedestrian. He was knocked and landed down by a fast-moving motorcycle, which pushed him and landed on the left side of his hip. The patient had the injury 8 months prior to hospital admission.

The patient from Karatu was taken to Karatu District Hospital, where he was given first emergency services; then he was referred to Northern Zonal Hospital, Kilimanjaro Christian Medical Centre by Ambulance. The patient was received at KCMC (EMD), Emergency Department, with isolated trauma to the left hip. A quick assessment clinical and physical examination were done at EMD.

The limb was externally rotated, with apparent shortening of about 4cm, no bleeding at the injured site, and unable to use the affected limb. Radiological investigation at EMD was ordered, including pelvic X-rays, left femur X-ray, and pelvic CT scan, which was done as an emergency.

Both the CT scan and x-ray seen with intertrochanteric fracture of the left proximal femur extending to the calcar and the lesser trochanter, making unstable hip fracture. Next day after hospital admission on 12 April 2022, the patient was taken to the operating orthopedic theatre for open reduction, calcar reconstruction and total hip joint replacement.

Surgical Technique and Approach

Preoperative optimization

Before surgery, the patient underwent comprehensive assessment, which included medical history, physical examination, and imaging studies to assess joint damage, bone quality, and anatomy of the hip joint. Our preoperative planning also involved appropriate selection of hip prosthetic implant and to determining actual leg length. We clearly informed the patient and close relative about the procedure. Anesthetic option, expected intraoperative complication and expected rehabilitation period.

Patient Positioning and Anaesthesia

The patient was kept on the orthopaedics operating table and positioned in the right lateral decubitus position under spinal anaesthesia. The patient lying on his right side helped to provide optimal access to the hip joint while protecting surrounding tissues.

Surgical Incision and Exposure

The surgeon made an incision from the proximal femur over the hip joint, which was a posterior lateral approach [Kocher-Langenbeck]. We stated dissection of soft tissues, which involved skin, subcutaneous tissues, fascia lata, muscles and tendons, while carefully avoiding injury of blood vessels, tendons, and nerves. Piriformis tendon and short external rotators were released from of insertion to allow good joint visualization and access.

The T-shaped capsule incision was performed to enable full visualisation of the femoral head and acetabulum. We selected the posterior approach because it provides excellent visibility of the hip joint and makes it easier for the orthopaedic surgeon and other experts to position the hip component properly and correctly.

The posterior approach was considered because of its minimally invasive osteosynthesis (MIO), as it avoids cutting the key muscles which are responsible for walking and helps preserve the strength of the lower limb. The approach is also flexible and can be used by different types of patients and for different types of procedures around the hip, including those with complex hip problems, obesity, and revision surgery.

Femoral Head Removal

The femoral head was dislocated from its attachment in the acetabulum, and the femoral neck remnant was separated using a reciprocating saw. All the arthritic and damaged fragments were removed, ready for the femoral stem prosthetic component.

Acetabular Preparation

The acetabulum, or hip socket, was clearly examined for signs of any deformity or hip osteoarthritis [HOA]. The transverse ligament, all cartilage and remaining tissue were carefully cleaned. Then a hemispheric reamer of different sizes was used to shape and smooth the socket to fit the acetabular component. To ensure the proper and tight fit size we used different trial components for orientation and absolute hip stability. The exact tight-fit acetabular cup was then mounted, and a liner was then inserted inside the acetabular cup to complete the socket assembly.

Femoral Preparation and Prosthesis Insertion

The lower limb was flexed and externally rotated, giving room for femoral canal preparation to accommodate the femoral stem. A box osteotomy instrument was used to perforate the femoral canal, then different trial components were used to measure and check the leg length, offset, and femoral stem stability. At the end, we confirmed the final exact femoral stem size and was properly connected with the acetabular component to make a total hip component. Articulation, dislocation and telescoping were tested to assess the stability and the accuracy of the hip component.

Wound care

We started repairing the hip capsule, followed by soft tissues, short external rotators [SeRs], muscles, and fascia. The incision was closed with sutures [VICRYL monofilament and NYLON monofilament]. The wound was dressed with sterile gauze to reduce the risk of infection and surgical site infection[SSI].

Postoperative Care

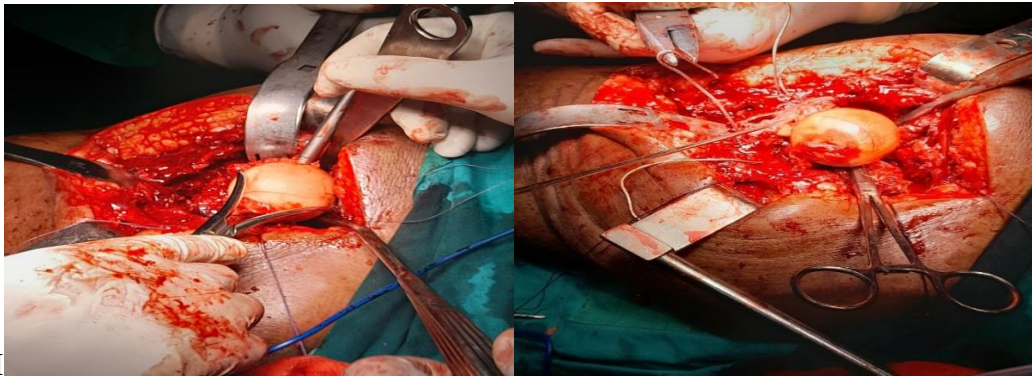
After the operation, the patient was monitored in a recovery room for vital signs and pain management. Early joint movement was initiated and encouraged, often within 24 hours, with physiotherapy to strengthen muscles and improve balance. Patients typically begin walking with assistance by day 2 and day3 and was walking with walking aid followed by discharge occurs in day 5.

We scheduled the patient for a follow-up clinic visit, which includes a follow-up X-ray to monitor proper implant positioning, healing, and rehabilitation to resume his daily activities. After the procedure, we examined the patient and noted a leg lengthening of 0.3 cm and 2cm telescoping of the operated limb. To prevent the risk of developing deep venous thrombosis (DVT), the patient was covered with blood thinner prophylactic anticoagulants was routinely administered for 7 days post-operative.

We scheduled the patient to attend the orthopaedic clinic for follow-up every 4 weeks post-operative, where the patient was able to ambulate full weight-bearing and without the use of any assistive walking device after the first 4 weeks. After examination, we found no limping, and there was no Trendelenburg sign on physical exam. Follow-up X-ray after 16 weeks showed no implant loosening, dislocation or peri-prosthetic fracture.



Fig E. Pre-operative CT scan showing unstable complex intertrochanteric fracture of the left femur with calcar and lesser trochanter destruction. Fig K, above showing surgical incision site.



FigM FigN

Fig. A. Surgical procedure showing reduction of the avulsed lesser trochanter to the femoral shaft using a pointed reduction clamp. Fig. B. Surgical procedure showing reconstruction of the lesser trochanter to the femoral shaft using tension band wire.



FigO

Fig.O: Post-operative X-ray showing modular total hip replacement prosthesis, calcar reconstruction with tension band wire and screw.

Discussion.

This case study report adopted the common, well-known posterolateral surgical approach and techniques for total hip replacement, which was introduced as a result of a complex intertrochanteric fracture with calcar destruction. The technique used showed great promise as a safe, less invasive, cost-effective, and effective surgical option (Zheng et al., 2025).

Total hip replacement in patients with calcar femoral destruction and femoral neck fracture with lesser trochanteric fracture is a rare complication. Our case study was able to identify some anatomical considerations connected to the horizontal and vertical calcar, dense trabecular bone, which buttresses (primary compressive strut) the femoral neck of the medial femoral component of the neck, extending to the epiphyseal region of the femoral head. (Hammer, 2019b).

The mechanical importance of the calcar femoral is to provide mechanical support to complex proximal femoral forces which occur at the junction of the proximal femoral shaft and neck. The exact role of the calcar femoral is not clearly known, but many theories and scientists suggest its

core role is that it provides an important part of the internal weight-bearing structure of the proximal parts of the femur.(Xu et al., 2021). (*TOTAL-HIP-MANU-SCRIPT (1)*, n.d.).

It is believed that the main role of calcar femoral is to redistribute stresses to the proximal femur. It also helps in the reduction of the posterior and medial cortical loads, increases the anterior and lateral cortical loads, and makes the process of transmitting stress from the femoral head to the femoral shaft more reasonable. (Huang et al., 2019). (Garofalo et al., 2025).

Proper reduction or reconstruction of the calcar femoral can help to effectively improve the mechanical transmission of weight to the proximal femur. According to the management of the destroyed calcar femoral (Fig. 1 above) in hip fractures, the type of fracture should be considered first, and different methods of surgical procedures can be opted for depending on the severity of the calcar destruction. (Karakus et al., 2018).

The greater and lesser trochanters of the femur are places with the lowest bone mineral density (BMD) in the hip and are the most prone to bone loss after injury. Low bone density and fragility are among the main causes of fractures in this region, especially in elderly people. Some researchers believe that for every one standard deviation increase in bone density, the risk of fracture increases by 2 to 3 times. (Karakus et al., 2018).

Bone mass can also be used as a predictor for hip fractures. In a comparison between osteoporotic and normal bone, researchers find no significant differences in the density or rigidity of the calcar femoral. Therefore, the risk of intertrochanteric fractures increases in osteoporosis rather than due to changes in the calcar femoral(Looker et al., 2001).

In the management of calcar femoral, the calcar femoral is an important part of the femur which plays a main role in the proximal femur biomechanics. The load transmitted from the femoral head to the upper femur does not follow a straight line, considering the femoral neck-shaft angle and the anteversion angle. Not only can the calcar be destroyed in trauma, but sometimes destroyed by bone disease, such as bone tumor, inflammatory disease, etc. (Huang et al., 2019)(Hammer, 2019b).

Conclusion

This Case report highlights the critical role of selecting an appropriate surgical procedure and appropriate surgical implant which will stay for a specified period of time. Selection of an appropriate implant and material was a very important factor for the success of this surgery.

We therefore opted for a total hip replacement /total hip arthroplasty procedure specifically for a 75-year-old patient because of a complexity of hip injury which involved calcar femoral destruction, comminuted neck fracture and lesser trochanteric avulsion fracture. Although hip replacement is common in elderly patients, but children and young elderly patients face significant treatment challenges, which emphasizes the need for hip-preserving surgery.

Acknowledgements:

I kindly express my sincere gratitude to all participants who helped me to accomplish this case study.

Strength.

This type of study is rare at Kilimanjaro Christian University College in the Department of Orthopaedics and Traumatology. Its publication will create awareness and impact skills and knowledge.

Weakness.

This study involved one participant, which was limited to a convenience sampling method) Only one case report cannot be used to give conclusion about the problem in the general population; hence, bias. Furthermore, a single case report does not support the analysis, which can give us a true result. Therefore, we recommend another study with large sample size.

Ethical Approval

Ethical clearance to conduct this case study was obtained from the Ethics Committee of Kilimanjaro Christian Medical University College.

Declaration

This case study observed all principles and procedures as illustrated by the World Medical Association developed the Declaration of Helsinki as a statement of ethical principles for medical research involving human participants (2024). As a result of the primary data explained in this study, the review board waived informed consent. Additionally, this article does not contain any personal information about patients. All authors were in agreement with the manuscript.

Consent for Publication

We obtained publication consent from the patient and institutional approvals from Kilimanjaro Christian Medical University College. The participant also provided explicit consent for the publication of his data and all necessary information.

Author Contributions

All authors were active and made a significant contribution to the work reported, whether that is in the conception, study design, execution, or acquisition of data; they also took part in drafting, revising, and reviewing the article and gave final approval of the manuscript to be published. They have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no conflicts of interest in this work.

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