Vertebral fracture secondary to suicide attempt: demographics and patient outcome in a Scottish spinal rehabilitation unit

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Objective: To establish occurrence, method of injury, length of stay (LOS), psychiatric diagnosis, rehabilitation outcome, and demographic data for those admitted to a Scottish Spinal Injuries Rehabilitation Unit as a consequence of deliberate self-harm (DSH).

Design: A retrospective audit of case-notes and electronic databases of admissions and rehabilitation outcome in a spinal cord injury (SCI) unit where the mechanism of injury was (DSH).

Results: Forty-six (44 having detailed data available) patients were identified with 95% of injuries resulting from falls. Thirty-six people had pre-existing mental health problems (82%) with 15 (34%) having this diagnosis established shortly after admission. Seventy-five per cent received follow-up from mental health services. Ninety-five per cent returned to their pre-injury (or similar) residence. LOS and functional independence measure (FIM) for the DSH group were compared with a non-DSH group. No differences were found in those with SCI. LOS was significantly longer in the patients with vertebral fracture and no neurological impairment (32 versus 22 days). Sixty-four per cent of those who had self-harmed had substance dependence problems. The predominance of falls (63%) occurred in a residential setting. Annual admissions due to individuals self-harming were stable across the studied period.

Conclusions: Spinal column fracture in the DSH group is predominantly caused by falls. High levels of mental health and substance abuse problems are noted necessitating formal mental health assessment and follow-up. DSH as a mechanism for injury appears to have a significant impact on LOS only if the patient has fracture without SCI. Immediate rehabilitation outcomes are similar to that of non-DSH group.

Keywords: Spinal cord injuries, Rehabilitation, Self-injurious behaviour, Suicide

Introduction

Previous research in three regional spinal injuries (English, Australian, and Scandinavian^{1–3}) units has established demographics, history, and outcome for the relatively small cohort of individuals who have been admitted due to suicide attempt, comprising 1–3% of total annual admissions. They describe a group with significant mental health problems, disproportionate rates of psychotic illness (20–30%), and an increase in deliberate self-harm (DSH)-coded admissions over a period studied (possibly due to increased substance abuse, deinstitutionalization, and changes in recording practices²). The majority of injuries (80–95%) in the three relevant samples are caused by

falls. Suicide by hanging seldom causes significant cervical damage and death is usually from strangulation, hence the non-occurrence of hanging-related spinal cord injury (SCI) in samples.⁴

As noted by previous research, self-harm by falling is a rare phenomenon,^{1–3,5} accounting for 4–7% of suicidal deaths in the developed world. Scotland has a relatively high suicide rate when compared with other developed nations with differences attributed to marked social deprivation and substance abuse,⁶ with those in lower socio-economic demographic groups at significantly more risk of self-harm.⁷ The rate per 100 000 in 2004 was 30.3 and 10.2 for men and women, respectively; a total of 833 deaths by suicide, 9% resulting from falls.⁶ While traditionally gender differences have been seen in method, with males choosing more violent and lethal means, this has changed in recent years in

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Scotland. Trends since 1994 have seen men move to less lethal methods (ingestion rather than hanging), which is attributed to the lowering of rates of suicide from a peak in the late 1990s.⁶

Community samples estimate that 8–10% of all those who attempt suicide eventually will die as a result of self-harm, most of these within 5 years of attempt^{8,9} depending on diagnosis. SCI literature estimates suicide as being responsible for approximately 5% of deaths, though this varies greatly between populations.^{1,2,10–12} The English¹ and Scandinavian² samples reported 4 and 7% of their DSH cohort dying from suicide after discharge. Comparing that with norms from their own unit Stanford *et al.*³ observes that 1% of all persons with SCI go on to die from DSH. Risk tends to be higher in the years immediately post-injury, but there is an increased life-time risk if an individual has ever attempted suicide or self-harm.

The impetus for the current study emerged as there was a similar cohort of persons who sustained SCI after DSH in a Scottish rehabilitation setting. The present study intended to build on previous knowledge and establish demographics, psychiatric history, and rehabilitation outcome for this group who sustained their SCI as a result of DSH. There was also an informal perception that individuals with significant mental health issues or self-harm history could have extended stays and are prone to underachieve in rehabilitation. Consequently, length of stay (LOS) and rehabilitation outcome data were collected. Finally, as persons with vertebral fractures (with no neurological impairment) are also admitted for orthopaedic management, we considered the additional burden in mortality imposed by a spinal injury in addition to existing mental health problems.

Method

The setting for the study was a Scottish Rehabilitation Unit. Since 1993, the unit has accepted all those Scots who have experienced acute SCI for initial medical management and rehabilitation (a population of approximately 6 million⁶). The unit also accepts a number of non-neurologically impaired individuals for care of complex spinal fractures.

Inclusion criteria

The primary inclusion criterion was a self-harm episode resulting in admission to the rehabilitation unit. An electronic data set is maintained locally, which includes cause of admission using International Classification of Diseases codes (ICD-9¹³). This data set was searched identifying all individuals whose injuries were coded as

being caused by DSH (consecutive ICD-9 codes: E950–E959) admitted in the period 1993–2007.

Selected files ($n = 86$) of those individuals, where digital records were unclear, were also examined. The primary inclusion criterion was a record in the notes that stated the injury was due to self-harm. This was usually a recorded description of the patient's account of the self-harm attempt or corroborating evidence (e.g. witness account). Staff members who recorded this information included junior medical staff and nursing staff on admission pro-forms and mental health staff (psychologists or consulting psychiatrists and psychiatric nurses from the hospital liaison service). Cases where there were suspicion of self-harm, inconsistent stories, or 'dubious' accidents were not considered for inclusion. Forty-six cases were identified and 44 sets of notes were accessible.

File information

Established cases of admission secondary to self-harm were reviewed by the primary author and information collected on a standardized form in addition to electronic records. This included basic demographic information, discharge data and destination, admission details, psychiatric history, rehabilitation outcome (measured by the functional independence measure, FIM¹⁴), and diagnosis and information on previous attempts at self-harm and impairment category (according to International Standards for Neurological Classification of SCI).¹⁵

International Standards for Neurological Classification of SCI

The international standards provide a meaningful categorization of the nature of the SCI and these data are recorded for all admissions. The standards classify SCI by levels A–E. A being a complete injury below a dermatome with no movement or sensation, B and C denote an incomplete paralysis with significant disruption to movement and sensation, D denotes power to move against gravity in the majority of muscles, and E denotes no neurological impairment (intact).

Functional independence measure

FIM is recognized as a means of tracking progress in rehabilitation. It is composed of 18 items; 13 directly refer to motor tasks involved in activities of daily living (e.g. dressing or washing) and 5 refer to social and cognitive domains. Each item is scored on a scale of 1–7: 1 denotes needing complete assistance, 2–5 is scored when an individual needs a percentage of assistance to complete a task, 6 is scored if the person is independent with a device, and 7 denotes the individual is

fully independent. The total FIM score ranges from 18 to 126 (motor FIM 13-91).

Psychiatric diagnosis

Psychiatric diagnosis was established in the first instance by the author's review of a senior clinician's admission note, formal review, or discharge letter. In the absence of this probable diagnosis was established from written notes, report of previous diagnosis from the patient (recorded in admission pro-forma) or prescription. For example, report of heavy alcohol use by the patient and noted withdrawal on the ward would lead to an individual being coded for alcohol problems. Likewise, an admission report of an individual hearing voices telling the patient to jump and a prescription of an anti-psychotic would lead to coding for a psychotic illness.

Follow-up and mortality

Medical and nursing staff from the rehabilitation unit offer outpatient follow-up to all Scottish patients with SCI, annually, for life. Therefore, outcome data were available for those with SCI and limited follow-up data were available for patients with fracture but no SCI. Outcome points included final discharge destination, mortality, and total FIM on discharge. Established cases were checked with registers of deaths in the United Kingdom (Births and Deaths, England Wales and Northern Ireland, General Registrars' office Scotland) to establish mortality.

Comparison group

In an effort to explore the question of whether those individuals whose injury had been caused by DSH had longer stays or were not as successful in rehabilitation, a comparison group was identified by further database search. Primary inclusion criteria were guided by characteristics of the DSH group; injury by fall and age under 60 years (as only one of the DSH group was older than 60 years). Any incomplete data sets were eliminated. The comparison group was then further grouped by neurological impairment category for analysis.

Results

Demographics

During the period of 1993 to December 2007 there were a total of 2343 patients admitted. There were 1106 with SCI (impairment categories A-C); of this group 21 people were admitted secondary to DSH (1.9%). There were 1237 individuals with vertebral fractures with little or no neurological impairment (impairment category D/E, 25 who were admitted after DSH (2%).

There were 21 males and 25 females; the average age was 30.1 years, range 19-69 (non-significant differences between genders on age and only one individual older than 60 years). Twelve admissions were people with paraplegia and nine people with tetraplegia (including central cord/significant monoplegia, impairment categories A-C). The average follow-up available was 7.1 years. Of those who were admitted after DSH 43 (95%) had their injury caused by a fall, with one admission after a car crash and two patients admitted following an overdose and an extended period of time with necks in flexion.

Table 1 outlines fall location, the majority fell from residential settings ($n = 28$, 63%) followed by bridges ($n = 10$, 23%). *Post-hoc* analysis (paired t -tests, Pearson's r) showed no statistically significant relationships between estimated height of fall, location of fall, choice of location, psychiatric diagnosis, and length of illness, previous attempt, or impairment category. There were no significant differences in height or location of fall between the intact and impaired groups. The only finding of note was that (at 20 versus 40 feet) men fell significantly further ($t(38) = 4.92$, $P < 0.05$). The distribution of admissions over the 15 years was stable (mean = 3.28 per year, range 2-6, Pearson's $r = 0.03$ ns).

Mental health and addiction problems

There was a high incidence of established (pre-injury) mental health problems with 22 ($n = 44$, 50%) of the sample having reported or had file information indicating a mental health problem at admission. On admission 22 individuals reported no formal psychiatric diagnosis or cited social problems as a cause for their DSH. At mental health review subsequent to admission 14 of these individuals were given a new psychiatric diagnosis. The majority of these newly established diagnoses were of mood or substance abuse problems. Therefore, formal psychiatric disorder was likely present at the time of injury for 36 individuals (82%).

The majority of patients ($n = 34$, 78%) attracted multiple psychiatric diagnoses. Table 2 shows the

Table 1 Location of fall leading to spinal injury

	Raw count	Percentage (%)
No. of patients	43	
Home	28	63
Bridge	10	23
Flyover	2	5
Hospital/prison	1	2
Scaffold	1	2
Car park	1	2

Table 2 Diagnosis category, inpatient review, and onward referral by primary diagnosis and cumulative occurrence of all diagnoses

	Primary diagnosis* (n = 44)		Inpatient mental health/review (n = 33, 75%) [†]		Referral (n = 33, 75%) [‡]		Cumulative diagnoses**	
Personality disorder	8	18%	6	75%	6	75%	11	25% ^{††}
Alcohol/drug Dependence [§]	7	16%	3	43%	3	43%	28	64%
Primary low mood	11	25%	11	100%	11	100%	16	36%
Bipolar disorder	2	5%	2	100%	2	100%	2	5%
Psychosis	7	16%	6	86%	6	86%	9	20%
Schizophrenia	2	5%	2	100%	2	100%	2	5%
Psychosocial stress ^{††}	6	14%	3	50%	3	50%	12	27%
Other [¶]	1	2%	0				4	

*Coded as the principle presenting psychiatric problem on admission.

[†]Formal review completed by hospital psychiatric liaison or psychology service.

[‡]Evidence of onwards referral for or input from community addiction or mental health services post-discharge.

[§]Alcohol or drug dependence.

[¶]Psychogenic component, history of abuse or head injury.

**Often individuals attracted multiple psychiatric diagnoses. A total count of all diagnoses is given by category. While each data point in a diagnostic category represents a single individual; most individuals will be represented in multiple categories.

^{††}Percentage of sample (n = 44) who were given this diagnosis.

^{‡‡}Those for whom a stressful life event was identified as the precipitator for self-harm in the absence of any other psychiatric diagnosis.

distribution of primary diagnosis and absolute occurrence of all diagnoses; ordered by disorder category. In absolute terms the most frequently occurring problem was substance dependence where 28 people (64%) had evidence sufficient to indicate significant alcohol- or drug-dependence problems.

Of those for whom a reliable psychiatric history was included (n = 38), individuals had an average of 6.3 years of difficulties prior to SCI and 11 individuals were noted to have a history of self-harming behaviour or suicide attempt (28%). Of note, all these individuals who had a history of self-harm carried a primary diagnosis of mood or personality disorder, whereas patients without these diagnosis had no history of self-harm ($\chi^2(1, 38) = 26.56, P < 0.001$). Thirty-three individuals (75%) were reviewed by hospital mental health services and all those reviewed were referred on to community services.

Comparison group

Table 3 shows the demographics of the comparison groups compared with the DSH group. Despite selecting

a group based on a similar age range as that of the DSH group (i.e. younger than 60 years) for both the intact and low-tetraplegic category the comparison group was significantly older had a significantly greater proportion of men (325 males and 158 females, $\chi^2(1, 529) = 8.69, P < 0.001$) than the DSH group. *Post-hoc* analysis (Pearson's *r*) suggested no relation between age and LOS or total FIM score and no difference (χ^2) between genders in total FIM or LOS in the comparison group.

Rehabilitation

Fig. 1 shows total or motor FIM scores for the DSH group compared with comparison groups, ordered by impairment category. FIM motor scores (possible range 13–91) is shown for impairment categories A–C. For impairment category D/E total FIM is reported and indicates a ceiling effect (i.e. no variability as scores were near a maximal 126). There was no significant difference between total and motor FIM for the DSH group when compared with the relevant comparison group. Fig. 2 shows LOS for the DSH and

Table 3 Count and age data for deliberate self harm (DSH) and comparison group (non-DSH)

	DSH				Non-DSH				Significance
	No.	Age (mean)	SD	Range	No.	Age (mean)	SD	Range	
Tetraplegia*	8	32.38	8.83	20–57	92	45.81	12.41	13–60	<i>t</i> (98) = 2.99 <i>P</i> < 0.05
Paraplegia [†]	12	33.58	12.72	16–57	81	35.71	12.59	14–60	n.s.
Intact [‡]	25	31.04	14	15–69	310	37.95	13.41	13–60	<i>t</i> (333) = 2.47 <i>P</i> < 0.05

*Patients with tetraplegia, impairment category, A–C, at dermatome C5–C8.

[†]Patients with paraplegia, impairment category, A–C, dermatome T1 and below.

[‡]Patients with no or minimal neurological impairment (impairment category, D/E).

Figure 1 Comparison in functional independence measure scores (total/motor FIM) between deliberate self-harm (DSH) and non-deliberate self-harm by impairment category.

Figure 2 Comparison in mean length of stay (days) between deliberate self-harm (DSH) and non-deliberate self-harm by impairment category and injury level.

comparison groups, ordered by impairment category. There was no significant difference in LOS for the DSH group for patients with SCI (impairment categories A–C). Among patients with a category D/E injury, individuals who sustained their injury as a result of DSH had a significantly longer stay than those who had not self-harmed (32.64 versus 22.22 days, $t(333) = 2.17$, $P < 0.05$). The single individual with high tetraplegia (injury at level C1–C4) was excluded from this analysis.

Table 4 lists the final discharge destination as identified; 35 (80%) returning to a private home, 7 returned to their previous institutional living arrangements, and only 2 individuals required more supportive accommodation than pre-injury.

Mortality

Hospital records and UK government registers of deaths were searched for the names of the 46 identified patients who were admitted after DSH. Five people had died subsequent to their discharge from rehabilitation (11% of the total sample); three of these deaths were due to DSH (one of these persons being in the D/E category ($n = 25$, 4%). Four ($n = 21$, 19%) deaths occurred in those with SCI (category A–C); two people died after deliberate overdose and two people died from medical complications of SCI. The average years to death were 3.5. Average follow-up was 7.5 years.

Discussion

The subcohort of individuals, who sustained vertebral fracture or SCI, described in this paper resembles those in similar retrospective case studies.^{1–3} The present study extended this work by establishing factors that are relevant to a Scottish population and examining immediate rehabilitation outcomes for this group.

Similar to previous studies, falls were the predominant cause of SCI (ICD 9 code E957) in those who deliberately self-harmed and this group composed approximately 2% of admissions. Unlike the data reported by Kennedy *et al.*¹ and Stanford *et al.*³ (which spans a greater period), rates of admission for those with vertebral fractures after DSH are stable

over time in the Scottish population and mirror general rates of self-harm in Scotland.⁶ While of a similar gender mix to general spinal admissions those in the DSH group are younger (age 16–69 years compared with 13–92 years for general spinal admissions at the Scottish unit for this period) and have a significant mental health history. The age finding reflects more general findings in the self-harm literature where active methods (falling) are seen in younger individuals.^{6,12}

Also unique to the Scottish cohort was the high levels of alcohol- and drug-dependence issues identified. Sixty-four per cent of those admitted after DSH likely had a diagnosable dependence problem (compared with the Australian² (36%) or English¹ (7%) cohorts). There are a number of possible explanations. Scotland has a comparatively high rate of alcohol use and dependence problems when compared with other developed countries and this general problem would likely be reflected in the studied population.^{16,17} Also compared with Kennedy *et al.*¹ and Stanford *et al.*³ the current paper examined a shorter period and may reflect a more general increase in substance use in recent years in the UK.¹⁸

Eighty-two per cent of those admitted as a result of DSH that resulted in vertebral fracture in the Scottish cohort had an ICD or DSM psychiatric condition at the time of their fall. It is notable that 39% of this group (32% of total sample) only had this established on their admission. This is consistent with studies on those individuals who completed suicide; where a third had not had any contact with mental health services^{19–21} prior to their attempt.

Admission data suggested that patients gave social explanations (marital or social difficulties or a specific financial problem) but after formal mental health review the primary diagnosis and explanation for DSH shifted to a diagnosis of alcohol, drug, or mood difficulties. This is a similar phenomenon as observed by Connor²² where those who self-harm attribute local social circumstances and underestimate the role of mood or substance abuse problems. This finding supports public health efforts to normalize the occurrence of mood and substance problems and ensure accessible and well-publicized community treatment. It also underscores the need for those coming into professional contact with individuals to remain alert for problems and to offer assistance.

Beyond the fact of falling there is no particular characteristic that further differentiates those who sustained vertebral fracture after DSH that are described in this study. There is a range of duration of problem (6 months to >20 years), a mixture of psychiatric problems, and includes

Table 4 Final discharge destination

No. of patients	44
Psychiatric hospitalization (previously at home)	1
Returned to long stay hospital	4
Returned to prison	2
Returned home	35
New nursing home (previously at home)	1
Returned to secure school	1

those people who were previously hospitalized and had self-harmed and those who had not. Due to the limits of the sample sizes in the study comparisons need to be considered with caution. However within those limits a similar disproportionate occurrence of those with psychotic problems (25% in this study, 30% in Stanford *et al.*³ and Kennedy *et al.*¹) is observed, when compared with the proportion of those experiencing psychosis as a percentage of all psychiatric populations.

Unique to the Scottish cohort are that falls are predominantly from domestic rather than public buildings or bridges. Also the co-occurrence of substance abuse and falling in a domestic setting may also be a factor of the nature of Scottish housing. A common dwelling is a block of three to four story tenement flats with (for example) approximately 80% of public authority dwellings in Scotland being of this type.²³ Therefore, a ready means of self-harm can present to those in severe distress or to those whose distress co-occurs with a period of substance use; rather than an individual needing to either have planned sufficiently or be unimpaired enough to locate a height from which to fall.

Formal psychiatric or psychological inpatient review occurred for 75% of those admitted after self-harm and 75% had follow-up from community psychiatric or addiction services arranged. This is in addition to the life-long outpatient medical/nursing follow-up that is routinely offered to all those who have completed rehabilitation at the Scottish Unit.

There are a number of possibilities as to why 25% of the sample did not have community follow-up. Ten of the 11 who did not receive onward referral had a primary diagnosis (Table 4) of personality disorder, dependence issues, psychosocial problems, or brain injury. Also the individuals who did not receive psychiatric or addiction follow-up were admitted prior to 1999. Service provision has changed in recent years with a requirement that all those who are admitted after self-harm are reviewed by the psychiatric liaison service. The results of this study suggest that once individuals are reviewed, onward referral occurs. Therefore, those who were not reviewed (and consequently not offered further input) may represent a historical phenomenon.

It also needs to be considered that follow-up may have simply been declined or unwarranted. However, it may also reflect a perception that alcohol- or drug-dependence issues or social difficulties (without a clear psychiatric component) would not warrant psychiatric referral. Therefore (given the co-occurrence of dependence issues for those described in this study), it is perhaps a caution that DSH should not be seen purely in psychiatric terms. Substance abuse and dependence

issues are worthy independent treatment targets; especially, so when dependence can be both a predictor and disinhibitor for future suicide attempt.

Given the small numbers with SCI in the DSH group and the variability possible in outcome due to motor recovery (especially in those with incomplete injuries) conclusions about functional improvement and LOS should be cautiously drawn. Notably, while increased sample sizes could conceivably elicit a statistical significance there was no trend in the data to suggest that those with SCI (categories A–C) after DSH have different outcomes than those whose injuries were caused by another mechanism. Those in the DSH group appeared to rehabilitate to a similar level in a similar amount of time as patients in the non-DSH group. Also 95% of those in the DSH group returned to their previous type of accommodation. Therefore, the service impact of an individual admitted after DSH on either LOS or total FIM would likely be small.

In contrast, there is a significant difference in LOS for those with vertebral fracture and no significant SCI (category D/E). This may be due to time taken to establish referral to community services to ensure safe discharge. LOS difference may also reflect the consequence of mental health problems. For example, people being in a poorer physical state due to self-neglect, infection, or withdrawing from alcohol, which may limit options for surgical fixation and early mobilization.

While immediate rehabilitation and discharge data suggest equivalent outcome, the mortality data are less optimistic. For a relatively young group there is a significant mortality (for those who died, the average time to death from discharge was 3.6 years) with five individuals out of the 46 having died (three person's deaths were likely from suicide). There also appears to be a trend towards the deaths being clustered in the group who have an SCI (four deaths, 19% of the DSH group, two person's deaths likely from suicide). Due to the small numbers this did not reach significance and these data need to be viewed with caution. However, this seems to suggest that SCI (with prior suicide attempt) represents an additive risk over and above simple fracture (with suicide attempt), or for that matter, having a SCI without significant prior mental health problems. This (considered alongside the results from Kennedy *et al.*¹ and Stanford *et al.*³) indicates those who have a SCI after DSH are a group at continued risk of harm to self.

Limitations

There are a number of limitations to the present study, sample size was small and a retrospective methodology

meant establishing accurate history and outcome was difficult. As information was not collected during admission there can be inaccuracies introduced as a result of different clinicians recording over time. Also measures (total FIM/LOS) were likely not sufficiently nuanced to gauge a different course in those with a DSH history; especially in using total FIM for those with no neurological impairment where a ceiling effect was observed. Additional measures such as staff input on the ward, eventual participation in community activities, return to employment, and comparative medical input over time or readmission rates may provide a fuller understanding of needs and outcome of the vulnerable group with SCI secondary to DSH.

Within those limitations this study extends knowledge of those who sustain fracture due to DSH to a Scottish population. At a practice level it highlights the need for review from both a medical and psychiatric perspective if DSH is suspected. It also indicates that self-harm by falling should not be dismissed as an aberration and that there may well be underlying mood or substance problems. The mortality data support the need for ongoing review and indicate the risk that individuals carry with them through the period following discharge. More broadly, in a Scottish context the importance of accessible community interventions and assistance with substance abuse is highlighted.

Conclusion

Further research could look profitably at the individual factors which led to mortality in the SCI DSH group and perhaps suggest mechanisms to reduce mortality. It may also be profitable to examine the risk to self that all individuals bring with them into rehabilitation by merit of their past DSH or mental health history, as a way of better targeting support for all of those with SCI who have been discharged.

Despite the significant difficulties for individuals who have sustained injury as a result of DSH, this study demonstrates that they profit from their time in rehabilitation and have comparable outcomes to a non-DSH group in the short term. Deliberate falls and vertebral fractures are responsible for 2% of admission to a Scottish unit. Substance and mental health problems are significant in this group. These difficulties appear to impact little on immediate rehabilitation and discharge.

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