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Unplanned Return to Theatre Following Hip Hemiarthroplasty: Indications and Clinical Implications

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Abstract

Purpose

Mortality rates following neck of femur fracture surgery are a critical measure of patient outcomes and healthcare quality. An important distinction is the difference between mortality rates after primary surgery versus after a return to theatre. Understanding and stratifying these rates are essential for improving patient care and prognostication.

Methods

We report a multicentre retrospective review of 2211 consecutive primary hip hemiarthroplasty cases resulting in unplanned returns to theatre in 78 patients. The primary outcome was mortality rate (30 days and one year). A total of 34 of these 78 patients returned to theatre within 30 days and were also analysed as their own subgroup. Overall return-to-theatre rate was 3.5%. Return to theatre within 30 days was 1.5%. A total of 25.6% of the 78 patients returned to theatre twice, and 6.4% returned three times.

Results

Mortality rate following return to theatre is significantly higher than the UK National Hip Fracture Database average mortality for primary surgery at 30 days (12.8% vs 5.6%, χ^2=8.0, df=1, p=0.005), geographically and temporally matched to the three centres in the study. At 12 months, mortality remains higher compared to reported median published rates, as per a literature review performed for this study (35.9% vs 27%, χ^2=3.1, df=1, p=0.08), although this does not reach statistical significance. Mortality for patients returning to theatre within 30 days is also increased (8.8% vs 5.6%), but this did not reach statistical significance. Infection carries the highest mortality from the indications studied.

Conclusion

This study highlights the importance of getting it right the first time for this vulnerable cohort of patients, reflected in the recent inclusion of hemiarthroplasty procedures in the UK National Joint Registry. A return to theatre following a complication of hip hemiarthroplasty carries a higher mortality risk, which needs to be clearly and carefully communicated to patients and relatives during multidisciplinary team (MDT) decision-making.

Categories: Geriatrics, Orthopedics
Keywords: elderly hip fracture, fracture femoral neck, hip hemi-arthroplasty, hip hemi-arthroplasty complications, return to theatre

Introduction

Mortality following primary surgery for neck of femur fracture (NOF) is well studied and audited, especially in the United Kingdom (UK). The National Hip Fracture Database (NHFD) provides a wealth of data on NOF patients with annual reporting [1]. Recently, the National Joint Registry in the UK has started to collect data on hip hemiarthroplasty implants, reflecting the importance of monitoring outcomes in this vulnerable cohort of patients. A wealth of data is available on primary surgical outcomes [1-7], with 30-day and one-year mortality generally reducing over time from a traditionally quoted 10% and 30%, respectively, to 6% at 30 days and 16.6-28.3% at one year. Literature is not as well furnished about outcomes of complications following these primary procedures, especially if a return to theatre is involved. Evidence points towards an increased risk of mortality with dislocations [8], fractures [9] and infection [10] in cohorts of primary hip

fracture surgery patients, but limited evidence exists to outline mortality risk following the same complications following a re-operation. By defining this more clearly, clinical decision-making in such complex cases can be supported by a better understanding of peri-operative risk.

The primary aim of this study was to quantify the post-operative mortality following an unplanned return to theatre following hip hemiarthroplasty performed for NOF, encompassing a variety of complication types at all time points within the study period as well as within 30 days of the index procedure. The secondary aim was to assess mortality between different indications for returning to theatre, which is sparsely reported in the literature thus far.

Materials And Methods

Data were collected retrospectively from three institutions in the North West of England: a Major Trauma Centre (MTC), a Trauma Unit (TU) and a Local Emergency Hospital (LEH), as classified by the United Kingdom Major Trauma Network [11].

Electronic databases and electronic patient records were searched in each site to identify patients who underwent hip hemiarthroplasty for NOF and then to identify those who sustained a post-operative complication, which necessitated a return to theatre. Specifically, departmental trauma list databases as well as operating room management and information systems were interrogated, and data were extracted from operation notes, clinic letters and case notes. A return to theatre was classified as any procedure undertaken under any form of anaesthesia on the trauma operating list in the operating theatre. Across all three sites, data were collected according to the same criteria between January 2019 and December 2023 for all consecutive cases of hip hemiarthroplasty for NOF. The same electronic systems were also used to identify all patients returning to theatre via the trauma list for complications following hemiarthroplasty, regardless of timing after primary. Exclusion criteria included misidentified total hip replacements, internal fixation procedures, patients returning to theatre for elective procedures in the same theatre complex or for complications relating to a total hip replacement. Mortality was assessed by searching patient records on a regional electronic database, which covered all three sites, as well as local electronic records. This was performed over one year after the end of the study period. Data were collected on basic demographics, including patient American Society of Anesthesiologists (ASA) grade where available, complication types, implant types, revision procedures undertaken, as well as mortality at 30 days and one year postoperatively following return to theatre. This mortality rate at 30 days was then compared to the 30-day NHFD mortality rate specific to each site during the study period, as well as published one-year mortality rates for primary NOF surgery. Mortality rates across different indications for return to theatre were also assessed individually. A return to theatre was classed as a separate event; therefore, a single patient may have more than one episode depending on surgical indication. Mortality rates, however, were calculated on a “per patient” basis to avoid repeated measures bias.

Descriptive statistics were used throughout in the form of percentages as well as mean and standard deviation (SD) where appropriate, using 95% confidence intervals. Two-tailed t-tests were used when assessing for differences in mortality based on age, accepting a p-value of 0.05 as significant. To compare mortality rates between different indications for return to theatre, chi-squared tests were used, again accepting a p-value of 0.05 as significant, calculated using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). For one-year mortality rates, a single source of data such as the NHFD for 30-day mortality is not available. Hence, a median was calculated across all studies included in our literature review within Microsoft Excel. To calculate this median, a literature search was conducted using the PubMed database in October 2023 during study design. Search terms used were “mortality following fragility fracture surgery”, “hip fracture post operative complications mortality” and “hip hemiarthroplasty complications”. This generated 10 relevant publications for analysis [1-3,5,8-10,12-14]. Where available in relevant papers, if UK-specific one-year mortality rates were available, this value alone was used in the calculation of the median. Otherwise, the reported one-year mortality figure was extracted and used in the median calculation.

Results

Mean age at return to theatre across the cohort was 84.6 years (7.8 years), and within the cohort of patients returning within 30 days, this was 85.9 years (7.8 years). Where available, ASA grade information is displayed in Table *1*. The cohort of patients who died within one year was older than the cohort who survived (mean 87.8 vs 82.8 years, t=1.99, df=76, p=0.006).

ASA Grade	Overall Frequency (n)	Proportion (%)	Within 30 Days Frequency (n)	Proportion (%)
1	0	0.0	0	0
2	6	9.4	3	10.7
3	33	51.6	10	35.7
4	25	39.1	15	53.6
5	0	0.0	0	0
N/A	14	-	6	-

TABLE 1: ASA grade of patients returning to theatre following complications of hip hemiarthroplasty

ASA data are presented for 78 patients returning to theatre during the overall period and 28 patients who returned within 30 days.

ASA: American Society of Anesthesiologists; N/A: data not available

Procedure types necessitating a return to theatre are shown in Table 2. The most common re-operation performed was a closed reduction of a dislocated prosthesis.

Procedure	Closed Reduction	Girdlestone Excision Arthroplasty	Deep Washout	Revision to THR	Superficial Washout	Open Reduction	ORIF
n	31	22	14	12	12	10	7

TABLE 2: Types of procedures constituting overall return to theatre

Deep washout refers to a surgical washout in which the prosthesis is exposed.

ORIF: open reduction internal fixation; THR: total hip replacement

Across the three sites, most patients received a cemented Thompson hemiarthroplasty, whereas a smaller proportion received a more modern cemented stem design. A breakdown of implant usage can be seen in Table 3. The modern implants included the Exeter system (Stryker, Michigan, USA), comprising the Exeter V40 with bipolar articulation and the Exeter Trauma Stem, as well as the C-Stem (DePuy, Indiana, USA).

	Thompsons	Modern Cemented Bipolar	Modern Cemented Unipolar
Overall implants (n)	59	7	12
Return within 30 days implants (n)	24	2	8

TABLE 3: Implant usage in primary procedures among patients who returned to theatre overall and within 30 days following complications of hip hemiarthroplasty

One patient was excluded from analysis because of a planned return for acetabular wear/erosion and groin pain. The patient was revised to a cemented dual mobility total hip replacement one year after their primary procedure.

Return to theatre rates can be seen in Table 4. Across a total of 2211 primary hemiarthroplasties, there were 109 returns to theatre in 79 patients. There were no bilateral procedures. Following exclusion criteria, this was 108 returns in 78 patients, equating to 4.9% of cases and 3.5% of patients. A total of 25.6% (20) of the 78 patients returned to theatre twice, and 6.4% (5) returned three times. There were 34 patients who returned to theatre within 30 days of their primary procedure.

Site	Primary Hemiarthroplasties (n)	Returns to Theatre (n)	Patients (n)	Per Procedure Rate of Return (%)	Per Patient Rate of Return (%)
MTC	792	60	43	7.6	5.4
TU	838	41	31	4.9	3.7
LEH	581	7	4	1.2	0.7
Total	2211	108	78	4.8	3.5

TABLE 4: Rates of return to theatre following complications of primary hip hemiarthroplasty for neck of femur fracture

MTC: Major Trauma Centre; TU: Trauma Unit; LEH: Local Emergency Hospital

Overall mortality rates at 30 days and one year, classified by whether the return to theatre occurred within 30 days or not, can be seen in Table 5. Average 30-day mortality rates taken from the NHFD specific to our three sites for the same time period as this study stand at 5.6%. The median one-year mortality rate from the review of the literature was 27% (IQR 6.5%).

Return to Theatre Timeframe	Mortality Cutoff	Mortality (n)	Crude Mortality (%)
Overall	30 days	10	12.8
	One year	28	35.9
Within 30 days	30 days	3	8.8
	One year	9	26.5

TABLE 5: Total 30-day and one-year mortality rates following return to theatre after hip hemiarthroplasty, calculated on a per-patient basis

Mortality is presented on a per-patient basis.

Mortality rates at 30 days and one year can be seen in Table 5. For acute returns within 30 days, 30-day mortality was 8.8% (3/34 patients) and one-year mortality was 26.5% (9/34 patients). When compared to expected mortality at 30 days (χ^2=0.53, df=1, p=0.47) as per NHFD and one-year mortality as per study median (χ^2=3.41, df=1, p=0.06), there was no difference in mortality at either time point.

At 30 days for all returns, there is a significantly increased mortality rate (χ^2=8.0, df=1, p=0.005) compared to NHFD figures for primary surgery for all indications. At one year, mortality was also higher across all indications than the median reported in this study, although the difference was not statistically significant (χ^2=3.1, df=1, p=0.08). Infection carried the highest risk (47% at one year) of mortality across all indications (8/17 patients returning for infection), but this did not reach statistical significance compared to subgroups of other indications (χ^2=1.39, df=2, p=0.49).

Of the total 78 patients, 20 had two returns to theatre, and five returned to theatre three times. The one-year mortality rate for the patients returning twice was 5% (n=1), and for those returning three times, it was 60% (n=3). For the remaining 53 patients who went back to theatre for a single visit, the one-year mortality was 45.3% (n=24). Within the cohort of 34 patients who returned within 30 days, 12 had more than one return to theatre. The one-year mortality from this group was 33.3% (n=4).

Discussion

A recently published UK multicentre prospective cohort study demonstrated a 2.7% risk of re-operation within 120 days for any indication for all NOF patients in a cohort of 24,523 patients [15], of which 11,283 patients received a hemiarthroplasty. The authors also acknowledge that although mortality is declining, the risk of complications is still high in this vulnerable cohort of patients. Our return-to-theatre rate of 3.5% is similar but is specific to hemiarthroplasty. In the same study, the 30-day primary surgery mortality rate was 4.5%, compared to our 30-day mortality figure for a return to theatre of 12.8%.

Patients who return to theatre after a hip hemiarthroplasty for NOF have a significantly higher risk of mortality than for their primary procedure. This is when compared to time- and location-specific NHFD figures, as well as the figures of a large multicentre national study [15]. This increased mortality risk appears to be present whether the patient returns to theatre acutely within 30 days, or subacutely beyond this timeframe. When the ASA grades of patients from our study in Table *1* are compared to UK national figures in the NHFD [1], there is a greater proportion of patients with an ASA grade higher than 3, equating to severe systemic disease that is a constant threat to life. In our study, patients with ASA 1-3 counted for 61%, whereas nationally the figure is consistently around 75-76% throughout the study duration. The remaining patients in our study were ASA 4. This suggests that patients who suffer complications necessitating a return to theatre are even more comorbid and frail than the primary population of patients, who are already a physiologically vulnerable group [16].

The risk of mortality is higher within the first 30 days post-operatively and remains high up to one year, although in this study, the one-year timepoint cannot be proven with statistical significance. Despite being one of the largest cohorts of hip hemiarthroplasties presented in the literature, this finding could be secondary to a type 2 error due to low numbers in different subcategories of indications for return to theatre.

Mortality following a Girdlestone excision arthroplasty of hip hemiarthroplasty is around 41.7% at one year [17], and this study has found a similar figure with a larger, more recent cohort of patients. This highlights the physiological toll taken for any return to theatre, regardless of the scale of intervention performed.

Infection was associated with a higher mortality at both 30 days and one year, although this could not be proven with statistical significance. This is regardless of whether the return to theatre was for superficial or deep infection. Across the MTC and TU sites, infection had the highest mortality rate, whereas in the LEH, no patients with infection died within 12 months. Other studies looking at deep infection around hip hemiarthroplasty have also noted significantly elevated one-year mortality as well as highlighting that a prosthesis-preserving washout/debridement often requires repeated procedures and carries a high failure rate [10,18].

Various authors have published poor results following repeated returns to theatre for dislocation and infection [8,10,18,19], and in our cohort, the worst mortality rates were seen in patients returning to theatre the most often, albeit small numbers in this subgroup. The same pattern was observed for returns to theatre within 30 days, although the magnitude of effect was less marked. This would suggest that if faced with a complication that needs to go back to theatre, a careful discussion needs to be had with the patient and/or relatives outlining risks involved with repeated procedures. Definitive management with an excision arthroplasty if an initial washout or manipulation fails needs to be carefully considered. Further research is needed to establish if this would be a suitable option to consider early if faced with such circumstances.

This study includes various types of UK hospitals, encompassing all three categories of trauma services. This pragmatic representation helps to highlight mortality rates and complications from a broad spectrum of unit types. Dislocation was the most common indication for return to theatre, followed by infection. This pattern was observed across all hospitals included. Regardless of complication type, however, the impact of a return to theatre on post-operative mortality is considerable. This underlines the importance of careful workup and prompt, appropriate surgery being undertaken by a suitably trained surgeon as per Best Practice guidelines, which have been shown to improve mortality for hip fracture patients [20].

This study, although with a large cohort of primary procedures, is limited by its retrospective design and limited numbers of returns to theatre. When assessing factors such as mortality by indication or by number of returns to theatre, especially for those returning within 30 days, subgroup case numbers were small. This increases the chance of a type two error within our subgroup analysis and, as such, the observed associations presented here cannot be used to prove a causal effect. Further work with a larger cohort of patients would be needed to further assess for differences in mortality rates in returns to theatre for infection, fracture or dislocation. The lack of robust nationally published mortality data also means that a median figure from reported literature was used. It was not possible to standardise and control for differences in nationality, comorbidity burden, methodology or study design within the papers used. The effect of the COVID-19 pandemic on mortality in our cohort was not known, but it has been adjusted for in the analysis of 30-day mortality by using NHFD outcomes matched to the same study period, as well as specific hospitals in this cohort.

Conclusions

Returning to theatre following a complication related to hip hemiarthroplasty is associated with more than double the mortality risk at 30 days. The mortality risk at one year remains elevated, although this was not a statistically significant finding in our data. Those who undergo complications are more comorbid than the cohort of primary fracture patients, and this is important to discuss with patients and relatives when counselling them about management options. Repeated procedures are associated with higher mortality and, as such, definitive early management with excision arthroplasty needs to be an important option discussed in the multidisciplinary meeting. This needs to be carefully discussed on an individualised case-by-case basis with patients and/or relatives as an option early in the decision-making process if considering

a return to the operating theatre.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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