Outcomes of conversion total hip arthroplasty following previous hip fracture surgery

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Aims
The conversion of previous hip fracture surgery to total hip arthroplasty (CTHA) can be surgically challenging with unpredictable outcomes; reported complication rates vary significantly. This study aimed to establish the medium-term survival and outcomes of CTHA performed following a previous hip fracture surgery.

Methods
All CTHAs performed at our tertiary orthopaedic institution between January 2008 and January 2020 following previous ipsilateral hip fracture surgery were included. Patients were followed up clinically using Oxford Hip Scores (OHS), and radiologically until death or revision surgery. Postoperative complications, radiological implant failure, and indications for revision surgery were reviewed.

Results
A total of 166 patients (167 hips) were included in the study, with a mean age of 71 years (42 to 99). Of these, 113 patients (67.7%) were female. CTHA followed cannulated screw fixation in 75 cases, hemiarthroplasty in 18, dynamic hip screw fixation in 47, and cephalomedullary nail in 27 cases. Patients were followed up for a mean of four years (0.1 to 9.3). During the follow-up period, 32 patients (19.2%) died. Overall, 14 patients (8.4%) suffered a complication of surgery, with intraoperative fractures (4.2%) and dislocations (3.6%) predominating. The survival probability was 96% at 9.53 years in the cemented group and 88% at 9.42 years in the uncemented group (p = 0.317). The median OHS improved from 13 (IQR 7.75 to 21.25) preoperatively to 39 (IQR 31 to 45) postoperatively in the uncemented group, and from 14 (IQR 10.5 to 22) to 38 (IQR 27 to 45) in the cemented group.

Conclusion
This study highlights that CTHA from hip fracture surgery is associated with higher complication rates than conventional THA, but good medium-term results can be achieved. Their classification within the NJR requires review, acknowledging the increased potential for complications.

Take home message
- Conversion total hip arthroplasty (THA) following hip fracture surgery should not be considered equivalent to primary THA, as it is associated with different outcomes and higher complication rates.
- Intraoperative fractures are more frequent especially after CMN and hemiarthroplasty, and CMN conversions have the highest rate of developing heterotopic ossification. Cemented stems show superior survivorship to uncemented stems, and poorer cementation in cases with larger cortical defects was not linked to progressive loosening or lysis.These findings support the need to classify CTHA as a distinct entity within the National Joint Registry.

Introduction
In a report by the UK National Hip Fracture Database group, 72,160 patients aged

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over 65 years sustained a hip fracture in 2022, with an annual expenditure exceeding £2 billion. This represents an additional cost of £75 million compared to the previous review period of 2016 to 2019.[1,2] The 30-day mortality rate reported in 2022 was 6.4%.[1] Recent publications have found that one-year mortality varies between 16.6% and 27.0%.[3-6]

With increasing life expectancy and greater functional demands, the requirements placed upon hip fracture fixation surgery are growing in number. As a result, secondary issues such as acetabular erosion, nonunion, malunion, avascular necrosis, early onset arthritis, and problems arising from metalwork are seen more frequently.[7] These factors may subsequently lead to conversion total hip arthroplasty (CTHA). The National Joint Registry (NJR), which uses data from England, Wales, Northern Ireland, the Isle of Man, and the States of Guernsey, indicates that nearly 1% of all primary THAs are conversions from hip hemiarthroplasty.[8]

CTHA is defined as THA after failed prior hip surgery.[9] Reported complication rates vary widely from 7.5% to 30.7%,[10–12] with conversion of previous hip fracture surgery to THA showing an increased incidence of complications such as periprosthetic fracture, dislocation, infection, and poorer patient-reported outcome measures (PROMs).[10,13–15] The potential reasons behind this include altered proximal femoral anatomy, soft-tissue condition, and the impact of prior implants.[9–12] Additionally, there is an increased cost compared to conventional THA, as demonstrated by several cost-effectiveness analysis studies.[10,12,16,17]

The primary aim of this study was to establish the complication profile, survival, and outcomes of CTHA performed for previous hip fracture surgery. Additionally, it aimed to investigate if there is variability in survival between initial fracture pattern and methods of fixation.

Methods

At our tertiary orthopaedic institution, all CTHAs performed between January 2008 and January 2020 following prior hip fracture surgery were identified from the hospital's electronic patient records (EPRs). All surgeries were performed or directly supervised by a consultant orthopaedic surgeon experienced in revision arthroplasty. Ethical approval was exempted for the current study, as all data were routinely collected for clinical and audit purposes.

Inclusion criteria comprised all patients undergoing CTHA who had previous ipsilateral hip fracture surgery by any method and were aged over 18 years at the time of the index fracture. Patients who had CTHA following previous femoral osteotomy were excluded.

A total of 166 consecutive patients (167 hips) were included in the study. The mean age of the cohort at the time of CTHA was 71 years (42 to 99); 113 patients (67.7%) were female. Overall, 98 (58.3%) had CTHA performed following index intracapsular fractures, and 69 (41.3%) had previously suffered extracapsular injuries.

In addition to demographic data, the following datasets were retrieved from the EPR: type of fracture, type of initial hip fracture surgery, indication for CTHA, time from initial fracture surgery to CTHA, CTHA implant used, American Society of Anesthesiologists (ASA) grade,[18] Charlson Comorbidity Index (CCI),[19] and operating time.

Following CTHA, patients were monitored clinically and radiologically until death or revision surgery. Indications for revision surgery were reviewed. Oxford Hip Scores (OHSs)[20,21] were retrieved from our PROMs database.

Patients underwent anteroposterior (AP) radiography of both hips, and a lateral radiograph of the affected hip preoperatively and followed up at three, six, and 12 months postoperatively. All radiographs were assessed by two authors (DD, SG), with any revised or failing CTHAs reviewed in addition by the two senior authors (BB, GT). Radiographs were examined for prosthetic failure on both the acetabular and femoral side. For cemented stems, adequacy of cementing was determined by the system reported by Barrack et al.[22] The presence of radiolucent lines (RLLs) (> 1 mm wide and > 5 mm long) at either the stem-cement or cement-bone interfaces for cemented prosthesis were recorded.[23] RRLs were noted between the stem-bone interfaces in uncemented prosthesis. Radiographs were examined for osteolysis.[24] Heterotopic bone formation was recorded according to the criteria described by Brooker et al.[25]

Statistical analysis

Continuous variables were assessed for normality using frequency histograms. Where normal distribution of data was found, parametric testing using unpaired *t*-test was performed, and is presented as means with 95% CIs set. Where normality of data was not found, it was compared using non-parametric Wilcoxon rank-sum test and presented using the median with IQR. A One-way ANOVA was performed to compare the means across more than two groups. Categorical data were compared using chi-squared test or Fisher's exact test, where the expected frequency was less than five. Operating time, intraoperative periprosthetic fracture, dislocation, infection, revision for any cause, and implant survival were compared using Cox proportional hazard test. Implant survival was plotted using Kaplan-Meier survival curves with 95% CIs, with endpoints being revision due to infection, aseptic loosening, instability, or reoperation for any cause.[26] Where multiple complications were identified, mechanical failures were preferentially noted for the analysis. Statistical analysis was performed using R 3.4.3 (R Foundation for Statistical Computing, Austria).

Results

The mean age of the patients undergoing CTHA with previous intracapsular fracture was 70 years, and 73 years in the extracapsular group (p = 0.033, unpaired *t*-test). Table I shows the demographics and baseline characteristics of the intracapsular and extracapsular fracture groups.

The mean age at CTHA was 74 years (45 to 99) for cemented femoral stems and 70 years (42 to 96) for uncemented prothesis (p = 0.002, unpaired *t*-test). Table II shows demographics and baseline characteristics of cemented and uncemented CTHA patients.

Mean ages for patients who underwent CTHA previously fixed with cannulated screws (CS) were 68 years (43 to 99), for hip hemiarthroplasty 78 years (62 to 96), for dynamic hip screw (DHS) 74 years (42 to 89), and for cephalomedullary nail (CMN) 74 years (50 to 88) (p = 0.001, one-way analysis of variance (ANOVA)). Among these cohorts, 47 of the CS patients (61.8%), 15 of the hemiarthroplasty patients (88.2%), 35 of the

Table I. Demographic data of intracapsular and extracapsular fracture patients.

Characteristic	Intracapsular	Extracapsular	p-value
Number of fractures	98	69	
Mean age, yrs (range)	70 (42 to 99)	73 (50 to 89)	0.033*
Male sex, n (%)	66 (32)	46 (23)	1.000†
Median LoS, days (IQR)	5 (4 to 8)	5 (3 to 9)	0.570*
Left side, n (%)	43 (55)	28 (41)	0.754†
Mean age at death, yrs (range)	80 (65 to 106)	83 (66 to 92)	0.446*
Median ASA grade (IQR)	II (I to II)	II (II to III)	0.011‡
Mean CCI (range)	3 (0 to 5)	4 (0 to 5)	0.011*
Median preop OHS (IQR)	14 (10 to 23)	13 (7 to 20)	0.313‡
Median postop OHS (IQR)	39 (28 to 45)	38 (28 to 44)	0.454‡

*Unpaired *t*-test.
†Fisher's exact test.
‡Wilcoxon rank-sum test.
ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index; LoS, length of stay; OHS, Oxford Hip Score.

Table II. Demographics of cemented and uncemented conversion to total hip arthroplasty.

Characteristic	Cemented	Uncemented	p-value
Number of hip	71	96	
Mean age, yrs (range)	74 (51 to 99)	70 (42 to 96)	0.002†
Male sex, n (%)	51 (20)	61 (35)	0.053*
Median LoS, days (IQR)	5 (4 to 8)	4 (3 to 8)	0.218‡
Left side, n (%)	26 (45)	45 (51)	0.892§
Mean age at death, yrs (range)	84 (79 to 89)	79 (71 to 86)	0.210†
Median ASA grade (IQR)	II (II to III)	II (I to II)	0.225‡
Mean CCI (range)	4 (I3 to 5)	3 (2 to 4)	0.004†
Median preop OHS (IQR)	14 (9 to 21)	13 (9 to 22)	0.933‡
Median postop OHS (IQR)	38 (27 to 45)	39 (31 to 45)	0.534‡

*Fisher's exact test.
†Unpaired *t*-test
‡Wilcoxon rank-sum test.
§Chi-squared test.
ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index; LoS, length of stay; OHS, Oxford Hip Score.

DHS patients (74.5%), and 15 (55.6%) of the CMN patients were female (p = 0.132, Fisher's exact test). Table III shows the demographics and baseline characteristics according to previous hip fracture surgery.

The mean ASA grade and CCI were II and 4, respectively, for the whole cohort. For both intracapsular and extracapsular fractures, the mean ASA grade was II (p = 0.011, Wilcoxon rank-sum test). An ASA grade of II was seen in the CS, hemiarthroplasty, DHS, and CMN groups (p = 0.057, chi-squared test), and this remained the same for uncemented and cemented stems (p = 0.225, Wilcoxon rank-sum test). The mean CCI was 3 and 4 for intracapsular and extracapsular fractures (p = 0.013, Wilcoxon rank-sum test), 3 for CS, and 4 for hemiarthroplasty, DHS, and CMN (p = 0.441, chi-squared test). Patients implanted with cemented and uncemented stems had a mean CCI of 4 and 3, respectively (p = 0.004, Wilcoxon rank-sum test).

Fracture type was intracapsular in 126 cases (75%), intertrochanteric in 23 (13.7%), subtrochanteric in nine (5.3%), and femoral shaft in ten (6%). The prior hip fracture surgery was CS in 76 patients, hemiarthroplasty in 17, four-hole DHS in 47, and CMN in 27 patients. Of the 17 hemiarthroplasties, 14 (82.4%) were cemented stems and three (17.6%) were uncemented Austin Moore prosthesis (Auxein, India).

The most common indications for CTHA were the development of OA in 71 hips (42.3%), avascular necrosis in 33 hips (19.6%), and prosthetic cut-out in 16 hips (9.5%) (Table IV).

The median time from index hip surgery to CTHA was 2.2 years (IQR 1.4 to 5.1). The median times varied based on prior hip surgery: 2.0 years (IQR 1.7 to 7.2) for CS, 3.6 years (IQR 3.4 to 6.9) for hemiarthroplasty, 1.8 years (IQR 1.0 to 3.2) for DHS, and 3.7 years (IQR 1.0 to 5.5) for CMN.

At the time of CTHA, 32 hips had a fully cemented construct, 40 a hybrid, six a reverse hybrid construct, and 89 a fully uncemented THA. A total of 71 (42.5%) of the CTHAs were performed with a cemented stem, and 96 (57.5%) with an uncemented stem design, all performed using the posterior approach. The cemented stems implanted were the Exeter V40 (Stryker, USA) or C-stem (Johnson & Johnson (J&J), USA). The uncemented design implanted was the Corail stem (J&J).

The most commonly used acetabular cups were Pinnacle (J&J) in 72 cases (42.9%), Trident (Stryker) in 17 (10.1%), and Exeter Contemporary (Stryker) in 14 (8.3%). The liner was lipped in 62 cases (37.1%), neutral in 33 (19.8%), dual-mobility in seven (4.2%), and constrained in two (1.2%). Head size was predominantly 28 mm in 71 cases (42.5%) and 32 mm in 67 (40.1%), while 36 mm was used in 13 cases (7.8%). The smallest head size was 22 mm in three cases (1.8%), and the largest was 48 mm in one case (0.6%).

CTHA operating time varied by type of previous fixation. Mean operating times were 99 minutes (SD 41) in CS, 124 minutes (SD 40) in four-hole DHS, 133 minutes (SD 46) in hemiarthroplasty, and 144 minutes (SD 48) in CMN (p < 0.054, one-way ANOVA). Mean operating times for implantation of cemented and uncemented femoral prosthesis were 125 ± 35 and 108 ±42 minutes, respectively (p = 0.021, unpaired *t*-test).

Of the 71 cemented CTHAs, the immediate postoperative Barrack grading was Grade A in 31 (43.7%) hips, Grade B in 27 (38%) hips, and Grade C in 13 (18.3%) hips (Table V). There was a statistical difference in quality of cementing when comparing initial fracture pattern (p < 0.001, Fisher's exact

Table III. Demographics by treatment type.

Characteristic	CS	Hemiarthroplasty	Four-hole DHS	CMN	Overall	p-value
Number of fractures	76	17	47	27	167	
Mean age, yrs (range)	68 (44 to 99)	78 (62 to 96)	74 (42 to 89)	74 (50 to 88)	71 (42 to 99)	0.001*
Male sex, n (%)	47 (28)	15 (3)	35 (12)	15 (12)	113 (54)	0.132†
Median LoS, days (IQR)	4 (3 to 8)	7 (5 to 15)	5 (4 to 10)	5 (3 to 7)	5 (3 to 8)	0.047*
Left side, n (%)	34 (41)	6 (12)	26 (21)	10 (17)	70 (97)	0.732†
Mean age at death, yrs (range)	76 (70 to 78)	88 (84 to 91)	82 (80 to 87)	87 (85 to 89)	81 (73 to 88)	0.090*
Median ASA grade (IQR)	2 (1 to 2)	2 (2 to 3)	2 (2 to 3)	2 (2 to 3)	2 (2 to 3)	0.057†
Mean CCI (range)	3 (2 to 4)	4 (3 to 4)	4 (3 to 5)	4 (3 to 5)	4 (2 to 4)	0.440†
Median preop OHS (IQR)	13 (9 to 22)	27 (20 to 29)	11 (7 to 18)	13 (11 to 25)	14 (9 to 21)	0.022*
Median postop OHS (IQR)	40 (29 to 46)	36 (27 to 41)	37 (28 to 44)	40 (33 to 45)	39 (31 to 46)	0.428*

*One-way analysis of variance (ANOVA).
†Chi-squared test.
ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index; CMN, cephalomedullary nail; CS, cannulated screw; DHS, dynamic hip screw; LoS, length of stay; OHS, Oxford Hip Score.

Table IV. Indications for conversion to total hip arthroplasty.

Description	n (%)
Osteoarthritis	71 (42.3)
Avascular necrosis	33 (19.6)
Cut-out of prosthesis	16 (9.5)
Nonunion	15 (8.9)
Acetabular wear	10 (6.0)
Failed fixation	8 (4.8)
Periprosthetic fracture	6 (3.6)
Infected nonunion	4 (2.4)
Prominent metalwork	2 (1.2)
Failed metalwork	2 (1.2)
Dislocation	1 (0.6)

Table V. Quality of cementing as per Barrack's grading.

Grade	CS	DHS	Hemiarthroplasty	CMN
A	16	7	7	1
B	16	5	2	4
C	0	4	1	8

CMN, cephalomedullary nail; CS, cannulated screw; DHS, dynamic hip screw.

test) and type of hip surgery ($p < 0.001$, Fisher's exact test). In the intracapsular group, 15 (33.8%) stems had Barrack A cementing, while in the extracapsular group this was three (9.8%). When assessing quality of cementing by type of fixation, 50% of CS, 70% of hemiarthroplasty, 43% of DHS, and 7.7% of CMN had Barrack A.

Patients were followed up for a mean four years (0.1 to 9.3). During this period, 32 patients (19.2%) died without radiological evidence of prosthesis failure or revision surgery. Figure 1 shows the survival probability of the entire cohort of CTHA until the end of the follow-up period.

The fate of all stems was known, with none having been revised for aseptic loosening or osteolysis. Of the hips in patients who had died during the study period, none were revised or failed clinically or radiologically at last follow-up. Two hips were lost to radiological follow-up; however, we were able to establish clinical follow-up in one of them, leaving clinical follow-up in 99% of hips and radiological follow-up in 98%.

Heterotopic ossification (HO) occurred in 76 hips (45.5%). The amount of HO, as per Brooker's classification, was not related to the initial fracture pattern ($p = 0.259$, Fisher's exact test). The amount of HO was related to the type of previous hip fracture surgery ($p = 0.015$, chi-squared test) (Table VI). Brooker grades three and four were prevalent in the different fixation groups as follows: CS five hips (7.9%), hemiarthroplasty four (23.5%), DHS six (12.8%), and CMN five (18.5%). The CMN group had the highest prevalence, with 20 hips (74.1%) developing HO. HO was not related to type of stem converted to ($p = 0.838$, Fisher's exact test) (Table VII).

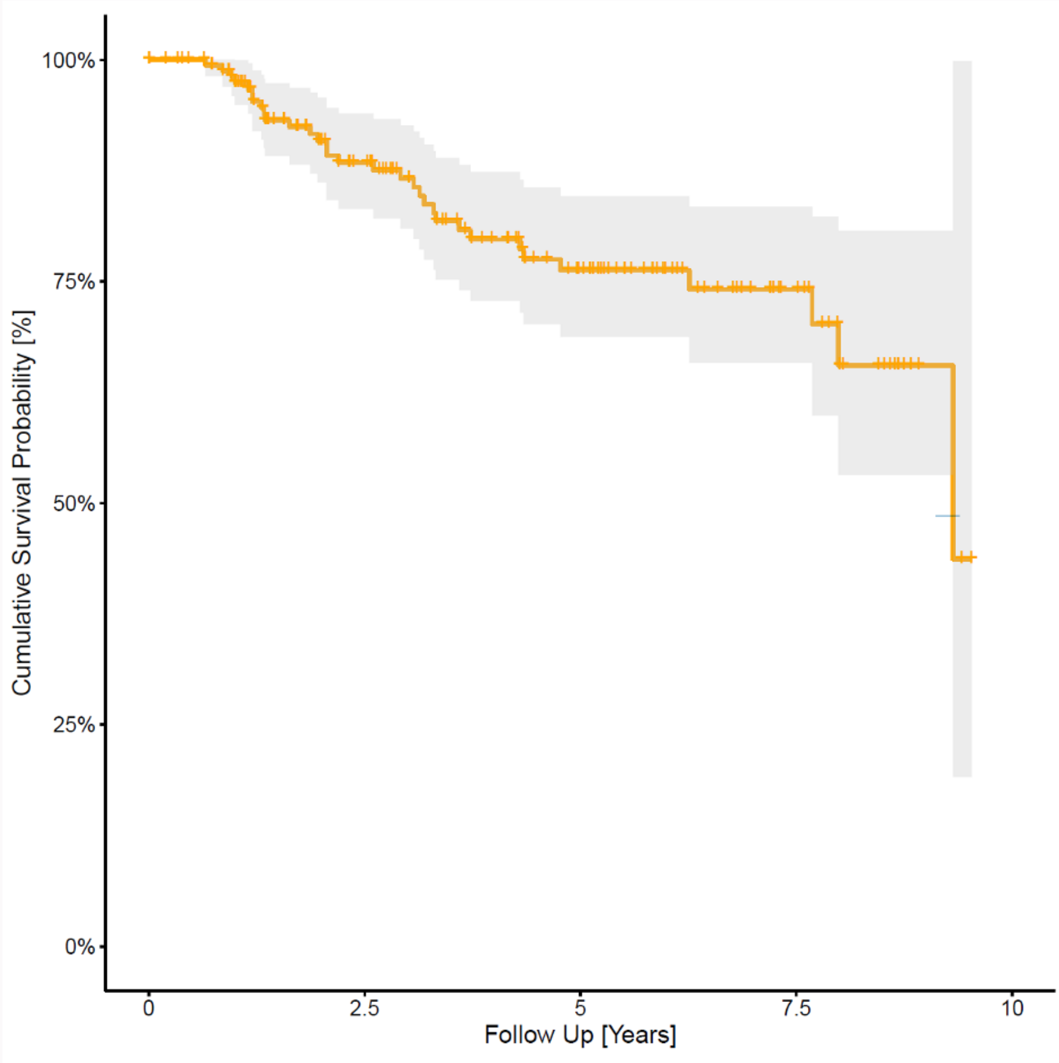

Fig. 1
Kaplan-Meier mortality curve of conversion to total hip arthroplasty. Shaded area represents 95% CI.

Table VI. Level of heterotopic ossification based on hip fracture fixation.

HO*	CS	DHS	Hemiarthroplasty	CMN
0	44	29	10	7
1	24	7	2	13
2	1	5	2	2
3	5	4	4	4
4	0	2	0	1

*As per Brooker's classification system.
CMN, cephalomedullary nail; CS, cannulated screw; DHS, dynamic hip screw; HO, heterotopic ossification.

Table VII. Level of heterotopic ossification based on conversion to total hip arthroplasty.

HO	Cemented	Uncemented
0	38	52
1	20	26
2	3	7
3	8	9
4	1	2

HO, heterotopic ossification.

Complications occurred in 14 patients (8.4%): seven (4.2%) intraoperative fractures, six (3.6%) dislocations, and one (0.6%) washout of haematoma.

Three intraoperative fractures occurred in the intracapsular fracture group (3.1%) and four in the extracapsular group (5.8%) ($p = 0.706$, chi-squared test). There were no intraoperative fractures when converting from CS, two (11.8%) from hemiarthroplasty, two (4.3%) from DHS, and three (11.1%) from CMN ($p = 0.438$, chi-squared test). Three (3.9%) intraoperative fractures occurred in the cemented group and five (4.4%) in the uncemented group ($p = 0.257$,

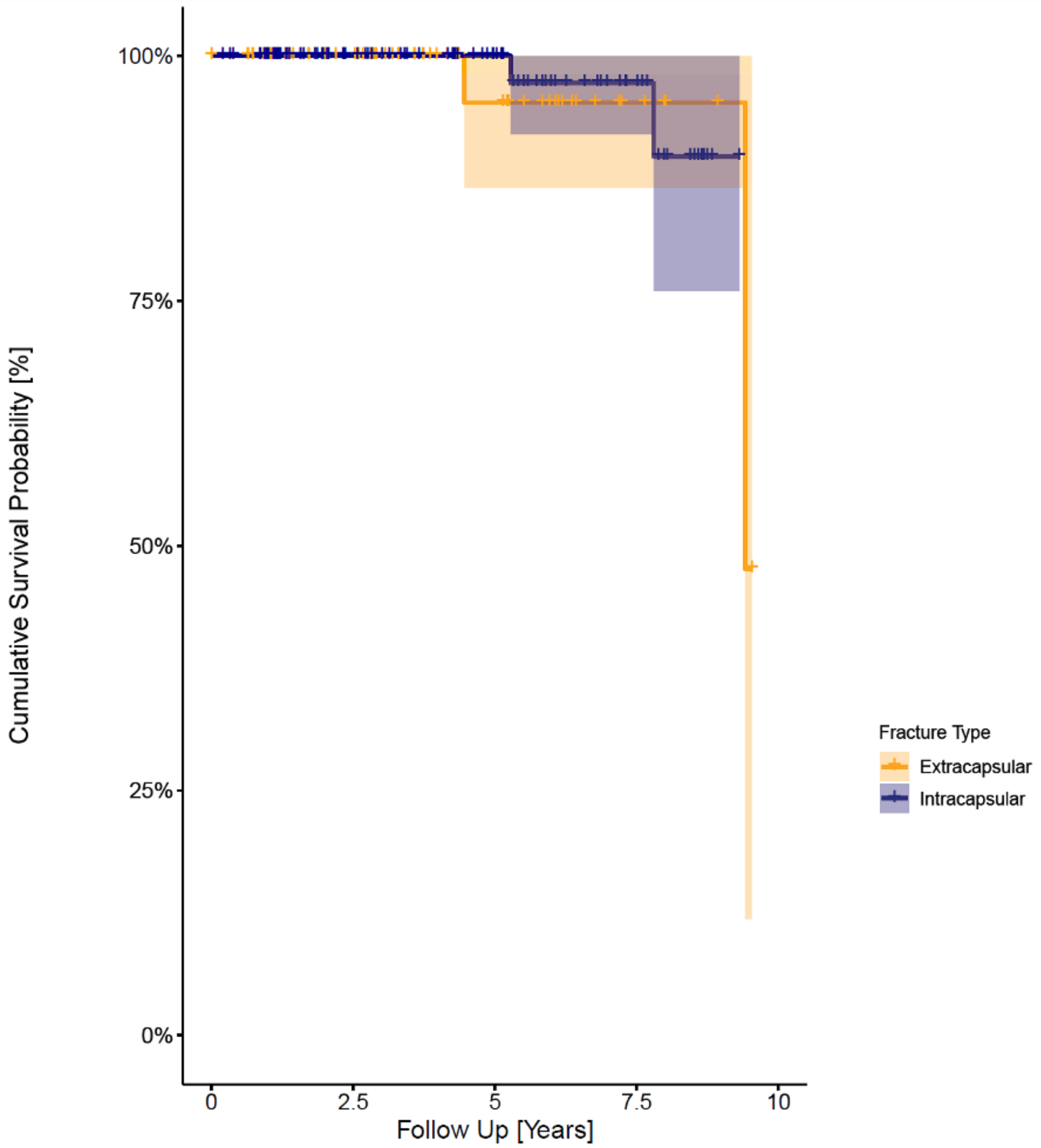

Fig. 2
Kaplan-Meier survival curve of intracapsular versus extracapsular fractures. Shaded areas represent 95% CI.

chi-squared test). All intraoperative fractures were identified during surgery and addressed at the time – none required further surgery.

Four hips dislocated in the intracapsular fracture group (4.1%) and two in the extracapsular group (2.9%) (p = 0.414, chi-squared test). There were three (3.9%) dislocations in the CS group, one (5.9%) in the hemiarthroplasty group, two (7.4%) in the CMN group, and none in the DHS group (p = 0.343, chi-squared test). One (1.4%) dislocation occurred in the cemented group and five (5.2%) in the uncemented group (p = 0.103, chi-squared test). Three (1.8%) went on to have revision surgery for recurrent dislocation. All six dislocations occurred with neutral liners (p = 0.024, chi-squared test). Three dislocations occurred with a head size of 28 mm, two with 32 mm, and one with 40 mm (p = 0.614, chi-squared test). The dislocations occurred in the Delta Motion cup (LimaCorporate) in two patients, RM Classic (Mathys, Switzerland) in two, and Exeter Contemporary in two (p = 0.922, chi-squared test).

Four hips (2.4%) of the total cohort required revision surgery. There were no cases of deep infection. Three hips (1.8%) required revision for dislocation: two (2.1%) were in uncemented stems and one (1.4%) in the cemented group. Revision for dislocation was seen across fixation types with CS (n = 1), hemiarthroplasty (n = 1), and CMN (n = 1). Following CMN fixation, one uncemented hip was revised for early periprosthetic fracture. No patient has required revision for aseptic loosening.

Survival probability was 95% at nine years in the extracapsular group and 89% at nine years in the intracapsular group (p = 0.923, Cox proportional hazard test) (Figure 2). Survival probability was 90% (95% CI 87 to 93) at eight years in the CMN group and 89% (95% CI 85 to 92) at 9.53 years in the CS group, 100% at 9.53 years in the DHS group, and 83% (95% CI 79 to 87) in the hemiarthroplasty group (p = 0.312, Cox proportional hazard test) (Figure 3). Survival probability was 100% at nine years in the cemented group and 85% (95% CI 87

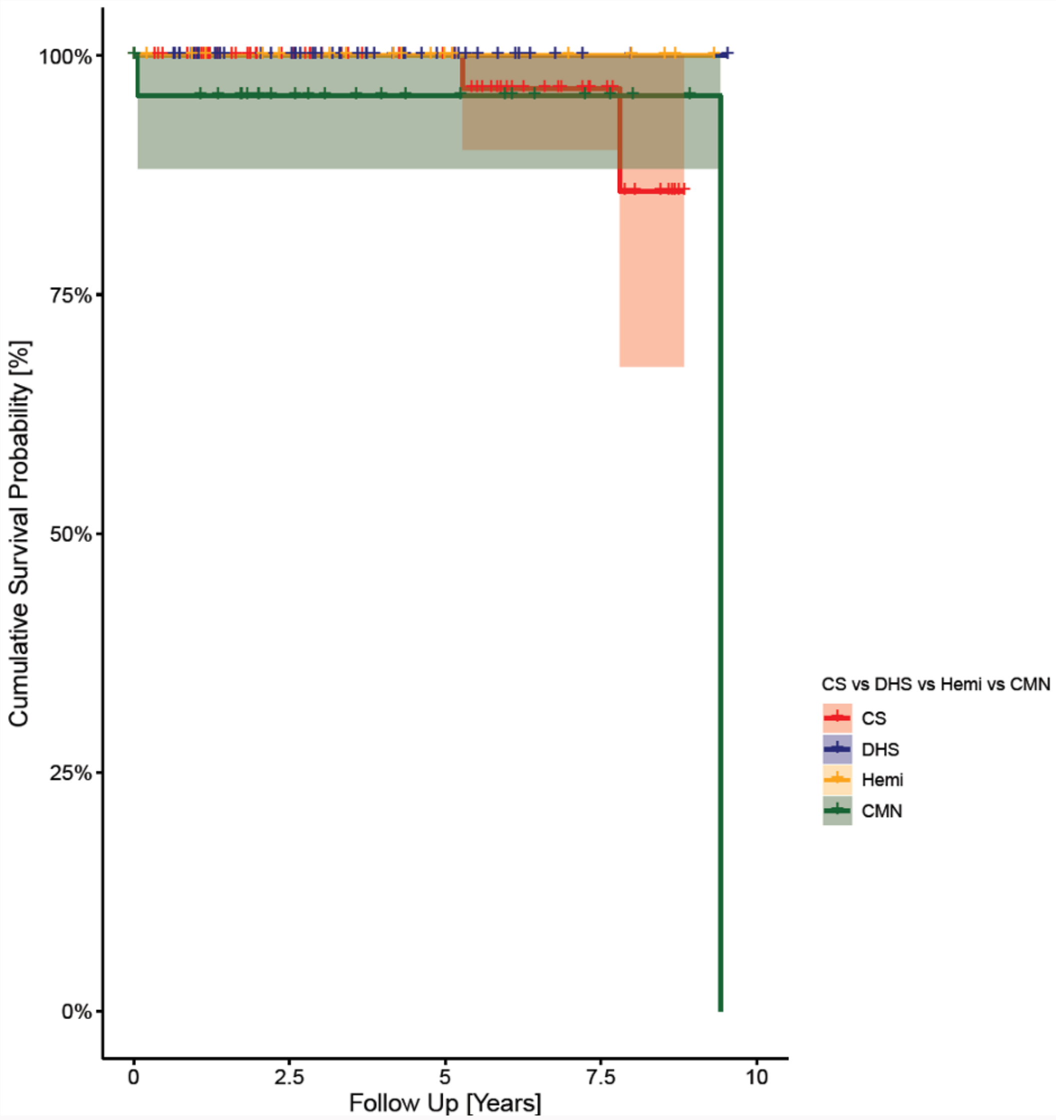

Fig. 3

Kaplan-Meier survival curve of cephalomedullary nail (CMN), dynamic hip screw (DHS), cannulated screw (CS), and hemiarthroplasty. Shaded areas represent 95% CI.

to 90) at nine years in the uncemented group (p = 0.028, Cox proportional hazard test) (Figure 4).

The median OHS improved from 15 (IQR 8 to 21) to 39 (IQR 31 to 46) following CTHA. The median postoperative OHS was not significantly different between the intracapsular fracture group 39 (IQR 28 to 45) and the extracapsular group 38 (IQR 28 to 44) (p = 0.450, Wilcoxon rank-sum test). In addition, there was no statistical difference in the median postoperative OHS based on the different types of hip fracture surgeries (CS = 40, hemiarthroplasty = 36, DHS = 37, and CMN = 40) (p = 0.428, one-way ANOVA). The median postoperative OHS was 38 (IQR 27 to 45) for the cemented group and 39 (IQR 31 to 45) for the uncemented group (p = 0.534, Wilcoxon rank-sum test).

Discussion

The objective of this study was to determine the complication profile, survival, and outcomes of CTHA from hip fracture surgery, from a high-volume tertiary centre in the UK.

The study population included in this report was primarily female (113 patients, 67.7%) with a mean age of 71 years (42 to 99). This is similar to patients included in the NJR undergoing primary THA for fractured neck of femur (NOF) (72.6% female and median age 73 years).[27] Other studies looking at CTHA reported similar demographics.[11,12] The median ASA grade and CCI of II and 4, respectively, of patients included in this study were lower than might be expected for a hip fracture group, and similar to patients undergoing THA for other indications.[11]

The two most common indications for CTHA were osteoarthritis (OA) (42.3%) and avascular necrosis (AVN) (19.6%) (Table V). This is the first study to demonstrate the indications for CTHA across all fracture and fixation types. A study conducted at the Mayo Clinic found that the leading indications for CTHA in minimally displaced fractures were osteonecrosis (44%) and OA (35%).[11] Loizou and Parker[28] reviewed 1,023 cases of intracapsular fractures fixed with internal fixation and found that the overall incidence of AVN

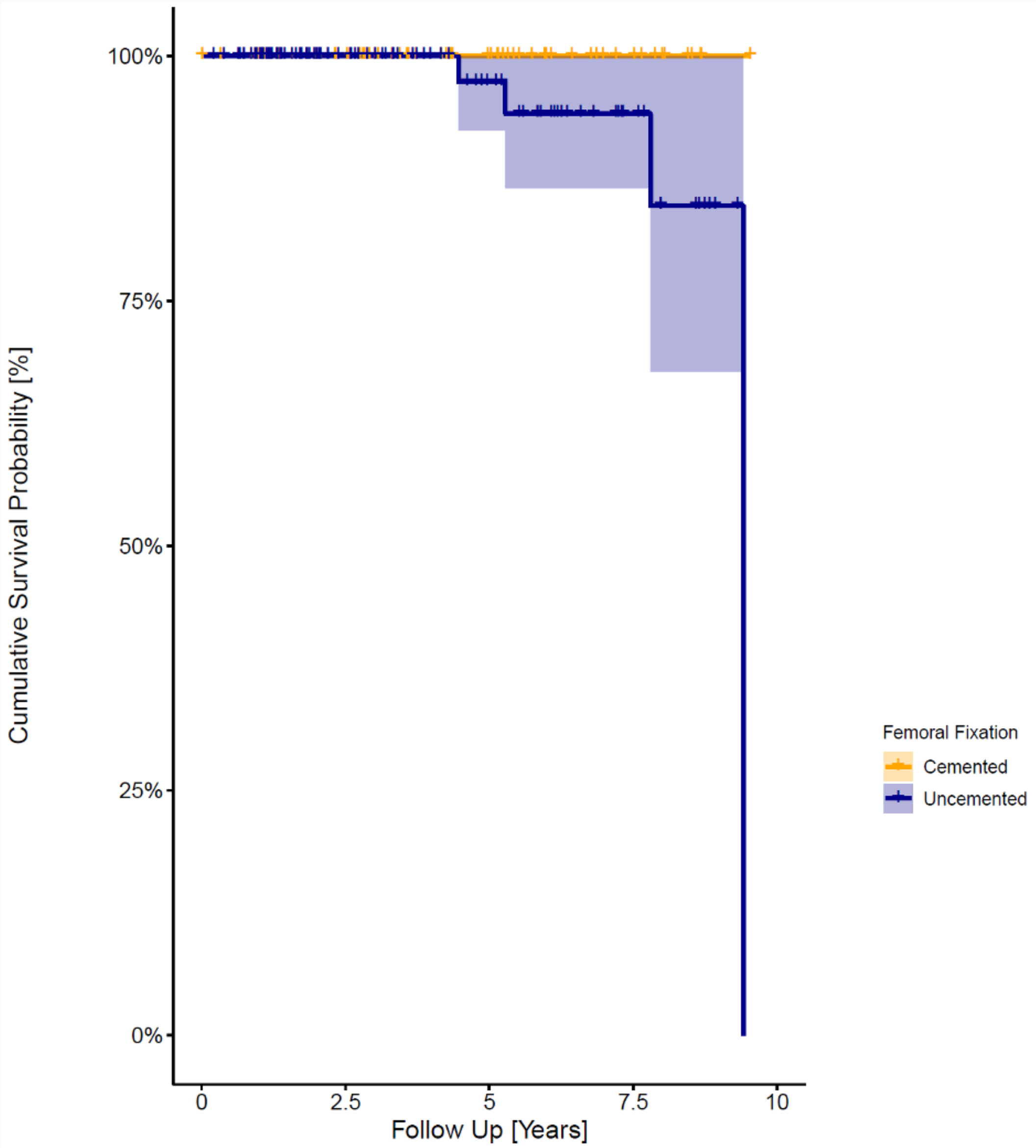

Fig. 4
Kaplan-Meier survival curve of cemented and uncemented stems. Shaded areas represent 95% CI.

was 6.6%. However, it was noted that this could be as high as 20.6% in younger patients with displaced fractures.[28]

There was significant variation in operating times in CTHA depending on the methods of initial fracture fixation, which, to our knowledge, have not been reported before. In particular, a 45-minute increase in operating time between CS and CMN CTHA was observed. This finding aligns with previously published literature on conversion due to any reason, which reported a mean 49-minute difference in time between CTHA and matched primary hip surgeries; however, this was shorter than the revision THA by a mean of 29 minutes.[29] This practical information is important when planning theatre lists.

The overall complication rate in our cohort was 8.4%, which is significantly higher than that of standard primary THA.[10] However, this compares favourably with other published series where complication rates as high as 30% are reported.[10,12,29] Douglas et al[12] reported infection rates of 7.7% versus 1.4%, dislocation rates of 4.5% versus 2%, and mechanical complications rates of 5.5% versus 1% in their matched cohort analysis comparing conversion due to any reason with primary THA.

We observed a greater incidence of intraoperative fractures compared to our routine population undergoing THA for OA. The highest fracture rates in our series occurred when metalware needed to be removed from the endosteal cavity, as observed in CMN and hemiarthroplasty extraction. This trend was evident in our CTHA for hemiarthroplasty and CMN, where 11.8% and 11.1% of patients, respectively, sustained intraoperative fractures. Rates of intraoperative fracture reported in studies range between 9% and 20%.[30–32] Conversely, when implants were removed solely from the lateral cortex of the femur, as in DHS and CS fixation, the rates remained low, particularly for the narrower-diameter CS. The Mayo Clinic study reported that 3% of patients experienced intraoperative fractures when converting from in situ fixation,[11] whereas 1.6% of our patients whose fractures were fixed in situ experienced these. The DHS group had an intraoperative fracture rate of 4.3%. Three (3.9%) intraoperative fractures occurred in the cemented group and five (4.4%) in the uncemented group (p = 0.257, chi-squared test).

Our highest rate of dislocation was seen in the CMN group, a cohort where the hip abductors have commonly been disrupted by both injury and surgery. The dislocation rates reported in the literature for the conversion of CMN to CTHA vary between 5% and 8%.[11,15,32–34] Studies have shown that CMN reaming disrupts the gluteal tendon insertion in 27% of patients.[35,36] Interestingly, we only had one dislocation in the hemiarthroplasty group. It could be that the posterior approach used at our institution provides protection to the abductors, as they are not violated when removing the metalwork. The Exeter group analyzed the outcome of CTHA of hemiarthroplasty and reported rates of dislocation as 7.1%, similar to the Mayo group.[11,37] None of our patients who had CTHA from DHS experienced a dislocation. Pui et al[38] also reported no episodes of dislocation among their CTHA from DHS patients. The dislocation rate was higher in the uncemented CTHA group (5.2%) compared to the cemented group (1.4%), but this difference was not statistically significant (p = 0.103, chi-squared test). All dislocations in our cohort occurred with neutral liners, which suggests that these patients could benefit more from lipped liners or dual-mobility designs due to their higher risk of dislocation.

No patients in our cohort died before 90 days after CTHA. The NJR 2023 reports mortality of primary hip arthroplasties in all cases between the ages of 70 and 74 years old as 0.43% at 90 days and 29.32% at ten years.[27] The NJR does not currently compile data longer than 90 days in hip revision surgery. Mortality at one year was 1.8%. This is significantly lower than the national one-year mortality average for the hip fracture population in the literature, which is reported to be as high as 30%.[3-6] Mortality in hip fracture patients in their first year has been reported to be as high as 30%.[39] Over the total period of 12 years, our mortality rate was 19.8% (33 patients). As previously highlighted, this is a self-selecting group, and therefore it is expected that the mortality in the CTHA would be lower.

Our overall revision rate was 2.4%. Douglas et al[12] reported a one-year revision rate of 10.1% compared to 2.8% in the primary group. Ryan et al[10] reported revision rates in CTHA of 11.7% versus 4.7% in the primary group. Hernandez et al[29] reported that CTHA has a hazard ratio (HR) of 1.8 for revision compared to primary THA (p = 0.147) and a HR of 1.4 for revision compared with revision THA (p = 0.373). These findings indicate that CTHA carries a higher risk of revision surgery than primary THA, and potentially more than revision THA.

The survival probability in our unit at 9.53 years was 84% in the CS group, 100% in the hemiarthroplasty group, 100% in the DHS group, and 96% in the CMN group. A study by the Mayo Clinic of 62 patients who underwent CTHA for their hip fracture, pinned with CS, found a survival free of reoperation for any cause of 97% at five years.[11] This was lower in the conversion of hemiarthroplasty, with survival free of reoperation for all causes at 92.5% at five years and 88.4% at ten years.[30] The survival probability of CTHA in cemented stems was 96% at 9.53 years and 88% at 9.42 years in those with uncemented stems. Data from the NJR 2023 demonstrate a revision rate of 2.94% for all cemented and 4.45% for all uncemented primary THAs.[27]

In those implanted with cemented stems, the Barrack grading was strongly related to the size of cortical defects left after metalware removal, with CMN and DHS faring the worst. Such defects are thought to prevent optimal pressurization of cement.[40] However, despite the poorer cementing in this group, we have not found radiological signs of progressive loosening or lysis. Previous studies with polished tapered stem designs have demonstrated excellent long-term outcomes, even in cases where poorer cementing has taken place. Despite challenges in cementing of CTHA due to distorted femoral anatomy, and the postoperative radiological appearance of poor cementing impacted by prior metalwork, cemented stems survive longer than uncemented stems in CTHA.

HO, particularly high-grade, was more commonly observed than in a standard THA population.[23] It was particularly prevalent in cases converted from hemiarthroplasty and CMN, where the initial surgery would have included gluteal muscle dissection. Spencer-Gardner et al[41] reported higher rates of HO following conversion THA, but from different indications such as hip arthroscopy and surgical hip dislocation compared with primary THA. This highlights the importance of careful assessment of these patients to identify those at higher risk of HO for consideration of prophylaxis.

Several studies have reported that the total cost of CTHA is higher than that of primary THA. This has been estimated to be 26.4% higher than primary THA, which is an important consideration when planning financial incentives.[10,12,16,17]

This review reports the highest number of CTHAs from previous hip fracture in the UK. However, we acknowledge that this is a retrospective review of patients from a single high-volume orthopaedic centre. Despite being only a medium-term follow-up, our results are strengthened by excellent clinical and radiological follow-up rates. We recognize that there will be an element of bias in relation to mortality, as this cohort of patients are self-selecting. However, this is likely to be representative of the type of patients suitable for CTHA.

In conclusion, although our cohort had a low revision burden, this complex surgical cohort does have a higher complication rate than standard primary THA. With careful patient selection and optimization, excellent outcomes can still be achieved. Implant survival lies somewhere between primary and revision arthroplasties, and as such, there exists an argument to treat these complex primaries as a separate entity in the NJR.

Social media

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