



Management and analysis of concurrent neck of femur and upper limb fractures:

A retrospective single centre study

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Abstract

Objectives: To analyse rehabilitation outcomes of patients with both upper and lower limb fractures vs those with isolated hip fractures and determine if fixation improves management by looking at length of stay and overall outcomes.

Methods: Patient data reviewed from local trauma database revealing 287 patients with both upper and NOF fractures over the previous 10 years. Outcomes were compared to local ortho-geriatric data for 701 neck of femur fractures and national hip fracture data for 2020.

Outcomes: The results showed a lower average age for patients with concurrent fractures compared to the general hip fracture population. This was particularly true for those who had operations on both limbs. Although the average stay was around 4 days longer, the median stay was 2 days less than those with isolated NOF fractures. Most patients did not have an upper limb operation other than an MUA either in theatre or in the emergency department. A higher percentage of patients were able to go home but also a higher percentage required further rehabilitation after their inpatient stay. Mortality was marginally higher in all patients but lower in those that had both limbs fixed.

Discussion: The results show that outcomes are typically better when both fractures are fixed. This may be skewed however by younger patients being more likely to undergo fixation. Interestingly, MUAs do remarkably well vs fixation in the data set in all the categories with the exception of humeral shaft fractures.

Keywords: Fractures, orthopaedic, National Hip Fracture, Limb Fractures.

INTRODUCTION

Hip fractures are one of the most common reasons for elderly patients to be admitted to hospital with an average of over 65,000 admissions over the last 6 years across the UK and this is continuing to rise as the population ages [1]. These can be complicated by any number of medical and social problems that affect length of stay and outcomes and require multi-disciplinary involvement from therapy, orthopaedic, ortho-geriatric, social work teams and other associated healthcare professionals. An aspect that has a big effect on outcomes and discharge destinations is the presence of a concurrent upper limb fracture [2]. These are relatively uncommon compared to isolated hip fractures with a prevalence of around 4% in the general hip fracture population [3]. However, the presence of an upper limb fracture can have a large influence on the management of the patient, the length of stay, discharge destination and resultant outcome^{5,6}. This is in part due to the increased rehabilitation needs for those patients with multiple fractures in spite of them generally being younger and generally starting at a higher functional baseline than the usual hip fracture population [4-6].

The aim of this retrospective study was to look at the differences between those patients who have upper limb fractures and those without in a cohort of hip fracture patients from a large district general hospital in England. The main objective was to look at the differences in outcomes between those patients who had an operative fixation for the upper limb fracture versus those that were managed non-operatively and whether the timing of the operation affects the outcome and discharge destination as well as comparing both groups to those patients with isolated neck of femur fractures both locally and nationally.

PATIENTS AND METHODS

This retrospective study looked at the data of hip fracture patients in a large district general hospital which averages around 600-700 such patients per year. Using the local database of hip fractures for the last 10 years (up to January 2021) those patients with concurrent upper limb fractures were identified.

This revealed 308 total patients of which 21 were excluded from the study for being related to malignant processes, whose operations were prophylactic prior to fracture rather than as a fracture fixation procedure or did not have concurrent fractures during a single admission. This left 287 patients for an average of 28.7 patients per year showing similar rates to the 3%-5% seen in previous studies [4,5]. These patients were then compared to the hip fracture patients from the previous year's utilising data from the local ortho-geriatrics department and to the UK National Hip Fracture Database¹. This gave a comparison data set of 701 local patients and 63,284 patients nationally.

The main parameters recorded were acute length of stay in an orthopaedic ward; overall length of inpatient rehabilitation; the timing of the operation for the upper limb in relation to the neck of femur fracture and the discharge destination. The patients were categorized by specific bone fractured and the part of the bone to enable differentiation between proximal, mid-shaft and distal fractures. Statistical analysis was conducted using paired t-test to determine significance between the datasets.

RESULTS

Of the 287 patients identified in the data collection there were 123 patients with humeral fractures (42.9%) and 164 patients with forearm fractures (57.1%). The concurrent lower limb fracture in the cohort was a neck of femur fracture in 274 (95.5%). 7 (2.5%) patients had more distal femur fractures and 6 (2%) patients had either peri-prosthetic or pelvic fractures (Figure 1). In the cohort analysed 67 (23.3%) patients had an operation on the upper limb, this rises to 94 (32.75%) if in-theatre manipulations are included.

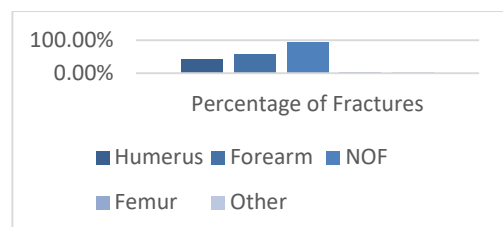


Fig. 1. Locations of Fractures

As a cohort, these 287 patients had a lower average age than isolated neck of femur fractures (79 vs 83, $p < 0.005$) a difference that is even starker when looking at the operated group in isolation (72 vs 83, $p < 0.005$) (Figure 2). Looking at the acute length of stay, those with concurrent upper limb and neck of femur fractures stay 4 days longer (21 vs 17, $p < 0.005$) than the 2020 average and 7 days longer than the National Hip Fracture database average (21 vs 13.5, $p < 0.05$) (Figure 3).

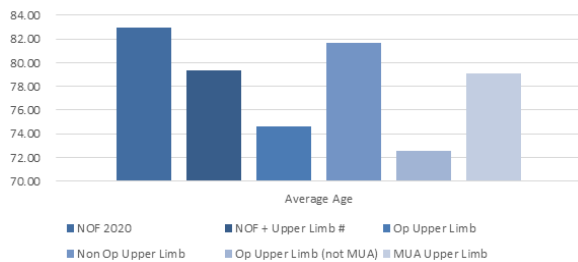


Fig. 2. Average Age

Breaking this down between the operated cohort and the non-operatively managed cohort reveals that both groups spend an average of 21 days on an acute orthopaedic ward before discharge. There was no significant difference between the 2 groups length of stay (p 0.38) however both groups did have a significant difference in length of stay versus the local 2020 data ($p < 0.05$). Those patients who had an in-theatre manipulation only stayed on average 18 days though this was not significant compared to the local data or the operative groups (p 0.32).

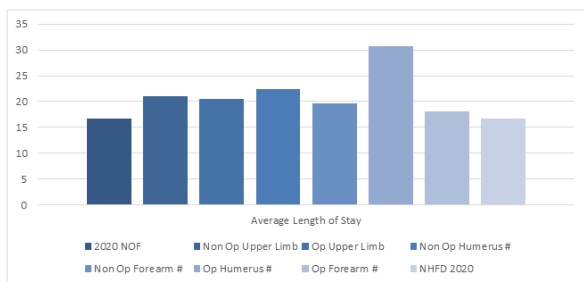


Fig. 3. Average Length of Stay

Given the increased rehabilitation needs associated with having two fractured limbs fewer patients are successfully discharged to home with only 119 (41.5%) of the cohort managing to go home directly after their acute stay

compared to 75% of isolated neck of femur fractures (Figure 4). This number increases to 54.5% with an upper-limb operation, is unchanged with an in-theatre manipulation (41%) and decreases with non-operative management (37.5%). The requirement for additional rehabilitation results in a significant increase in the need for further rehabilitation in community hospitals compared to isolated neck of femur fractures (30% vs 9%). This increase is observed regardless of whether the patients have an operation or not. Given the burden of injury an increased mortality rate is observed in the concurrent fracture group (7.3% vs 5.3%), this is most notable in the non-operative group with 10.4% mortality displaying the increased frailty of this group. Mortality in the operative group is much reduced compared to both the non-operative group and the 2020 data for NOFs (1.5% vs 5.3%) displaying the fact that the operative group were less frail than the general population studied. This is also shown in the reduced requirement for residential or nursing home placements for the operative group patients compared to the non-operative group and the 2020 data (7.3% vs 18.2% vs 8.5%).

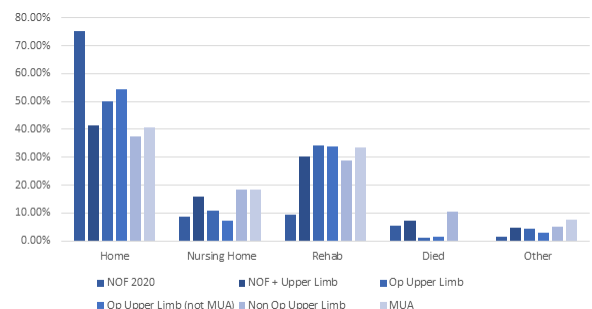


Fig. 4. Discharge Destinations

The average time between operations was 1.5 days for the forearm fractures and 11.5 days for the humeral fractures. The time between operations was most marked with mid-shaft humerus fractures with most having a trial of conservative management before a decision was made to operate (Table 1). This resulted in an average of 12.5 days between operations and an average acute length of stay of 32 days. Of those mid-shaft humerus fractures treated non-operatively one patient died shortly after arriving at a hospice. The other patient

was an inpatient for 97 days before being discharged to a rehabilitation unit for ongoing care.

Table 1. Summary of weight bearing status for each fracture as per local physiotherapy guidelines, full guidelines in Appendix 1

	Operative Fixation	Conservative Management	MUA & Cast
NOF + Head / Proximal Humerus	NWB (2-4 weeks)	NWB (6 weeks)	N/A
NOF + Mid Shaft Humerus	NWB (2-4 weeks)	NWB (6 weeks)	N/A
NOF + Distal Humerus	NWB (2-4 weeks)	NWB (6 weeks)	NWB (6 weeks)
NOF + Proximal Radius/Ulnar	NWB (2-4 weeks)	NWB (4 weeks)	NWB (4 weeks)
NOF + Midshaft Radius/Ulnar	NWB (2-4 weeks)	NWB (2 weeks)	NWB (2 weeks)
NOF + Distal Radius/Ulnar	NWB (2-4 weeks)	NWB (2 weeks)	NWB (2 weeks)

DISCUSSION

This retrospective analysis has shown a similar rate of concurrent fracture as previous studies with 4.1% of the hip fracture patients analysed showing concurrent fractures; evidence that it remains a rare occurrence in the hip fracture population. This represents the largest single centre analysis of these type of injuries to date. The demographic of the patients matches previous studies in showing that the majority of these patients are younger and less co-morbid than the general hip fracture population despite suffering a more significant injury. Considering this, the rehabilitation potential of these patients is greater and therefore every measure should be taken to maximise this potential to achieve the best outcome. Operative fixation of the upper limb fracture results in a better outcome for the majority of patients reviewed in this study. Given the typical rehabilitation potential of these patients as shown in their demographics this should be considered early in these patients' journey in conjunction with each individual's biopsychosocial factors.

On average the operative group had a much younger age and some of this maybe down to patient selection and associated co-morbidities when deciding suitability for operative management. However, it could also be down to the fact the majority of these patients are younger with a

higher level of function than the typical cohort of patients seen with neck of femur fractures which replicates what has been seen in previous studies. With the majority of operations for the neck of femur fracture occurring within the first 48 hours of a patient's admission the delay in management for the upper limb fracture can have a significant impact on both the acute and overall length of stay. This is partly down to the impact on rehabilitation from reduced mobility and inability to load an affected upper limb. There is evidence of possible selection bias within the data set since the younger patients had a higher chance of an operative fixation than the older cohort of patients. Part of this is due to the nature of the injuries sustained with lower impact fractures seen in the older population, in particular humeral head and distal radius fractures that are not usually amenable to fixation due to fracture location, type, and bone quality. With an increasing number of people living longer and in good general health, age is no longer just a number and the whole biopsychosocial picture needs to be looked at when considering the best management for each patient. In this respect each patient needs to be managed with consideration of all these factors to ensure the most appropriate management is followed.

Mid-shaft humerus fractures are the concurrent fractures that this study shows to benefit most from early fixation. This is likely because early fixation allows for more activity during the rehabilitation process and therefore reduces hospital stay by speeding up the physiotherapy aspects of patient recovery. The decision to fix the upper limb was typically taken after a period of rehabilitation with a non-operatively managed upper limb fracture with poor progress before an operation was considered with a noticeably improved functional status post operatively. The 5 patients operated on in 2020 had a median duration between fixations of 14 days and a median acute length of stay of 24 days. With hip fractures recommended to be fixed within the first 48 hours of admission per NICE guidance, this delay in being able to appropriately rehabilitate the patient has a negative effect on length of stay as evidenced by the patients typically being discharged within 10 days of fixation. Reducing this decision-making time will reduce acute inpatient stay and

provide additional benefits in rehabilitation potential.

The fractures least likely to be operatively managed were the distal radius and humeral head fractures. With these typically being considered low impact fractures due to fragility and osteoporosis this is not unexpected given the cohort of patients. Interestingly in-theatre non-operative management still results in a better outcome than that observed with non-operative management alone. In light of this analysis, it is recommended for distal radius fractures in particular, to have an in-theatre manipulation, reduction and plaster application if not already achieved by the emergency department to enable early mobilization with a gutter frame post fixation of their neck of femur fracture.

CONCLUSION

The data acquired supports the literature showing that concomitant hip and upper limb fractures prolong both acute hospital stay and overall rehabilitation period. The rates observed are similar to previous studies highlighting that it remains a steady problem in the elderly population. The evidence suggests early stabilization of the upper limb fracture either surgically or with a well applied plaster after an in-theatre manipulation reduces both acute length of stay and the overall rehabilitation period in this group of patients. At a time of reducing acute bed availability, this earlier management of concomitant upper limb fractures enables more effective mobilization to reduce acute and overall length of stay.

Other factors that will impact on the rehabilitation of the patient with an upper limb fracture in addition to neck of femur fracture

- Side of UL fracture compared to NOF #
- Dominant v/s non-dominant arm
- Age
- Balance
- Previous level of function
- ROM and power of the uninjured sides

Please note these weight bearing statuses and durations are determined by the Orthopaedic Consultant. Occasionally physiotherapists will challenge these in order to advocate for a patient's individual circumstances, and they may be adjusted to suit the individual.

With an upper limb fracture in addition to NOF#, regardless of how it is managed, patients will most likely need assistance for activities of daily living e.g. washing and dressing, meal preparation, domestic tasks and occasionally feeding/ drinking. Those who are managed non-operatively often require large packages of care for the duration of their NWB period and in some circumstances need a NWB bed in a care home, which are limited in the community.

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Appendix 1: Full Local Weight Bearing Guidelines for NOF and Upper Limb Fracture patients

Injury	WB status	Duration	Impact on rehabilitation
NOF + humeral head/neck fracture (managed conservatively)	NWB	Usually 6/52, in collar and cuff sling to allow for traction on the humerus	Patient is usually in sling, unable to use their upper limb. They will be reliant on one upper limb and one lower limb for transfers and mobility. Most NOF# patients will need to use a transfer aid and only transfer from bed to chair to commode because of this, as even though they are able to FWB on their repaired NOF#, most are limited by pain and reduced strength. Progression is limited for the duration of their NWB period due to not being able to use a frame for mobility.
			Patient is encouraged to remove the sling for short periods of time throughout the day to practice range of movement exercises of their elbow, wrist and hand
NOF + mid shaft humeral fracture (managed conservatively / clasp brace)	NWB	Usually 6/52, in sling or clasby brace	As above
NOF + Distal humeral fracture (managed conservatively)	NWB	Usually 6/52 in sling	As above
NOF + proximal / midshaft radial/ulnar fractures (POP)	NWB	Long arm POP, usually 2/52 before being converted to full synthetic cast	Patient is unable to WB through a POP/ backslab due to the risk of splitting the plaster. Most of these patients will need to use a transfer aid and be limited to transfers between bed, chair and commode.
			Progression is limited for the duration of their NWB period due to not being able to use a frame for mobility, as they cannot weight bear through the elbow.
			Patient is encouraged to complete finger/ hand dexterity and range of motion exercises. They are likely to need range of motion exercises for their elbow once out of the cast

NOF + proximal / midshaft radial/ulnar fractures (Full cast / synthetic)	NWB	Long arm synthetic cast usually 4/52	Most of these patients will need to use a transfer aid and be limited to transfers between bed, chair and commode.
			Progression is limited for the duration of their NWB period due to not being able to use a frame for mobility, as they cannot weight bear through the elbow.
			Patient is encouraged to complete finger/ hand dexterity and range of motion exercises. They are likely to need range of motion exercises for their elbow once out of the cast
NOF + wrist fractures (POP)	NWB	Short arm POP, usually 2/52 before being converted to full synthetic cast	Patient is unable to WB through a POP/ backslab due to the risk of splitting the plaster. Because of this, the patient will need to use a transfer aid and be limited to transfers between bed, chair and commode.
NOF + wrist fractures (Full cast / synthetic)	NWB	Short arm cast, usually 4/52	Patient may need to use a transfer aid initially but should be able to progress to mobilising with a gutter frame. Depending on different factors impacting recovery, the patient may be able to progress to using gutter crutches or a walking stick in their uninjured hand.
NOF + humeral head/neck fracture (operative fixation)	NWB	Dependant on post op instructions	Patient is usually in sling, unable to use their upper limb. They will be reliant on one upper limb and one lower limb for transfers and mobility. Most NOF# patients will need to use a transfer aid and only transfer from bed to chair to commode because of this, as even though they are able to FWB on their repaired NOF#, most are limited by pain and reduced strength. Progression is limited for the duration of their NWB period due to not being able to use a frame for mobility. If the patient is allowed to WB after a period of time for transfers, they may be progressed to a wheeled zimmer frame for transfers.

	In some cases, WB may be allowed for transfers after 2-4/52		Patient is encouraged to remove the sling for short periods of time throughout the day to practice range of movement exercises of their elbow, wrist and hand, in addition to pendular exercises of the shoulder
NOF + mid shaft humeral fracture (operative fixation - IM nail/ORIF)	NWB	Dependant on post op instructions, often shorter duration than conservative management	As above
NOF + Distal humeral fracture (Operative fixation)	NWB	Dependant on post op instructions, often shorter duration than conservative management	As above
NOF + proximal / midshaft radial/ulnar fractures (Operative fixation)	NWB	Dependant on post op instructions, likely cast for 2-4/52 which may be changed to a short arm cast	Initially the patient is NWB and likely to be limited to a transfer aid for transfers between bed, chair and commode. The shorter duration allows for progression of mobility sooner, and changing the cast to a short arm cast will allow the patient to use a gutter frame for mobilisation. Depending on different factors impacting recovery, the patient may be able to progress to using gutter crutches or a walking stick in their uninjured hand.
NOF + wrist fractures (operative fixation)	NWB	2/52 often in futura splint	Initially the patient is NWB, but the shorter time frame allows for further progression of the patient's functional mobility. They can begin using a gutter frame for mobilisation immediately following their surgery, and can progress to zimmer frame, crutches or walking stick dependent on other factors impacting their recovery.