<u>Fragility Fracture Post-Operative Mobilisation (FFPOM) – The reality of weight-bearing practices following operations for lower limb fragility fractures</u>

<u>Abstract</u>

Aim: The purpose of this study was to determine the weight-bearing practice of operatively managed fragility fractures in the setting of the UK and Ireland National Health Service (NHS).

Methods: The Fragility Fracture Post-Operative Mobilisation (FFPOM) multicentre audit included all patients aged 60 and over undergoing surgery for a fragility fracture of the lower limb between 1st January 2019 – 30th June 2019 and 1st February 2021 – 14th March 2021. Fractures arising from high-energy transfer trauma, patients with multiple injuries, and those associated with metabolic deposits or infection were excluded. We conducted an analysis of this patient cohort to determine adherence to the British Orthopaedic Association (BOA) Standard *'all surgery in the frail patient should be performed to allow full weight-bearing for activities required for daily living'.*

Results: 19557 patients (mean age of 82 years, 16241 having a hip fracture) were included. Overall, 16614 patients (85.0%) were instructed to perform weight-bearing where required for daily living immediately post-operatively (95.7% hip fracture and 32.3% non-hip fracture patients). The median length of stay was 12.2 days (12.6 days for hip fracture and 10.3 days for non-hip fracture patients).

Discussion: Non-hip fracture patients experienced more post-operative weight-bearing restrictions, though they had a shorter hospital stay. Patients sustaining fractures of the shaft and distal femur had a longer median length of stay than demographically similar patients who received hip fracture surgery.

Conclusion: We have shown, for the first time, a significant disparity in weight-bearing restrictions placed on patients with fragility fractures despite the publication of a national guideline. Surgeons intentionally restrict post-operative weight-bearing in the majority of non-hip fractures, but in contrast, are content with unrestricted weight-bearing following operations for hip fractures.

Introduction

Patients need to be able to mobilise in order to rehabilitate, and fixing fractures helps to enable meaningful mobility. However, immediate post-operative weight bearing can be restricted by surgeons. At times this may be appropriate, for example, for the patient with marked peripheral neuropathy or wound breakdown. There are also concerns around construct failure and loss of reduction. Fixation of fractures in the distal femur has been associated with significant loss of reduction (19%), delayed or non-union (6%) and fixation failure (5%), however, these complication rates are from studies published over 15 years ago.[1] Furthermore, a recent Cochrane review on the management of distal femur fractures highlighted the major limitations of the available evidence to guide surgeons on these fractures.[2] Restricting weight-bearing comes at a cost to the patient; it is associated with complications such as sarcopenia, pressure sores, and blood clots; plus requires intact cognition and can lead to loss of independence.[3,4] These complications of immobility are more marked in the older and frail patient and therefore bring the justification of restricted weight-bearing into question.

It has become routine practice to allow early full weight-bearing post-operatively for hip fractures. The introduction of the National Hip Fracture Database (NHFD) and the Best Practice Tariff (BPT) has driven improvements in hip fracture care over the last decade.[5] The focus is on minimising morbidity and mortality, which includes physiotherapy assessment on day one post-operatively as part of the BPT. Furthermore, 'prompt mobilisation' (being mobilised out of bed – standing or hoisting – by the day after hip fracture operation) is a key performance indicator recorded as part of the data collected by the NHFD; the national average for 2021/22 was 81%.[5] In 2020, the BPT and NHFD were extended to include the distal femur and femoral fragility fractures, but there is no similar national drive for fragility fractures outside the femur.[6]

Where non-hip fragility fractures are concerned, the culture around weight-bearing and focus on mobilisation lags behind. This can be seen with ankle fractures. In 2012 a systematic review reported no risk of fixation failure or adverse events in patients with operatively-treated ankle fractures that were permitted early weight-bearing and ankle mobilisation. Yet, over five years later, a study reported that six-week delayed weight-bearing remains standard for surgically fixed ankle fractures across the United Kingdom (UK).[7] Outside of the hip and ankle, single-centre studies demonstrate the safety of immediate post-operative weight-bearing in patients treated for distal femur and tibial plateau fractures.[8,9] However, there is limited high-quality clinical trial or registry evidence for non-hip fractures to reassure surgeons.

The British Orthopaedic Association (BOA) has recognised the disparity between hip and non-hip fragility fracture care and has updated their guidelines accordingly; The BOA Standard states that *'all surgery in the frail patient should be performed to allow full weight-bearing for activities required for daily living and within 36 hours of admission, in line with current hip fracture care'*.[10] Adherence or adoption of this standard is, until this point, unclear. The purpose of this paper was to report the post-operative weight-bearing practices for fractures of the lower limb, and to understand the extent to which restricted weight-bearing pervades.

Methods

The BOA Standard 'The care of the older or frail orthopaedic trauma patient' was the metric for this study.[11] Collaborator recruitment was via social media channels and through the British Orthopaedic Trainees Association (BOTA). Using the Health Research Authority decision tool (http://www.hra-decisiontools.org.uk/research/), Research and Ethics Committee approval was not required. All collaborators obtained local approval from their respective institutions and registered the study as a service evaluation or audit. Data collection was both retrospective (1st January 2019 – 30th June 2019) and prospective (1st February 2021 – 14th March 2021). These time periods were selected to provide a reflection of routine contemporary practice, minimising the influence of the SARS-CoV-2 pandemic. Furthermore, a retrospective and prospective capture period enabled a large number of collaborative data to be submitted, aligned to junior doctor rotation dates.

All patients aged 60 and over with a lower extremity fracture managed operatively were included. Fractures arising from a high-energy transfer mechanism, patients with multiple injuries or those associated with infection or metastatic deposits were excluded. Patients were classified as having multiple injuries if they had any of the following in addition to their lower limb fracture:

1. A second fracture in either lower limb
2. An upper limb fracture excluding the hand
3. A pelvic fracture
4. A chest injury (rib or scapula fractures, or any intra-thoracic injury requiring intervention)
5. Intra-abdominal injury
6. Head injury (intra-cranial event, or a fracture to the skull or facial bones)
7. Spinal injury (spinal cord injury, or fracture and ligamentous injuries that require operative management or restriction to weight-bearing or mobility of the spine).

The study population was limited to the lower extremity as the key aim was to assess adherence to the BOA weight-bearing standard.[11] Data were collected on patient demographics, fracture description, operation details, post-operative weight-bearing status and length of stay. All data were anonymised and no personal patient data was shared between institutions or with the study authors. No outcome data were collected.

Statistical analysis

Count data were summarised as absolute numbers and proportions. Parametric continuous data were summarised as means and standard deviations and non-parametric data as medians and interquartile ranges. A Student's t-test was used to compare parametric continuous data, a Mann-Whitney U test was used to compare non-parametric continuous variables and Pearson's chi-squared test for categorical variables. Other than age, all variables in the multivariable logistic regression model were categorical and were entered without exclusions for collinearity.[12] Data were analysed using R version 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria).

Results

430 collaborators from 84 NHS hospitals provided data from 20193 fragility fractures (Figure 1). Following exclusions, 19557 patients (mean age of 82 (SD 9), 70.4% female) were analysed. 5253

(26.9%) had cognitive impairment, and 11613 (60.2%) were independently mobile prior to injury. Baseline demographics, post-operative weight-bearing status and length of stay for all patients, and for hip and non-hip fragility fractures, are in Table 1. Time to weight-bearing is given only for patients who were advised not to weight-bear immediately by their operating surgeon, and length of stay excludes patients that died as an inpatient. Detailed demographics grouped by fracture site and operation are reported in the first paper of this series. Overall, 16614 patients (85.0%) were allowed to perform weight-bearing for activities of daily living immediately post-operatively. This comprised a hip fracture cohort of 16241, in which 15543 (95.7%) were given post-operative full weight-bearing instructions. However, in the non-hip fracture population of 3316, 1071 (32.3%) were instructed to fully weight-bear immediately after operation. The median length of stay for patients not permitted to weight-bear immediately was 10.2 days (IQR 12.5) compared to 12.6 days (IQR 12.3) in those who were.

Table 2 demonstrates the proportion of non-hip fragility fractures by fracture site and post-operative weight-bearing status. The majority of these fractures were of the foot and ankle (45.1%), which was also the population with the lowest proportion of full weight-bearing instructions in the immediate post-operative period (11.2%). Table 3 presents the proportions of patients instructed to weight-bear without restrictions immediately post-operatively grouped by procedure and fracture site.

In the hip fracture population, the mean age and median length of stay for patients instructed not to weight-bear immediately post-operatively was 80 years (SD 9) and 12.1 days (IQR 11.7) respectively, compared to 83 years (SD 9) and 12.6 days (IQR 12.1) in those who were instructed to weight-bear immediately. Table 4 displays the results of multivariable logistic regression exploring factors associated with full weight-bearing immediately post-operatively. The C-statistic for the model was 0.912 suggesting most of the variables influencing the decision to permit weight-bearing post-operatively were included.

In patients with hip fractures, 9159 were independently mobile pre-injury, of which 8701 were permitted to weight-bear immediately post-operatively (95.0%) This compares to 6870 patients that were not independently mobile pre-injury, of which 6647 were permitted to full weight-bear post-operatively (96.8%). In patients with non-hip fractures, 2454 were independently mobile pre-injury, of which 660 were permitted to weight-bear immediately post-operatively (26.9%) This compares to 809 patients that were not independently mobile pre-operatively, of which 396 were permitted to full weight-bear post-operatively (48.9%). Independently mobile pre-injury was defined as those using one stick or less to mobilise outdoors independently. Figure 2 demonstrates the weight-bearing practice across participating hospitals for hip fractures. Figure 3 demonstrates the weight-bearing practice across participating hospitals for non-hip fractures.

During the retrospective study period 12908/15262 (84.6%) were instructed to weight-bear immediately post-operatively and the median length of stay was 12.5 days (IQR 12.8). In the prospective study period 3706/4295 (86.3%) patients were instructed to weight-bear immediately and the median length of stay was 11.5 days (IQR 10.3).

Discussion

Early return to weight-bearing post-operatively decreases the morbidity and mortality for the frail patient.[3] Restricted weight-bearing and decreased mobilisation leads to deconditioning and sarcopenia, and puts the patient at increased risk of pressure sores and blood clots.[4,13,14] For locomotion in the older patient, it is hugely important that the fragile balance of core muscle function and extremity muscle capacity is maintained. Sarcopenia, the loss of muscle mass and resultant decrease in strength, mobility and function seen in older patients, is now firmly established as a priority in caring for older trauma patients.[15,16] The orthopaedic surgeon's role in preventing the degradation of muscular function is underappreciated; weight-bearing contributes to protecting patients from entering the downward spiral of physiological deterioration resulting from muscle function loss.[17]

Skeletal loading is also beneficial for the fracture itself, as union occurs with dynamic loading within a tolerable strain environment. By contrast, extended periods of immobility, signalling decreased requirement for structural bony support, result in disuse osteopenia.[18] Osteopenia and osteoporosis are already a challenge in the older fracture population.

Restricted weight-bearing is also often unachievable and unadvisable for the frail patient, irrespective of the surgeon's wishes. Hopping on one leg, the state required for elderly patients to non-weight-bear, requires a huge increase in energy expenditure and carries a high risk of falls and subsequent injuries.[19] Unsurprisingly, many patients are unable to maintain partial weight-bearing restrictions.[20] Therefore, non-weight-bearing instructions in older patients do not translate into mobilisation using only one leg: realistically, they translate into immobility and a significant threat to independence. Fear of falling, a huge issue in this population, is also exacerbated by instructions to non-weight-bear.[21] All these factors contribute to the importance of unrestricted weight-bearing for fragility fracture patients.

The National Hip Fracture Database (NHFD) and the Best Practice Tariff (BPT) have driven improvements in hip fracture care since their introduction.[5,22] Although unrestricted weight-bearing post-operatively is not explicitly prescribed by these initiatives, there is a large focus on mobilisation and early physiotherapy involvement as part of the multidisciplinary care these patients received. Perhaps it is this drive, in part, that has influenced surgeons' decisions to allow nearly all hip fracture patients to fully weight bear post-operatively. However, for the remainder of the lower extremity, governance is less present. This study is the first to investigate and compare weight-bearing practices for patients sustaining hip fractures and non-hip fragility fractures of the lower limb.

In our study the non-hip fracture population, when compared to the hip fracture population, was younger, more mobile and more likely to have normal cognition pre-operatively. Non-hip fracture patients faced more post-operative weight-bearing restrictions, though they experienced a shorter length of hospital stay (10.3 days vs 12.6 days). Less than a third of the non-hip fracture patients were permitted to fully weight-bear after their surgery: a stark contrast to that seen in hip fracture care (95.7%). There is variation between injury location in non-hip fractures, with a high proportion (71.8%) of patients sustaining patella fractures instructed to weight-bear immediately post-operatively, compared to only

11.2% of patients with fractures of the foot and ankle. This is despite two sets of BOA national guidance advocating immediate weight-bearing after operatively treated fragility or ankle fractures.[23] Figures 2 and 3 illustrate that this disparity in weight-bearing practice is not just confined to some units but is a nationwide phenomenon. Similar findings were demonstrated between the retrospective and prospective study periods. Such variation in practice indicates a need for more stringent monitoring of, or education about, national guidance at unit level to effect change and minimise the harm occurring from restricting the mobilisation of frail patients.

Despite being demographically similar, the proportion of patients instructed to weight-bear without restriction following operative fixation of the shaft (47.8%) and distal (64.6%) femur was lower than patients receiving surgery for a proximal femoral fracture (95.7%). Length of stay was longer in the shaft (13.9 days) and distal (16.0 days) femur cohort, than in the proximal femur cohort (12.6 days). This disparity may be partly explained by the higher proportion of periprosthetic fractures in this group; periprosthetic fractures accounted for 45.6% of distal femur and 44.2% of femoral shaft fractures, yet only 2.2% of proximal femur fractures. Table 4 supports this reluctance to instruct immediate weight-bearing after surgery for a periprosthetic fracture (OR 2.55 , CI 2.10-3.10, $p<0.001$). Other factors that made surgeons less likely to instruct immediate post-operative weight-bearing include sustaining an open injury, non-arthroplasty surgery, and where the consultant was the primary surgeon, which may reflect operative complexity. However, caution is required in such analyses because it is unknown if the associations are representative of injury factors, or whether they are reflective of patient demographics, fracture location, or other factors not collected.

The NICE and BOA guidance[5,10] advocates surgery to enable immediate weight-bearing because the physiological consequences of delayed weight-bearing outweigh the risk of displacement or minor differences in function when attempting to restore and maintain native anatomy.[3] Many surgeons will opt for arthroplasty for a patient with a hip fracture, even if the fracture is minimally displaced, because of the morbidity and mortality associated with delayed weight-bearing or revision surgery.[3] This may explain the 4.3% of hip fractures in this study who were not permitted to weight-bear immediately; they

were younger and a higher proportion were treated with internal fixation. Similarly, the finding that patients permitted to weight-bear immediately post-operatively had a longer length of stay may be reflective of the difference in pre-operative age and function We found that in the hip fracture population, pre-operative mobility status had little influence on prescribed post-operative weight-bearing status (95.0% vs 96.8%). However, for non-hip fracture patients, being independently mobile pre-injury meant surgeons were less likely to permit immediate weight-bearing post-operatively (26.9% vs 48.9% p=<0.01). Results from the multivariable logistic regression model found that whilst pre-injury mobility did appear to influence the decision to weight-bear post-operatively, after multivariable adjustment, fracture location (hip fracture vs no hip fracture) had the largest predictive impact on the weight-bearing decision (OR 18.29 (16.22-20.64, p<0.001)). The reluctance to allow weight-bearing for the non-hip fracture population may be due to an uncertainty in the treatment goals for this younger and more mobile population, or due to the challenges of offering arthroplasty outside of the hip joint.
Our data implies that the non-hip fracture population exhibits a greater variation in frailty than the non-hip fracture population. This is linked to a fundamental limitation of our study; the use of surrogacy indicators of frailty. Due to the nature of multicentre, collaborative data collection, and the lack of routine frailty assessments, simple surrogate indicators of a "fragility fracture" were used, including age over 60, isolated (non-polytrauma) injuries and lower energy transfer mechanisms of injury. The ability to define frailty is central to this study's limitations and to the orthopaedic surgeon operating on patients with lower extremity fractures. The Modified Frailty Index (mFI) has been shown to correlate with higher rates of post-operative surgical complications.[24] The routine use of frailty assessments in orthopaedic trauma clerkings could help to identify our frail patients better and place the concern of frailty closer to the forefront of the orthopaedic surgeons' mind when considering fracture management. The patients best placed to benefit from unrestricted weight-bearing post-operatively would be readily identified.

As with any prospective, unstratified, uncontrolled, non-comparative cohort with no outcomes provided, we acknowledge there are limitations in this work’s ability to provide the complete solution around this important topic. Although this notwithstanding, we believe we have described some key factors of patient care, accurately and reproducibly, for the first time. We are aware of several specific, important limitations, in addition to that described above. We have reported only the decisions of the treating clinicians; we did not collect data on patient outcomes, complications, or mortality. It is not known if patients adhered to their weight-bearing advice, regardless of instructions. It is well established across patients with lower limb injuries, following nicely conducted sensor studies, that over a quarter of patients do not comply and weight-bear.[25] Furthermore, a national survey, *the Weight-bearing in Trauma Surgery (WiTS) Study,* found inconsistency around weight-bearing language and interpretation among healthcare professionals; only 89% of respondents interpreted "Full Weight-bearing" as 100% of body weight, with even greater variability for ten other commonly used terms.[26] This highlights both an additional source of confusion for patients and a potential target solution if standardised weight-bearing terminology could allay fears related to misinterpretation.

Level 1 evidence is lacking. Once reported, the Weight-bearing in Ankle Fractures (WAX) trial may provide confidence in weight-bearing after ankle fracture surgery[27], but other sites remain a challenge for research. This partly reflects the lower incidence of non-hip fragility fractures. The Knee Fix or Replace Trial (KFORT) feasibility trial[28] found that it would be unfeasible to deliver an adequately powered Randomised Controlled Trial in the UK alone due to the relatively low incidence and clinical equipoise for distal femoral fractures. Therefore, multinational collaboration may be required to answer research questions regarding the optimal surgical and weight-bearing strategy for non-hip fragility fractures.

Conclusion

This multicentre audit has shown a wide discrepancy in the post-operative weight-bearing restrictions for low energy lower limb fractures in the over 60s. Surgeons are confident in allowing hip fracture patients to fully weight-bear post-operatively, however only 32% of non-hip fracture patients are allowed to mobilise freely immediately post-operatively. Immobility is associated with complications, which are more significant in the frail patient; this reflects the BOA guidance against which we have audited national practice. Whilst we accept that the over 60s with non-hip lower limb fractures is a heterogenous group with varying frailty, this stark difference in post-operative practice should prompt reflection from the orthopaedic community. We ask you to question whether it is still valid to limit weight-bearing for your fragility fracture patient when the benefits of early mobilisation are so significant, national guidance advises early full weight-bearing, and there is no good-quality evidence that early weight-bearing is associated with increased post-operative complications. The routine use of reliable, user friendly frailty assessments would also aid surgeons by correctly identifying this population.

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Tables

Table 1: Patient demographics, weight-bearing status and LOS by fracture type (All)

	All Fractures	Hip Fractures	Non-hip Fractures	p-value
No. of patients	19557	16241	3316	<0.001
Mean age in years (SD)	82 (9)	83 (9)	75 (10)	<0.001 CI 7.3-8.0
Female	13776 (70.4%)	11337 (69.8%)	2439 (73.6%)	<0.001
Cognitive impairment	5253 (26.9%)	4917 (30.3%)	336 (10.1%)	<0.001
Independently mobile	11613 (60.2%)	9159 (57.1%)	2454 (75.2%)	<0.001
Periprosthetic	858 (4.4%)	354 (2.2%)	504 (15.0%)	<0.001
Open injury	247 (1.3%)	13 (0.1%)	234 (7.1%)	<0.001
Consultant as primary surgeon	7060 (36.3%)	5368 (33.1%)	1692 (51.0%)	<0.001
Allowed to weight-bear immediately post-op	16614 (85.0%)	15543(95.7%)	1071 (32.3%)	<0.001
Median days restricted weight-bearing (IQR)	42 (0)	42 (28)	42 (0)	<0.001
Median days LOS (IQR)	12.2 (12.1)	12.6 (12.1)	10.3 (13.2)	<0.001

IQR, Interquartile Range; SD, Standard Deviation; CI, Confidence Intervals; LOS, Length of stay

Table 2: Patient demographics, weight-bearing status and LOS by fracture type (Non-hip fragility fractures)

Fracture sites	No. of patients	Consultant as primary surgeon	Allowed to weight-bear immediately post-op	Median days restricted weight-bearing (IQR)	Median days LOS (IQR)
Foot & ankle	1496 (45.1%)	582 (38.9%)	167 (11.2%)	42 (1)	8.0 (10.8)
Femur (distal)	554 (16.7%)	369 (66.6%)	265 (47.8%)	42 (0)	16.0 (15.9)
Femur (shaft)	503 (15.2%)	315 (62.6%)	325 (64.6%)	42 (0)	13.9 (13.7)
Tibia (proximal)	204 (6.2%)	141 (69.1%)	28 (13.7%)	42 (0)	10.3 (12.2)
Tibia (distal)	191 (5.8%)	109 (57.1%)	50 (26.2%)	42 (28)	9.9 (14.4)
Patella	156 (4.7%)	59 (37.8%)	112 (71.8%)	28 (28)	6.4 (7.1)
Tibia (shaft)	150 (4.5%)	66 (44.0%)	89 (59.3%)	42 (21)	10.1 (12.1)
Acetabulum/pelvis	62 (1.9%)	51 (82.3%)	35 (56.5%)	42 (14)	17.0 (14.2)

IQR, Interquartile Range; LOS, Length of stay

Table 3: Proportion of patients permitted to weight-bear immediately post-operatively by fracture site and operation

Fracture site	Arthroplasty	ORIF	IM nail	Ex-fix/ring fixator	MUA	Primary fusion	Other
Femur (Proximal)	8378/8541 (98.1%)	4858/5235 (92.8%)	2298/2453 (93.7%)	-	-	-	9/12 (75%)
Foot & Ankle	2/4 (50.0%)	117/1306 (9.0%)	37/68 (54.4%)	3/40 (7.5%)	4/57 (7%)	4/21 (19.0%)	-
Femur (Distal)	54/59 (91.5%)	125/362 (34.5%)	86/ 129 (66.7%)	0/1 (0.0%)	0/3 (0.0%)	-	-
Femur (Shaft)	23/49 (46.9%)	111/226 (49.1%)	191/227 (84.1%)	-	-	0/1 (0.0%)	-
Tibia (Proximal)	6/7 (85.7%)	10/172 (5.8%)	5/7 (71.4%)	6/9 (66.7%)	1/9 (11.1%)	-	-
Tibia (Distal)	2/2 (100%)	6/86 (7.0%)	30/66 (45.5%)	10/25 (40%)	0/9 (0.0%)	2/3 (66.7%)	-
Patella	-	110/153 (71.9%)	-	-	1/2 (50.0%)	1/1 (100.0%)	-
Tibia (Shaft)	-	13/26 (50.0%)	69/110 (62.7%)	5/10 (50.0%)	2/3 (66.7%)	-	0/1 (0.0%)
Acetabulum/pelvis	13/17 (76.5%)	21/43 (48.8%)	-	1/1 (100.0%)	-	-	0/1 (0.0%)

ORIF, Open Reduction Internal Fixation; IM, Intramedullary; Ex-fix, External Fixation; MUA, Manipulation Under Anaesthesia

Table 4: Multivariable logistic regression exploring factors associated with post-operative weight-bearing restrictions

	Immediate post-operative weight-bearing instructions			
Variable	Restricted	Unrestricted	Univariable OR (CI)	Multivariable OR (CI)
Age in years, Mean (SD)	75.1 (9.8)	82.8 (8.7)	1.09 (1.09-1.10, p<0.001)	1.05 (1.04-1.05, p<0.001)
Independently mobile pre-injury	2252 (19.4%)	9361 (80.6%)	-	-
Not independently mobile pre-injury	636 (8.3%)	7043 (91.7%)	2.66 (2.43-2.93, p<0.001)	1.51 (1.32-1.73, p<0.001)
Female	2114 (15.3%)	11662 (84.7%)	-	-
Male	829 (14.3%)	4951 (85.7%)	1.08 (0.99-1.18, p=0.074)	1.03 (0.92-1.17, p=0.583)
Normal cognition	2615 (18.3%)	11656 (81.7%)	-	-
Cognitive impairment	321 (6.1%)	4932 (93.9%)	3.45 (3.06-3.90, p<0.001)	1.16 (0.98-1.37, p=0.082)
Open injury	163 (66.0%)	84 (34.0%)	-	-
Closed injury	2779 (14.4%)	16519 (85.6%)	11.53 (8.87-15.11, p<0.001)	1.40 (1.03-1.91, p=0.033)
Non-hip fracture	2245 (67.7%)	1071 (32.3%)	-	-
Hip fracture	698 (4.3%)	15543 (95.7%)	46.68 (42.05-51.88, p<0.001)	18.29 (16.22-20.64, p<0.001)
Periprosthetic fracture	404 (47.1%)	454 (52.9%)	-	-
Non-periprosthetic fracture	2539 (13.6%)	16160 (86.4%)	5.66 (4.92-6.52, p<0.001)	2.55 (2.10-3.10, p<0.001)
Non-arthroplasty	2742 (25.2%)	8136 (74.8%)	-	-
Arthroplasty	201 (2.3%)	8478 (97.7%)	14.22 (12.31-16.50, p<0.001)	4.78 (4.04-5.69, p<0.001)
Consultant as primary surgeon	1431 (20.3%)	5629 (79.7%)	-	-
Not consultant as primary surgeon	1512 (12.1%)	10985 (87.9%)	1.85 (1.71-2.00, p<0.001)	1.29 (1.15-1.45, p<0.001)

OR, Odds Ratio; CI, Confidence Intervals; SD, Standard Deviation