3. Organisation of vascular services

Introduction

Patients with an abdominal aortic aneurysm should expect to be cared for in a setting with the appropriate facilities available, and treated by staff of the right expertise. These criteria should apply whether the patient is undergoing elective or emergency aortic aneurysm repair. This chapter will examine how well hospitals met these requirements.

3. Organisation of vascular services

Size of vascular unit

Hospital staff completing the organisational questionnaire were asked to classify the size of the vascular unit at their hospital as large, intermediate or remote:

> **Large vascular unit:** Hospital with sufficiently large catchment population (at least 500,000) to employ at least four vascular surgeons and the potential for an on-site vascular rota.
>
> **Intermediate vascular unit:** Hospital with catchment population of less than 500,000, fully equipped for vascular surgery but with insufficient vascular surgeons for an on-site emergency rota.
>
> **Remote vascular unit:** Separated by long distances from other hospitals, and usually serving small catchment population.

Figure 1 shows how hospitals classified themselves. 47 hospitals were classified as large units, 106 as intermediate and 16 as remote. For 12 hospitals the question was not answered. Of the 884 patients in this study, 411 were cared for in larger vascular units, 411 in intermediate units and 19 in remote vascular units. The size of unit was not given for 43 patients.

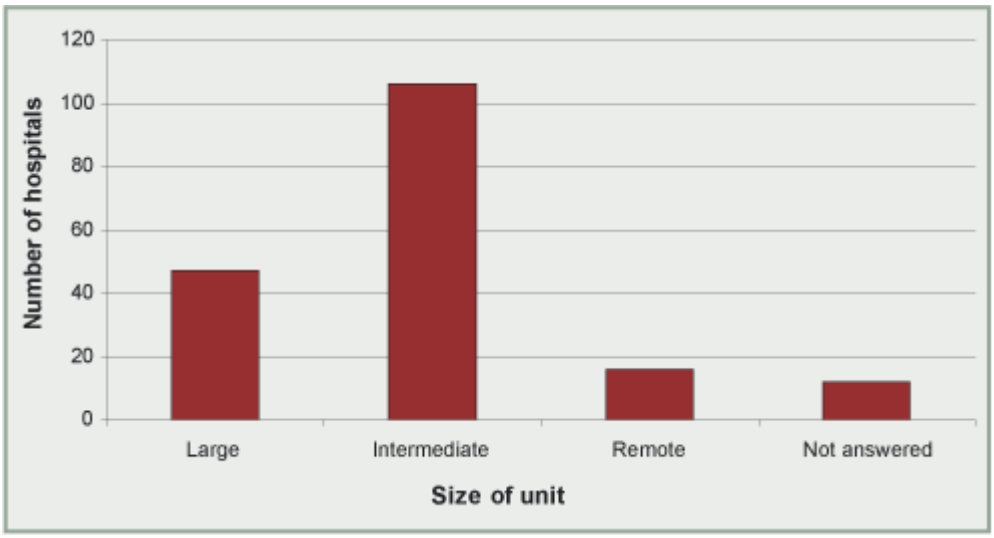

Figure 1 . Size of vascular unit *n=181*

3. Organisation of vascular services

Imaging facilities >> Elective patients

Poor availability of radiology services out of hours was common.

Imaging is crucial to the successful care of patients with aortic aneurysms. Proper imaging before elective repair will establish the true size of the aneurysm and thus whether the patient should be advised to undergo operation, or whether it might be better to continue with observation only. Imaging will establish the precise anatomy of the aneurysm, information necessary to decide on the operation required. Furthermore, the operation indicated may require particular facilities that need to be planned in advance. Full knowledge of the patient's particular anatomy and the procedure required is essential before the surgeon can properly inform the patient of the risks and benefits of AAA repair when seeking consent for the operation.

Table 1. General availability of different imaging facilities according to size of vascular unit

	Angiography	%	CT scanner	%	Interventional radiology	%	MRI scanner	%	Ultrasound	%
Large	45	100	46	100	44	98	44	96	47	100
Intermediate	100	96	104	99	98	94	95	91	106	100
Remote	13	81	16	100	12	75	14	88	16	100
Total	**158**	**96**	**166**	**99**	**154**	**93**	**153**	**92**	**169**	**100**

Percentages refer to the number of hospitals with the facilities available as a proportion of the total number of hospitals that replied to that particular question.

There was little difference in provision of services between different sized units (Table 1). Provision was less good in remote units but the numbers of such units was small. One should note that respondents may have interpreted the question regarding availability of 'Interventional radiology' as including procedures such as biliary stenting, and may not have restricted an affirmative answer to vascular procedures only. Similarly, the affirmative answers as to the availability of ultrasound may refer to ultrasound in general; hospitals that answered "Yes" may not necessarily have access to **vascular** ultrasound services.

Table 1 shows that nearly all hospitals performing aortic aneurysm repair have the imaging modalities required to care for such patients. Superficially this is reassuring. However, NCEPOD's advisors were strongly of the opinion that these services are not necessarily readily accessible to vascular surgery patients. Department of Health targets specified that by 2001 there should be a maximum two month wait from GP referral to treatment for breast cancer and that this standard should be rolled out to other cancer sites so that by 2005 all cancers would be treated within two months of referral by their GP. In order to meet these targets, patients with cancer are given a high priority for radiological investigations. In contrast, the advisors reported that patients who do not have cancer, for example those with aortic aneurysms who need a CT examination before surgery, can wait several months before the appointment for their CT examination. Although not malignant, large AAAs (greater than 6 cms diameter) pose a threat to life and require urgent treatment. Is it acceptable that patients with an AAA should carry a 85% risk of dying [1,2] should their aneurysm rupture while they wait for their appointment, whilst other patients receive greater priority?

3. Organisation of vascular services

Imaging facilities >> Emergency patients

Many patients admitted as an emergency with a diagnosis of ruptured aortic aneurysm do not need any imaging before being transferred to the operating theatre. In fact when the diagnosis of a ruptured aneurysm is obvious from the clinical history and examination, any delay for further investigation may compromise the chances of a successful outcome. However, in other cases where the patient's haemodynamic status is acceptable and the diagnosis of ruptured aortic aneurysm is in doubt, imaging may be required. Clearly it is essential that facilities for radiological investigations are available 24 hours a day.

Table 2 shows the proportion of facilities that were available out of hours using data from all hospitals.

Table 2. Out of hours availability of different imaging facilities according to size of vascular unit

	Angiography	%	CT scanner	%	Interventional radiology	%	MRI scanner	%	Ultrasound	%
Large	29	64	36	78	27	61	15	34	29	62
Intermediate	46	46	85	82	41	42	25	26	74	70
Remote	5	38	11	69	6	50	5	36	11	69
Total	**80**	**51**	**132**	**80**	**74**	**48**	**45**	**29**	**114**	**67**

Percentages refer to the number of hospitals with the facilities available as a proportion of the total number of hospitals that replied to that particular question.

Whilst in four out of five hospitals that had a CT scanner it was possible to have a CT scan out of hours, only half of hospitals could organise out of hours angiography or interventional radiography, and in only one third was MRI scanning available out of hours. It is surprising how many hospitals are unable to provide a comprehensive range of imaging facilities out of hours. This obviously has implications for all patients admitted as emergencies. Given that a CT scan is usually the most important investigation for patients with an aortic aneurysm [3] it is disappointing that the proportion of CT scanners available 24 hours a day is not 100%. Some CT scanners are initially funded via cancer initiatives, but all hospitals admitting patients with aortic aneurysms should provide the resources for 24 hour working for all patients. Are patients told if the hospital to which they are being admitted does not provide a full range of imaging for emergency patients?

One reason for the poor provision of out of hours services in interventional radiology is the shortage of consultants. A survey was carried out by the Royal College of Radiologists Audit Office on behalf of the British Society of Interventional Radiologists in 1999 and 2000, covering the whole of the United Kingdom [4]. This identified 165 hospitals with surgical vascular services. At that time there were only 87 specialist vascular radiologists. Approximately half were single handed. Returns for this study showed that 33% of hospitals had an on-call rota for interventional radiology. In many hospitals interventional radiologists will participate in the general radiology on-call rota. If a patient requires an emergency interventional radiology procedure on a day when the on-call radiologist does not have interventional skills, the hospital depends on the goodwill of an interventional radiologist to come back into the hospital to provide the service.

The ability to provide out of hours imaging facilities depends on the size of the hospital. Table 2 shows that angiography, interventional radiology and MRI scanning were more likely to be available in large vascular units compared to intermediate or small units. However, even in large vascular units, many hospitals were unable to provide a satisfactory imaging service out of hours.

NCEPOD has no information as to why most hospitals could provide a satisfactory service to meet clinical need whereas others of a similar size could not.

3. Organisation of vascular services

Hospital workload

Hospitals were asked to supply the number of elective and emergency aneurysm repairs performed in the financial year 2002/03. The data for endovascular procedures are considered in a separate chapter.

>> Numbers of elective open operations

49 hospitals performed 10 or fewer elective aortic aneurysm repairs in 2002/03.

The figures for elective surgery for different sized units are shown in Figure 2.

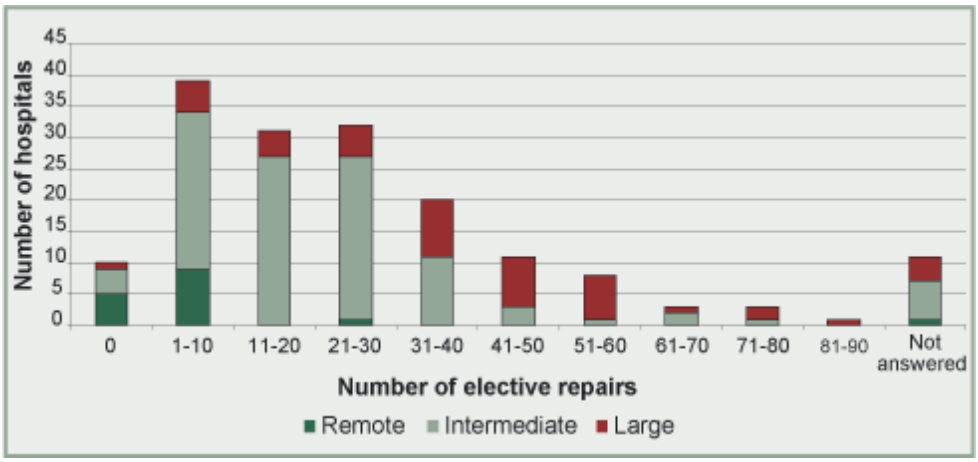

Figure 2. Number of elective open repairs performed in year 2002/03 by size of unit *n=181*

As expected, larger units had a bigger workload. However the numbers of operations performed at some hospitals appears remarkably small. Six large units reported performing 10 or fewer elective AAA repairs in 2002/03, and 29 intermediate hospitals reported performing 10 or fewer (fewer than one a month). All but one of 15 remote units reported performing 10 or fewer procedures. In total 31% (49/158) of hospitals performed 10 or fewer elective open AAA repairs in the 12 month period. It must be remembered that this is the total for the whole institution. Individual surgeons and anaesthetists will have done fewer cases in the year than this.

3. Organisation of vascular services

Hospital workload >> Emergency open repairs

87 hospitals performed 10 or fewer emergency aortic aneurysm repairs in 2002/03.

The pattern is repeated for emergency open repairs (Figure 3).

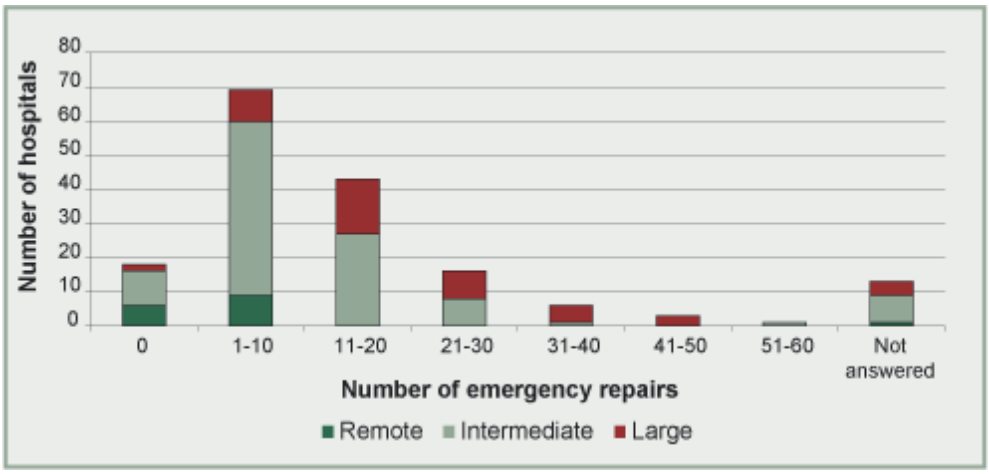

Figure 3. Number of emergency open repairs performed in year 2002/03 by size of unit *n=181*

Again, some hospitals report performing small numbers of open emergency AAA repairs. 11 large units and 61 intermediate sized units reported doing 10 or less emergency repairs in 2002/03. In total 56% (87/156) of hospitals performed 10 or fewer open AAA repairs on patients admitted as an emergency in the 12 month period.

3. Organisation of vascular services

Hospital workload >> Elective versus emergency repairs

There was a great variation between hospitals in the number of elective operations performed compared to the number of emergency operations. Figure 4 plots the elective to emergency ratio for all hospitals that did at least one elective and one emergency aortic aneurysm repair in 2002/03. Three hospitals carried out no elective repairs in 2002/03 but at least one emergency repair.

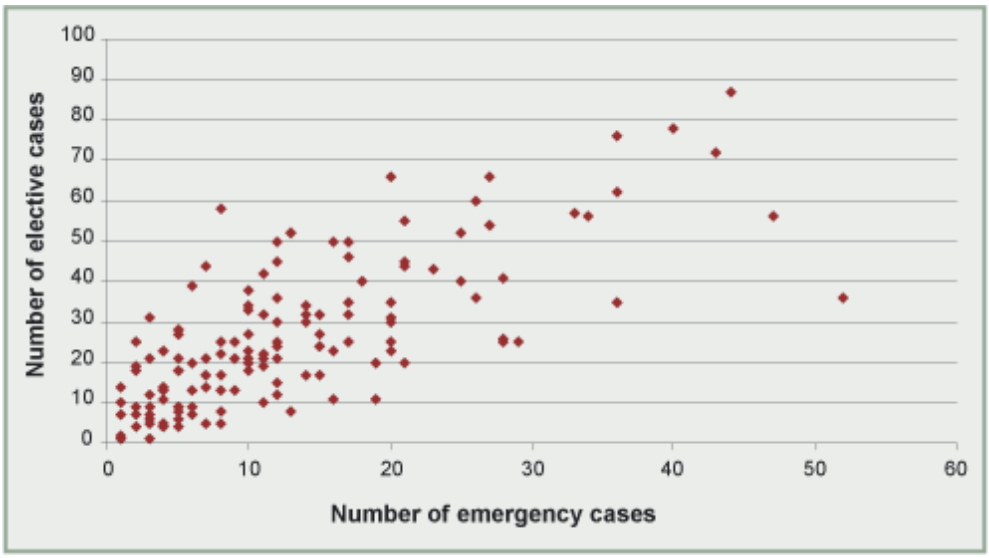

Figure 4. Number of emergency open repairs by number of elective open repairs *n=137/181*

It is remarkable that there should be such a variation in the pattern of work. Some hospitals had a ratio of two elective operations to one emergency operation, whilst in others the ratio was reversed. NCEPOD has no data that would explain why there should be such variations in the pattern of work, even between hospitals that were performing substantial numbers of procedures. Nor does NCEPOD have the data to analyse whether there is a difference in outcome between hospitals that correlates with the difference in the proportion of elective to emergency operations performed.

3. Organisation of vascular services

Hospital workload >> Volume of procedures versus outcome for open operation

Many people feel intuitively that it is better for major procedures to be performed by staff who do such operations regularly, but is this true, and if so, what number of procedures is it necessary to perform to confer competency and good outcomes?
The numbers of procedures done by individual hospitals were too small for meaningful examination of whether there was an association between volume of work and outcome by individual hospital. Therefore, hospitals were grouped according to whether they performed fewer elective open AAA repairs (low volume group) or more elective repairs (high volume group) than the median value for the number of elective repairs reported for 2002/03. For each group NCEPOD has calculated the number of patients who died within 30 days of operation and the number who were alive at 30 days. The results are shown in Table 3.

Table 3. Outcome of elective cases by number of elective open procedures performed in hospital in the previous year

Outcome	Volume of cases						
	Low	%	High	%	Sub-total	Not answered	Total
Died within 30 days	11	6	14	7	25	2	**27**
Alive at 30 days	185	94	173	93	358	47	**405**
Sub-total	**196**		**187**		**383**	**49**	**432**
Not answered	1		1		2	0	**2**
Total	**197**		**188**		**385**	**49**	**434**

There does not appear to be a pattern to suggest that there is a reduced proportion of deaths associated with hospitals that perform a greater number of operations. A similar representation of the outcome of emergency operations is shown in Table 4.

Table 4. Outcome of emergency cases by number of elective open procedures performed in hospital in the previous year

Outcome	Volume of cases						
	Low	%	High	%	Sub-total	Not answered	Total
Died within 30 days	45	40	32	29	77	17	**94**
Alive at 30 days	68	60	77	71	145	25	**170**
Total	**113**		**109**		**222**	**42**	**264**

There do appear to have been proportionately fewer deaths in the hospitals performing a greater volume of operations, but the total number of operations is not large. The relationship of outcome and the size of vascular unit is considered later in this chapter.

If it is not possible to draw firm conclusions from these data, is there other evidence from published sources that could help interpret the findings of this study that many hospitals are performing small numbers of procedures?

3. Organisation of vascular services

Hospital workload >> Published evidence

Numerous studies of surgical practice in recent years have examined the relationship between the volume of procedures performed and outcome. Birkmeyer [5] used Medicare data from the United States to look at the effect of the number of operations performed by a hospital on the outcome of mortality, for 14 procedures. Mortality decreased as volume increased for all 14 procedures, although the strength of the effect varied between different types of procedure.

One of the procedures examined was elective repair of unruptured aortic aneurysm. There were over 140,000 such operations in the Medicare population in the study period. Figures were adjusted for a number of risk factors including mode of admission. Taking the risk adjusted odds ratio for hospitals performing less than 17 cases a year as one, the ratio for hospitals doing 31-49 cases a year was 0.70 (confidence intervals [CI] 0.64-0.76), and for hospitals doing greater than 79 cases a year the odds ratio was 0.58 (0.53-0.65).

A second paper by Birkmeyer [6] used two years' data from the United States from Medicare patients to examine the interaction of a surgeon's volume of cases with the hospital workload. Surgeons working at a large hospital will probably do a large number of procedures, but some individual surgeons working in high volume hospitals may do a low number of procedures. This may or may not affect outcome. The paper examined how much of the observed phenomenon of reduced mortality at high volume hospitals should be ascribed to the volume of work performed by the surgeon, for a number of procedures. For repair of non-ruptured abdominal aortic aneurysm, surgeons were divided into low, medium and high volume surgeons on the basis of performing less than eight, eight to 17.5, and greater than 17.5 aneurysm repairs annually. The adjusted odds ratio for operation in a low volume hospital (as defined for this study) compared to a high volume hospital was 1.4. Of this variation 57% could be ascribed to variations in the volume of operations performed by the surgeon. (As a comparison, 100% of the variation in aortic valve surgery outcome could be ascribed to the effect of the volume of work of the surgeon.)

A paper by Urbach [7] examined data for five complex procedures from Canadian hospitals. This paper showed an adjusted odds ratio of 0.62 (CI 0.46-0.83) for repair of unruptured AAAs at high volume hospitals compared to low volume hospitals (number of aneurysm repairs 6,279). This study also found that for some combinations of procedures, improved outcome in one procedure was associated with high volumes of another procedure.

These results from studies with much greater numbers than the number of unruptured AAAs in this study (434 elective AAA repairs, 86 emergency unruptured repairs) show that outcome is better when both surgeon and hospital undertake greater rather than smaller volumes. Presumably the effect of hospital volume reflects expertise and resources in anaesthesia, intensive care, nursing care, laboratory and imaging services and so forth.

The definitions of low volume and high volume used in these studies were constructed for the purpose of analysis and cannot be used to set levels of work to define good practice. The Leapfrog Group [8] is an American collaboration of 170 organisations that purchase healthcare. The Group's aims are to improve the safety, quality and affordability of healthcare. It has suggested that hospitals should perform a minimum volume of 50 elective AAA repairs a year. Only 19 hospitals in this study achieved this level of work.

3. Organisation of vascular services

Hospital workload >> Implications

These large scale studies do not mean that individual surgeons and hospitals performing small numbers of procedures cannot have excellent results. Nevertheless, it is of concern that so many hospitals are carrying out small numbers of procedures. Clinicians, Trust managers and purchasers should examine whether existing referral and work patterns are in the best interests of patients. The centralisation of such surgical services as cardiac surgery, neurosurgery and some cancer surgery is well established, as are networks for the management of cancer. The data from this study together with the published evidence suggest that serious consideration should be given to restricting elective open aortic aneurysm surgery to many fewer hospitals than are presently carrying out the procedure.

There will be an inevitable impact on the provision of emergency aortic surgery if elective surgery is restricted to fewer hospitals. Patients admitted to hospitals that have increased their aortic vascular workload will be treated by a surgical team that has the possibility of increasing its expertise. Patients admitted to a hospital that has faced a reduction in its vascular workload, or that now does no elective aortic cases at all, will be treated by a surgical team that only performs an occasional case. This is bound to lead to apprehension on the part of the patient and the surgical team, and may result in a worse outcome.

Screening programmes to identify asymptomatic aortic aneurysms before they rupture, and to offer elective surgery when appropriate, have been debated for some years. There appears now to be sufficient evidence to show that screening programmes for aortic aneurysm are beneficial [9,10] and screening may be implemented. The National Screening Committee has stated that randomised controlled trials have demonstrated a reduction in mortality from ruptured abdominal aortic aneurysm and that a working group set up to appraise the policy implications will report by the end of 2005 [11].

At present, some patients with a ruptured AAA present to hospitals that undertake very few or no emergency aneurysm repairs. Although the numbers of such patients would be reduced with the implementation of a screening programme, some patients will not be picked up by a screening programme and will continue to present with a ruptured AAA. Possible options are that a surgeon without any regular vascular experience may step into the breach to do the best they can; a vascular surgeon may travel from another hospital to operate in the admitting hospital (this solution will provide surgical expertise but the patient will not have access to anaesthetic, nursing and ICU expertise); or the patient may be transferred from the admitting hospital to a vascular unit in another hospital. Several recent publications explore the various models of care that are potentially available [12,13,14].

There is evidence that patients with a ruptured aortic aneurysm can be transferred safely for journeys of more than an hour by road or over 25 miles [15]. Some areas within the United Kingdom have already instituted schemes for the transfer of patients from a particular catchment area into a central vascular unit. It will be necessary to consider similar schemes whenever planning to withdraw vascular services from hospitals with small workloads.

3. Organisation of vascular services

Specialist on-call rotas >> Vascular surgical on-call

Only 57% of hospitals reported that there was a separate on-call rota for vascular surgery.

Vascular surgery is a specialised branch of surgery; trainees are expected to spend at least two years in a vascular surgical training post before gaining accreditation. A ruptured aortic aneurysm is a major surgical crisis. It is logical that such patients should be cared for by vascular surgeons. However, not all hospitals were organised so that a vascular surgeon was always available out of hours.

Hospitals were asked whether there was a separate vascular on-call rota for vascular surgery. Overall 57% (103/181) of hospitals had a separate rota, 43% did not. The proportion varied between units of different size (Figure 5).

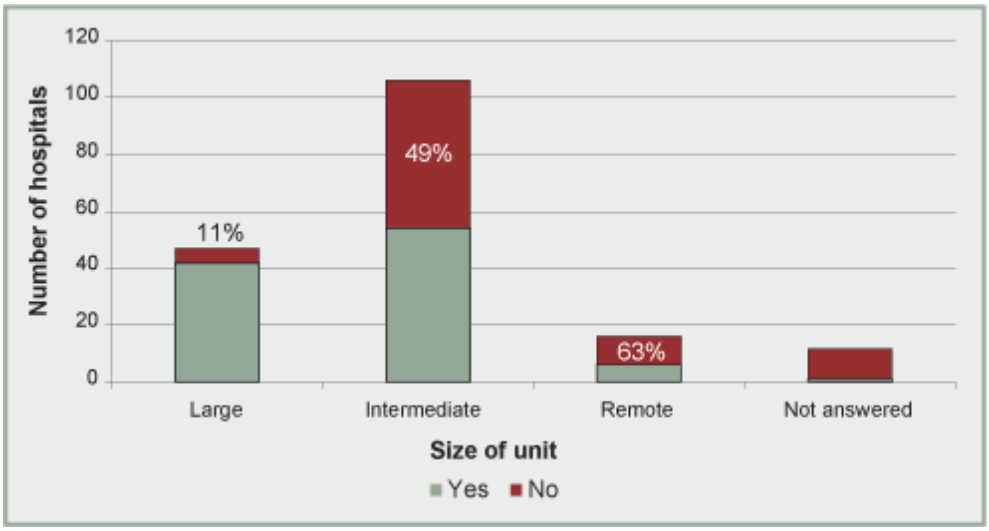

Figure 5. Separate surgical on-call rota for vascular surgery by size of vascular unit *n=181. Percentages refer to hospitals without a separate rota.*

The definitions provided by NCEPOD suggested that large vascular units would have the potential for a vascular surgical rota whereas an intermediate unit would have insufficient vascular surgeons to form an on-site emergency rota. It is notable that despite this, 51% of intermediate units had managed to organise such a rota. It is unclear as to why all large units did not have a rota. It is likely that surgeons on a vascular rota will have a more onerous on-call commitment than their consultant colleagues on a general surgical rota, both in terms of frequency of on-call and attendance required when on duty. Consultants will be deterred from establishing vascular rotas if this extra commitment is not recognised in consultant job plans. It may also be that Trust managers may be reluctant to appoint sufficient vascular consultants to form an acceptable specialist rota because there may be insufficient elective work during the working day to occupy the increased surgical capacity.

63% (64/102) of the on-call rotas were shared with another hospital or Trust. Shared rotas are obviously a common way of organising a specialist vascular rota when a hospital has limited resources to organise an on-call rota on its own. Hospitals should explore the potential for collaborating with neighbouring Trusts, so as to provide specialist on-call rotas. Financial arrangements for the payment of hospitals should be set up in such a way that there are no perverse incentives to arrange clinical services so as to maximise income for the hospital rather than promote patient care. Trusts must accept that work should be shared with other Trusts if this

will promote patient care, even if the result is a loss of income to the Trust.

It is unsatisfactory for hospitals that are able to organise vascular on-call emergency rotas, either within their own hospital or in partnership with neighbouring hospitals, not to do so. When there is not a vascular on-call rota, vascular surgeons or older general surgeons with vascular expertise will often come in to their hospital at night when they are not on-call to assist a colleague who is struggling with a ruptured aortic aneurysm. Such surgeons are to be applauded for their commitment to patient care, but Trusts should not depend on ad hoc arrangements and the goodwill of clinicians. Patients requiring emergency aneurysm repair should be treated by a surgeon who is practised in the management of this condition, working to a properly established emergency on-call rota. It is wrong to expect surgeons to carry the burden of responsibility of performing major emergency surgery outside their regular area of competence.

It should be noted that this issue is in a state of flux. On the one hand, the number of older general surgeons who had some vascular experience in their training and exposure to aortic surgery on-call is declining, and their place is being taken by newly appointed consultants in colorectal surgery and other disciplines who may have never seen a ruptured aortic aneurysm; these consultants may refuse to treat vascular emergency patients. On the other hand, these pressures may have accelerated the move to forming vascular surgical on-call rotas since NCEPOD collected its data in April 2004. A survey by the Association of Surgeons of Great Britain and Ireland in 2004 reported that 72% of Trusts (not hospitals) had a vascular on-call rota, and that 64% of vascular surgeons also participated in the general surgical on-call work [16].

There have been suggestions that despite the intuitive feeling that outcome following emergency AAA repair should be better when care is delivered by a specialist vascular surgeon, results are actually no different. NCEPOD examined the outcome of the patients in this study. The data for patients admitted as an emergency with unruptured and ruptured AAAs are analysed separately (Figures 6 and 7) because overall outcomes for the two groups are different; emergency unruptured AAAs have a mortality higher than AAAs admitted electively but lower than ruptured AAAs.

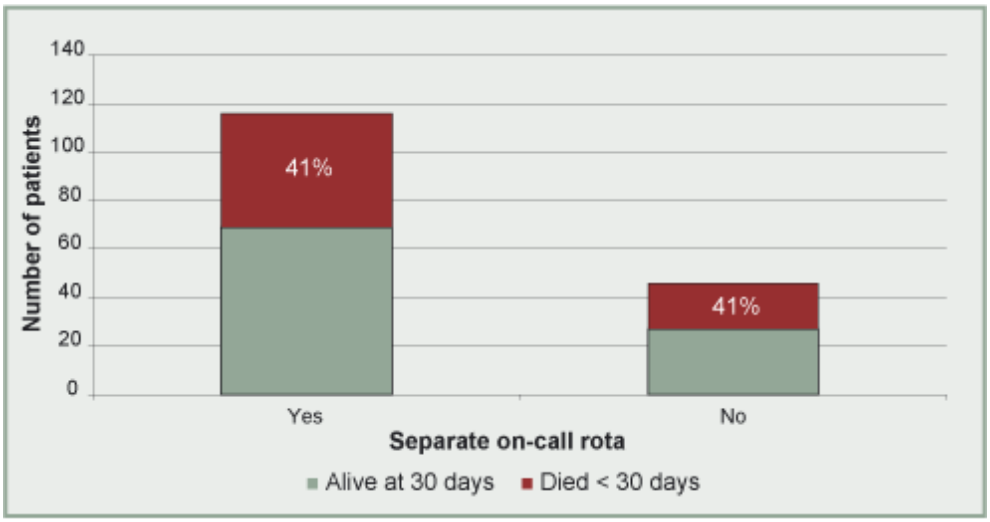

Figure 6. Outcome in ruptured emergency open procedure cases by whether or not there is a separate on-call rota for vascular surgery *n=162/168. Percentages refer to patients who died in hospital within 30 days.*

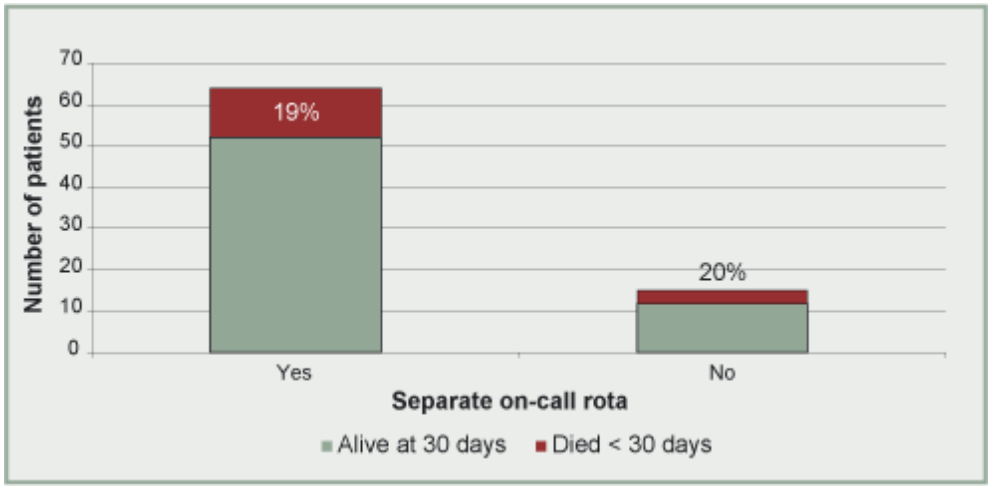

Figure 7 . Outcome in unruptured emergency open repairs by separate on-call rota for vascular surgery *n=79/81. Percentages refer to patients who died in hospital within 30 days.*

There was no difference in the outcome of surgery for ruptured or unruptured AAA between those hospitals where there was a surgical on-call rota and where there was not. Overall numbers are not large. Patients in hospitals without a formal vascular surgery on-call rota may have been operated on by vascular surgeons who attended the hospital despite being off duty. NCEPOD is unable to make a judgement as to whether or not the case-mix of the patient populations were the same.

3. Organisation of vascular services

Specialist on-call rotas >> Anaesthetic on-call rotas for vascular surgery

Anaesthetic on-call rotas for vascular surgery were very uncommon. Only 3% (5/178) of hospitals responded that they had a vascular anaesthetic rota. It appears to be accepted practice that whilst individual anaesthetists will develop expertise in anaesthesia for elective vascular surgery, any anaesthetist should be prepared to anaesthetise a patient for surgery for an emergency AAA repair. This seems illogical. The NCEPOD advisors commented that now that anaesthetic training has been shortened, new anaesthetic consultants may have seen very few operations for ruptured aortic aneurysm before appointment. It is not possible from the data collected for this study to make any observation as to whether better outcome for emergency AAA surgery is associated with the presence of a vascular anaesthetic rota. However, is it not time for at least large vascular units to implement vascular anaesthetic on-call rotas so that the sickest vascular patients are cared for by the most experienced practitioners?

3. Organisation of vascular services

Specialist on-call rotas >> On-call rota for interventional radiology

Overall, 24% (41/173) of hospitals reported that they had an on-call rota for interventional radiology. These rotas were chiefly found in large vascular units (Figure 8).

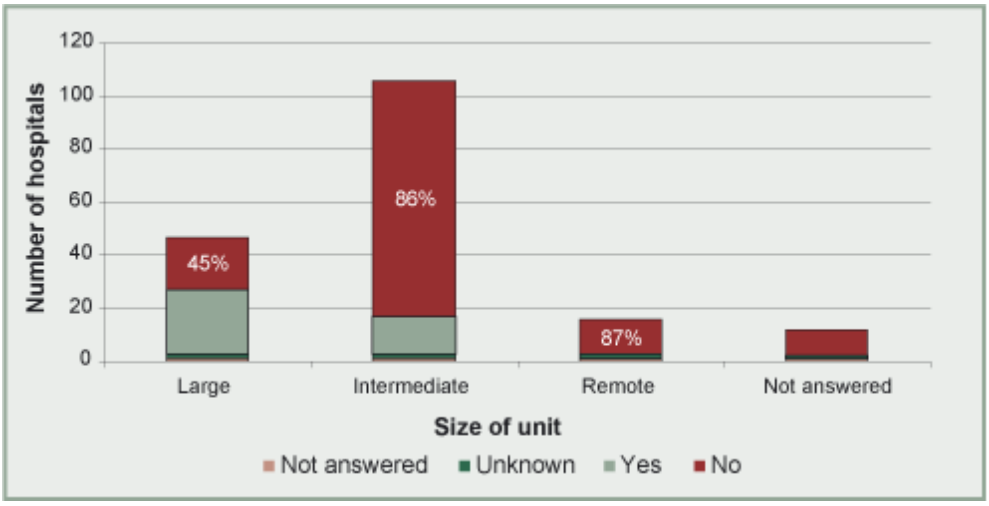

Figure 8. Separate on-call interventional rota in hospitals by size of vascular unit *n=181. Percentages refer to hospitals without a separate on-call rota.*

The problems of providing out of hours imaging have already been discussed earlier in this chapter.

3. Organisation of vascular services

Provision of theatre sessions for vascular surgery

20% of hospitals did not have dedicated daytime general surgical theatre sessions (NCEPOD lists).

>> Elective dedicated vascular sessions

Hospitals were asked whether there were dedicated elective theatre sessions for vascular surgery, and if so, how many. 80% (144/180) had dedicated elective sessions. Figure 9 shows the relationship between the number of elective AAA repairs reported for the year 2002/03 and the number of elective vascular sessions reported.

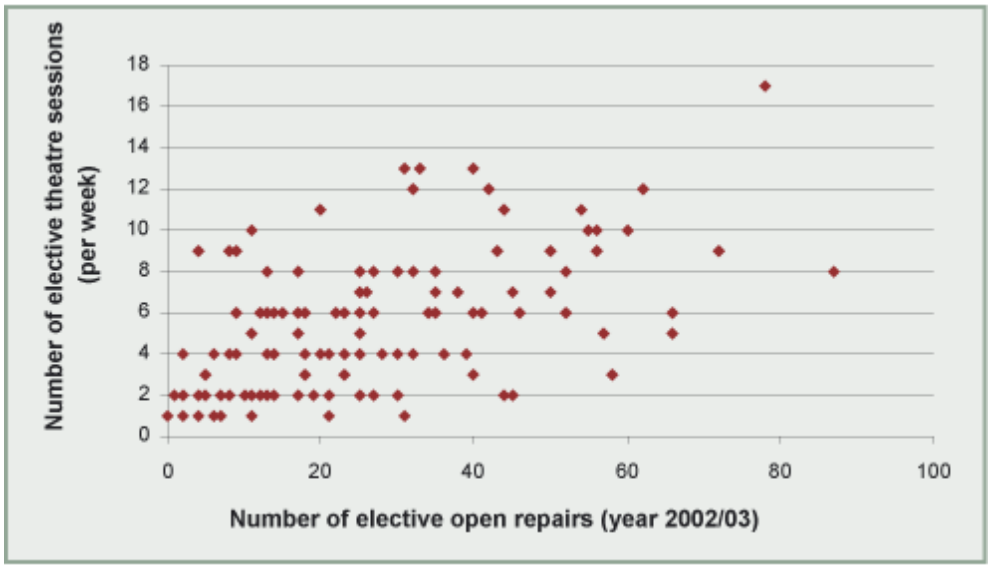

Figure 9. Number of elective theatre sessions by number of elective open repairs *n=128*

As expected, the greater the number of repairs done in a hospital the more likely it was that there would be a greater number of elective vascular sessions. However, it is striking that for hospitals carrying out the same number of AAA repairs, e.g. approximately 60, the number of sessions could vary from three to 12. Hospitals may wish to compare their own provision of services with the data presented here.

3. Organisation of vascular services

Provision of theatre sessions for vascular surgery

>> Emergency dedicated vascular sessions

Only 2% (4/181) of hospitals made provision for dedicated emergency vascular theatre sessions. Three of these were hospitals with large vascular units and one a hospital with an intermediate sized unit.

3. Organisation of vascular services

Provision of theatre sessions for vascular surgery

>> Daytime general emergency theatre sessions

If it was unlikely that a hospital had provision for dedicated vascular emergency theatre sessions, did hospitals at least have daytime theatre sessions allocated for surgical emergency cases of all sorts?

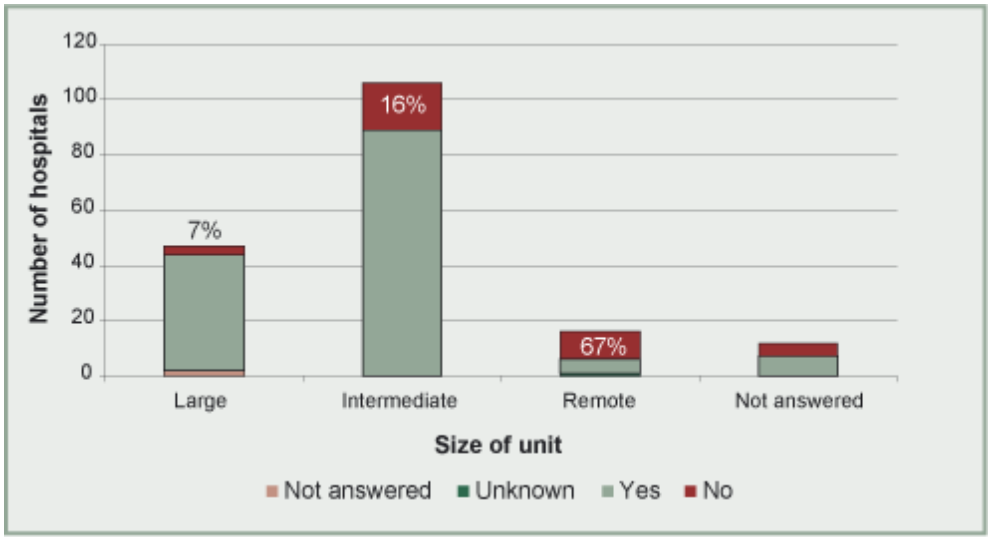

Figure 10. Dedicated emergency daytime theatre in hospitals by size of vascular unit *n=181. Percentages refer to hospitals without dedicated emergency daytime theatre.*

It is very disappointing that 18% of hospitals (30/166) did not have theatres immediately available (NCEPOD theatres) for emergency surgery during the daytime (Figure 10). Larger units were more likely to have NCEPOD theatres, but provision was not universal even in this group of institutions. These facilities were first recommended by NCEPOD in 1990. If a patient presents with a ruptured aortic aneurysm and the hospital does not have an emergency theatre, the patient will have to wait until an ongoing operation is finished and the theatre is cleared before surgery can commence. Any delay in operating on a ruptured aneurysm has the potential to affect adversely the patient's outcome. It is hard to understand the clinical priorities in hospitals that do not provide daytime emergency theatres when so many hospitals have managed to establish this facility. Trusts should give serious consideration to this issue in the interests of patient safety.

3. Organisation of vascular services

Use of blood products

Only 55% of hospitals routinely provided a cell salvage machine for aortic surgery.

Repair of AAA is inevitably associated with blood loss, sometimes small, sometimes considerable. Despite substantial investment in improving the safety of donated blood, the administration of donor blood is still associated with risks [17]. The introduction of extra safety checks has resulted in an increase in the cost of donor blood and restricted its supply. “Better Blood Transfusion” [18] set the objectives of exploring the use of pre-donation of autologous blood and perioperative blood salvage.

3. Organisation of vascular services

Use of blood products >> Preoperative autologous blood donation

20% (34/173) of hospitals provided a service whereby patients could donate blood in the weeks preceding elective AAA repair. It is disappointing that this figure was so low. One reason suggested by the advisors was that it is unrealistic to try to organise blood donation for an operation booked for a particular date, only to find that the operation is frequently cancelled because other resources such as an HDU bed are unavailable (see the chapter on Surgery); the donated blood is then wasted. Reducing the rate of cancellations might allow greater use of this valuable technique.

3. Organisation of vascular services

Use of blood products >> Perioperative cell salvage

55% (93/168) of hospitals responded that cell savers for intraoperative cell salvage were routinely available in theatre (Figure 11). Cell savers were more likely to be available in large vascular units.

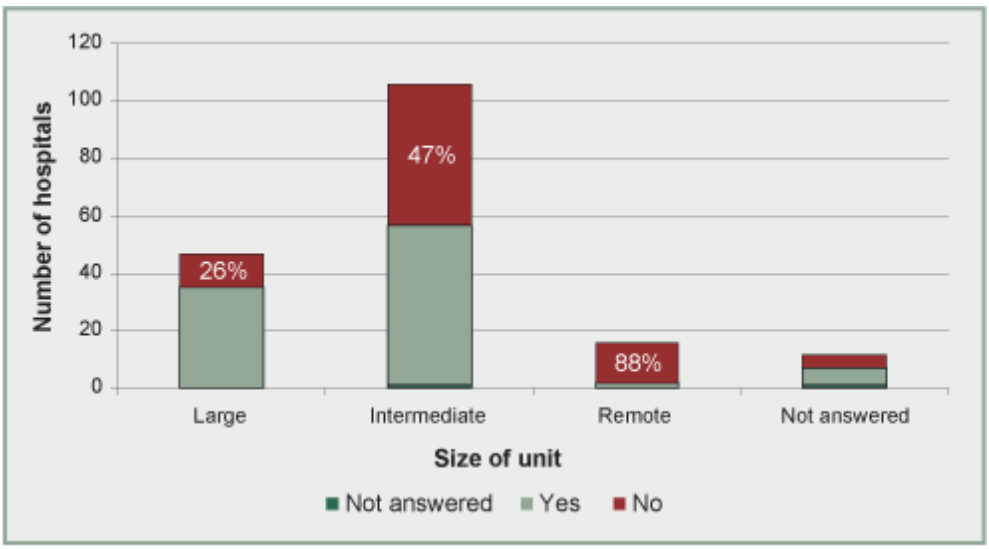

Figure 11. Routine availability of cell saver devices in hospitals by size of vascular unit *n=181. Percentages refer to hospitals that do not have cell saver devices routinely available.*

The technology for intraoperative cell salvage has been available for some years. The capital cost of the machines is substantial but with the rise in the cost to Trusts of donor blood, the cost of the disposable equipment required for each operation now equates to the cost of one donated unit of blood. If use of the machine results in averting the use of two units of donated blood then there is the potential for a net saving to the hospital. In addition, the patient is protected from the risks of donated blood. The introduction of cell saving equipment requires that sufficient theatre staff are trained in its operation so that someone competent is always available when the equipment is needed.

“Better Blood Transfusion” was circulated in July 2002 [18]. By Spring 2004 when this data was collected only 55% of hospitals in the study had managed to introduce this technology.

3. Organisation of vascular services

Destination after AAA repair >> Elective AAA repair

There was a extensive use of Level 3 ICU care after elective open AAA repair.

9% of patients were reported to have been nursed in recovery areas for a substantial period after surgery.

Hospitals were asked to specify their recommended immediate destination after an elective AAA repair. There were differences in the answers from different sized units. Respondents were specifically directed not to mark “recovery area” if the patient only received immediate post-anaesthetic care before transfer to one of the other destinations listed in Table 5.

Table 5. Size of vascular unit by recommended immediate destination for elective AAA repair *n=181. Answers may be multiple.*

Size of unit	Recovery area	ICU	HDU	Combined ICU/HDU	Vascular ward	General ward	Not answered
Large	2	15	20	10	1	0	0
Intermediate	1	46	31	29	0	0	3
Remote	1	7	2	3	0	1	2
Sub-total	**4**	**68**	**53**	**42**	**1**	**1**	**5**
Not answered	0	2	2	1	0	0	7
Total	**4**	**70**	**55**	**43**	**1**	**1**	**12**

The replies that gave “Combined ICU/HDU” as the patient’s destination after elective surgery make it difficult to assess the level of care given at those hospitals. It appears that overall, patients in large vascular units were more likely to go to HDU after elective AAA, whereas patients at intermediate and small units were more likely to go to ICU. Assuming that there is no difference in the case-mix between the various size units, this finding implies a misuse of resources by the smaller units. With modern anaesthesia and analgesia it is possible for patients to be warm, in a stable cardiovascular status and breathing spontaneously at the end of elective AAA repair, and therefore not to require Level 3 support. It is well recognised that the demand for Level 3 beds exceeds the supply so that patients should not be sent to ICUs when the resources of ICUs are not required. Anaesthetists, surgeons and intensivists should examine the destination of patients after elective AAA repair. If patients commonly are admitted to ICU Level 3 care they should investigate what is preventing these patients being cared for in Level 2 beds.

One possible reason for the use of Level 3 beds may be the quality of Level 2 care. There was anecdotal evidence from advisors that some hospitals with beds designated as being Level 2 standard find it difficult to provide nursing staff who are actually able to deliver Level 2 care on a consistent basis. In such circumstances, clinicians may feel that the only way to ensure safe care for patients after complex surgery is to admit them to Level 3 beds. “Comprehensive Critical Care” [19] recommends that Level 2 and Level 3 beds should be adjacent so that skills may be used flexibly to prevent such situations arising. Investment following the publication of “Comprehensive Critical Care” has resulted in a larger increase in HDU than ICU beds, so cancellations will be less likely if AAA patients are scheduled for HDU care after surgery.

From the organisational questionnaire, 2% (4/169, no answer on 12 questionnaires) of hospitals specified that the recovery area was the intended destination after elective surgery. These recovery areas may have been specifically equipped and staffed to manage high level postoperative care. From the anaesthetic questionnaire, 9% (35/373) of elective patients were reported to have gone to the recovery area as a primary destination (57 questionnaires were

unanswered). Presumably staff were forced to keep patients in recovery areas because a staffed bed in HDU or ICU was not available when needed. Most recovery areas are not equipped to the standard required to care for patients after major surgery for substantial periods of time nor do they have adequate arrangements for medical cover. Despite the stress and upset to the patient, major surgery should not proceed unless all the essential elements of the care package (surgeon, anaesthetist, critical care facilities etc) are available.

If the provision of care for aortic surgery, elective or emergency, is changed so that surgery is transferred to another hospital, the resources for critical care must be transferred as well, otherwise the critical care facilities at the receiving hospital will be unable to cope with the extra workload.

3. Organisation of vascular services

Destination after AAA repair >> Emergency AAA repair

Four hospitals usually admitted emergency AAA repair patients to HDU after surgery. All other hospitals admitted patients to either an ICU or a combined ICU/HDU. This is appropriate and would be expected for patients after surgery that is complex and carries a very high mortality.

No hospital specified the recovery area as the intended destination after emergency aortic aneurysm repair. Nevertheless the data from the anaesthetic questionnaire were that 6% of patients went to the recovery area after surgery. This may be further evidence of inadequate critical care resources.

Anaesthetic and critical care staff should ensure that all instances when patients cannot get access to critical care beds after aortic surgery are documented so that pressure can be placed on purchasers and Trust management to provide the facilities required for this major surgery.

3. Organisation of vascular services

Outcome of surgery >> Elective open AAA repair

Overall mortality for elective open aortic aneurysm repair was 6.2%.

Figure 12 shows the outcome after repair of AAA in elective admission patients in the different sized units. The overall mortality was 6.2% (27/434).

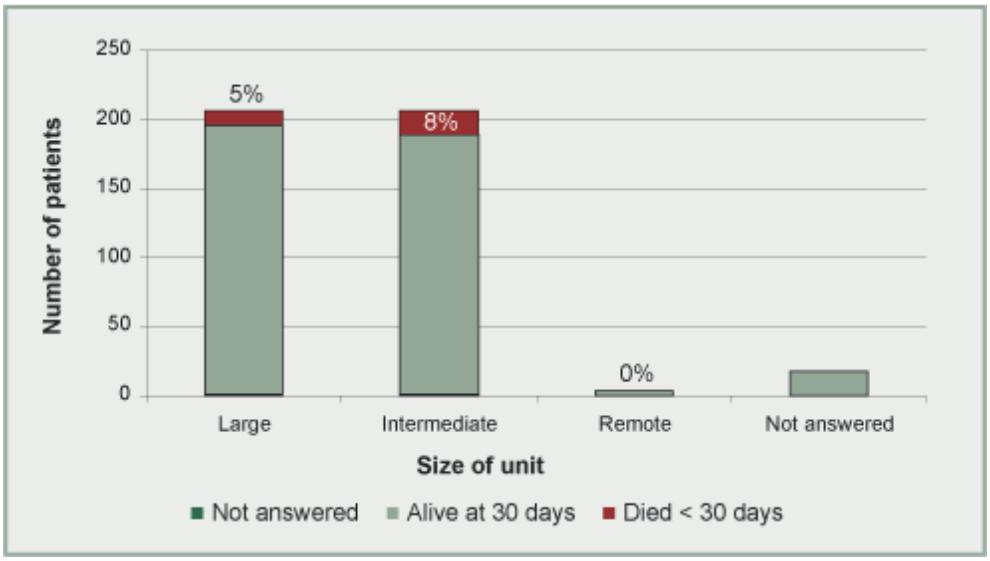

Figure 12. Outcome in elective open repairs by size of vascular unit *n=434. Percentages refer to patients who died in hospital within 30 days.*

3. Organisation of vascular services

Outcome of surgery >> Open repair after emergency admission

Overall mortality for open AAA repair after emergency admission was 36%.

Patients admitted as an emergency with an aortic aneurysm were more likely to receive palliative, non-operative treatment in an intermediate sized vascular unit than in a large unit.

The overall mortality for patients who underwent open AAA repair after emergency admission was 36% (94/264). There was little difference between the operative outcome between large and intermediate units (Table 6).

Table 6. Outcome after emergency open repair by size of vascular unit

	Large unit	%	Intermediate unit	%	Remote unit	%	Not answered	Total
Died within 30 days	35	29	44	35	6	75	9	**94**
Alive at 30 days	86		80		2		2	**170**
Total	**121**		**124**		**8**		**11**	**264**

It is known that there is a difference in operative mortality for emergency patients depending on whether the aneurysm is ruptured or not, so the outcome of patients has been considered separately for patients with ruptured and unruptured aneurysms.

3. Organisation of vascular services

Outcome of surgery >> Ruptured aneurysms

Outcome after operation for ruptured AAA is strongly influenced by how many patients who present with a ruptured aneurysm actually proceed to operation. It is reasonable to assume that a decision not to operate, whether made by the patient, the family, or the surgeon, is more likely when the outcome is thought to be particularly hopeless; therefore a hospital that has a greater propensity to recommend non-operative, palliative treatment will tend to have a better outcome for those patients who do undergo surgery.

Figure 13 presents the outcome for patients in this study admitted with a ruptured AAA, whether or not the patient went for surgery; that is, the figures for the patients who died include the patients who received palliative care as well as those who died within 30 days of surgery.

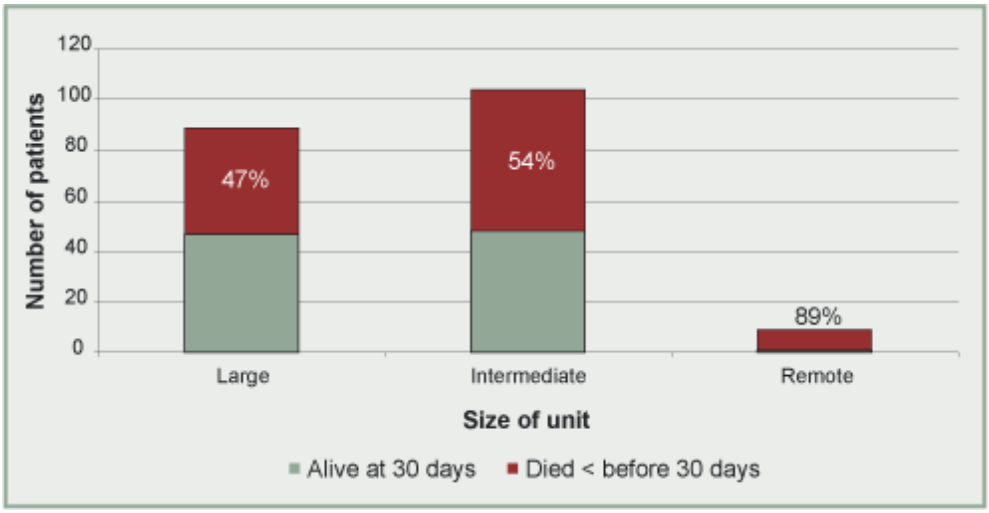

Figure 13. Outcome in ruptured emergency open repairs by size of vascular unit (including palliative patients *n=202/212. Percentages refer to patients who died in hospital within 30 days.*

According to these data a greater proportion of patients died in intermediate sized units. This was associated with a greater reluctance by intermediate sized units to operate on patients admitted as an emergency with an aortic aneurysm (Figure 14).

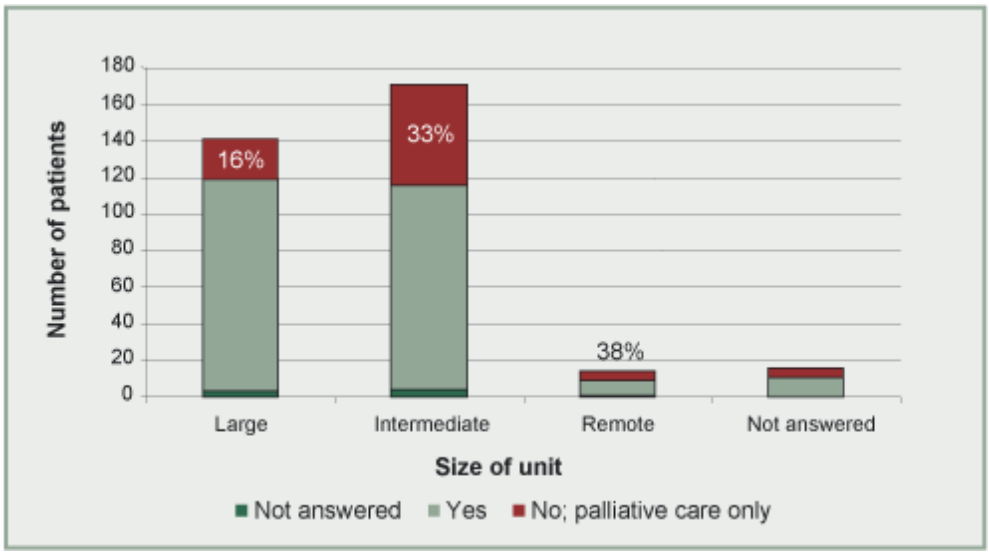

Figure 14. Decision to operate on emergency cases (including palliative patients) by size of vascular unit *n=342. Percentages refer to patients who received palliative care only.*

3. Organisation of vascular services

Outcome of surgery >> Unruptured aneurysms

Figure 15. Outcome in unruptured emergency open cases (including palliative patients) by size of vascular unit *n=98/101. Percentages refer to patients who died within 30 days.*

There was a difference in outcome associated with undergoing surgery at a large vascular unit compared with an intermediate vascular unit (Figure 15). This is an unexpected finding. The numbers were small. Further investigations of the management of unruptured AAAs admitted as emergencies would be helpful to determine if this phenomenon is sustained in other studies, and if so, the cause.

Transfer policies may also have an influence on figures for the survival of emergency AAA patients.

3. Organisation of vascular services

Transfer of patients

There were 50 patients who were transferred as emergencies from one hospital to another. There have been concerns that in some circumstances the outcome for such patients could be worse, either because of adverse effects of the transfer process itself or because of the extra delay that is likely to accompany transfer. NCEPOD examined the outcome associated with patients that were transferred as opposed to those who were admitted directly to the hospital where the operation took place.

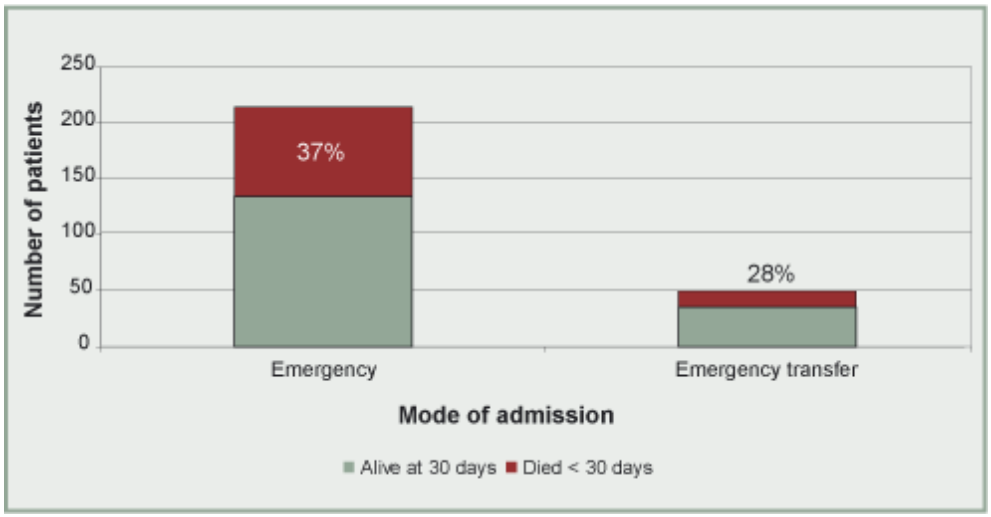

Figure 16. Outcome in emergency open repairs by whether patients were transferred *n=264. Percentages refer to patients who died in hospital within 30 days.*

There did not appear to be an adverse effect on outcome for patients who were admitted as an emergency transfer (Figure 16). NCEPOD collected information from the hospital where the operation took place, so has no data on whether any patients died during the transfer, nor whether the population of patients chosen to be transferred differed from the patients whom hospitals chose not to transfer out.

Variations in transfer policies may affect the survival of patients in different sized units. It is possible that smaller units may transfer the relatively stable patients to tertiary centres. Patients judged too unfit to be transferred would be managed in the smaller unit and would be likely to have a poor outcome with or without surgery.

3. Organisation of vascular services

Audit /clinical governance meetings

Hospitals were asked whether the surgical department held regular audit/clinical governance meetings. 97% (173/178) held such meetings. This figure is commendable.

At those hospitals that held audit meetings the numbers of health professionals that were involved are detailed in Table 7.

Table 7. Health professionals involved in audit/clinical governance meetings

Health professional	Number of hospitals
Surgeons	173
Nurses	125
Anaesthetists	76
Radiologists	66
ICU consultants	52
Operating department practitioners	37
Pathologists	27
Pharmacists	25
Microbiologists	24
Physiotherapists	21
Nutritionists	8
Other	50

Hospitals were also asked whether there were separate multidisciplinary meetings specifically for vascular surgery. At those hospitals that held separate vascular surgery meetings the numbers of health professionals that were involved are detailed in Table 8.

Table 8. Health professionals involved in vascular surgery meetings

Health professional	Number of hospitals
Surgeons	98
Nurses	59
Anaesthetists	23
Radiologists	105
ICU consultants	15
Operating department practitioners	10
Pathologists	4
Pharmacists	6
Microbiologists	3
Physiotherapists	15
Nutritionists	2
Other	37

All hospitals should have meetings to discuss and reflect on the process and outcome of surgical services, especially vascular surgical services which will have a higher associated mortality for

both elective and emergency operations than almost all other areas of surgery. It is unimportant whether the meetings are termed audit, governance, morbidity and mortality or some other title so long as there is a structured process to assess and improve practice. Hospitals should consider if the needs of vascular surgery can be met within a general forum or whether they are best served by meetings devoted to vascular surgery alone. It is not acceptable that even a small minority of hospitals do not have governance meetings of any sort.

It is praiseworthy that such a wide range of clinical specialties contribute to these meetings. These data should lead clinicians to consider whether all the necessary people attend their local meetings. The high number of radiologists attending specific vascular meetings may reflect their part in assessing patients for interventional procedures and in performing these procedures. NCEPOD did not ask specifically whether cardiologists attended audit/governance meetings. This was unfortunate given the involvement of cardiologists in the preoperative assessment of vascular surgery patients. Attendance by cardiologists may have contributed to those marked ‘Other’.

There is little point in organising multidisciplinary meetings if people are unable to attend because of the timing of the meeting or other clinical commitments. Audit/governance is a proper and essential part of patient care. Meetings should be held during the working day, not in the early morning or evening. The time required should be reflected in consultant job plans.

3. Organisation of vascular services

Patient information

The data above indicate that there are substantial differences between hospitals in the range of services they are able to provide for elective and emergency aortic surgery patients and in the expertise of their staff. Patients should always have as much information as possible so that their decisions about their care are fully informed. The ‘Choose and Book’ initiative reinforces the need for patients to receive information to help them make choices. Hospitals, general practitioners and patients should consider how best to present all the information patients need for them to make a proper decision about the quality of care that a hospital provides.

3. Organisation of vascular services

Recommendations

Trusts should ensure the availability outside normal working hours of radiology services including CT scanners.

Clinicians, purchasers, Trusts and Strategic Health Authorities should review whether elective aortic aneurysm surgery should be concentrated in fewer hospitals.

Major elective surgery should not take place unless all essential elements of the care package are available.

3. Organisation of vascular services

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