

5. Anaesthesia

Introduction

This section examines the data collected from the anaesthetist responsible for the patient and recorded on the anaesthetic questionnaire. There are no data from patients in whom a decision was made not to operate and who received palliative care because no anaesthetic questionnaires were received relating to those patients.

5. Anaesthesia

Preoperative drug therapy >> Beta blockade

Beta blocking drugs were not widely prescribed before elective operation.

The anaesthetists caring for the patients in this study were asked whether the patient had received beta blockers before admission. There has been controversy about the possibility that the administration of beta blockers to patients with a history of cardiac disease undergoing major surgery could reduce the incidence of adverse outcomes. Some papers show a benefit whilst others fail to find any effect. Some authorities¹ have suggested that whenever possible beta blockers should be started days or weeks before surgery in high risk patients. This recommendation is likely to cover most patients undergoing aortic surgery.

Table 1 gives the number of elective patients receiving beta blockers for patients undergoing open procedures.

Table 1. Elective patients receiving beta blockers prior to admission (all open operation patients)		
Beta blockers	Total	%
Yes	130	35
No	245	65
Sub-total	375	
Unknown	1	
Not answered	58	
Total	434	

Table 2 shows the number of patients admitted as an emergency who were receiving beta blockers prior to admission. Emergency patients are likely to have been receiving beta blockers as part of their regular medication rather than because beta blockers had been prescribed as part of preoperative optimisation.

Table 2. Emergency patients receiving beta blockers prior to admission		
Beta blockers	Total	%
Yes	52	26
No	147	74
Sub-total	199	
Unknown	21	
Not answered	44	
Total	264	

35% (130/375) of elective patients were receiving beta blockers before admission, compared to 26% (52/199) of emergency admissions.

These data suggest that UK anaesthetists were choosing not to implement the recommendations on the use of preoperative beta blockade cited above at the time of this study. This is consistent with other recent studies showing that only a minority of vascular patients are prescribed beta blocking drugs preoperatively.

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Preoperative drug therapy >> Statins

53% of elective admission patients were taking statins at the time of operation.

One could expect that the use of statins would have been widespread in this population, because patients with aortic aneurysms are regarded as being at risk of coronary heart disease and statins are indicated for any patient with a suspicion of coronary heart disease. There is also evidence that the outcome of surgery in patients at high risk of cardiac complications is improved by the administration of statins^{2,3,4}. The questionnaire asked whether the patient was taking statins at the time of the operation (Table 3).

Table 3. Elective patients taking statins at the time of operation		
Statins	Total	%
Yes	198	53
No	174	47
Sub-total	372	
Unknown	4	
Not answered	58	
Total	434	

Table 4 shows the number of patients admitted as an emergency who were taking statins at the time of operation.

Table 4. Emergency patients taking statins at the time of operation		
Statins	Total	%
Yes	61	31
No	135	69
Sub-total	196	
Unknown	23	
Not answered	45	
Total	264	

53% (198/372) of patients admitted electively were receiving statins, compared with 31% (61/196) admitted as an emergency.

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Preoperative drug therapy >> Effect of beta blockers and statins on outcome

This was an observational study. Differences in outcome between those patients who were and were not taking beta blockers before admission could be because of an effect of beta blockade or because patients with a greater risk of cardiac complications were more likely to be prescribed beta blockers. It had been hoped to apply case-mix corrections to the data but as described in the Methods chapter, this was not possible. Therefore it is unsafe to present any conclusions about outcomes in relation to the use of beta blockade. Similarly, no conclusions on the effect of statins on outcome are presented.

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Preoperative investigations

The process of preoperative assessment is considered in the surgical section. This section considers the content of the preoperative assessment process.

Echocardiography was the most common cardiac investigation. Other cardiac investigations were not widely used.

All patients would have had a clinical examination and a 12 lead ECG. Anaesthetists were asked to indicate whether elective patients had received more sophisticated cardiac investigations. Emergency admission patients were excluded because it would have been unlikely that there would have been time to organise these sorts of investigations. For this analysis the figures do include patients who went on to have endovascular repair.

The standard basic clinical history and examination together with a standard 12 lead ECG will allow patients to be allocated into one of three risk groups; low, intermediate or high. According to published guidelines¹ extra cardiac investigations are only indicated for the intermediate group, in order to identify whether patients in this group need further medication or intervention before operation.

Patients may have had more than one preoperative investigation. The results for large and for intermediate sized vascular units are shown in Figures 1 and 2. Only three cardiac investigations were reported from remote units, all being transthoracic echocardiography. In 14% (67/477) of questionnaires no data was available as to whether any investigations had been performed or not.

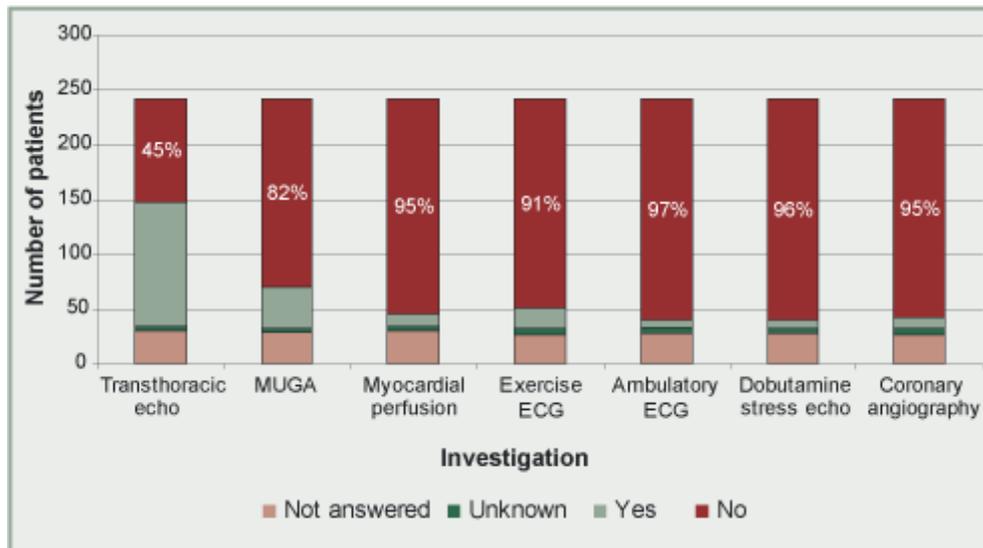


Figure 1. Investigations in large vascular units (elective open and endovascular procedure patients) $n=242$. Percentages refer to investigations that were not performed.

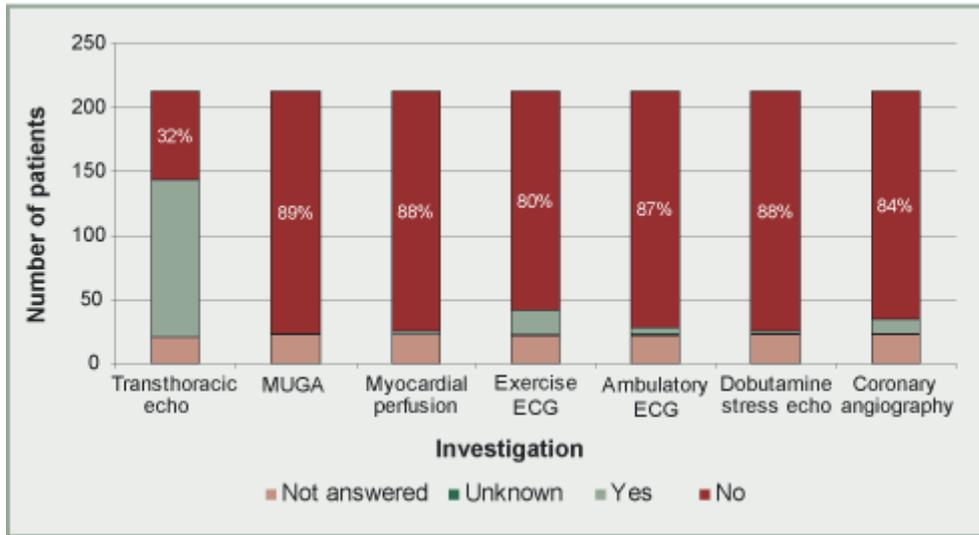


Figure 2. Investigations in intermediate vascular units (elective open and endovascular procedure patients) $n=213$. Percentages refer to investigations that were not performed.

Transthoracic echocardiography was the most common investigation being used in 60% (244/410) of cases overall. The NCEPOD advisors suggested that it is relatively easy to obtain a transthoracic echocardiography investigation for a vascular patient compared to the other investigations listed. The advisors were of the opinion that the test was helpful as an estimate of ventricular function and as a means of excluding unsuspected valvular disease, although there is little published evidence that the use of echocardiography affects outcome. It was thought that echocardiography was indicated in most aneurysm patients when it was not possible to judge ventricular function by simple clinical tests (e.g. the ability to climb two flights of stairs).

Other investigations were utilised to a small extent in the large units, but hardly at all in intermediate units. This may indicate greater difficulty in accessing sophisticated investigations at intermediate sized units. NCEPOD did not have enough information to calculate the cardiac risk for each individual patient so it was not possible to make an overall judgement as to whether the investigations were appropriate or not.

The anaesthetist was asked, if an investigation had been performed, whether or not they judged that the results of the investigations had affected the management of the patient. Table 5 details the numbers of tests, for all sizes of unit, which were regarded as affecting management.

Table 5. Investigations and effects on management of elective cases $n=477$														
	Transthoracic echo	%	MUGA	%	Myocardial perfusion	%	Ex. ECG	%	Amb. ECG	%	Dob. stress echo	%	Coronary angiography	%
Yes	70	31	19	53	6	43	12	36	1	11	2	25	10	59
No	153		17		8		21		8		6		7	
Sub-total	223		36		14		33		9		8		17	
Unknown	1		1		0		2		0		0		0	
Not answered	20		2		0		3		2		2		4	
Total	244		39		14		38		11		10		21	

NCEPOD cannot tell how great the changes in management may have been. There was quite a variation in the utility of the different investigations. Overall these figures would suggest that investigations are not being misused, but individual units should ensure that they have protocols agreed with cardiology colleagues concerning the indications for ordering these investigations. A mechanism for audit of the usefulness of the results, in order to ensure the most effective use of resources, should be implemented.

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Preoperative investigations >> Assessment by a cardiologist

22% of elective admission patients were seen preoperatively by a cardiologist.

Anaesthetists were asked whether the patient had been assessed preoperatively by a cardiologist.

Table 6 shows the results for elective patients. The data provide a useful benchmark, that approximately one patient in five was referred to a cardiologist.

Table 6. Preoperative assessment by cardiologist, elective open and endovascular procedure patients									
Assessed by cardiologist	Large	%	Intermediate	%	Remote	%	Not answered	Total	%
Yes	46	23	37	20	1	33	4	88	22
No	157	77	149	80	2	67	4	312	78
Sub-total	203		186		3		8	400	
Unknown	5		5		0		0	10	
Not answered	34		22		1		10	67	
Total	242		213		4		18	477	

It is not possible to state an appropriate level of referral for a cardiology opinion. Referral to a cardiologist can assist in advising on further sophisticated cardiac investigations. Referral can also be very helpful in optimising the condition of patient with severe coronary artery disease or impairment of myocardial function. However, some patients may already be under review by the cardiology service so further referral is not necessary. For many others their cardiac status may be such that an anaesthetist who regularly anaesthetises patients for major vascular surgery is entirely competent to supervise their preoperative cardiac preparation. Referral to a cardiologist may introduce a delay before the patient is admitted for operation.

Coronary artery angioplasty and bypass before elective surgery

21 elective patients had coronary angiography. Three of the patients had coronary angioplasty and nine had coronary artery bypass grafting before surgery. This low rate of intervention mirrors evidence that the decision to offer patients bypass grafting or angioplasty should be based on their cardiac status alone and should not be influenced by the prospect of vascular surgery ⁵.

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The anaesthetist >> Elective open operations

A consultant anaesthetist was involved in 97% of cases.

Table 7. Grade of the most senior anaesthetist present at the start of anaesthesia		
Grade of anaesthetist	Total	%
Consultant	351	93
Associate specialist	4	1
SpR year 3+	20	5
SpR year 1/2	2	<1
Other	1	<1
Sub-total	378	
Not answered	56	
Total	434	

Of the 27 non-consultant responses, a more senior anaesthetist took over responsibility during the operation in 14 cases. From the data available, a consultant anaesthetist started the operation in 93% (Table 7) of cases and had a part in 97%.

This probably represents excellent practice. However, the question was not completed in 13% (56/434) of cases. If a consultant had been present at the start of operation in all the cases with missing data, 94% of operations would have been started by a consultant anaesthetist: if a consultant had been present for none of the cases with missing data, 81% would have been started by a consultant.

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The anaesthetist >> Emergency open operations

A consultant anaesthetist was involved in 97% of emergency cases.

Table 8. Grade of the most senior anaesthetist present at the start of anaesthesia		
Grade of anaesthetist	Total	%
Consultant	185	85
Associate specialist	2	<1
Staff grade	3	1
SpR year 3+	25	11
SpR year 1/2	3	1
Sub-total	218	
Unknown	2	
Not answered	44	
Total	264	

A consultant anaesthetist was present at the start of the anaesthetic in 85% of cases. In 27 cases a more senior anaesthetist (always a consultant) took over responsibility during the operation, so that from the data available, overall a consultant was involved in 97% of cases.

Again this probably represents good practice but the question was not completed in 17% of cases. If a consultant had been present at the start of operation in all the cases with missing data, 88% of operations would have been started by a consultant anaesthetist: if a consultant had been present for none of the cases with missing data, 70% would have been started by a consultant.

5. Anaesthesia

The anaesthetist >> Membership of the VASGBI

VASGBI Membership

The anaesthetist was a member of the Vascular Anaesthesia Society of Great Britain and Ireland in 52% of elective admission cases and 26% of emergency admission cases.

Table 9 gives the number of anaesthetics for open operations when the most senior anaesthetist present was a member of the VASGBI.

Table 9. Proportion of anaesthetics given by whether anaesthetist was a member of VASGBI							
Member of VASGBI	Elective operation	%	Emergency operation	%	Not answered	Total	%
Yes	187	52	54	26	19	260	42
No	170	48	153	74	32	355	58
Sub-total	357		207		51	615	
Unknown	20		12		1	33	
Not answered	57		45		2	104	
Total	434		264		54	752	

The objectives of the VASGBI are: "To promote the highest standard of management and care for patients suffering from cardiovascular disorders, and in particular those undergoing vascular surgery, and to further the development of the art and science of vascular anaesthesia"⁶. The Society runs educational meetings, awards travelling fellowships and research grants, and collects audit data on vascular anaesthesia. The advisors discussed whether membership of the VASGBI could be viewed as a surrogate for the competence of the anaesthetist at vascular surgery. It is important to recognise that the Society is open both to those who are actively involved in vascular anaesthesia on a regular basis and to those who wish to remain up to date but only have an occasional exposure to vascular cases. Membership is entirely optional, and highly competent vascular anaesthetists may not wish to join, for a variety of reasons.

The anaesthetist was more likely to be a member of the VASGBI for elective operations, when the anaesthetist would probably cover the list regularly, than for emergency operations when the anaesthetist would be drawn from the whole of the on-call rota.

Outcome

There was no difference in the outcome of elective surgery associated with whether the anaesthetist was a member of the VASGBI or not. (Table 10).

Table 10. Anaesthetist's membership of the VASGBI by outcome of elective open repairs					
Member of VASGBI	Died within 30 days	% died within 30 days	Alive at 30 days	Not answered	Total
Yes	12	6	174	1	187
No	12	7	158	0	170
Sub-total	24		332	1	357
Unknown	1		19	0	20
Not answered	2		54	1	57
Total	27		405	2	434

There was no difference in the outcome of emergency open operations for unruptured aneurysms (Table 11). However, there was a difference in the outcome of emergency open operations for ruptured aneurysms (Table 12).

Table 11. Anaesthetist's membership of the VASGBI by outcome of emergency open repairs for unruptured aneurysms				
Member of VASGBI	Died within 30 days	% died within 30 days	Alive at 30 days	Total
Yes	5	16	26	31
No	6	14	37	43
Sub-total	11		63	74
Unknown	0		1	1
Not answered	7		4	11
Total	18		68	86

Table 12. Anaesthetist's membership of the VASGBI by outcome of emergency open repairs for ruptured aneurysms				
Member of VASGBI	Died within 30 days	% died within 30 days	Alive at 30 days	Total
Yes	6	26	17	23
No	47	46	55	102
Sub-total	53		72	125
Unknown	5		6	11
Not answered	14		18	32
Total	72		96	168

There was a better outcome for open repair of ruptured aortic aneurysm associated with the presence of an anaesthetist who was a member of the VASGBI. The numbers are very small and data were missing in 26% of cases, so this finding should be treated with caution. Is this finding genuine? If so, is membership of the VASGBI by the anaesthetist only a marker of other differences in service provision?

5. Anaesthesia

The anaesthetist >> Volume of cases done by anaesthetists

Volume of cases done by anaesthetists

In 49% of cases the anaesthetist could not calculate the number of the anaesthetics they had given for aortic surgery from a logbook or information system.

One in five (22%) elective patients were cared for by anaesthetists who performed five or fewer elective aneurysm repairs in 2002/03.

Three out of five (61%) emergency patients were cared for by anaesthetists who performed five or fewer emergency aneurysm repairs in 2002/03.

The most senior anaesthetist present was asked to supply the number of anaesthetics for elective AAA repairs administered in 2002/03 and the source of that information. Figure 3 gives the number where the answer was taken from a logbook or other information system, and the number where the answer depended on memory.

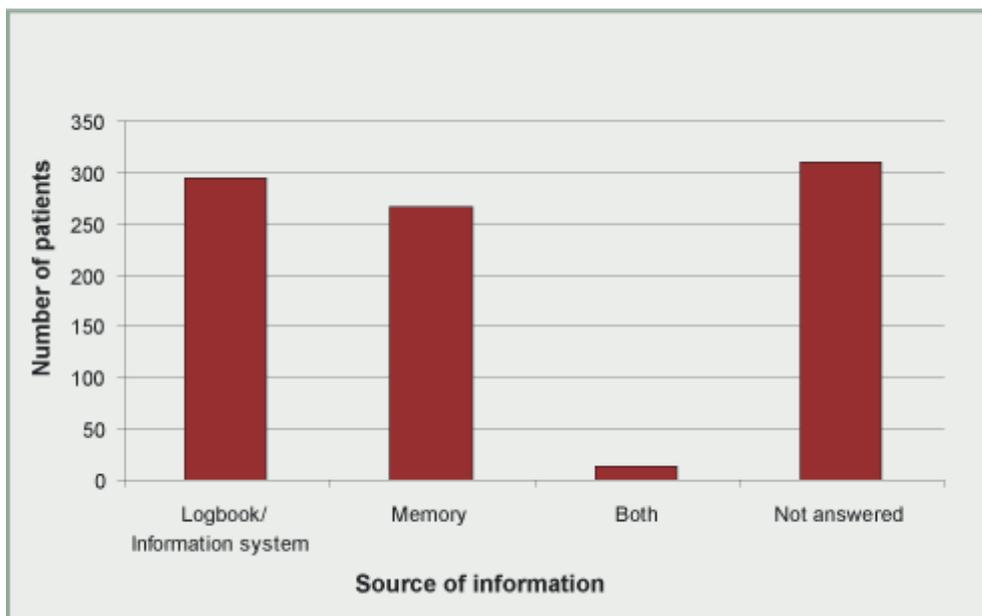


Figure 3. Source of information about the most senior anaesthetist involved in the operation $n=805$

Of the 575 answers to this question, 295 (51%) reported using a logbook or information system alone rather than using their memory completely or in part. The question was unanswered in 309 cases.

Anaesthetists who were involved in more than one case in this study may have answered this question more than once, but it is surprising that in only a half of the cases anaesthetists could provide accurate data on their work. Logbook information is important for appraisal and for demonstrating competence in this and other specialised branches of anaesthesia.

Elective operations

The most senior anaesthetist present at elective open operations was asked to supply the number

of anaesthetics for elective AAA repairs they administered from April 2002 to March 2003. In 88 cases anaesthetists reported that the number of anaesthetics given for elective aneurysm repair in 2002/03 was 'Unknown'. 58 questionnaires failed to supply any answer.

288 questionnaires supplied a figure for the number of elective AAA repairs carried out in 2002/03 by the anaesthetist caring for that patient. Figure 4 gives the range of responses. Some anaesthetists may have been involved in more than one case.

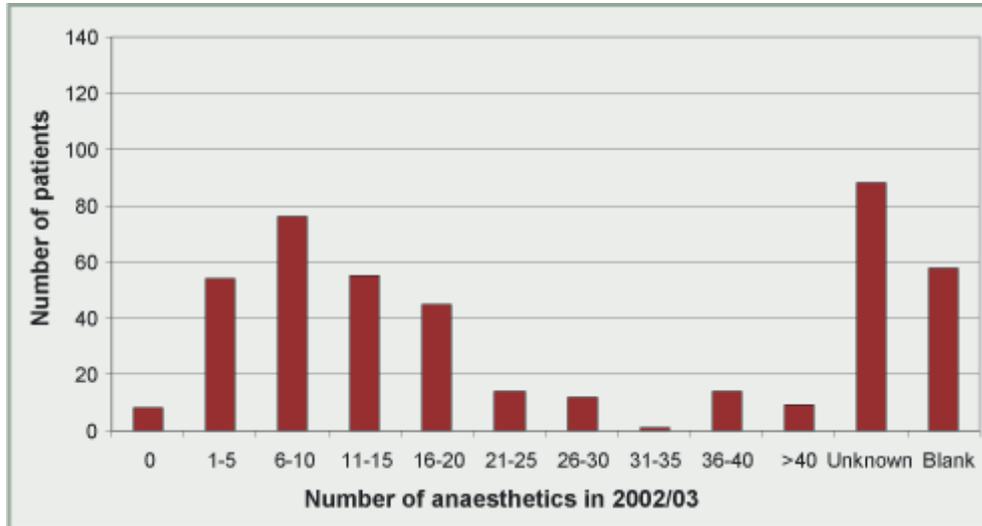


Figure 4. Number of anaesthetics for elective open AAA repair performed by most senior anaesthetist in 2002/03 $n=434$

48% (138/288) of the patients in this study anaesthetised for elective open AAA repair were cared for by anaesthetists who reported doing 10 or fewer elective aneurysm repairs in the year 2002/03, or less than one a month. 22% (62/288) of patients were cared for by anaesthetists who performed five or fewer a year. Is this level of experience of anaesthesia for aortic surgery acceptable?

It has been suggested that anaesthetists who undertake more vascular anaesthetics may be associated with patients who have a better outcome. NCEPOD has examined whether the data available to NCEPOD can be of use in examining this suggestion. The cases were allocated into two groups according to whether the most senior anaesthetist present reported doing more anaesthetics in 2002/03 than the median (high volume group) or fewer anaesthetics (low volume). The total number of patients who died before 30 days and who survived to 30 days were then calculated for each group. Table 13 shows the results of this analysis.

Table 13. Outcome of open AAA repair by number of anaesthetics for elective AAA repair given in 2002/03						
	Low volume	%	High volume	%	Unknown	Total
Died within 30 days	13	9	6	4	8	27
Alive at 30 days	132		136		137	405
Sub-total	145		142		145	432
Unknown	1		0		1	2
Total	146		142		146	434

More deaths occurred in patients cared for by anaesthetists who undertook fewer anaesthetics than the median but the overall number of deaths was small. This pattern does conform with the

published evidence that hospitals and surgeons performing greater numbers of aortic aneurysm repairs have better results (see Organisation of vascular services). One cannot conclude that this pattern is caused by the anaesthetist. It may be that anaesthetists who perform few major vascular cases a year work in hospitals that do few aneurysms overall, with limited resources and expertise in caring for such patients.

Emergency operations

The most senior anaesthetist present at the 264 emergency open repairs was asked to supply the number of anaesthetics for elective and emergency AAA repairs they administered from April 2002 to March 2003.

Regarding elective aneurysm experience, 43 questionnaires reported that the number of anaesthetics given for elective aneurysm repair in 2002/03 was 'Unknown': 56 questionnaires failed to supply any answer. 78% (128/165) of emergency patients undergoing open aortic aneurysm repair were cared for by anaesthetists who anaesthetised 10 or less elective repairs in 2002/03. 61% (101/165) were cared for by anaesthetists who performed five or less elective repairs in 2002/03.

Regarding emergency aneurysm experience, 47 questionnaires reported that the number of anaesthetics given for elective aneurysm repair in 2002/03 was 'Unknown' and 48 questionnaires failed to supply any answer. 98% (166/169) of emergency patients undergoing open aortic aneurysm repair were cared for by anaesthetists who anaesthetised 10 or less emergency repairs in 2002/03: 85% (143/169) were cared for by anaesthetists who performed five or less emergency repairs in 2002/03. Only three anaesthetists reported anaesthetising more than 10 emergency patients for aortic aneurysm repair in 2002/03.

Figure 5 gives the range of responses.

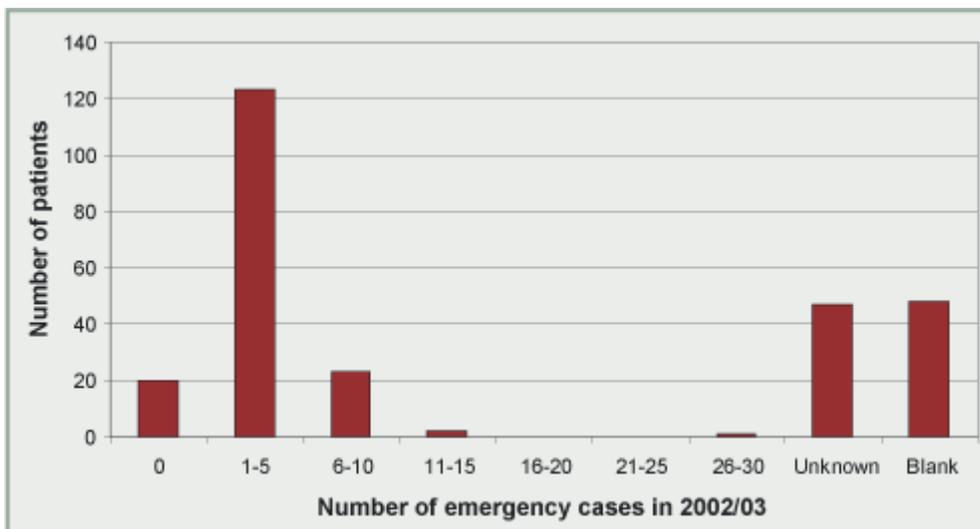


Figure 5. Number of anaesthetics for emergency open AAA repair performed by most senior anaesthetist in 2002/03 $n=434$

These data show that most anaesthetists have a very small exposure to the major emergency operation of emergency aortic aneurysm repair. Is this situation unavoidable given the number of anaesthetists on call for emergency aneurysm repair and the number of cases that present to each hospital a year?

The data for the outcome of emergency operations associated with the number of emergency cases performed by the anaesthetist have been analysed in the same manner as for elective

operations (Table 14).

Table 14. Outcome of open AAA repair by number of anaesthetics for emergency AAA repair given in 2002-03						
	Low volume	%	High volume	%	Unknown	Total
Died within 30 days	32	40	23	27	39	94
Alive at 30 days	48		62		60	170
Sub-total	80		85		99	264
Unknown	0		0		0	0
Total	80		85		99	264

As with elective operations, there is a pattern that there were fewer deaths associated with the anaesthetists who performed more emergency procedures. NCEPOD cannot say that this pattern was directly related to the performance of the anaesthetist, only that anaesthetists who performed fewer emergency aneurysm repairs in 2002/03 were part of a system of care that appeared to result in less favourable outcome.

Given the very small number of cases, elective and emergency, that are done by many anaesthetists, anaesthetic departments should review whether these cases could be concentrated in the hands of a smaller number of anaesthetists, so that fewer anaesthetists do the occasional aneurysm repair. One change could be the introduction of a specialist vascular anaesthetic on-call rota.

5. Anaesthesia

The anaesthetist >> Use of epidural anaesthesia

Use of epidural anaesthesia

92% of elective admission patients received an epidural catheter as part of the anaesthetic technique.

An epidural catheter was inserted in 92% (345/377) of elective patients having an open operation. The question was unanswered in 57 cases. An epidural catheter was inserted in 73% (57/78) of emergency unruptured open aneurysm repairs. The question was unanswered in nine patients. In emergency ruptured aneurysm patients, an epidural catheter was inserted in 8% (11/133) of cases. Four were answered as unknown and 32 questions were unanswered.

Use of epidurals with agents that affect coagulation

Including the patients who underwent endovascular repair, a total of 465 patients received an epidural catheter. Anaesthetists were asked whether the epidural catheter had been inserted when the patient had received drugs that might impair coagulation.

Table 15. Preoperative epidural catheter insertion by whether patients received aspirin in the seven days before surgery

Aspirin in patients who received an epidural	Total	%
Yes	168	38
No	274	62
Sub-total	442	
Unknown	19	
Not answered	4	
Total	465	

Nine patients had received subcutaneous unfractionated heparin in the six hours before surgery, 448 had not.

Table 16. Fractionated heparin in patients who received an epidural

Fractionated heparin in patients who received an epidural	Total	%
Yes	61	14
No	390	86
Sub-total	451	
Unknown	7	
Not answered	7	
Total	465	

It would appear that anaesthetists do not think there is much risk associated with placing epidural catheters when the patient has been taking aspirin (Table 15).

The finding that 14% of patients had an epidural catheter placed within 12 hours of receiving fractionated heparin is worrying (Table 16). The consensus is that this practice exposes the

patient to a significant risk of developing an epidural haematoma and the morbidity associated with this complication of treatment.

Removal of epidural catheters

In 16% of patients undergoing elective open repair the anaesthetist could not report when the epidural catheter was removed.

For the 345 patients undergoing elective open repair in whom an epidural catheter was inserted, no answer at all was given in seven cases to the question asking when the epidural catheter was removed. Of the 338 responses, in 55 cases (16%) the anaesthetist reported that they did not know when the epidural catheter was removed. If an anaesthetist inserts an epidural catheter it is their responsibility to ensure that the management of the catheter and of the epidural analgesia is safe. Some anaesthetists will want to exercise that responsibility personally until the catheter is removed. Others will wish to delegate that responsibility to a properly organised acute pain team. The finding that the anaesthetist was often unable to retrieve from the patient's notes the date when the epidural catheter was removed suggests, at the least, failure in documentation of the care given to the patient. This would cause an anaesthetist considerable difficulty if there were a problem with the epidural catheter resulting in a complaint or medico-legal correspondence. More worryingly, this failure may be a symptom of problems with the supervision of epidural analgesia and the delivery of safe clinical care. Clinicians should ensure that hospitals have robust systems in place for the postoperative care of epidural catheters, that demonstrate who is responsible for the care of the epidural catheter and for the accompanying appropriate documentation.

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The anaesthetist >> Blood loss in open operations

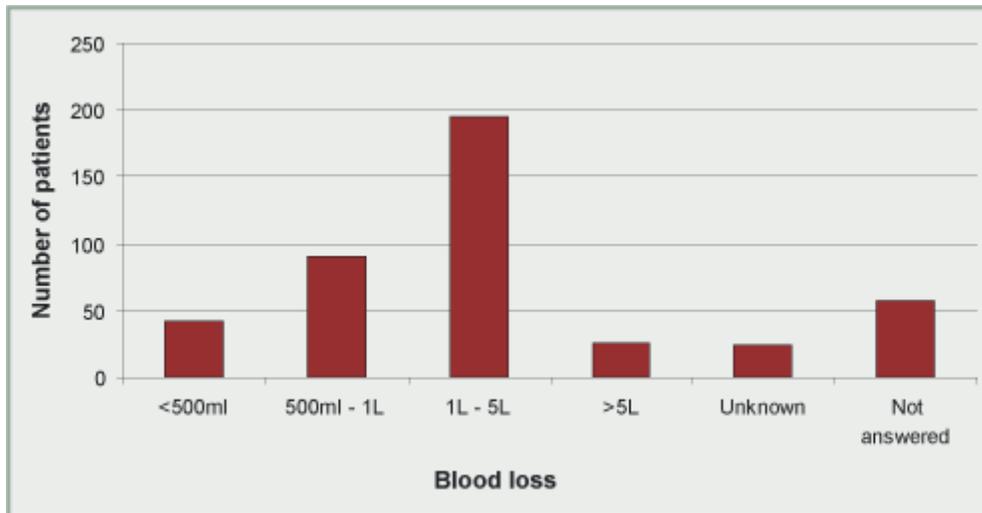


Figure 6. Blood loss in elective cases $n=434$

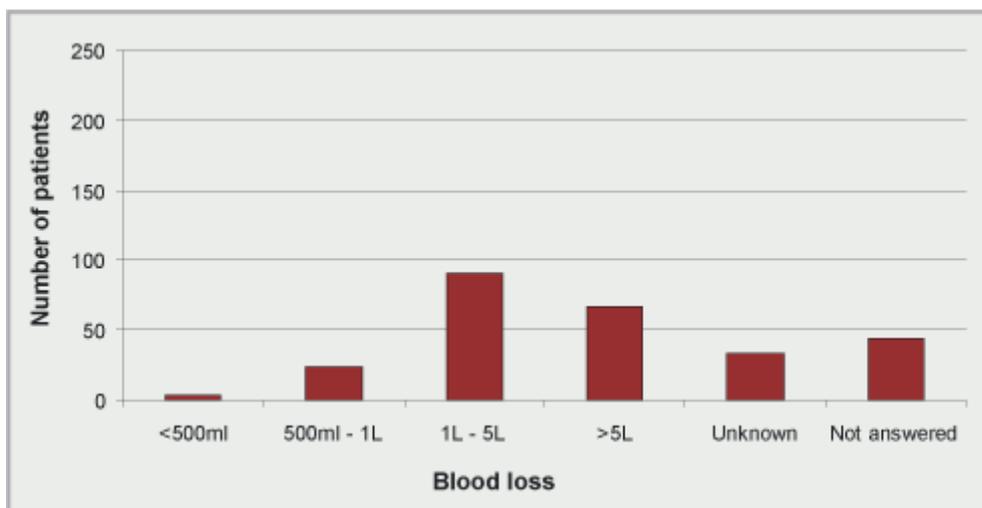


Figure 7. Blood loss in emergency cases $n=264$

The calculation of blood loss is recognised to be difficult for emergency operations (Figure 7). As expected, blood loss is less for elective operations (Figure 6) than for emergency ones, but 7% of patients (26/353) lost over five litres. The low blood loss reported for emergency aneurysm repair may be for cases when the aneurysm was unruptured.

91 patients were reported to have lost over five litres of blood at either elective or emergency open operations. 64% (58/91) of these patients received platelet transfusions, 77% (70/91) received fresh frozen plasma and 41% (40/98) received their own blood retrieved by a cell salvage system. 26% (25/98) received all three interventions. Are these figures acceptable?

The use of cell saver equipment is discussed in Organisation of vascular services. The NCEPOD advisors were of the opinion that there are sometimes problems with the release of blood products, especially platelets. There are published guidelines on the use of platelet replacement and the use of fresh frozen plasma^{7,8}. These guidelines seek to reduce the inappropriate use of these components in the context of published evidence. They suggest that treatment should be decided on the results of clotting tests and that factors are not required unless the platelet count is

below $50 \times 10^9/L$ and coagulation times are increased. This situation is regarded as unlikely to occur until 1.5 blood volumes have been lost.

The guidelines acknowledge that there is very little published work on situations such as aortic aneurysm repair where there can be rapid ongoing surgical blood loss and they do sanction the use of components when there is clinical evidence of a coagulopathy. Guidelines from the American Society of Anesthesiologists recognise that these cases can require special arrangements for transfusion on the basis of observed blood loss and coagulopathy⁹. It may be helpful for Trusts to have protocols in place for the use of blood products for aortic aneurysm patients, and agreement about the utility of coagulation tests in this situation.

5. Anaesthesia

The anaesthetist >> Temperature

More than half the patients were hypothermic after open surgery.

Patients undergoing open aortic surgery are very vulnerable to heat loss. Anaesthetists were asked what site was used to monitor the patient's temperature (Table 17) and the patient's temperature at the end of the operation (Table 18).

Table 17. Site of temperature	
Site	Total (answers may be multiple) <i>n</i> =752
Nasopharyngeal	426
Oesophageal	84
Tympanic	40
Axillary	16
Other	7
Unknown	38
Not answered	142

Table 18. Patient temperature at the end of the operation						
Temperature	Elective	%	Emergency	%	Not answered	Total
> 36 degrees C	171	49	68	38	16	255
34 – 36 degrees C	171	49	93	51	26	290
< 34 degrees C	4	1	20	11	4	28
Sub-total	346		181		46	573
Unknown	29		38		7	74
Not answered	59		45		1	105
Total	434		264		54	752

More than half the patients were hypothermic (<36°C) at the end of the operation (Table 18). The adverse effects of low temperature are well documented: hypothermia can lead to cardiac arrhythmias and adverse effects on oxygen consumption, haemostasis and tissue perfusion. In view of the number of patients in whom the patient's temperature was being recorded, anaesthetists appear to recognise that temperature control is important. There are several interventions available to anaesthetists to prevent heat loss. Anaesthetists should make all possible efforts to prevent hypothermia.

5. Anaesthesia

The anaesthetist >> Monitoring and vasoactive drugs

It is reasonable to assume that all patients for aortic aneurysm repair surgery will be monitored with the standard mandatory monitors, together with direct arterial pressure and central venous pressure monitoring (subject to the exigencies of the emergency situation for ruptured aneurysms). There is less agreement about the use of pulmonary artery flotation catheters and cardiac output monitors.

Table 19 shows the number of patients undergoing open elective aneurysm repair in whom a pulmonary artery flotation catheter was inserted.

Table 19. Intraoperative use of pulmonary artery flotation catheter						
Pulmonary catheter	Elective	%	Emergency	%	Not answered	Total
Yes	8	2	2	1	1	11
No	370	98	217	99	52	639
Sub-total	378		219		53	650
Unknown	0		2		0	2
Not answered	56		43		1	100
Total	434		264		54	752

It would appear that at the time of this study very few anaesthetists thought that the use of pulmonary artery catheters was justified for either elective or emergency open aneurysm repair.

Table 20 shows the number of patients undergoing open aneurysm repair in whom it was reported that the cardiac output was measured.

Table 20. Intraoperative measurement of cardiac output						
Cardiac output monitoring	Elective	%	Emergency	%	Not answered	Total
Yes	30	8	14	6	3	47
No	347	92	204	94	50	601
Sub-total	377		218		53	648
Unknown	0		2		0	2
Not answered	57		44		1	102
Total	434		264		54	752

In 10 of the cases (two were emergencies) a pulmonary artery flotation catheter was inserted and presumably was used for measuring the cardiac output by the thermodilution technique. The use of other techniques in 37 patients must reflect the increasing availability of non-invasive methods such as oesophageal Doppler devices and rebreathing devices. Overall, cardiac output was monitored in 7% (47/648) of patients.

Table 21 shows the numbers of patients who received inotropic drugs, defined as “drugs given for inotropic effect e.g. epinephrine, dobutamine”.

Table 21. Use of inotropes						
Inotropes	Elective	%	Emergency	%	Not answered	Total
Yes	113	30	115	53	23	251
No	263	70	103	47	30	396
Sub-total	376		218		53	647
Unknown	1		2		0	3
Not answered	57		44		1	102
Total	434		264		54	752

Table 22 shows the numbers of patients who received vasoconstrictor drugs, defined as "...drugs ... given for vasoconstrictor effect e.g. metaraminol, phenylephrine, norepinephrine".

Table 22. Use of vasoconstrictors						
Vasoconstrictors	Elective	%	Emergency	%	Not answered	Total
Yes	258	69	142	66	34	434
No	117	31	74	34	18	209
Sub-total	375		216		52	643
Unknown	2		3		0	5
Not answered	57		45		2	104
Total	434		264		54	752

It is not surprising that vasoactive drugs were used frequently. Patients undergoing elective operation are likely to have received vasodilating anaesthetic techniques such as epidural anaesthesia, and emergency operation patients may have been hypotensive due to hypovolaemia or myocardial ischaemia. The logical use of vasoactive drugs requires knowledge of the effect of therapy on cardiac output and systemic vascular resistance, not just the effect on the blood pressure. It is of concern that whilst a total of 39% (251/647) of patients received inotropic drugs and 67% (434/643) of patients received vasoconstrictor drugs, the cardiac output was monitored in only 7% of patients. When cardiac output monitoring was not used, was the anaesthetist certain that the patient's condition was being optimised with minimal effects on myocardial ischaemia?

5. Anaesthesia

The anaesthetist >> Destination after surgery

56% of elective patients went to ICU after operation.

9% of elective patients were nursed in a recovery area for a significant time after surgery.

32 patients died in theatre, four of which we could not determine whether they were elective or emergency cases. The destinations of patients who left theatre after open surgery are given in Tables 23 and 24.

Table 23. Immediate destination of patients after elective surgery		
Destination	Total	%
Recovery area	35	9
Level 3 care (e.g. ICU)	210	56
Level 2 care (e.g. HDU)	125	33
Level 1 care (vascular surgical ward)	2	<1
Other	2	<1
Died in theatre	3	<1
Sub-total	377	
Not answered	57	
Total	434	

Table 24. Immediate destination of patients after emergency surgery		
Destination	Total	%
Recovery area	10	4
Level 3 care (e.g. ICU)	156	70
Level 2 care (e.g. HDU)	27	12
Level 1 care (vascular surgical ward)	1	<1
Another hospital	2	<1
Other	2	<1
Died in theatre	25	11
Sub-total	223	
Unknown	3	
Not answered	38	
Total	264	

The figure of 79% of emergency repair patients going to Level 3 care is to be expected as it is usual for patients undergoing emergency aneurysm repair to require this level of care. 23 of the 27 patients who underwent emergency repair and were sent to Level 2 care after surgery had unruptured aneurysms so may have been more stable during operation.

It is very surprising that 56% of patients undergoing elective repair were sent to Level 3 care. With current anaesthetic techniques it should be possible for most patients at the end of surgery to be warm, with a stable cardiovascular system, breathing spontaneously and with their pain controlled,

such that Level 2 care only is required. Is this not a misuse of the limited availability of Level 3 resources?

The practice of postoperative mechanical ventilation of the lungs is considered in the following section.

The numbers of patients nursed in recovery areas after operation is disturbing. The use of recovery areas for the prolonged care of patients after aortic surgery is discussed in Organisation of vascular services. Recovery areas have neither the staffing, medical or nursing, nor the equipment to care properly for such patients for extended periods. Patients cannot give valid consent to their care and treatment if the possibility of being nursed in a recovery area and the risks involved are not explained to them.

5. Anaesthesia

The anaesthetist >> Mechanical ventilation after surgery

42% of elective patients were ventilated after surgery.

Table 25 shows the numbers of open operation patients who left theatre whose lungs were mechanically ventilated after open surgery.

Table 25. Mechanical ventilation of lungs postoperatively						
Ventilation postoperatively	Elective	%	Emergency	%	Not answered	Total
Not ventilated	215	58	42	22	25	282
< 4 hours	49	13	9	5	4	62
4 – 24 hours	78	21	81	42	11	170
> 24 and < 72 hrs	15	4	29	15	3	47
> 72 hours	13	4	32	17	7	52
Sub-total	370		193		50	613
Unknown	4		6		0	10
Not answered	60		65		4	129
Total	434		264		54	752

Is there scope for the anaesthetists of the 127 (34%) of elective patients whose lungs were ventilated for less than 24 hours to review their management of elective open aortic aneurysm repair? It might have been possible for most of these patients to breathe spontaneously at the end of surgery and to be sent to an HDU for postoperative care. Analysis shows that 51 of the 127 patients lost less than five litres of blood and had a temperature greater than 36° C, and a further 53 had a blood loss of less than five litres and a temperature between 34° C and 36° C.

54 of the 215 elective patients who did not receive mechanical ventilation after surgery were admitted to Intensive Care Units. This would appear to be another misuse of Level 3 beds. Is it historical practice that causes clinicians to continue to mechanically ventilate the lungs and to send patients to Level 3 beds after elective aortic surgery?

5. Anaesthesia

Death certification

NCEPOD asked for details of the mode of death, and the cause of death, as stated on the death certificate. As might be expected, the main modes of death included cardiac failure, multi-organ dysfunction syndrome and respiratory failure, but the variability of responses did not allow any detailed analysis.

Similarly, the way in which death following aneurysm repair was described on death certificates was very varied. Some entries would include conditions such as haemorrhage or cardiac failure, with aortic aneurysm entered under (b) or (c) of Part 1 of the death certificate; other entries would have "Ruptured aortic aneurysm" alone. Some entries would have "Aortic aneurysm" in Part 1, others in Part 2. Most worryingly, there were some death certificates that made no mention of "Aortic aneurysm" in the death certificate at all, although it was quite clear that the patient would not have died at that time unless they had had an operation for repair of an aneurysm.

NCEPOD has commented on inadequacies in the formulation of the cause of death in death certificates before ^{10,11}. These data provide further evidence of failings in the completion of the medical certificates of cause of death. The Office of National Statistics derives data for the main causes of death from the bottom line of Part 1 in the medical certificate of the cause of death. If doctors complete the certificate wrongly they are misleading relatives and distorting national statistics on the causes of death of the population.

5. Anaesthesia

Recommendations

Trusts should ensure that anaesthetists can identify the major cases that they have managed in order to support audit and appraisal.

Anaesthetic departments should review the allocation of vascular cases so as to reduce the number of anaesthetists caring for very small volumes of elective and emergency aortic surgery cases.

Trusts should ensure they that they have robust systems for the postoperative care of epidural catheters with accompanying appropriate documentation.

Anaesthetic departments and critical care units should review together whether vascular surgery patients who routinely receive postoperative mechanical ventilation could be managed in a Level 2 High Dependency Unit breathing spontaneously.

5. Anaesthesia

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