Assessment of pre-operative delays in the management of elective abdominal aortic aneurysms

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ABSTRACT

INTRODUCTION Successful endovascular aneurysm repair (EVAR) requires detailed pre-operative imaging to allow device planning. This process may delay surgery and some aneurysms may rupture prior to intervention. The aim of this study was to quantify these delays.

PATIENTS AND METHODS Data were collected prospectively on all patients presenting with non-ruptured abdominal aortic aneurysms (AAAs) between January 2003 and October 2005. The delay between referral, the first out-patient visit, CT-scan, follow-up appointment and surgery were quantified in all patients and compared between two groups undergoing open repair and EVAR.

RESULTS A total of 146 patients underwent AAA repair during the study (48 EVAR versus 98 open repair). There was no significant differences in the wait for CT scans between the groups (median 42 days for EVAR versus 47 days for open repairs [$P = 0.48$]) or the median interval between decision to operate and surgery (56 days versus 42 days [$P = 0.075$]). However, the median delay between referral and surgery was significantly longer in those patients undergoing EVAR at 129 days versus 77 days for open repair ($P = 0.02$).

CONCLUSIONS Patients presenting electively with AAAs experienced significant delay from referral to surgery. This delay was significantly greater in those patients undergoing endovascular repair. Inevitably, some patients will rupture whilst waiting and strategies aimed at reducing delay should be pursued.

KEYWORDS

Abdominal aortic aneurysms – Surgery – Endovascular repair – surgical delay

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Elective abdominal aortic aneurysm (AAA) repair is a prophylactic procedure aimed at preventing aneurysm rupture and its associated high mortality. Historically, elective AAA repair was performed by an open technique after ultrasound diagnosis. Endovascular aneurysm repair (EVAR) requires more detailed pre-operative imaging with spiral CT scanning to assess anatomical suitability and to allow accurate endograft sizing. This process and the subsequent endograft procurement may delay aneurysm repair and, thus, some patients may rupture prior to intervention.

This study was initiated after two AAA patients ruptured, one whilst awaiting magnetic resonance (MR) carotid imaging for concomitant symptomatic carotid disease, who died without surgery, and another who was on the surgical waiting list for open surgery and survived emergency repair.

We hypothesised that patients undergoing EVAR waited longer for surgery than those who underwent open surgery. We aimed to quantify the length of time from initial out-

patient assessment to CT scan and surgery in patients undergoing both open and endovascular AAA repair.

Patients and Methods

All patients with non-ruptured aortic aneurysms operated on elective lists in the Cambridge Vascular Unit between 1 January 2003 and 30 October 2005 were included in this study. Data were collected prospectively on all AAA patients and submitted routinely to the National Vascular Database. These data were supplemented by retrospective case note and hospital database analysis to validate waiting times. Three patients were excluded from the study because of incomplete data (2 open, 1 EVAR).

Waiting times

The CT scan waiting time was defined as the day the CT scan was requested until the day it was performed. The

Table 1 Baseline patient and aneurysm demographics presented as medians and IQRs and percentages where appropriate

	EVAR (<i>n</i> = 48)	Open (<i>n</i> = 98)	<i>P</i> -value
Males, <i>n</i> (%)	45 (93.8)	90 (91.8)	NS
Age in years, median (IQR)	74 (68, 79)	75 (70, 80)	NS
Size of AAA in cm at first visit, median (IQR)	5.6 (5.03, 6)	6 (4.8, 7.1)	NS
Size of AAA in cm at time of decision to operate, median (IQR)	6 (5.7, 6.6)	6.5 (5.7, 7.4)	NS
Number of patients with AAA > 5.5 cm at first presentation	36 (75%)	73 (72%)	NS

NS, not statistically significant.

surgical waiting time was defined as the interval from the date on which patient was booked for surgery to the day of surgery. The date of booking for surgery was the date both surgeon (along with interventional radiologist in case of endovascular repair) and patient agreed to proceed with surgery. The postoperative stay was defined as the time from day of surgery to day of discharge from hospital. The total time from first referral to the day of surgery was also noted in both groups for patients who initially presented with AAAs > 5.5 cm.

Radiological imaging

All CT scans were performed on a Siemens Somatom Sensation 64 Multi-detector body CT scanner with computer generated 3-D reconstruction. Anatomical suitability for EVAR was determined in accordance with standard accepted criteria.

Statistical analysis

SPSS v.12.0.1 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Continuous variables were compared using the Mann–Whitney test and categorical variables (sex

and type of first scan) were assessed by Fisher's exact test. The level of statistical significance was set at 0.05.

Results

A total of 146 elective AAA patients were included in the study (135 male; 93%). All had CT scans to assess suitability for EVAR. Two-thirds of this group underwent conventional open repair (98 patients; 67%) and one-third EVAR (48 patients; 33%).

There was no significant difference in age, sex or aneurysm size between the two groups (Table 1). Both groups had similar risk factors (Table 2). However, V-POSSUM scoring showed unsurprisingly significantly higher operative severity scores after open repair (Table 2).

The delays from referral to surgery are detailed in Table 3. In order not to overestimate the time from referral or initial out-patient visit to surgery, this figure was calculated only in patients who initially presented with AAAs > 5.5 cm (see Table 1) not in those presenting with small aneurysms who subsequently underwent surveillance. There was a significantly longer delay from referral to surgery in the EVAR group

Table 2 Patient co-morbidities and V-POSSUM scores in the EVAR and open groups, demonstrating an anticipated higher V-POSSUM operative severity scores after open repair

	EVAR (<i>n</i> = 48)	Open (<i>n</i> = 98)	<i>P</i> -value
IHD, <i>n</i> (%)	18 (37.5)	49 (50.0)	NS
HTN, <i>n</i> (%)	29 (60.41)	43 (43.87)	NS
MI, <i>n</i> (%)	11 (22.91)	32 (32.65)	NS
Angina <i>n</i> (%)	11 (22.91)	25 (25.55)	NS
Smoking <i>n</i> (%)	43 (89.5)	82 (83.6)	NS
Physiology score, median (IQR)	18 (17, 18)	18 (17, 18)	NS
Operative severity score, median (range)	10 (10, 11)	12 (9, 16)	< 0.0001

NS, not statistically significant.

Table 3 Waiting time in days for endovascular and open repair groups demonstrating significantly greater delay from referral to surgery in the EVAR group

	EVAR	Open	P-value
Referral to first consultation, median (IQR) days	20 (9, 40)	12 (6, 57)	NS
Referral to surgery in patients presenting with AAA > 5.5 cm median (IQR) days	129 (77, 160)	77 (41, 169)	0.015
Decision made and surgery, median (IQR) days	56 (32, 82)	42 (24, 66)	NS
CT-scan requested and CT-scan performed, median (IQR) days	42 (28, 68)	47 (22, 72)	NS
Surgery and discharge, median (IQR) days	4 (4, 6)	9 (7, 14)	< 0.0001

NS, not statistically significant.

(median delay of 129 days [IQR 77–161 days] compared to open repair median 77 days [IQR 41–170 days]; $P = 0.015$).

The delay from a CT request to the investigation being performed was similar in both groups (median 47 days open and 42 days EVAR), as were the delays from decision to operate and surgery (median 41 days and 56 days, respectively).

There was an anticipated significantly shorter postoperative stay after EVAR (median 4 days versus open repair median 9 days; $P < 0.0001$).

Discussion

This study has demonstrated that delays in the treatment of AAAs are multifactorial. There were delays at all steps of the process from diagnosis to surgery. Patients who presented with AAA > 5.5 cm and subsequently underwent EVAR waited significantly longer from referral to surgery than those undergoing open repair. The delays in both groups were much longer than we had anticipated. In the UK, the NHS is currently undergoing radical changes. It has been proposed that no patient should wait more than 18 weeks from referral to treatment from 2008.¹ Nearly half the patients in this study with a life-threatening condition waited longer than 18 weeks from referral to surgery, suggesting that this may be a difficult target to achieve.

Historically, cross-sectional imaging was not routinely performed on patients prior to planned open AAA repair; however, since the advent of EVAR, it has become mandatory to determine anatomical suitability and all AAA patients undergo CT in our unit whatever form of repair is subsequently undertaken. Therefore, both groups had similar waits for spiral CT of between 6–7 weeks. These delays are avoidable and, as a result of these findings, a new dedicated vascular CT list has been organised to reduce this wait.

One of the criticisms of the EVAR 2 study was the high rate of rupture prior to intervention in patients randomised to EVAR.² In total, 9 aneurysms ruptured causing nearly half of aneurysm-related deaths in this group.³ The median time

from randomisation to surgery was 57 days in EVAR 2. Interestingly, we found a very similar delay from decision to operate to EVAR in this study, a median 56 days. The EVAR 2 study, however, was for high-risk patients, whereas we have studied all aneurysm patients. It might have been that optimising concomitant medical conditions contributed to delays in the EVAR 2 study. However, the similar delays in these two studies suggest an accurate contemporary reflection of the current UK practice. Furthermore, the recent publication of the NCEPOD report identified that 21% of patients scheduled for elective AAA repair spent more than 12 weeks on the waiting list.⁴ More worryingly, this study identified 18 patients admitted as emergencies had been on a waiting list for elective repair. The authors commented that abdominal aortic aneurysm is a life-threatening condition; once a decision to operate has been made, this should be carried out as expeditiously as possible. This study also identified considerable delays caused by the lack of high dependency and intensive care facilities, with one in six patients having their operation postponed. Fortunately, we have resolved this problem by the provision of bookable overnight recovery beds.⁵

A number of factors lead to delay after the decision to perform EVAR has been made. These include device planning and sizing, ordering and delivery of the appropriate device, and the length of the surgical waiting list. EVAR in our centre is performed by a team of vascular surgeons and interventional radiologists, and the logistics of having both specialists available occasionally causes delay. The main finding of this study was that the EVAR patients waited longer from referral to surgery; however, the delays to CT and to surgery once a decision to operate had been made were similar between the two groups. The extra delays in this study in the EVAR group may due to delays in multidisciplinary meeting (MDT) decisions on the suitability for EVAR; however, these delays were not recorded separately. Suitability for EVAR is discussed at the MDT meeting; however, the final decision on fitness and suitability for either

EVAR or open repair is made by the surgeon at the follow-up clinic visit in most cases. In order to reduce some of these delays, documentary records of all decisions made on AAA patients at the vascular MDT meeting are now kept and we also keep records of the dates of endograft orders. These time points not recorded during this study will help further identify and delineate delays in a planned re-audit. Furthermore, we have recently acquired a consignment stock of endografts which has enabled not only expedient elective EVAR but also the endovascular management of ruptured AAAs.

Although we did not have any problem with approval of EVAR funding from patients' primary care trusts, this can be a problem in different parts of the UK leading to possible delays in patient management.

In some circumstances, a period of delay may benefit the patient, particularly if the time is used to investigate and optimise associated medical conditions. Many vascular patients have other co-morbidities, which require assessment and treatment. However, a longer wait increases the chance of rupture. Emergency surgical repair of a ruptured aortic aneurysm carries 50% mortality in those patients who reach hospital alive⁶ and has an overall mortality of 90%.⁷ There is also clear evidence that suggests the risk of rupture increases with aneurysm size; therefore, expeditious investigation and management of AAAs over 6.5 cm in size is warranted.⁸

In order to reduce pre-operative delays, prospective studies such as this are required to quantify and identify the causes of delay. Sobolev *et al.*⁹ have demonstrated that retrospective waiting time studies have an inherent bias. They argue that mean and median waiting times are underestimated with retrospective analysis because this method does not include patients who are on the waiting list but do not receive surgery. However, De Coster and colleagues^{10,11} have successfully shown that retrospective analysis of waiting times for surgical patients are as valid as the prospective analysis.

Conclusions

This study has identified significant delays in the elective management of patients with AAAs. The delay from referral to surgery was significantly greater for patients undergoing

EVAR. In response to these findings, further dedicated vascular CT sessions have been organised and consignment endovascular grafts acquired. Every effort should be made to reduce these delays and prevent rupture. AAA is a life-threatening condition and, once a decision to operate has been made, surgery should be carried out as soon as possible.

Acknowledgements

We would like to thank Dr Claire Cousins, Dr Derek Appleton and Dr TC See consultant radiologists; Mr. Neil Osborne for helping with the theatre database and Ms Isla Kuhn for helping with library information services.

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