1. Method

Introduction

Recent studies in the detection[1] and management[2] of Abdominal Aortic Aneurysms (AAA) have focused on screening programmes and clinical interventions to reduce mortality in this group of patients. Further studies have addressed the cost and outcome implications of providing care for patients with AAAs[3] and the organisation of vascular services[4].

This report describes the process of care of elective (surgical and endovascular repair) and emergency patients in relation to outcome and also describes the process of care of emergency patients when a decision was made not to operate.

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Sample size & data collection

1,129 operated cases and 106 non-operated cases were expected during the study period. These figures were based on a percentage of the data from Hospital Episode Statistics (HES) in England, Wales and Northern Ireland for the year 2002/03. An estimate was made for cases from the independent sector.

Retrospective data collection took place for two months from 1st February until 31st March 2004.

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Hospital participation

All relevant National Health Service hospitals in England, Wales and Northern Ireland were expected to participate, as well as relevant hospitals in the independent sector, public hospitals in the Isle of Man and Guernsey and the Defence Secondary Care Agency.

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Population

Data were collected from two groups of patients:

- Adults (≥16 years of age) that underwent surgery for the first time repair of an AAA; both elective and emergency procedures were included, as well as endovascular repair.
- Adults who were diagnosed with an AAA but did not undergo surgery and subsequently died in hospital during the same hospital episode.

Patients undergoing a repeat repair of an AAA or surgery that was for complications arising from the initial repair of the AAA were excluded.

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Identification of sample cases

Sample cases were identified by NCEPOD local reporters. This was done either at the end of each month or at the end of the two month period. Cases were identified as samples if they were coded with one of the Office of Population Census and Surveys' (OPCS) procedure codes or International Classification of Diseases' (ICD) diagnosis codes which are listed in Table 1.

Table 1. OPCS and ICD codes used to identify sample cases

OPCS Procedure codes (4th Revision)	
L18.3	Emergency replacement of aneurysmal segment of suprarenal abdominal aorta by anastomosis of aorta to aorta
L18.4	Emergency replacement of aneurysmal segment of infrarenal abdominal aorta by anastomosis of aorta to aorta
L18.5	Emergency replacement of aneurysmal segment of abdominal aorta by anastomosis of aorta to aorta nec
L18.6	Emergency replacement of aneurysmal bifurcation of aorta by anastomosis of aorta to iliac artery
L18.8	Emergency replacement of aneurysmal segment of aorta - other specified
L18.9	Emergency replacement of aneurysmal segment of aorta - other unspecified
L19.3	Replacement of aneurysmal segment of suprarenal abdominal aorta by anastomosis of aorta to aorta nec
L19.4	Replacement of aneurysmal segment of infrarenal abdominal aorta by anastomosis of aorta to aorta nec
L19.5	Replacement of aneurysmal segment of abdominal aorta by anastomosis of aorta to aorta nec
L19.6	Replacement of aneurysmal bifurcation of aorta by anastomosis of aorta to iliac artery nec
L19.8	Replacement of aneurysmal segment of aorta - other specified
L19.9	Replacement of aneurysmal segment of aorta - other unspecified
ICD Diagnosis codes (10th Revision)	
I71.0	Dissecting aneurysm of aorta (ruptured) [any part]
I71.3	Abdominal aortic aneurysm, ruptured
I71.4	Abdominal aortic aneurysm, without mention of rupture
I71.8	Aortic aneurysm of unspecified site, ruptured (Rupture of aorta NOS)
I71.9	Aortic aneurysm of unspecified site, without mention of rupture: aneurysm, hyaline necrosis, dilatation of aorta

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Questionnaires

For each patient a maximum of three clinical questionnaires were to be completed. The questionnaires were either sent to the NCEPOD local reporter to disseminate or directly to the clinician involved, depending upon the choice of the hospital.

A questionnaire was completed by the surgeon that performed the aneurysm repair or made the decision not to operate if the patient did not undergo surgery. In cases where surgery was not performed and the patient died before being seen by a surgeon, the admitting consultant was asked to complete the questionnaire. This questionnaire covered aspects such as comorbidities, preoperative assessment and details of the operation.

A separate questionnaire was also completed by the senior anaesthetist involved in the repair or decision not to operate and covered details about preoperative investigations and the anaesthetic.

If endovascular repair of the aneurysm was performed, a supplementary questionnaire was sent to the radiologist involved in the case.

Hospitals were also asked to complete an organisational questionnaire relating to the facilities at the hospital.

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Quality and confidentiality

A number of predetermined key fields on each questionnaire had been set to ensure that data analysis could be performed effectively. If these key fields were not completed on receipt of the questionnaire by NCEPOD, the NCEPOD local reporter or clinician was contacted to see if the data could be obtained.

Once the questionnaire was as complete as possible, the identifying casenote number on each questionnaire was entered into an encryption programme that generated a new unique number for each patient that was not linked to a hospital. The original casenote number was then removed from the questionnaire, along with any identifiable information relevant to the patient or clinician.

The data from all questionnaires received were electronically scanned into a preset database. Prior to any analysis taking place, the data were cleaned to ensure that there were no duplicate records and that erroneous data had not been entered during scanning. Any fields that contained spurious data that could not be validated were removed.

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Data analysis

All data were analysed using Microsoft Access and Excel by the staff at NCEPOD. The data were aggregated before review by the NCEPOD clinical co-ordinators and advisors.

During the course of the study, large amounts of data were collected about many different aspects of the management of AAA. Analysis of these data has focused on providing descriptive statistical analyses. No attempt has been made to carry out formal statistical hypothesis testing and hence no p-values are presented. This is because the study was not designed with *a priori* hypotheses in mind. Also if significance testing were to be carried out for every analysis provided, then correcting for multiple comparison on such a large scale would render all results insignificant. On the other hand, retrospectively to choose a small number of analyses to subject to hypothesis testing would not be scientifically valid.

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Risk-stratified models of clinical outcome

Prytherch et al[5] have shown that it is possible to develop models that accurately predict the risk of adverse outcome (mortality in this case) following admission for general surgery, using data that is routinely collected in hospitals. Models have been developed for both patients undergoing operation and those not undergoing operation. Data items required were: urea, sodium, potassium, haemoglobin, white cell count, age on admission, sex, mode of admission and classification of operation. Subsequent work shows that inclusion of albumin and creatinine levels may improve the models. These models were applied to the totality of general surgical admissions – no attempt was made to model separate sub-specialties. However, this model has been successfully applied to the analysis of the VSGBI National Vascular Database[6] using the same limited data items which has generated the Vascular Biochemical and Haematological Outcome Modelling (V-BHOM) model [7].

It had been originally hoped to carry out case-mix correction using V-BHOM, to examine if for example, there was a systematic difference in the risk profiles of patients treated at large centres compared to others. Unfortunately, it was found that there was an imbalance in the availability of the data that such risk adjustment depends on. Risk data concerning emergency admissions were more frequently missing than for elective cases. In view of this, risk adjustment using only the risk data that are available might well give a very distorted representation of actuality and so risk adjustment has been omitted.

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Advisor group

A multidisciplinary group of advisors reviewed the aggregated data. The group comprised of vascular surgeons, general surgeons who took part in on-call rotas, anaesthetists, intensivists, cardiologists, vascular radiologists, a theatre manager and two lay representatives. The aim of this group was to discuss and comment on the findings and to suggest any further analysis that should be performed.

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References

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