Three-year audit and cost assessment of open abdominal aortic aneurysm repair in a district general hospital

J EL KAFSI, J WAKE, P LINTOTT, A NORTHEAST, A McLAREN

Department of General Surgery, Stoke Mandeville Hospital, Aylesbury, UK

ABSTRACT

INTRODUCTION The aims of this study were to audit the outcome of elective open abdominal aortic aneurysm (AAA) repair in a district general hospital, as well as investigate the true costs for this procedure in relation to the national tariff.

PATIENTS AND METHODS A database is maintained on AAA surgery in the trust. Data were supplemented by drawing information from blood bank and clinical notes. Patients with symptomatic or emergency aneurysms were excluded. Data from January 2005 to December 2007 were obtained on demographics, morbidity, 30-day mortality and blood usage. Costs were obtained from the trust finance department.

RESULTS Between January 2005 and December 2007, 79 elective AAA procedures were undertaken. Median age was 75 years (range, 52–85 years), median aneurysm size was 63 mm (range, 42–105 mm) and median ITU stay was 3 days (range, 1–41 days). Major morbidity rate was 20.3% (16 of 79 patients) and 30-day mortality overall was 5.1% (4 of 79 patients). Average cost per case was £15,012.91 (range, £4,040.03–£82,158.00), when National Tariff is £6,722.00 (£5,649.00 × local Market Forces Factor of 1.19). Loss per case for our trust was £8,290.91 with a total annual loss of £218,299.56.

CONCLUSIONS Morbidity and mortality in this district general hospital compare well with national studies; however, the total cost is far in excess of the national tariff.

KEYWORDS

Abdominal aortic aneurysm – District general hospital – Cost analysis

CORRESPONDENCE TO

Andrew McLaren, Consultant Surgeon, Stoke Mandeville Hospital, Buckinghamshire NHS Trust, Aylesbury HP21 8AL, UK
T: +44 (0)1296 315072; F: +44 (0)1296 315199; E: andrew.mclaren@buckshosp.nhs.uk

Introduction

It is estimated that there are over 5000 deaths per annum directly related to abdominal aortic aneurysms (AAAs).¹ Reported mortality from elective AAA repairs is as low as 5%,^{2,3} although some population studies suggest that the death rate is closer to 10%.^{4,5} The disparities depend partially on patient selection through screening and non-screening centres.^{5–7} Remuneration for admitted patient episodes in UK hospitals now depends on the National Tariff, whereby the procedures are costed and trusts are paid accordingly.^{8,9}

We sought to audit the morbidity and mortality of elective AAA repairs in our trust spanning the period of 2005–2007 and compare these with the national figures. We also investigated the costs of elective repairs and drew a direct comparison with the national tariff available.

Patients and Methods

All NHS patients who underwent an elective AAA repair in Buckinghamshire Hospitals NHS Trust (BHT) between 2005 and 2007 inclusive were studied, whilst those undergoing emergency repairs were excluded. At the time of this study, the trust was not undertaking endovascular aneurysm repair. A prospective database is maintained on AAA surgery in our trust. Data were collected from our existing elective AAA surgery database and supplemented by drawing further information on blood product usage peri-operatively from blood bank, and on demographics, aneurysm size, morbidity and 30-day mortality from clinical notes. Further data on graft type (tube graft [W. L. Gore & Associates, Inc., Medical Products Division, PO Box 2400, Flagstaff, AZ 86003-2400 USA] and bifurcated graft [Mantis Surgical Ltd, Unit B1-B2, Bond Close, Kingsland Business

Park, Hampshire RG24 8PZ, UK)) and pre-operative renal function was extracted from the on-line pathology and radiology trust databases.

Information on prices was obtained from the finance department, theatre managers and blood bank. Costs were calculated per case for theatre use, type of aortic grafts, blood product usage, ITU/HDU and ward stay. A single repair was estimated to occupy a half-day of operating and anaesthetic time, with every subsequent re-look equating to an additional half-day.

Results

A total of 79 patients had an elective open AAA repair in Buckinghamshire between January 2005 and December 2007 (male:female ratio, 8:1); none were screen-detected. The

median age was 75 years (range, 52–85 years), median pre-operative creatinine level was 106 $\mu\text{mol/l}$ (range, 54–235), median aneurysm size was 63 mm (range, 42–105 mm) and median ITU stay was 3 days (range, 1–41 days) as summarised in Figure 1 and Table 2. The major morbidity rate was 20.3% (16 of 79; 13 cardiovascular events, 2 multi-organ failures and 1 nephrectomy) and 30-day mortality overall was 5.1% (4 of 79; (Fig. 2). A cell saver was used in appropriate cases. The four cases of death were from myocardial infarction ($n = 3$) and multi-organ failure ($n = 1$).

Whilst the National Tariff amounted to £6,722.00 (£5,649.00 $\times$ local Market Forces Factor of 1.19),⁸ the mean cost per case was £15,012.91 (range, £4,040.03–£82,158.00). Only 8.9% of cases (6 of 79) cost less than £6,722.00, in contrast to 32% (25 of 79) which approximated at more than double the allocated tariff. Mean loss per case was £8,290.91, with an annualised loss of £218,165.87 (Table 3 and Fig. 3). The Market Forces Factor varies around the UK and is an attempt to adjust for variations in costs which trusts cannot control – the adjustment varies between a multiplier of 1.08 and 1.42 times the baseline National Tariff.

Discussion

The 30-day mortality for BHT is 5.1% and compares well with rates in most other studies of unscreened patients,

Table 1 Costs required for a AAA repair

Item	Cost
Theatre half-day	£750
ITU/HDU stay per day	£1,928
Bifurcated graft	£484
Tube graft	£201
Red blood cells per unit	£134
Ward per day (including staff)	£387

Table 2 Population demographics

	Total/median	Range
<i>n</i>	75	–
M:F	69:6	–
Tube bifurcated	49:26	–
Age (years)	74	52–85
AAA size (mm)	65	42–105
Pre-operative creatinine level ($\mu\text{mol/l}$)	106	54–235
ITU stay (days)	5	1–41

Table 3 Costs for an ideal open AAA repair

Half-day theatre	£750
Two days in ITU	£3,856
Three days on ward	£1,548
Tube graft	£201
No RBC/use cell saver*	£90
Total	£6,445

*Cell saver (Sorin Biomedica UK Ltd, Centurion House, Olympus Bus Park, Quedgeley, Gloucester GL2 4NF, UK).

such as 5.8% in the UK Small Aneurysm Trial and 9% in the Gloucestershire Vascular Group study.^{5,7}

Most series report principally cardiovascular and respiratory complications.¹⁰ All patients seen in pre-operative assessment clinic are warned that the procedure carries a 20% major morbidity rate and a 5% mortality rate. The majority of complications in this study were cardiovascular (nine cardiac events, three haemorrhages) and all 30-day mortalities were aneurysm-related (three myocardial infarctions, one multi-organ failure).

Endovascular repair is a minimally invasive alternative to open aneurysm repair. A recent meta-analysis of over 21,000 cases concluded that EVAR is a safe and effective alternative in high-risk patients as it reduces short-term complications and aneurysm related deaths when compared to open repair.^{10–12}

EVAR is more cost effective in the short term. The costs per patient of the primary procedure and hospitalisation for the EVAR 1 trial were £10,818 and £9,204 for EVAR and open repair, respectively. However, the mean estimated discounted costs per patient over 4 years were £13,257 for the EVAR group and £9,946 for the open repair group.¹² At the time of

this study, we did not offer EVAR in the trust and a small number of high-risk patients were referred to other centres for consideration. EVAR is associated with a significantly reduced ITU and hospital stay, cardiovascular and respiratory morbidities and overall aneurysm-related 30-day mortality.^{10–12} However, as a result of increased re-admission rates for endovascular complications (*e.g.* endoleaks) requiring re-intervention, its medium-to-long term maintenance costs are high although subject to further reimbursement on tariff.^{10,12–15}

The cost analysis demonstrates that expenses for AAA repairs are considerably higher than the National Tariff allows for. As seen in Figure 3, intensive care stay accounts for 67% of costs. Although the summative median stay in intensive care and high dependency is of 3 days, a few cases reach a length of stay of up to 41 days, greatly contributing to the cost rise. Our unit has a combined ITU/HDU, so bed costs are the same for each – this may reduce costs marginally in other centres where HDUs are run on a separate basis. An ideal AAA case (Table 3), based on a half-day of theatre use and one night in intensive care, was modelled for illustrative purposes. With total costs of £6,445, an ideal case can only generate a profit margin of less than 5%. The vast majority of cases can be expected to exceed the tariff.

Subsequently, pre-operative assessment becomes a crucial tool in reducing morbidity and costs by highlighting high-risk cases. Such patients suffer major morbidities requiring considerable intensive care input. We have not considered the costs of pre-operative assessment and investigation. This is something which varies widely across different units and would have made comparisons to the National Tariff difficult as this considers purely the surgical procedure and stay. As part of the audit process, we did identify weaknesses in our assessment protocols, in particular the cardiology work-up and this has now been improved with all patients being formally reviewed by the cardiology team. We hope that this will reduce our cardiovascular-related morbidity and mortality further in subsequent audits.

The extent of underfunding for elective open repairs in BHT is a striking finding. Only 8.9% of repairs complied with the National Tariff rate, whilst a third cost more than double. The considerable annual losses are primarily due to ITU/HDU expenses, notably so in BHT where both services are provided on a single ward and are costed equally. Nevertheless, we suspect losses of similar magnitude are true nation-wide.

Conclusions

Elective open AAA repair is a proven treatment option for aneurysms greater than 55 mm.¹⁶ The procedure carries significant risk of morbidity and mortality. This study

demonstrates that the National Tariff does not take into account the true costs of repair. Costs may be reduced with more targeted pre-operative assessment to identify high-risk (and high-cost) patients. However, even ideal cases will only get minimal income for the NHS Trust. This suggests that the tariff is in urgent need of revision.

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