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A Worsening Trend - Possum and NHFS in Patients with a Fractured Neck of Femur

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Research Article

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Abstract

With an aging population, an increasing number of patients are presenting with a fractured neck of femur (NOF) and concurrent multiple co-morbidities. Two scoring systems developed to predict morbidity; mortality and long-term outcomes are the Physiological and Operative Severity Score for enumeration of Mortality and morbidity score (POSSUM) and the Nottingham Hip Fracture Score (NHFS).

Our study set out to identify the developing trends in patients presenting with a fractured NOF using the POSSUM score and NHFS.

Data was retrospectively collected on all 139 patients operated on with a fractured neck of femur June and December 2011 and 2014. The results demonstrated a significant increase in both the POSSUM score and the NHFS between 2011 and 2014 (mean POSSUM score 35.39 vs. 40.19 respectively, P <0.001, 95% CI -6.94 to -2.65 and the mean NHFS 3.63 vs. 5.19 respectively, P <0.001, 95% CI -2.01 to -1.12).

Our study demonstrated that patients presenting with a fractured NOF have worse physiological year on year. We believe that more research needs to be done to predict and prevent fractured NOF.

Keywords: Enumeration; Possum; The Nottingham Hip Fracture Score; Venous Thrombosis

Introduction

The incidence of fractured neck of femur is rising globally. In the United Kingdom (UK) it has been estimated to rise substantially with an aging population with giving the UK an annual incidence of 80,000 per year [1]. The estimated global annual incidence is 1.3 million [2]. The elderly population in the UK continues to grow disproportionately to all other demographic groups. Despite falls intervention and secondary fracture prevention the incidence of neck of femur fractures will rise in any event just by the growing numbers within this stratum. There is no doubt also that improved medical care allows individuals to live long into old age even with significant morbidity. Hip fractures generate a substantial clinical and economic burden with high patient morbidity and mortality. The financial impact in the UK is estimated to currently cost £2 billion [2].

Patient care and outcomes have improved by a proactive and aggressive approach to these patients with a combined approach from the National Institute of Clinical Excellence (NICE) [2], and the British Orthopaedic and Geriatric Associations [3]. Various strategies have been employed to affect these outcomes including

orthopaedic surgeons, anaesthetists, orthogeriatricians, and fracture neck of femur nurses. Best practice and best outcomes involves these approaches. In the UK incentives for proactive theatre management of these patients with Best Practice Tariff have been introduced [4]. However, despite these interventions, mortality rates have not significantly fallen in recent years [5]. The Physiological and Operative Severity Score for enumeration of Mortality and morbidity score (POSSUM) by Copeland and colleagues [6] (Table 1) was originally designed to assess the likely outcome from a surgical intervention given the physiological parameters of the patient. This comprises 12 physiological factors and operative factors. Patients are scored and subjected to logistic regression analysis to generate two equations for morbidity and mortality [6].

The Nottingham Hip Fracture Score (NHFS) [7] is a physiological score specifically designed to predict the mortality of patients who have suffered a neck of femur fracture (Table 2). This was originally developed and validated for a single centre data set from 2000–2007 [7]. It has subsequently been used to predict functional and longer-term outcomes.

Our study aims to identify developing physiological trends in patients presenting with a fractured neck of femur using the POSSUM score and the NHFS.

Physiological score					**Operative severity score**				
	1	2	4	8		1	2	4	8
Age (yrs)	<60	61-70	>71		Magnitude	Minor	Intermediate	Major	Major +
Cardiac signs	Normal	On cardiac medication	Oedema Warfarin	Raised JVP	Number of operative variable within 30 days	1		2	>2
Chest radiograph	Normal		Borderline Cardiomegaly	Cardiomegaly	Blood loss per operation (ml)	<100	101 - 500	501 – 999	>1000
Resp signs	Normal	SOB on exertion	SOB on stairs	SOB at rest	Contamination	None	Incised wound	Minor contamination or necrotic tissue	Gross contamination or necrotic tissue
Chest Radiograph	Normal	Mild COPD	Moderate COPD	Any other change	Presence of malignancy	None	Io	Metastases to nodes	Distant metstases
Systolic BP (mmHg)	110 – 130	131- 170 101- 109	>171 90 - 99	<89	Timing of operation	Elective		Emergency Resuscitation possible <48hrs	Emergency or Immediate <6hrs
Pulse	50 – 80	81- 100	101 – 120	>121					
		40 - 49		<39					
GCS	15	12 – 14	9 – 11	<8					
Blood Urea (mmol/L)	<7.5	7.6 - 10	10.1 - 15	>15.1					
Blood Na (mmol/L)	>136	131 - 135	126 - 130	<125					

Bloo K (mmol/L)	3.5 - 5	3.2 – 3.4	2.9 – 3.1	<2.8					
		5.1 – 5.3	5.4 – 5.9	>6					
Hb (g/100mls)	13 – 16	11.5 – 12.9	10 – 11.4	>18.1					
		16.1 - 17	17.1 - 18						
White cell count x1012/L	10-Apr	10.1 – 20 3.1 – 3.9	>20.1 <3						
ECG	Normal		AF (60-90)	Any other change					

Table 1: POSSUM Score Parameters.

Paramater		
Age	66-85	3
Age	>85	4
Sex	Male	1
Abbreviated Mental Test Score	<7	1
Hb on admission	<100 g/L	1
Residence	Living in institution	1
Co-morbities	>=2	1
Active malignancy	<20 years	1
Total		Max 10

Table 2: Nottingham Hip Fracture Score.

Patients and Methods

This was a retrospective cohort study with data collected for one summer and one winter month (June and December) in 2011 and 2014 at Wirral University Teaching Hospital (WUTH). All patients admitted and subsequently operated on for a fracture neck of femur were included. All of these patients had Orthopaedic POSSUM score retrospectively collected and calculated as described by Mohamed et al. which included 12 factors in the physiological and 6 factors in the operative score with 4 grades in each category (Table 1). The four grades are scored with exponentially increasing value. The data was collected using patient notes, electronic records and histology as appropriate. The records were taken form the admission clerking prior to surgery.

The NHFS comprises 7 preoperative variables (Table 2). These were retrospectively recorded and calculated from the admission clerking, electronic records and histology as appropriate.

The results of both scoring systems were recorded using an excel spreadsheet including the method of hip fracture management. Almost all the score variables were available for every patient but when a figure was missing a score of 1 was allocated. This was as per the original method used by the authors of the initial paper Mohamed et al.

To account for the unequal variance and sample size, the data was analyzed using the Welch's unequal variance *t*-test (Graph Pad Prism 7 software). A p-value of <0.005 was considered statistically significant.

The combined total score of both the POSSUM and NHFS was used to identify trends in patients presenting with a fractured neck of femur between 2011 and 2014.

Results

Over the four study periods, June and December 2011 and 2014, we identified 139 patients who were eligible for inclusion. This consisted of 29 patients in June 2011, 35 patients in December 2011, 34 patients in June 2014 and 41 patients in December 2014. These time periods were used as we anticipated that there would be seasonal variation in patients presenting with a fracture neck of femur. The male to female ratio was 1:3.5 (31 vs. 108 respectively). Mean age of patients in June 2011 was 79.4 (43–95) and in December 2011 was 83.3 (63-97). The mean age in June 2014 was 81.9 (66–97) and December 2014 was 85.5 (70–94).

The overall mortality at 30 days 8.2% and at 1 year was 26% in 2011 and in 2014 8.6% at 30 days and 33% at 1 year. In our cohort the 30 day mortality in June 2011 was 8% and NHFS predicted 9.1%. In December 2014 our observed mortality was 10.2% and predicted 11.3%. In June 2014 the 30day mortality was 9.1% and NHFS predicted 11%. In December 2014 our observed mortality was 9.8% and NHFS predicted 11.6%.

The mean POSSUM score was 35.39 in 2011 (27-52) compared with a significant rise, as determined by

Welch's unequal variance *t*-test, to 40.19 in 2014 (29–63, P<0.00195%, CI -6.94 to -2.65). There was no significant difference in the POSSUM score between June and December 2014 with a mean POSSUM score in June of 39.06 vs. 41.1 in December (P 0.1940, 95% confidence interval (CI) -5.20 to 1.07). However there was a significant difference in the POSSUM score between June and December 2011 with a mean POSSUM score in June of 32.55 vs. 37.74 in December (P <0.001, 95% CI -7.75 to -2.63). There were also significant differences in POSSUM scores of June 2011 vs. June 2014 (mean 32.55 vs. 39.06 respectively, P<0.001, 95% CI -9.09 to -3.92) and December 2011 vs. December 2014 (mean 37.74 vs. 41.12 respectively, P 0.0341, 95% CI -6.50 to -0.26).

The significant differences are as follows. The mean NHFS in 2011 were 3.63 (0-6) compared with a significant rise, as determined by Welch's unequal variance *t*-test, to 5.19 in 2014 (3-9, P <0.001, 95% CI -2.01 to -1.12). There were significant differences in NHFS scores of June 2011 vs. June 2014 (mean 3.45 vs. 5.12 respectively, P<0.001, 95% CI -2.37 to -0.97) and December 2011 vs. December 2014 (mean 3.77 vs. 5.24 respectively, P <0.001 95% CI -2.04 to -0.91).

Possum Score			NHFS	
	Jun-11	**Dec-11**	**Jun-11**	**Dec-11**
N	29	35	29	35
Mean	32.55	37.74	3.45	3.77
Range	27-44	30-52	0-6	5-Jan
SEM	0.77	1.02	0.26	0.16
	Jun-14	**Dec-14**	**Jun-14**	**Dec-14**
N	34	41	34	41
Mean	39.06	41.12	5.12	5.24
Range	29-52	30-63	8-Mar	9-Mar
SEM	1.04	1.18	0.23	0.23
	Jun-11	**Jun-14**	**Jun-11**	**Jun-14**
N	29	34	29	34
Mean	32.55	39.06	3.45	5.12
Range	27-44	29-52	0-6	8-Mar
SEM	0.77	1.04	0.26	0.23
	Dec-11	**Dec-14**	**Dec-11**	**Dec-14**
N	35	41	35	41
Mean	37.74	41.12	3.77	5.24
Range	30-52	30-63	5-Jan	9-Mar
SEM	1.02	1.18	0.16	0.23
	2011	**2014**	**2011**	**2014**
N	64	75	64	75
Mean	35.39	40.19	3.63	5.19
Range	27-52	29-63	0-6	9-Mar
SEM	0.73	0.8	0.15	0.16

Table 3: Results of POSSUM and NHFS

Discussion

Sustaining a fractured neck of femur is a devastating injury for the frail and elderly patient [8]. There is great morbidity and mortality associated with this group of patient. Associated with a higher rate of mortality is male sex, increasing age, pre-fracture mental state and mobility with recent addition of physiological and blood parameters [9]. Despite identifying and recognizing these considerations with increasing MDT care, mortality still remains high. Patients are living longer with multiple medical co-morbidities and mortality remains high.

The senior author observed that over time the patients presenting with fractured neck of femurs appeared to be more elderly, suffering from multiple medical co-morbidities, have a natural age related or physiological cause for mental decline and increase reliance on institution living. At this point this has not been quantified. There are prognostic scoring system for morbidity and mortality. We attempted to qualify this observation by undertaking this observation using the Possum and NHFS as measures of physiology.

We have shown with POSSUM and NHFS, that patients presenting with a fractured neck of femur in 2014 have higher scores compared with 2011. It is likely that worse physiology, patients presenting with multiple medical co-morbidities and more severe end stage cardio-respiratory disease contribute to the increase in both the POSSUM score and NHFS. Although the POSSUM and NHFS are used to predict 30-day mortality we did not look at this as this has been previously researched. Copeland, in his original description used POSSUM for all emergency and elective general surgery operations to predict mortality [6]. Subsequently Mohamed measured the POSSUM score in orthopaedic patients [10]. Their results demonstrated accuracy in POSSUM in predicting mortality. The accuracy of POSSUM in predicting mortality was later confirmed by Wright [11]. Mohammed [10] noted that with a predicted mortality in 2326 orthopaedic operations both elective and emergency of 53, 51 were observed. They comment that POSSUM accurately predict mortality with a predicted mortality of 53 deaths an observed mortality of 51 deaths. Wright [11] observed 25 deaths in 230 necks of femur patients with a predicted mortality of 21. The surgical component of the POSSUM score has a relatively narrow range. As a consultant performs the procedures, or a supervised registrar, with a consultant anesthetist the POSSUM score is minimally influenced by the surgical components. Thus the POSSUM score changes are mainly due to the physiological (pre-operative) score factors.

Our study records the POSSUM and NHFS as a measure of physiology and by proxy a marker of patient fitness. Although we recognize that the POSSUM and NHFS were not designed to measure fitness, this, along with age data allowed some conclusions to be drawn as to the changing nature of our population. We show that patients presenting with a fracture neck of femur in 2014 were more likely to have a higher NHFS than those who presented in 2011. Moppet undertook a multicentre analysis of 7290 patients [12]. He noted that there was an increase in the NHFS particularly in the subgroup of patients with a score of 4 or higher; this is mirrored by our findings.

This study has highlighted the need for more medical input in these frail patients who are presenting to us with end stage disease culminating in a fractured neck of femur. Since this study has been performed there has been a change in practice at our hospital. All patients are assessment by an orthogeriatrician on admission and everyday postoperatively. This has lead to a more rapid appreciation of the deteriorating patient and more definitive action. There has also been more intensive physiotherapy for these patients so normal practice is now to mobilize on day one post surgery which we believe will reduce the risk of venous thrombosis, infection and associated risks of remaining bedbound for longer. We are currently reviewing the outcomes of the multidisciplinary team approach.

We hypothesized that there would be a seasonal variation effect in our patient population with patients who are physiologically more compromised presenting in the winter. This was not supported by our data.

We conclude that our patients as measured over a 4 year interval were both older and had greater physiologic compromise. We hypothesize that these findings are not confined to a geographic area and have national relevance. Mortality increases in this group as predicted by both scoring systems, with the NHFS non-significantly overestimating mortality. Given that the general health of this patient group is likely to worsen still, the clinical relevance of this is the need to manage these frail, compromised patients in the appropriate care setting by the appropriately skilled practitioner sutiliting a multidisciplinary team.

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