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The Utility and Necessity for Radiographic Follow-Up After Arthroplasty for Geriatric Neck of Femur Fractures

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Abstract

Background: Hip fractures are a common and debilitating condition posing not only a huge health care but also socioeconomic burden. Surgical management for a neck of femur fracture is typically with arthroplasty in the form of total hip arthroplasty or hip hemiarthroplasty. Serial radiographs are typically performed routinely as part of follow-up to look for complications, although their clinical utility in asymptomatic patients is yet to be validated. Our paper therefore aims to review the utility and necessity of radiographic follow-up following arthroplasty for NOF fractures. **Materials and Methods:** Patients who underwent operative management for acute fragility neck of femur fractures in the year from 1st January 2018 to 31st December 2018 at the author's institution were identified. All patients who underwent surgery, and had at least one pre and one post-operative plain film radiograph of the affected hip were included in this study. Exclusion criteria included patients who had undergone surgery for chronic fractures, avascular necrosis of the femoral head, mortality within 1 year, peri-prosthetic fractures, pathological fractures from metastases, had concomitant injuries, or had inaccessible or incomplete records. Clinical records were assessed for the number of visits, an abnormal presenting history or clinical examination, as well as changes in management of the patient. The number and type of radiographs were also assessed, and each radiograph analyzed for abnormal findings. **Results:** A total of 157 patients were included in our study with a mean age of 79.5 at the time of surgery, and a mean follow up of 17.3 months. Data was collected from 626 clinical visits and a total of 973 radiographs. The 3 abnormal radiographic series identified with a corresponding normal consult did not result in a change of management for the patient. A negative change in management was only observed in 1 patient with an abnormal consult and a corresponding normal radiograph. **Conclusion:** Post-operative complications following arthroplasty for NOF fractures are likely to result in a symptomatic presentation of the patient. Routine radiographic follow-up provides limited utility in asymptomatic patients and should only be performed if clinically indicated.

Keywords

osteoporosis, geriatric trauma, fragility fractures, geriatric hip fracture, hip fracture

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Introduction

Hip fractures are a common and debilitating condition affecting up to 6% of men, and 18% of women in the elderly population.[1] As life expectancy increases due to better health care, the incidence of fragility hip fractures is similarly expected to do so, therefore posing not only a huge health care but also socioeconomic burden.[2,3]

Hip fractures are currently classified into neck of femur (NOF), intertrochanteric and subtrochanteric fractures.[4] Surgical management for a NOF fracture is typically arthroplasty due to the high risk of avascular necrosis of the femoral head, with the choice between a total hip replacement or a hip[5] hemiarthroplasty being patient and surgeon dependent.[6,7]

Following surgery, an immediate post-operative radiograph is often performed for to check for any peri-prosthetic fractures, implant position, dislocations of the hip[8] and cement. However, serial radiographs are still typically performed in routine fashion during each clinic visit regardless of clinical assessment resulting in increased costs as well as radiation exposure.[9] In addition, elderly patients with NOF fractures often have multiple co-morbidities including chronic conditions which require long term follow up and thus multiple visits to the hospital or clinic.

Currently, the number and purpose of the orthopedic follow up clinic visits are not well defined in the literature, and the utility of post-operative hip in patients treated with arthroplasty for NOF fractures is inadequately studied, and is not evidence based. As the number of hip fractures increases, there is a need to optimize the delivery of health care to be more efficient and cost effective.

Our paper therefore aims to review the utility and necessity of radiographic follow-up following arthroplasty for NOF fractures. We hypothesize that the majority of post-operative complications are typically first noticed after symptomatic presentation of the patient prompting further investigation, and therefore routine hip radiographic evaluation in an asymptomatic patient is unnecessary.[10]

Materials and Methods

All patients who underwent hip arthroplasty for an isolated acute NOF fractures in the year from 1st January 2018 to 31st December 2018 at the author's institution were identified via a manual chart review.

Patients who had a hip radiograph before discharge and at least one hip radiograph during a post-operative visit were included in this study. Exclusion criteria included patients who had undergone surgery for chronic fractures, avascular necrosis of the femoral head, mortality within 1 year, peri-prosthetic fractures, pathological fractures from metastases, had concomitant injuries, or had inaccessible or incomplete records.

A total of 188 patients were first identified. Following application of the above-mentioned predetermined inclusion and exclusion criteria, the remaining 157 patients who were finally included in this study had their pre and post operative plain film radiographs, clinical and operative notes analyzed.

Clinical Records

Clinical records were reviewed independently by two authors. Each clinical visit recorded was evaluated for the subjective history from the patient, physical examination performed by the attending doctor, as well as the management plan.

The clinical visit was considered to be abnormal if the patient reported disproportionate pain affecting the operated hip, or if physical examination revealed any signs such as an antalgic gait, wound complications, as well as reduced power and range of motion of the operated hip.

Any change in management of the patient in terms of weight bearing status, change in treatment course, and any hip related complications (including wound complications, readmission and reoperation) were also recorded as abnormal.

Radiographic Measurements

Record was made if each clinical visit had plain film radiographs performed. If so, the numbers of radiographs as well as type were also recorded.

All plain film radiographs were then individually reviewed by both authors, as well as clinical notes commenting on the radiograph, and the official radiology reports. Radiographs were recorded as abnormal if any one of the three highlighted any abnormality.

Results

Patient Demographics

A total of 157 patients were included in our study, of which 41 (26.1%) were male, and 116 (73.9%) female. Majority of the patients were Chinese in ethnicity 131 (83.4%). The mean age at the time of surgery was 79.5 (Range 60 – 100), with an average body mass index of 21.4 kg/m^2 (Range 13.6 – 32.6). In terms of laterality, there were 68 (43.3%) operated right hips, and 89 (56.7%) left hips.

In terms of operative procedure, 72 (45.9%) patients underwent cemented bipolar hemiarthroplasty (HA), 79 (50.3%) underwent uncemented bipolar HA, and 6 (3.8%) underwent total hip arthroplasty (THA). Implants and surgical approach were surgeon dependent based on local institution guidelines.

For those who underwent a bipolar HA, the surgical approach taken was either direct lateral or posterior, dependent on the treating surgeon, and similarly for the choice of implant. All 157 (100%) of patients were allowed full weight-bearing status after immediate post-operative check X-Rays were reviewed and noted to be satisfactory.

Data was collected from a total of 626 clinical visits with a mean follow-up duration of 17.3 months (Range 0.6 – 72.8). A total of 973 radiographs were performed, and the most common radiographic order (144/168, 85.7%) order was an antero-posterior (AP) view of the pelvis, as well as an AP and lateral view of the operated hip.

The above information is summarized in Table 1 below.

An abnormal radiographic series was identified in 3/973 (0.3%) of all radiographs performed. These abnormal radiographic series had a corresponding normal consult and did not result in a change in management of the patients.

Table 1. Patient Demographics.

Parameter	Value
Total no. of patients	157
Gender	
Male	41 (26.1%)
Female	116 (73.9%)
Laterality	
Right	68 (43.3%)
Left	89 (56.7%)
Age	79.5 ± 7.6 (range 60 – 100)
BMI	21.4 ± 4.14 (range 13.6 – 32.6)
Race	
Chinese	131 (83.4%)
Malay	14 (8.9%)
Indian	5 (3.2%)
Others	7 (4.5%)
Operative procedure	
Uncemented bipolar HA	79 (50.3%)
Cemented bipolar HA	72 (45.9%)
THR	6 (3.8%)
Weight bearing status on discharge	
Full weight-bearing	152 (100 %)
Total no. of clinical visits	626
Average follow-up duration	17.3 mths ± 13.9 (range 0.6 – 72.8)
Total no. of radiographs	973
Radiograph orders	
Hip AP/Lateral	8 (4.76%)
Hip AP/Lateral + pelvis AP	144 (85.7%)
Hip AP/Lateral + pelvis AP + femur AP/Lateral	8 (4.76%)
Pelvis AP + femur AP/Lateral	8 (4.76%)

AP – Antero-Posterior.
*Lat – Lateral.

2 of the 3 abnormal radiographic series identified belonged to the same patient who had a cemented left bipolar HA performed where a cortical irregularity suspicious for a fracture line was noted just superior to the lesser trochanter on the Pelvis AP and Hip AP and lateral views. This radiographic finding was noted during the second and third follow up visits (0.6 and 1.6 months post-operatively respectively), and was not seen on subsequent radiographs after. The remaining 1 abnormal radiographic series identified belonged to a patient who had a right cemented THA performed, and showed a 2 mm stem subsidence on the Pelvis AP and Hip AP and lateral views. This radiographic finding was noted during the first follow up visit (0.9 months post-operatively), with no further subsidence seen in subsequent radiographs.

A negative change in management was only observed in 1/157 (0.6%) patient. The patient had a left THA performed, and presented with an abnormal consult 19 weeks post-operatively with a 3-day history of pain at the hip. Clinical examination revealed some erythema surrounding the surgical incision, with mild purulent discharge expressible. The patient also had an antalgic gait with limited ability to weight bear, and reduced range of motion of the hip. Plain radiographs performed during the same clinic visit showed no radiographic abnormalities. The patient was subsequently admitted for further management and eventually treated for a prosthetic joint infection with debridement synovectomy and a change of femoral head and liner.

The above information is summarized in Table 2 below.

Discussion

In our study, a negative change in management was only seen in 1 patient, who presented with an abnormal clinical consult, and had corresponding normal radiographs. There were also 2 patients with an abnormal radiographic series and normal consults which did not lead to change in management.

Patients with complications after arthroplasty for hip fractures are likely to be symptomatic, and would therefore present with an abnormal consult leading to the need for further investigation. In the setting of an asymptomatic patient with a normal clinical examination, the necessity for radiographs are not yet proven. A recent study has also similarly shown that abnormal radiographs alone regardless of clinical assessment rarely lead to changes in management.[11] Following elective primary THA, the utility of routine serial radiographs has also proven to have limited utility in asymptomatic patients.[12] Radiographs as a screening test for complications after arthroplasty for NOF fractures lack sensitivity and specificity, and limited clinical benefit.[9] Furthermore, unnecessary radiographs

Table 2. Clinical and Radiographic Relation.

	No.	No. with a Resultant Change of care
Normal consult + abnormal radiograph	3/626 (0.5%)	0
Abnormal consult + abnormal radiograph	0/626 (0.0%)	0
Abnormal consult + normal radiograph	1/626 (0.2)	1

cause not only high costs, but also increased radiation hazard to the patient.[11]

The abnormal radiographic series that were identified in our paper were also seen in the early post-operative period (earliest at 0.6, latest at 1.6 months post-op). These abnormal radiographic findings were not seen in subsequent radiographs after. Consideration can be given to have routine radiographs performed in the early post-operative period where radiographic changes may become evident, although further research is required to determine the optimal duration.

The most common radiographic series performed included an AP view of the pelvis, and an AP and lateral view of the operated hip (144/168, 85.7%). Previous studies have suggested that a single AP view of the pelvis is sufficient for evaluation of key parameters such as leg length, the vertical and horizontal center of the hip, as well as femoral stem positioning.[13] To reduce the number of radiographs performed, consideration should be made to have a single AP pelvis view done, unless there other clinical indications needing more orthogonal views, such as the evaluation of acetabular anteversion.

Our paper is not without limitations. Firstly, the study can be repeated with a larger sample size with a longer duration of follow up as majority of complications are also seen five to 20 years post operation.[14] Secondly, these results are only applicable to the local population, Lastly, the rate of complications after hip arthroplasty also differ based on the surgical approach used,[15] further studies should explore the utility of radiographic follow-up in patients based on this as well.

Conclusion

Post-operative complications following arthroplasty for NOF fractures are likely to result in a symptomatic presentation of the patient. Routine radiographic follow-up provides limited utility in asymptomatic patients and should only be performed if clinically indicated.

Author Contributions

Koh Jun Rui Don – Conceptualization, Methodology, Formal analysis, Data Curation, Writing – Original Draft, Visualization
Kuei Siong Andy Yeo – Conceptualization, Methodology, Formal analysis, Data Curation, Writing – Review & Editing, Visualization, Supervision
Charles Kam King Kon – Conceptualization, Methodology, Formal analysis, Data Curation, Writing – Review & Editing, Visualization, Supervision
Ing How Moo – Conceptualization, Methodology, Formal analysis, Data Curation, Writing – Review & Editing, Visualization, Supervision

Declaration of Conflicting Interests

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Ethical Statement

Ethical Approval

This retrospective study was approved by the SingHealth Institutional Review Board (IRB) Institution with approval number 2022/2318.

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Data Availability Statement

The data involved in the writing of this paper is available directly from the author.

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