The Nottingham Hip Fracture Score as a predictor of early discharge following fractured neck of femur

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Abstract

Background: hip fracture represents a huge medical, social and financial burden on patients, their carers and the health and social care systems. For survivors, return to their own home may be a key outcome. The Nottingham Hip Fracture Score (NHFS) is a validated score, based on admission characteristics, for predicting 30-day and 1-year mortality that may be of benefit in predicting return-to-home, directly from the acute orthopaedic ward.

Objective: to assess the utility of the NHFS as a predictor of return-to-home in patients following hip fracture.

Methods: the NHFS was calculated for all patients admitted from their own home and the correlation between the NHFS and eventual return-to-home was calculated, as well as the probability of discharge by within 7, 14 and 21 days.

Results: a total of 6,123 patients were available for analysis. Of which, 3,699 (60%) were discharged from acute hospital to their own home. Increasing NHFS was negatively correlated with eventual return-to-home ($r^2 = 0.949$) and with the proportion of patients discharged back to their own home at 7, 14 and 21 postoperative days, respectively ($r^2 = 0.84, 0.94, 0.96$, respectively).

Conclusions: the NHFS is a reliable tool for predicting return-to-home. It may be useful for discharge planning, and for the design of future research trials.

Keywords: hip fracture, prediction, scoring, discharge destination, elderly
Introduction

In excess of 68,000 patients in the United Kingdom sustained a hip fracture in 2008–09 [1]. Current predictions estimate that by 2033, 23% of the UK population will be aged >65 [2] and thus the incidence of hip fracture will continue to increase, despite focussed interventions targeted at primary and secondary prevention [3, 4]. Most of these patients are elderly (median age 82 years), are female (75%) and they are amongst the most vulnerable in society. Many of the patients have significant co-morbidities, which lead to delays in surgery and functional recovery. The median stay in hospital is 23.5 days, although this varies considerably from hospital to hospital, ranging from 17 to 40 days [5, 6]. In the past year, one-third of hospitals in England have seen a rise in median bed days between 1 and 9 days [5].

Hip fractures are estimated to cost £1.1 billion per year, of which acute costs are largely driven by hospital bed costs [7]. Clearly, early discharge planning would allow suitable support services to be set up at an earlier stage for those who are likely to return home, and to search for a suitable rehabilitation unit or care home for those who have a low probability of being discharged home. Previous work, involving relatively small sample sizes, has shown that age, cognition, pre- and postoperative mobilisation scores, medical comorbidities [8] and ability to perform activities of daily living may all impact upon mobility and the chances of early home-to-home admission-discharge after hip fracture [9–11]. This suggests that the patients’ underlying physiological state rather than their postoperative management determines their ability to return home. The Nottingham Hip Fracture Score (NHFS) is a scoring system that reliably predicts 30-day and 1-year mortality for patients after hip fracture [12, 13]. It is made up of seven independent predictors of postoperative mortality that have been incorporated into a risk score: age (66–85 years, ≥86 years; sex (male); number of comorbidities (≥2); admission mini-mental test score (≥6 out of 10); admission haemoglobin concentration (≤10 g dl⁻¹); living in an institution and presence of malignant disease. As such, it predicts risk independently of anaesthetic and surgical techniques and is fundamentally based on the patient’s premorbid physiological status. The NHFS may, therefore, be able to predict the probability of early discharge to home after hip fracture surgery. The UK National Hip Fracture Database has identified increasing home-to-home discharge as a key target [5].

We aimed to investigate the predictive value of the NHFS for home-to-home admission-acute hospital discharge at day 7, 14 and 21 in patients undergoing surgical repair of fractured neck of femur.

Methods

From May 1999 to April 2009, all patients admitted with a fractured neck of femur to the Queen’s Medical Centre campus of Nottingham University Hospitals have had prospective collection of demographic, physiological and operative data in order to allow for local departmental audit to take place. The database is fully compliant with Caldicott principles [14] and patient anonymity and confidentiality is strictly maintained. Data are collected prospectively by dedicated audit officers and the accuracy of the data has been verified with internal cross-checking, demonstrating an error rate of <3%.

We have previously developed and validated the NHFS [12, 13]. In brief, this is a weighted score of 7 independent admission variables that reliably predicts 30-day and 1-year postoperative mortality. The total NHFSs can range between 0 and 10. The median NHFS is 4. Details of the NHFS are provided in Table 1.

We chose arbitrary time-points of 7, 14 and 21 days. Early supported discharge schemes are targeted to reduce the length of stay, so these time-points were taken to reflect what the authors consider may be plausible targets.

All data were entered into a Microsoft Office 2007 Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA).

Results

During the 10-year study period, 7,136 patients underwent operative management of fractured neck of femur. A total of 1,013 patients were excluded (261 had no date of surgery recorded; 33 had no discharge date recorded; 49 had no admission residence recorded; 30 had no discharge destination recorded; the NHFS could not be calculated for 640 patients due to missing data (admission mini-mental test score 465 patients, admission haemoglobin 174 patients, date of birth 1 patient) leaving 6,123 patients for analysis. Previous analysis by the audit team has not found any systematic differences between the spread of available data for the patients with missing data and those with complete data. The length of stay, discharge destination and mean haemoglobin are all similar between included and excluded subjects.
The median age of the study cohort was 82 years (IQR 76–88). In total, 4,720 (77%) patients were female. The overall postoperative mortality was 8.3% at 30 days and 29.3% at 1 year (Tables 2 and 3).

Table 2. Post-fracture discharge destinations and in-patient mortality, based on the place of residence at the time of fracture

<table>
<thead>
<tr>
<th>Residence at time of fracture</th>
<th>n (%)</th>
<th>Acute hospital in-patient mortality (n, %)</th>
<th>Discharged from acute hospital to pre-fracture residence (n, %)</th>
<th>Discharged from acute hospital to rehabilitation unit (n, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own home</td>
<td>3,699 (65)</td>
<td>294 (9)</td>
<td>2,229 (60)</td>
<td>1,071 (29)</td>
</tr>
<tr>
<td>Residential home</td>
<td>769 (13)</td>
<td>97 (13)</td>
<td>484 (72)</td>
<td>120 (18)</td>
</tr>
<tr>
<td>Nursing home</td>
<td>754 (12)</td>
<td>58 (8)</td>
<td>619 (89)</td>
<td>50 (7)</td>
</tr>
<tr>
<td>Warden-aided flat</td>
<td>550 (9)</td>
<td>54 (10)</td>
<td>231 (47)</td>
<td>186 (38)</td>
</tr>
<tr>
<td>Other</td>
<td>54 (1)</td>
<td>6 (11)</td>
<td>4 (7)</td>
<td>14 (26)</td>
</tr>
</tbody>
</table>

Only patients returning from acute hospital to their own home (3,699) are included in subsequent analysis.

Table 3. Distribution of patients in studied cohort

<table>
<thead>
<tr>
<th>Nottingham Hip Fracture Score</th>
<th>n (%)</th>
<th>Females (%)</th>
<th>Age, median [IQR]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>176 (5)</td>
<td>176 (100)</td>
<td>58 (53–62)</td>
</tr>
<tr>
<td>1</td>
<td>233 (6)</td>
<td>62 (27)</td>
<td>55 (43–61)</td>
</tr>
<tr>
<td>2</td>
<td>58 (2)</td>
<td>11 (19)</td>
<td>61 (53–63)</td>
</tr>
<tr>
<td>3</td>
<td>1,037 (28)</td>
<td>1,010 (97)</td>
<td>79 (74–82)</td>
</tr>
<tr>
<td>4</td>
<td>1,270 (34)</td>
<td>1,020 (80)</td>
<td>82 (77–87)</td>
</tr>
<tr>
<td>5</td>
<td>683 (18)</td>
<td>375 (55)</td>
<td>86 (80–89)</td>
</tr>
<tr>
<td>≥6</td>
<td>242 (7)</td>
<td>97 (40)</td>
<td>87 (84–90)</td>
</tr>
</tbody>
</table>

The median age of the study cohort was 82 years (IQR 76–88). In total, 4,720 (77%) patients were female. The overall postoperative mortality was 8.3% at 30 days and 29.3% at 1 year (Tables 2 and 3).

The place of residence at the time of fracture and the subsequent discharge destination are shown in Table 1. The majority of patients (3,699, 60%) in the study cohort were admitted from their own home. Of this subgroup, 2,229 (60%) were eventually discharged from the hospital back to their home. The overall numbers (percentage) of patients returning to their own home for each of the time-points were 235 (6%) (<8 days), 871 (24%) (<15 days) and 1,263 (34%) (<22 days). The NHFS was calculated retrospectively for this subset of patients (Figure 1). There was good negative correlation between increasing NHFS and the chance of eventual home–home admission–discharge ($r^2 = 0.949$). The NHFS was also closely related to the proportion of patients discharged back to their own home at 7, 14 and 21 postoperative days, respectively (Figure 2). Although we have reported the linear correlation for the data, visual inspection of both Figures 1 and 2 suggests that there may be a step change between NHFS 0 and 1 (younger men with no co-morbidities, or younger women with no/minor co-morbidities) and those with higher scores.

Discussion

We have demonstrated that the NHFS, which is calculated on admission, is strongly correlated with the likelihood of patients returning home. It has a strong predictive value for discharge at both 14 and 21 days.

With increasing pressure on hospital bed-days, if it is possible to predict those patients probably to return home quickly, then discharge planning may be appropriately planned around early discharge. Those patients predicted to require 7–21 hospital bed-days may benefit from early supported discharge schemes. These schemes have been shown to be effective in selected patients. Patients randomised to accelerated discharge and home-based

Figure 1. The probability of discharge back to own home in survivors following hip fracture according to the NHFS.

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rehabilitation compared with conventional care showed a significant reduction in hospital bed-days, significant improvement in the modified Barthel index, and scored higher on the Falls Efficacy Scale at 4 months [15]. More recently, home rehabilitation that focused on early supported discharge and enhancing self-efficacy demonstrated improved balance confidence, independence and physical activity [16]. For those patients very unlikely to return home, then discharge planning may be more usefully engaged with identifying suitable supported care or targeted intermediate care rehabilitation. These data show that patients with the NHFS 0, 1 or 2 have >70% chance of returning home; they have >50% chance of returning home within 15 days of admission. Although it can only be suggested by a study such as this, it is plausible that this group would be a key target group to support early discharge. This group consists of younger patients, <66 years of age, either male with no co-morbidities, or female with minor co-morbidity. This is a relatively small group of the overall hip fracture population. Conversely, patients with the NHFS ≥3 have 57% chance of returning home but only they have 32% chance doing this within 15 days of admission.

There is no single outcome measure that defines good outcome following hip fracture. The length of stay and post-operative mortality are often quoted in hip fracture research. These have the benefit of being ‘hard’ endpoints, but do not reflect the decrement in independence often seen following hip fracture. Furthermore, with respect to length of stay, there are often many other factors that delay discharge such as delays in providing care packages and equipment rather than peri-operative care per se. Home-to-home discharge, whilst only relevant to a proportion of patients with hip fracture, may be a more patient-centred marker of quality of care.

This is a single-centre study, and other centres may have different proportions of patients admitted from, and returning to, their own home. The hospital aims to discharge patients admitted from their own home, back home within 14 days. However, if by around day 10, it is felt that the patient requires further rehabilitation, they are referred for off-site rehabilitation. However, other aspects of the Nottingham population appear to be broadly similar to other populations: 30-day mortality is approximately the same as national figures as is median length of stay [5]. The proportion of patients excluded due to lack of complete data is relatively high at 14%. Although there do not appear to be any systematic differences between included and excluded patients on the data that are present, we can not exclude a confounding effect of these patients.

In summary, admission characteristics can be used to predict the likelihood of returning home following hip fracture. The NHFS provides an objective measure and could be a useful clinical tool for selecting patients with a high probability of discharge to their own home, and to allow targeted, early support for discharge. The NHFS could also be a useful research tool, allowing objective stratification of patient groups in randomised studies designed to evaluate the efficacy of different care regimes in this group of patients.
Key points

- Return to home following hip fracture can be predicted at admission
- Prediction of timing of return to home may be useful for discharge planning
- Future research studies may benefit from stratifying patients according to likelihood of return to home following hip fracture

Conflicts of interest

None declared.

References


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Patterns and correlates of grip strength change with age in Afro-Caribbean men

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