

## Optimising Post-Operative Imaging in Hemiarthroplasty

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### Abstract

#### *Introduction*

Hip hemiarthroplasty is a common procedure for femoral neck fractures in the geriatric population. Immediate implant-related complications such as dislocation, periprosthetic fracture, and leg length discrepancy are uncommon, but should be ruled out with the use of post-operative X-rays. There is some debate as to the timing of the post-operative X-rays. Some orthopaedic units prefer immediate postoperative in theatre X-rays, while other units opt for departmental X-ray the following day. The aim of this study was to compare in theatre postoperative X-rays versus departmental next day X-rays, to see if there was any significant difference in diagnosing immediate implant related complications.

#### *Methods*

This is a single centre retrospective observational study including radiologic review of AP Pelvis X-rays for patients who had a cemented or uncemented bipolar hemiarthroplasty for neck of femur fracture from May 2018 until January 2023. Two independent orthopaedic surgeons reviewed the X-rays, to exclude any periprosthetic fractures, dislocations or other immediate implant related complications. A total of 1115 patients who underwent uncemented or cemented bipolar hemiarthroplasty data was collected from 2018 to 2023. Patients were operated using Anterolateral or Posterior approach as per preference of the operating consultant.

#### *Results*

Minimal or no complications were observed in 1,095 (98.2%) patients, both immediately after hip hemiarthroplasty and 24 hours postoperatively. At the same time, 20 (1.8 %) patients had complications, which were picked up on the x-rays two weeks or later after the procedure. It explains that postoperative in-theatre X-rays have negligible clinical influence. It emphasises the lack of early postoperative problems detected by intraoperative theatre x-rays after hip hemiarthroplasty. This gives an indication that such early postoperative imaging might not be critical in recognising early complications.

### *Discussion*

Day one post operative, inter departmental, post mobilization hip x-rays are reliable, cost effective, less time consuming, require less manual handling, better quality and are sufficient enough to out rule implant related complications, in patients post Bipolar Hip Hemiarthroplasty.

### **Introduction**

This study determines the need for a 24-hour postoperative X-ray in patients with femoral neck fractures who have undergone a hip hemiarthroplasty. A hip hemiarthroplasty is commonly used to repair broken hips, mainly fractures of the femoral neck<sup>1</sup>. This differs from a total hip replacement, in which the head of the femur and hip socket are removed and replaced. In a hemiarthroplasty, only the ball part of the hip joint is removed and replaced<sup>2</sup>. There are a number of different postoperative complications that can occur from a hip hemiarthroplasty. One of the risks is that the implant may be dislocated, the artificial ball may pop out of place, and the patient's natural socket may pop out of place<sup>3</sup>. One also needs to consider that the patient's bone structure is not that strong. Hence, there is the risk of the fractured bone, i.e., Peri prosthetic fracture<sup>4</sup>. The postoperative X-rays following a hip hemiarthroplasty are important in determining how well the surgery is performed and also the placement and alignment of the artificial implant within the femur<sup>5</sup>. For a successful hemiarthroplasty, the artificial femoral head should fit well in the natural acetabulum (hip socket), demonstrating accurate positioning<sup>6</sup>.

A postoperative X-ray is checked immediately after a hip hemiarthroplasty to verify proper placement of the implant and reliability, requiring an additional X-ray 24 hours post-surgery as a routine protocol that has not been definitively established. However, early detection of a serious complication is a crucial factor. The additional radiation exposure, increased healthcare costs, and potential patient discomfort raise concerns about whether it is worth the value<sup>7</sup>. There is no universal consensus on the optimal timing of postoperative imaging for our patients to balance early detection of a serious complication against those concerns<sup>8</sup>. In addition, uniformity was lacking in the criteria utilized to judge postoperative X-rays, as either predicted postoperative changes or the earliest possible signs of trouble leading to

dissimilarities in care decisions and results<sup>9</sup>. The purpose of the investigation is to evaluate the effectiveness of routinely performed 24-hour postoperative radiographs for the early detection of complications following a hip hemiarthroplasty, and to compare their effectiveness with those x-rays done in operation theatre. The results will be compared between patients who receive postoperative X-rays in operation theatre and those who had postoperative X-rays in the department after 24 hours.

## **Methods**

This study is based on a single-centre retrospective radiologic review. A total of 1115 patients who underwent uncemented or cemented bipolar hemiarthroplasty data was collected from May 2018 to May 2023. Patients were operated using Anterolateral or Posterior approach as per preference of the operating consultant. The collected data was analysed using SPSS software. A postoperative x-ray is commonly performed immediately after the hip hemiarthroplasty within theatre to ensure significant implant settlement. On the other hand, the routine procedure of organising an additional x-ray 24 hours or during first week, post-surgery lacks decisive development. While the early recognition of major complications is important, challenges grow concerning the value of additional exposure to radiation, enhanced healthcare costs, and the potential discomfort of patients.

Data collection for this study involved the review of a total of 1115 medical records of patients who underwent hemiarthroplasty for Neck of Femur Fractures due to acute trauma at a single tertiary care trauma unit. Inclusion criteria included, patients who had immediate postoperative X-rays in the theatre and departmental X-rays on the next day when weight bearing was allowed. Exclusion criteria included revision surgery and any other surgery for femur fractures. The X-rays were independently reviewed by 2 Orthopaedic Consultants for complications such as dislocation, malalignment, and periprosthetic fractures.

Data analysis was carried out using patient postoperative medical records of 1115 patients who had hemiarthroplasty for Neck of Femur fracture. Data is analysed using SPSS statistical software to allow the statistical tests and calculations to be carried out so as to find the

diagnostic accuracy of X-rays, and, by default, it has facilitated the reliability and validity of the study results.

### *Ethical Considerations*

The study was solely based on the retrospective data analysis, minimising patient risk, as no direct intervention or alteration to clinical care was involved<sup>10</sup>. Prior permission was obtained from the hospital's research ethics committee before the research was carried out<sup>11</sup>.

### **Results**

A total of 1115 patients who had undergone hemiarthroplasty for a neck of femur fracture were enrolled in this study. This section helps represent the outcome and provides significant and detailed information on the topic based on the cases included.

*Table 1: Demographics*

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	1115	62	99	83.392	8.95

The patients had an age range between 62 and 99. The mean age of patients was 83.392, with an 8.95 standard deviation, as depicted in Table 1. This reflects that a higher number of patients belonged to 83-year-old age group.

*Table 2: Gender*

<b>Sex</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	513	45.9	46.0	46.0
	Male	602	53.9	54.0	54.0
	Total	1115	99.8	100.0	
<b>Total</b>		<b>1115</b>	<b>100</b>		

Table 2 represents the information related to the AP pelvic X-rays of patients immediately after the operation. Out of 1115 participants, males were 602 in number, females were 513

in number, and the percentage of female participants was 45.9 and male participants were 53.9.

*Table 3: Hip X-Rays in Theatre*

Hip x-rays in theatre					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	7	0.5	0.5	0.5
	Yes	1108	99.5	99.5	100.0
	Total	1115	100.0	100.0	

This represents the frequency of the patients that were reviewed within one week of hemi-arthroplasty postoperative period. It indicates that about 7 patients' AP Pelvis X-rays were not reviewed, whereas about 1108 patients' AP Pelvis X-rays were reviewed. The difference in the rate of postoperative AP Pelvis X-ray review within one week of hemi-arthroplasty is an important source of information related to the compliance and strictness of postoperative assessment protocols.

*Table 4: Hip X Rays After 24 Hours in Department*

Hip x-rays within Theatre					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	132	11.0	11.0	11.0
	Yes	983	89.0	89.0	100.0
	Total	1115	100.0	100.0	

Similarly, Table 4 demonstrates the statistics of patients who had AP Pelvis X-ray after 24 hours in the postoperative period. It shows that 132 patients don't, while 983 patients had AP Pelvis X-rays in the radiology department, after 24 hours post operative period.

Table 5: Complications

Complications					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Nil	1095	98.4	98.4	98.4
	Yes	20	1.8	1.6	100.0
	Total	1115	100.0	100.0	

Table 5 indicates that minimal or no complications were observed in 1095 patients, neither in theatre immediately after hip hemiarthroplasty nor after 24 hours post-operatively. At the same time, 20 patients, who had complications, were picked up on the x-rays either two weeks or later after the procedure. It explains that postoperative in-theatre X-rays have negligible clinical influence. It emphasises the lack of early postoperative problems detected by intraoperative theatre x-rays after hip hemiarthroplasty. This gives an indication that such early postoperative imaging might not be critical in recognising early complications. The implication here is two-fold: either the surgical procedures are very efficacious with low short-term risk, or the complications occur later from the capture of in-theatre imaging. With this information, the timing and frequency of postoperative imaging should be reconsidered to optimise resource utilisation, and patient care strategies.

There were 6 patients who experienced complications in week one of the postoperative period. Mostly GT (greater tuberosity) fracture on day one of the postoperative period. Those were observed and corrected during the procedure inside the theatre. These complications that did develop consisted of greater trochanteric fractures, especially on the same operative day can be related to poor bone quality and surgical procedure complications. These particular timing and form of complications could suggest an inherent weakness just after the surgery when physical safety is most threatened.

Furthermore, the re-operation of one patient at eleven days of post-operation was performed due to a fall in the immediate postoperative period. One patient in week six experienced

dislocation and one GT fracture due to a fall. Besides that, other patients mostly experienced mechanical complications, including periprosthetic fracture and avulsion fracture of GT in the second week. Two patients within four- and six-weeks respectively, experienced dislocation. Hence, a total of twenty patients experienced complications, and, no complications were identified in theatre after operation in the immediate postoperative period.

## **Discussion**

The main purpose of this study was to compare the in-theatre X-rays immediately after Hip hemiarthroplasty and the X-rays, after 24-hour period in the department, to diagnose any implant related complications.

Although a postoperative radiograph (X-ray) is an important measure of screening to identify any mechanical complications, the efficacy of screening tests and the prevalence of complications are necessary to focus on effective clinical outcomes<sup>(12)</sup>. The study findings revealed that postoperative X-rays had no significant influence on the theatre after the surgery. However, 0.8% of X-rays showed mechanical complications within week two and the coming weeks after surgery. Acquiring postoperative radiographs for HA patients must be focused on medical and logical reasons rather than clinical indications. As per the perception of the Radiologist at Royal College, the request for investigation must be justified by clinical need and should be focused on influencing the management of patients<sup>13</sup>. Thus, exposing patients to X-ray radiation regardless of any clinical indication is not advisable.<sup>14</sup> The results also support these findings that immediate radiographs in theatre are not necessary for HA patients. Despite any indication of serious complications, physical radiograph examination is questionable.<sup>14</sup> claimed that an X-ray examination immediately after HA implantation is unlikely to influence the outcome for the patient. The examination must be followed after the indication of any signs and symptoms of mechanical complications. However, performing radiographs without any indication utilises extra theatre time. This is mainly because the AP Pelvis X-rays are a resource-intensive approach that requires human resources, time, and financial support as well.

Similarly, the findings of<sup>15</sup> are also in line with this study's results, which state that a review of HA patients for any mechanical complications in theatre increases the cost of healthcare. It is mainly because the single view of the anterior-posterior pelvis accounted for £53. The number of pelvic checks during an eight-year period costs £10,000 each year. This reflects that AP Pelvis X-rays in theatre after HA increase the cost burden for healthcare. Similarly,<sup>16</sup> findings also demonstrated that for patients with spinal surgery or hip arthroplasty and hip hemiarthroplasty routine radiograph examination without any sign or symptom of mechanical complications is not necessary as it does not cause a significant influence on patient health outcome. The immediate radiograph examination increases the health cost burden and exposure of the patient to radiation which cannot be justified.

The main strength of this study is the utilisation of a large sample size of 1115 patients, which helped in representing the population as a whole. D. Lakens<sup>17</sup> also claimed that a large sample size is essential for the generalisation of the findings. The study helped in observing the need for radiographs in theatre to examine HA patient mechanical complications in the postoperative period by considering the reports of 1115 patients. Hence, the study findings are important in highlighting the healthcare cost and the lack of necessity for hip X-rays in operation theatres after surgery. Although this study provided evidence that helped in understanding the necessity of X-ray immediately to the HA, it also possesses certain limitations. It is mainly because this study did not include any control group to observe the difference between patients who had complications prior to the operation. And all data was collected retrospectively. However, 7 patients included in the study were not examined with pelvis X-ray in theatre, which minimises the study's limitation. Future studies may focus on examining the need for radiograph examination of patients with HA by including both control and focused groups.

Thus, the authors recommend postoperative radiographs for hip hemiarthroplasty patients only if clinically indicated by signs and symptoms like pain, inability to weight-bear or potential infection<sup>4</sup>.

The findings of the study conclude that immediate postoperative X-rays within the operating theatre can have limited importance in detecting implant-related complications after hip



hemiarthroplasty. Instead, performing a departmental postoperative x-ray on the very first day is primarily planned as satisfactory for screening frequent implant-relevant concerns following bipolar hemiarthroplasty for the femoral neck fractures. The study findings highlighted that immediate radiography observation after the surgery increases the cost burden and resource utilisation. Besides that, the exposure of patients to radiation without any clinical and medical indication was not justified, as it did not influence patient health outcome. However, indications for theatre x-rays after Bipolar Hemiarthroplasty are any consultant preference due to any odd event during the surgery, which may include, malalignment of prosthesis during fitting due to difficult anatomy, known complication during the surgery like Greater trochanteric fracture and education purposes. In summary, Day one post-operative, inter-departmental, post-mobilisation hip x-rays are reliable, cost-effective, less time-consuming, require less manual handling, better quality, and are sufficient enough to rule out implant-related complications in patients post-Bipolar Hip Hemiarthroplasty.

**Declarations of Conflicts of Interest:**

None declared.

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