

# ORIGINAL ARTICLES

## Displaced Intracapsular Hip Fractures in the Working Age Alcohol-Abusing Patient

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### Interests

No financial or commercial interests to declare.

### Abstract

Management of alcohol-abusing patients presenting with intracapsular hip fractures is controversial. The aim of this study was to compare the management and outcome of working-age alcohol-abusing patients with similar-aged controls.

Patients were identified from a prospectively collected database of trauma admissions. Full case notes were available for 78 patients under 65 of age presenting with a displaced intracapsular fracture at a teaching hospital between 1998 and 2002. Thirty seven patients had evidence of alcohol abuse.

Alcohol-abusing patients presented to hospital later ( $p=0.05$ ), underwent surgery a median of 18 hours later ( $p=0.011$ ) and required a longer post operative stay ( $p=0.003$ ) compared to non-abusers. Despite this, the results of internal fixation were comparable. There was no significant difference between alcohol-abusers and non-abusers in rates of avascular necrosis (6.9% vs 9.7%; odds ratio 0.69, 0.11-4.47) or revision surgery (0.21 vs 0.10 procedures/ patient; odds ratio 1.49, 0.30-7.33).

The high rates of alcohol abuse in this low-velocity trauma population suggest such patients are at increased risk of osteoporosis. Routine screening for osteoporosis should be considered in working-age alcohol abusers. After subcapital fracture, reduction and internal fixation is an acceptable treatment in this sub-group of patients.

### Introduction

There is controversy over the best management of displaced intracapsular femoral neck fractures.<sup>1,2</sup> Extensive evidence can be found to support both reduction and fixation<sup>3</sup> and femoral head replacement<sup>4,5</sup> in the general elderly frail population sustaining these injuries. Displaced intracapsular fractures in patients under the age of 65 years are rare, and the current literature frequently attributes them to high energy trauma.<sup>6,7,8</sup> There is little debate that fracture reduction and fixation is preferred in younger patients in order to preserve the femoral head.<sup>9,10</sup> In working age patients the potential lifespan of the patient makes internal fixation a more attractive option with acceptance of a failure rate requiring conversion to an arthroplasty.

Conversely primary arthroplasty in trauma patients has been associated with higher rates of infection<sup>11</sup> and dislocation,<sup>12</sup> and in the younger subpopulation an increased likelihood that the patient will outlive the prosthesis and revision will be required. The alcoholic patient presents an interesting problem in that it is assumed that bone healing will be poorer,<sup>13,14</sup> and avascular necrosis (AVN) higher. These factors, combined with the likely reduced life expectancy,<sup>15</sup> increase the case for primary replacement in the alcohol abuser. Compliance issues are important in both fixation and replacement scenarios with an intoxicated patient unable to comply with weight bearing restrictions following fixation;<sup>16</sup> dislocation may be more likely in the uncontrolled arthroplasty patient.

The purpose of the study was to assess the presentation, management and outcome of alcohol-abusing patients under the age of 65 sustaining displaced intracapsular fractures. Our unit, serving in part an inner city population with high rates of alcohol dependence, reviewed our experience of intracapsular hip fractures in a working age population. Alcohol excess is associated with increased risk of femoral neck fracture<sup>17,18</sup> and our study specifically focussed on this subgroup of patients.

### Methods

This retrospective study was compiled using a prospectively collected database of all trauma admissions to a teaching hospital (Glasgow Royal Infirmary) from 1998 to 2002. All patients aged under 65 presenting with displaced intracapsular hip fractures were investigated. Full case notes and radiographic review were performed for each patient. Information was recorded using a standardised data extraction form for each patient.

Specific evidence of alcohol abuse was sought. This required either self-admission to chronic alcohol abuse (greater than 40 units per week) or documented evidence of complications of long-term abuse (such as Korsakoff's Syndrome or alcoholic liver disease). Biochemical or haematological markers of alcohol-excess such as elevated gamma-glutamyl transpeptidase or mean cell volume were not deemed sufficiently specific.

Radiological review included grading of the fracture according to the Garden classification, with Garden grades I and II classified as undisplaced, grades III and IV displaced. Only those patients with Garden III or IV were investigated, as internal fixation is the accepted standard of care for undisplaced fractures.

Follow-up was performed by review of inpatient records, outpatient clinic notes and correspondence with the patient's general practitioner.

**Statistical Analysis**

Patients were divided into two cohorts: those with evidence of alcohol abuse, and those without. These were analysed for statistical significant difference using Mann-Whitney non-parametric tests for continuous data and Fisher's exact test for categorical data. Univariate regression analysis was carried out using Spearman's rank correlation; multinomial regression analysis used Cox's proportional hazard analysis.

**Results**

During the period 1998 to 2002, 139 patients aged less than 65 presented acutely with intracapsular hip fractures. Complete records were available for 94 patients; of these 78 patients presented with displaced fractures.

There was evidence of alcohol-abuse in 37 patients. The remaining 41 patients were classed as non-abusers. The mean age for both groups was very similar, 57.3 years for alcohol-abusers compared to 55.6 years for non-abusers. The demographics for these two groups are shown in Table I.

Table I: Comparison of the Demographics, Compounding Risk Factors and Treatment Modalities for Alcohol-Abusers and Non-Abusers

Variable	Alcohol-Abusers	Non-Abusers	p-Value
<b>Age</b>			
Mean	57.3 years	55.6 years	0.426
Range	35.8-64.9 years	30.4-64.4 years	
<b>Sex</b>			
Male	28 (76%)	13 (32%)	<0.001
Female	9 (24%)	28 (68%)	
<b>Smoking</b>			
Smoker	28 (76%)	24 (59%)	0.086
Non-smoker	9 (24%)	17 (41%)	
<b>Major Co-morbidity</b>			
Co-morbidity	23 (62%)	17 (41%)	0.055
No Co-morbidity	14 (38%)	24 (59%)	
<b>Injury Mechanism</b>			
Spontaneous	0 (0%)	2 (4.9%)	-
Simple Fall	32 (86%)	34 (83%)	
Fall <12 feet	0 (0%)	3 (7.3%)	
Fall ≥12 feet	2 (5.4%)	0 (0%)	
Assault	3 (8.1%)	2 (4.9%)	
<b>Treatment Modality</b>			
Sliding hip screw	25 (68%)	27 (66%)	-
Cannulated screws	2 (5.4%)	2 (4.9%)	
Sliding hip screw & Cannulated screw	1 (2.7%)	2 (4.9%)	
Hemiarthroplasty	8 (22%)	8 (20%)	
Total hip replacement	1 (2.7%)	2 (4.9%)	
<b>Follow-up</b>			
Mean	3.81 years	3.38 years	0.280
Range	0.04-5.96 years	0.01-5.93 years	

There was a significant difference in distribution of sexes: whilst there were 41 males (53%) and 37 females (47%) in the two cohorts, males predominated in the alcohol-abuse cohort whilst females predominated in the non-abuse cohort. In alcohol-abusers, there were higher levels of comorbidity and smoking was more frequent, although this did not reach statistical significance.

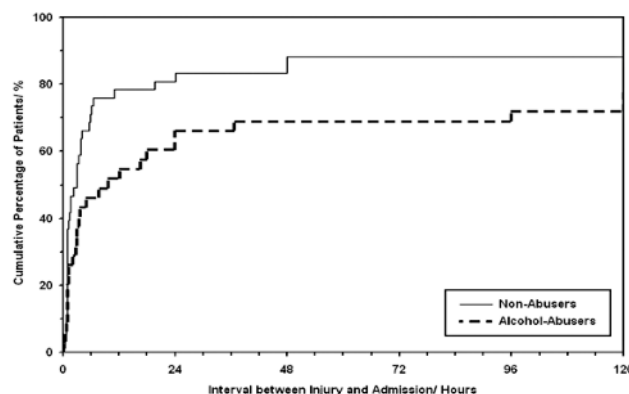
The mechanism of injury was similar between cohorts with low-energy injuries accounting for approximately 85% of injuries.

Follow-up was similar between groups, a mean of 3.81 years and 3.38 years for alcohol-abusers and non-abusers respectively.

**Intervals Between Injury, Presentation and Surgery**

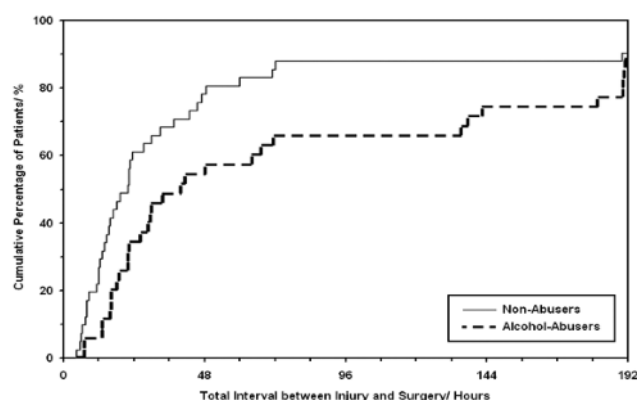
Intervals between injury and assessment by an orthopaedic surgeon showed median times of 9.67 hours (range 0.25-504) for abusers and 2.87 hours (range 0.35-504) for non-abusers (p=0.05), Figure 1. Alcohol-abusers tended towards longer pre-operative delays than non-abusers, although this did not reach statistical significance (p=0.059). Median time taken to prepare patients for theatre from the time of initial assessment was 22.6 hours for the test cohort versus 15.6 hours for the non-abuser group. Sixty seven percent of alcohol-abusers underwent surgery within twenty-four hours of presentation, compared to 78% of non-abusers.

Figure 1: A Plot of Cumulative Total Percentage Against Delay to Presentation for Alcohol-Abusers and Non-Abusers



There was a significant difference between groups when examining the total interval between injury and surgery (p=0.011); with a median time of 40.2 hours for alcohol-abusers compared to 22.2 hours for non-abusers (Figure 2).

Figure 2: A Plot of Cumulative Total Percentage Against Pre-Operative Stay for Alcohol-Abusers and Non-Abusers



**Treatment**

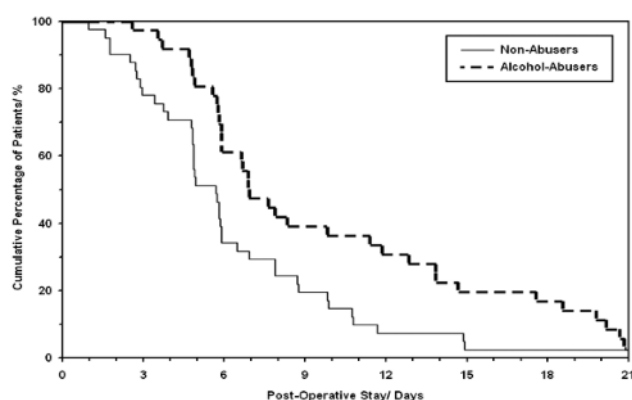
The methods used to treat both cohorts were very similar with all patients undergoing operative management. Treatment selection was by individual surgeon preference with an underlying default policy of internal fixation in under 65 year olds.

The majority underwent internal fixation either with a sliding hip screw or cannulated screws. The remainder were treated either with a hemiarthroplasty or with total hip replacement. The details of implants used in each group are shown in Table I.

### Post-Operative Course

There was a significant difference in post-operative stay between the two cohorts ( $p=0.003$ ). Abusers remaining inpatients for a median of 7.0 days compared to 5.8 days for non-abusers (Figure 3). There was a similarly significant difference ( $p=0.002$ ) in total inpatient stay (median 7.9 days versus 6.4 days).

Figure 3: A Plot of Cumulative Percentage Against Post-Operative Stay for Alcohol-Abusers and Non-Abusers



Univariate analysis of potential factors relating to duration of post-operative stay identified three statistically significant risk factors: alcohol abuse, age greater than 55 and major comorbidity. However, only alcohol abuse was statistically significant when using multivariate regression analysis to assess the impact of these independent and potentially confounding factors. The p-values for these are summarised in Table II.

Table II: Table Showing p-Values for Potential Factors Relating to Duration of Post-Operative Stay. <sup>a</sup>Spearman's rank correlation; <sup>b</sup>Mann-Whitney test; <sup>c</sup>Cox's regression analysis

Risk Factor	Univariate Analysis	Multivariate Analysis
Delay to hospital presentation	0.493 <sup>a</sup>	-
Pre-operative stay	0.679 <sup>a</sup>	-
Interval between injury and surgery	0.687 <sup>a</sup>	0.840 <sup>c</sup>
Alcohol status	<b>0.003<sup>b</sup></b>	<b>0.007<sup>c</sup></b>
Smoking status	0.740 <sup>b</sup>	0.967 <sup>c</sup>
Co-morbidity	<b>0.027<sup>b</sup></b>	0.159 <sup>c</sup>
Age >55 years	<b>0.034<sup>b</sup></b>	0.272 <sup>c</sup>
Sex	0.850 <sup>b</sup>	0.210 <sup>c</sup>
Early complication	0.112 <sup>b</sup>	0.086 <sup>c</sup>

Addition of early complications into the stepwise regression analysis showed early complications were not significantly related to post-operative stay ( $p=0.086$ ). Inclusion of this factor in the analysis increased the significance of the relationship between alcohol-abuse and delayed discharge ( $p=0.0065$ ). This strengthens the suggestion that it is alcohol-abuse alone that is leading to delayed discharge, not increased incidence of complications.

There was no significant difference between cohorts in the rate of patients requiring an increased level of care on discharge (24% of abusers vs. 17% of non-abusers;  $p=0.304$ ).

### Complications

#### Early Complications

There was a trend to an increased rate of early complications in alcohol-abusers compared to non-abusers, both with respect to event rate (0.32 vs. 0.15 events/patient) and percentage of patients experiencing one or more complications (24% vs. 12%). Neither reached statistical significance however ( $p=0.055$  and  $p=0.136$  respectively). If delirium tremens was excluded from the analysis, the two groups were very similar, with six adverse events in five separate patients in each group. Smoking status, delays to presentation and delays to surgery were not significantly related to early adverse events.

One death occurred in each cohort within 30 days of surgery. In the abuser cohort, this was in a 60-year-old male who died 13 days post-operatively from a large upper gastrointestinal haemorrhage. In the non-abuser cohort, this was a 63-year-old female who died from bronchopneumonia three days post-operatively.

The early complications observed are summarised in Table III.

Table III: Distribution of Early Complications for Alcohol-Abusers and Non-Abusers

Early Complication	Alcohol-Abusers	Non-Abusers
Wound infection	2 (5.4%)	1 (2.4%)
Lower respiratory tract infection	2 (5.4%)	3 (7.3%)
Cardiovascular complication	0 (0%)	1 (2.4%)
Deep vein thrombosis & Pulmonary embolism	1 (2.7%)	0 (0%)
Delirium tremens	6 (17%)	0 (0%)
Death	1 (2.7%)	1 (2.4%)
Total number of events	12	6
Total number of patients	9 (24%)	5 (12%)

#### Late Complications

Two patients (both from the non-abuser cohort) died at 3.5 months and 17 months post-operatively. There were no known deaths in the alcohol-abusers cohort. Of those patients undergoing internal fixation, five patients developed AVN. Three were from the non-abuser cohort (9.7%); only one of whom underwent revision surgery with removal of metalwork. Both patients from the alcohol-abusers group (6.9%) underwent revision surgery to a bipolar hemiarthroplasty. One of these dislocated post-operatively and was converted to an excisional arthroplasty. Two patients developed a deep infection, one in each cohort. In the first patient, from the alcohol-abuser group, the implant was removed and the infection resolved. This patient subsequently received a total hip replacement for non-union. The patient from the non-abuser cohort was treated initially with conversion to an uncemented hemiarthroplasty; this was subsequently converted to an excisional arthroplasty. The fixation failed in one patient from the alcohol-abuse cohort, the dynamic hip screw cutting out of the femoral head. This patient underwent revision to a bipolar hemiarthroplasty. One further patient from the non-abuser group underwent a revision procedure to total hip replacement for significant ongoing pain. These revision procedures are summarised in Table IV.

**Table IV: Distribution of Revision Procedures Between Alcohol-Abusers and Non-Abusers**

Cohort	Age/ Sex	Complication	Revision Procedure	Time/ Months
Alcohol	60/F	Avascular necrosis	Bipolar hemiarthroplasty	3
Alcohol	60/M	Deep infection	Removal of implant Total hip replacement	3 19
Alcohol	63/M	Avascular necrosis Dislocation of femoral head	Bipolar hemiarthroplasty Excisional arthroplasty	10 11
Alcohol	64/F	Failure of implant	Bipolar hemiarthroplasty	1
Control	30/ M	Deep infection	Excisional arthroplasty	4
Control	34/ F	Avascular necrosis	Removal of implant	15
Control	59/ M	Ongoing pain	Total hip replacement	53

There was no significant increase in incidence of revision procedures in alcohol-abusers receiving internal fixation compared with non-abusers. This was the case for analysis both by procedure rate per patient (0.21 vs. 0.10 procedures per patient;  $p=0.442$ ) and by proportion of patients undergoing one or more revision procedures (14.3% vs. 9.7%;  $p=0.192$ ). There was no significant relationship between delay to theatre and incidence of late complications. A comparison of the rates of AVN and of revision procedures is shown in Table V.

**Table V: Distribution of Late Complications Between Alcohol-Abusers and Non-Abusers**

Late Complication	Alcohol-Abusers	Non-Abusers	Odds Ratio (95% C.I.)
Death	0 (0%)	2 (6.5%)	-
Avascular Necrosis	2 (6.9%)	3 (9.7%)	0.69 (0.11-4.47)
Non-union	0 (0%)	0 (0%)	-
Revision Procedure	4 (13.8%)	3 (9.7%)	1.49 (0.30-7.33)

Examining all the patients receiving internal fixation, the overall rate of major long-term complications (either AVN, or any complication requiring revision surgery) was similar between groups: 14.3% in alcohol-abusers vs. 16.1% in non-abusers.

## Discussion

Displaced intracapsular fractures of the neck of femur are generally regarded as rare injuries in young patients, with few previous studies in the literature. Most previous studies describe predominantly high-energy injuries, ranging between 31% and 100%.<sup>19,20,21,22</sup> Much of this is directly related to the source of study patients, for example young military personnel.<sup>23</sup> However our study based on an unselected (but largely very deprived<sup>24</sup>) population found that these were overwhelmingly low-energy injuries in patients with significant co-morbidities. Low energy injuries are suggestive of osteoporosis or other pathology; this underlines the need to screen young hip fracture patients, treating porosis as necessary. It would be reasonable to expect our patients to have poorer nutritional status, and so poorer bone quality, than many other study centres, explaining the discrepancy in injury mechanisms. It is tempting to speculate that deprivation is responsible for the high volume of such injuries we observed, anecdotally much higher than seen in other centres.

This study also found a large proportion of young hip fracture patients had definite evidence of alcohol abuse. Previous studies investigating links between alcohol and hip fracture have been inconsistent.<sup>17,25,26</sup>

Whilst we can neither confirm nor refute such an association, there is an over-representation of alcohol-abusers in our patients. We suggest alcohol-abuse might be an important underlying causative factor for low-velocity hip fractures in atypical age groups, and suggest clinicians exclude this in working-age hip fracture patients.

There is a general consensus that the best management of displaced intracapsular fractures in young patients is early reduction and internal fixation, although this is not entirely supported by evidence.<sup>16,27,28,29</sup> Some authors recommend fixation within six hours of injury.<sup>30</sup> This was found to be a practical impossibility due to delays in presentation, and was achieved by only 5% of non-abusers and none of the alcohol-abusers. Only 5.7% of abusers and 24% of non-abusers reaching theatre within a more generous twelve hour period after injury, as recommended by other authorities.<sup>7</sup>

Alcohol-abusing patients presented later and required a longer period of post-operative care prior to discharge, probably due to poor- and non-compliance with mobilisation regimes.<sup>16</sup> Despite this, longer term there was no significant difference in the rate of either AVN or revision surgery. Our results showing an overall incidence of AVN of 8.5% are consistent with many of the previously published incidences of AVN, notably the largest prospectively collected series which reported an incidence of 9.6%.<sup>31</sup>

As this study did not prospectively follow-up the patients, it is likely to underestimate the true incidence of AVN, particularly in alcohol-abusers who are less likely to comply with extended out-patient follow up. Furthermore, it is possible that there were patients with radiographic evidence of AVN, but without clinical symptoms at the time of study. The minimum follow-up time in this study was 1.11 years, and most cases of AVN present within two years.<sup>32</sup> Patients usually develop pain early on in the process before the femoral head collapses.<sup>33,34</sup>

In summary, we found that in a deprived population low-energy injuries are the most frequent cause of hip fracture in working age patients, many of which also have evidence of alcohol-abuse. This underlines the importance of screening and treating for osteoporosis in working-age patients who have sustained a hip fracture. The high incidence of alcohol-abuse in such patients suggests hospital and general practitioners should specifically seek evidence for this in young hip fracture patients.

We found that the working-age alcohol-abusing patient with a displaced intracapsular fracture can be treated with reduction and internal fixation even when presentation is delayed. The results are comparable with a non-alcohol abusing cohort. Replacement of the femoral head has low complications in the short term but may increase as time since surgery increases.

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