Process of care and mortality of stroke patients with and without a do not resuscitate order in the West Midlands, UK

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Abstract

Objectives. To compare the process of care of stroke patients with and without a do not resuscitate (DNR) order.

Design. Retrospective case note review with prospective follow up of mortality.

Setting. Seven acute hospitals, with stroke units, in the West Midlands, UK.

Participants. A random sample of patients (n = 702) admitted to hospital with acute stroke over a twelve month period.

Main outcome measures. Case mix and process of care measures derived from the intercollegiate stroke audit package. Thirty day and one year mortality.

Results. About one-third (34%, 238/702) of stroke patients had DNR orders. The thirty-day mortality for DNR patients was 67% (160/238) versus 10% (46/449) for patients without DNR orders. DNR patients had significantly worse case-mix profile than non-DNR patients – median age 81 y vs 75y; fully conscious 36% vs 79%, able to walk 1% vs 21% and no loss of power in either arm 5% vs 24% (all p < 0.0001).

DNR patients were more likely to be assessed early by a speech and language therapist (77% vs 59%, p < 0.001), but less likely to receive the majority of their care in a stroke/rehabilitation unit (20% vs 57%, p < 0.0001), or be cared for on a stroke unit or by a stroke team (42% vs 70%, p <0.0001), or had a description of the site of the cerebral lesion (31% vs 38%, p = 0.05) or be given aspirin (30% vs 42%, p = 0.007).

Conclusions. Stroke patients with a DNR order are not receiving optimum care in that they are not being cared for on stroke units or by specialist teams. This may reflect the inadequate provision of specialist stroke services in the UK.

Keywords: stroke, do not resuscitate, DNR, mortality, process of care, quality of care, outcome

Introduction

A do not resuscitate (DNR) order is often applied to acutely ill, often elderly, patients [1] (subject to issues of patient and relatives consent [2]) who are considered to have a poor prognosis [2]. The practical intention of a DNR order is that in the event of such a patient having a cardiac arrest, cardio-pulmonary resuscitation will not be attempted [2].

Studies from the USA [3] and Canada [4], suggest that DNR orders are frequently (18–31%) used in stroke patients and that a high proportion (90, 88%) of in-hospital stroke deaths are in patients with DNR orders [4,5]. Although the association between the use of DNR orders and death in stroke may not be surprising, the differential mortality rates between DNR stroke patients and those in whom resuscitation (non-DNR) would be attempted (3–25 times higher) [4–6] has raised concern about whether stroke patients with DNR orders are treated differently from those without such orders in ways not related to resuscitation. To explore this, we aimed to compare the process of care of stroke patients with and without DNR orders.

Method

We conducted a secondary analysis of a data set that had been collected to explore the process of care in hospitals with high and low mortality in the West Midlands, UK [7]. These com-
stroke patients with and without do not resuscitate orders

prised one large teaching hospital (976 beds), one large acute hospital (776 beds), four medium-sized acute hospitals (330–557 beds), and one small acute hospital (146 beds). All hospitals had a stroke unit.

The data set comprised information on a randomly selected cohort of 702 patients from these seven hospitals, admitted from the community with a stroke during 2000–2001. We used the validated intercollegiate stroke audit package, to collect data on patient case-mix factors (Table 1) and on process of care measures (Table 2) based upon nationally agreed standards of best practice [8]. The rationale for the selected case-mix factors and measures of process of care are given elsewhere [7]. The presence of a DNR order was also recorded. The intercollegiate stroke audit package is a well established validated data collection tool with adequate interrater reliability and is widely used in the UK and elsewhere [9–11]. Mortality after discharge from hospital was ascertained using the NHS Tracing Service [12].

Our analysis compares the case-mix profile of patients with and without a DNR order, their process of care and mortality. Differences in proportions between DNR and non-DNR patients were tested using the \( \chi^2 \) test. Differences in mean age were tested using a \( t \)-test. We also undertook a post hoc two-level (patient at level 1 and hospital at level 2) logistic regression analysis using S-PLUS version 6.1 (Insightful Corporation, Seattle, WA, USA) to see how patient case-mix factors and the presence/absence of a DNR order influenced a key process variable—cared for by a stroke team within 7 days of admission.

Results

Mortality

There were 702 stroke patients in our study of whom 238 (34%) had DNR orders during their hospital stay. The DNR status could not be determined for 15 (2%) patients. The 30-day mortality in DNR patients was 67% (160/238) compared with 10% (46/449) in non-DNR patients (\( P < 0.0001 \)). Over three-quarters of all 30-day deaths (160/206, 78%) were accounted for by DNR patients. Six (1%) patients were lost to follow up over a 1-year period. Differences in survival were maintained after 1 year (336/444 76% non-DNR versus 23/237 10% DNR, \( P < 0.0001 \)).

Patient case-mix factors

Patient case-mix factors are summarized in Table 1. DNR patients were less likely to have their type of stroke recorded, but appeared to suffer from a higher proportion of haemorrhagic strokes than non-DNR patients and a lower proportion of ischaemic/infarct strokes than non-DNR patients. DNR patients had worse case-mix and less complete recording of case-mix data in their case notes, with the exception of ability to walk.

Process of care

Process of care indicators are summarized in Table 2. There were no differences in the types of medication that patients were on at admission, and DNR and non-DNR patients underwent similar assessments in their first 24 hours of hospital care, with only one significant difference observed—whether the likely site of the lesion had been described. This reflects the fact that fewer DNR patients had brain imaging performed.

There were differences in the post-24 hours care between DNR and non-DNR patients. DNR patients were less likely to have been given aspirin (excluding patients who had a haemorrhagic stroke), more likely to have their swallowing assessed by a speech and language therapist, and less likely to be cared for by a stroke team within 7 days. With regard to

Table 1 Case-mix profile of stroke patients with and without do not resuscitate (DNR) orders

<table>
<thead>
<tr>
<th>Type of stroke</th>
<th>DNR (N = 238)</th>
<th>Non-DNR (N = 449)</th>
<th>( P ) value(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n ) (%)</td>
<td>Missing data</td>
<td>( n ) (%)</td>
</tr>
<tr>
<td>Ischaemic/infarct</td>
<td>111 (47)</td>
<td>–</td>
<td>325 (72)</td>
</tr>
<tr>
<td>Haemorrhagic</td>
<td>41 (17)</td>
<td>–</td>
<td>46 (10)</td>
</tr>
<tr>
<td>Unknown</td>
<td>86 (36)</td>
<td>–</td>
<td>78 (17)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( &lt;0.0001, 2 ) df)</td>
</tr>
<tr>
<td>Patient case-mix factor</td>
<td></td>
<td></td>
<td>( &lt;0.0001 )</td>
</tr>
<tr>
<td>Mean [median] age years</td>
<td>80 [81]</td>
<td>–</td>
<td>73 [75]</td>
</tr>
<tr>
<td>Pre-stroke independence in activities of daily living (ADL)</td>
<td>128 (54)</td>
<td>66 (28)</td>
<td>342 (76)</td>
</tr>
<tr>
<td>No loss of power in either arm</td>
<td>11 (5)</td>
<td>113 (47)</td>
<td>108 (24)</td>
</tr>
<tr>
<td>Fully conscious(^2)</td>
<td>85 (36)</td>
<td>2 (1)</td>
<td>353 (79)</td>
</tr>
<tr>
<td>Able to walk</td>
<td>3 (1)</td>
<td>74 (31)</td>
<td>95 (21)</td>
</tr>
<tr>
<td>Lived alone pre-stroke</td>
<td>73 (31)</td>
<td>6 (3)</td>
<td>166 (37)</td>
</tr>
<tr>
<td>No comorbidity listed</td>
<td>44 (18)</td>
<td>–</td>
<td>115 (26)</td>
</tr>
</tbody>
</table>

\(^1\) One degree of freedom unless stated, \( P \) values excluding missing data.

\(^2\) At time of maximum severity during hospital stay.
where the care was carried out, DNR patients were moved between wards less during their hospital stay but were less likely to have spent most of their time in hospital in a rehabilitation ward. If the latter analysis is restricted to patients with lengths of stay over 2 weeks, the difference persists (DNR: 41/102 40% versus non-DNR: 198/255 78%,
\[P \leq 0.0001\]), suggesting that the difference is not an artefact of DNR patients’ high early mortality.

**Modelling**

To further explore the relationship between process of care (specifically, care by a stroke team within 7 days), patient case-mix factors and DNR order we undertook a two-level (patient level 1 and hospital level 2) logistic regression analysis based on 543 patients (158 had DNR orders). The dependant binomial variable was ‘cared for by a stroke team within 7 days of admission (yes/no)’, and so only those patients who were alive and in-hospital for seven or more days were included in our model. To reduce bias from missing case-mix data, we based our analysis on the four case-mix factors with near complete data (Table 1)—age, fully conscious, live alone pre-stroke and no comorbidity listed. (This model was associated with a significant reduction in log-likelihood when compared to an empty model: –1194 to –1165, \[P \leq 0.0001\].)

The results of the modelling exercise (Table 3) identified the presence/absence of a DNR order to be statistically the most significant predictor of patients being cared for by a stroke team within 7 days. Patients with a DNR order were about 60% less likely [odds ratio (OR) = 0.39; 95% confidence interval (CI) = 0.26–0.61] to be cared for by a stroke team within 7 days of admission. There was no statistically significant variation between hospitals (level 2: sigma 0.27, 95% CI = 0.10–0.71).

**Discussion**

In our study about a third of stroke in-patients are issued with a DNR order, and these patients account for most of the deaths and are much more likely to die than patients without DNR orders. This is consistent with previous studies [1,4,5,13], and very much what one would anticipate, given that DNR orders are issued for people with poor prognosis, as reflected in their worse case mix. The question of interest is whether case-mix factors explains all the variation in mortality between DNR and non-DNR patients, or whether how the
patients are cared for also contributes to the mortality differential? Hemphill et al. [13] in a large study in the USA (234 hospitals, 8233 patients with intracerebral haemorrhage) found that the presence of a DNR order was independently associated with increased mortality. Again in the USA, Shepardson et al. [3] found that after adjusting for nine case-mix and socioeconomic factors (age, admission from a nursing home, race, coma on admission, lethargy or stupor on admission, presence of cancer, emergency admission, severity of illness score, intracerebral haemorrhage) DNR stroke patients still had a substantially increased risk of deaths, suggesting that there may have been differences in how they were cared for. It is this hypothesis that we have explored in this study.

We did find differences in the processes of care, but many of these were predictable. In some aspects, care for DNR patients was better—they were moved less during their stay (though this may be an artefact of their high early mortality), and they were more likely to be assessed early by a speech and language therapist (presumably a reflection of their worse case mix). Although fewer DNR patients were prescribed aspirin, this probably reflects the lower early use of brain imaging in these patients (though according to the national guidelines in operation at the time of the study, the proportions of DNR and non-DNR patients who received appropriate early scanning were similar). However, in one important respect, the care of DNR and non-DNR patients was different: DNR patients were significantly less likely to be cared for on a stroke unit or by a stroke team.

Therefore, this study does provide some evidence that the high mortality of DNR stroke patients is in part contributed to by where they receive their care. This may reflect case-mix, rather than the DNR order itself, and that hospital caregivers may be rationing a valuable resource (stroke unit) where need outstrips supply. A national audit of stroke care in the UK carried out in 2004 found that only 46% of stroke patients are admitted to a stroke unit at some point during their stay and that two thirds of hospitals use selection criteria for admission to their stroke units [14]. The national guidance is that essentially all stroke patients should be cared for on a stroke unit [8]. Thus, the national picture is that in the UK, optimum care for stroke patients is not being provided because of insufficient size and numbers of stroke units. Our study suggests that access to stroke units is being rationed on the basis of prognosis. This may reflect pragmatic decision-making, but unfortunately, there is no evidence base (or national guidance) to support this policy. There is strong evidence that survival of stroke patients is improved if they receive organized in-patient care, whether on a stroke unit or by a stroke team, and this benefit is independent of stroke severity and prognosis [15]. Indeed, in absolute terms, it could be argued that the greatest benefit for lives saved would be gained by targeting stroke unit care at people with the most severe strokes.

An alternative interpretation of our results is that DNR orders are more likely to be issued for stroke patients who are not in stroke units, as compared to patients in stroke units. A limitation of our study is that we do not know the timing of the DNR order, so we cannot determine whether the DNR order influenced access to stroke team care, or vice versa. Shepardson et al. [3] found that 64% of DNR orders are issued within 2 days of hospitalization. Thus, another consequence of not knowing the timing of the DNR order is that we are likely to have underestimated differences in process of care between DNR and non-DNR patients because of misclassification of some patients’ status in the early course of their illness. Another limitation is that there may be other process of care differences that are important that we did not measure. For example, there are several aspects of acute stroke care such as oxygen treatment, hydration, early nutrition, use of antipyretics which may contribute to the outcome [16]. Finally, we cannot be sure whether case-mix (and hence prognosis) per se influences process of care or whether the DNR order itself contributes to care differences. Our post hoc regression analysis found that DNR order was a much stronger predictor of whether patients were cared for by a stroke team within 7 days than any patient case-mix variable, and this gives some support to the notion that the DNR order itself has contributed to the care difference. Interestingly the patient’s age, despite its strong association with presence of a DNR order [17], was not predictive of receipt of care by a stroke team within 7 days of admission. This suggests that, contrary to previous concerns [17], clinical practice in our study was not driven by age.

Regardless of whether the difference in access to specialist care for stroke in these hospitals is due to case mix or the presence of the DNR order, our results suggest that patients with stroke are being triaged on the basis of prognosis. This may or may not be a sound policy in the face of limited access

### Table 3

<table>
<thead>
<tr>
<th>Fixed effect variable</th>
<th>Odds ratio</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNR order (yes/no)</td>
<td>0.39</td>
<td>0.26 - 0.61</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Lived alone pre-stroke (yes/no)</td>
<td>1.55</td>
<td>1.05 - 2.29</td>
<td>0.029</td>
</tr>
<tr>
<td>Fully conscious (yes/no)</td>
<td>1.88</td>
<td>1.23 - 2.86</td>
<td>0.003</td>
</tr>
<tr>
<td>Age (years)</td>
<td>1.00</td>
<td>0.98 - 1.01</td>
<td>0.61</td>
</tr>
<tr>
<td>No co-morbidity listed? (yes/no)</td>
<td>0.95</td>
<td>0.61 - 1.46</td>
<td>0.80</td>
</tr>
</tbody>
</table>

DNR, do not resuscitate.

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**Stroke patients with and without do not resuscitate orders**
to stroke unit care, but the fact that it occurs perhaps highlights the under-provision of this service in the UK [18]. Nevertheless, there are significant differences in the pattern and provision of stroke care in the UK compared with other countries [18], and it is interesting to speculate on the extent to which such triaging might occur outside the UK.

Acknowledgements

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References


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