

# The Provision of Services for Patients with Vascular Disease 2012



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*All patients with vascular disease should have 24/7 access to a specialist vascular team in all parts of the UK*



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## 2012

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British Society of Interventional Radiology  
British Society of Endovascular Therapy  
Circulation Foundation  
General Surgical Specialist Advisory Committee  
Irish Association of Vascular Surgeons  
Rouleaux Club  
Society of Academic and Research Surgery  
Society of Vascular Nurses  
Society for Vascular Technology of Great Britain and Ireland  
Vascular Anaesthesia Society of Great Britain & Ireland

## List of Abbreviations

AAA	Abdominal Aortic Aneurysm
ABPI	Ankle brachial pressure index
AKI	Acute kidney injury
ASGBI	Association of Surgeons of Great Britain and Ireland
AVF	Arterio-venous fistula
BMI	Body Mass Index
BSIR	British Society of Interventional Radiology
CAS	Carotid artery stenting
CCT	Certificate of Completion of Training
CEA	Carotid endarterectomy
CF	Circulation Foundation
CPEX	Cardio Pulmonary Exercise Testing
CREST	Carotid revascularisation endarterectomy versus stenting trial
CSTC	Carotid Stenting Trialists Collaboration
CTA	Computerised Tomographic Angiography
DoH	Department of Health
DVT	Deep venous thrombosis
EBIR	European Board of Interventional Radiology
ECST	European Carotid Surgery Trial
EVAR	Endovascular aneurysm repair
EWTR	European Working Time Regulation
F1/2	Foundation 1 or 2 doctors
FEBVS	Fellowship of the European Board of Vascular Surgery
FRCR	Fellowship of the Royal College of Radiologists
FRCS	Fellowship of the Royal College of Surgeons
GI	Gastro-intestinal
HDU	High dependency unit
HES	Hospital Episode Statistics
IR	Interventional radiology
ISB	Intercollegiate Specialty Boards
IT	Information technology
ITU	Intensive care unit
JCIE	Joint Committee on Intercollegiate Examinations
MDT	Multi-disciplinary team
MRA	Magnetic Resonance Angiography
MRSA	Methicillin-resistant Staphylococcus aureus
NAAASP	NHS Abdominal Aortic Aneurysm Screening Programme
NASCET	North American Symptomatic Carotid Endarterectomy Trial
NCEPOD	National Confidential Enquiry into Peri-operative Deaths
NHS	National Health Service
NSF	National Service Framework
NICE	National Institute for Health and Clinical Excellence

## Abbreviations *continued*

NNT	Number needed to treat
NVD	National Vascular Database
PACU	Post-anaesthesia care unit
PAD	Peripheral arterial disease
PCT	Primary Care Trust
RCR	Royal College of Radiologists
SAC	Specialty Advisory Committee
SCG	Specialised Commissioning Groups
ST3-8	Specialty training years 3-8
SVN	Society of Vascular Nurses
SVT	Society for Vascular Technology of Great Britain and Ireland
TAAA	Thoraocabdominal aortic aneurysm
TEVAR	Thoracic endovascular aneurysm repair
TIA	Transient ischaemic attack
UK	United Kingdom
VASGBI	Vascular Anaesthesia Society of Great Britain and Ireland
VM	Vascular malformation
VSGBI	Vascular Society of Great Britain and Ireland

## Executive Statement

The Vascular Society of Great Britain and Ireland is actively engaged with driving down the mortality of patients undergoing vascular procedures in the UK and Ireland. Our primary objective is to provide all patients with vascular disease with the lowest possible elective and emergency morbidity and mortality rates in the developed world. To achieve this we will need to modernise our service and deliver world class care from a smaller number of higher volume hospital sites.

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 within one hour of travel from a recognised vascular unit in most locations in the UK. It is no longer acceptable for emergency vascular care to be provided by generalists who do not have a specialised elective vascular practice. The current Vascular Society advice is that high quality world class vascular care can be delivered in the UK with the establishment of high volume arterial centres. This can involve a centralised service or a modern clinical network.

A modern clinical network exists when two or more adjacent hospitals collaborate to provide patient care. Such networks should decide upon a single hospital which will provide both elective and emergency arterial vascular surgical care. Networks might be based on a local aortic aneurysm screening programme or aligned to a major trauma centre, but it is required that all major arterial intervention is performed on the designated arterial site. All vascular consultants involved in a modern clinical network should be timetabled to provide out patient and ward specialist vascular care to patients within the non-arterial network hospitals. This may include a service to amputees and to patients with chronic venous insufficiency and diabetic feet.

Many centralised models of care already exist and fulfil the criteria for the high volume arterial centres described above. They are more likely to be feasible in areas of dense population where two or more hospitals are relatively close. When centralisation occurs, outpatient clinics and perhaps day surgery should continue in the hospitals that no longer have the primary service. 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 to their centralised vascular hospital for treatment.

The Society is aware of the special circumstances required of many isolated areas including those in the Highlands and Islands and more rural areas of the UK. In these circumstances, local arrangements should be put in place to ensure that patients living in these areas are not denied high quality vascular care delivered by a high volume arterial centre.

In summary, the Vascular Society believes that every patient has the right to consult with a vascular specialist at their local hospital, but they 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.



## Overview

The Vascular Society of Great Britain and Ireland (VSGBI), along with its fundraising arm, the Circulation Foundation (CF) and its affiliates, the Society of Vascular Nurses (SVN) and the Society for Vascular Technology of Great Britain and Ireland (SVT) comprise the majority of health care professionals who are responsible for delivering care to patients with vascular disease in the United Kingdom (UK). It aims to promote the best possible care for patients with peripheral vascular disease and is fully committed to the safety of all patients under the care of our members. The Society first produced a document that described the essential components of a vascular service thirteen years ago (Provision of Vascular Services, 1998). It proved extremely useful to Members of the Society when developing their local vascular services<sup>1</sup>.

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 revisions in 2004 and 2009 continue to evolve<sup>2,3</sup>. The European Working Time Regulation (EWTR) has required changes to the vascular specialty training programmes and to the effective junior doctor staffing of our vascular wards. At the time of writing, vascular surgery has had its application for specialty status approved by the Department of Health (DoH) and the separation from general surgery is imminent and awaiting ratification by the Secretary of State and Parliament.

Many vascular problems can be treated by endovascular methods in both the elective and emergency settings and future vascular services will build upon the close working relationships between surgeons and radiologists in order to provide a world class vascular service to the population of the UK. The close links with cardiac surgery and cardiology are continuing to develop, in addition to those already established with vascular medicine, diabetic and stroke services. Practical experiences of interventional radiology (IR) techniques are increasingly being developed by surgical trainees, and likewise we are keen to promote the teaching of further clinical skills to radiology trainees wishing to become vascular specialists in the future.

It is clear from many of the regional reviews of vascular services that the Provision of Vascular Services for Patients with Vascular Disease 2009<sup>3</sup> required updating, as service reconfiguration continues to develop, driven largely by volume outcome data, the NHS Abdominal Aortic Aneurysm Screening Programme (NAAASP) and the reduction in hours worked required by EWTR. The current document Provision of Services for Patients with Vascular Disease 2012 has been revised to reflect the changes in service provision which are accompanying our specialty status and reflects a multidisciplinary service with vascular patients at its centre, taking full account of DoH service initiatives and guidance from the National Institute for Health and Clinical Excellence (NICE).

# 1. Summary

All patients with vascular disease should have 24/7 access to a specialist vascular team in all parts of the UK for both elective and emergency care.

- 1.1 Patients with disorders of the arteries, veins and lymphatics should expect to be cared for by vascular specialist teams (vascular surgeons, specialist nurses and anaesthetists, interventional radiologists and radiographers, clinical vascular scientists, occupational and physiotherapists) with a thorough understanding of their condition, who are able to organise all appropriate investigations and treatment, including lifestyle advice, drug and exercise therapy, IR, vascular/endovascular surgery, and manage their post-operative care.
- 1.2 Changes 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; these are minimised by the availability of a local specialist vascular service dealing with sufficient numbers of patients to maximise expertise. Minimising adverse outcomes is the most cost-effective way to deliver the service. Sometimes, withholding intervention (conservative treatment/best medical therapy) is the most appropriate management option.
- 1.3 There is a progressive increase in the number of patients with vascular disease who need intervention. The development of endovascular alternatives to many standard surgical techniques has increased the options for patients and has provided real advances in the treatment of certain conditions. There remains, however, a shortage of practitioners trained to deliver these complex endovascular therapies, especially out of normal working hours.
- 1.4 Clinicians without vascular training no longer have the necessary skills to intervene on vascular patients and produce less good outcomes. Patients with vascular disease should expect to be managed by vascular specialists, both electively and as an emergency. General surgeons should be sufficiently skilled to triage patients before seeking the involvement of a vascular specialist, but they should no longer be involved in providing out of hours emergency management for vascular patients.
- 1.5 Patients with emergency vascular conditions should expect to be able to access a vascular team rapidly in all parts of the UK. This team will involve vascular surgeons, specialist nurses and anaesthetists, interventional radiologists and radiographers, clinical vascular scientists and occupational and physiotherapists. Vascular services need further reconfiguration to provide 24/7 specialist vascular and endovascular cover for their local population. Patients may need to travel beyond their local hospital to access this high quality treatment.
- 1.6 Since the Provision of Vascular Services for Patients with Vascular Disease 2009 document<sup>3</sup>, there has been considerable change in the structure of vascular services. In some areas there has been consolidation onto a single site, and in others clinical networks have formed in response to the need to provide comprehensive emergency cover. It is no longer acceptable to provide elective or emergency vascular cover outside a fully centralised service or a formalised modern clinical network with a designated single site for all arterial interventions providing a 24/7 on-site service. The current document outlines the models of clinical care required and describes the essential components of an effective vascular service.
- 1.7 Vascular services are not supported by a National Service Framework (NSF) but are subject to National Health Service (NHS) initiatives such as stroke prevention, diabetes management, renal service provision and the operating procedures of the new 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 patients do not have timely access to a vascular specialist opinion at their local hospital. Emergency networks and outreach vascular clinics



organised through adjacent vascular units are the solution to this problem. Clear written protocols for dealing with both elective and emergency vascular patients should exist in all hospitals, including arrangements for transfer to the nearest specialist vascular service.

- 1.8 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 treating common vascular conditions will speed access to the service and ensure patients receive treatment at the right time and in the right place. Each vascular specialist should have knowledge of their own outcomes; this is an important component of clinical governance and individual revalidation. The National Vascular Database (NVD) and other recognised registries such as the British Society of Interventional Radiology (BSIR) Iliac Angioplasty and Stent registry should be the focus of data collection with respect to index vascular procedures. Results should be available in a way that is transparent and accountable and the specialist societies should provide back up and support for any service with evidence of a problem.
- 1.9 The aim of each individual vascular unit is to provide a world class service.

## 2. Introduction

- 2.1 This document sets out the principles by which a 24/7 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 for commissioners of the service. Potential mechanisms for the development of existing, and the provision of new, 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:
- a. Preventing death from abdominal aortic aneurysm
  - b. Preventing stroke due to carotid artery disease
  - c. Preventing leg amputation due to peripheral arterial disease
  - d. Symptom relief from peripheral arterial and venous disease
  - e. Healing venous leg ulceration
  - f. Promoting cardiovascular health
  - g. Improving quality of life in patients with vascular disease
  - h. Assisting colleagues from other specialities with the control of vascular bleeding
  - i. Assisting colleagues in the management of the vascular complications of diabetes and renal disease
  - j. Providing a renal access service for patients requiring haemodialysis
- 2.4 Patients suffer from many different vascular disorders that adversely affect quality of life, such as intermittent claudication, varicose veins, lymphatic disorders, hyperhidrosis, thoracic outlet syndrome, vascular malformations (VM) and many more. The vascular specialist team has access to both interventional and medical therapies that may alleviate the symptoms and complications of these disorders.
- 2.5 Those specialising in image guided endovascular therapy will also need to provide core elective and emergency services for the control of bleeding in the context of trauma for patients with vascular disease and for specialists from other disciplines (general surgery, orthopaedics, gynaecology, urology etc.).

### Current Problems and Pressures for Change

- 2.6 As many as 50% of patients with vascular disease present urgently or 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 respective commissioning groups and Health Boards should ensure that the remainder are covered as soon as possible. Patients with a vascular emergency should expect to have immediate access to a specialist vascular team involving surgeons, radiologists, anaesthetists, clinical vascular scientists, specialist nurses and occupational and physiotherapists in all parts of the UK.
- 2.7 Vascular surgery in the UK has emerged as a separate specialty 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 (ASGBI) has recognised this and indicated that it does not expect vascular specialists to be involved in the management of general surgical emergencies<sup>4</sup>.

- 2.8 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; they should, however, be sufficiently skilled to assess and triage patients appropriately. Patients with a vascular emergency should expect to be treated by a trained specialist. Few general surgical consultants are currently equipped to deal with vascular emergencies using modern techniques. This clinical governance issue is driving the changes in the way in which emergency vascular services are delivered.
- 2.9 It is no longer possible to train vascular surgeons to provide the full spectrum of both emergency general surgery and vascular on call, given the current constraints on working time and increasing surgical complexity. General surgery emergency on call is best delivered by surgeons with an elective practice in gastrointestinal surgery.
- 2.10 All vascular surgeons are becoming more specialised and consequently deskilled in other areas of general surgery. This lack of elective general surgical practice creates governance pressures on vascular surgeons to withdraw from the general surgery emergency rota as they instigate separate vascular emergency rotas. General surgeons agree and understand 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. It is no longer appropriate for the vascular specialist to be providing emergency general surgical cover. In addition, vascular surgeons should not be expected to provide elective general surgical services. Occasionally some surgeons will undertake specific procedures to maintain competencies directly related to local service needs, but this should be the exception.
- 2.11 The demands of the EWTR mean that trainee vascular surgeons have much less exposure to emergency general surgery than has been the case in the past. Rotas more onerous than 1:6 at both consultant and trainee level will become untenable. Daytime training in elective surgery is also restricted and it will not be possible for trainees to obtain competence in the sub-specialty areas of general surgery in the time available. With the development of the new speciality, trainees will only be accredited as vascular surgeons and will not be able to offer a general surgical elective or emergency service<sup>5</sup>.
- 2.12 Likewise, IR is now a recognised subspecialty of radiology and there has been a drive to increase the numbers of IR trainees through the UK medical workforce agencies and the Centre for Workforce Intelligence. Nevertheless, it will be a few years before IR numbers are sufficient to deliver equitable vascular services across the UK and, at present, many hospitals attempting to provide a comprehensive vascular service have too few vascular radiology consultants.
- 2.13 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 modern clinical network as vascular surgeons. Elective and emergency vascular surgical and IR services should be developed and co-ordinated jointly.
- 2.14 The provision of robust 24/7 vascular services has been increasingly recognised as essential for the NHS. In 2010, the National Imaging Board (DoH) published a document entitled *Interventional Radiology: Guidance for Service Delivery*<sup>6</sup>. This provides a roadmap for improvement and investment in the provision of IR services. Current work with NHS Improvement (DoH) is finalising a map of IR out-of-hours service provision throughout England and aims to provide a focus for service improvement and provide guidance on forming modern clinical networks.

- 2.15 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 1998 document, it was recommended that coalescence of adjacent vascular services onto a single site was the optimal model for service delivery<sup>1</sup>. 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.
- 2.16 The Provision of Services for Patients with Vascular Disease 2009 recommended networks of vascular care as an alternative to centralisation<sup>3</sup>. This involved the formation of a network of adjacent hospitals and specialists providing collaborative care. It is now apparent that such networks, involving arterial intervention at more than one site, often result in a reduction in the quality of care and increased mortality for patients in out of hours periods. For this reason, current strategies for the provision of vascular care require that all arterial interventions are performed on a larger volume hospital site, with intervention provided at these hospitals by vascular surgeons and interventional radiologists from both the central and network hospital sites. This allows for 24/7 patient care and the expeditious treatment of any complications which may occur.
- 2.17 The responsibility for purchasing vascular services is the remit of Primary Care Trusts (PCTs) and/or the GP Commissioning Consortia. By contrast, specialty commissioning in England is the responsibility of the Specialised Commissioning Groups (SCGs); this does not include vascular surgery at present, but it is anticipated that this arrangement will change in 2013.
- 2.18 The formation of NAAASP has required the formation of local screening units based on a minimum population of 800,000<sup>7</sup>. This has resulted in a move towards the delivery of a service within larger volume units who can demonstrate low elective aortic aneurysm mortality rates, thus reducing the number of small independent vascular units. The organisation of local screening programmes is under the control of the specialist commissioning groups. Similar themes exist in the commissioning of services in Wales, Scotland and Northern Ireland.
- 2.19 For example, in April 2011, a document entitled Abdominal Aortic Aneurysm Screening (AAA) Programme Standards was published by Healthcare Improvement Scotland<sup>8</sup>. This describes the proposed delivery of the Scottish AAA screening service, which will be aligned to the UK NAAASP recommendations. A national screening programme, with screening centres which in turn will link with appropriate NHS boards (and where appropriate collaboratives), will be established, providing ultrasound screening of the abdominal aorta for men aged 65 years and over.
- 2.20 In Wales, vascular services are widely spread and are currently commissioned by the 7 Health Boards. Each is responsible for its own population, but it is recognised that elective vascular networks need to be developed to deliver world class vascular services to the population of Wales in a coordinated fashion.
- 2.21 At present, most large hospitals have a vascular service, although not all of them provide 24/7 vascular surgical/radiological emergency care, and many perform a relatively low volume of some of the more complex vascular procedures. There is now good evidence that for aortic aneurysm surgery, outcomes improve as volumes increase<sup>9</sup>. The DoH is currently considering specialised commissioning for vascular services in England. In order to be included in the Specialised Services National Definitions Set, specialised services for vascular disease are required to be concentrated in relatively few high volume arterial centres. If agreed, this will further drive vascular intervention towards high volume hospitals who can demonstrate adequate volume outcome parameters in their provision of modern vascular services. A treatment threshold of a minimum of 33 elective aneurysm repairs per annum would equate to around 50 hospitals covering the whole of England<sup>10</sup>.

- 2.22 Both the DoH and NICE have focused attention on stroke prevention<sup>11,12</sup>. Together with detailed access targets are recommendations for carotid endarterectomy within 48 hours of a neurological event in high risk patients. In the absence of a National Service Framework for the treatment of vascular disease, such 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. It is, therefore, important for the NHS to consider the requirements of vascular services in line with its development of cardiac, renal, diabetes, stroke and trauma services.
- 2.23 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, and readmission rates due to disease progression are significant. 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 IR facilities and disposables. Replicating these services in every hospital is not cost effective and this must be balanced against issues of equality of patient access and aspirations for a local service.
- 2.24 Lord Darzi's NHS review in 2007 supported centralisation of high technology services, but with an expectation of an increase in care close to home<sup>13</sup>. 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 and quality 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<sup>14-17</sup>.
- 2.25 Every patient in the UK should have the opportunity to consult with a vascular specialist at a 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<sup>11, 18-21</sup>, and in these circumstances outpatient services should be offered at local hospitals with in-patient care for arterial intervention (both surgical and radiological) at a nearby high volume arterial hospital. Only after a full discussion with a 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 working with the local hospital and community services will help increase awareness of the benefits to 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.
- 2.26 In the absence of limitless resources, an agreement 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 vascular service. The driver for this must be the achievement of the best possible outcomes for individual patients. Solutions may cross natural commissioning boundaries, but that should not restrict the construction of sensible models of vascular care that benefit local communities.
- 2.27 The front door of the vascular service will remain the patient's local hospital and it is important to maintain local vascular services which are as good, if not better than, before. Vascular specialists will be on site to perform clinics and see referrals in the local hospitals. It is only patients requiring intervention or emergency treatment who will be transferred, but may still be repatriated to their local hospital for rehabilitation.

### 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 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 (anti-platelet and lipid-lowering therapy, blood pressure control). Some will require further investigation by clinical vascular scientists or radiologists, with a view to IR 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 IR 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 wards for dedicated vascular patients 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 and in the recovery and rehabilitation of other post surgical vascular patients. Radiographers and clinical vascular scientists offer diagnostic services and postoperative bypass graft surveillance.
- 3.5 Traditionally, interventional radiologists have offered diagnostic and IR and vascular surgeons have undertaken surgical management. With the development of newer endovascular techniques, these roles are evolving and many vascular specialists of the future will be trained in both open and endovascular techniques. At all times vascular interventions should be delivered or supervised by a consultant with appropriate training in that procedure.
- 3.6 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 involving surgeons, radiologists and anaesthetists achieve superior clinical outcomes<sup>13,22</sup> and specifically have lower mortality rates after AAA repair<sup>18,23</sup>, lower amputation rates for critical lower limb ischaemia<sup>17,22</sup> and lower stroke risks after carotid endarterectomy<sup>20,24</sup>. 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<sup>25</sup>.
- 3.7 Up to 50% of vascular patients present as emergency or urgent referrals. Given the complexity of acute presenting conditions, emergency vascular services are primarily consultant delivered. 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 100,000 generates an average of 70 (range 46-92) arterial operations, 47 (range 40-75) IR procedures and 81 (range 32-125) venous operations per annum (excluding renal access surgery).
- 3.8 To deal with these volumes, a hospital with a vascular service needs a minimum of one vascular surgical specialist per 150,000 population. 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 have 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<sup>26</sup>.
- 4.2 From 2005-7, data from the Department of Health suggest that volumes of arterial surgery were decreasing<sup>3</sup>, yet Hospital Episode Statistics (HES) data suggest that over the last four years there has been a steady increase in the elective index procedures performed for both carotid and elective aortic intervention (Figure 1)<sup>27</sup>. For aortic procedures this may be explained by the ageing population, as there has been no increase in procedures for patients less than 75 years old. In addition, interventions for aortic rupture are reducing and this is likely to continue with the introduction of the NAAASP.
- 4.3 Vascular interventional radiologists are also increasingly specialising and focusing on both the diagnostic and therapeutic aspects of vascular disease. HES data show that the number of endovascular interventions has increased despite a large decrease in the proportion of diagnostic angiograms (Figure 2)<sup>27</sup>. Vascular diagnostic studies are now performed using duplex imaging,

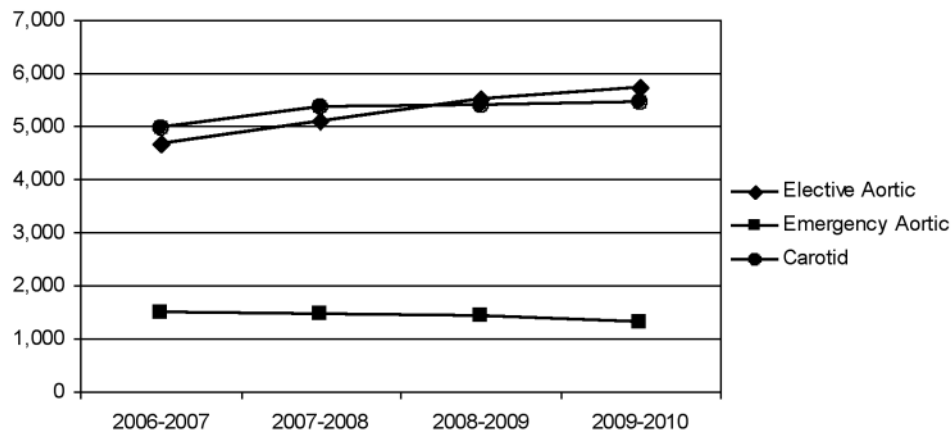


Figure 1: Number of carotid and aortic interventions (y-axis) plotted against year (x-axis). HES Data Search on codes L18, L19, L27, L28, L29, L30.

computerised tomographic angiography (CTA) or magnetic resonance angiography (MRA), and this has added to the reporting workload. A consequence of this shift to non invasive imaging has been an increase in the number of patients requiring intervention and this will have a direct impact upon future service requirements.

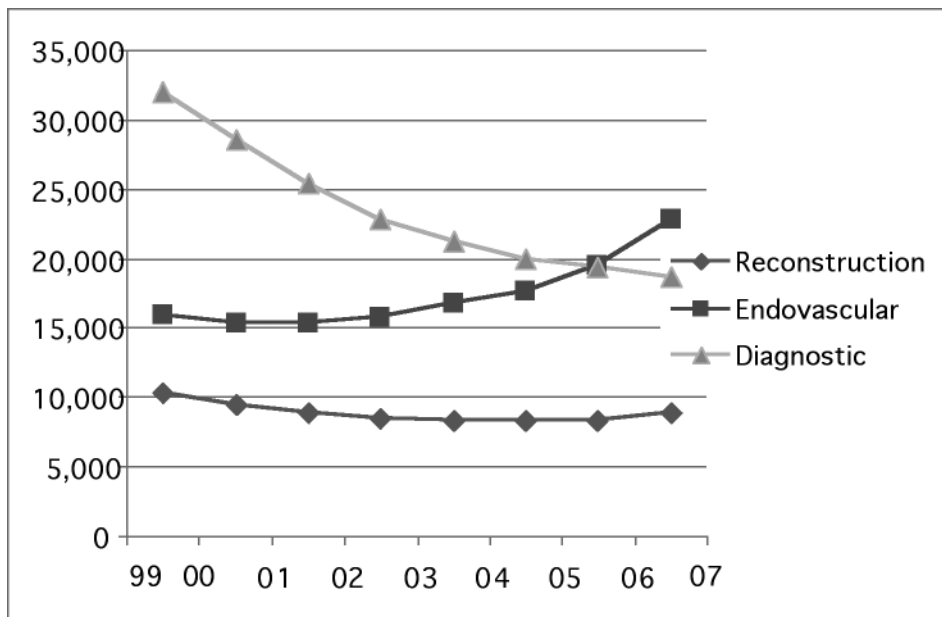


Figure 2: Number of interventions per year for peripheral vascular disease (y-axis) plotted against year (x-axis).

4.4 For varicose veins, the number of interventions for venous disease also appears to be falling, almost certainly as a result of local restrictions on access to care, rather than to any change in the prevalence of the disease (Figure 3)<sup>27</sup>.

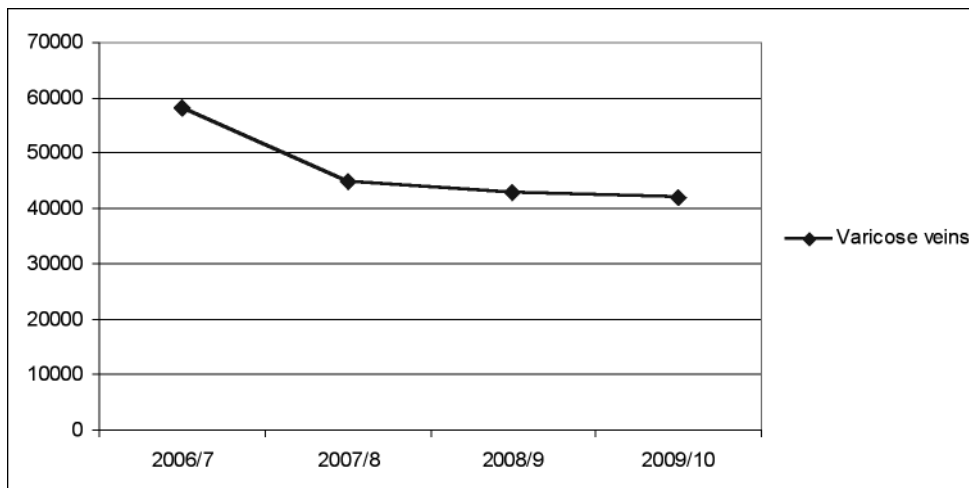


Figure 3: Numbers of interventions for varicose veins (y-axis) plotted against years (x-axis). HES Data Search on codes L84 – L88.



## The Impact of Risk Factors for Vascular Disease

4.5 The prevalence of vascular disease increases with age. The complexity, outcome and costs of vascular intervention are also age-dependent. Average life expectancy continues to rise especially in males (Figure 4) and this factor alone suggests that demand for vascular services is likely to continue to increase with time<sup>28</sup>.

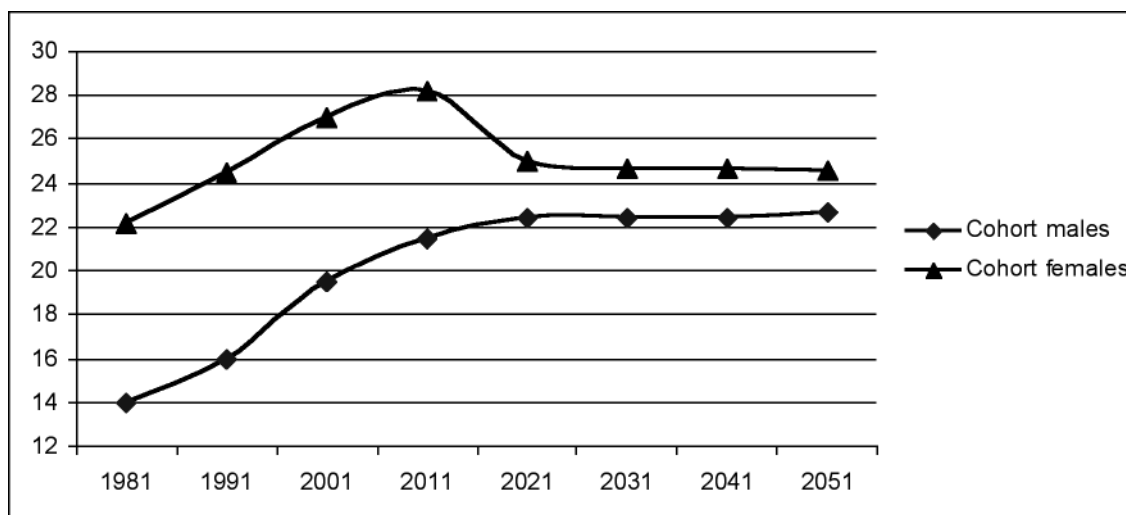


Figure 4: Projected principal cohort and period life expectancies in years (y-axis) by sex, 1981 to 2051 (x-axis). Source: Office for National Statistics.

4.6 This applies equally to all of the home countries (Table 1)<sup>28</sup>.

	Men	Women
UK	82.2	84.9
England	82.3	85.1
Wales	81.9	84.6
Scotland	81	80.7
Northern Ireland	81.8	84.7

Table 1. Life expectancy in years by country and sex. (Estimates calculated using life table data from the Office for National Statistics, and health related data from the GHS, CHS and the Census) .

4.7 There are currently an estimated 3 million people with diabetes mellitus in England. Type 2 diabetes mellitus 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<sup>29,30</sup>. 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 the numbers of diabetics in the UK. In 1993, 15% of adults were classified as obese; this had risen to 25% in 2008 (Figure 5)<sup>28</sup>.

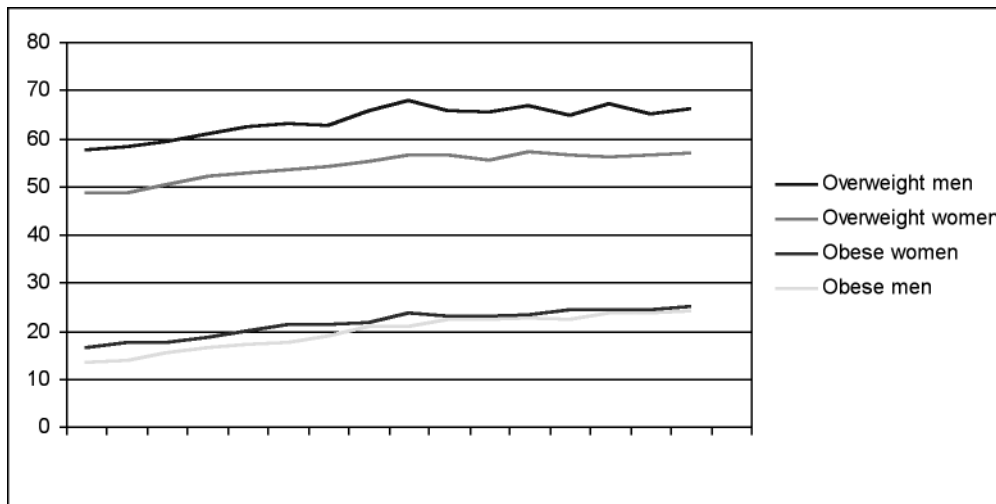


Figure 5: Adult obesity and overweight levels expressed as a % of the total population: by sex, 1993 to 2008. (Adults are defined as obese if they have a Body Mass Index (BMI) greater than 30 kg/m<sup>2</sup>, and overweight if they have a BMI greater than 25 kg/m<sup>2</sup>).

4.8 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 DoH 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 2007<sup>31</sup> (Figure 6). Smokers are at greater risk of complications from vascular interventions because of cardiac and respiratory co-morbidity; in addition, the longer-term success of vascular intervention is reduced in patients who continue to smoke.

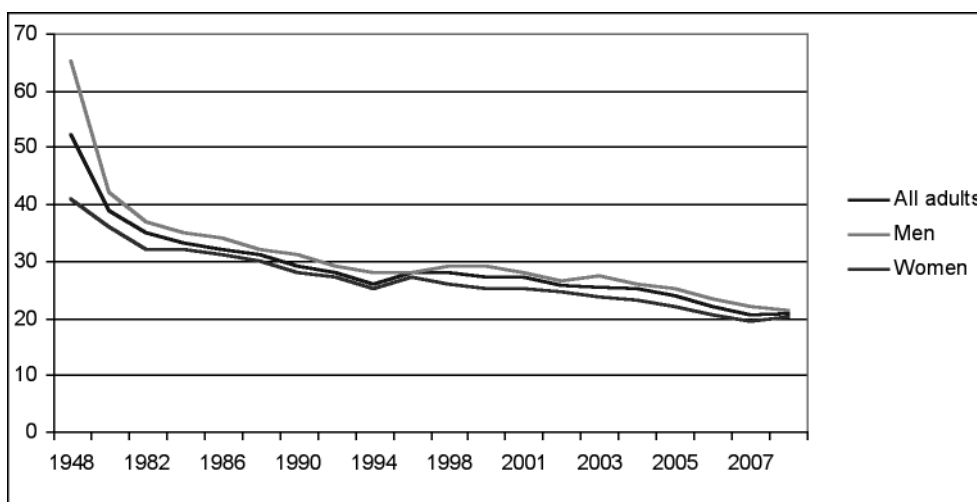


Figure 6: Prevalence of smoking among adults by gender (NHS Information Centre for Health and Social Care).

- 4.9 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.
- 4.10 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. 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 DoH's target was to reduce mortality from circulatory diseases by 40% before 2010. In a 2010 report from the National Audit Office entitled Tackling inequalities in life expectancy in areas with the worst health and deprivation, it is evident that this work is ongoing<sup>32</sup>. Additional resources to help deliver these risk reduction strategies, such as the provision of exercise classes for claudicants, should be provided.
- 4.11 There are variations in the prevalence of vascular disease between different parts of the country<sup>33</sup>. 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.

## Lower limb ischaemia

- 4.12 Around 20% of the population over 60 years of age have peripheral arterial disease (PAD), although only a quarter of those affected are symptomatic; people who smoke or have diabetes or 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, there may be a case for population screening using the ankle/brachial pressure index to identify patients at risk. This is as yet unproven, although the VIVA trial in Denmark is addressing this issue<sup>34</sup>.
- 4.13 PAD produces pain in the leg on walking (intermittent claudication). Symptoms only become severe and progressive in about 10-15% 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<sup>35</sup>. 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<sup>36</sup>.
- 4.14 PAD 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 vascular intervention is essential to avoid amputation. Recent research has suggested that initial endovascular treatment in these patients (particularly by sub-intimal angioplasty) is as effective up to two years as initial surgery<sup>30</sup>. Such treatment is cost-effective<sup>14</sup>. When loss of the leg becomes unavoidable, amputation and early postoperative rehabilitation is the responsibility of the vascular specialist<sup>37,38</sup>.

- 4.15 The incidence of chronic limb ischaemia in the UK is estimated at between 500-1000 patients per million population, yet the majority of these patients do not present with vascular claudication. Many patients present to elderly care services and may not be referred. A vascular unit serving a population of 500,000 will therefore expect to see around 150-200 patients with critical leg ischaemia per year. Only 1-2% of patients with claudication eventually need limb amputation<sup>39</sup>, although the risk is higher (5%) in patients with diabetes.
- 4.16 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<sup>37</sup>. Many patients can no longer cope independently in the community after amputation and may require nursing home care.
- 4.17 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)<sup>17</sup>. They also perform a higher proportion of below knee compared to above knee amputations; this is beneficial because around 50% of below knee amputees become independently mobile with an artificial leg, compared to only 25% of above knee amputees<sup>38</sup>.
- 4.18 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 and revascularisation, if required, can minimise the risk of subsequent amputation. Multidisciplinary diabetic foot clinics, involving vascular surgeons, foot and ankle orthopaedic surgeons, diabetologists, orthotists and podiatrists can identify problems, facilitate timely intervention and save limbs. There is, however, a wide variation in the number of diabetes related amputations across the UK; this has recently been highlighted as unacceptable in the NHS atlas of healthcare variation<sup>40</sup>.
- 4.19 There is a need for improvements in amputation surgery, and better integration with specialised mobility and rehabilitation services including physiotherapists, prosthetists and rehabilitation physicians. Amputees also need to be provided with better artificial limbs if their walking potential is going to be maximised.

## Abdominal aortic aneurysm

- 4.20 An abdominal aortic aneurysm (AAA) occurs when the wall of the abdominal aorta weakens and stretches, caused by atherosclerotic degeneration. AAA are commoner in the elderly and the incidence rises with age; population screening has shown that 4% of men aged 65 have an enlarged aorta, although 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 as many as 30-40% who have urgent intervention will die. When those who die without reaching hospital are included, the overall mortality from a ruptured aneurysm is about 85%. 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 by palpation alone.
- 4.21 Population screening for AAA in men by ultrasound scanning has been shown to reduce disease-specific mortality by about 50% in meta-analysis of the existing randomised trials<sup>41</sup>. It is also cost effective<sup>42</sup>. In 2008, the Department of Health in England announced that it would fund a national NHS Abdominal Aortic Aneurysm Screening Programme (NAAASP) for men, to be introduced over five years<sup>7</sup>, with an aim to reduce deaths from AAA through early detection.

- 4.22 Elective repair of AAA 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 decline<sup>43</sup>. 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 after counselling they are more likely to request intervention, particularly if suitable for endovascular repair. 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 incidental aneurysms in localities where screening is not undertaken.
- 4.23 Elective or emergency open surgery to repair an AAA 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 5.5 cm in diameter, as the risk of rupture is less than the risk of open surgery<sup>44</sup>. It is generally safe to observe smaller aneurysms with regular ultrasound imaging until the aneurysm reaches 5.5cm in diameter, unless it expands quickly (> 0.5cm in 6 months) or causes symptoms. The risk of rupture increases significantly in aneurysms over 6cm, but 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.
- 4.24 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 aneurysm repair (EVAR) using current technology, but this is a fast moving field. EVAR has not been shown to reduce overall mortality after four years compared to open repair in randomised trials, although the EVAR 1 trial was not powered to answer this question. Nevertheless, there are short term advantages in reduced early mortality, length of hospital stay and quality of life<sup>45</sup>. Issues of long term durability and cost remain challenges. Current NICE recommendations are that endovascular repair is appropriate to offer to suitable patients<sup>46</sup>.
- 4.25 Endovascular repair is also emerging as a treatment for ruptured AAA. Although this is not yet recommended by NICE<sup>46</sup>, a UK randomised controlled trial is in progress (IMPROVE trial)<sup>47</sup>, and if this finds in favour of EVAR, the establishment of a service for emergency endovascular repair would have a major impact on the need for out of hours vascular interventional cover; this may involve vascular surgeons trained in endovascular surgery.
- 4.26 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 NICE guidelines state that the technique should not be used without special arrangements for consent and for audit or research, and that all data should be submitted to the NVD<sup>48</sup>.

## Carotid artery intervention

- 4.27 Stroke prevention is a priority for the Department of Health<sup>11</sup>. 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 debris from a ruptured atheromatous plaque 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 North American Symptomatic Carotid Endarterectomy Trial, NASCET measurement method or 70% by the European Carotid Surgery Trial, ECST method) have an increased risk of subsequent stroke. This excess risk can be reduced significantly by carotid artery surgery/endarterectomy (CEA). 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<sup>49</sup>. 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<sup>50</sup>; 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<sup>51</sup>.

- 4.28 Some asymptomatic individuals are found to have a carotid artery stenosis on ultrasound imaging. The risk of subsequent stroke is less than in symptomatic patients, but if they are fit and under the age of 75 with a carotid stenosis >70% (ECST), they do gain a small benefit from surgery (NNT approximately 20)<sup>52</sup>; this benefit is maintained to ten years<sup>53</sup>. Nevertheless, considerably more asymptomatic patients need to be treated in order to prevent one stroke compared to symptomatic patients, as it takes over four years after the operation for the overall stroke risk to show a benefit over best medical therapy alone. Whether or not they undergo intervention, all patients should have appropriate medical therapy with anti-thrombotic, blood pressure and lipid-lowering drugs for life<sup>12</sup>.
- 4.29 CEA 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 latest DoH guidelines on stroke prevention recommend that by 2017, carotid endarterectomy should be performed within 48 hours of onset of symptoms<sup>11</sup>. The establishment of such rapid access treatment requires the development of new referral and diagnostic pathways, and close co-operation with stroke physicians and neurologists<sup>54</sup>. 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.
- 4.30 An alternative to CEA is carotid artery stenting (CAS), which does have potential advantages over carotid endarterectomy (no incision, no cranial nerve injury). The recently published carotid revascularisation endarterectomy versus stenting trial (CREST) was designed to compare the safety and efficacy of CAS versus CEA in patients with high-grade symptomatic carotid stenoses<sup>55</sup>. In line with a meta-analysis of previous randomised trials<sup>56</sup>, CREST concluded that the 30-day stroke and death rates were significantly lower following CEA. However, for both CEA and CAS, stroke and death rates were below or at least comparable to those of previous randomised trials and were within the complication thresholds suggested in guidelines for both symptomatic and asymptomatic patients.
- 4.31 Recommendations may change as the results of further trials become available, but at present CAS should normally be performed as suggested by NICE guidance<sup>57</sup>. 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 audited procedural complications may continue to treat patients on an individual case basis.
- 4.32 In line with the move towards expedited intervention, symptomatic patients should be treated as soon as possible after the onset of symptoms. The Carotid Stenting Trialists Collaboration (CSTC) observed that procedural strokes were three times more common after CAS than after CEA if these treatments were performed within 14 days of the most recent symptom<sup>58</sup>. Accordingly, expert CAS centres who have low audited procedural risks within the hyperacute period after onset of symptoms (<14 days) can continue to offer this intervention. Less experienced centres and those with higher procedural risks should consider CEA as the first line intervention in the hyperacute period after onset of symptoms. Normal risk patients with an asymptomatic carotid stenosis should not currently undergo carotid stenting unless as part of a controlled trial.



## Haemodialysis Access Intervention

- 4.33 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. Central venous catheter use should be minimised. Formation of an arteriovenous fistula, preferably in the non-dominant arm, at least six months before the anticipated need for renal replacement therapy is the ideal. This allows adequate time 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 arteriovenous fistula (AVF).
- 4.34 Approximately 100 patients per million population start dialysis in the UK every year, of which 70 will undergo haemodialysis<sup>59</sup>. 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)<sup>60</sup>.
- 4.35 Because of the known failure rate of new AV fistula, 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 the need was 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) assuming 3-4 patients can be operated upon per list.
- 4.36 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 IR 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<sup>61</sup>. Vascular radiologists also deal with central line access problems, particularly where the central veins have occluded. These procedures are time consuming, with a significant morbidity and mortality.
- 4.37 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. 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<sup>62</sup>. There is a need for increased numbers of vascular surgeons and radiologists to become involved with dialysis access formation and maintenance. Vascular surgeons who are required to commence vascular access work late in their careers as part of service reconfiguration need to be properly trained.

## Other conditions requiring vascular care

- 4.38 Rarer conditions that require a vascular specialist include suprarenal and thoracoabdominal aneurysms (TAAA), aortic dissections, mesenteric artery disease, renovascular disease, arterial/graft infections, vascular trauma, upper limb vascular occlusions, VMs and carotid body tumours. All can be successfully treated by surgeons and/or interventional radiologists with appropriate training/experience and in units with adequate back up. An increasing number of patients with thoracic aneurysms or TAAA/dissections are managed by endovascular (TEVAR) or hybrid procedures. These are complex and highly skilled interventions and should be undertaken in a small number of high volume centres with the expertise to offer both open and endovascular repair.

- 4.39 Vascular specialists should be readily available to assist colleagues from other specialties in the advent of unexpected vascular trauma. This may either be at the major arterial hub or in the modern vascular network hospitals. Protocols must be in place to ensure 24/7 availability of the vascular team for the immediate treatment of patients suffering iatrogenic vascular trauma; often this will be at a non arterial site and arrangements should be made for the transfer of vascular instruments and grafts when necessary.
- 4.40 Vascular surgeons are also the specialists who undertake transthoracic endoscopic sympathectomy, a procedure that can alleviate symptoms of hyperhidrosis or severe peripheral ischaemia in the hands (as can phenol lumbar or open lumbar sympathectomy in the feet). They also perform thoracic outlet surgery to alleviate upper limb neurological symptoms, to prevent recurrent axillary vein thrombosis and to minimise the complications associated with occlusive and aneurysmal subclavian arterial disease.
- 4.41 The main health gains for 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<sup>63-66</sup>.
- 4.42 Chronic venous disorders rarely threaten life or limb, but can have significant effects on health and quality of life. The patients should be managed by a vascular specialist who is the best equipped to undertake their sometimes quite complex evaluation, investigation and treatment.
- 4.43 There are now a number of alternatives to standard surgery for varicose veins. These include 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 settings. Clinical trials to evaluate the exact role of each method are ongoing. Each technique has fundamental training and equipment requirements, and should only be undertaken by specialists with appropriate training<sup>64</sup>. All centres offering surgery for varicose veins should offer at least one of the endovenous therapies in addition to standard open surgical techniques.
- 4.44 Over 30% of the population will develop varicose veins at some stage in their life. Whereas all clinicians would recommend treatment of patients with the complications of varicose veins (eczema or ulcer), the treatment of patients with uncomplicated varicosities is often sub-optimal. Intervention for incompetent, but uncomplicated varicose veins is among the first to be rationalised 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<sup>67</sup>. 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.
- 4.45 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<sup>68</sup>. The development of community leg ulcer clinics has increased demand on vascular services; this is because the routine measurement of the ankle brachial pressure index (ABPI) 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.



- 4.46 Vascular specialists are increasingly involved in the management of deep venous thrombosis (DVT). This can involve the use of lysis and thrombectomy catheters for ilio-femoral DVT, venous stenting for outflow obstruction, venous bypass surgery and ovarian vein embolisation. Deep venous intervention should only be performed in specialist centres by specialists trained in the management of these patients.

## **Lymphatic Disorders**

- 4.47 Patients with impairment of the lymphatic drainage develop chronic leg swelling (lymphoedema) and are at increased risk of infection in that 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 external patient referrals unless their lymphatic obstruction is due to cancer. This continues to be an area of serious under-provision in the NHS and vascular specialists should develop local arrangements with their oncology colleagues for the effective management of patients with lymphoedema. 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.
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## 5. Components of the Vascular Service

- 5.1 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 IR 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.
- 5.2 General surgeons with a significant interest and expertise in vascular intervention should aim to either commit their clinical practice to the sole care of vascular patients or drop their vascular commitments and continue as general surgeons. This decision will depend on local arrangements for the provision of both general and vascular services and will be aligned to the service provision changes required to deliver safe and effective vascular and general surgery to their populations. 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.
- 5.3 As vascular surgery moves towards a new specialty, provision will need to be made for the eventual separation of vascular and general surgery, with vascular surgeons only treating patients with vascular disease; this will be required at both consultant and trainee level.
- 5.4 The weekly job plan for a clinical vascular surgical specialist team should be negotiated locally and should include sufficient outpatient clinics, all day operating lists (endovascular if indicated) and lists for day surgery, renal access or endovascular where training has included endovascular work as a special interest. 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. In addition, it is essential for a multi-disciplinary team (MDT) meeting to be included in consultant job plans.
- 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 work commitment by the vascular team. The EWTR requires a maximum 48 hour working week<sup>69</sup>. This would result in an optimal vascular service comprising of at least six vascular surgeons and a similar number of colleagues offering endovascular intervention. The exact numbers will depend upon the population size (see section 6).
- 5.6 Vascular on call rotas should be no more onerous than 1 in 6 and clinical services covering populations in excess of 1 million people will have to deal with higher volumes of emergency cases; 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 as fixed commitments within the consultant's weekly job plan. The vascular specialist needs to be supported by an appropriate team; this may involve a combination of junior doctors, nurse specialists and specialty registrars.
- 5.7 The formation of the new vascular specialty is not expected to impact significantly on the numbers of juniors required to train in vascular surgery. The new nationally selected training programme will recruit about 20 trainees per year and, along with the training provided to general (GI) surgeons (agreed with the general surgery Specialty Advisory Committee - SAC), we anticipate that numbers will remain relatively stable. Nevertheless, vascular centres will be required to compete for trainees

and will need to offer a full range of training opportunities. Along with the continued reduction in availability and surgical expertise of Foundation 1/2 (F1/2) doctors as a result of EWTR, some duties of the unit may be taken over by ward-based vascular nurse specialists.

- 5.8 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. The alternative is a very onerous working programme for consultants in small groups. Much vascular work is emergency, complex and out of hours and consultant involvement is inevitable. Without a tier of juniors, hospitals will require a team of 8-9 consultants to provide an acceptable rota.
- 5.9 All patients with vascular disease should have 24/7 access to vascular surgeons and interventional radiologists. This will require the rationalisation of current vascular services to ensure that high quality specialist care is available to our patients. In a limited number of more rural areas, this may require collaboration to provide the required 24/7 access to vascular surgery and IR to ensure that patients living in those areas are not denied high quality vascular care delivered by a high volume arterial centre.
- 5.10 For complex interventional procedures, teams comprising more than one specialist (in either vascular surgery, IR, 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

- 5.11 Currently, surgeons seeking appointment to vascular specialist posts should have spent a minimum of the last two years of their specialist registrar training in recognised vascular training units. These units are recognised 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<sup>70</sup>. 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 EVAR.
- 5.12 The planned Vascular Specialty Training Programme will have a minimum duration of eight years, comprising two years core surgical training and six indicative years of specialist training. Entry into ST3 will involve a competitive national selection process. At the intermediate stage (ST3-4), trainees will gain experience of managing patients with common elective and emergency vascular conditions. Vascular procedures within the abdomen, including open AAA repair, will require training in GI surgery. To gain this familiarity, vascular training will include one year of elective GI surgery and one or two years of emergency general surgery (preferably also including emergency vascular surgery). In exchange, general surgical trainees will be offered 6 months training in elective and emergency vascular surgery at the same ST3-4 level.
- 5.13 The final stage of training at ST5-8 will include appropriate exposure to those vascular surgical and endovascular procedures likely to be encountered in specialist consultant vascular practice, including vascular access. Training will also require regular attendance at multi-disciplinary clinics and meetings, competence in basic duplex ultrasound and an appropriate understanding of axial imaging interpretation, manipulation and planning. The necessary skills should be acquired in these four indicative years. The degree of specialisation in all aspects of open vascular surgery, access surgery and endovascular surgery may vary depending on individual career aims. However, it is expected that a trainee will be able to manage competently the majority of unselected vascular cases by the end of ST8. Complex elective and emergency cases may require the assistance of more experienced or other specialty colleagues, even after gaining a Certificate of Completion of Training (CCT).

- 5.14 Currently, examination and certification of completion of specialist training are in general surgery and in the UK there is no separate measure of knowledge or competence in vascular surgery. Vascular trainees may opt to have a clinical examination and an oral in vascular surgery as part of their intercollegiate examination, but this is not mandatory. The VSGBI is working with the Intercollegiate Specialty Boards (ISB) and the Joint Committee on Intercollegiate Examinations (JCIE) to try and improve the vascular component of this examination.
- 5.15 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 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 recognised in Sweden and Switzerland. For IR, the European Board of Interventional Radiology (EBIR) has a similar purpose and status to FEBVS.
- 5.16 IR achieved sub-specialty status in 2010 and future interventional radiologists will have defined subspecialty training over a six year total period (incorporating a three year IR period) and terminating with qualifications in both diagnostic and IR. A defined curriculum and training path is likely to progressively consolidate the provision of IR services. Until recently, some radiologists have provided limited IR within a largely diagnostic work pattern. However, it is likely that in the future most vascular intervention will be provided by interventional radiologists who have undergone a specific prescribed training path.
- 5.17 In Scotland, details regarding the pattern and number of training positions for future interventional radiologists are under consideration by the Specialty Training Advisors, NES (NHS Education for Scotland) and the Scottish Governments Health Directorates (SGHD). Additional evidence has been supplied regarding the need to improve access to 24/7 IR services for consideration during the calculation of the final training numbers. The first radiologists trained through this programme will complete training in 2014-15. Interim arrangements will ensure that, in the intervening years, fellowship type training will maintain an output of trained clinicians.
- 5.18 It is vital that vascular/interventional 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.
- 5.19 With the formation of the new specialty, an exit intercollegiate Fellowship of the Royal College of Surgeons (FRCS) examination in vascular surgery will be developed. Trainees must maintain an e-logbook of experience (e.g. Pan-Surgical Electronic Logbook), and demonstrate progression and achievement of the competencies required through a record of courses, practice on simulation, workplace-based assessments and examinations. This portfolio will continue into consultant practice.
- 5.20 High quality research into methods of preventing and treating vascular disease are needed. This could improve outcomes, identify optimum treatments and evaluate new therapies. 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. The Society actively encourages surgical research and supports a fundraising charity, the Circulation Foundation, and a grant giving body, administered by its Research Committee.
- 5.21 Depending upon the speciality, local University and academic support Academic Clinical Fellows (ACF) can be appointed at either CT (core training) year 1-2 or at ST (specialty training) year 3. At the

present time there are several National Institute for Health Research (NIHR) ACF and Academic Clinical Lecturer (ACL) posts in general surgery with an interest in vascular surgery. It is anticipated that a proportionate number of general surgery ACFs will be allocated to vascular surgery.

- 5.22 All trainees will have an Annual Review of Competence Progression (ARCP). The ARCP panel will make recommendations regarding future placements on the regional specialist training programme to ensure comprehensive training. Specific deficiencies or advanced competencies which cannot be addressed regionally may require Out of Programme Experience (OOPE), such as that provided by an Endovascular Fellowship.

## Specialist Vascular Training Units

- 5.23 Vascular training will be on specialist units with surgeons who are in dedicated vascular practice<sup>63</sup>. They also need to have been trained as educational and/or clinical supervisors and be registered for Intercollegiate Surgical Curriculum Programme (ISCP). Vascular surgery units who wish to provide training must demonstrate (1) a high volume of work, (2) outcomes in line with national defined standards and (3) a consultant rota which provides a sustainable 24/7 emergency surgical and IR service. Consultants should not have any elective commitments when on-call. The rota may be supported by non consultant career grades (Associate Specialists, Staff Grades & Clinical Fellows).
- 5.24 Most vascular training units will have insufficient specialty trainees to provide middle-grade cover, especially at night. There will be only approximately 120 vascular trainees in the UK, because a ratio of 1 trainee to 3 consultants is required to conform to workforce planning requirements. The timetable for vascular trainees from ST5 upwards should maximise their supervised elective and emergency vascular experience. Shift-working will not deliver this experience. Alternative arrangements such as on-call from home, or long-day rather than night working are required.
- 5.25 Other staff supporting the delivery of the service may include core surgical trainees, foundation trainees, surgical care practitioners, vascular specialist nurses, physiotherapists, occupational therapists and vascular anaesthetists. All staff should work within a MDT framework. If there are more approved training places than trainees, placements will be allocated on the basis of the quality of training and outcomes. However, popular units must ensure that there is sufficient capacity for each trainee.
- 5.26 Specialist vascular units should have an elective and emergency vascular workload that provides sufficient supervised experience for trainees to achieve the expected competencies for their level of training. Trainees should work within a team with one assigned educational supervisor and at least 2-3 clinical supervisors during a year to ensure adequate supervision and experience. If there is more than one trainee on a unit, then ideally they should be at different stages of training.
- 5.27 The volume of work should be sufficient to achieve outcomes in line with national standards for all index procedures (AAA repair, carotid endarterectomy, infrainguinal bypass, major amputation, arterio-venous fistula and varicose veins). Whenever possible, all elective and emergency procedures (part or whole) should be performed by a trainee under consultant supervision, if a trainee at the appropriate level is available. Sufficient elective and emergency experience cannot be delivered by shift-working and alternative arrangements such as non-resident on-call, or long-day rather than night working are required to maximise experience.
- 5.28 The training unit should be recognised by the UK NHS AAA Screening Programme as an AAA treatment centre. A dedicated vascular hybrid interventional suite with high-quality fixed imaging equipment, theatre-specification room with adequate radiation protection, full anaesthetic facilities and trained staff should be available. Detailed requirements of this have been published by an Expert Vascular Advisory Group in association with the MHRA<sup>71</sup>.

- 5.29 Wards for dedicated vascular patients are required, with nursing staff experienced in looking after these patients. Ideally, wards should have ring-fenced elective beds with clean bays for elective patients and day-case capability, if not provided by a separate day-case facility. The unit should also have dedicated vascular outpatient clinics at least twice a week, with links to diabetic foot clinics and other specialties such as IR and stroke-prevention, plus vascular access clinics.
- 5.30 24/7 access to ITU, HDU and post-operative care facilities are essential and units should work towards rotas that provide 24/7 cover by anaesthetists with an interest in vascular intervention. There should be access to a CEPOD theatre during daytime/evening hours to avoid delays for patients who require urgent intervention.
- 5.31 In addition, a 24/7 vascular emergency rota and 24/7 access to on-site diagnostic and interventional vascular radiology facilities are required, including digital subtraction angiography, spiral CTA and MRA. Units should also provide regular exposure for vascular trainees in axial imaging and IR, appropriate to their level of competence and subspecialty ambitions. Trainees should be able to access non invasive vascular ultrasound facilities, with accredited clinical vascular scientists or sonographers, and regular sessions for vascular trainees to obtain experience in duplex ultrasound.
- 5.32 Weekly multidisciplinary team meetings with nursing staff, physiotherapists, occupational therapists, interventional radiologists and relevant physicians (cardiologists, diabetologists, nephrologists, stroke physicians) and good access to rehabilitation facilities (preferably onsite), in line with local amputation quality improvement frameworks are essential.
- 5.33 Outcome data should be recorded or audited independent of the clinician who performed the procedure, and all index data should be submitted to the NVD. A climate which encourages clinical audit, research and participation in relevant multicentre randomised clinical trials is encouraged.
- 5.34 Consultant clinical supervisors should be registered with the ISCP, maintain a CPD portfolio and be trained in assessment and giving feedback. Educational Supervisors should have completed their School of Surgery/Deanery training requirements and should have allocated SPA time for supervision of trainees. Clinical Supervisors must have time for teaching in outpatients, on ward rounds and in the operating theatre.
- 5.35 There should be access to a procedural skills centre with appropriate facilities to allow trainees to achieve adequate competence on simulators before treating patients, according to the national framework for simulation training. Adequate provision must be in place for attendance at regional training courses and/or funding to permit trainees to attend the key national courses recommended in the vascular curriculum.

## Interventional Radiology

- 5.36 Interventional radiology is recognised as a subspecialty within radiology and a sub-specialty training curriculum was published in 2010<sup>72</sup>. This curriculum defines the process of training and the competencies needed for the successful completion of training in IR. When followed as part of a prospectively approved training programme, it leads to the award of a certificate of completion of training (CCT) in Clinical Radiology with IR sub-specialisation.
- 5.37 Current training extends over six years with the first three years focusing on acquiring general radiological competencies at the same time as acquiring core interventional skills. Trainees pursuing this curriculum will take all components of the Fellowship of the Royal College of Radiologists (FRCR) in Clinical Radiology. The last three years of training as an interventional radiologist concentrate on developing advanced interventional competencies at the same time as maintaining core competencies in general radiology. The defined curriculum and training path is likely to progressively



consolidate the provision of IR services. In the past some radiologists have provided limited areas of IR within a largely diagnostic work pattern. While it may still be possible within training programmes to access modules that include IR techniques for specific areas it is very likely that most vascular intervention will be provided by interventional radiologists who have undergone a specific prescribed training path in the future.

- 5.38 Details about the pattern and number of training positions of future Interventional Radiologists are under current consideration. Additional evidence has been supplied regarding the need to improve access to 24/7 IR services for consideration during calculation of final training numbers. The first radiologists trained through this programme will complete training in 2014-15. Interim arrangements will ensure that in the intervening years, fellowship type training will maintain an output of trained clinicians.
- 5.39 Vascular surgical specialists work closely with their radiology colleagues and should manage the care of their patients through regular MDT meetings, 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 IR services detailing staffing levels and service organisation is covered in a separate document produced jointly by the Royal College of Radiologists and the VSGBI<sup>73</sup>.
- 5.40 It is envisaged that with the further development of endovascular procedures for the treatment of patients with vascular disease, the vascular radiology and surgical specialists should work together as a team to provide world class care to their patients. Both specialist groups should recognise and utilise the skills of their colleagues and should have knowledge of the relative benefits of endovascular and surgical procedures for common vascular problems. They must jointly 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.
- 5.41 It is essential, when planning provision of vascular service that both vascular surgical and radiological expertise are available on a 24/7 basis to manage any complication that may occur following endovascular intervention. Again, such arrangements must be underpinned by written protocols to ensure optimum patient care is provided at all times.
- 5.42 All care (medical, open surgical and endovascular) should be managed through a local MDT meeting. Outcomes of these meetings should be clearly recorded in the patient's medical record. Dedicated vascular radiographers and IR nurses should be available for all elective and emergency vascular radiology procedures. After these procedures, patients need to be monitored by appropriately experienced staff on a ward for dedicated vascular patients. Protocols should be available for the monitoring and care of these patients. A theatre specification radiology suite or dedicated vascular intervention theatre must be available 24/7 for urgent vascular interventional procedures, including the management of complications.
- 5.43 Provision of emergency services places pressures on radiologists that are similar to those described above for vascular surgeons. Many are non-vascular radiologists and do not have the skills necessary for interventional vascular treatment. In 2012, 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<sup>4</sup>. Collaborative clinical networks should apply to vascular radiology units in a similar manner to those for vascular surgical units for patients who

require immediate vascular imaging or interventional treatment out of hours. Commissioners of vascular services should consider whether the rationalisation of vascular surgery to larger volume hospitals to include radiologists as well as surgeons would address these manpower problems.

- 5.44 The VSGBI, RCR (Royal College of Radiology) and BSIR recognise the changing roles of specialists in the provision of care to patients with vascular disease. Their aspiration is to train specialists with the necessary clinical and team-working skills to provide comprehensive care for patients with vascular diseases.
- 5.45 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

- 5.46 The medical management of patients with PAD has been shown to make 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 the blood vessels. Units with a large workload may consider the appointment of specialist vascular physicians.
- 5.47 Vascular specialists recognise 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

- 5.48 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.
- 5.49 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.
- 5.50 Considerably more resource is needed if this service is based around the vascular laboratory. Both CTA and MRA 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.



## Wards for Dedicated Vascular Patients

- 5.51 Vascular patients are often elderly and their surgery is complex. Their 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, 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 approximately 15-20 beds on wards for dedicated vascular patients, excluding rehabilitation, short stay, day case and intensive care unit (ITU) or high dependency unit (HDU) beds.
- 5.52 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 ward dedicated to the care of vascular patients 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

- 5.53 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.
- 5.54 Hand-held Doppler ultrasound machines should 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, but all centres should now be offering single visit clinics with access to duplex imaging for the majority of patients.
- 5.55 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 performed in the outpatient area. Specialists who base interventions on the results of their own diagnostic imaging should have received appropriate training.

## Day Case and Short Stay Facilities

- 5.56 There needs to be facilities for day care and 23-hour stay 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.
- 5.57 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, although these services are increasingly being undertaken in outpatients. Appropriate space and supporting facilities are required when and wherever the procedures are undertaken. Day care does not need to be co-located with the vascular service and often provision nearer to the patient's home may be preferable.

## Operating and Endovascular Theatres

- 5.58 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 specific training in this area are valuable. A vascular theatre also requires stocks of specialist grafts, instruments, haemostatic agents and sutures that are stored nearby, as they are often needed without delay.
- 5.59 At least one endovascular theatre or theatre specification IR suite is required, preferably with a fixed C arm and a dedicated X-ray table.
- 5.60 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 IR. 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<sup>61</sup>.
- 5.61 Many vascular operations take longer than a half day session and so arrangement should ensure that vascular teams have access to sufficient all day theatre lists for their elective workload. In addition, many vascular procedures are unscheduled and there should be easy access to additional urgent theatre time as required. A 24/7 emergency CEPOD theatre must be readily available to undertake emergency vascular procedures.

## Anaesthesia, ITU, HDU and PACU (post-anaesthesia care unit)

- 5.62 Vascular patients benefit from being looked after during their surgery by specialist vascular anaesthetists. There is recent published evidence that such specialists can affect patient outcome, including reduced mortality for elective and emergency vascular surgery<sup>74-76</sup>.
- 5.63 Vascular anaesthetists will have completed a period of specialised training in vascular anaesthesia, have an interest in vascular anaesthesia, and may be members of the Vascular Anaesthesia Society of Great Britain and Ireland (VASGBI).
- 5.64 Different anaesthetic techniques can influence outcome, however, probably the most important factor is the teamwork that develops between vascular surgeons, vascular anaesthetists, interventional radiologists and the other members of the team. Local policies may influence the choice of anaesthetic techniques and protocols.
- 5.65 Vascular anaesthetists should increasingly attend the MDT meetings and be involved in the pre-operative assessment of vascular patients. All patients undergoing open or endovascular repair of AAA should be seen pre-operatively by a vascular anaesthetist.
- 5.66 The management of vascular patients post-operatively may also affect outcome. Local policies will also determine where vascular patients undergoing high-risk surgery should be managed post-operatively. Anaesthetists and intensivists should be involved in the post-operative management of vascular patients including the timing of epidural withdrawal in relation to any anticoagulant therapy.
- 5.67 Consideration should be given by anaesthetic departments in vascular centres to ensure that consultant anaesthetists experienced in the management of patients with vascular emergencies are available 24/7.

- 5.68 Anaesthetic specialists and intensivists caring for vascular patients need to be familiar with the management of sick high-risk surgical patients. They also have an important role in pre-assessment and optimisation of patients before complex surgery. Vascular surgeons should support the use of and resource for non invasive cardiac assessment, which may include Cardio Pulmonary Exercise Testing (CPEX).
- 5.69 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 or PACU rather than an ITU.
- 5.70 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<sup>1</sup>. This may decline once the NAAASP reduces the number of ruptured aneurysms.

### Major Trauma Centres/Emergency Departments

- 5.71 An estimated 450 to 600 lives could be saved in NHS hospitals each year if trauma services were better organised. To achieve this, the NHS is setting up regional trauma networks to ensure that patients with serious and life-threatening injuries are treated quickly in a specialist hospital where expert staff are available 24/7, including vascular surgeons and interventional radiologists. This programme will make big changes to existing ways of dealing with major trauma and the ways in which patients are admitted to hospital or referred for treatment. Around 20 major trauma centres are expected to be set up in England as part of the programme<sup>77</sup>.
- 5.72 It is essential that any new vascular service is situated in a hospital with a major trauma centre or an accident and emergency department. If an existing vascular service is sited in a hospital without a trauma or emergency department, there must be robust mechanisms available for the direct admission of vascular emergencies. Many patients needing vascular expertise will present to an emergency department; if the vascular service is not in the same hospital, there need to be clear protocols for the management of such patients.
- 5.73 The establishment of major trauma centres nationally may provide an opportunity to increase the number of trainees by aligning vascular and trauma training programmes. The London Deanery, with support from the London Trauma Office, is appointing four such posts and surgeons with dual training may have sufficient flexibility to help with the provision of vascular surgery in some more rural areas.
- 5.74 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<sup>75</sup>. 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 if required.

### The Vascular Nurse Specialist

- 5.75 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 the 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

- 5.76 Vascular patients are susceptible to acute kidney injury (AKI) either as a result of contrast induced nephropathy or following intervention. Facilities for haemofiltration must be available in HDU and ITU. Where AKI is recognised, the involvement of a nephrologist, or a physician with an interest in renal medicine, is required to minimise the risk of permanent renal failure.
- 5.77 Patients with vascular disease often have significant chronic kidney disease and expert nephrology input may help to minimise 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.
- 5.78 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, renal transplant and interventional specialists to provide optimal care.
- 5.79 Renal access surgery is a growing part of vascular surgical practice. This work requires careful organisation and a service of sufficient size is best served by the appointment of a dedicated specialist vascular access co-ordinator<sup>61</sup>. Complications of AVF include thrombosis and bleeding and often result in an urgent requirement for renewed vascular access; this necessitates the provision of an on-site emergency vascular service.

## Physiotherapy/Occupational Therapy

- 5.80 Vascular patients are often elderly or disabled and require specialist physiotherapy to aid 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.
- 5.81 Supervised exercise classes are of significant value in the treatment of claudication and should also be provided in the gym by suitably trained physiotherapists with experience of exercising patients with cardiovascular disease<sup>35</sup>.

## Limb Fitting Service/Rehabilitation

- 5.82 PAD 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; a pre-amputation 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

### Medicine for the Care of Older People:

- 5.83 Patients with vascular disease are often very elderly. The recent NCEPOD review of the care of elderly patients undergoing surgery makes the following recommendations that are applicable to elderly vascular patients<sup>78</sup>:
- a. Routine daily input from medicine for the care of older people should be available to elderly patients undergoing vascular surgery and is integral to inpatient care pathways in this population.
  - b. Co-morbidity, disability and frailty need to be clearly recognised as independent markers of risk in this elderly population. This requires skill and multidisciplinary input including early involvement of medicine for the care of older people.
  - c. Delays in surgery for the elderly are associated with poor outcome. They should be subject to regular and rigorous audit in line with agreed standards.
  - d. All elderly patients should have a formal nutritional assessment during their admission so that malnutrition can be identified and treated.
  - e. Intra-operatively temperature monitoring and management of hypothermia should occur and is particularly important in elderly patients. There should be clear strategies for the intra-operative management of low blood pressure in the elderly to avoid cardiac and renal complications. Non-invasive measurement of cardiac output facilitates this during major vascular surgery.

### Cardiology

- 5.84 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 catheterisation and angioplasty/stenting) is required. Vascular specialists and interventional radiologists are also required to deal with the complications of cardiac catheterisation.

### Cardiac Surgery

- 5.85 Peripheral arterial complications requiring vascular intervention occasionally occur after cardiac surgery. Collaborative surgery/intervention is often required for patients with combined cardiac and carotid disease, or TAAA/dissections. Reconstruction with extra-anatomic diversion of arterial flow is a growing part of the endovascular management of complex thoracoabdominal aortic disease (hybrid surgery). In addition, full or left heart bypass are adjuncts to the repair of TAAs particularly if the procedure is open.
- 5.86 Stroke is a significant complication in older patients undergoing coronary bypass surgery. 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 intervention, although the evidence for such practice is lacking. Nevertheless, vascular surgeons should develop local protocols with their cardiac surgeons for the management of these patients.

- 5.87 In some centres, cardiac surgeons are involved with TEVAR. The future management of thoracic aneurysms should be based on close collaboration between regional cardiac units and vascular teams. Vascular surgeons and radiologists involved in thoracic intervention should develop close working relationships and local networks with the cardiac surgeons to deliver this service.

## Diabetes

- 5.88 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 optimise care and minimise tissue loss<sup>79</sup>.
- 5.89 The development of formal pathways of care and/or combined clinics for diabetic foot disease is a potential means to minimise the risk of amputation in this vulnerable group<sup>80</sup>. In the outpatient setting these patients have complex foot problems requiring multi-specialty input. A multi-disciplinary foot care team comprising a diabetologist, diabetes nurse specialist, a surgeon with expertise in managing the diabetic foot, a podiatrist and a tissue viability nurse should be available to manage inpatients with diabetic foot complications<sup>79</sup>. The specialists involved in such a team will be determined by local interest and expertise.

## Dermatology

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

## Clinical Laboratory Services

- 5.91 Blood disorders may initiate or exacerbate vascular problems, and close collaboration with the haematology service is needed to deal with these patients effectively. There is frequently a need for blood replacement during major vascular interventions, although with continued development of modern surgical methods and the routine use of haemostats and cell salvage, the requirement for blood products is reducing. Nevertheless, vascular interventions should not be undertaken unless there is ready access to blood and blood products for transfusion.
- 5.92 Infective complications of surgery have particularly serious implications for patients with prosthetic arterial grafts. There should be agreed unit policy on prophylactic antibiotics based on microbiology advice. Current problems with hospital-acquired bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and the development of other 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.
- 5.93 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.

## Neurology/Stroke physicians

- 5.94 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. With the DoH recommendation for CEA within 48 hours of a neurological event in high risk patients, it will be important that acute or hyperacute stroke units (providing 24/7 thrombolysis) are closely linked with high volume arterial centres<sup>11</sup>. Service organisation, with agreed protocols and MDT are needed to ensure such timely access to carotid intervention.

## Plastic Surgery

- 5.95 Once revascularisation 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.

## Other Surgical Disciplines

- 5.96 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, or the patient is stable for transfer; this will depend on local protocols. These events are rare and should not dictate 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<sup>81</sup>. 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.

## Audit, Governance & Quality Improvement

- 5.97 Vascular services must be accompanied by a comprehensive programme for audit of clinical outcomes. The data system needs to be based on an adequate information technology (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 nine years of data collection and analysis to decide whether or not clinical outcomes for an individual surgeon lie within the norm<sup>82</sup>. There are methods to use standard data collected in every hospital to prove evidence of safety<sup>83</sup>.
- 5.98 Vascular surgeons are required to submit their figures to the 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.
- 5.99 The Vascular Society has a standard that all index vascular procedures should be entered on the NVD. Surgeons have identified time in their work programme through SPA activity to ensure both adequate data entry into national clinical audit and to quality assure the coding of vascular

procedures within their unit. A minimum of 0.25 SPA (0.5 in busy units) per surgeon should be identified to support national clinical audit. Audit of outcomes benchmarked against peers should form an integral part of a vascular surgeon's annual appraisal and will be an essential requirement for revalidation.

- 5.100 The UK Government has indicated that it is likely to require publication of data from individual surgeons to enter the public domain<sup>84</sup>. 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 DoH are as accurate as possible. Good outcomes are fundamental to the cost efficacy of vascular intervention. The UK does not compare well with international comparators for some vascular procedures. It has the highest mortality rates in Western Europe following elective AAA surgery and is among the slowest nations for uptake of new endovascular technology<sup>85</sup>. Patients are not always treated by a vascular specialist and stay longer in hospital following their surgery than the rest of Europe. Poor results also undermine the value of the NAAASP to men with an AAA.
- 5.101 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 was introduced in 2009<sup>86</sup>. This was updated in 2012<sup>87</sup> with a revised date of 2014 to allow for completed data analysis up to December 31st 2013. The document describes the optimal conditions for treatment of aortic aneurysms and has recommended the following:

## Preoperative

- 5.102 All patients should undergo standard preoperative assessment and risk scoring, including cardiac, respiratory, renal, diabetes, peripheral vascular disease, as well as CTA to determine their suitability for EVAR.
- 5.103 Each hospital should have defined pathways for the correction of significant medical risks (cardiology/renal/respiratory) before intervention.
- 5.104 All patients should be seen in preassessment by an anaesthetist with experience in elective vascular anaesthesia. At this stage, medication should be reviewed and optimised for the intervention<sup>88</sup>.
- 5.105 All elective procedures should be reviewed pre-operatively in an MDT that includes surgeon(s) and radiologist(s) as a minimum. Ideally, a vascular anaesthetist should also be involved to consider fitness issues that may affect whether open repair or EVAR is offered. Facility to offer both procedures should be available either in house, or by referral through an agreed pathway.

## Operative

- 5.106 Interventions should be undertaken (or supervised) by a consultant surgeon/radiologist/anaesthetist with training and expertise in elective vascular procedures and a routine clinical practice in this specialty.
- 5.107 Open AAA repair should include the following components: normothermia, cell salvage, rapid infuser, easy access to blood products (within 1 hour) and availability of haemostatic agents including glue.
- 5.108 EVAR should only be undertaken in a sterile environment of theatre standard, with optimal imaging facilities. A range of rescue stents and devices should be immediately available, together with the expertise to deploy them.



## Facilities

Elective AAA repair should only be undertaken in hospitals where:

- 5.109 There is 24/7 on call rota for vascular emergencies, covered by consultant vascular surgeons and interventionists, to ensure adequate postoperative care. Cover may be provided within a centralised service or from a designated arterial hospital as part of a modern vascular network. Centres without 24/7 vascular cover should make immediate arrangements to transfer their elective and emergency arterial services to a local large volume arterial hospital.
- 5.110 There is a critical care facility with ability to undertake mechanical ventilation and renal support, and with 24/7 on-site anaesthetic cover.
- 5.111 Wards for dedicated vascular patients should be available with the provision for single sex cubicles or bays.
- 5.112 At least one endovascular theatre or theatre specification IR suite is required, preferably with a fixed C arm and a dedicated X-ray table.
- 5.113 A minimum number of AAA procedures are undertaken. It is recommended that hospitals undertaking fewer than 33 elective AAA interventions per year (100 over three years) should not continue to offer these procedures. Hospitals who undertake fewer than 100 procedures in 2008-2011 inclusive should move their elective aortic interventions to the nearest major vascular centre. This is because it will never be possible to prove evidence of safety for their aortic procedures. It should be noted that this recommendation is made with the knowledge of a known volume-outcome relationship for AAA repair. In the future, outcome modelling is likely to result in the recommended volume of procedures being higher.
- 5.114 Hospitals should know their AAA mortality and should seek to validate both national audit and Trust data. They should be able to demonstrate safe practice. Units with mortality rates for elective repair of 6% or greater should seek external professional review of their care processes (6% is the achievable standard set by NAAASP)<sup>7</sup>.
- 5.115 An on site vascular laboratory should be available.
- 5.116 Specialists undertaking aortic intervention should submit all their procedures to the NVD and undertake regular review of their practice and outcomes (morbidity and mortality meetings).
- 5.117 Vascular teams that cannot meet the requirements of the above framework should engage actively with service managers and commissioners to effect the changes required to develop safe and effective services that meet the local needs of their patients with vascular diseases.
- 5.118 Similar quality improvement programmes are planned for carotid surgery and amputation, although the numbers required to prove evidence of safety for these procedures are more difficult to define.

## 6. Strategies For Vascular Services

- 6.1 The Vascular Society of Great Britain and Ireland is actively engaged with driving down the mortality of patients undergoing vascular procedures in the UK and Ireland. Our primary objective is to provide all patients with vascular disease with the lowest possible elective and emergency morbidity and mortality rates in the developed world. To achieve this we will need to modernise our service and deliver world class care from a smaller number of higher volume hospital sites.
- 6.2 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 generalist surgeons and radiologists who do not have a specialised elective vascular practice; they may, however, 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 vascular specialists. 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.
- 6.3 Recent studies have shown that patients may suffer unnecessary strokes or amputations unless they have access to the full range of vascular services<sup>14-17,22</sup>. Thus, smaller vascular units and hospitals without vascular surgeons that are unable to provide this care should develop pathways to ensure that relevant patients are referred to a specialist centre with which they have a formal arrangement. This implies development of a local or regional networking arrangement, including access to vascular out-patient facilities in all networking hospitals, joint multi-disciplinary meetings and consolidation of all major arterial surgery on a single high volume site in the modern clinical network.
- 6.4 The Provision of Surgery for Patients with Vascular Disease (POVS) 2009 document described the case for Centralisation or Networking as the two favoured models of care<sup>3</sup>. Although each model has in many instances been able to deliver high quality care to patients with vascular disease, it has become apparent that many networks are unable to adequately provide the required 24/7 access to vascular and radiological expertise. When clinical networks are set up to allow for arterial intervention on multiple sites, it is often difficult for on call vascular surgeons and interventionalists to provide adequate care to all patients at all times of the day. This is especially true, and to the disadvantage of patients, when they develop complications on differing sites within the network at the same time, resulting in stretching of the expert cover arrangements.
- 6.5 In addition, strong volume outcome data is emerging suggesting a benefit for patients receiving their arterial intervention at high volume arterial hospitals with 24/7 cover from a team of specialists dedicated to the treatment of patients with vascular disease<sup>14</sup>. It is also clear from this volume outcome data that the results of vascular intervention are not only dependent upon the mortality and morbidity associated with the primary procedure, but also the availability of experts to deal with complications as and when they occur.
- 6.6 Coupled with the introduction of the 48 hour week, the reduction in both consultant and trainee numbers which will result from specialty status, and the strict mortality standards set for the provision of aortic aneurysm surgery by the NAAASP, it is apparent that the Society's advice on the provision of vascular services to our patients requires updating.
- 6.7 The current Vascular Society advice is that high quality world class vascular care can be delivered in the UK with the establishment of high volume arterial centres. Modern clinical networks of care should be established for the assessment and treatment of vascular patients who do not require arterial intervention in network hospitals nearer to their homes.

- 6.8 Increasing numbers of vascular services are considering consolidation onto a single site. These models of care are strongly supported. The Society recommends that all vascular surgeons and interventionalists working in high volume services should be available to provide high quality care to those hospitals without arterial services who contribute to their network. This requires the development of formal arrangements and protocols and a commitment to continue out patient clinic, ward work and non-arterial surgery on network sites.
- 6.9 The Society is aware of the special circumstances required of many isolated rural areas including those in the Highlands and Islands and more rural areas of the UK. In these circumstances, local arrangements should be put in place to ensure that patients living in these areas are not denied high quality vascular care delivered by a high volume arterial centre.

## The Case for Clinical Networking to High Volume Arterial Hospitals

- 6.10 Vascular services need to be organised to allow reasonable elective activity to exist alongside an acceptable consultant emergency on call rota. This should be no more onerous than a 1 in 6, and for large centralised units may be 1 in 8 or more. Units with fewer than 4 surgeons should no longer be performing arterial surgery and should merge or collaborate in a modern clinical network to achieve 24/7 emergency cover. Such networks should designate a single centre to provide all elective and emergency arterial intervention.
- 6.11 The Vascular Society recommends a service that would allow for all arterial interventions (including non day case peripheral artery angioplasty and stenting) to take place in a high volume arterial hospital which can provide the following facilities:
- a. A 24/7 on-site vascular on call rota for vascular emergencies of 1:6 or greater covered by consultant vascular surgeons and interventional radiologists to ensure adequate postoperative care.
  - b. A 24/7 critical care facility with ability to undertake mechanical ventilation and renal support and with 24/7 on-site anaesthetic cover.
  - c. Wards for dedicated vascular patients should be available with single sex cubicles or bays.
  - d. At least one endovascular theatre or theatre specification IR suite is required, preferably with a fixed C arm and a dedicated X-ray table.
  - e. A minimum number of AAA procedures are undertaken. It is recommended that hospitals undertaking fewer than 33 elective AAA interventions per year (100 over three years) should not continue to offer these procedures.
  - f. Hospitals should know their AAA mortality and should seek to validate both national audit and Trust data. They should be able to demonstrate safe practice by aiming for an elective AAA mortality to 3.5% by the end of 2013. Data will be analysed and available by mid 2014 and units with mortality rates for elective AAA repair of 6% or greater should seek external professional review of their care processes.
  - g. An on site vascular laboratory should be available.
  - h. Specialists undertaking aortic intervention should submit all their procedures to the NVD and undertake regular review of their practice and outcomes (morbidity and mortality meetings).
- 6.12 These high volume arterial hospitals may be aligned to NAAASP (based on a minimum population of 800,000), and although they can involve a modern clinical network with a designated arterial hospital, the preferred model of care is a fully centralised single site.

## Modern Clinical Networks

- 6.13 A modern clinical network exists when two or more adjacent hospitals collaborate to provide patient care. Such networks should decide upon a single hospital which will provide both elective and emergency arterial vascular surgical care. Networks might be based on a local aortic aneurysm screening programme, but it is required that all major arterial intervention is performed on the designated arterial site. All in-patients on the vascular unit should be reviewed daily by a member of the vascular team.
- 6.14 The majority of vascular patients do not require major vascular intervention and it is important that local protocols are agreed to provide high quality specialist care to patients at the non arterial network hospitals. 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 and the transfer of emergencies out of hours.
- 6.15 All vascular consultants involved in a modern clinical network should be timetabled to provide out patient and ward specialist vascular care to patients within the non-arterial network hospitals. This may include a service to amputees and to patients with chronic venous insufficiency and diabetic feet. Local models of care should be developed, and it may be appropriate to offer amputation and rehabilitation in designated non-arterial hospitals, if local amputation quality improvement frameworks allow. It is however important that all patients considered for amputation are fully assessed by a consultant vascular specialist and given the same opportunities for limb salvage as those in the high volume arterial hospitals.

## Hospitals without on site elective arterial intervention

- 6.16 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 and is available on a daily basis to review ward patients or attend to vascular emergencies required of other specialties. The visiting consultant needs flexibility to review patients on the wards, give advice to other clinical teams and if required support teams doing elective work where they anticipate needing vascular input.
- 6.17 Patients must be allowed to make an informed choice about transfer to the adjacent hospital for specialist care following vascular 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.
- 6.18 Visiting vascular specialists/teams should provide a service for in-patients at the hospital and may also undertake day and non-arterial surgery locally.
- 6.19 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.
- 6.20 Hospitals 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 these services.

- 6.21 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 travel times 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<sup>89,90</sup>. This advantage persists even with up to 4 hours of hypotension<sup>91</sup>, although patients who suffer a cardiac arrest are unlikely to survive transfer<sup>92</sup>.
- 6.22 Patients arriving at a non-vascular hospital with a vascular condition requiring emergency intervention should be diagnosed and referred within one hour of arrival. Services should be arranged to minimise transfer times (target less than one hour). 95% of patients should be triaged, referred and have arrived at the vascular unit within two hours of arrival at the spoke hospital. A few remote rural communities may need to agree different transfer target times, but should audit their service provision against locally agreed standards.

## Hospitals with A Single-Handed Vascular Service

- 6.23 This type of service cannot be supported 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<sup>22</sup>) 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.
- 6.24 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, usually by the former single-handed surgeon who is subsequently based in the adjacent high volume arterial hospital. For vascular emergencies, this type of hospital will become a unit without a vascular service.
- 6.25 Even if the local population might sustain two vascular specialists, unless the area is geographically remote, centralisation of vascular services into 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 MDT meetings.
- 6.26 If additional surgeons are appointed locally this must coincide with participation in a collaborative clinical network with adjacent hospitals and the designation of a single large volume arterial hospital for the provision of all elective arterial and emergency vascular cover.

## Hospitals with 2-4 Vascular Surgeons

- 6.27 These hospitals should set up a modern clinical network with neighbouring trusts and decide upon a single designated high volume arterial centre. If they are chosen to provide the service, they should develop a rota no more onerous than 1 in 6 with neighbouring vascular surgeons to provide 24/7 vascular care to the network patients. They should have all the facilities listed in Section 6.11, including a dedicated angiography suite, spiral CT and MRA, a vascular laboratory and a ward for

dedicated vascular patients. The critical care facilities should be large enough to cope with the vascular workload for the network.

- 6.28 Appropriate support must be available from interventional radiologists and vascular anaesthetists.
- 6.29 If they are not designated as the high volume arterial hospital within the network, all elective and emergency vascular surgery should cease and be transferred to the designated network hospital. A daily vascular presence must be maintained at the site to provide care to vascular patients with non arterial disease, those rehabilitating from arterial surgery nearer to home, and for affiliated specialties who occasionally require vascular assistance.
- 6.30 Where moving arterial services on to one site may leave large rural areas and other medical services (e.g. obstetrics, interventional cardiology, stroke management and GI bleeding) vulnerable (more than 1hr blue light between network sites), there may be a reasonable case for allowing the current network model to continue. In such cases we would recommend public consultation to consider these risks and to determine whether a successful fully audited and scrutinised rural network model should continue, provided outcomes comparable with centralised vascular units can continue to be demonstrated.
- 6.31 Appropriate care pathways and repatriation protocols must be in place for the management of all elective and emergency vascular patients involved in the modern clinical network. This will include detailed convalescence pathways for patients transferring to non arterial hospitals following surgery at a designated arterial centre.

## Centralised services

- 6.32 These models of care already fulfil the criteria for the high volume arterial centres described above. They are more likely to be feasible in areas of dense population where two or more hospitals are relatively close. Essentially, the criteria for the delivery of vascular services are the same as for network high volume vascular hospitals, except that the numbers of patients requiring specialist vascular treatment are usually higher and there is a greater requirement for specialist care. This includes dedicated services for the provision of TAAA repair (open and TEVAR), the management of aortic dissection (type A and B), complex branched and fenestrated endovascular technology, carotid stenting, mesenteric intervention (open, angioplasty and stenting), and joint procedures involving cardiac, transplant, neuro, orthopaedic and general surgeons (cancer and benign).
- 6.33 Centralisation is the preferred method of providing high quality vascular services in our major cities. 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. It is important for hospitals to provide adequate resource and infrastructure to facilitate the development of centralisation when it occurs.
- 6.34 Whilst modern 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, investigation and treatment. These include larger and more specialised radiology units, with multiple CT/MR/angiography facilities, more vascular operating/endovascular theatres and specialist staff, dedicated vascular anaesthetists, improved facilities for endovascular management and the better availability of critical care beds and expertise.
- 6.35 In centralised units, opportunities for high quality multidisciplinary working, clinical research and postgraduate training should all be enhanced. Such units are usually 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 maximises the use of expensive equipment and facilitates the introduction of new technology.

- 6.36 When centralisation occurs, outpatient clinics and perhaps day surgery should 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.
- 6.37 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 to their centralised vascular 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 centralised hospital. Any increase in workload may provide justification for additional vascular consultant appointments and facilities at the centralised hospital.
- 6.38 NCEPOD has shown better outcomes for patients treated by a vascular as opposed to a general surgeon for ruptured aortic aneurysm<sup>25</sup>. 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 networking without designated high volume arterial hospitals.
- 6.39 Centralisation of vascular services will also make it easier to comply with the recommendations of the DoH stroke and TIA initiative which requires provision of urgent carotid endarterectomy for appropriate patients presenting with these neurological events<sup>11</sup>. As for aortic aneurysm, the literature 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

- 6.40 The provision of vascular surgery is developing rapidly with the realisation of specialty status, the requirement to adhere to the 48 hour week, the standards required by NAAASP and the realisation that in the future we will have lower numbers of consultants and trainees to deliver world class vascular care to our patients.
- 6.41 Both centralisation within our major cities and modern clinical networking to high volume arterial hospitals for more diverse population demographics will have implications for resource allocation. In many instances this may cross the boundaries of individual commissioning groups, and specialised commissioning at a national level, or agreement between Health Boards, will be required to co-ordinate planning for these services. A decision on the formation of a specialty commissioning group for vascular services is expected imminently and, if agreed, this will result in further rationalisation of service and the concentration of resource onto a smaller number of high volume and high quality vascular centres.
- 6.42 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<sup>11,13,15</sup> be delivered alongside the best possible elective and emergency outcomes for individual patients.



## References

1. The Vascular Society of Great Britain and Ireland. **The Provision of Vascular Services**. London 1998.
2. The Vascular Society of Great Britain and Ireland. **The Provision of Vascular Services 2004**. London 2004.
3. Vascular Society of Great Britain and Ireland. **The Provision of Services for Patients with Vascular Disease**. London 2009. [www.vascularsociety.org.uk/library/vascular-society-publications.html](http://www.vascularsociety.org.uk/library/vascular-society-publications.html)
4. Association of Surgeons of Great Britain and Ireland. **Emergency General Surgery: the Future. A consensus statement**. London 2007. [www.asgbi.org.uk/en/publications/consensus\\_statements.cfm](http://www.asgbi.org.uk/en/publications/consensus_statements.cfm)
5. Association of Surgeons of Great Britain and Ireland. **The impact of the European Working Time Directive on Delivery of Surgical Services: a consensus statement**. London 2008. [www.asgbi.org.uk/en/publications/consensus\\_statements.cfm](http://www.asgbi.org.uk/en/publications/consensus_statements.cfm)
6. Department of Health. **Interventional Radiology: Guidance for Service Delivery – a report from the National Imaging Board**. London 2010. [www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_121904](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_121904)
7. NHS Abdominal Aortic Aneurysm Screening Programme. **NHS Screening Programmes**. London 2008. [aaa.screening.nhs.uk/](http://aaa.screening.nhs.uk/)
8. Healthcare Improvement Scotland. **Abdominal Aortic Aneurysm Screening (AAA) Programme Standards**. Edinburgh 2011. [www.healthcareimprovementscotland.org/programmes/cardiovascular\\_disease/screening\\_for\\_aaa/aaa\\_screening\\_standards.aspx](http://www.healthcareimprovementscotland.org/programmes/cardiovascular_disease/screening_for_aaa/aaa_screening_standards.aspx)
9. Holt PJ, Poloniecki JD, Gerrard D et al. **Meta-analysis and systematic review of the relationship between volume and outcome in abdominal aortic aneurysm surgery**. *Br J Surg* 2007; 94: 395-403.
10. Specialised Services for Vascular Disease (adult) - **Definition No. 30. Specialised Services National Definitions Set (3rd Edition)** 2010. [www.specialisedservices.nhs.uk/library/26/Specialised\\_Vascular\\_Services\\_adult.pdf](http://www.specialisedservices.nhs.uk/library/26/Specialised_Vascular_Services_adult.pdf)
11. Department of Health. **National Stroke Strategy** London 2007. [www.dh.gov.uk/stroke](http://www.dh.gov.uk/stroke)
12. National Institute of Clinical Excellence (NICE). **Diagnosis and initial management of acute stroke and transient ischaemic attack (TIA)**. London 2011. [www.nice.org.uk/CG68](http://www.nice.org.uk/CG68)
13. Department of Health. **High Quality Care for All. NHS next stage review final report**. London 2008. [www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_085825](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_085825)
14. Michaels J, Brazier J, Palfreyman S et al. **Cost and outcome implications of the organisation of vascular services**. *Health Technology Assessment* 2000; Vol 4 (11).
15. Oliver SE, Thomson RG. **Are variations in the use of carotid endarterectomy explained by population need? A study of health service utilisation in two English health regions**. *Eur J Vasc Endovasc Surg* 1999; 17: 501-506.
16. Adam DJ, Bain M, Shanks E et al. **Geographical inequality in the provision of carotid endarterectomy in Scotland. Scottish Vascular Audit Group**. *Br J Surg* 1998; 85: 1075-1079.
17. Michaels JA, Rutter P, Collin J et al for the Oxford Regional Vascular Audit Group. **Relation between rates of leg amputation and distal arterial reconstructive surgery**. *Br Med J* 1994; 309: 1479-1480.
18. Dimick JB, Stanley JC, Axelrod DA et al. **Variation in death rate after abdominal aortic aneurysmectomy in the United States: impact of hospital volume, gender and age**. *Ann Surg* 2002; 235: 579-585.
19. Clason AE, Stonebridge PA, Duncan AJ et al. **Acute ischaemia of the lower limb: the effect of centralizing vascular surgical services on morbidity and mortality**. *Br J Surg* 1989; 76: 592-593.
20. Holt PJ, Poloniecki JD, Loftus IM et al. **Meta-analysis and systematic review of the relationship between hospital volume and outcome following carotid endarterectomy**. *Eur J Vasc Endovasc Surg* 2007; 33: 645-51.
21. Dimick JB, Cowan JA Jr, Henke PK et al. **Hospital volume-related differences in aorto-bifemoral bypass operative mortality in the United States**. *J Vasc Surg*. 2003; 37: 970-975.
22. Michaels JA, Browse DJ, McWhinnie DL et al. **Provision of vascular surgical services in the Oxford Region**. *Br J Surg*. 1994; 81: 377-381.
23. Samy AK, MacBain G. **Abdominal aortic aneurysm: ten year's hospital population study in the city of Glasgow**. *Eur J Vasc Surg*. 1993; 7: 561-566.
24. Segal HE, Rumind L, Wu B. **The utility of PRO data on surgical volume: the example of carotid endarterectomy**. *Qual Rev Bull* 1993; 19: 152-7.
25. National Enquiry into Perioperative Deaths (NCEPOD). **Abdominal Aortic Aneurysm: a Service in need of Surgery**. London 2005. [www.ncepod.org.uk/2005aaa.htm](http://www.ncepod.org.uk/2005aaa.htm)

26. Galland RB, Magee TR. **Survey of changes in the provision of vascular surgical services in the Oxford region over five years.** *Br J Surg* 1998; 85: 637-40.
27. Total procedures and interventions. HES on-line. NHS. **The information centre for health and social care 2011.** [www.hesonline.org.uk/Ease/ContentServer?siteID=1937&categoryID=210](http://www.hesonline.org.uk/Ease/ContentServer?siteID=1937&categoryID=210)
28. Pension Trends, **Chapter 3: Life expectancy and healthy ageing.** Office for National Statistics 2011. [www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-170341](http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-170341)
29. Steg PG, Bhatt DL, Wilson PW et al. **One year cardiovascular event rates in outpatients with atherothrombosis.** *JAMA* 2007; 297: 1197-1206.
30. Adam DJ, Beard JD, Cleveland T et al. **Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre randomised controlled trial.** *Lancet* 2005; 366: 1925-34.
31. **Smoking patterns in adults and children.** The Information Centre for Health and Social Care 2011. [www.ic.nhs.uk/webfiles/publications/smoking%2010/Statistics\\_on\\_Smoking\\_England\\_2010.Tables.xls#'2.1!A1](http://www.ic.nhs.uk/webfiles/publications/smoking%2010/Statistics_on_Smoking_England_2010.Tables.xls#'2.1!A1)
32. **Tackling inequalities in life expectancy in areas with the worst health and deprivation.** Department of Health. National Audit Office 2010. [www.nao.org.uk/doc.ashx?docId=a08e42d2-a219-459b-9678-40b6931ec2d2&version=-1](http://www.nao.org.uk/doc.ashx?docId=a08e42d2-a219-459b-9678-40b6931ec2d2&version=-1)
33. **Comparison of causes of death per 100000 in Great Britain (1997) and Ireland (1996).** World Health Authority (WHO). [www3.who.int/whosis#](http://www3.who.int/whosis#)
34. Grøndal N, Søgaard R, Henneberg S et al. **The Viborg vascular (VIVA) screening trial of 65-74 year old men in the central region of Denmark: study protocol.** *Trials* 2010, 11:67. [www.trialsjournal.com/content/11/1/67](http://www.trialsjournal.com/content/11/1/67)
35. Watson L, Ellis B, Leng GC. **Exercise for intermittent claudication.** *Cochrane Database of Systematic Reviews* 2008, Issue 4. Art. No. CD002945. DOI: 10.1002/14651858.CD002945.pub2.
36. The MIMIC Trial participants. **The adjuvant benefit of angioplasty in patients with mild to moderate claudication (MIMIC) managed by supervised exercise, smoking cessation advice and best medical therapy: results from two randomised trials for stenotic femoropopliteal and aortoiliac arterial disease.** *Eur J Vasc Endovasc Surg* 2008; 36: 680-8.
37. Cheshire NJ, Wolfe JH, Noone MA et al. **The economics of femorocrural reconstruction for critical leg ischaemia with and without autologous vein.** *J Vasc Surg* 1992; 15: 167-174.
38. De Luccia N, Pinto MA, Guedes JP et al. **Rehabilitation after amputation for vascular disease: a follow-up study.** *Prosthet Orthot Int.* 1992; 16: 124-128.
39. **Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II).** *Eur J Vasc Endovasc Surg* 2007; 33 (Suppl 1): S1-S75.
40. **Introducing the NHS atlas of variation in care.** QIPP Right Care 2011. [www.rightcare.nhs.uk/atlas/](http://www.rightcare.nhs.uk/atlas/)
41. Cosford PA, Leng GC. **Screening for abdominal aortic aneurysm.** *Cochrane Database of Systematic Reviews* 2007, Issue 2. Art. No. CD000990. DOI:
42. Multicentre Aneurysm Screening Study Group. **Multicentre aneurysm screening study (MASS): cost effectiveness analysis of screening for abdominal aortic aneurysms based on four year results from randomised controlled trial.** *BMJ* 2002; 325: 1135-41.
43. Earnshaw JJ, Shaw E, Whyman MR et al. **Screening for abdominal aortic aneurysms in men.** *BMJ* 2004; 328: 1122-4.
44. The UK Small Aneurysm Trial Participants. **Mortality results for randomised controlled trial of early elective surgery or ultrasonographic surveillance for small abdominal aortic aneurysms.** *Lancet.* 1998; 352: 1649-55.
45. The EVAR Trial Participants. **Endovascular aneurysm repair versus open repair in patients with abdominal aortic aneurysm (EVAR trial I): randomised controlled trial.** *Lancet* 2005; 365: 2179-86.
46. National Institute of Clinical Excellence (NICE). **Abdominal Aortic Aneurysm – endovascular stent grafts: guidance.** [www.nice.org.uk/Guidance/TA167/Guidance/pdf/English](http://www.nice.org.uk/Guidance/TA167/Guidance/pdf/English)
47. **The Immediate Management of the Patient with Rupture: Open Versus Endovascular repair (IMPROVE) aneurysm trial--ISRCTN 48334791 IMPROVE trialists.** IMPROVE Trial, Powell JT, Thompson SG, Thompson MM, et al. *Acta Chir Belg.* 2009 Nov-Dec;109(6):678-80.
48. National Institute of Clinical Excellence (NICE). **Laparoscopic Repair of Abdominal Aortic Aneurysm.** London 2007. [www.nice.org.uk/nicemedia/pdf/IPG229Guidance.pdf](http://www.nice.org.uk/nicemedia/pdf/IPG229Guidance.pdf)
49. Rothwell PM, Eliasziw M, Gutnikov SA et al for the Carotid Endarterectomy Trialists' Collaboration. **Analysis of pooled data from the randomised controlled trials of endarterectomy for symptomatic carotid stenosis.** *Lancet* 2003; 361: 107-116.
50. Walker J, Naylor AR. **Ultrasound-based diagnosis of carotid stenosis>70%: an audit of UK practice.** *Eur J Vasc Endovasc Surg* 2006; 31: 487-90.

51. Oates C, Naylor AR, Hartshorne T et al. **Joint recommendations for reporting carotid ultrasound investigations in the United Kingdom.** Eur J Vasc Endovasc Surgery 2009 (in press).
52. Naylor AR. **What is the current status of angioplasty vs. endarterectomy in patients with asymptomatic carotid artery disease?** J Cardiovasc Surg (Torino) 2007; 48: 161-80.
53. Halliday A et al, on behalf of the ACST Collaborative Group. **10-year stroke prevention after successful carotid endarterectomy for asymptomatic stenosis (ACST-1): a multicentre randomised trial.** Lancet 2010; 376: 1074-84.
54. Rothwell PM, Giles MF, Chandratheva A et al. **Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS Study): a prospective population-based sequential comparison.** Lancet 2007; 370: 1432-42.
55. Silver FL, Mackey A, Clark WM, et al. **Safety of stenting and endarterectomy by symptomatic status in the Carotid Revascularization Endarterectomy versus Stenting Trial (CREST).** Stroke 2010; 42(3): 675-80
56. Carotid Stenting Trialists' Collaboration. **Short-term outcome after stenting versus endarterectomy for symptomatic carotid stenosis: a preplanned meta-analysis of individual patient data.** Lancet 2010; 376(9746): 1062-73.
57. National Institute of Clinical Excellence (NICE). **Carotid artery stent placement for carotid stenosis.** London 2006. [www.nice.org.uk/nicemedial/pdf/ip/PG191guidance.pdf](http://www.nice.org.uk/nicemedial/pdf/ip/PG191guidance.pdf)
58. International Carotid Stenting Study investigators. **Carotid artery stenting compared with endarterectomy in patients with symptomatic carotid stenosis (International Carotid Stenting Study): an interim analysis of a randomised controlled trial.** Lancet 2010; 375: 985-997.
59. Department of Health. **National Service Framework for Renal Services: Part One - Dialysis and transplantation.** London 2004. [www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_4070359](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4070359)
60. UK Renal Registry Report. Eds: Ansell D, Feest T, Williams AJ et al. **UK Renal Registry Report 2005. Chapter 6. The national Dialysis Access Survey-preliminary results.** 2005: 87-102. [www.renalreg.co.uk/report%202005/cover.frame2.htm](http://www.renalreg.co.uk/report%202005/cover.frame2.htm)
61. Joint Working Party. **The Organisation and Delivery of the Vascular Access Service for Maintenance Haemodialysis Patients.** London 2007. [www.vascularsociety.org.uk/Docs/vascular%20access%20joint%20working%20party%20report.pdf](http://www.vascularsociety.org.uk/Docs/vascular%20access%20joint%20working%20party%20report.pdf)
62. Rayner HC, Pisoni RL, Gillespie BW et al. **Creation, cannulation and survival of arteriovenous fistulae: data from the Dialysis Outcomes and Practice patterns Study.** Kidney Int 2003; 63: 323-30.
63. Michaels JA, Brazier JE, Campbell WB et al. **Randomized clinical trial comparing surgery with conservative treatment for uncomplicated varicose veins.** Br J Surg 2006; 93: 175-81.
64. Ratcliffe J, Brazier JE, Campbell WB et al. **Cost effectiveness analysis of surgery versus conservative treatment for uncomplicated varicose veins in a randomized clinical trial.** Br J Surg 2006; 93: 182-6.
65. Mackenzie RK, Lee AJ, Paisley A et al. **Patient, operative and surgeon factors that influence the effect of superficial venous surgery on disease-specific quality of life.** J Vasc Surg 2002; 36: 896-901.
66. Berridge D, Lees T, Earnshaw JJ. **The Venous Intervention (VEIN) Project.** Phlebology 2009; 24: 1-2.
67. **National Institute of Clinical Excellence (NICE) guidelines for referral of patients with varicose veins to secondary care.** [www.nice.org.uk/guidancel/index.jsp?action=referral](http://www.nice.org.uk/guidancel/index.jsp?action=referral)
68. Gohel MS, Barwell JR, Taylor M et al. **Long term results of compression therapy alone versus compression plus surgery in chronic venous ulceration (ESCHAR): randomised controlled trial.** BMJ 2007; 335: 83-7.
69. **Working time limits (the 48-hour week).** DirectGov 2011. [www.direct.gov.uk/en/Employment/Employees/WorkingHoursAndTimeOff/DG\\_10029426](http://www.direct.gov.uk/en/Employment/Employees/WorkingHoursAndTimeOff/DG_10029426)
70. The Vascular Society of Great Britain and Ireland. **Training in Vascular Surgery.** London 2011. [www.vascularsociety.org.uk/library/education-and-training.html](http://www.vascularsociety.org.uk/library/education-and-training.html)
71. **Joint Working Group to produce guidance on delivering an Endovascular Aneurysm Repair (EVAR) Service.** MRHA 2010. [www.mhra.gov.uk/Publications/Safetyguidance/Otherdevicesafetyguidance/CON105763](http://www.mhra.gov.uk/Publications/Safetyguidance/Otherdevicesafetyguidance/CON105763)
72. **Sub-Specialty Training Curriculum for Interventional Radiology (2010).** Royal College of Radiologists 2010. [www.rcr.ac.uk/content.aspx?PageID=1876](http://www.rcr.ac.uk/content.aspx?PageID=1876)
73. The Royal College of Radiologists and the Vascular Society of Great Britain and Ireland. **Provision of Vascular Radiology Services.** London 2003.
74. Gibbs PJ, Darke SG, Parvin SD. **Survival after repair of ruptured aortic aneurysm: an anaesthetic view.** Br J Surg 1998; 85: 554.

75. Sandison AJ, Wyncoll DL, Edmondson RC et al. **ICU protocol may affect the outcome of non-elective abdominal aortic aneurysm repair.** *Eur J Vasc Endovasc Surg* 1998; 16: 356-361.
76. Walsh SR, Bhutta H, Tang TY, et al. **Anaesthetic specialisation leads to improved early- and medium-term survival following major vascular surgery.** *Eur J Vasc Endovasc Surg.* 2010 Jun;39(6):719-25.
77. **Emergency and urgent care services. Major trauma services.** NHS Choices 2010.  
[www.nhs.uk/NHSEngland/AboutNHSservices/Emergencyandurgentcareservices/Pages/Majortraumaservices.aspx](http://www.nhs.uk/NHSEngland/AboutNHSservices/Emergencyandurgentcareservices/Pages/Majortraumaservices.aspx)
78. **Elective & Emergency Surgery in the Elderly: An Age Old Problem** (2010). NCEPOD 2010.  
[www.ncepod.org.uk/2010eese.htm](http://www.ncepod.org.uk/2010eese.htm)
79. **Diabetic foot problems. Inpatient management of diabetic foot problems.** NICE clinical Guideline 119 2011.  
[www.nice.org.uk/nicemedia/live/13416/53558/53558.pdf](http://www.nice.org.uk/nicemedia/live/13416/53558/53558.pdf)
80. **International Working Group on the Diabetic Foot.** International Consensus on the Diabetic Foot 2007. International Diabetes Federation: Brussels 2007. [www.idf.org/homel/index.cfm?node=1408](http://www.idf.org/homel/index.cfm?node=1408)
81. The Vascular Society of Great Britain and Ireland. **The Provision of Emergency Vascular Services.** London 2007.  
[www.vascularsociety.org.uk/library/vascular-society-publications.html](http://www.vascularsociety.org.uk/library/vascular-society-publications.html)
82. Irvine CD, Grayson D, Lusby RJ. **Clinical governance and the vascular surgeon.** *Br J Surg* 2000; 87: 766-770.
83. Holt PJ, Poloniecki JD, Loftus IM et al. **Demonstrating safety through in-hospital mortality analysis following elective abdominal aortic aneurysm repair in England.** *Br J Surg* 2008; 95: 64-71.
84. NHS Choices. [www.nhs.uk/Pages/homepage.aspx](http://www.nhs.uk/Pages/homepage.aspx)
85. The European Society for Vascular Surgery. **Second Vascular Surgery Database Report 2008.**
86. **Framework for improving the results of elective AAA repair.** The Vascular Society 2009.  
[www.vascularsociety.org.uk/library/quality-improvement.html](http://www.vascularsociety.org.uk/library/quality-improvement.html)
87. **Framework for improving the results of elective AAA repair – 2011.** The Vascular Society 2011.  
[www.vascular.society.org.uk](http://www.vascular.society.org.uk)
88. The Vascular Anaesthesia Society of Great Britain and Ireland. [www.vasgbi.com](http://www.vasgbi.com)
89. Adam DJ, Mohan IV, Stuart WP et al. **Community and hospital outcome from ruptured abdominal aortic aneurysm within the catchment area of a regional vascular surgical service.** *J Vasc Surg* 1999; 30: 922-928.
90. Basnyat PS, Biffin AH, Mosely LG et al. **Mortality from ruptured abdominal aortic aneurysm in Wales.** *Br J Surg* 1999; 86: 765-77062.
91. Cassar K, Godden DJ, Duncan JL. **Community mortality after ruptured abdominal aortic aneurysm is unrelated to the distance from the surgical centre.** *Br J Surg* 2001; 88: 1341-1343.
92. Farooq MM, Freischlag JA, Seabrook GR et al. **Effect of the duration of symptoms, transport time and length of emergency room stay on morbidity and mortality in patients with ruptured abdominal aortic aneurysms.** *Surgery* 1996; 119: 9-14.











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