CASE REPORT

Utilisation of plain film and theatre radiography in the diagnosis and treatment of neck of femur fracture in an elderly woman in Zambia

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ABSTRACT

Neck of femur (NOF) fractures are a common reason for referral to the radiology department, especially in elderly patients, with plain radiography being the first-line imaging modality for diagnosis. This imaging case report discusses an 85-year-old woman who presented with right hip pain following a fall and was diagnosed with a fractured NOF. She underwent hip hemiarthroplasty and, at a 3-month follow-up, had nearly regained her pre-fracture walking ability. The case highlights the importance of trauma and theatre radiography as specialised areas within diagnostic imaging, requiring technique adjustments due to the limited mobility and cooperation of trauma patients. Standard imaging for suspected NOF fractures should include an anteroposterior (AP) view of the pelvis and a horizontal beam lateral view of the affected hip to allow comparison of both hips, rule out additional injuries in the pelvis region, assess fracture displacement and comminution, and aid in pre-operative hip planning. Post-operative radiographs should also include both hips to evaluate implant positioning, alignment, and potential complications. In this imaging case report, variations in imaging were noted due to the lack of established protocols for trauma and theatre radiography at our radiology department, highlighting the need for standardised guidelines in these settings.

INTRODUCTION

Neck of femur (NOF) fractures are a common indication for referral to the radiology department. These fractures predominantly occur in the elderly population and are frequently associated with falls. Other contributing risk factors include osteoporosis, decreased physical activity, and chronic medication use.[1, 2] NOF fractures are typically classified into three types based on anatomical location: subcapital, transcervical, and basicervical.[2] Subcapital fractures occur at the femoral head-neck junction, transcervical fractures involve the midportion of the neck, and basicervical fractures are located at the base of the femoral neck. Prompt

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diagnosis and appropriate treatment are critical to prevent serious complications such as avascular necrosis (AVN) and non-union.[2] Furthermore, literature indicates that these fractures are associated with high morbidity and mortality, especially in older patients following trauma. [1]

In trauma medicine, rapid diagnosis and treatment are essential.[3] Medical imaging plays a pivotal role in the diagnosis of traumatic injuries.[4-6] For suspected NOF fractures, plain film radiography is considered the first-line imaging modality.[2] While trauma and non-trauma radiographic principles are fundamentally similar, trauma radiography often requires modified techniques due to the limited mobility and cooperation of patients in acute settings.[4-5] These challenges may compromise image quality, making it imperative for radiographers to possess specialised knowledge and skills in trauma radiography to optimise imaging outcomes under such conditions[5] Radiographers also play a critical role during the surgical management of NOF fractures in the operating theatre, a practice known as theatre radiography. Depending on the surgical procedure, either a mobile image intensifier (C-arm) or a mobile X-ray unit is used to provide intraoperative imaging.[7] In Zambia, both trauma and theatre radiography are included in the undergraduate curriculum to prepare radiographers for these specialised roles.

However, trauma and orthopaedic theatre radiography in Zambia remains underdeveloped, likely due to the absence of a structured trauma healthcare system.[8,9] Although there is currently no dedicated orthopaedic public hospital in the country, the introduction of postgraduate orthopaedic training has increased the number of orthopaedic surgeons and led to the establishment of specialised orthopaedic units in several hospitals.[10] Despite these advances, anecdotal evidence suggests that theatre radiography remains underutilised in orthopaedic cases.

This medical imaging case report highlights the role of both plain film and theatre radiography in the diagnosis and surgical management of an 85-year-old woman with a fractured neck of the femur who presented to a private hospital.

CASE PRESENTATION

An 85-year-old woman presented to the private hospital of Lusaka District in February 2025, complaining of right hip and thigh pain following a fall at home. The right lower limb was shorter and externally rotated. The patient was stable, and pain was managed with analgesia. She has a known history of hypertension. The casualty medical doctor requested for right hip X-ray to confirm a fractured NOF. Table 1 illustrates the timeline from patient presentation to hospital discharge.

Table 1: Timeline from patient presentation to hospital discharge

Timeline	Activities
Day 1 of admission	Initial right hip X-ray performed
Day 2 post-admission	The patient was taken to the operating theatre for hemiarthroplasty
Day 3 post-admission	First post-operative right hip X-ray performed
Day 6 post-admission	Second post-operative right hip X-ray performed
Day 8 post-admission	Patient discharged from the hospital
Three months post-operation	Patient review (Follow-up)

An elderly female patient was brought to the radiology department on an accident and emergency (A&E) trolley. The electronic radiology request form (RRF), submitted through the Hospital Management System (Insta HMS), indicated a request for a right hip X-ray to confirm a suspected neck of femur (NOF) fracture. The patient, accompanied by a nurse and a relative, was already

in a hospital gown. After preparing the computed radiography (CR) equipment and accessories, the procedure was explained to the patient, who was then carefully transferred to the X-ray table and positioned for the anteroposterior (AP) pelvis. The radiograph was acquired using exposure settings of 80 kilovoltage peak (kVp) and 30 milliampere-seconds (mAs). The imaging plate was processed using the CR reader, and the image was annotated and assessed for diagnostic quality before being sent to the referring casualty medical officer via Insta HMS. The patient was subsequently returned to the A&E department. The radiograph (Figure 1) revealed a fracture of the neck of the right femur, with a disrupted Shenton line.

Figure 1: AP radiograph showing a fracture of the neck of the right femur

The initial radiographic image was interpreted by the referring casualty medical officer, after which the patient was admitted to the surgical ward, reviewed by the orthopaedic surgeon, and scheduled for surgery the following day. On the second day of admission, the patient underwent a Thompson bipolar hemiarthroplasty procedure. During the operation, a radiographer was called to perform intraoperative fluoroscopy using a mobile C-arm to assess the positioning of the prosthetic implant. However, no theatre or fluoroscopic images were saved due to a malfunction in the C-arm's saving function. On the second post-operative day, a right hip X-ray was performed in the radiology department, which confirmed that the prosthetic implant was in a satisfactory position (Figure 2).

Figure 2: AP radiograph of the first post-operative right hip X-ray

Figure 3: AP radiograph of the second post-operative right hip X-ray

A second post-operative X-ray of the right hip was performed on post-operative day four (Figure 3). The patient demonstrated good recovery and was discharged from the hospital on the eighth day of admission. She was scheduled to begin physiotherapy and advised to return for a follow-up appointment in three months.

During her stay, the patient expressed gratitude and satisfaction with the care she received. She reported feeling respected and treated with dignity and noted effective pain management throughout her admission to the hospital.

At the three-month follow-up, the patient returned for review. She was doing well and had nearly regained her pre-fracture level of mobility. No further follow-up was scheduled, with instructions to return only if any new issues arose. There was no imaging performed.

DISCUSSION

This case report highlights the critical role of plain film and theatre radiography in the diagnosis and management of hip fractures. In trauma radiography, it is essential to consider the patient's history and mechanism of injury to anticipate possible fracture patterns and associated injuries. This approach ensures the production of high-quality diagnostic images.[5] Consequently, the completion of radiology request forms (RRFs) is necessary to justify imaging examinations. However, an audit conducted in Zambia by Bwalya et al.[11] revealed that the majority (n = 881, 90.5%) of paper-based RRFs for plain film radiography were incompletely filled. In contrast, all three RRFs in this case were fully completed, attributed to the private hospital's use of an electronic system for requesting imaging and viewing radiographic images. Literature supports that implementing electronic request systems significantly reduces the occurrence of incomplete RRFs, as mandatory fields must be completed before submission. [11,12] Based on our experience with this system, it greatly enhances documentation and follow-up imaging processes. It also provides patient and result tracking for all relevant staff, ensuring seamless follow-up and clear communication. This reduces the risk of errors, improves data accuracy, and guarantees secure data transmission.

For patients with suspected fractured NOF, the recommended imaging projections include an AP view of the pelvis and a lateral view of the affected hip.[4,5] In this case, only the affected hip was imaged, and no lateral view was taken. In trauma settings, especially with suspected NOF fractures, radiographers must be skilled in obtaining diagnostic-quality images even when patients cannot assume standard positions.[6,13] In such cases, the horizontal beam lateral projection is a crucial adaptation that enables lateral imaging without requiring the patient to turn, which is often not possible due to pain or instability.[4,5] However, some X-ray equipment may be limited, making dedicated systems for trauma patients essential. Several medical imaging manufacturers offer specialised X-ray equipment designed specifically for trauma radiography.[5] Imaging the pelvis in cases of suspected NOF fracture is also important for comparative purposes, to detect additional fractures on the contralateral side, and to aid in surgical planning. A lateral view of the affected hip is particularly valuable in assessing fracture displacement and comminution, informing appropriate treatment strategies. In this case, variations in pre-operative imaging were noted due to the lack of established protocols for trauma radiography and highlighting the need for standardised guidelines in these settings.

At this hospital, CR is used for plain film imaging. In Zambia, three main imaging acquisition methods are currently available: traditional film-screen, CR, and direct digital radiography (DDR). Both CR and DDR are superior to film-screen imaging systems, particularly in trauma radiography, due to improved image quality, reduced radiation dose, and faster image acquisition.[4,5] Digital imaging allows for rapid diagnosis and treatment, critical in trauma care by enabling immediate image processing and electronic transfer to multiple locations for

interpretation.[14] Furthermore, digital imaging systems offer wide exposure latitude, reducing the need for repeat exposures due to suboptimal positioning or technique errors.[15,16] Enhanced image quality, including better contrast, brightness, and magnification, further improves fracture visualisation and diagnostic accuracy. Reduced repeat imaging also minimises patient radiation exposure.

Theatre radiography, particularly using mobile imaging systems like the C-arm, is essential during orthopaedic trauma surgeries such as those for hip fractures. The C-arm provides real-time intraoperative imaging, guiding surgeons in accurate fracture reduction and the proper placement of orthopaedic implants.[7,17,18] Mobile X-ray systems are also employed in other procedures, such as hip hemiarthroplasty (Figures 2 and 3), where the femoral head is replaced with a prosthesis while the acetabulum remains intact.[5,7,9] Post-operative radiographs, including bilateral hip imaging, are typically acquired to evaluate the alignment, positioning, and potential complications of the prosthetic implant. The contralateral hip serves as a reference for assessing leg length, offset, and pelvic symmetry. These comparisons assist radiologists, reporting radiographers, and orthopaedic surgeons in detecting signs of loosening, implant wear, or other complications. In our case report, variations in post-operative imaging arose from the absence of established protocols for follow-up radiographs, underscoring the need for standardised guidelines in such settings. Other trauma-related orthopaedic procedures that utilise the mobile C-arm to provide intraoperative imaging in theatre include dynamic hip screw (DHS) fixation, gamma nailing, cancellous screw fixation, and intramedullary (IM) nailing.

CONCLUSION

Fractured NOF is a common orthopaedic injury associated with high morbidity and mortality if not promptly diagnosed and managed, with trauma and theatre radiography playing a vital role in its care. Unlike routine imaging, trauma radiography requires modified techniques due to patients' reduced mobility and limited cooperation, demanding specialised skills, dedicated X-ray equipment, and the use of digital imaging systems for faster processing and improved image quality. Theatre radiography equipment is also essential to facilitate intraoperative fracture management. However, in Zambia, trauma and orthopaedic theatre radiography remain underdeveloped, highlighting the need for research to explore the challenges faced by radiographers in these settings and to determine whether specialised short courses could enhance their competence and improve patient outcomes.

CONFLICT OF INTEREST

The second (WM) and the third authors (YM) work at the medical facility described in this case report. The remaining authors declare no conflicts of interest.

CONSENT

Due to the patient's age, verbal informed consent was obtained from the patient, and written informed consent was obtained from her next of kin for the publication of this case report and accompanying images. Additionally, permission was obtained from the Chief Medical Director of the private medical facility to use the radiographic images and relevant patient information for publication.

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