

Service Specification for Vascular Services in Wales

**The Vascular Implementation Network, on behalf of NHS
Wales Performance and Improvement**

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Introduction

Service specifications play a crucial role in clearly defining the standards of care expected from healthcare organisations in Wales offering specialised services. Developed collaboratively by a vascular multidisciplinary team, and public health representatives, this specification defines both core and developmental service standards. Core standards are those that the three Welsh Vascular Networks are expected to meet, while developmental standards represent areas that may need development over time to achieve excellence. Additionally, this document outlines the standards required by the National Clinical Pathways specific to vascular services.

Scope of vascular services

Vascular services manage disorders of arteries, veins and lymphatics. Which include:

- Limb ischaemia
- Stroke and transient ischaemic attack
- Aortic aneurysm and dissection
- Mesenteric artery occlusive disease
- Renovascular disease
- Arterial/vascular graft infections
- Vascular trauma
- Venous access for haemodialysis
- Treatment of venous disease including varicose veins and/or venous leg ulceration.

Vascular surgeons also take a lead role in the management of acute diabetic foot problems as part of multi-disciplinary diabetic foot care teams, performing:

- Revascularisation for ischaemia
- Debridements, minor amputations or major lower limb amputation

There are several less common conditions which fall within the remit of the vascular surgeon working closely with other specialities.

Core activities of the multidisciplinary team

- Promoting cardiovascular health
- Communication and shared decision making with patients and families

- Preventing limb loss due to peripheral arterial disease and/or complications of diabetes
- Preventing stroke due to carotid artery stenosis
- Preventing death from aortic diseases
- Improving quality of life for people with venous disease

Time critical service

A small number of individuals require urgent, life- or limb-saving interventions (such as for a ruptured aneurysm or acute limb ischemia). Most vascular referrals are time-sensitive, necessitating either inpatient admission or a well-coordinated pathway for outpatient assessment and imaging, as in cases of chronic limb-threatening ischemia (CLTI). Some patients are placed on a waiting list, such as those with non-urgent conditions like varicose veins without ulcers or bleeding. However, individuals with venous ulcers should not have to wait 'in turn' for treatment.

Aging and frailty

The average age of vascular patients is increasing with one third of people treated over 75 years. Older people present with more comorbidities, spend longer in hospital and are more likely to have ongoing care needs and to be readmitted. In Wales 21% of the population is aged 65 years and over. [1] Frailty and old age are recognised as predicting poorer outcomes and longer hospital length of stay after vascular surgery. [2]

Cardiovascular disease

Cardiovascular disease (CVD) refers to diseases of the heart and circulation. [3] The primary underlying condition in most patients is atherosclerosis. CVD includes both inherited conditions and those that develop over time:

- Coronary heart disease
- Heart failure
- Peripheral arterial disease
- Stroke
- Vascular dementia
- Chronic kidney disease
- Aortic aneurysm or dissection

In 2022, 4.2 million people in the UK had a risk of over 20% for cardiovascular disease (CVD).[4] Missed opportunities for CVD prevention often lead to a reduced quality of life and shorter life expectancy.

Cigarette smoking

Cigarette smoking leads to illness and premature death and is the leading cause of health inequalities. In 2023, 16% of the Welsh adult population, or approximately 510,000 people, were smokers. [5]

Proportion of current smokers	
Elective AAA repair	85%
Lower limb bypass	89%
Lower limb angioplasty	80%

Smokers are at an increased risk of complications following interventions due to associated cardiac and respiratory conditions, and the long-term success of vascular procedures is also diminished. Public health initiatives encourage smoking cessation, and the Welsh Government has introduced a plan to make Wales 'smoke-free' by 2030, aiming to reduce the smoking rate to below 5%. In 2021, Wales implemented a smoking ban in playgrounds, school grounds, and hospital grounds. [6]

Diabetes mellitus

Public Health Wales (PHW) in 2022 reported that there were 212,716 adults living with diabetes in Wales, representing 8% of the population. [7] PHW estimates that this number will rise by 48,000 by 2035. Vascular disease is the leading cause of morbidity in diabetes, and the risks of disease progression are increased, leading to an anticipated epidemic of diabetic foot disease in the coming decade. More than 40% of vascular patients admitted with peripheral arterial disease (PAD) have diabetes. [8]

Deprivation

There is significant regional variation in the premature death rate from CVD, with individuals from the 10% most deprived populations in the UK more than twice as likely to die from CVD compared to those from the 10% most affluent populations. [9] Cigarette smoking, unhealthy eating, and lower levels of physical activity are most prevalent among the more disadvantaged groups in society.

Mental health

People with mental health conditions have higher rates of CVD and premature death. [9] Factors contributing to this increased risk include lifestyle behaviours (poor diet, physical inactivity, and smoking) and physiological factors (inflammation and dysregulation of the autonomic nervous system). Several medications used in the treatment of mental health conditions have side effects that contribute to cardiovascular risk, such as weight gain, metabolic syndrome, and changes in cholesterol and blood sugar levels.

Ethnic group

A person's ethnicity can influence their risk of developing CVD. [9] Multiple factors contribute to these disparities, including genetics, lifestyle behaviours, socioeconomic status, and access to healthcare. Individuals of African descent have an elevated risk of developing hypertension, while those of Asian descent may be more susceptible to developing diabetes.

Vascular disease

The geographic distribution of the Welsh population does not support a national aortic centre. However, strong partnerships with units in Bristol, Birmingham, and London enable complex aneurysm repairs on a case-by-case funding basis. [12]

Aortic aneurysm or aortic dissection

- In the UK, approximately 3,500 elective AAA repairs are performed annually.
- The Welsh Abdominal Aortic Aneurysm Screening Programme (WAAASP) identified AAAs $\geq 3\text{cm}$ in 0.9% of those screened. [10]
- This indicates a steady decline in deaths from thoracic and abdominal aortic aneurysms in the 21st century.
- Approximately 3,900 individuals are diagnosed with acute aortic dissection annually in the UK. This incidence is on the rise, partly due to greater awareness, enhanced diagnostic methods and an aging population.

Peripheral arterial disease (PAD)

- 20% >60 years suffer with PAD. [13]
- One in five of the population will experience intermittent claudication.
- One in five individuals with symptomatic PAD will develop CLTI (500-1,000 per one million population).
- PAD is the largest single cause of leg amputation:

- Approximately 4,000 major lower limb amputations in the UK, of which 1,700 performed below the knee
- 43% of individuals had diabetes
- The mortality risk for those >70 years following leg amputation is as high as 44%, 59% and 63% at one, three and five years.

Stroke and Transient Ischaemic Attack

- Up to 15% of embolic strokes are caused by atherosclerotic of the carotid arteries. [15]
- The total number of carotid endarterectomies have dropped by about 30% since 2011.

Leg ulceration

- 38,000 adults (1.5% of the adult population) of Wales have a leg ulcer in one year. [16]
- One in 170 adults had a venous leg ulcer (15,000 people).
- One in 20 people with diabetes had a foot ulcer (13,000 people).

Vascular trauma

- Vascular injuries accounted for 4% of trauma admissions to an MTC. [17]
- Arterial injuries result in severe trauma with high mortality and morbidity risks. [17]

Vascular networks

Outpatient clinics and vascular diagnostic imaging should be offered in every hospital. Inpatient arterial surgery should be undertaken in a specialist 'arterial centre'. This network model has been established in Wales, leading to the formation of three vascular networks: North, South East, and South West. These arrangements have four key benefits:

- Patient safety (body of evidence relating to surgical volumes and outcomes)
- Workforce (24/7 availability of the MDT)
- Training (better training opportunities)
- Economic (avoiding replication of expensive technology and staff on multiple sites).

However, centralisation of vascular services into arterial centres also carries risks of:

- Increased travel times (potential harm in the emergency setting)
- Inequalities in access to care (peoples' ability to travel to access specialist vascular care)
- Arterial centre is overwhelmed (unable to deliver safe, high-quality care).

Population size

Eight hundred thousand people has become the established minimum population for UK vascular networks (an arbitrary figure from the AAA screening programme):

- A population size of <800,000 people may be appropriate in geographically remote areas with poor road transport links, such as Wales, Scotland and Southwest England.
- The three Welsh vascular networks will agree pathways of care, governance and quality improvement.
- All networks must provide 24/7 vascular surgery and interventional radiology, but some will have agreed pathways to send complex cases to another arterial centre.

Low procedure volumes

The Vascular Society recommends a network should perform 60 aortic and 35 carotid procedures per year. [18] The Society also recommends a minimum of 13 open intact AAA repairs per year. [12]

Volume and outcome relationships

Vascular services in the UK have been transformed since the creation of a separate vascular surgery speciality in 2013. [19] NHS Wales Performance and Improvement in collaboration with the three Welsh vascular networks have agreed clinical pathways from diagnosis to rehabilitation. For 'time critical' vascular conditions, treatment pathways include time-frame standards and how these are recorded and monitored. [20]

Emergency vascular pathways

- Acute limb ischaemia
- Ruptured (symptomatic) aortic aneurysm
- Major vascular injury

- Foot sepsis with CLTI or diabetes

In addition, the vascular networks have agreed clinical pathways for the acute management of:

- Mesenteric ischaemia (managed with gastro- intestinal surgery)
- Aortic dissection (managed with cardiac surgery)

Referrals

Network-wide co-ordination of the triage of referrals is important to ensure equality and avoid delays. A single point of contact for time critical referrals (or advice) is provided, usually a vascular speciality trainee or vascular consultant, contacted via Consultant Connect or the hospital switchboard. [21]

Inter-hospital transfer

The Emergency Medical Retrieval and Transfer Service (EMRTS) Cymru operates the Adult Critical Care Transfer Service Cymru (ACCTS), which has established transfer agreements with all networked health boards to reduce transfer delays. Individuals requiring emergency vascular intervention should be swiftly transferred to the network's arterial centre. [22] The Royal College of Emergency Medicine published guidance for the transfer of people with ruptured aortic aneurysms. [23]

A South Wales 'tool kit' for aortic dissection is under development, whereas North Wales is covered by the North West of England service. These tool kits include advice on patient transfer to specialist aortic centres.

Infrequently, rather than transfer an unstable or anaesthetised patient, the on-call vascular surgeon should travel to a network hospital to operate.

Repatriation

Network wide support is required to ensure patients only occupy specialist arterial beds when requiring vascular input. Delayed repatriation will result in the arterial centre losing capacity to admit time critical patients.

Consultant of the week

The three Welsh vascular networks have implemented a 'Consultant of the Week' model of care. One consultant, on a rotational basis, manages all vascular inpatients, with a seven day a week ward round, and daytime 'NCEPOD' operating.

On call (emergency cover)

There should be a vascular surgeon (supported by a middle grade rota), interventional radiologist, and suitably skilled anaesthetist on call 24/7 at an arterial centre.

Multidisciplinary team meeting (MDM)

Hosting a single weekly network MDM organised by an MDM coordinator is a key component of the vascular network delivering high quality outcomes (and monitoring care). Network clinical pathways mandate discussion at the MDM of all major vascular cases; however, this discussion should not delay treatment and can be in retrospect for patients already treated.

The vascular service

Vascular inpatients should receive care from a multidisciplinary team (MDT) consisting of specialist clinicians, nurses, and allied healthcare professionals. The same level of service support for time-sensitive care must also be available during weekends and overnight. Arterial centres should provide, as a minimum, the following:

- 24/7 consultant vascular surgeon on call rota.
- 24/7 consultant interventional radiology oncall rota. Major arterial centres should have access to interventional radiology (IR) services around the clock, but many large centres face challenges in providing this level of support. If a 24/7 IR on-call service is not feasible within a network, formal arrangements must be established to ensure access to such services. Major arterial centres should strive to implement a 24/7 interventional radiology on-call capability.
- 24/7 Operating theatre, 'hybrid' theatre and interventional radiology room.
- Level 3 critical care beds. [24]
- Dedicated ward for vascular patients. [25]
- Access to sessions in a second operating theatre (GIRFT recommend that this is seven days of the week). [25]
- Hybrid operating theatre compliant with MHRA guidance. [26]
- Dedicated interventional radiology suite with day care beds.
- Vascular laboratory (or equivalent).

Operating theatres

Theatre capacity should be allocated based on the time-critical nature and duration of vascular procedures. For a typically sized regionalised arterial network, this would be expected to equate to an all-day elective theatre list Monday-Friday, with access to additional CEPOD theatres for emergencies. Whenever feasible, time-critical vascular cases should be carried out on daytime theatre lists. [12]

Hybrid theatre

To ensure efficient use of this theatre in addition to endovascular aortic procedures and 'hybrid' lower limb revascularisation these sessions should be used for:

- Open surgical cases
- Percutaneous angioplasty/stenting under general anaesthesia
- Deep venous interventions.

Hybrid theatres must meet the requirements of Health Building Notice (HBN) 6 '*Facilities for diagnostic imaging and interventional radiology*' and HBN 26 '*Facilities for surgical procedures*'. [27] [28]

In Wales, the establishment of hybrid theatres has fallen behind the rest of the UK and Ireland, with only the North Wales network currently having access to one. The absence of hybrid theatre facilities has adversely affected the recruitment of interventional radiologists and the recruitment and retention of vascular surgeons. [12]

Anaesthetic services

Anaesthesia for patients undergoing major vascular surgery should be provided by, or directly supervised by, an anaesthetist suitably qualified, trained and experienced in vascular anaesthesia. [29]

Post anaesthesia care unit (PACU)

'High-risk' vascular patients will be admitted to PACU following surgery.

Critical care unit (CCU)

Critical care level 3 (ICU) and level 2 (HDU) beds are essential for major vascular procedures. For a population of 800,000, there should be a minimum provision of 1.2 to 2 critical care beds (0.15 to 0.25 per 100,000 population) to adequately support the vascular service.

Pre-operative assessment clinic (POAC)

Patients requiring major vascular surgery should be assessed in a dedicated pre-operative clinic.

Vascular ward

A dedicated vascular ward is crucial for ensuring that admitted patients receive care from a specialist vascular MDT. Based on current experience, a population of 800,000 will require approximately 20 to 25 vascular beds (2.5 to 3.1 per 100,000 population).

Workforce

Vascular surgeons

The Vascular Society recommends one vascular surgeon per 100,000 people and calls for more vascular trainees to meet increasing demand.

Region	Consultants	Consultants needed	Change	%
Wales	28	32	+4	+12
UK	550	718	+168	+31

Interventional radiologist

The BSIR recommends ≥ 1 interventional radiologist per 64,000 of UK population. [30]

Vascular nurse specialist

There should be a minimum of 2.0 whole time equivalent (WTE) vascular nurse specialists (VNSs) attached to the arterial centre, and 1.0 WTE VNS per network hospital.

Other roles

The following roles and responsibilities should sit with each of the networks:

- Network clinical lead
- Network governance lead
- Lead vascular nurse specialist
- Lead interventional radiologist
- Lead vascular anaesthetist
- Lead clinical vascular scientist
- Network manager
- MDM coordinator
- Data manager
- Lead podiatrist.

Education and training

The GMC has approved curricula for vascular surgery, interventional radiology (as a sub- specialty of clinical radiology) and for a CCT in anaesthetics. [31] [32] [33]

Specialist vascular training units

Vascular training units should meet the JCST quality indicators, including performing a sufficient volume of major elective and emergency vascular cases to provide sufficient supervised operative experience for each trainee to achieve the expected competencies for their level of training.

Units should be recognised by AAA screening Programme as a treatment centre. [34] Units should deliver outcomes in line with national standards. [35]

Operative and endovascular experience

Trainees should rotate within and between units. Each trainee must work within a team that includes one designated educational supervisor and at least two to three clinical supervisors during each year of their specialist training.

'On call'

Trainees should undertake 'on call' commitments in every year of their training. Vascular surgery on- call from home, or long-day rather than night working, are more desirable options for training.

Peripheral arterial disease

Individuals with lifestyle limiting intermittent claudication symptoms should have their risk factors modified and commenced on secondary prevention medication. Ideally, they should be assessed in a nurse-led clinic and complete a supervised exercise programme. Patients who develop foot / leg wounds or progressed to CLTI should be referred to the vascular service for assessment.

Chronic Limb Threatening Ischaemia

Individuals presenting with CLTI are typically at an advanced stage of PAD and often have significant CVD and other comorbidities. [38] Although the incidence of CLTI is approximately 1% of that of PAD, the treatment of CLTI accounts for the majority of the urgent workload within vascular networks: [37]

Standards for CLTI pathway: non-admitted

	Achievable	Minimum
Assessment including imaging within seven days	>90%	>80%
Revascularisation <14 days	>90%	>80%

- Vascular network serving 800,000 population sees 350-400 people each year with CLTI.
- This number is likely to increase with population ageing and rising prevalence of diabetes.

Standards for CLTI pathway: admitted - uncontrolled rest pain +/- significant tissue loss +/- infection

	Achievable	Minimum
Admission to vascular <48 hours from decision to admit	>90%	>80%
Review by vascular consultant within 14 hours of admission	>90%	>80%
Vascular assessment including imaging <48 hours of admission	>90%	>80%
Revascularisation within five days	>90%	>80%

If the decision is made to admit a patient with CLTI, the following are recommended timelines for management: [12]

Stable CLTI (minor tissue loss/manageable rest pain) can be assessed and worked up for intervention through an outpatient pathway. This pathway is 'time critical' as the foot can rapidly decline.

Standards for CLTI pathway: non-admitted - uncontrolled rest pain +/- significant tissue loss

	Achievable	Minimum
Vascular assessment including imaging within seven days	>90%	>80%
Revascularisation within 14 days	>90%	>80%

Revascularisation

All people presenting with CLTI should be assessed as to their benefit from revascularisation.

Primary amputation

In certain cases, a primary amputation may be appropriate. For elderly, frail, or comorbid patients, a conservative approach may be a suitable management strategy for CLTI. [43]

Amputation surgery

The VS major lower limb amputation quality improvement framework (2010) significantly improved lower limb amputee care:

- All major lower limb amputations should be performed by surgeons with expertise
- All above-the-ankle amputations by vascular surgeons should occur in an arterial centre with a rehabilitation MDT.

Standards for major amputation pathway: admitted

	Achievable	Minimum
Medical review for poor glycaemic control <12 hours after admission	>90%	>80%
Pain team review for ischaemic rest pain <12 hours after admission	>90%	>80%
Vascular assessment unless unsalvageable limb	100%	>95%
Major amputation within 48 hours of decision to amputate	>90%	>80%

Diabetic Foot Service

Complications from diabetes and PAD are the two leading causes of non-traumatic lower limb amputations.

NICE guidelines and Prudent Healthcare

The NICE [NG19] guidelines support patients, clinicians, and service providers in preventing and managing foot disease. In Wales, this guidance aligns with Prudent Healthcare principles to promote an efficient, effective, and person-centred approach, emphasising the importance of self-management alongside medical management.

To support this delivery of care, UHBs must ensure the following key structures are available:

Foot screening service

Foot screening/checks are part of the annual eight care processes for diabetes within primary care and if patients have identified clinical hazards, they will be referred to the Foot Protection team. Empowerment to supported self-care will be central in how to reduce or manage these hazards.

Foot protection service

Foot protection services aim to prevent and manage diabetic foot problems in the community. Led by Podiatry teams, they collaborate with primary care and are integral to the multidisciplinary foot team. Podiatrists work with orthotics and dieticians, referring to vascular services as needed.

Multidisciplinary foot care service

A multidisciplinary foot care service manages diabetic foot problems in hospitals and communities that the foot protection service cannot handle. Patients with active diabetic foot disease should be referred within one working day. Care is coordinated by a member of the MDT, incorporating input from diabetologists, podiatrists, vascular surgery, foot and ankle surgeons, interventional radiology, infectious diseases, pharmacists, physiotherapists, and clinical psychologists. A vascular specialist should attend multidisciplinary foot care clinics across the vascular network.

Robust protocols and clear local pathways

UHBs must establish robust protocols and clear pathways for integrated care across all settings, including emergency care and general practice. These protocols should define the relationship between the foot protection service and the multidisciplinary foot care service. [45]

Measurable outcomes

Regular treatment reviews and patient outcomes should align with the National Diabetes Foot Care Audit (NDFCA). The Diabetes Insights and Variation Atlas (DIVA) will help capture relevant demographics, treatment indicators, and outcomes in Wales. UHBs are accountable for delivering these outcomes, with reporting mechanisms essential for maintaining a national data repository to support peer reviews and quality service provision.

Sepsis drainage and/or debridement

Patients with life- or limb-threatening foot sepsis require emergency admission to the network arterial centre under the vascular service, unless local arrangements for immediate drainage at the network hospital are in place. [39]

Revascularisation

Individuals with diabetes needing revascularisation should be treated within the same timeframes and pathways as those with CLTI without diabetes:

- Admitted patients should have specialist review, WIFI (Wound, Ischaemia, and Foot Infection–classification) score and vascular imaging performed within 48 hours of referral
- Non-admitted patients should have specialist review, WIFI score, and vascular imaging performed within seven days of referral

Venous disease

The expert assessment and treatment of patients with acute and chronic venous conditions is a core vascular service. Acute venous disease is a potential threat to both life (from pulmonary embolus) and limb (from 'phlegmasia').

Superficial venous reflux (Varicose veins)

Superficial venous reflux affects 35-50% of adults, contributing significantly to the workload of vascular services. Treatment for superficial vein reflux is effective and cost-efficient for symptomatic varicose veins. NICE [CG168] recommends immediate referral to vascular services for patients with bleeding varicose veins.

Assessment

NICE [CG168] recommends duplex ultrasound assessment for patients with symptomatic varicose veins. This assessment should be conducted by a specialist with the necessary training and experience.

Superficial venous interventions

The three vascular networks offer a range of interventions including endovenous thermal ablation, ultrasound guided foam sclerotherapy and/or phlebectomy. Endovenous treatments are delivered as ambulatory, local anaesthetic procedures in network hospitals. NICE recommends that compression therapy is not used alone as a treatment unless a patient is not suitable or declines interventional treatment.

Lower limb venous ulceration

Compression therapy is the mainstay of treatment for venous leg ulceration. [41] Superficial venous interventions of all types are highly effective in promoting healing of venous leg ulcers and reducing subsequent recurrence. [42] Compression should be used alongside endothermal ablation.

Superficial venous thrombosis

Superficial venous thrombosis (SVT) management takes place in primary care. Best practice is for a venous duplex scan to be performed in people with SVT. The incidence of concomitant deep vein thrombosis is 6-40% and pulmonary embolus 2- 13%. [43] If varicose veins are present (up to 62% of people with SVT) these should be treated to reduce the risk of recurrence. Treatment should be delayed for three months until after the pro-thrombotic phase.

Deep vein thrombosis (DVT)

DVT carries a risk of fatal pulmonary embolism (PE), symptomatic recurrence, and post- thrombotic syndrome, which affects 20% to 50% of patients within

two years. [54] Early interventional radiology intervention may be required to save life or limb due to:

- Massive PE with circulatory compromise
- Threatened venous infarction of the leg (phlegmasia cerulea dolens).

Individuals with ilio-femoral DVT, such as young women experiencing left-sided symptoms, should be considered for early thrombus removal to help minimize the risk of developing post-thrombotic syndrome.

Deep venous interventions

Chronic deep venous disease is most commonly as consequence of past venous thrombotic episodes. Treatment options include early thrombus removal, usually by a combination of pharmacological and mechanical means, or later intervention with venous stenting. The use of intravascular ultrasound (IVUS) is considered best practice when performing venous stents.

Upper Extremity DVT

Upper extremity DVT should primarily be treated with three months of anticoagulation. [43] Thrombus removal strategies may be considered in certain cases, followed by decompression of any identified thoracic outlet compression.

Carotid disease

The 2021 Welsh quality statement for stroke outlined the characteristics of high-quality stroke services in Wales. This included restructuring service design to enhance access to thrombectomy, thrombolysis, imaging, and rehabilitation services. [44] [45]

Stroke service model

The model outlines the personnel and resources required to provide high-quality stroke care.

Symptomatic carotid stenosis

It is crucial to acknowledge that stroke, TIA (transient ischemic attack), and transient loss of vision (amaurosis fugax or transient monocular vision loss) are medical emergencies.

Imaging

Carotid imaging is recommended for people presenting with symptoms suggesting anterior circulation cerebral ischaemia who might be suitable for carotid artery intervention:

- Carotid imaging, when indicated, should be performed within 24 hours

- Cross-sectional imaging (CTA or MRA) is obtained in addition to duplex to aid decision making

Carotid endarterectomy (CEA)

The benefit of CEA in patients with symptomatic internal carotid stenosis graded 50-99% was demonstrated in the NASCET and ECST trials. [46] [47] The greatest benefit for the patient is derived when CEA is performed <14 days and ideally <7 days, and in patients with stenosis graded 70-99%.

Carotid artery stent (CAS)

Current evidence does not support the routine use of CAS for symptomatic carotid stenosis.

Key performance indicators

	Achievable	Minimum
Percentage of people receiving intervention ≤14 days of symptoms	≥70%	≥50%
Number of CEAs performed annually [12]	-	≥35%
Risk adjusted procedural stroke +/- mortality <30 days of intervention	≤2%	≤3%

Asymptomatic carotid stenosis

Performing carotid endarterectomy (CEA) in all individuals with asymptomatic stenosis offers limited benefits, as about 20 procedures are required to prevent one stroke but may be indicated in certain limited scenarios. [48] [49]

Aortic disease

The prevalence of aortic disease is changing, with fewer people presenting with abdominal aortic aneurysm (AAA) and more presenting with acute aortic dissection (AD). [50] This fall in AAA repairs reflects a reducing prevalence of AAA in the UK. [62] In addition, NICE has questioned the effectiveness of repairing intact AAA with aortic stent grafts (EVAR). [51]

Regional coordination

Aortic procedures should only be performed in arterial centres that treat a sufficient volume of patients. [52] Regional coordination means that aortic services are delivered either by, or with input from, regional or supra-regional specialist aortic MDTs.

Aortic multi-disciplinary teams

Aortic MDTs involve vascular surgeons, interventional cardiologists, interventional radiologists, vascular anaesthetists and specialist vascular nurses.

Screening for AAA

AAA screening continues to be cost-effective at current prevalence rates. Men are referred for treatment to a vascular service that complies with the VS Quality Improvement Framework standards and has undergone the WAAASP pre-implementation quality assurance process.

AAA Screening Programme

In Wales, the screening programme is run by PHW. Men aged 65 receive a written invitation for an ultrasound to measure their infrarenal aortic diameter:

- Men with a diameter < 3.0 cm are discharged.
- Those with a small or medium AAA (3-5.4 cm) receive health and lifestyle advice.
- Men with a large AAA (≥ 5.5 cm) or >1 cm expansion in one year are referred to their local vascular network for treatment.

Repair intact AAA

Timely treatment is critical to reduce aneurysm rupture risk before repair. While some individuals (for example, older adults, frail individuals, or those with comorbidities) may not be candidates for AAA surgery, many opt for intervention. Surgery offers no significant survival benefit for most AAAs under 5.5 cm, as rupture risk is lower than repair risk. [66] People with limited life expectancy / significant co-morbidities do not benefit from aortic intervention.

Open surgical repair

Open surgery to repair an AAA is a major procedure associated with considerable morbidity and mortality. Based on recent data, the Vascular Society recommends that arterial centres should perform a minimum of 13 open intact AAA repairs per year. [54]

Endovascular aneurysm repair (EVAR)

Randomized controlled trials have shown that endovascular aneurysm repair (EVAR) does not reduce overall mortality compared to open repair after four years. [51] Nevertheless, there are short term advantages in terms of:

- Reduced early (in hospital) mortality
- Reduced length of hospital stays
- Improved early quality of life.

Long-term durability and cost continue to be major challenges for EVAR. As a result, the 2020 NICE guidelines recommend open AAA repair as the preferred approach, unless patients have a "hostile" abdomen or comorbidities and risk factors that make them unsuitable for open repair. [51]


Patients deemed 'unfit'

For patients deemed unfit for open AAA repair, the decision to offer EVAR or no intervention requires careful MDT consideration.

Repair of symptomatic or ruptured AAA

For individuals who are frail, have multiple comorbidities, or present *in extremis* (such as in cardiac arrest), the recommended approach is palliative care focused on symptom relief. For patients who may benefit, emergency EVAR or open repair can be considered, depending on the patient's anatomy. In-hospital mortality for ruptured AAA (rAAA) treatment options remains high, ranging from 30-40%.

The IMPROVE trial demonstrated a quality-of-life benefit following endovascular repair of rAAA in women and in men over 70 who are anatomically eligible: [56]

- NICE recommends EVAR for men >70 years and in women with rAAA [63]
- NICE recommends open repair in men <70 years of age  rAAA

Ruptured AAA

	Achievable	Minimum
Emergency repair using EVAR (in men ≥ 70 years and in women)	-	$\geq 25\%$

Intact AAA: Time critical care delivery

AAA 5.5cm	Achievable	Minimum
Referral to vascular service within one day	≥85%	≥75%
Percentage of AAAs >5.5 cm assessed <2 weeks	≥90%	≥80%
Time from AAA reaching threshold to treatment <8 weeks ^{1 2} [62]	≥80%	≥60%

1. Unless treatment deferred
2. People waiting >12 weeks with screen-detected aneurysm repair to be reported as a long waiter

Intact AAA surgery: Cases per annum

Cases per annum	Achievable	Minimum
All AAA repairs (open, EVAR, intact or rupture) ¹ [62]	-	≥60 ²
Open AAA repair	-	≥13
Open supra-renal cases	-	≥5
TEVAR	-	≥10

1. Includes EVAR with iliac branch device (IBD/IBE) as infrarenal AAA procedure
2. >100 aortic procedures for specialised aortic centre

Intact AAA surgery

Open, standard EVAR or Complete EVAR	Achievable	Minimum
Median length of stay for standard EVAR	≤One day	≤Two days
Median length of stay for open AAA repair	≤Seven days	≤Ten days
In-hospital mortality	≤3.5%	≤6%
Readmission <30 days	≤10%	≤15%
TEVAR	Achievable	Minimum
In-hospital mortality	-	≤8%
FEVAR and/or BEVAR	Achievable	Minimum
In-hospital mortality	-	≤5%

Thoracic aortic aneurysm

Thoracic aortic disease should be managed by specialised teams that handle a sufficient number of cases. These cases should be reviewed during a specialist regional aortic MDT or, in emergency situations, with the on-call aortic consultant.

Aortic dissection

Vascular units have engaged with Emergency Departments and diagnostic radiology to highlight the necessity of a CT imaging for diagnosing aortic dissection (AD). Upon confirmation of AD, an immediate referral is made to a designated point of contact at the regional aortic centre. If accepted for transfer, it is essential to act quickly (using 'blue light' or adult critical care transfer service) for critical care management (for type B AD) or urgent aortic root surgery (for type A AD).

In select cases of acute type B AD, the aortic service can facilitate admission to a local high dependency unit for blood pressure control and monitoring. The NHS Wales Performance & Improvement is developing an aortic dissection

'toolkit' to help vascular networks collaborate with cardiac units to improve acute AD pathways.

Aortic surveillance imaging

	Achievable	Minimum
Small AAA ¹ (screening detected)	≥95%	≥85%
Small AAA ¹ (non-screen detected)	≥95%	≥85%
Post standard EVAR ¹	}	1. Written network pathways for aortic surveillance 2. List of patients updated annually
Post complex EVAR ²		
Aortic dissection ²		
1 Abdominal aortic ultrasound by clinical vascular scientists or sonographers 2 Cross-sectional imaging (usually annually) with either CTA or MRA		

Mycotic aneurysm or graft infection

Both open aortic grafts and aortic stent grafts can become infected, occasionally leading to the development of an aorto-enteric fistula. The management of aortic graft infections, both medically and surgically, is complicated and carries a high risk of morbidity and mortality.

Aortic surveillance

Comprehensive imaging surveillance is essential for the safe management of individuals with aortic disease, including those who have undergone implantation of an endovascular aortic stent graft.

Acute ischaemia

Acute ischemia of an organ or limb is a critical vascular emergency which requires urgent review due to the potential for significant morbidity and mortality.

- Acute limb ischaemia (ALI): incidence 10 per 100,000 people per year
- Acute mesenteric ischaemia (AMI): incidence eight per 100,000 people per year.

Severity of ischaemia and time to revascularisation are the main factors determining outcomes. [57]

Acute lower limb ischaemia

ALI is differentiated from CLTI by the duration of symptoms being <2 weeks: [58]

- Approximately 70% of individuals present within those two weeks
- Most patients present immediately with ALI.

The vascular networks have established a clinical pathway for managing acute limb ischemia (ALI). This includes bypassing local Emergency Departments by the Welsh Ambulance Services Trust (WAST) to prevent treatment delays. Revascularisation is time-critical and may involve multiple treatment modalities, such as embolectomy, thrombolysis, and/or surgical bypass.

Acute mesenteric ischaemia

Cause of acute mesenteric ischaemia (AMI) include arterial embolus (often due to atrial fibrillation), acute thrombosis and malperfusion associated with aortic dissection. Management of the ischaemic or infarcted bowel and consideration of revascularisation requires good collaboration between the vascular specialist and the gastro- intestinal surgeons.

Haemodialysis access

Approximately 1,400 individuals are currently undergoing haemodialysis in Wales, and this number continues to grow each year. [60] In these patients, mortality rates are lower when dialysis is initiated with a functioning arteriovenous fistula (AVF) compared to using a central venous catheter (CVC). The creation and revision of new AVFs result in an annual workload of 100 to 150 operations per million of population.

Renal Access Team

- Nephrologist
- Surgeon trained in vascular access
- Interventional radiologist
- Renal access coordinator
- MDM coordinator
- Renal access nurses
- Clinical vascular scientist / sonographer.

Patients should have arterial and venous ultrasound mapping prior to fistula creation. The renal access MDM assess and decides on 'right access for the

right patient at the right time' as part of an end stage kidney disease 'Life-Plan'. [61] Most AVF are performed as day case surgery under local or regional anaesthesia.

Vascular trauma

In the UK, major trauma services are provided through major trauma networks (MTNs) with designated major trauma centres (MTCs). The 'trauma team' at each MTC responds first, and vascular surgeons assist in cases of vascular injury, primarily involving the extremities. Up to half of all trauma deaths within the first 48 hours after injury are attributable to major haemorrhage. The priority in vascular trauma is therefore to resuscitate the patient and control active sites of major haemorrhage:

- For internal bleeding, except in the most haemodynamically unstable patients, a CT angiogram should be performed to identify all injuries
- Consider use of a hybrid theatre to facilitate rapid interventional radiology ('embolisation') and/or surgical ('ligation') haemorrhage control.

The second priority is then relief of limb or organ ischaemia, or primary amputation of a non-salvageable limb. The MTNs have written policies in place, agreed with their vascular networks, setting out their approach to vascular trauma.

Thoracic injuries

Blunt deceleration injuries causing an acute traumatic rupture or dissection to the thoracic aorta can be treated using TEVAR to prevent delayed rupture.

Abdominal injuries

Immediate open surgery remains the mainstay of treatment due to high rates of associated visceral injuries. Damage control surgery principles should be followed in haemodynamically unstable patients.

Extremity injuries

Immediate open surgical exploration remains the first-line treatment in the presence of hard signs of vessel injury, such as haemorrhage or ischaemia. [62] The availability of hybrid theatres has increased the use of minimally invasive treatments for extremity vascular injuries.

Specialist practice

These are areas of vascular surgery in which only a small number of surgeons have a regular practice.

Thoracic outlet syndromes

Thoracic outlet syndromes are disorders caused by the compression of neurovascular structures at the thoracic outlet. [63] Treatment is most effective in a centre with high patient volumes. The core multidisciplinary team for thoracic outlet syndrome should consist of a vascular surgeon, physiotherapist, interventional radiologist, and radiologist. If conservative management fails, surgical decompression should be considered.

Carotid body tumour

Patients with carotid body tumours (paragangliomas) are referred to vascular and head and neck surgeons. Their management requires a collaborative effort between surgeons, geneticists, endocrinologists, radiologists, clinical oncologists, and the patient. In 2020, the British Skull Base Society issued consensus guidelines for managing head and neck paragangliomas. [64]

Assisting other specialities

Vascular surgeons are uniquely positioned to support other specialties in managing vascular control. The need for emergency intervention to control significant haemorrhaging typically arises in cases of major trauma and obstetric peri-partum bleeding. However, vascular surgeons can also be called upon to assist most other surgical specialties with vessel management and repair.

Cancer resection

Cancer resections may require the mobilisation, management, and *en bloc* removal of blood vessels that could be involved in the planned resection margins. Tumour removal might also necessitate in situ or extra-anatomic revascularization of arteries and veins.

Transcatheter aortic valve implantation (TAVI)

Vascular complications, including iliac artery rupture or femoral artery occlusion have been reported in up to 15% of TAVI cases. [65] Vascular surgeons can facilitate femoral or axillary arterial access to reduce the risk of arterial perforation, dissection, or thrombosis. Written standard operating procedures are in place for vascular surgery when TAVI procedures are being performed.

Spinal surgery

Published series of anterior lumbar surgery report significant incidences of vascular injury requiring repair (6-11%): [66] [67] Assistance from vascular surgery or interventional radiology may be necessary for arterial injuries and more significant venous injuries. A patient's death following an L4/5 discectomy in 2017 led the British Association of Spinal Surgeons to recommend that spinal surgery providers establish protocols for vascular imaging and collaboration

with vascular surgeons. The specification template for complex spinal surgical services also suggests that a vascular service should be available on-site for revision anterior lumbar spinal surgery.

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APPENDIX 1 (Standards)

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