“Patients with a vascular emergency should have rapid access to a specialist vascular team in all parts of the UK.”
The contents of this document have been endorsed by the following organisations:

ASGBI  
Association of Surgeons of  
Great Britain and Ireland

British Society of  
Interventional Radiology

Circulation Foundation

Foundation

Society of Vascular Nurses

wwwsvnorguk

Society of Vascular Technologists
The Provision of Services for Patients with Vascular Disease

2009

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Overview

The aim of the Vascular Society of Great Britain and Ireland (VSGBI) is to promote the best possible care for patients with peripheral vascular disease. The Society first produced a document that described the essential components of a vascular service ten years ago (Provision of Vascular Services, 1998). It proved extremely useful to Members of the Society when developing their local vascular services. Much has changed in the last decade, and the latest version of the document focuses on the various new ways in which vascular specialists work. Some issues that were problematic at the last revision in 2004 continue to evolve. The European Working Time Directive has made achieving vascular specialty training more difficult, and staffing vascular wards with junior medical staff almost impossible. It is increasingly recognised that Vascular Surgery is separating from General Surgery with patients expecting round the clock availability of a vascular specialist, and both general and vascular surgeons becoming deskillled in each other's fields. Many vascular problems can be treated by endovascular methods. Evolution of vascular services will require a new relationship with radiology colleagues, as well as evolving links with vascular medicine and stroke services. Practical experience of interventional radiology techniques will be sought increasingly by surgical trainees, and further clinical skills will be desired by radiology trainees wishing to become a vascular specialist. The aim of this revision of Provision of Vascular Services 2004 is to describe a multidisciplinary service with vascular patients at its centre, taking full account of Department of Health service initiatives and guidance from the National Institute of Health and Clinical Excellence (NICE).
1. **Summary**

This document sets out the principles by which individual patients should obtain access to high quality vascular services for both elective and emergency care.

1.1 Patients with disorders of the arteries, veins and lymphatics should expect to be cared for by a vascular specialist with a thorough understanding of their condition, who is able to organise all appropriate investigations and treatment, including lifestyle advice, drug therapy, interventional radiology and surgery.

1.2 Pressures for change in the way vascular services are delivered should be driven by patient outcomes. Adverse outcomes in patients with vascular disease include unnecessary deaths, strokes and limb amputations, and are minimised by the availability of a local specialist vascular service, dealing with sufficient volumes to maximise expertise. Minimising adverse outcomes is the most cost-effective way to deliver the service. Sometimes withholding intervention, i.e. conservative treatment, is the most appropriate management.

1.3 There is a progressive increase in the number of patients with vascular disease who need treatment. The development of endovascular alternatives to many standard surgical techniques has increased the options for patients, and in some cases, has provided real advances. There remains, however, a shortage of practitioners trained to deliver complex endovascular therapies.

1.4 Clinicians without vascular training no longer have the necessary skills to intervene on vascular patients and produce demonstrably worse outcomes. Patients with vascular disease should expect to be managed by vascular specialists, both electively and as an emergency. General surgeons should no longer be involved in providing out-of-hours emergency cover for vascular patients, though they should be sufficiently skilled to triage patients before seeking the involvement of a vascular specialist. Patients with a vascular emergency should expect to be able to access a vascular team rapidly in all parts of the UK, and vascular services may need further reconfiguration to provide 24/7 vascular cover for their local population. Patients may also need to travel beyond their local hospital to access this high quality treatment.

1.5 Since the 2004 Provision of Vascular Services document, there has been considerable change in the structure of vascular services. In some areas there has been centralisation, and in others clinical networks have formed in response to the need to provide comprehensive emergency cover. It is no longer acceptable to provide single-handed, or even two surgeon cover for vascular surgery outside a network. The current document outlines the different types of clinical network and describes the essential components of an effective vascular service.

1.6 Vascular services are not supported by a National Service Framework (NSF) but are subject to National Health Service initiatives such as stroke prevention, diabetes management, renal service provision and the operating procedures of the new NHS Abdominal Aortic Aneurysm Screening Programme (NAAASP), as well as guidelines from NICE. There remains evidence of inequality in both provision and outcome according to geographical area in the UK. Inferior and often more costly outcomes occur where the patient does not have access to a vascular specialist opinion at their local hospital. Outreach vascular clinics organised through adjacent vascular units are the solution to this problem. No patient should suffer from the lack of inpatient vascular services in their local hospital. Clear written protocols for dealing with both elective and emergency vascular patients should exist in all hospitals, including arrangements for transfer to the nearest vascular service.

1.7 The vascular service should be underpinned by a programme to improve the quality of both service provision, and the outcomes of intervention. Clinical pathways for the common vascular conditions will speed access to the service and ensure patients receive treatment at the right time in the right place. Each vascular specialist should have knowledge of their own outcomes, an important
component of clinical governance and individual revalidation. The National Vascular Database and other recognised registries such as the BSIR British Iliac Angioplasty and Stent registry should be the focus of data collection with respect to index vascular procedures, whereby results should be available in a way that is transparent and accountable. The Societies should provide back up and support for any service with evidence of problems.
2. Introduction

2.1 This document sets out the principles by which a 24 hour, high quality, consultant-led vascular service might best deliver optimal patient care.

2.2 The document is intended to assist those responsible for the provision and resourcing of health care, as well as commissioners of the service. Potential mechanisms for the development of existing resources are discussed, which balance the needs of patient access with the provision of comprehensive vascular services.

2.3 Both arterial and venous diseases are common in the community and their incidence and severity increase with age. The core activities of the vascular specialist include:

- Preventing death from ruptured abdominal aortic aneurysm
- Preventing stroke due to carotid artery disease
- Preventing leg amputation due to peripheral arterial disease
- Healing leg ulceration

In addition, patients suffer from many different vascular disorders that adversely affect quality of life, such as intermittent claudication, varicose veins, lymphatic disorders, and many more. The vascular specialist has access to both interventional and medical therapies that may alleviate the symptoms and complications of these disorders.

- Those specialising in endovascular therapy will also need to provide core elective and emergency services for control of bleeding in the context of trauma, gastrointestinal haemorrhage and obstetric emergencies; endovascular therapy for dialysis and cancer patients including fistula salvage, and insertion of central lines; embolisation therapy for cancers and management of thromboembolic disease.

Current Problems and Pressures for Change

2.4 Many patients with vascular disease present as an emergency, and in the past have often been managed by a general surgeon. This is no longer acceptable. Every patient with a vascular emergency should expect to be treated by a trained vascular specialist. This includes patients with trauma to any major artery or vein, and acute bleeding that can be managed radiologically. The majority of the UK and Ireland now has comprehensive coverage by vascular specialists, but PCTs and SHAs should ensure that the remainder are covered as soon as possible. Patients with a vascular emergency should expect to have rapid access to a specialist vascular team in all parts of the UK.

2.5 Vascular surgery in the UK and Ireland is emerging as a separate speciality from its background as a subspecialty of general surgery. For the first time, the majority of Members of the VSGBI specialise only in treating vascular disease, rather than being general surgeons. The Association of Surgeons of Great Britain and Ireland has recognised this and indicated that it does not expect vascular specialists to be involved in the management of general surgical emergencies.

2.6 Consultants who have not undertaken specialist training in vascular surgery no longer have sufficient experience to offer an emergency vascular service within the umbrella of a general surgery emergency take, although they should be sufficiently skilled to assess and triage patients so they are referred appropriately. Patients with a vascular emergency should expect to be treated by a trained specialist. Newly appointed consultant gastrointestinal surgeons are seldom equipped to deal with vascular emergencies and rightly refuse to take them on. This clinical governance issue is driving the changes in the way in which emergency vascular services are delivered.
2.7 Most remaining general vascular surgeons are still needed to cover emergency general surgery on call, but seldom undertake elective major surgery outwith their specialty. As vascular surgeons become more specialised, they become deskilled in other specialist areas of general surgery. This lack of elective practice also creates governance pressures on vascular surgeons to withdraw from the general surgery emergency rota as they instigate separate vascular emergency rotas. Non-vascular general surgeons should appreciate that their vascular colleagues cannot run a separate vascular emergency service without withdrawing from the general surgery rota in order to maintain equity of on call commitment.

2.8 The demands of the European Working Time Directive (EWTD) mean that trainee vascular surgeons have much less exposure to emergency general surgery than has been the case in the past. Daytime training in elective surgery is also restricted and it will be not be possible for trainees to obtain competence in more than one sub-speciality area of general surgery in the time available. Newly appointed vascular consultants seldom have sufficient expertise outside vascular surgery to offer a general surgery emergency service.

2.9 There is a shortage of vascular interventional radiologists; many hospitals that attempt to provide a comprehensive vascular service have too few vascular radiology consultants. Emergency vascular radiology demands skills that may not be provided by non-vascular radiologists and so the range of diagnostic and therapeutic options available to vascular patients out of hours is limited. If an optimum service is to be provided to vascular patients, particularly for emergencies, then interventional radiologists should form part of the same clinical network as vascular surgeons. Elective and emergency vascular surgical and interventional radiology services should be developed and co-ordinated jointly.

2.10 There has been little strategic planning in the way vascular services are commissioned and delivered. As far back as the original Provision of Vascular Services document, it was recommended that coalescence of adjacent vascular services onto a single site is the optimal model for service delivery. This centralisation has been achieved in many of the larger conurbations where existing services were already in close proximity. In less densely populated areas, moving specialists and facilities into a central hospital has not proved easy. The main driver for change has been the need to provide a comprehensive emergency vascular service. One solution that avoids centralisation is the formation of a network of adjacent hospitals and specialists providing collaborative care.

2.11 The responsibility for purchasing vascular services formerly lay in the hands of Primary Care Trusts (PCTs). Commissioning in England currently lies in the hands of ten Specialised Commissioning Groups (SCGs), for England. These are joint subcommittees of all PCTs in a region (within an Strategic Health Authority - SHA – boundary). Many PCTs and even SHAs lacked experience in the issues surrounding configuration of hospital services and were more concerned with the provision of hospital services within their own locality rather than covering a wider geographical area. The SCGs should play a bigger role in reconfiguration of vascular services where more than one PCT is involved, in order to overcome these problems. The recent announcement of a NHS Abdominal Aortic Aneurysm Screening Programme requires the formation of local screening units based on a population of 800,000. This should stimulate work to increase the number of networks, and reduce the number of small independent vascular units. The organisation of local screening programmes will remain the responsibility of the SHAs, unless passed over to the SCGs. Similar themes exist in the commissioning of services in Wales, Scotland and Ireland.

2.12 Both the Department of Health and NICE have focused attention on stroke prevention. Together with detailed access targets are recommendations for carotid endarterectomy within 48h of a neurological event in high risk patients. In the absence of a National Service Framework for the treatment of vascular disease, these government initiatives will underpin planning for vascular services for the foreseeable future. One problem resulting from this is that apart from aneurysm screening (funded for the first two years only) there is likely to be no direct additional investment in...
vascular services. Paradoxically the benefit from investment in service development to treat one condition may be erased by lack of investment in another. It is therefore important that the NHS should consider the requirements of vascular services in line with its development of cardiac, renal and diabetes services.

2.13 The provision of an effective vascular service is relatively expensive. Vascular units have high bed occupancies and some patients may need prolonged hospital stay, particularly in centres where rehabilitation and community services are not readily available. The surgery is technically demanding with significant demands on both theatre time and critical care. Advances in endovascular treatment may offset some of this expense but many of these procedures are also technically demanding and time consuming and require sophisticated and often expensive interventional radiology facilities and disposables. Replicating these services in every hospital may not be cost effective, but must be balanced against issues of equality of patient access and aspirations for a local service.

2.14 Lord Darzi's recent NHS review supported centralisation of high technology services, but with an expectation of an increase in care close to home. Patients who need vascular intervention are normally willing to travel to obtain specialist care, but provision of a local vascular service is important to achieve equality of access to elective care. There is evidence of a geographical variation in the number of vascular interventions according to the level of local vascular services. Patients are more likely to undergo conservative management or amputation in hospitals with low volumes of vascular surgery rather than be transferred to an adjacent high volume hospital to access carotid or limb salvage surgery.

2.15 Every patient in the country should have the opportunity to consult with a vascular specialist at a convenient local hospital. Yet, it is not appropriate or practical to provide the full range of vascular facilities on every hospital site. It is generally agreed that hospitals with low volumes of vascular interventions achieve worse outcomes and in these circumstances outpatient services should be offered at local hospitals, with in-patient care at an adjacent higher volume hospital. Only after a full discussion with the vascular specialist will a patient be in a position to make an informed judgment regarding the need to undergo treatment in an adjacent hospital with specialist facilities. The vascular specialist will also be in a position to educate local hospital and GP colleagues of the benefits to their patients that such transfers might offer. The provision of a local vascular presence can also help to alleviate concerns from colleagues in other specialties who depend on special relationships with vascular surgery.

2.16 In the absence of limitless resources a compromise must be achieved between local access and the delivery of specialist care. There needs to be a balance between the manpower, capital and other resources required to provide an effective service. The driver for that balance must be the achievement of the best possible outcomes for individual patients. Solutions may cross natural PCT and SHA boundaries, but that should not restrict the construction of sensible models of vascular care that benefit local communities.
3 The Nature of Vascular Services

3.1 Vascular services deal with disorders of the arteries, veins and lymphatics.

3.2 Many patients referred to a vascular specialist by their GP with diseases of their arteries do not require surgical or radiological intervention. They require simple reassurance and lifestyle advice (stop smoking, lose weight, take regular exercise) coupled with measures to reduce their future risk of heart disease and stroke (aspirin and lipid-lowering therapy, blood pressure control). Some will require further investigation by vascular technologists or radiologists, with a view to interventional radiology treatments such as balloon angioplasty or stenting. Only a small proportion will require surgery.

3.3 Patients should expect to be referred to vascular units able to provide complete medical, surgical and interventional radiology care. The medical management of peripheral arterial disease is provided in most hospitals by vascular surgical specialists. It is important that whoever assesses a vascular patient has a full understanding of potential medical, surgical and endovascular interventions available, together with their risks and benefits.

3.4 Vascular services should be provided by multi-disciplinary teams. Specialist vascular nurses can offer claudication, diabetic foot and lifestyle advice clinics, as well as managing dedicated vascular wards with their special expertise in wound and ulcer care. Vascular research nurses play an important role in research and audit. Physiotherapists offer supervised exercise classes for claudicants, and rehabilitation to amputees, where they work closely with limb-fitting services. Occupational therapists assist in the return of amputees to the community. Radiographers and clinical vascular scientists of fer diagnostic services and postoperative bypass graft surveillance. Traditionally, interventional radiologists have offered diagnostic and interventional radiology and vascular surgeons have undertaken surgical management. There is already blurring of these roles and this is likely to further develop in the future. At all times vascular interventions should be delivered or supervised by a consultant with appropriate training in that procedure.

3.5 It is no longer acceptable for a patient with vascular disease to be cared for by a general surgeon without specialist vascular training. Specialist vascular teams achieve superior clinical outcomes and specifically have lower mortality rates after abdominal aortic aneurysm repair, lower amputation rates for critical lower limb ischaemia and lower stroke risks after carotid endarterectomy. The National Confidential Enquiry into Perioperative Deaths (NCEPOD) has repeatedly emphasised the need for patients with acute vascular conditions to be treated by a specialist vascular team.

3.6 Up to 40% of vascular patients present as emergency or urgent referrals. Consultants are directly involved in the care of the majority of these patients, given the complexity of the conditions. The out-of-hours workload is therefore more onerous than in many other surgical specialties. Data from a survey by the VSGBI in 2003 suggested that a population of 100000 generates an average of 70 (range 46-92) arterial operations, 47 (range 40-75) interventional radiology procedures and 81 (range 32-125) venous operations per annum (excluding renal access surgery). To deal with these volumes, a hospital with a vascular service needs a minimum of one vascular surgical specialist per 150,000 population, or one transplant surgeon with a vascular interest per 100,000 population. A survey by the Yorkshire Chief Executive demonstrated a similar high workload out-of-hours for interventional radiology. An equivalent number of interventional radiologists will be required to provide emergency care. These figures do not take into account the increasing workload in recent years, and the reduction in the amount of time that junior staff working on full shift rotas are available for service activity on the wards, in theatre and in outpatients. They represent a minimum estimate of the number of consultants required until more detailed workload figures are available.
4 Factors Affecting Vascular Workload

4.1 The 1990s saw an increase in the volume of arterial reconstructions, coincident with an increase both in the number of vascular surgeons and their degree of sub-specialisation. Between 1990 and 1995 the number of arterial reconstructions rose in one region from 20.8 to 28 per 100,000 population per annum and the number of in-patient episodes for treatment of arterial disease rose from 35.7 to 47.6 per 100,000. More recent data from the Department of Health suggest that volumes of arterial surgery have started to decrease (Figure 1). Similarly the number of interventions for venous disease also appears to be falling, almost certainly as a result of local restrictions on access to care. Vascular interventional radiologists are also increasingly specialising and focusing on both the diagnostic and therapeutic aspects of vascular disease. The move towards non-invasive imaging of patients with vascular disease is reflected in Figure 1b. Data from Leeds show that the number of endovascular interventions has increased despite a large decrease in the proportion of diagnostic angiograms. Vascular diagnostic studies are now performed using duplex imaging, CT or MR angiography. Such a shift in imaging strategy will have an impact upon the requirement for the newer imaging modalities.

Figure 1: Summary of vascular procedures in England. NHS Statistics (www.dh.gov.uk)

(a) carotid and aortic interventions

(b) interventions for leg ischaemia
The Impact of Risk Factors for Vascular Disease

4.2 The prevalence of vascular disease increases with age. The complexity, outcome and costs of vascular intervention are age-dependent. Average life expectancy continues to rise (Table 1) and this factor alone suggests that demand for vascular services is likely to continue to increase with time.

Table 1: Male and female life expectancy in England (Office of National Statistics www.dh.gov.uk)

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4.3 There are currently 2.35 million people with diabetes mellitus in England, a 4% increase in the last five years. This is projected to rise above 2.5 million by 2010. Type 2 diabetes is up to six times more common in people of South Asian descent and up to three times more common in those of African and African-Caribbean descent. Mortality and morbidity are increased by socio-economic deprivation. Morbidity from the complications of diabetes is three and a half times higher in social class V than social class I. Vascular disease is the major cause of morbidity in diabetes and the risks of disease progression are higher. Over 40% of patients admitted under the care of the vascular team have diabetes. Lack of exercise, poor diet and increasing age are all associated with an increasing incidence of Type 2 diabetes. The epidemic of obesity is likely to have the biggest impact on the prevalence of diabetes in the next decade, and may well cause a dramatic rise. In 1993 15% of adults were classified as obese; this has risen to 24% in 2006 (Figure 2).
4.4 Smoking is a major cause of vascular disease and over 80% of vascular patients are current or ex-smokers. Although there was a rapid decline in the proportion of smokers during the 1980s, when 39% of adults smoked, this decline then levelled off in both men and women aged less than 65 years. New Department of Health initiatives on smoking, the development of smoking cessation clinics in primary and secondary care, and the ban on smoking in public areas has resulted in a further decline from 24% in 2005 to 22% in 2006. Smokers are at greater risk of complications from vascular interventions because of cardiac and respiratory co-morbidity and the longer-term success of vascular intervention is reduced in patients who continue to smoke.

4.5 The affluence of modern society encourages high fat diets, obesity and lack of exercise. These factors all contribute to the development of hyperlipidaemia and hypertension, both potent risk factors for vascular disease. Childhood obesity has also been linked to the development of diabetes and hypertension in later life.

4.6 There is clear evidence that secondary prevention by antiplatelet therapy, lipid lowering therapy, control of hypertension, smoking cessation, exercise and weight loss play a major role in reducing the morbidity and mortality of atherosclerosis.
Figure 4: Target for reducing mortality from cardiovascular disease

Rates are calculated using the European Standard population to take account of differences in age structure. ICD9 data for 1993 to 1998 and 2000 have been adjusted to be comparable with ICD10 data for 1999 and 2001 onwards. Source ONS (ICD 9 390-459; ICD10 100-199).

Vascular services are taking on the additional role of advising primary care physicians in this growing field of secondary prevention for patients whose atherosclerosis affects their peripheral arterial system. The Department of Health target is to reduce mortality from circulatory diseases by 40% before 2010 (Figure 4).

4.7 There are variations in the prevalence of vascular disease between different parts of the country. These variations are shown by example in Table 2, where vascular disease is included within circulatory disease, cerebrovascular disease and thrombosis/embolism of other arteries. The reasons for this are complex and poorly understood but include genetic influences, diet, social class, age and possibly climate. These factors introduce geographical variation in the demands for vascular services. Popular retirement areas are places of high demand on vascular services as they have relatively higher proportions of elderly patients.

Table 2: Comparison of causes of death per 100000 in Great Britain (1997) and Ireland (1996)

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<td>Thrombosis/embolism of other arteries</td>
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4.8 In addition there remain significant variations in the provision of vascular procedures around England. For example, the rate of carotid endarterectomy per 100,000 people varies from 2.5 to 14 in England (Figure 5).

Figure 5. Regional variation in carotid endarterectomy procedures

**Carotid endarterectomies performed per 100 000 population by region 2005-2006**

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**Lower limb ischaemia**

4.9 Around 20% of the population over 60 years of age have peripheral arterial disease, although only a quarter of those affected are symptomatic. Smokers, diabetics and patients with coronary artery disease have a particularly high incidence. Even in the absence of symptoms, the presence of a reduced blood pressure at the ankle signifies a 3 to 4-fold increase in the risk of subsequent heart attack or stroke. As this morbidity and mortality can be reduced significantly by the use of secondary prevention (see above) there may be a case for population screening using the ankle/brachial pressure index to identify patients at risk. This is as yet unproven.

4.10 Peripheral arterial disease produces pain in the leg on walking (claudication). Symptoms only become severe and progressive in about 20% of patients, but the remainder still need lifestyle advice and secondary prevention. While many patients with mild symptoms are managed in primary care, there is still a large number with more severe symptoms who are referred to the vascular service for assessment. Some pose difficult diagnostic dilemmas and may require investigation and treatment for risk factors and associated diseases. A minority will require interventional treatment with balloon angioplasty or surgery, if the symptoms are particularly disabling. Supervised exercise classes have been shown to improve walking distance and quality of life \(^1\). Recent evidence from the MIMIC trial suggests that the combination of angioplasty and exercise has a greater effect on quality of life in patients with claudication \(^2\).
Peripheral arterial disease may progress to critical limb ischaemia, with constant and intractable pain preventing sleep, often with ulceration or gangrene. These patients are at particular risk of losing their leg without treatment. Many are referred for emergency admission and interventional treatment (surgery or radiology) is essential to avoid amputation. Recent research has suggested that initial endovascular treatment in these patients (particularly by subintimal angioplasty) is as effective up to two years as initial surgery. Such treatment is cost-effective. When loss of the leg becomes unavoidable, amputation and early postoperative rehabilitation is the responsibility of the vascular specialist.

Only 1-2% of patients with claudication eventually need an amputation, although the risk is higher (5%) in patients with diabetes. A vascular unit serving a population of 500,000 will therefore expect to see around 100 patients with critical leg ischaemia per year. While the in-hospital costs of limb salvage surgery are broadly equivalent, the subsequent community healthcare costs of amputation are greatly in excess of those following successful arterial reconstruction. Many patients can no longer cope independently in the community after amputation and may require nursing home care.

There is evidence that hospitals providing high levels of interventional treatment also perform significantly fewer amputations (6 per 100,000 per annum vs. 10 per 100,000 per annum, P=0.02 in one example). They also perform a higher proportion of below knee compared to above knee amputations, which is beneficial because around 50% of below knee amputees become independently mobile with an artificial leg, compared to only 25% of above knee amputees.

It is likely that the great increase in the number of patients with diabetes over the next decade will have the biggest impact on vascular services. Many of these patients present as an emergency, and are at high risk of amputation. Prompt treatment of the infected diabetic foot can minimise the risk of subsequent amputation.

Abdominal aortic aneurysm

An aortic aneurysm occurs when the wall of the abdominal aorta weakens and stretches, caused by atherosclerotic degeneration. Aneurysms are commoner in the elderly and the incidence is rising as people live longer. There is a male preponderance; population screening has shown that 4% of men aged 65 have an enlarged aorta, though not all go on to develop a significant aneurysm. The more the aorta dilates, the weaker it gets, increasing the risk of rupture. Rupture of an aneurysm into the abdominal cavity is fatal if untreated and many patients die rapidly from exsanguination before they can reach hospital. Emergency open or endovascular repair is the only possible treatment. The patients are often so ill from loss of blood that only half of those who have urgent intervention survive; the overall mortality from a ruptured aneurysm is about 85% when those who die without reaching hospital are included. Eight to ten thousand patients die each year from ruptured aneurysm in England and Wales (1.5% of all deaths). It is clearly better to repair an abdominal aortic aneurysm before it ruptures, but non-ruptured aneurysms seldom cause symptoms and can be difficult to detect clinically.

Population screening for aortic aneurysm in men by ultrasound scanning has been shown to reduce disease-specific mortality by about 50% in meta-analysis of the existing randomised trials. It is also cost effective. In 2008, the Department of Health in England announced that it would fund a NHS Abdominal Aortic Aneurysm Screening Programme (NAAASP) for men, to be introduced over 5 years.

Elective repair of aortic aneurysm is one of the main functions of a vascular unit. The volume of elective procedures will increase as the NAAASP comes on stream, whilst the number of operations for rupture should gradually fall. Aneurysms occur in the elderly, who are not always suitable for operative repair. However, in the current era, many elderly patients are relatively fit and they are more likely to request intervention, particularly if suitable for endovascular repair, after counselling.
General practitioners are also more likely to refer elderly or unfit patients for consideration of surgery. A general increase in diagnostic imaging for other medical conditions also detects a number of aneurysms detected incidentally in localities where screening is not undertaken.

4.18 Elective or emergency open surgery to repair an abdominal aortic aneurysm is a major operation with a significant morbidity and mortality and requires adequate critical care facilities. There is no significant survival advantage to be gained from surgery to most aneurysms below 5.5cm in diameter, as the risk of rupture is less than the risk of open surgery. It is generally safe to observe smaller aneurysms with regular ultrasound imaging until the aneurysm reaches 5.5cm in diameter, unless it expands quickly or causes symptoms. The risk of rupture increases in aneurysms over 6cm in diameter and elective surgery is appropriate in fit patients with aneurysms larger than 5.5cm. Patients return to a normal life expectancy for their age after successful aneurysm repair.

4.19 An alternative treatment for selected aneurysms is endovascular repair using a covered stent graft introduced from the groin, an operation that is less stressful for the patient. Not all patients have an aneurysm that is anatomically suitable for endovascular repair using current technology, but this is a fast moving field. Endovascular repair has not been shown to reduce overall mortality after four years compared to open repair in randomised trials, but there are short term advantages in reduced early mortality, length of hospital stay and quality of life. Issues of long term durability, and cost remain challenges. Current National Institute of Health and Clinical Excellence (NICE) recommendations are that endovascular repair is appropriate to offer suitable patients. Endovascular repair is also emerging as a treatment for ruptured aneurysms, though this is not yet recommended by NICE. Setting up a service for emergency endovascular repair would have a major impact on the need for out of hours interventional vascular radiology.

4.20 A further novel approach to the treatment of aortic aneurysms is laparoscopic repair (either total laparoscopic, or laparoscopic-assisted). Clinical data are few and there are no randomised trials. The approach has theoretical advantages in reducing hospital stay and improving quality of life, but needs formal evaluation. If laparoscopic repair were widely introduced it would have major implications for the training of the future vascular specialist.

Carotid artery intervention

4.21 Stroke prevention is a priority for the Department of Health. A small number of patients who suffer a stroke will have had warning symptoms involving focal paralysis (transient ischaemic attack – TIA) or temporary blindness (amaurosis fugax). These symptoms are usually caused by embolisation of platelet thrombus or atheromatous debris from a ruptured plaque of atheroma in the carotid arteries. There is good evidence that patients who have a TIA or amaurosis, and who have a stenosis of the internal carotid artery (>50% using the NASCET measurement method or 70% by the ECST method) have an increased risk of subsequent stroke. This excess risk can be reduced significantly by carotid artery surgery (carotid endarterectomy). The maximum benefit is seen in patients with 70-99% NASCET stenosis, but not subocclusion, where the number needed to treat (NNT) to prevent one stroke is about five. Surgery confers a moderate, but still significant benefit in symptomatic patients with 50-69% stenosis (70-85% ECST). UK centres vary with respect to the exact thresholds they use for intervention; it is therefore essential that each vascular unit knows whether they employ NASCET or ECST measurement and that methods of reporting are standardised, as recommended.

4.22 Some individuals without symptoms are found to have a carotid artery stenosis on ultrasound imaging. The risk of subsequent stroke is less than in symptomatic patients, but otherwise fit subjects under the age of 75, with a carotid stenosis >70% (ECST) gain a small benefit from surgery (NNT approximately 20). The advantage conferred by surgery is greater in men than women. Considerably more asymptomatic patients need to be treated in order to prevent one stroke compared to symptomatic patients, as it takes over 4 years after the operation for the overall stroke risk to show
a benefit over best medical therapy alone. Patients who do not undergo carotid intervention should have optimal medical therapy that includes as a minimum antiplatelet and statin therapy for life (as should those who have undergone intervention).

4.23 Carotid endarterectomy is a well established evidence based treatment for symptomatic patients with a significant carotid stenosis, including patients with good recovery from recent stroke. Recent research suggests that the risk of stroke is highest soon after the onset of symptoms and that the quicker the surgery is done, the greater the reduction in the risk of subsequent stroke. The recent Department of Health guidelines on stroke prevention recommend performing carotid endarterectomy within 48h of the onset of symptoms. The establishment of such rapid treatment requires the development of new referral and diagnostic pathways, and close co-operation with stroke physicians and neurologists. Vascular teams will also need to work flexibly in order that carotid endarterectomy can be expedited, and may need to create referral networks to ensure prompt treatment is always available. Outcomes from interventions should be audited regularly and surgery should only be undertaken by specialist teams with the full range of facilities expected for elective procedures, since the risks of urgent surgery may be higher than in less acute patients.

4.24 There remains evidence of significant inequality in access to carotid surgery according to geographical area within the UK. It is possible to calculate from the known incidence of the disease that each vascular service should be undertaking around 15 carotid endarterectomies per 100,000 population per annum. Although the number of operations performed is steadily increasing (there was a six-fold increase in Scotland between 1989 and 1995), there are still areas where the carotid endarterectomy rate remains at 0 per 100,000.

4.25 An alternative to carotid endarterectomy is carotid angioplasty and stenting. The method remains under investigation, but it does have potential advantages over carotid endarterectomy (no incision, no cranial nerve injury). Recommendations may change as results of ongoing trials become available, and at present the procedure should normally be performed as suggested by NICE guidance. The risk of stroke arising from technical complications during carotid stenting means that it should only be undertaken by those trained and experienced in this type of intervention. Centres performing high volumes of stenting with low procedural complications may continue to treat patients on an individual case basis. Normal risk patients with an asymptomatic carotid stenosis should not currently undergo carotid stenting unless as part of a controlled trial.

**Haemodialysis Access Intervention**

4.26 Patients undergoing haemodialysis require a means of access to the circulation to allow the rapid withdrawal and return of blood so that it can pass through a dialysis machine at a rate of at least 300ml/min. Whereas this can be achieved using a double lumen central venous catheter in the short term, long term catheter use is associated with increased infection, higher mortality and central venous stenosis or thrombosis, which compromises further access to the circulation. Thus central venous catheter use should be minimised and patients should undergo the creation of an arteriovenous fistula, preferably in the non-dominant arm, at the earliest opportunity and, if possible, up to six months before the anticipated need for renal replacement therapy, to allow for maturation before needles can be inserted for dialysis. Some patients will require the insertion of a prosthetic graft between an artery and a vein for access because of poor vessels or the thrombosis of previous AV fistulae.

4.27 Approximately 100 patients per million population start dialysis in the UK every year, of which 70 will undergo haemodialysis. The total dialysis population was over 20,000 in 2005 (based on 17,409 prevalent patients reported by 62 of the 72 renal units in the UK) and is increasing at about 6% per annum. About a quarter of these are undergoing peritoneal dialysis leaving about 15,000 on haemodialysis (approximately 250 per million population).
Because of the known failure rate of new AV fistulae it has been estimated that 135 new vascular access operations are required for every 100 patients starting haemodialysis. In addition, 30 new access operations are required per 100 patients undergoing chronic haemodialysis because of intercurrent thrombosis of their fistula. This would indicate a need for about 210 procedures per million population per year in 2005 (Total approx 12,600 per annum in the UK, rising to an expected 281 procedures per million (17,140 total) by 2010. It has been estimated that one dedicated vascular access operating list is necessary for each 120 patients on dialysis (including peritoneal dialysis) assuming 3-4 patients can be operated upon per list. Most patients can be operated on under local anaesthesia and many of the operations can be performed as a day case procedure. In addition there is a need for up to 2 interventional radiology sessions per week per 100 patients on dialysis for preoperative imaging, postoperative surveillance and for percutaneous angioplasty or thrombectomy of failing or thrombosed AV fistulae and grafts.

At present, about two thirds of vascular access is provided by vascular surgeons and a third by transplant surgeons; the involvement of vascular surgeons is likely to increase as more peripheral dialysis units are opened outside transplant centres. At present there is a considerable underprovision of vascular access surgery in the UK, resulting in long waiting times for definitive vascular access and a much higher proportion of patients starting and continuing to dialyse on a central venous catheter compared with other European countries and Japan. There is a need for increased numbers of vascular surgeons and radiologists to become involved with dialysis access formation and maintenance.

**Other conditions requiring vascular care**

Rarer conditions that require a vascular specialist include thoracoabdominal aneurysms, mesenteric artery disease, renovascular disease, arterial infections, vascular trauma, upper limb vascular occlusions, vascular malformations and carotid body tumours, all of which can be successfully treated by surgeons and/or interventional radiologists; these sort of interventions should only be undertaken by specialists with appropriate experience and in units with adequate back up. An increasing number of patients with thoracic and thoracoabdominal aortic aneurysms are managed by endovascular (TEVAR) or hybrid procedures. These are often complex, and highly skilled interventions and should be undertaken in centres with expertise and a commitment to provide a centralised service for these patients.

Vascular surgeons are also the specialists that undertake transthoracic endoscopic sympathectomy that can alleviate symptoms of hyperhidrosis or severe peripheral ischaemia in the hands, as can phenol lumbar or open lumbar sympathectomy in the feet.

**Venous Surgery**

The main health gains of the management of venous disease are relief from the symptoms and complications of varicose veins and, in particular, the healing and prevention of recurrence of chronic leg ulceration. Intervention is also appropriate for symptomatic but uncomplicated varicose veins, where patients gain highly significant health benefits in terms of both generic and disease-specific quality of life.

Chronic venous disorders rarely threaten life or limb but can have significant effects on health and quality of life. The patients are best managed by a vascular specialist, who is the best equipped to undertake the sometimes quite complex evaluation, investigation and treatment. There are now a number of alternatives to standard surgery for varicose veins: endovenous thermal ablation (laser or radiofrequency), and foam sclerotherapy. The indications for each technique are different, but the fundamental principle is that all move the treatment of varicose veins away from general anaesthesia.
and the operating theatre, into ambulant local anaesthetic treatment. Clinical trials to evaluate the exact role of each method are ongoing. Each technique also has fundamental training and equipment requirements, and should only be undertaken by specialists with appropriate training.

4.34 Over 30% of the population will develop varicose veins at some stage in their life. Whereas all clinicians would recommend treatment for complicated varicose veins (eczema or ulcer), the management of uncomplicated varicose veins is to some extent at the mercy of local financial imperatives. Intervention for incompetent, but uncomplicated varicose veins is often among the first to be sacrificed in a locality with financial constraints, leading to an inequality of provision across the country. Guidelines from NICE have undoubtedly reduced referrals for uncomplicated varicose veins from primary care. Despite this reduction, varicose vein surgery remains a significant demand on the vascular service because 5% to 10% of the population will develop complications or troublesome symptoms.

4.35 Chronic venous ulcers occur in 1% to 2% of the population over the age of 60 years and consume up to 2% of total health spending. The majority of leg ulcers are due to chronic venous insufficiency alone but there are often other contributory causes such as peripheral arterial insufficiency. Many patients with varicose ulcers are treated successfully by compression bandaging in community leg ulcer clinics, but there is a role for treating incompetent superficial veins by surgery or other means to reduce the risk of ulcer recurrence. The development of community leg ulcer clinics has increased demand on vascular services because the routine measurement of the ankle/brachial pressure index has increased the identification of patients with mixed arterio-venous ulcers that are not suitable for compression therapy alone, and who may need intervention to improve their arterial circulation.

**Lymphatic Disorders**

4.36 Patients with impairment of the lymphatic drainage develop chronic leg swelling (lymphoedema) and are at increased risk of infection in the limb. Most patients can be treated with a combination of massage and compression bandaging but surgery is occasionally needed in severe cases. Appropriate conservative management from specially trained nurses is commonly available only in oncology centres, but they will often not accept referrals of patients unless their lymphatic obstruction is due to cancer. This continues to be an area of serious under-provision in the NHS; vascular specialists should strive to develop local arrangements with their oncology colleagues. Only a small number of patients develop such severe limb swelling that they require surgical treatment, which is appropriately provided only in a few specialist centres.
5. Components of the Vascular Service

5.1 An effective vascular service requires a team approach, with each member of the multidisciplinary team being aware of the potential contributions of the others and all working together to provide the best possible outcomes for the patient.

Vascular Surgery – the role of the specialist

5.2 Vascular specialists have the necessary clinical skills to provide care for patients with diseases of the arteries, veins and lymphatics. They have a sound knowledge of the relevant aspects of basic sciences and critical care and of the roles of vascular medicine and interventional radiology in the management of vascular diseases. The skills of the specialist include knowledge of the role of a vascular laboratory in the diagnosis and management of vascular disease, and of the relevant diagnostic imaging investigations that may be required to care for the patient.

5.3 Specialists with a significant interest and expertise in vascular intervention should commit a minimum of half their clinical practice to the care of vascular patients in order to maintain their expertise. Local circumstances may necessitate continued participation in an acute general surgery or transplantation emergency rota. Many vascular surgeons no longer undertake general surgery, apart from minor and intermediate procedures. Vascular specialists increasingly provide both open surgical and endovascular care for their patients. There is also a need for vascular specialists to work in renal failure services, providing renal access surgery and renal transplantation. The exact combination of specialist services provided will be determined by local requirements as well as the training and competencies of those providing it.

5.4 The weekly job plan for a clinical vascular surgical specialist should include at least two outpatient clinics, one all day operating list (endovascular if indicated) and one half day list for either day surgery, renal access or endovascular work. Diagnostic work, such as vascular ultrasound may replace outpatient clinics if this provides patients with better access to care. Emergency work, either when on call or when dealing with unexpected urgent surgery, is onerous in vascular surgery and job plans should be designed locally to reflect the amount of on-call commitment expected.

5.5 The increasing complexity of vascular surgical interventions requires the service to be delivered by fully accredited surgical specialists with relevant training. This, coupled with an ageing population, means an increasing out of hours commitment by the vascular team. Vascular on call rotas should be no more onerous than 1 in 6, where population size allows. Clinical networks covering populations in excess of 1 million people will have to deal with higher volumes of emergency cases and in such cases the emergency rota should be no more onerous than 1 in 8. Elective work should not be programmed to coincide with emergency duties for large populations and the emergency duties should be scheduled within the consultant’s weekly job plan.

5.6 The optimal vascular service should have four to six vascular surgeons and a similar number of colleagues offering endovascular intervention. The exact numbers will depend upon the population size (see section 6). The team will need the support of an appropriate number of F1/F2 staff, and both surgical and radiology SpRs to care for the inpatient workload, appropriate to the complexity, comorbidity and overall volume of vascular patients. With the continued reduction in availability and surgical expertise of junior support, as a result of EWTD, some duties of the F1/F2 doctors may be taken over by ward-based vascular nurse specialists. Where services are unable to accommodate such changes and provide appropriate levels of care, consideration should be given to increasing the number of vascular specialists, or merging with adjacent units to provide a large enough team to care safely for the patients.
5.7 For complex interventional procedures, teams comprising more than one specialist (in either surgery, interventional radiology, or both) working together are becoming routine. Such practice needs to be supported by NHS Trusts seeking to provide improved care for their patients.

Training and assessment of competence

5.8 Currently, surgeons seeking appointment to vascular specialist posts should normally have spent a minimum of the last two years of their specialist registrar training in recognized training vascular units. These units are recognized for specialist training by the local Programme Director in General Surgery. Specifications for training units and goals for trainees have been specified by the VSGBI in its document on “Training in Vascular Surgery” (under revision, 2009). It is important that the competencies of vascular specialists are clearly identifiable to their NHS Trust and to the public, particularly so that only those with appropriate training undertake complex procedures such as endovascular aneurysm repair.

5.9 Examination and certification of completion of specialist training are currently in ‘general surgery’ and there is no separate measure of knowledge or competence in vascular surgery. Vascular trainees may opt to have an oral in vascular surgery as part of their Intercollegiate examination, but this is not mandatory. The VSGBI is working with the Intercollegiate Examination Board to try and improve the vascular component of this examination. The process of becoming a separate specialty will bring the advantage of an exit exam in vascular surgery alone to future trainees. There is a separate European Board of Surgery Qualification in vascular surgery (FEBVS – Fellowship of the European Board of Vascular Surgery), which can be taken by those within six months of their Certificate of Completion of Specialist Training (CCT). The purpose of this specifically vascular examination is to ensure consistency of training standards across Europe. Although it currently has no official standing in most member countries with regard to certification, the FEBVS is recognized in Sweden and Switzerland. It is vital that vascular trainees keep detailed records of their training progression and competency assessments. Such logbooks should become the norm for all vascular specialists and form part of revalidation of surgeons in the future.

5.10 Vascular specialists are active in research, both clinical and laboratory based. Many University Hospitals have a Chair in vascular surgery and vascular specialists are prolific contributors to scientific meetings. The recent development of academic training pathways allows those hoping to become an academic surgeon to combine clinical training with research. Despite this enthusiasm for research, funding is difficult to come by. It is important for the specialty to continue to make the case for future research funding, given the ongoing evidence of high morbidity and mortality in vascular patients. Vascular specialists should be encouraged to contribute to collaborative research that may help define future management strategies for vascular diseases.

Interventional Radiology/Endovascular Surgery

5.11 Interventional radiology is recognised as a discipline within radiology, although not all interventional radiologists work in the vascular field. Vascular surgical specialists work closely with their radiology colleagues and should manage the care of their patients through regular multi-disciplinary team meetings (MDT), which should occur at least once a week. The meetings should be underpinned by established care pathways for problems requiring more rapid consideration (e.g. ruptured AAA or TIA/stroke). Time should be available in the working week, and recorded as direct clinical care on Job Plans to develop MDT for clinical problems requiring the input of other specialist services (e.g. stroke care, renal access, thoracic aneurysms). The provision of vascular interventional radiology services detailing staffing levels and service organization is covered in a separate document produced jointly by the Royal College of Radiologists and the VSGBI.

5.12 The vascular radiology specialists and their surgical colleagues in each locality should work as a team. Both groups should have an adequate knowledge of the relative benefits of endovascular and
surgical procedures for common vascular problems. Both must be capable of decision making with respect to patient selection and management of complications. The team caring for the patient must be able to identify who has the relevant expertise to manage each case and who is providing clinical leadership within the team. Written protocols and pathways of care are essential to underpin this process.

5.13 In the event that a single site service cannot be offered, it is essential that both vascular surgical and radiological expertise are readily available to manage any complication that may occur. Such arrangements must be underpinned by written protocols to ensure optimum patient care is provided at all times.

5.14 All care (medical, open surgical and endovascular) should be managed through the local multidisciplinary team meetings (MDT).

5.15 Dedicated vascular radiographers and interventional radiology nurses should be available for all elective and emergency vascular radiology procedures.

5.16 After vascular radiology procedures, patients need to be monitored by appropriately experienced staff on a vascular ward. Protocols should be available for the monitoring and care of these patients.

5.17 A radiology suite or dedicated vascular intervention theatre must be available for urgent vascular interventional procedures, including the management of complications.

5.18 Provision of emergency services places pressures on radiologists that are similar to those described above for vascular surgeons. Many non-vascular radiologists are no longer prepared to perform arteriography and do not have the skills necessary for interventional vascular treatment. There are few hospitals with enough vascular interventional radiologists to provide a 24/7 emergency service. Non-vascular radiologists are reluctant to see their colleagues leave the general radiology emergency rota to allow participation in a separate emergency vascular radiology rota. Collaborative clinical networks should apply to vascular radiology units in a similar manner to those for vascular surgical units described above for patients who require immediate vascular imaging or interventional treatment out of hours. Local commissioners should consider whether centralisation of adjacent vascular units to include radiologists as well as surgeons working in a single larger unit would address these manpower problems in the provision of an emergency vascular radiology service.

5.19 The VSGBI, Royal College of Radiology (RCR) and British Society of Interventional Radiology (BSIR) recognize the changing roles of specialists in the provision of care to patients with vascular disease. Their proposal for joint training and the increasing skills of both surgical and interventional specialists is a central part of planning for the future of both these specialties. The aspiration is to train specialists with the necessary clinical and team-working skills to provide comprehensive care for patients with vascular diseases.

5.20 Interventional cardiologists are skilled in the management of atherosclerosis of the coronary vessels. Unless they can demonstrate that they have received training in the management of peripheral vascular disease (and have the necessary competencies), they should not undertake interventions in this area. This applies particularly to interventions in the carotid artery.

**Vascular Medicine**

5.21 The medical management of patients with peripheral vascular disease has been shown to have a major contribution in reducing morbidity and mortality. In the UK there are few specialist vascular physicians (angiologists) and so medical management is mainly provided by vascular surgical specialists. Such care is provided with the collaboration of other specialists for the care of patients with diabetes, stroke, vasospastic and inflammatory conditions of blood vessels. Units with a large
workload may consider the appointment of specialist vascular physicians. Vascular specialists recognize the increasingly important role of medical interventions in the care of their patients. In particular the use of antiplatelet agents, anticoagulants, antihypertensive and lipid lowering medications are central to the optimum care of their patients. Care protocols should include specific mention of the use of these drugs based on the evidence available. Particular care should be paid to the role of cardio-active medication and the role of statins in reducing peri-operative morbidity.

**Structural components of the service**

**Vascular Imaging**

5.22 Imaging is central to the diagnosis, pre-operative assessment and post-operative surveillance of arterial and venous disease. Radiographers and clinical vascular scientists are specialists trained and certified in the use of duplex ultrasound for the noninvasive imaging of arteries and veins. A population of 500,000 generates between 3000 to 4000 tests per year in the vascular laboratory and requires a minimum of three full-time clinical vascular scientists with appropriate clerical support. Workload is rising particularly with the expansion of services dependent on ultrasound such as renal access. This workload excludes duplex ultrasound scanning for the diagnosis of acute deep vein thrombosis, which is more often provided in the radiology department. Considerably more resource is needed if this service is based around the vascular laboratory. Both CT angiography and MR angiography are now routinely used to image the vascular system. These are expensive items and require a strategy of sustained long-term investment in hardware and staff.

**The Vascular Ward**

5.23 Vascular patients are often elderly and their surgery is complex, so average length of stay is longer than for many other branches of surgery, though recent endovascular advances have shortened hospital stay for some conditions. The older the patient demography in the population served, the bigger will be the demand for vascular beds. If local rehabilitation and nursing home facilities are limited then this will also increase pressures on vascular bed capacity by delaying discharge after medical treatment is completed. Based on current experience, and depending on local case-mix, a population of 500,000 will require 20-25 beds on a dedicated vascular ward, excluding rehabilitation, short stay, day case and ITU/HDU beds.

5.24 The nursing care of vascular in-patients requires specialist skills, combining aspects of general surgical nursing, critical care, limb and wound assessment, tissue viability, wound care, rehabilitation, care of the disabled and care of the elderly. A dedicated vascular ward is essential to ensure an appropriate skill mix of nurses who have been specially trained in the care of vascular patients. The input of physiotherapists, occupational therapists and social workers is central to successful discharge of frail and disabled patients. This process is best managed in the context of regular discharge-planning meetings.

**Vascular Outpatient Clinics**

5.25 Clinics need to be appropriately staffed by nurses with expertise in ulcer and wound dressing. Sufficient examination rooms and nurses must be available to prevent delays while wounds are being redressed after consultation. Hand-held Doppler ultrasound machines must be available for venous assessment and for measuring the ankle/brachial pressure index. A treadmill exercise machine is useful for the differential diagnosis of peripheral arterial disease. Many specialists also employ portable duplex devices that may be used for investigation, or as part of an endovenous therapy. Foam sclerotherapy, and thermal endovenous ablation are increasingly done in the outpatient area. Specialists who base interventions on the results of their own diagnostic imaging should have had appropriate training.
Day Case and Short Stay Facilities

5.26 There need to be facilities for day care and 23-hour stays on site for the vascular service. These facilities are required for patients undergoing diagnostic angiography, selected interventional procedures, varicose vein treatment and renal access work. Written protocols for the management of complications must be in place. Endovenous procedures, renal access and varicose vein surgery all require a clean/sterile environment with a recovery area. This may best be provided through a day case facility, though is increasingly undertaken in outpatients. Appropriate space and supporting facilities are required wherever the procedures are undertaken. Day care does not need to be co-located with the vascular service (indeed provision nearer to the patient’s home may be preferable).

Operating Theatres

5.27 Vascular surgery is technically complex and theatre personnel need to be specially trained in the use of specialist instruments, prosthetics and techniques. Theatre nurses with special training in this area are valuable. A vascular theatre also requires stocks of specialist grafts, instruments and sutures that are stored nearby, as they are often needed without delay. Rationalisation of equipment in dedicated theatres can have cost advantages. Theatre staff need to be capable of operating cell salvage devices for blood conservation. Radiolucent operating tables and X-ray C-arms are required for on-table arteriography and interventional radiology. Those vascular surgeons who provide a central venous line placement service require access to ultrasound imaging in the theatre. A renal access service will require one additional, dedicated theatre session/week for every 120 dialysis patients\(^4\). Many vascular operations take longer than a half day session and so each vascular surgeon should have one all day theatre list per week for elective procedures. Many vascular procedures are unscheduled and there should be easy access to additional urgent theatre time as required. In addition, a 24-hour emergency CEPOD theatre must be readily available to undertake emergency vascular procedures.

Anaesthesia, ITU and HDU

5.28 There is evidence that the results of complex vascular procedures are better if the anaesthetist is experienced in dealing with vascular patients; this is particularly the case for emergencies such as ruptured aortic aneurysm\(^5\). Anaesthetic specialists and intensivists caring for vascular patients need to be familiar with the management of sick high-risk surgical patients. They may also have an important role in optimizing patients before complex surgery.

5.29 A Critical Care facility is essential for the care of patients treated for a vascular emergency, particularly those with a ruptured aortic aneurysm. The majority of elective vascular patients can be managed in an HDU rather than an ITU. Both ITU and HDU beds must be available on site for the vascular service, in sufficient numbers to prevent cancellation of elective procedures due to lack of facilities. The size of the Critical Care ward will vary according to population size and the influence of other specialties using the facilities, but the vascular service alone requires at least one ITU and one HDU bed per 500,000 population\(^6\). This may decline once the NAAASP reduces the number of ruptured aneurysms.

Emergency Departments

5.30 Ideally the vascular service should be situated in the same hospital as the local accident and emergency department. If a vascular service is sited in a hospital without an emergency department, there must be mechanisms available for the direct admission of vascular emergencies. Many patients needing vascular expertise will present to an emergency department, so if the service is not in the same hospital, there need to be clear protocols for the management of such patients. There is no need to have a vascular service in every hospital with an emergency department, but every department needs to know which adjacent hospital is on call for vascular emergencies and clear local protocols need to be developed with both clinicians and ambulance services if patients are to be transferred appropriately\(^7\). On call general surgeons need to be sufficiently trained in the assessment of vascular emergencies to be able to make appropriate referrals to the vascular emergency service.
Vascular Team personnel

The Vascular Nurse Specialist

5.31 Vascular nurse specialists contribute to both inpatient and outpatient care. They have a key role to play in liaising between team members. The vascular nurse specialist usually provides independent care and advice using agreed protocols. These should be drafted in consultation with relevant specialists. Nurse specialists may provide independent care to patients through lifestyle advice clinics, claudication clinics, leg ulcer clinics and diabetic foot clinics. They play an important role in vascular research and audit and are involved in the training and education of both community and hospital nursing staff.

Renal Services

5.32 Vascular patients are susceptible to acute renal failure; facilities for haemofiltration must be available in HDU and ITU. Where acute kidney injury is recognized, the involvement of a nephrologist is essential to minimize the risk of permanent renal failure. Patients with vascular disease often have significant chronic kidney disease and expert nephrology input may help to minimize the adverse effect of surgical intervention on renal function. Nephrologists provide valuable assistance on the need for, and timing of dialysis in patients with established renal failure.

5.33 Renal access surgery is a growing part of vascular surgical practice. This work requires careful organization and a service of sufficient size is best served by the appointment of a dedicated specialist vascular access co-ordinator.

Physiotherapy/Occupational Therapy

5.34 Vascular patients are often elderly or disabled and require specialist physiotherapy to aid in their rehabilitation following vascular intervention. Amputees in particular need specialist facilities and equipment in a physiotherapy gym to rehabilitate to the stage where they can safely be discharged from hospital. Occupational therapists provide home assessment visits and co-ordinate safe discharge back into the community.

5.35 Supervised exercise classes are of value in the treatment of claudication and can also be provided in the gym by suitably trained physiotherapists with experience of exercising patients with cardiovascular disease.

Limb Fitting Service/Rehabilitation

5.36 Peripheral vascular disease is one of the major indications for lower limb amputation. Vascular specialists most commonly perform these operations. Patients need local access to a limb fitting service and although this need not necessarily be on the same site, there should be close collaboration with the prosthetists using a team approach tailored to the individual needs of each patient. Indeed, a preamputation visit by the rehabilitation team is often valuable. A specialist rehabilitation unit is a more appropriate environment than an acute surgical ward for amputees who no longer require active medical treatment but have not yet reached the stage where they can manage at home.

Relationship with Other Specialties

5.37 Cardiology. Patients with arterial disease frequently have cardiac disease, as the risk factors for peripheral arterial and cardiac disease are the same. Cardiac assessment and optimisation of cardiac status can improve the results of surgery, particularly in high risk patients undergoing aortic interventions. This should be managed in the majority of cases by agreed protocols, but cardiology
input in complex cases (including pre-operative catheterization and angioplasty) is sometimes required. Vascular specialists and interventional radiologists are also required on occasion to deal with the complications of cardiac catheterisation.

5.38 Cardiac Surgery. Peripheral arterial complications requiring vascular intervention occasionally occur after cardiac surgery. Collaborative surgery is increasingly being undertaken for patients with combined cardiac and carotid disease, or thoracoabdominal aneurysms. Reconstruction with extra-anatomic diversion of arterial flow is a growing part of the endovascular management of complex thoracoabdominal aortic aneurysms. Stroke is a significant complication in older patients undergoing coronary bypass surgery and many such patients are now screened preoperatively for co-existing carotid stenosis, increasing demand on the vascular ultrasound service. Where a significant carotid stenosis is found, the risk of perioperative stroke may be reduced by carotid endarterectomy either before, or at the same time as the coronary surgery, or preoperative stenting.

5.39 Diabetes. Patients with diabetes form a significant, and increasing part of a vascular specialist practice. Protocols for the management of these patients should be developed with diabetic specialist colleagues. Many patients with diabetes present with limb and life threatening ischaemia and sepsis. Such patients need joint care with the diabetic team to optimize care and minimize tissue loss. The development of formal pathways of care for diabetic foot disease is a potential means to minimize the risk of amputation in this vulnerable group. In the outpatient setting these patients have complex foot problems requiring multi-specialty input. They are best managed through multi-disciplinary clinics with vascular, diabetes, orthopaedic, orthotic and podiatry input.

5.40 Dermatology. The management of leg ulceration involves an integrated approach between the vascular, dermatological and community leg ulcer services.

5.41 Clinical Laboratory Services. Blood disorders may initiate or exacerbate vascular problems, and close collaboration is needed with the haematology service to deal with these patients effectively. There is also frequently a need for blood replacement during major vascular interventions; these procedures should not be undertaken unless there is ready access to blood and blood products for transfusion. Infective complications of surgery have particularly serious implications for patients with prosthetic arterial grafts, needing microbiological assessment and advice. Current problems with hospital-acquired bacteria such as MRSA and the development of resistant bacteria mean that close contact with a microbiologist is often valuable. All vascular patients, whether admitted as an emergency or electively, should be screened for MRSA, and consideration should be given to treatment or decolonisation before intervention, particularly if this includes a prosthetic graft. Lipid disorders are a common cause of arterial disease and clinical chemists often offer specialist lipid clinics. Rapid access to haematology, blood biochemistry and blood gas analysis is also essential in peri-operative management.

5.42 Nephrology. Patients with chronic renal failure or those needing dialysis are best managed by a vascular service linked to an in-patient nephrology service. The management of renal artery stenosis and vascular access for dialysis require close collaboration between nephrologists, vascular and interventional specialists to provide optimal care.

5.43 Neurology/Stroke physicians. Neurologists or other physicians who manage the stroke service or rapid access TIA clinics collaborate closely with the vascular service, both for duplex ultrasound imaging of the carotid arteries and for vascular procedures in those patients where intervention is indicated. Service organization, with agreed protocols and MDT are needed to ensure timely access to carotid intervention.

5.44 Plastic Surgery. Once revascularization has been achieved for critical leg ischaemia, collaboration with plastic surgeons may be needed to provide skin cover for soft tissue defects arising either from ulcers, from removal of gangrenous tissue or from fasciotomy incisions. Many vascular specialists will
be familiar with common skin grafting methods, for which plastic surgery advice is not needed. Complex reconstruction and microvascular free flap transfer needs plastic surgery input, and should only be undertaken by a vascular specialist with training in microvascular suture techniques. This includes arterial injuries in neonates. Hand surgery expertise may also be helpful in the management of gangrenous fingers to preserve maximum function.

5.45 Other Surgical Disciplines. Vascular injuries may occur during the course of any surgical intervention in any surgical discipline. Local pressure or packing to control haemorrhage is needed until a vascular specialist can arrive to assist. These events are rare and should not dict ate service configuration. Hospitals without a vascular service should develop clear arrangements with adjacent vascular units for a vascular specialist to travel to the patient when such emergencies arise in theatre, as patient transfers are often inappropriate in this setting. Vascular specialists from an adjacent site need to be consulted in advance regarding availability when vascular difficulties are anticipated before the surgery, such as when a tumour is seen to be encroaching around major vessels on pre-operative scans.

Vascular Training Units

5.46 At the time of writing, the Society is in the middle of negotiating separate specialty status within general surgery. If this is achieved it will mean a major reorganization in the way training and education are provided, and will require revision of the current Vascular Training Document. This reorganization will benefit from close collaboration with radiology colleagues, the BSIR and the Royal College of Radiology, and possible other partner organizations, such as clinical vascular science.

Audit and Governance

5.47 Vascular services must be accompanied by a comprehensive programme for audit of clinical outcomes. The data system needs to be based on an adequate IT infrastructure and needs to be sufficiently detailed so that analysis for clinical governance purposes can take full account of case mix and physiological status. This type of audit requires financial support, not just for computer hardware and software, but also for someone to support, monitor and maintain the database in larger units. Annual volumes of particular operations per surgeon are not high in arterial surgery, and it may take up to 9 years of data collection and analysis to decide whether or not clinical outcomes for an individual surgeon lie within the norm. There are methods to use standard data collected in every hospital to prove evidence of safety. Vascular surgeons should submit their figures to the VSGBI National Vascular Database (NVD) and will then be provided with risk-adjusted comparative outcomes for their procedures compared with their peers in the UK and Ireland. Currently, submission of data is voluntary, but those who undertake EVAR or laparoscopic aneurysm repair have been instructed by NICE to include their data, and all surgeons wishing to be part of NAAASP are required to submit data to the NVD. It is the aim of the Society that all index vascular procedures should be entered on the NVD. The UK Government has indicated that it is likely to allow publication of data from individual surgeons to enter the public domain; it is therefore in the interests of the vascular specialist to become personally involved with their hospital’s operation coding system to ensure that hospital activity and outcome returns to the Department of Health are as accurate as possible.

5.48 Good outcomes are fundamental to the cost efficacy of vascular intervention. There is a suggestion that the results of elective aortic surgery in the UK are not as good as elsewhere in Europe. Poor results also undermine the value of the NAAASP to men with an aortic aneurysm. As part of a campaign to halve the elective mortality rate for aortic intervention in the UK (to 3.5%) by 2013, a quality improvement framework will be introduced that describes the optimal conditions for treatment of aortic aneurysms.
6. Strategies For Vascular Services

6.1 Satisfactory provision of vascular services requires equal patient access to both elective and emergency care throughout the United Kingdom. When emergency assessment and treatment are necessary this should be available from a recognised vascular unit in most locations in the UK within one hour of travel. It is no longer acceptable for emergency vascular care to be provided by generalists who do not have a specialised elective vascular practice, although they may be involved in triage of patients in hospitals with no vascular service before referral to a vascular unit. Similarly, all elective management (for both arterial and venous disease) should be undertaken by these same clinicians. Only by achieving this can all patients have an expectation of equality in clinical outcomes. These criteria must underpin the future strategies for vascular services within the NHS.

6.2 Previous studies have shown that patients may suffer unnecessary strokes or amputations unless they have access to the full range of vascular services. Thus smaller vascular units and hospitals without vascular surgeons that are unable to provide this should develop care pathways that ensure that relevant patients are referred to a centre with which they have a formal arrangement. This implies development of a local or regional networking arrangement, including joint multi-disciplinary meetings, or alternatively centralisation of vascular surgery.

The Case for Clinical Networking or Centralisation

6.3 No other options other than networking or centralisation will ensure that the aims expressed in 6.1 are achieved.

6.4 Vascular services need to be organised to allow reasonable elective activity to exist alongside an acceptable consultant emergency on call rota - ideally 1 in 6, but no more onerous than 1 in 4. Units with fewer than 4 surgeons should consider merging or collaborating in a clinical network to achieve 24/7 emergency cover.

Clinical Networks

6.5 A clinical network exists when two or more adjacent hospitals collaborate to provide patient care. Although generally confined to emergency cover it could include elective services, or might be based on a local aortic aneurysm screening programme. A number of models exist, according to the level of vascular service in the participating hospitals. Clear written arrangements should exist for cover of inpatients at each site out of hours.

Hospitals without onsite elective arterial intervention

6.6 Whilst this previously applied to small or remote hospitals, centralisation of vascular services increases the risk that smaller hospitals will become clinically isolated. Patients served by these hospitals will only achieve equality of access to elective vascular surgery if a visiting vascular specialist from an adjacent unit performs outpatient clinics. This will allow patients to make an informed choice about transfer to the adjacent hospital for specialist care following their consultation. Outpatient facilities should include a nurse with experience in wound and ulcer management and a hand-held Doppler ultrasound machine. If arterial or venous duplex is required this should ideally be provided locally to avoid patients travelling for further investigation. Appropriate experience may be available in the local radiology department, or alternatively a vascular scientist might accompany the visiting vascular specialist since most, if not all, hospitals will have suitable ultrasound machines.
6.7 Visiting vascular specialists could provide a service for in-patients at the hospital and may also undertake day surgery locally.

6.8 For remote hospitals the physiotherapy/rehabilitation services should be familiar with the needs of amputees and other vascular patients referred back to the hospital once their acute care has been completed, so that rehabilitation can be accomplished close to home and family.

6.9 Hospitals (Trusts/PCTs) without a vascular service should have formal pathways for patients with vascular disease. They may consider a contractual arrangement with an adjacent hospital to provide both these services.

6.10 Protocols must be developed, particularly by the Accident and Emergency Department and ambulance service, to allow transfer of vascular emergencies to the adjacent vascular unit without delay. Very few hospitals are more than an hour by road from their neighbours, although there is evidence that even with transfers of more than one hour, transfer to a vascular unit improves patient outcomes. Patient survival after a ruptured aortic aneurysm is between 5-15% if they stay in a hospital with no vascular surgeon, compared to 35-65% if transferred to an adjacent vascular service. This advantage persists even with up to 4 hours of hypotension, although patients who suffer a cardiac arrest are unlikely to survive transfer.

Hospitals with A Single-Handed Vascular Service

6.11 This type of service cannot be endorsed as it is considered to disadvantage local patients. Single-handed surgeons have limited opportunities for peer-related development or team working, and the elective service is suspended when the consultant is on leave. Many of these hospitals undertake a low volume of vascular surgery (which is associated with poorer clinical outcomes) with limited facilities, which fall short of those recommended in Section 5. Further, emergency cover may be provided by non-vascular general surgeons who may be more inclined to inappropriate conservative management in high-risk patients with a vascular emergency.

6.12 Assuming that the local population will not sustain enough elective work for a vascular service, the hospital should merge its in-patient elective and emergency vascular activity with an adjacent hospital. Outpatient clinics and day case surgery should still be performed locally as in 6.6, usually by the former single-handed surgeon who is subsequently based in the adjacent hospital. For vascular emergencies this type of hospital will become a unit without a vascular service.

6.13 Even if the local population might sustain two vascular specialists, unless the area is geographically remote, centralisation of vascular services in an adjacent larger vascular centre is the preferred option. This avoids unnecessary duplication of resources, and would be a driver for the development of the high quality facilities described in section 5. Further, patients’ interests are better served in a single higher volume hospital with continued access to local outpatient clinics. This process should deliver an acceptable on-call rota for surgeons, with enhanced postgraduate training opportunities, including multidisciplinary meetings.

6.14 If a second surgeon is appointed locally this must coincide with participation in a collaborative clinical network with adjacent hospitals for the provision of vascular emergency cover as specified below.

Hospitals with 2-3 Vascular Surgeons

6.15 These hospitals should have all the facilities listed in Section 5, including a dedicated angiography suite, spiral CT and MRA, a vascular laboratory and a dedicated vascular ward. The critical care facilities should be large enough to cope with the vascular workload.
6.16 Appropriate support must be available from interventional radiologists and vascular anaesthetists.

6.17 For emergency vascular care, clinical networks must be developed between two or three hospitals collaborating as equal partners resulting in a consultant on call rota of 1 in 4 (minimum) to 1 in 6 (ideal). Appropriate care pathways and protocols, as described in 6.10 above must be in place.

6.18 Different models for emergency networks exist. The commonest is to transfer the patient to the on call hospital. A less satisfactory option involves the surgeon moving between hospitals to operate out of hours, without transferring the patient. A major disadvantage of this type of arrangement is that it ignores the potential need for input from an interventional radiologist. Thus an acute hospital with both a vascular surgeon and an appropriate radiologist on call will provide optimal care.

6.19 Sometimes the partnership is not so equal and a network may function at a more formal contractual level. One hospital may contract with an adjacent hospital to provide an emergency service for its patients when its own vascular surgeons are not on call. This type of arrangement may be required where the local surgeons also participate in the general surgery on call rota, although this is becoming less frequent with the increasing appointment of specialist vascular surgeons. Under these circumstances the local surgeons do not offer a reciprocal vascular emergency service to the adjacent, often larger, hospital. The contractual arrangement allows a transfer of resources to the adjacent hospital so that it can cope with the additional workload involved.

Centralisation

6.20 Whilst clinical networks should ensure that patients requiring emergency vascular care would be assessed in a specialist vascular unit within one hour, there are additional advantages to centralisation. These should include improved facilities for patient care (dedicated vascular wards), investigation (larger radiology unit with 24/7 interventional radiology) and treatment (vascular operating theatres and staff, vascular anaesthetists, improved facilities for endovascular management, better critical care). In centralised units opportunities for high quality multidisciplinary working, clinical research and postgraduate training should all be enhanced. Such units should be staffed by 6 or more surgeons, and an equivalent number of interventional radiologists, on one site together with appropriate diagnostic radiology and anaesthetic support. Centralisation will also prevent duplication of expensive equipment on two or more sites and facilitate the introduction of new technology.

6.21 Centralisation is more likely to be feasible in areas of relatively dense population where two or more hospitals are relatively close. It is the preferred method of providing high standard vascular services. Potential difficulties include the reluctance of surgeons to move, concerns on the part of hospitals losing vascular surgery and insufficient capacity on a single site to manage the increase in workload. For the latter, clinical networking may be the only option.

6.22 When centralisation occurs, outpatient clinics and perhaps day surgery could continue in the hospitals that no longer have the primary service. Similarly clear protocols for the transfer of patients requiring emergency care at the main centre must be developed. This will include liaison with the ambulance service for patients suspected of having a leaking aortic aneurysm.

6.23 Where there is an adjacent hospital with no vascular service, vascular surgeons should take active steps to initiate an outpatient consulting service at the hospital and ensure pathways exist to transfer patients with a vascular emergency from it to their base hospital for treatment. This initiative will better serve the needs of the patients in the locality and allow equality of access to all of the resources and treatments available at the base hospital. Any increase in workload may provide justification for additional vascular consultant appointments and facilities at the base hospital.
6.24 NCEPOD has shown better outcomes for patients treated by a vascular as opposed a general surgeon for ruptured aortic aneurysm. There is increasing evidence that the results of elective aneurysm surgery are positively related to the volume of procedures performed by a unit. This is likely to reflect more structured management from surgeons, anaesthetists, operating theatre staff, critical care services etc. This is a potential advantage of centralisation over clinical networking.

6.25 Centralisation of vascular services will also make it easier to comply with the recommendations of the Department of Health stroke and TIA initiative which requires provision of urgent carotid endarterectomy for appropriate patients presenting with these neurological events. As for aortic aneurysm, the literature also suggests that hospitals undertaking a larger number of these procedures have better results. Reconfiguration of vascular services may need a review of referral pathways and patterns, to ensure the provision of comprehensive vascular care to the local population.

**World class commissioning of vascular services**

6.26 Both centralisation and clinical networking will have implications for resource allocation. In many instances this may cross the boundaries of individual Primary Care Trusts, and Specialised Commissioning Groups will need to co-ordinate planning for these services. A similar broad strategy is needed in the other UK countries.

6.27 Every patient has the right to consult with a vascular specialist at their local hospital, but may have to travel to obtain access to diagnostic and interventional facilities. Only in this way can equality of access and the patients' desire for a local service be delivered alongside the best possible elective and emergency outcomes for individual patients.
References


50 NICE guidelines for referral of patients with varicose veins to secondary care. www.nice.org.uk/guideline/index.jsp?action=referral

60 NHS Choices. www.nhs.uk/Pages/homepage.aspx