Re-interventions, Readmissions and Discharge Destination: Modern Metrics for the Assessment of the Quality of Care

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Abstract
Aim: To determine whether administrative data can be used to determine metrics to inform the quality agenda. To determine the relationship between these metrics and the method of abdominal aortic aneurysm (AAA) repair undertaken.

Methods: The Hospital Episode Statistics (HES) data were taken for a 5-year period (01.04.2003–31.03.2008). Cases of elective AAA repair were identified. Outcomes were determined in terms of mortality, discharge destination, re-intervention rates and emergency readmission rates. The results were interpreted in light of whether AAA repair was open or endovascular and whether patients were octogenarians or younger patients.

Results: There were 18,060 elective AAA repairs with a mean in-hospital mortality rate of 5.9%. Of these 14,141 were open repairs with a mean mortality of 6.5% and 3919 EVAR (22%) with a mean mortality of 3.8%. EVAR patients were less likely to be discharged to ongoing care ($p < 0.001$) but were associated with a higher rate of re-intervention ($p < 0.001$) than open repairs. No differences were seen in one-year readmission rates.

Octogenarians were more likely to undergo EVAR ($p = 0.001$), to be readmitted within 30-days ($p = 0.009$), to require further interventions on their index admission ($p < 0.001$) and less likely to be discharged home ($p < 0.001$) than younger patients.

Conclusion: Administrative data can be used to identify metrics other than mortality and length of stay. These metrics might be used to inform service provision. In particular for AAA repair, differences in these outcomes were identified between open repair and EVAR and between octogenarians and younger patients.

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Introduction

Previous studies have demonstrated wide variations in the outcome of the repair of elective abdominal aortic aneurysms (AAA). In general these studies have employed the in-hospital, or 30-day, mortality rate from surgery as the primary metric of outcome. Mortality has been proposed as a perhaps the best proxy for the quality of care received, but there are well documented problems associated with its use. The hospital length of stay has also been proposed as a valid metric, although a variety of factors, such as wide variations in the availability of social services, may delay discharge and reduce the meaningful information provided on quality from this metric.

So, whilst mortality and length of hospital stay remain the most important and valid measures of the quality of care there is a need to augment these with other measures. In many countries, including the USA and the UK, the agenda has moved towards the production of new metrics for both safety and performance, which inform key stakeholders of the quality of care provided. One aim of these metrics is to drive more sensitive analyses that can track improvements in the quality and efficacy of care.

For example, a consistent and reproducible ability to perform technically successful operations with patients returning to their own home after the operation, without requiring a surgical re-intervention and without being subsequently readmitted to hospital, might be considered markers of a high-quality service. A low quality service might not reliably score highly on one or more of these metrics, for example patients might be discharged alive after an AAA repair, but a high percentage of patients are readmitted within 30-days of the operation with complications.

Many large epidemiological studies reporting on quality use routine data derived from large administrative databases to provide data for their analyses. One advantage in a number of these datasets is that the patient journey from one admission to another can be followed, allowing a number of patient outcomes to be determined through appropriate analyses. This allows the tracking and monitoring of outcomes to be a realistic goal. These outcomes, such as re-interventions, readmission to hospital and discharge destination, might be used to inform the quality agenda.

This study aims to show how the Hospital Episode Statistics (HES) data, the English National Health Service administrative dataset, might be used to identify and quantify outcomes other than mortality and length of stay for a common surgical procedure, AAA repair. It reports on the technical feasibility of these analyses as well as presenting current results for AAA repair in England that will inform service provision and configuration.

Methods

Dataset and extraction

The HES data were taken for a five-year period from 1st April 2003 to 31st March 2008. Patient-level data were extracted for elective AAA repairs in this period using established in-house programmes. The HES are the English National Health Service administrative dataset and contain information on every hospital admission to an NHS hospital. The data are based around two large coding systems: The International Classification of Diseases version 10 (ICD-10) diagnostic codes; and the Office of Population, Census and Surveys version 4 (OPCS-4) procedural codes. In summary the data extracted pertain to a diagnosis of, or repair of, an AAA along with patient-level demographic factors and co-morbidity data.

The AAA data were subdivided based on the mode of admission and procedure performed. The dataset reported here represent elective AAA repairs only. Both open AAA repair and endovascular repair (EVAR) are considered and the results reported. From this dataset, the feasibility and utility of three outcome metrics were established. The metrics of interest were:

1) The discharge destination of patients after the index procedure;
2) Any surgical re-interventions performed after the index procedure, but on the index admission;
3) Any emergency readmission to the same, or any other hospital, within 30-days and one-year after the index admission.

Statistical analyses

All analyses were performed using SAS version 9.1 (SAS Institute Inc., Cary, USA). Analyses were of elective AAA repairs using an overall treatment group and open and EVAR subgroups. Summary data were produced for each group pertaining to patient demographics. Results between groups were tested using chi-squared tests and Cochran-Armitage trend tests. Results were presented as odds ratios with 95% confidence intervals, p-values for trends and percentages. Account was taken for the multiplicity of testing using the Bonferroni correction.

Discharge destination

The discharge destination was selected as a measure of quality as it was felt that it might reflect differences in case selection criteria. High numbers of patients requiring convalescent care in nursing facilities might be associated with lower quality of clinical care where this would include clinical decision-making.

The discharge destination was determined through analysis of individual patient data using the field ‘disdest’. The destinations were subdivided into four groups to describe whether the patient was discharged home, to ongoing care, to any other destination (e.g. psychiatric in-patient care) or if they died in-hospital. The ongoing care group was subdivided into transfer to another hospital, transfer to residential care and to nursing care (both NHS and non-NHS funded). Other than mortality rates, the statistics for these data were based on surviving cases.

Re-interventions on the index admission

The majority operations are single stage on any given admission, especially elective infra-renal AAA repair. The
number of re-interventions (including medical re-interventions) required after an operation might be considered to be a surrogate marker of the overall success of a procedure and therefore of quality of care. Whilst success and quality do not necessarily go hand in hand for all avenues of medicine, it is likely that for AAA repair they are closely related. Furthermore, when surgical re-interventions are considered in particular, they have a significant bearing on the cost effectiveness of EVAR.7

Within each HES admission (spell), each operative procedure is linked to an operation date. For an elective AAA repair the main operation was the first operation to occur in any given admission. Any further interventions (medical and surgical) occurring after the primary procedures in the index admission were identified and the procedures performed were established and reported.

Emergency readmissions

Patients are discharged to home or to care after an operation and the hope is that they will not need further medical or surgical input. Where late surgical complications occur (for example endoleak detected post-discharge) or where patients are admitted soon after discharge with medical complications, this might be related to the quality of care received in the index admission. As such the emergency readmission rate has been identified as a key indicator of the quality of care in both the USA and the UK.8,9

In the HES, each patient is allocated a pseudo-anonymised unique identifier know as the EXTRACTHESID, which can be traced through multiple admissions of in-patient care. This means that the dataset allowed individual follow up (through the pseudo-anonymisation) during the time period after the initial hospital stay. This differs from other administrative datasets in which admissions are treated as unrelated entities and consequently makes the HES a powerful tool for analyses of ongoing care and longer-term outcomes. The index admission was defined as that in which the elective AAA repair took place. Each patient was followed for a period of one-year after the index admission. To prevent creating right-censored data, only index admissions in the first four years of this dataset were considered to allow a full twelve months of follow up data to be examined. Only emergency readmissions are reported in this study, at 30 day post-discharge and at one-year post-discharge. Deaths on admissions subsequent to the index admission are reported. The statistics for this group were calculated after exclusion of those cases that died on the index procedure. To avoid right censorship only index cases occurring any type of AAA repair were present and so re-interventions on the index admission were reported. The procedures performed were determined for both open and EVAR groups.

Results

Between 1st April 2003 and 31st March 2008, there were a total of 143,237 hospital admissions in England with a diagnosis of aortic aneurysm and 26,199 underwent AAA repair. Of these, 18,060 were elective procedures with a mean in-hospital mortality rate of 5.9%. There were 3919 EVAR (22%) with a mean mortality of 3.8% and 14,141 open AAA repairs with a mean mortality of 6.5% (odds ratio 0.57 (95% c.i. 0.48 to 0.68); p < 0.001). Octogenarians (patients eighty years of age or older) were more likely to undergo EVAR than younger patients with EVAR rates of 29% vs. 20% (1.65 (95% c.i. 1.53 to 1.79); p = 0.001). In terms of peri-operative mortality, octogenarians had higher in-hospital death rates for open repair of 10.2% against 5.3% for younger patients (2.03 (95% c.i. 1.76 to 2.35); p < 0.001). This relationship did not hold for EVAR (4.3% vs. 3.5%; N/S).

Discharge destination

In line with the primary aims of this study, it proved possible to identify discharge destination from the HES data. Of the surviving patients who were not discharged home, only 0.7% were included in the fourth discharge group ("other destinations"). Due to the small number and its unlikely subsequent influence on service provision, this group was not considered further.

4.7% of all surviving patients were discharged to some form ongoing care and of these, 3.6% were discharged to ongoing care after EVAR and 5.0% after open repair (OR 0.71 (95% c.i. 0.59 to 0.86); p < 0.001). Octogenarians were less likely to be discharged to home than younger patients (1.92 (95% c.i. 1.65 to 2.23); p < 0.001). Of the patients discharged to ongoing care, 68% were discharged to another NHS hospital, 17.5% to a non-NHS hospital and the remainder to residential or nursing care.

Re-interventions on the index admission

Cases were included where the date of both the index procedure and re-intervention were present and so temporal information could be attributed to the re-intervention. This comprised 86% of all cases and further analyses on re-interventions are based on this percentage of cases. EVAR cases were associated with a higher rate of medical or surgical re-intervention than open repairs (1.37 (95% c.i. 1.23 to 1.52); p = 0.001). Octogenarians undergoing any type of AAA repair were significantly more likely to require re-intervention than younger patients (1.23 (95% c.i. 1.10 to 1.36); p < 0.001).

Readmissions

Patients were followed for a one-year period after the index procedure. To avoid right censorship only index cases in the first four years were analysed. All cause emergency
readmissions were identified. Surviving EVAR cases were no
more likely to be readmitted for any cause than surviving
open repairs (13% vs. 12%; NS).

Octogenarian were more likely to be readmitted at 30-
days (OR 1.49 (95% c.i. 1.36–1.63); \( p < 0.001 \)) and within
the first post-operative year (OR 1.20 (95% c.i. 1.05–1.37);
\( p = 0.009 \)) than younger patients.

**Vascular readmissions with re-intervention**

There were 350 readmissions at one-year after the index
procedure requiring a further vascular procedure with any
mode of admission. The procedures represented were
a mixture of limb and aortic interventions and are shown in
Table 1. Patients undergoing open repair had a readmission
and re-intervention rate of 2.0% compared with EVAR
patients with a rate of 7.1% (OR 0.28 (95% c.i. 0.22–0.35);
\( p < 0.001 \)).

**Discussion**

This study demonstrated that the HES data could be used to
identify the discharge destination, re-interventions and
readmissions following a major surgical intervention. A
secondary finding was that significant variation was noted
in some of these metrics with age and method of repair.

The primary purpose of this article was aimed towards
an investigation of the feasibility of using three alternative
outcome measures that can be obtained from routine data.
The determination and use of these outcome measures has
been shown to be both a realistic goal and informative in
terms of the results obtained. It should be noted that this
study focussed on the process of determining these
outcomes and so all-cause re-intervention and all-cause
readmission were used. It will be possible to identify
specific causes for both in future studies, as demonstrated
in Table 1 but further evidence is needed proving the reli-
ability of these additional data fields. These measures
should at the current time be used only in conjunction with
metrics such as length of stay and mortality.

The authors would stress that this study was not directed
at defending the validity of the HES data. It is accepted
that the HES are an imperfect record of patient admissions,
or readmissions. However, they are the best data source
available at the current time and their use is likely to
become more common rather than less common. There are
levels of miscoding of diagnostic and procedural codes
within the HES. The true extent of this miscoding is not
known at the current time. A major workforce incentive has

<table>
<thead>
<tr>
<th>Table 1</th>
<th>one-year all-cause readmission with vascular surgical/interventional re-interventions. EVAR was associated with significantly higher numbers than open repairs.</th>
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</thead>
<tbody>
<tr>
<td>Open repair</td>
<td>EVAR</td>
</tr>
<tr>
<td>L634 Arteriography of femoral artery</td>
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<tr>
<td>L912 Central line insertion</td>
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<td>L631 SFA PTA</td>
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<tr>
<td>L264 Aortography</td>
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<tr>
<td>L593 fem-pop (vein)</td>
<td>10</td>
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<tr>
<td>L541 iliac PTA</td>
<td>10</td>
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<tr>
<td>L543 Iliac arteriography</td>
<td>8</td>
</tr>
<tr>
<td>L295 carotid endarterectomy</td>
<td>8</td>
</tr>
<tr>
<td>L133 Pulmonary arteriography</td>
<td>8</td>
</tr>
<tr>
<td>L198 Unspecified repair of aortic aneurysm</td>
<td>7</td>
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<tr>
<td>L622 Femoral embolectomy</td>
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<tr>
<td>L653 revision of reconstruction involving femoral artery</td>
<td>7</td>
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<tr>
<td>L592 fem-pop (prosthetic)</td>
<td>6</td>
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<tr>
<td>L913 Attention to Central line</td>
<td>6</td>
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<tr>
<td>L194 Infra-renal AAA repair</td>
<td>6</td>
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<tr>
<td>L268 Percutaneous transluminal procedure on aorta</td>
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<td>L161 Emergency axillo-femoral bypass</td>
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<tr>
<td>L571 fem–fem crossover</td>
<td>5</td>
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<tr>
<td>L742 creation of AV fistula</td>
<td>5</td>
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</table>
been undertaken to improve the quality of coding. Similarly, a large study is ongoing to investigate the quality of the HES with respect to AAA repair. The issues around this topic will be most usefully reported when the results of this study are known. The focus of this current study was a methodological study into the identification of potentially useful outcome metrics.

In May 2009, the UK Department of Health published a list of 232 Indicators for Quality Improvement (IQI) as part of a focus metrics for quality improvement. It is hoped that these will help measure the quality of care clinicians deliver, highlight areas for improvement and track the changes they implement. They span three dimensions of high-quality care: patient safety, effectiveness of care and patient experience. Specifically, emergency readmission (all-cause) was named as a defined quality metric for elective AAA repair along with a number of other procedures (laparoscopic cholecystectomy, stroke, hysterectomy, fractured neck of femur and hip replacement). This is the first wave of development of IQI that has involved clinicians, patients and politicians in their development.

The findings of this work suggested that emergency readmission might indeed be a valid indicator in so much that it highlighted some variations in this metric for AAA repair. However, any isolated indicator must be taken in the context of a larger horizon to ensure that the correct conclusions are drawn from the results. This would equally apply to the discharge destination, or re-intervention rates, or any other metric. How this context is achieved outside a scientific reporting framework requires forethought and considerable caution to ensure that new information does not become misinformation in the public domain, with unintended consequences.

The actual rates of referral to rehabilitation facilities were somewhat lower than those reported in the USA of 10% for EVAR and 23% for open repair. The differences reported between these two studies might be related to either the definition, or availability, of rehabilitation in the USA when compared with the NHS. The authors would suggest that more than a 5% rate of institutionalised care would seem excessive in the English system and individual hospitals with rates much higher than this might be encouraged to be more circumspect in case selection. This constitutes the authors opinion and is not based in fact.

Older patients and those undergoing EVAR had increased rates of re-intervention on the index admission. This might reflect the increased experience of this technique within these centres over a period where EVAR has now become the treatment of choice within the vascular community. At a time when both the quality and cost of treatments are under scrutiny, this finding might play a key role in our understanding of how aneurysm services are most effectively delivered.

There was support for the existing literature that octogenarians had poorer outcomes both globally and for open repair with broadly similar reported values. This article would support a case for EVAR for octogenarians, where morphology allows, as no difference was observed between the mortality rate for younger patients and octogenarians suggesting a survival benefit.

The readmission rate for EVAR cases in this study was 12.8% which was similar to the 11.6% found by Vogel et al. Readmissions at either 30-days or one-year were associated with high mortality rates both in this study and previous work. This finding would suggest that readmission is a useful outcome measure both for the burden on emergency services and because there is the underlying cause of the readmission has a direct impact on survival. Authorities have debated the utility of readmission rate as a valid measure of the quality of care. The techniques used here detected all-cause emergency readmissions to the same or any other hospital, which might provide an advantage over locally maintained databases in the completeness of the readmission data.

In England, a number of articles have suggested that there may be variations regarding the overall quality of care with regard to aneurysm services when compared to other European and Australasian nations. It is recognised that there are key differences in the patient characteristics that might be responsible for England having poorer expected outcomes from elective AAA repair, such as sicker patients with larger aneurysms. This accepted, the vascular community must seek to continuously improve the quality and efficacy of care that is delivered to reduce these unwanted variations.

This would be supported by Lord Darzi’s recent report on health services that suggested a focus on reporting health outcomes and increasing quality. With this in mind, the results of this work should be used to inform future commissioning frameworks that will commission on the basis of demonstrable quality of care and proposes three clinically useful metrics for major surgical interventions.

Conclusions

Administrative data can be used to determine a number of quality metrics aside from mortality. Since both re-interventions and readmissions are related to survival and discharge to care has quality of life implications, then these metrics are useful and informative. These data can be used to inform service provision and to guide the commissioning of services.

Conflict of Interest/Funding

None.

References


