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The Vascular Society of Great Britain and Ireland (VSGBI) is the pre-eminent organisation in the country promoting vascular health by supporting and furthering excellence in education, training and scientific research.

The Society represents and provides professional support for over 600 members, including vascular surgeons, vascular radiologists and others involved in independent vascular practices in Great Britain and Ireland.

The Society focuses on non-cardiac vascular disease, including diseases of peripheral arteries, veins and lymphatic. Vascular specialists are trained in the diagnosis and management of conditions affecting all parts of the vascular system.

The VSGBI is a charity organisation funded principally by Members who are vascular specialists in the UK and Ireland who treat non-cardiac vascular diseases. It has a professional structure including a permanent Secretariat, Executive Officers and Council elected by Members. The aim of the VSGBI is to have an interest in the provision of diagnosis and treatment of non-cardiac vascular diseases in the UK and Ireland.

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The Society represents and provides professional support for over 600 members, including vascular surgeons, vascular radiologists and others involved in independent vascular practices in Great Britain and Ireland. Membership of the Society is widely recognised in the vascular community as a mark of professional achievement.

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- The VSGBI **promotes vascular training**, runs training courses and has lobbied for positions such as the post CCT Fellowships, and the Endovascular Fellowships.
- The VSGBI **organises specialist courses and meetings** delivered locally, together with an annual meeting with scientific and political updates.
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- The VSGBI **publishes a quarterly journal,** the *Journal of the Vascular Societies Great Britain and Ireland*, which is available to its members.
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- The Society's **Professional Standards Committee, (PSC) offers support to individuals and hospitals**. For further information visit **www.vascularsociety.org.uk** Council and Committees page. Details of the support and advice scheme are given in the Professional Standards Committee section.
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Editor's foreword

Welcome to the February issue of the *Journal of Vascular Societies Great Britain and Ireland (JVSGBI)*. We are really pleased with the response to the launch issue, which took place at the Vascular Societies GB&I Annual Scientific Meeting held in December 2021. Attendees from all societies and industry were delighted to see the journal, which is open-access and represents the whole vascular community.

On behalf of the Editorial Board I would like to extend my thanks to all authors who have submitted articles. This issue includes two important editorials which present the views of both the trainers and the trainees regarding the recent changes to the Vascular Curriculum.

This issue also contains further outcomes from individual Special Interest Groups who worked with the James Lind Alliance and perhaps most importantly vascular patients, to identify research priorities across the sub-specialties of vascular surgery. These priorities, I am sure, will guide vascular research and funding for the foreseeable future. It gives me great personal satisfaction to see this crucial work in print. Thank you for all the hard work.

We cannot escape the impact of COVID-19 and this issue contains articles highlighting the impact of the pandemic on vascular surgical training in Scotland and the innovative modifications made to the ASPIRE 7 and 8 courses to enable delivery of these important courses despite heavy COVID associated restrictions.

Please remember this journal is for members of all societies involved in the management of vascular patients, and we would encourage submissions from all areas of interest to the vascular community. If you would like to share your work and experience with your fellow society members, and the wider vascular community, please submit your articles to *JVSGBI*, to ensure we can represent everyone with our content.

There is also a supplement to this issue of the journal – Provision of Services for People with Vascular Disease 2021. This update sets out the views of the UK Vascular Societies regarding the provision of high quality, evidence based, patient centred vascular services. We hope your organisation can use POVS 2021 to optimise the care delivered to people with vascular disease across your local vascular network. The UK vascular societies are committed to this aim, as is the Vascular Society charity, the Circulation Foundation. Visit the journal website to access the document.

Finally, I hope you enjoy reading this issue of *JVSGBI*, and please do continue to share your work by submitting articles for publication.

Ian Chetter
Editor in Chief JVSGBI
VSGBI Research Committee Chair

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EDITORIAL

The 2021 Vascular Surgery Curriculum journey

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In August 2021 the new Vascular Surgery Curriculum became active as the approved framework for the training of doctors to the level of independent consultant practice in Vascular Surgery, inclusive of a change to phases of training (1–3) and the introduction of a new assessment system with the Multiple Consultant Report (MCR). The MCR has the component parts of nine Generic Professional Capabilities (GPCs) and five Capabilities in Practice (CiPs).

This 2021 curriculum change was not an isolated update just for Vascular Surgery; indeed, changes to all the surgical curricula were mandated by the General Medical Council (GMC) as a response to the criticisms of the existing competence-based assessment regime being used in a manner that emphasised the gaining of competencies too heavily in comparison with the use of professional judgement.[1,2]

This GMC-mandated change to all the surgical curricula was also driven by medical education research, which showed that global judgements by supervisors were better able to take account of the context of a trainee's performance and were, therefore, more valid to assessment than deconstructed checklists.[3]

This research, in particular that of Olle Ten Cate, led to the concept of Entrustable Professional Activities, which proposed that performance was more than competence and included factors which could not be captured on a work-based assessment.[4,5] This format focused on the performance of higher-level activities such as the management of an outpatient clinic, and from this evolved the curriculum design that the GMC described as outcomes-based.

The Shape of Training review and Excellence by Design: Standards for Postgraduate Curricula provided opportunities to reform postgraduate training so the curriculum will produce a workforce fit for the needs of patients, producing doctors who are more patient-focused, more generalist and who have more flexibility in their career structure.[1,6] The GMC's introduction of updated standards for curricula and assessment processes laid out in Excellence by Design required all medical curricula to be based on high-level outcomes. The high-level outcomes of the Vascular Surgery Curriculum are called Capabilities in Practice (CiPs) and integrate parts of the syllabus to describe the professional tasks within the scope of specialty practice. The supervision level these CiPs are assessed against is that of a day 1 consultant in Vascular Surgery. At the centre of each of these groups of tasks are Generic Professional Capabilities (GPCs), interdependent essential capabilities that underpin professional medical practice and are common to all who practise medicine.[2] The GPCs are in keeping with Good Medical Practice,[5] and equipping all trainees with these transferable capabilities should result in a more flexible, adaptable workforce.

So, for Vascular Surgery this meant that, through the Specialty Advisory Committee (SAC), we needed to produce a curriculum that would be deliverable, using this outcomes-based model and would better support the needs of patients and service providers by ensuring the medical workforce would be able to meet patient and population trends. Hence the Vascular Surgery Curriculum purpose statement states "*The purpose of the curriculum for Vascular Surgery is to produce, at certification, competent doctors, able to deliver excellent outcomes for patients as consultant Vascular surgeons in the UK. Evidence from the last decade indicates significant improvement in outcomes with surgeons being trained in a special interest (Vascular Surgery rather than General Surgery with a special interest in Vascular Surgery), but also of the need to increase the consultant capacity to provide*

Key words: COVID-19, pandemic, vascular services

specialist Vascular Surgery in the United Kingdom and the Republic of Ireland". This also highlights the vascular-focused training benefit within the new specialty.

Therefore, under the direction of the Joint Committee of Surgical Training, the SAC formed a Curriculum Writing Group which produced a purpose statement that was approved by the GMC's Curriculum Oversight Group. This purpose statement had been requested to highlight that Interventional Radiology was clearly described within the scope of practice and that the future development of a Specific Capability in Practice common to all Specialty Curricula training in this skill be considered.

The next stage of the process was the writing of the new curriculum, with full stakeholder agreement, in order to submit to the GMC's Curriculum Advisory Group. This process included meetings and correspondence with the comparable Interventional Radiology Curriculum Writing Group to discuss the development of the common ground, from which was developed the descriptions of collaborative working within the syllabus and the description of hybrid procedures involving common femoral artery surgery with inflow or outflow endovascular procedures as Combined Open With Endovascular Reconstruction (COWER). At a full stakeholder meeting, patient groups, human resources, all allied specialties and trainee representatives were all able to input and support planned revisions to the curriculum including specified index case requirements.[7]

The plan at this stage was to make minimal changes to the curriculum syllabus content, but to simply incorporate the higher-level outcomes. However, on final review our Interventional Radiology colleagues requested a further change as it was felt that the technical skill levels – especially those related to endovascular skills – were difficult to deliver without negatively affecting the development of Interventional Radiology trainees. A further small working group looked for a solution and determined that actually removing these technical skill levels would be beneficial. The syllabus was therefore completely rewritten as a series of objectives that could be assessed with the MCR as to whether the trainee would be appropriate for phase of training and finally at the level of a day 1 consultant. This approach recognises the variation that may occur due to different work patterns within units, and we ensured it was documented that trainees may undertake periods of training in other regions in order to gain appropriate experience. By making these changes we actually aligned the curriculum even more closely to the GMC's higher-level outcomes with the development of the objectives assessed by the required supervision levels and the observed trainee performance by their Consultant Supervisors.

These changes enabled agreement from all stakeholder groups and subsequently from NHS employers. The GMC, in the Summer of 2020, approved the Vascular Surgery Curriculum, though due to COVID the implementation was delayed until August 2021 (although the Irish trainees started to use it in July 2021). The approval letter made it clear that Vascular Surgery trainees would learn endovascular techniques without limiting the training opportunities of Interventional Radiology trainees. As a further stipulation, the training of endovascular techniques would be monitored and any concerns about the accessibility to training of either group of trainees would be reported to the GMC. Both specialty groups would also be expected to report back about the deliverability at one year, in addition to the Joint Committee on Surgical Training implementation report regarding all curricula. The small joint specialty writing group considered the reciprocal training and training through collaborative procedures model. A typical example may be an Interventional Radiology trainee being taken through the iliac endovascular component of a COWER by a Vascular Surgery consultant in the hybrid operating theatre whilst the Vascular Surgery trainee is in the Interventional Radiology suite being supervised through a percutaneous lower limb angioplasty by an Interventional Radiology consultant.

For the trainee starting Vascular Surgery in 2021, the syllabus has six groups of topics including a group that covers the abdominal and general surgery objectives. The expectation is that the trainee will undertake one year of General Surgery placements within the first two years of the second phase of training and would not be expected to be on call for General Surgery beyond this time. Within the groups each topic has several components, each with an objective that will be assessed against the appropriate phase level or CiP supervision level within the MCR process. This makes it easy for a trainee to map their skill and knowledge progression against the objectives and be guided by the detailed feedback provided by the MCR and the Assigned Educational Supervisor directed learning agreements within the Intercollegiate Surgical Curriculum Programme (ISCP).

ISCP clearly sets out the expected CiP requirements at the critical progression points and for certification (Table 1). The most notable change is that the time requirement for training is removed and replaced by having achieved level IV or V in all the CiPs along with all the competencies in the nine domains of the GPC framework. This allows trainees to achieve a Certificate of

Table 1 Indicative supervision levels to be achieved by the end of each phase of training(adapted from the VS curriculum contained in the ISCP).

Capabilities in practice	Supervision level for end of phase 2	Supervision level for certification (end of phase 3)
Manages an outpatient clinic	SL III	SL IV
Manages the unselected emergency take	SL III	SL IV
Manages ward rounds and inpatients	SL III	SL IV
Manages the operating list	SL II	SL IV
Manages the multi-disciplinary meeting	SL II	SL IV

SL, supervision level.

Completion of Training more quickly than the indicative six years expected for the average trainee. These changes should specifically help the less than full time trainees with progression based on performance level and MCR feedback rather than purely a time requirement.

There was some concern over the removal of mandated components of the curriculum, such as no longer having to first author a peer-reviewed publication. However, four broad research areas are required for certification and require evidence of performance for clinical and educational supervisors and the Annual Review of Competence Progression (ARCP) panel to assess. The most straightforward method to generate this evidence may well remain a period of dedicated research towards a higher degree and associated publications. The certification requirements are clearly set out in the curriculum. Operative performance will be assessed as a component part of the 'Manages the Operating List' CiP and mapped against the phase relative objectives highlighted within the syllabus. Within this CiP and specific to Vascular Surgery is the requirement for trainees to determine the most appropriate environment in which to undertake an intervention (eg, operating theatre/hybrid or endovascular suite) and to be able to apply all the descriptors to optimally manage patients in all those environments.

As further guidance to trainees, the curriculum highlights key syllabus topics for learning which include Vascular Critical Conditions that specifically require evidence of being at the level of a day 1 consultant (ie, level 4 Case-based Discussion (CbD) or Clinical evaluation Exercise (CeX)). These are also assessed within the intercollegiate examination and supported by a satisfactory logbook. These Vascular Critical Conditions are Acute Limb Ischaemia, Abdominal Aortic Aneurysms and Fulminant Diabetic Foot Sepsis, which were chosen after extensive stakeholder feedback, and contain 11 groupings of cases with an indicative requirement to have 10 procedure based assessments (PBAs) that show progression to competence and to include four at level 4 by at least two trainers. Included within these groupings would be PBAs that also show collaborative working.

Finally, all mandatory courses have been removed from the curriculum with the exception of the Advance Trauma Life Support course, and even this allows equivalence to be undertaken. Previously undertaken courses such as Training the Trainers remain valuable examples of evidence for the relevant certification requirements. Again, these changes are common to all surgical curricula as directed by the GMC.

I hope I have described clearly the evolution of the 2021 Vascular Surgery Curriculum which contains syllabus objectives to improve and facilitate assessment of trainee performance and progression. The delivery of this curriculum will be enhanced by both trainer and trainee interaction with the MCR process. Within this process, I feel enhanced focused feedback from the supervisor to the trainee is the most important issue.

Conflict of Interest: KGJ is the Surgical Director of the ISCP.

Funding: None.

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EDITORIAL

Vascular Surgery Curriculum 2021: the trainee perspective

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The 2021 iteration of the Vascular Surgery Curriculum represents the first major change to vascular training since being awarded separate specialty status by the General Medical Council (GMC) in 2013.[1] Developed following the 'Shape of Training' review and in light of updated GMC guidance on postgraduate curricula, the new curriculum aims to specify the professional standards and clinical capabilities required to provide trainees with the competencies to be a day 1 consultant vascular surgeon in modern clinical practice.[2,3] The process of transition started in August 2021, with all trainees migrating to the new curriculum by August 2023. From a trainee perspective, the new curriculum offers a number of positive changes which should improve the process of working towards certification.

Focus on outcomes

Being a consultant vascular surgeon requires the integration of a broad array of clinical and professional skills across multiple clinical settings. Clearly, demonstrating proficiency in these skills as a trainee is more than just completing a defined number of workplace-based assessments (WBAs) or a set number of training years.

One welcome area of major change is the shift in focus towards outcomes, based around the expectation of what is required to competently perform as a day 1 consultant. Set around the concepts of 'Capabilities in Practice' (CiPs) and 'Generic Professional Capabilities' (GPCs), trainees will be required to demonstrate generic and specific vascular competencies across all areas of work (Table 1), from managing an operating list to multidisciplinary team working. Defining outcomes in this way provides trainees with a more 'real-world' understanding of the requirements for certification and provides greater context to the training syllabus. For the first time, the curriculum also defines and recognises excellence in training for those trainees exceeding expectations – a welcome addition.

Table 1 Capabilities in Practice (CiPs): common to all surgical specialties.

1	Manage an outpatient clinic
2	Manage the unselected emergency take
3	Manage ward round and the ongoing care of inpatients
4	Manage an operating list
5	Manage multidisciplinary working

The new curriculum also affords greater flexibility for trainees, particularly in terms of the length of training; the indicative six years can be shortened (or lengthened), based upon the rate of progression. This brings equality amongst all trainees. Historically, those in academic training who worked part time in clinical practice did not automatically have their training time lengthened; however, those in less than full time training for any other reason automatically had their training extended pro rata, irrespective of competence. Trainees moving into vascular surgery from other specialities can also transfer generic competencies to count towards training, something which to date has been highly challenging to define.

The Multiple Consultant Report

Arguably the biggest change to the new curriculum is the introduction of the Multiple Consultant Report (MCR), which forms the primary assessment tool within the workplace. The MCR involves clinical supervisors meeting to discuss the supervision level reached by a trainee in each of the CiPs, in addition to providing judgement on the development of GPCs and identifying the short to medium term training

Key words: teaching, vascular surgery procedures, curriculum, United Kingdom

needs to help a trainee progress towards certification. The information from this is then used by a trainee's assigned educational supervisor in combination with other evidence (eg, WBAs) to provide the end of placement report, which feeds into the Annual Review of Competence Progression (ARCP) process. Feedback from the MCR, with points for development, also automatically feed into the trainees' next learning agreement, focusing on areas where development is required. Although a major change, the MCR will hopefully provide a more accurate, up-to-date and complete judgement on a trainee's progression, which focuses on all aspects of work.

Crucially, the MCR also helps to rebalance the role of WBAs. Traditionally, WBAs have been the cornerstone of training, providing evidence of competencies across all parts of the curriculum. When used correctly, they are an excellent tool for demonstrating learning and receiving feedback; however, the focus on completing a minimum number – rather than their quality – undoubtedly detracts from their usefulness as an assessment tool. Although WBAs will still be a tool to demonstrate competencies in the syllabus 'critical conditions' and 'index procedures', the introduction of the MCR removes the need to complete a minimum number per training year. This welcome change not only helps to improve the role of WBAs for trainees, but also reduces the burden on assessment on both trainees and trainers.

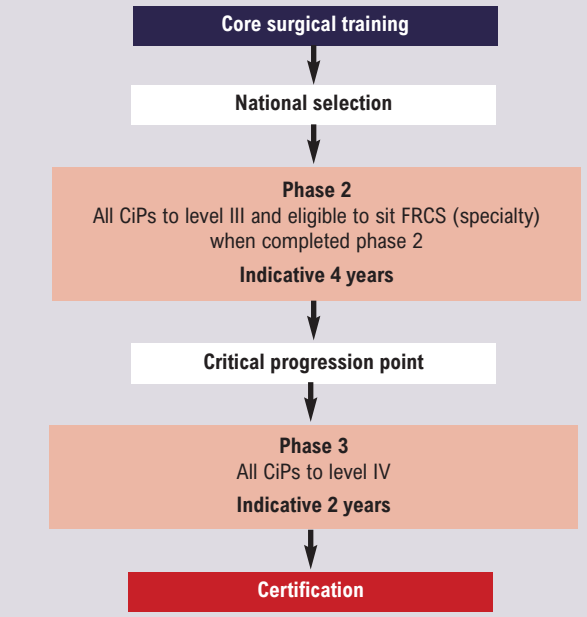
Clarity of trainee progression

Although having clarity on the expectations for certification is vital, as important is a clear expectation on the rate of progression, particularly for those in the middle years of training. Whilst under the previous curriculum benchmarking checklists were available, these primarily focused on operative experience and acted as simple 'tick-box' lists rather than giving a global appreciation of how trainees were progressing.

Within the 2021 curriculum, this changes with training being arranged into three distinct phases, extending from core surgical training to final certification (Figure 1). The junction between phases 2 (ST3–6) and 3 (ST7–8) now acts as a 'critical progression point', with progress based upon clearly defined requirements across all CiPs. For trainees, this not only provides greater clarity on their expected progression across all aspects of work, but also sets an objective benchmark for when trainees are deemed suitable to sit the Intercollegiate Specialty Examination in Vascular Surgery.

In addition to the benefits for trainees with a National Training Number (NTN), the new curriculum will hopefully provide greater clarity for those trainees applying for specialist registration through the Certificate of Eligibility for Specialist Registration (CESR) route, as mapping their competencies to CiPs, GCPs and index procedures, along with MCRs, will clearly demonstrate 'equivalence' with NTN trainees. This should help with the workforce crisis currently faced by vascular surgery in the UK.[4]

Figure 1 The new phases for a typical surgical training pathway. CiP, Capabilities in Practice. Adapted from the ISCP (www.iscp.ac.uk)



The proof of the pudding …

It is of course too early to make firm judgements about the success of these changes; however, with transition already in progress, many trainees should soon be getting first-hand experience of the new curriculum. Although it will undoubtedly take some time to adjust, credit must be given to the Intercollegiate Surgical Curriculum Programme (ISCP) for their clear advice and willingness to engage with trainees about the new process. Ultimately, the proof of the pudding is in the eating; however, at first look the new curriculum has the right ingredients to make a real positive change for trainees.

Conflict of Interest: ATON has no conflicts of interest to declare. HCT is co-author of the new vascular curriculum

Funding: None.

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ORIGINAL RESEARCH

Research priorities for patients with peripheral arterial disease: a James Lind Alliance Priority Setting Partnership

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Plain English Summary

Why we undertook the work: Research funding is limited and highly competitive and funders and policy makers need to know where best to direct their funding. A priority setting process can help address this issue by asking patients and healthcare professionals what areas of research are important to them. This paper presents the results of this process for the area of peripheral arterial disease (PAD), also referred to as narrowed arteries to the legs.

What we did: We asked patients and healthcare professionals in two separate surveys to tell us what research they felt was important for vascular conditions. The responses were organised and sent back out to patients and healthcare professionals separately, to be scored in order of importance. Both sets of responses were then combined and discussed at a workshop where a final list of PAD research priorities was created based on perceived importance to patients, carers and healthcare professionals.

What we found: A total of 481 clinicians and 373 patients or carers proposed research priorities related to vascular conditions in general, which were amalgamated into a list of 12 priorities specifically about PAD. These were discussed at the workshop and ordered in terms of their importance. The top 10 priorities, which are given in full in this paper, related to: improving outcomes, preventing operations, education and diagnosis, and stopping/slowing down PAD and cardiovascular disease.

What this means: PAD research, which is important to both patients and healthcare professionals, can now be undertaken within these topics. Funding bodies and research teams should now focus their efforts into addressing the PAD top 10 priorities.

Abstract

Introduction: Peripheral arterial disease (PAD) is a common health problem associated with reduced mobility, functional capacity and quality of life. Significant research exists in the field of vascular surgery, but its relevance to the research priorities of patients/carers and clinicians/healthcare professionals is unknown. The aim of this process, conducted by the Vascular Society of Great Britain and Ireland with the James Lind Alliance (JLA), was to identify the key research priorities for PAD, from the perspective of patients/carers and clinicians/healthcare professionals.

Methods: A modified JLA Priority Setting Partnership was performed in three stages: (1) a clinician/healthcare professional-led Delphi process; (2) a patient/carer-led JLA process; and (3) amalgamation of patient/carer and clinician/healthcare professional-led results for a final round of JLA-led prioritisation. The clinician/healthcare professional Delphi process surveyed vascular clinicians/healthcare professionals, inviting them to submit important research priorities for vascular surgery. This generated a list of priorities which were redistributed for interim scoring. The priorities fitted into nine specific Special Interest Groups (SIGs), one being PAD. This was followed by a patient/carer Delphi process (in association with the JLA) using a similar two-stage process. Finally, research priorities formed by these two processes were amalgamated to produce a refined list relevant to PAD. The PAD SIG then held a final JLA consensus workshop which was attended by patients/carers and clinicians/healthcare professionals, where a nominal group technique was used to produce a ranked top 10 list of research priorities specific to PAD.

Results: In the clinician/healthcare professional Delphi process, 481 clinicians/healthcare professionals submitted 1,231 research priorities related to vascular conditions. Two hundred

and six PAD-specific priorities were amalgamated into 17 priorities which were recirculated for scoring according to perceived importance. For patients/carers, 582 research priorities were submitted by 373 individuals, and 114 PAD specific priorities were amalgamated into 9. These were recirculated for scoring according to perceived importance. After amalgamation of both sets of priorities, 12 remained, which were discussed at the final consensus meeting, resulting in a final ranked list of 10 PAD-specific research priorities. Research priority themes included improving outcomes, maximising non-invasive therapy, education and diagnosis, and stopping/slowing down PAD and cardiovascular disease progression.

Conclusions: We have identified the top 10 PAD-related research priorities from the perspective of patients/carers and clinicians/healthcare professionals. This should provide guidance for researchers, clinicians, healthcare professionals and funders to ensure that proposed PAD research is addressing priorities that are considered important to all parties.

Key words: peripheral arterial disease, research priorities, James Lind Alliance

Introduction

Peripheral arterial disease (PAD) is an atherosclerotic process whereby the arteries supplying the lower limbs become narrowed or occluded. PAD is an increasingly common disease, estimated to affect 237 million people, with an increase of 45% between 2000 and 2015.[1,2] The PAD spectrum is wide and ranges from asymptomatic, whereby the patient is often unaware they have the disease, to critical limb threatening ischaemia (CLTI), which is associated with a high major amputation rate and mortality risk.[3,4] Intermittent claudication (IC), an ischaemic ambulatory muscle pain that is relieved by rest, falls between these being associated with more moderate ischaemia. IC is the most common symptomatic manifestation of PAD and is often stable with regard to leg symptoms, although it is associated with increased cardiovascular morbidity and mortality.[5,6] IC negatively impacts on balance, ambulation, functional capacity, activities of daily living and quality of life.[7–10] Patients with CLTI suffer more debilitating symptoms including intractable rest pain, trophic skin changes, gangrene, non-healing ulcers or any combination thereof.[6]

Suggested treatment algorithms vary depending on clinical presentation. All patients require optimisation of cardiovascular risk to reduce the recognised risk of cardiovascular events and death.[11,12] First-line treatment to improve the limb symptoms of IC is enrolment in a supervised exercise programme (SEP).[12] More invasive treatment for IC should only be instituted if a SEP has failed to improve symptoms. Patients with CLTI require revascularisation if possible to reduce the risk of major limb amputation.[12] Primary revascularisation is possible in only 50% of patients with CLTI, with the remainder undergoing primary amputation (25%) or medical management only (25%).[6]

Many elements of PAD management still lack high level supportive evidence and effective implementation. For example, it is recognised that clinician and patient adherence with cardiovascular risk reduction therapies is suboptimal, yet we do not understand fully how to improve this.[13] The provision of, and engagement with, a SEP is still poor in the UK despite evidence to support its benefits.[14,15] For patients with CLTI, it is still not known which level of amputation maximises functional recovery when a below-knee amputation is not possible.[6,16] These examples demonstrate clearly an unmet need for further high-quality research driven by the priorities of patients, carers and clinicians/healthcare professionals to improve the management of patients with PAD. Such information is also key in informing funding bodies, commissioners and policy makers about the research priorities for vascular surgery.

The James Lind Alliance (JLA; https://www.jla.nihr.ac.uk/) uses a well validated Priority Setting Partnership (PSP).[17] They facilitate PSPs to 'bring patient, carer and clinician groups together on an equal footing, identify evidence uncertainties which are important to these groups, work with these groups to jointly prioritise the uncertainties and produce a top 10 list of jointly agreed uncertainties as research questions to be presented to funders'.[17]

The vascular research collaborative and the vascular condition PSP were founded in 2016 and 2019, respectively, with the aim of developing a national research strategy for the vascular specialty and identifying the research priorities for each sub-specialty. We detail how we undertook a JLA PSP to ascertain and clarify the opinions of clinicians/healthcare professionals and patients/carers to identify the most important clinical research priorities for PAD that require future investigation.

Methods

A detailed methodology of the process has been provided previously.[18] We provide a summary below. A visual summary is also presented in Figure 1.

We used a modified JLA PSP methodology to identify the research priorities for vascular conditions. The JLA PSP states that a survey should be distributed to patients/carers and clinicians/healthcare professionals who can make suggestions for research uncertainties. These data are then processed to remove out-of-scope submissions, categorise eligible submissions, form indicative priorities and verify the uncertainties (ie, existing research does not already answer this uncertainty).[17] The indicative list of priorities is then shortened via an interim prioritisation. This involves redistributing the indicative list of priorities to patients/carers and

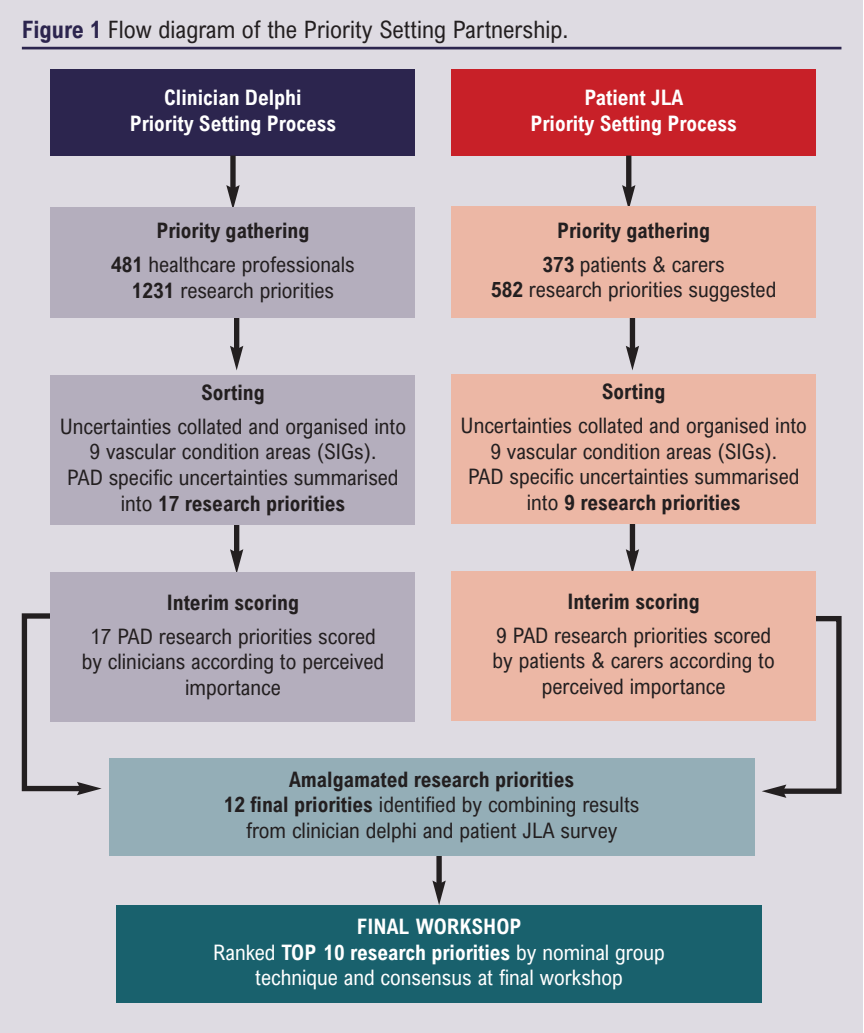

Figure 1 Flow diagram of the Priority Setting Partnership.

clinicians/healthcare professionals for scoring according to perceived importance, with the top priorities taken forward to the final workshop. This final workshop involves whole and small group discussions to produce a ranked list of research priorities, with the aim of delivering a 'top 10'.

In our case, due to initial resource limitation, the first two stages (survey completion and priority scoring) took place separately for clinicians/healthcare professionals and patients/carers, with oversight from a National Steering Committee.[18] The clinician/healthcare professionals survey was completed first, followed by the patient/carer survey two years later, in association with the JLA. The data from the first round of the clinician/healthcare professionals survey was analysed by a working subgroup of the steering committee and a refined list of summarised priorities was redistributed for interim scoring. This process also led to the creation of nine Special Interest Groups (SIGs) that were organised into different vascular specialty areas, one being PAD. This was followed by a JLA PSP to gather research priorities from a patient/carer perspective via a separate survey. The data from this survey were analysed by the respective SIGs and a summarised list of research priorities was redistributed to patients/carers for interim scoring.

Clinician/healthcare professional-led priority setting process

The clinician/healthcare professional-led PSP was completed in 2018 and published in 2020.[19] Out of 45 potential vascular themes, nine key areas were identified, leading to the creation of nine SIGs in the following areas: Access, Amputation, Aortic, PAD, Carotid, Diabetic foot, Venous, Wounds and a general category for Vascular Service Organisation.

This clinician/healthcare professional-led PSP was delivered via a modified Delphi approach. It involved two rounds of online surveys involving members of the Vascular Society of Great Britain and Ireland, Society of Vascular Nurses, Society for Vascular Technology and the Rouleaux Club for vascular surgical trainees. During round 1, participants were invited to submit the research priorities they felt were most pertinent to vascular surgery. These were then collated and categorised into pathological topics and research themes by the steering group. Priorities that addressed the same or a closely similar topic were amalgamated. In round 2, these summary priorities were then recirculated for interim scoring on a scale of 1–10 (1 being the least important, 10 being the most important).[19]

Patient/carer-led priority setting process

The vascular PSP, in association with the JLA, undertook a consultation with patients and carers to gather their vascular research priorities. The consultation in the form of a survey was open for six months (from September 2019 to March 2020). Patients and carers were approached and completed the survey either online or by paper, with patients being identified through outpatient clinics or from PAD focus groups. In addition, SIG members, UK vascular units, charities and patient groups were contacted to help promote the survey. PAD-specific priorities were identified, and similar or duplicate priorities were amalgamated. Priorities were edited by SIG chairs, with input from patient representatives, and those considered out of scope were excluded. This editing was necessary to ensure the refined list of priorities was easy to understand with no overlap and minimal uncertainty. The rest of the SIG team ratified these edits.

This list of PAD priorities was recirculated between November 2020 and February 2021 for scoring using a Likert scale (scores ranging from 1 = Not at all important to 5 = Extremely important). This process took place either online or via paper format.

Final consensus workshop

Prior to the final workshop, priorities derived from both the clinician/healthcare professional and patient/carer surveys were reviewed by the PAD SIG and similar or duplicate priorities were merged. The language used in the priorities was reviewed to ensure it was appropriate and understandable for patients. This generated a final research priority list which was again ratified by the PAD SIG.

The final consensus workshop for PAD was conducted virtually on 14 May 2021 using the Zoom platform. All attendees (including clinicians, healthcare professionals, patients and carers) were recruited via direct contact or were approached if they expressed an interest during the initial prioritisation process. Communication prior to, during and following the workshop was led by a JLA coordinator and involved prior circulation of the research priorities (in no particular order) and details of the workshop. Prior to the workshop, each attendee received the list of 12 research priorities and were asked to rank them in order of importance from 1 (most important) to 12 (least important).

The workshop was led by three advisers who were skilled in the JLA process and leading such workshops. The workshop used a nominal group technique to create the final ranked top 10 research priorities from the original combined list of 12. Following an initial welcome and introduction to the workshop, the attendees were split into three breakout rooms which consisted of a mix of patients, carers, clinicians and healthcare professionals. The importance of the research priorities was discussed in each group and each member presented their top three and bottom three priorities, outlining underpinning reasons. The group together then ranked the priorities via consensus (from 1 to 12). The priority order was then collected from each group to generate an initial ranked list (based on geometric and arithmetic scoring). This initial ranking was then presented to the overall group. The process was then repeated with the attendees allocated to different breakout groups to discuss the new ranking order. The attendees were then given another opportunity to reorder the priorities again via consensus if it was felt necessary. The results of the final rankings were again collated, creating a final hierarchical list of research priorities based on the same scoring methods. The final top 10 list of research priorities was then presented to all attendees in the closing session.

Members of the PAD SIG were present as observers and provided support if required (eg, if a patient needed emotional support), but they were not directly involved in the priority setting and had no influence over the final agreed list of priorities. In line with JLA guidance, they were muted with their camera off.

Results

Results from the clinician/healthcare professional-led research priority identification

A total of 1,231 research priorities were put forward by 481 clinician/healthcare professionals which, when removing duplicates, resulted in a total of 206 PAD-specific priorities. These were refined into a list of 17 summary priorities which were redistributed for scoring. The final list of clinician/healthcare professional priorities and their ranked mean scores is shown in Table 1.

Table 1 Research priorities from the clinician/healthcare professional survey and prioritisation process, with the mean ranking score

Research priority	Mean scores
What can be done to improve outcomes in critical limb ischaemia (including how best to identify those who would benefit from revascularisation and those who would be best managed with primary amputation or palliation)?	8.38
How can we reduce progression of arterial disease?	7.59
Can we develop a critical limb ischemia (CLI) care pathway to ensure optimal management?	7.56
What is the optimal assessment of distal vasculature and perfusion?	7.18
What is the best medical therapy for PAD?	7.15
How can we reduce cardiovascular risk in PAD patients?	7.14
What is the optimal antiplatelet therapy following lower limb revascularisation?	7.11
Is post revascularisation surveillance worthwhile and what is the optimal strategy (modality, timing)?	7.11
How can we improve provision and access to exercise programmes for patients with intermittent claudication?	7.02
What novel non-invasive interventions are effective for claudication?	6.89
Would a more aggressive revascularisation strategy improve outcomes for patients with intermittent claudication?	6.65
How can we promote awareness of PAD?	6.62
What is the optimal exercise prescription for claudication?	6.57
Is pre-conditioning prior to PAD surgery feasible and effective?	6.52
Is cell / gene therapy effective in PAD?	6.48
Can decision trees and pathways of care be used to improve care for PAD patients?	6.19
Is screening for PAD beneficial?	5.90

Patient/carer-led research priority identification

A total of 582 research priorities were put forward by 373 patients/carers, with 114 priorities specifically pertaining to PAD. These were refined into a list of nine summary priorities, which were redistributed for scoring in terms of importance. Two hundred and seventy three patients/carers engaged with this phase of the survey and the final list of priorities, and their ranked mean scores is shown in Table 2.

Final prioritisation workshop

The final workshop was facilitated by four members of the JLA team and was attended by six patients/carers, 10 clinicians/healthcare professionals (consisting of consultant vascular surgeons, specialist vascular nurses, specialist surgical trainees and clinical exercise physiologists) and an additional two observers. The prioritisation process resulted in a ranked list of research priorities, ordered 1–12

Table 2 Research priorities from the patient/carer survey and prioritisation process, with the mean ranking score

Research priority	Mean scores
How can we diagnose patients with poor circulation to their legs earlier and better? Would this make a difference in the long term?	4.63
What are the best ways to reduce the leg pain symptoms seen with patient with poor leg circulation without performing an operation?	4.54
What are the best operations to perform to improve the blood flow to the legs of people with poor circulation?	4.53
How can we make sure that operations to improve blood flow to the legs of people with poor circulation work for a long period of time?	4.52
How can we educate other doctors and health care workers so that they gain a better understanding of the consequences of a diagnosis of poor circulation to the legs?	4.49
How can we stop patients getting poor circulation to their legs?	4.48
How can we slow down any progression of symptoms in those patients with poor circulation to their legs?	4.43
How can we help educate better those patients who have poor circulation to their legs?	4.41
How can we make it easier for patients to get help for this problem (poor circulation to the legs)?	4.41

Table 3 Collated research priorities that were circulated to all attendees prior to the final workshop. The priorities were listed randomly and assigned a letter rather than a number.

A	What are the best operations to perform to improve the blood flow to the legs of people with poor circulation?
B	How can we make sure that operations to improve blood flow to the legs of people with poor circulation work for a long period of time?
C	What are the best ways to reduce the leg pain symptoms seen with patient with poor leg circulation without performing an operation?
D	How can we stop patients getting poor circulation to their legs?
E	How can we slow down any progression of symptoms in those patients with poor circulation to their legs?
F	How can we diagnose patients with poor circulation to their legs earlier and better? Would this make a difference in the long term?
G	How can we help educate better those patients who have poor circulation to their legs?
H	How can we educate other doctors and health care workers so that they gain a better understanding of the consequences of a diagnosis of poor circulation to the legs?
I	How can we make it easier for patients to get help for this problem (poor circulation to the legs)?
J	What can be done to improve outcomes in patients with severe circulation problems to their legs?
K	How can we reduce cardiovascular risk in PAD patients?
L	What is the optimal exercise prescription for patients with poor circulation to the legs? How can we improve provision and access to exercise programs?

by the attendees, from the initial pre-circulated list (ordered A–L to avoid bias; Table 3). This created the final ranked top 10 list of research priorities, being those that were ranked 1–10 (Table 4). During the final discussion it was confirmed by all participants that the top 10 list was a fair, accurate and comprehensive reflection of the discussions and viewpoints that were apparent in the individual breakout rooms and the order was therefore a reflection of the consensus. Results from the participant feedback indicated that 90% agreed or strongly agreed that the process for determining the top 10 priorities was robust and fair.

Table 4 Final ranked "Top 10" list of peripheral arterial disease research priorities

Ranking	Priority
1	What can be done to improve outcomes in patients with severe circulation problems to their legs?
2	What is the optimal exercise prescription for patients with poor circulation to the legs? How can we improve provision and access to exercise programs?
3	How can we diagnose patients with poor circulation to their legs earlier and better? Would this make a difference in the long term?
4	How can we educate other doctors and health care workers so that they gain a better understanding of the consequences of a diagnosis of poor circulation to the legs?
5	How can we help educate better those patients who have poor circulation to their legs?
6	How can we make it easier for patients to get help for this problem (poor circulation to the legs)?
7	What are the best ways to reduce the leg pain symptoms seen with patient with poor leg circulation without performing an operation?
8	How can we slow down any progression of symptoms in those patients with poor circulation to their legs?
9	How can we stop patients getting poor circulation to their legs?
10	How can we reduce cardiovascular risk in PAD patients?

Two research priorities were ranked as 11th ("How can we make sure that operations to improve blood flow to the legs of people with poor circulation work for a long period of time?") and 12th ("What are the best operations to perform to improve the blood flow to the legs of people with poor circulation?"). Both these priorities are related to performing operations for the treatment of PAD. The low ranking of these priorities was because it was felt that the top-rated priority "What can be done to improve outcomes in patients with severe circulation problems to their legs?" was more holistic and encompassed these two priorities, given that those with severe circulation problems often require surgical intervention.

Discussion

Using a modified JLA methodology, we have identified the key research priorities for PAD from the perspective of both patients/carers and clinicians/healthcare professionals, which should inform future research (Table 4). This focus on key research priorities will deliver patient relevant studies and will go some way to reducing research waste.[20]

The number 1 research priority was "What can be done to improve outcomes in patients with severe circulation problems to their legs?". This is most likely to pertain to those patients with CLTI, which forms most of the clinical workload. The outcomes for

patients with CLTI are still suboptimal, with data suggesting that only 50% are candidates for surgical revascularisation, whilst a quarter receive medical management only and the remaining quarter require primary amputation.[6] Further, the 5-year mortality rate is >30%, which is worse than some cancers.[21] The group agreed that this priority incorporated both the invasive and non-invasive management of those with CLTI, meaning it also encompassed the priorities ranked 11th and 12th. The importance of this research priority is also recognised by the most recent national Get It Right First Time (GIRFT) report and the Vascular Society of Great Britain and Ireland PAD quality improvement framework.[22,23]

The second most important research priority was "What is the optimal exercise prescription for patients with poor circulation to the legs?". Exercise therapy is recommended for all patients with IC as the first-line treatment.[12] This should ideally be delivered in the form of a SEP, which is more effective than unmonitored home-based programmes and exercise advice alone.[24,25] SEPs have been recommended as first-line treatment for patients with IC in the UK since 2012,[26] yet access to such programmes is limited and service delivery has not improved in 10 years.[15,27] For those who do have a programme, there is still a lack of consensus on the optimal exercise prescription or the value of differing exercise regimes. Finally, the development of technology including wearables and the use of apps alongside the rapid uptake of virtual meeting platforms due to COVID-19 opens potential new methods of delivering such exercise programmes. Despite the existing literature considering exercise for patients with IC, there is a clear need for patients and healthcare professionals to work together to identify further aspects, including the optimal exercise prescription.

The third highest priority was "How can we diagnose patients with poor circulation to their legs earlier and better?". Patients present at the workshop described a frustration at the length of time it took to receive the formal diagnosis of PAD, with some citing multiple trips to their general practitioner and/or other specialties before receiving the correct diagnosis and management. Frustration due to multifactorial delays in diagnosis has been reported previously.[28] First, patients may incorrectly assume that exertional pain is a normal part of the ageing process and may delay seeking medical help.[28] When medical help is sought, it may take significant time and effort to receive the correct diagnosis.[28] Therefore, research that aims to reduce the time to diagnosis is vital, and this may link to priorities 4 and 5 which relate to patient and clinician education about PAD, and priority 6 which relates to making it easier for patients to get help.

The final four top priorities were related to reducing or slowing down the progression of symptoms without an operation and reducing cardiovascular risk or stopping people from getting PAD. These are all important priorities. With regard to symptoms, IC is associated with reduced balance, functional capacity and quality of life, meaning that an improvement in symptoms would likely result in an improvement in these factors.[7–9] Also, people with PAD have an up to 15-fold increased risk of mortality, usually of cardiovascular origin, when compared with those without PAD.[11] As such, research that looks at stopping people from getting PAD or reducing their cardiovascular risk is vital to address this.

Strengths and limitations

This study used a well-established process through a recognised organisation – namely, the JLA – to identify the research priorities for PAD from the UK perspective of both patients/carers and clinicians/healthcare professionals. The process was systematic and transparent, included a variety of key stakeholders and ensured active contribution from all parties. This was evidenced in the feedback from participants, which stated that the process was robust and fair and that they were all largely happy with the final prioritised list.

However, there are some limitations to consider. First, the nature of data collection (survey) meant that there was a potential for responder bias, meaning the responses provided may not be reflective of the thoughts of all patients with PAD and the clinicians/healthcare professionals involved in their care. We did, however, attempt to minimise this bias. We were able to include patients from a range of geographical locations as well as different socioeconomic and health literacy backgrounds by offering both paper and electronic versions of the survey. We also included a range of clinicians/healthcare professionals, all of whom will interact differently with patients, to ensure varied responses.

The PSP was also conducted using a slightly modified approach to that recommended by the JLA by conducting separate initial prioritisation rounds for patients/carers and clinicians/healthcare professionals. It is possible that the top 10 may have differed had the clinician/healthcare professional and patient/carer research priorities been analysed, summarised and ranked by all participants together at the same time. Despite this, the results of the final prioritisation workshop and the subsequent top 10 research priorities were clearly of importance to both groups.

Implications for future research

Identifying the most important PAD research priorities for both patients/carers and clinicians/healthcare professionals is vital for guiding research in this field in both the immediate and long term. These priorities will aid research teams and funders to ensure that the research being designed, funded and undertaken is of upmost importance. While this process has focused on themes, it is incumbent on researchers to determine and develop research projects to address these priorities.

The PAD SIG aims to develop an expert national group of researchers and clinicians/healthcare professionals supported by professional bodies, making it likely that the group will play a key part in providing solutions to these research priorities.

Conclusion

By undertaking a JLA PSP, the PAD SIG has been able to identify

KEY MESSAGES

- 12 research priorities relating to peripheral arterial disease were reviewed by a mixed group of patients, carers, clinicians and healthcare professionals.
- This led to a final list of 'Top 10' priorities – ordered by perceived importance.
- Priorities related to: improving outcomes, preventing operations, education and diagnosis, and stopping/slowing down peripheral arterial disease and cardiovascular disease.

the top 10 research priorities from the perspective of patients/carers and clinicians/healthcare professionals, which should shape the research agenda in this field in the immediate and long term.

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ORIGINAL RESEARCH

Defining priorities in vascular access research

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Plain English Summary

Why we undertook the work: People with kidney failure need to be connected to dialysis machines by lines which provide access to high volumes of blood; this is called vascular access and can be delivered through direct connections to the main veins in the body or by surgically creating a high pressure system (arteriovenous fistula and graft) close to the surface of the skin. Despite dialysis becoming more common, there are not many large-scale studies which guide clinicians on how to manage patients who live with vascular access. We wanted to establish what the key priorities for research were, according to patients, carers and access clinicians.

What we did: We conducted four online surveys targeting doctors, nurses, patients and carers and held a workshop to define the top10 priorities in vascular access research.

What we found: There was a high response rate to the survey. The patients' and clinicians' top 10 priority list included questions regarding optimising access function and preventing complications, and ensuring everybody is well educated in access matters.

What this means: This top 10 list will hopefully serve as a basis to direct future research. Researchers may wish to consider whether their research proposals fit with these agreed priorities. Research funding bodies may also use this list to decide whether future research is justified and eligible for funding.

Abstract

Introduction: There is increasing need for renal replacement therapy associated with the aging population and dramatic increases in diabetes prevalence. Despite an increasing clinical vascular access workload, there are significant unanswered research questions and a paucity of high quality trials to guide clinical practice. To address where future research in vascular access should be directed, we conducted a Priority Setting Partnership involving multiple disciplines, specialties, patients and carers.

Methods: In collaboration with the James Lind Alliance, four rounds of surveys were circulated to identify and score professional and patient priorities in vascular access research. Finally, in a consensus workshop attended by patients and professionals, priorities were discussed and a ranked top 10 list was produced using a nominal group technique.

Results: A total of 1,813 research priorities were submitted within all areas of vascular surgery. Following removal of duplicates, consolidation and categorisation, 15 patient and professional priorities in vascular access research were taken forward to the consensus workshop. The workshop produced a ranked top 10 list of vascular access research priorities relating to: optimising access function, preventing access complications and education of patients and healthcare staff.

Conclusions: These research priorities should help to direct and contextualise future research in vascular access.

Key words: vascular access, haemodialysis, arteriovenous fistula, arteriovenous graft

Introduction

The global prevalence of renal failure is rising, driven predominantly by diabetes.[1] In the UK, 37.8% of the 68,111 patients on renal replacement therapy receive haemodialysis.[2] Accordingly, there is a sustained increase in the need for vascular access and vascular access interventions. The Standardized Outcomes in Nephrology – Hemodialysis (SONG-HD) initiative is an international consensus process involving >1,300 patients, caregivers and health professionals from >70 countries; vascular access

was identified as one of four areas in haemodialysis care considered critical to all stakeholders.[3,4] Despite this, vascular access for haemodialysis remains a 'Cinderella' sub-specialty of vascular and transplant surgery. There are no landmark trials on the scale of those in aneurysm repair, carotid surgery, venous disease or peripheral arterial disease. Thus, clinical decision-making is based upon guidance that is not backed up by a robust evidence base and many significant questions remain in vascular access care.

Funding for vascular access research – and vascular surgery research more broadly – is lacking. There are no established large-scale funding charities for work in this field. As a consequence, funding applications must compete against many other clinical specialties in broad funding competition. Researcher-led funding applications in vascular access surgery have had low rates of success and are often developed in isolation. To combat this challenge, over the last three years the Vascular Society of Great Britain and Ireland (VSGBI) has partnered with the James Lind Alliance (JLA) in a Priority Setting Partnership (PSP). The aim of the PSP was to define the top 10 research priorities in vascular surgery through an international (UK and Ireland) prioritisation process involving patients, carers and professionals. This 'Top 10' would be the foundation of a clear strategy for research in vascular access over the coming years and be a demonstrable base on which to justify future proposals.[5]

Methods

The methodology was adapted from that used by other JLA PSPs,[6] as previously reported.[7]

In the first stage, a national online Delphi survey was launched to members of VSGBI, the Society of Vascular Nursing (SVN), the Rouleaux Club (the UK and Ireland vascular surgery trainees society) and the Society of Vascular Technology (SVT). Members were contacted by email. Clinicians were asked to submit suggestions for what they perceived to be the key priorities in vascular surgery research through an online portal (Bristol Online Survey Tool). Respondents were free to suggest as many priorities as they wished. Duplicate and overlapping priorities were removed or consolidated by a sub-group of the PSP steering committee. Priorities were then grouped by clinical categories.

A second round of survey was launched asking prior contributors to score the importance of the rationalised and re-categorised priorities on a scale from 1 (least important) to 10 (most important). Sum scores were to be used to draw a preliminary rank of 30 priorities, as published previously.[5]

Following review of the priorities, the research committee of VSGBI and vascular patient representatives concluded that assessment of patient priorities would necessitate sub-speciality investigation. Separate Specialist Interest Groups (SIGs) (Table 1) were formed to address multiple sub-PSPs. The SIGs were to have relevant multispecialty and multidisciplinary representation. Chairs and deputy chairs were advertised nationally and appointed by the VSGBI research committee following competitive interview. Further stages in the overall PSP were coordinated centrally by the VSGBI and JLA, although each SIG took charge of its own sub-specialty PSP. The vascular access SIG at the time of the PSP was made up of a vascular surgeon, a vascular surgery trainee, a radiologist, a patient representative, a nephrologist, a dialysis nurse specialist and a vascular scientist.

Table 1 VSGBI research Specialist Interest Groups (SIGs).

Aorta	Carotid	Diabetic foot disease
Peripheral arterial disease	Service organisation	Vascular access
Venous disease	Amputation	Wounds

Following formation of the SIGs, a second survey was launched, this time targeting patients and carers. The survey could be completed online (Qualtrics™) or on paper and returned to the PSP coordinating centre. The survey was advertised to vascular surgery and nephrology charities and patient groups. Patients and carers were asked to state their experience of vascular surgery (access, aneurysm, etc) and submit their perceived research priorities. Patients and carers were also asked if they could be contacted to participate in further work in this process. Proposed research priorities were consolidated in the same manner as in the first survey, this time by the SIG. Priorities were re-worded by the SIG members with the assistance of the PSP coordinator for clarity and wording.

In the next step, patients and carers were canvassed again via a further survey and were asked to score the summarised priorities on a scale from 1 (least important) to 5 (most important). This resulted in the preliminary list of scored patient priorities to take forward to a consensus workshop.

The final step in the vascular access PSP process was to hold a consensus workshop which, due to the COVID-19 pandemic, was held by means of an online meeting. Six patient representatives and six healthcare professionals joined the workshop with the aim of ranking the priorities to identify a final top 10. The workshop was facilitated by two members of the JLA and led by the SIG chair. Participants were invited either through SIG contacts or drawn from survey respondents who had indicated that they were happy to be involved in future work. Full telephone technical support for accessing the online workshop was offered and a reserve 'telephone in' option was also made available for those without internet access. Participants were split into mixed groups of six. Participants in each group were asked to declare their top three and bottom three priorities to the group. This was followed by discussion, before agreeing a preliminary 'Top 10'. The priority lists from each group were pooled by their geometric mean and presented as a preliminary list to the whole group of 12 for consideration. Participants were then redistributed into two new sub-groups of six and could adjust the ranking once more. The final ranking from the two sub-groups was again consolidated by

geometric mean and this was agreed as the final ranked top 10 list of research priorities for vascular access. Participants were asked to complete a feedback survey after they had participated in the workshop to evaluate its effectiveness.

Results

In total, 1,231 priorities were submitted by 481 health professionals during the first Delphi survey. These were rationalised into 83 priorities in nine clinical categories, of which two were related to vascular access. For the subsequent healthcare professional scoring survey, 323 responses were received. The full results of this survey have been published previously.[5]

Among 373 patients and carers, 582 priorities were submitted, of which 61 related to vascular access. Consolidation and summarisation of priorities led to a list of 15 relating to vascular access. The patient and carer scoring survey received a total of 273 responses; 22 respondents chose to score vascular access priorities. These were consolidated with the two priorities from the healthcare professional survey into a final list of 15 priorities for the consensus workshop (Figure 1).

The workshop was attended by six patients, two carers, two vascular surgeons (one trainee), one vascular scientist, one nephrologist and two dialysis nurse specialists. The top 10 ranked vascular access research priorities agreed at the workshop are shown in Table 2. Patients and carers championed priorities on education, pain reduction and quality of life, whilst clinicians championed priorities relating to access longevity. Overall satisfaction with the workshop was high among participants who agreed that the final top 10 was a fair reflection of the aggregated view of the attendants.

Five research priorities did not rank sufficiently highly to be included in the top 10 priorities. Two of these related to the duties of non-medical staff: having a single nurse assigned to a patient for every needling was felt to be undeliverable and thus not worthy of research; the potential role for non-medical staff in performing central vein cannulation was received poorly by patients and carers. Although there was debate among patients regarding the utility of keeping a running fistula following successful transplantation, it was not felt to be of sufficiently high enough priority to justify its place in the top 10. Pain on needling was ranked high by some patients but dismissed by others following the use of topical agents and seen as unavoidable by healthcare professionals. Finally, reducing swelling in limbs after formation of vascular access was seen to be likely related to venous outflow problems, which overlapped with more highly ranked research priorities.

Table 2 'Top 10' priorities in vascular access surgery research.

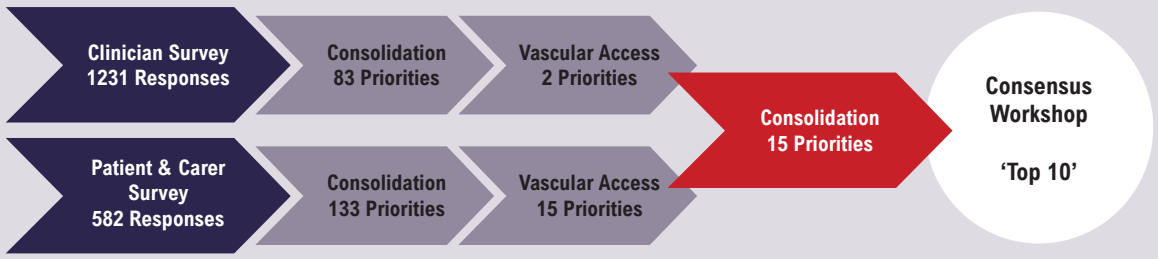
1	What can be done to make fistulas or grafts last as long as possible?
2	What staff education is needed to help them understand the experience of patients living with access?
3	What education do patients need regarding living with dialysis access, and its impact on quality of life?
4	What can be done to avoid narrow segments from forming in fistulas/grafts?
5	Is a fistula always the best option for all patients, of any age, who need dialysis?
6	What patient education is needed on the risk of access procedures including damage to the blood circulation system?
7	What features of a fistula or graft make it better or worse at providing dialysis?
8	How can we prevent fistulas becoming enlarged or at risk of a serious bleed?
9	How can we make needling of grafts/fistulas more accurate to lower the risk of problems?
10	What can be done to prevent infections related to dialysis lines?

Discussion

This paper describes a process for establishing a top 10 list of priorities in vascular access research according to a broad set of stakeholders including patients, carers and the professionals responsible for their care. To do so, a modified JLA process was adopted to identify, score and rank priorities sourced from clinicians and patients. The final top 10 represents a balanced view of contrasting priorities among healthcare professionals and patients. While PSP top 10 lists are ranked, all priorities identified are important, regardless of position.

Of interest, a dialysis PSP was facilitated by the JLA in Canada in 2014.[8] While none of the top 10 priorities in the Canadian

Figure 1 Selection and consolidation of questions in the vascular access priority setting partnership.



process match those of the ones described here, there is notable overlap in themes, such as assessing differences in dialysis modalities or access types in different patient cohorts and enhancing patient and staff education and communication. A systematic review of priority setting in kidney disease was also undertaken in 2015.[9] There was significant discrepancy in methodologies applied and little patient involvement across the studies included; however, improvements to vascular access were a recurring theme in the top priorities of these studies. While chronic kidney disease and dialysis as a whole are broader in scope than vascular access, the recurring themes add support to the potential international impact of this PSP.

Study limitations

This process has some limitations which warrant discussion. Firstly, the process was partly conducted during the COVID-19 pandemic, requiring virtual and remote working for the final workshop. Even with the technical support offered, there may be an element of selection bias towards participants who are more comfortable with online working. In the same vein, although a paper questionnaire was made freely available, the majority of survey results were received electronically, conferring the same potential bias. As the process was initially designed to address priorities in vascular surgery broadly, there was under-representation of transplant surgeons, nephrologists and vascular access nurses in the clinician survey. This was compensated for in later stages. Lastly, any survey is inherently susceptible to responder bias.[10]

Attempts were made to have a fair distribution of experience and geographical location among participants in the workshop. However, this had to be balanced against a 'practical' number of people who could participate in an open video forum and lost participants due to absence on the day. Thus, the sum of subjective experience in the workshop may not be sufficient for a fully objective prioritisation.

Finally, throughout the earlier parts of the process, engagement with patients and carers was challenging. Many respondents and participants perceive themselves as 'dialysis' or 'kidney' patients; communication from 'the vascular society' about 'vascular disease' priorities was anecdotally reported as potentially irrelevant to the targeted patients. Equally, the term 'vascular access' was somewhat esoteric to this cohort. Supporting information regarding the applicability of the survey to vascular access patients was communicated through relevant kidney charities to try to minimise this.

Conclusion

A 'Top 10' of research priorities in vascular access offers an opportunity for researchers and funders to consider future research applications in a different context and frame the perceived impact their questions and results may have on patients and care. It is hoped that this list will not only be of use to researchers in the UK and more widely, but will also help to ensure that limited research funding is targeted at the projects that are most likely to have the most impact on patients and in assisting with common day-to-day clinical decisions made by healthcare professionals. The Vascular Access SIG is now tasked with developing research projects which address the top 10 priorities through a wide collaboration with relevant organisations, multidisciplinary professionals, patients and carers.

KEY MESSAGES

- Following multiple rounds of surveys, 15 vascular access research priorities were considered in a consensus workshop by key stakeholders.
- A 'Top 10' list of vascular access research priorities has been drawn up to help direct future research.
- Education for staff and patients and fistula function preservation were common themes among the 'Top 10' vascular access research priorities.

Conflict of Interest: The authors declare no conflicts of interest.

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ORIGINAL RESEARCH

Research priorities for aortic diseases: results of the James Lind Alliance/Vascular Society GBI priority setting exercise

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Plain English Summary

Why we undertook the work: Researchers often focus on what they think is important, which can be different from what patients, carers and clinicians think. For this reason, it can also make it difficult for funding bodies to decide where best to target their limited funding. To address this issue, the Vascular Society of Great Britain and Ireland (VSGBI), with the James Lind Alliance (JLA), undertook a national Priority Setting Process (PSP) to identify the most important areas of vascular research in the UK. This paper presents the results of this process, focusing on aortic condition-related research topics.

What we did: The PSP was undertaken in three main phases. The first was an open-ended survey which aimed to collect the views of vascular healthcare professionals about their research priorities. The second phase was conducted in the same way but was aimed at gathering the opinions of vascular patients and carers about research topics that were most important to them. The third stage brought together the results of the two surveys and created a combined list of both vascular professional and patient research priorities. These priorities were discussed at a final workshop meeting attended by patients, carers and professionals who agreed an ordered 'top 10' list of research priorities for aortic conditions.

What we found: A total of 481 healthcare professionals and 373 patients or carers submitted research priorities about vascular conditions. These were amalgamated into a list of 18 priorities specifically about aortic conditions and were put into an order of importance at a workshop meeting. The final 'top 10' aortic research priorities related to improving how aortic conditions were identified and monitored, finding out how treatment options are decided, supporting recovery after an operation and more ways of predicting those at risk of having aortic conditions.

What this means: We have identified the most important research priorities for aortic conditions and encourage researchers and funders to focus their efforts in addressing these important topics.

Abstract

Background: In order to identify research priorities for aortic disease, a partnership between the Vascular Society of Great Britain and Ireland (VSGBI) and the James Lind Alliance (JLA) was established to capture the interests of a wide group of patients, carers and health professionals. One of the aims of the partnership was to establish the top 10 research priorities in the field of aortic disease.

Methods: A modified JLA Priority Setting Partnership was undertaken, during which healthcare professionals, patients and carers participated independently in two Vascular Society of Great Britain and Ireland (VSGBI)-led Delphi processes identifying research priorities in aortic disease. An aortic Special Interest Group composed of patients and healthcare professionals assessed the two lists of priorities, amalgamating similar priorities and generating a final list for ranking. An offer was sent to various patients, carers and healthcare professionals from different backgrounds with an interest in aortic disease to attend the final consensus workshop where a ranked top 10 list of aortic disease research priorities was produced using a nominal group technique.

Results: A total of 1,231 research priorities relating to general vascular surgery were submitted by 481 clinicians. From these, 162 aortic-specific research priorities were identified and combined into 15 final clinical priorities. In addition, 582 research priorities related to vascular surgery in general were submitted by 373 patients or carers. From these, 24 further aortic-specific research priorities were identified after combining similar priorities. Amalgamation of

the clinician and patient priorities resulted in 18 priorities that were taken to the final consensus workshop, where a ranked top 10 list of aortic disease research priorities was produced. These priorities include themes of diagnosis, surveillance, management, recovery and predisposition.

Conclusion: A collaborative effort between healthcare professionals and patients has identified a ranked top 10 list of aortic disease research priorities. This list will inform and guide clinicians, researchers and funders for the foreseeable future and will support future research that encompasses the important interests and representation of the wider network involved and affected by aortic disease.

Key words: aortic conditions, clinician, patient, research priorities

Background

In the UK, aortic aneurysm affects approximately 4% or 80,000 men between the ages of 65 and 74 years.[1] With a broad spectrum of rapidly evolving treatment options, advancing methods of management and investigation, many aspects of best clinical practice for aortic diseases are unknown.[2] Aortic diseases are exemplified by aortic aneurysm, the most common aortopathy.[3] Aortic disease research is integral to understanding the disease and guiding optimal management. In addition, it is imperative to consider the research goals and initiatives of all those involved in this vascular condition.[4] To ensure treatment is aligned with the best interests of all involved, robust methodologies used to identify research priorities must be conducted. Disparities between what is traditionally deemed important by the clinicians and that which is perceived to be important by the patients, carers and families is a potential area of mismatch that can distort the areas of investigation. Another important consideration is that continued optimisation of patient care must occur within the constraints of research funding opportunities with finite resources and competitive processes. In combination, these factors demonstrate the need to have well thought out and important discussion involving all relevant individuals.

Optimal aortic disease management is multidisciplinary.[2] Direct treatment of the aneurysm includes surgical and radiological intervention; however, pathways of care extend to a wider network including disease surveillance, rehabilitation and personal and professional support groups. To establish and develop key research priorities for aortic disease, the Vascular Society of Great Britain and Ireland (VSGBI) partnered with the James Lind Alliance (JLA) to conduct a validated research priority setting exercise reflective of both clinician and public interest.[5] The aim was to generate a ranked list of aortic specific research priorities to appropriately direct future research and help set the agenda for impactful studies.

Methods

To identify public research priorities for vascular diseases the VSGBI in association with the JLA undertook a research priority setting exercise. Due to the large scale of this exercise, nine discrete working groups were formed, each focusing on a particular vascular or clinical area and each conducting a separate research priority setting exercise focusing on their particular area. This paper reports the outcomes from the aortic disease research priority setting exercise.

An initial Delphi survey was conducted to obtain clinician priorities, and this was followed by a JLA survey to gather the opinions of vascular patients and carers about their research priorities. The results of the clinician and patient surveys were amalgamated and final workshops held for each Special Interest Group (SIG), where patients and clinicians worked together to agree on a final list of joint research priorities.[6–8]

Scope of the aortic SIG

The remit of the aortic SIG is to support research into the care of patients living with or affected by aortic disease including preoperative, perioperative and postoperative care, and to develop the top 10 aortic research priorities. The top 10 priorities were established through a five-stage process (Figure 1).

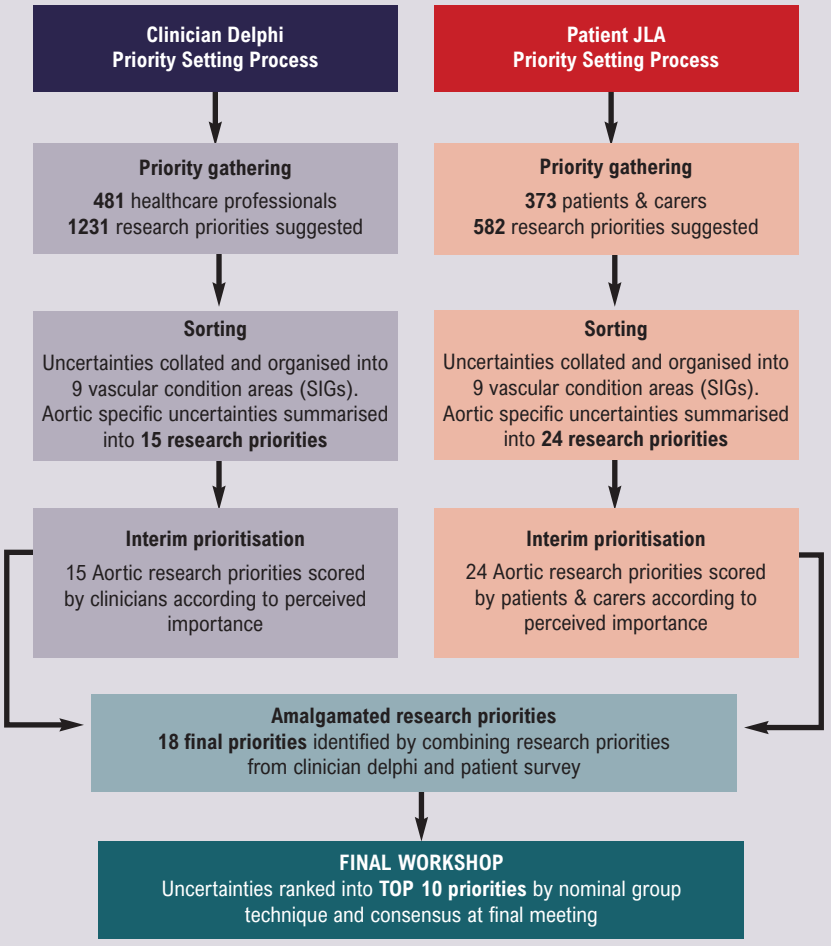
Clinician-led Priority Setting Process

A clinician-led Priority Setting Process (PSP) was completed in 2018, which identified nine key vascular condition areas. These areas were obtained from 45 potential topics using a modified Delphi approach. The topics were collected through two rounds of online surveys involving the membership of the VSGBI, Society of Vascular Nurses (SVN), Society for Vascular Technology (SVT) and the Rouleaux Club (vascular surgical trainees). The first round invited any suggestions for research priorities in the broad scope of 'vascular surgery', which were then collated and categorised into pathological topics and research categories by a steering group. Priorities relating to the same fundamental issue were amalgamated. Summarised priorities were then recirculated in the second round for scoring according to importance. These results have been published,[7] and the findings related to aortic disease are presented here.

Patient/carer-led research priority identification process

Patient and carer suggestions for research priorities were collected via an open-ended survey (27 August 2019 to 17 March 2020) which invited participants to submit their own opinions about vascular research priorities that they thought were important. The

Figure 1 Five-stage process identifying top 10 priorities for aortic disease.



survey was available online and in paper format (with freepost return), and copies made available in outpatient clinics. SIGs took a lead in helping to distribute the surveys, with the aim to ensure a representative number of responses gathered for their specialty area. Charities and patient groups were contacted and asked to distribute the survey in newsletters and via websites.

Submitted priorities were assigned to a SIG category for further review. SIGs were tasked with sorting the responses; those considered out of scope (eg, too broad, too specific or answered by existing evidence) were excluded and duplicates were combined and summarised into an overarching priority. A refined list was agreed for the next round of the survey (conducted between November 2020 and February 2021), which invited participants to select their vascular area(s) of interest and to score the priorities within this area using a Likert scale (ranging from 'Extremely Important' to 'Not at all Important' or 'Don't know'). All participants were invited to prioritise the Services Organisation priorities as these contained cross-cutting priorities that would apply to all vascular patients, regardless of their vascular condition.

Combining surveys process: sorting, interim prioritisation and amalgamation

The clinician-led and patient and carer-led processes presented 39 aortic research priorities: 15 clinician-derived and 24 patient-derived. The aortic SIG reviewed for duplication or redundancy when amalgamating clinician and patient priorities. Clinician priorities were reviewed with patient input to reword any technical language to ensure patient participants at workshops would understand. To ensure meaningful discussion in the focus group meetings, a final revision process was conducted by the SIG to refine the list of priorities that would be taken forward to the final workshop. This research priority refinement was conducted in alignment with JLA methodology. The JLA advises a maximum of 18 priorities for discussion at a final workshop to promote manageable and invested discussion. Further reduction was therefore performed by categorisation. Categorisation included judging the importance of each of the priorities according to ranking using survey scores. Consideration of bias and inequality assessment (eg, women may have been underrepresented in the Delphi survey as aneurysm disease is 10 times less common in women, so questions regarding sex-specific treatments were considered) was then conducted to take into account the potential influence of participants' demographics and influence on priority selection detailed in Table 1.

Final priority setting workshop

The aim of the workshop was to establish research priorities for aortic disease through facilitated, balanced and open conversation between patients, carers and healthcare workers. Participation of patients and carers in the final workshop was welcomed throughout the priority setting stages to ensure multiple opportunities for individuals to demonstrate interest and to share their views. Interested participants who have lived experience of aortic disease were then invited to attend the workshop to determine the top 10 research priorities. In addition, invitation through direct contact was made with patients/carers who are established members of patient representative bodies. Healthcare participants were contacted through direct communication with various national bodies, as well as through direct contacts of the SIG members.

The workshop was held virtually to accommodate COVID-19 restrictions. To address potential accessibility and technical considerations as well as possible, induction sessions were carried out with participants as appropriate. Although presenting some

Table 1 Selection criteria for priorities

	Description of criteria
1	Any research priority that achieved a rank 1–10 described method (Category I)
2	Any research priority that may have not been ranked 1–10 due to the potential lack of diversity or sexual representation in the respondents (Category II)
3	Unranked research priorities deemed important by the members of the panel (Category III)
4	Research priorities deemed to be the same/similar to already prioritised questions or were not specific to aortic disease/the focus of other research priority setting exercises were removed (Category IV)

limitations with the online virtual format potentially being a deterrent for participation, hosting a virtual workshop did enable the opportunity for some stakeholders to attend who ordinarily would not have been able to travel due to needs, caring or employment commitments. The experienced JLA facilitator opened the workshop and introduced the goals for the session. Participants were split into small breakout groups of approximately six, with a balanced representation of patients, carers and healthcare workers. Each small group was facilitated by a JLA representative, and members of the aortic SIG observed. All participants were informed of support services available to them during and after the workshop.

Participants were reminded that the focus of the workshop was to help shape the research agenda with priorities that mattered to people with lived experience and the healthcare professionals who work with them. Participants were asked to consider the priorities on their own merit and not to be concerned about the feasibility of research. Participants had been sent the 18 priorities in advance of the workshop and asked to rank these for themselves before the event. The workshop approach was based on a 'nominal group technique' which allows participants to share their own initial thoughts and priorities. Through a structured and facilitated set of steps of clarification and consolidation, the group comes to a consensus ranking.

Overview of small group discussions

First round of discussion: Each participant was asked, in turn, to share their top three and lowest three priorities with the others in the group. The group was then facilitated to have an open discussion about the differences and similarities of their choices and to discuss any priorities previously not mentioned.

Second round of discussion: The same groups then entered a second round of discussion. Participants were provided with a shared screen showing an approximate positioning of the priorities on a pre-prepared ranking template, which had been prepared by the facilitator during the break. Participants were then given the opportunity to reconsider their initial set of priorities through discussion. The facilitator moved the priorities on the screen to reflect the agreed order from the group ranked 1–18.

Third round of discussion: The ranked priorities of the three separate small groups were combined by the lead facilitator using a geometric mean of the respective ranked positions. Taking into consideration the potential for anomalous positioning if groups have large discrepancies between ranking of a particular priority, a further round of discussion was held. New small groups were established, again with a balanced representation of patients, carers and healthcare workers, with at least one representative in each group from the initial group. This approach promoted diversity of participants, whilst permitting discussion as represented by previous considerations. Members of the second groups were then asked to review this combined ranking and to clarify their views and the views of others, with the focus on which priorities they wanted to see in the top 10.

Fourth round of discussion: All participants came together as one group to discuss the combined results of the rankings of the three groups.

Table 2 Clinician Delphi results

Summary priorities	Mean scores
What is the best treatment option for 'complex' AAA (eg, short necks, juxta renal, iliac pathologies)?	7.64
What is the optimal management of patients with aortic aneurysm disease using individualised risk:benefit ratios?	7.56
How do we improve long-term outcomes following EVAR?	7.50
What is the optimal post-EVAR surveillance strategy following endovascular AA repair?	7.47
What is the optimum medical therapy for patients with AAA to minimise expansion/rupture?	7.43
What is the best management strategy for type B aortic dissection?	7.29
What is the optimal management of aortic graft infection?	7.27
How can we improve our understanding of AAA biology in relation to promotion and growth?	6.98
What are the most appropriate outcome measures in patients with AAA?	6.86
How do we prevent spinal cord ischaemia during aortic aneurysm repair?	6.77
What is the optimal pathway for patients undergoing AAA repair?	6.76
What is the optimum AAA screening strategy?	6.56
Should EVAR 2 be repeated in the modern era?	6.56
What is the optimal surveillance strategy for 'sub-threshold' aortas?	6.44
Should EVAR 1 be repeated in the modern era?	6.09

AAA, abdominal aortic aneurysm; EVAR, endovascular aneurysm repair.

Results

Clinician research priority identification and prioritisation

A total of 481 clinicians submitted 1,231 research priorities relating to vascular surgery in general. 162 aortic-related research priorities were submitted, 16 of which were excluded outright as they were too specific to single patient experience. The remaining 146 priorities were combined and summarised into 15 clinician priorities for scoring, the results of which are shown in Table 2.

Patient/carer research priority identification and prioritisation

A total of 373 patients/carers suggested 582 research priorities related to vascular surgery in general, of which 140 were specific to aortic disease. After data cleaning (eg, removing nonsensical suggestions) and combining overlapping priorities, 24 research priorities were redistributed for scoring. Forty-eight patients or carers with experience of aortic disease participated in the scoring exercise and the results are shown in Table 3.

Prior to the workshop, the SIG team pooled clinician and patient/carer research priorities, resulting in a list of 18 for discussion (Table 4). In order to reduce risk of bias, these priorities were randomly ordered and each assigned a letter (rather than a number).

Table 3 Patient/carer James Lind Alliance (JLA) results

Summary priorities	Mean scores
What methods, including digital technology, can be used to ensure that people with acute aortic conditions such as aneurysm rupture or dissection are diagnosed quickly and treated without delay?	4.67
When should people with aneurysms be offered an operation to repair their aneurysm and how quickly should this be done if this is required?	4.54
How do surgeons decide which treatment is best for aneurysms and are these decisions based on the latest evidence available?	4.53
How do we make aneurysm surgery safer and reduce the risk of complications?	4.42
What is the best way to monitor people after treatments to repair aneurysms to make sure they don't develop problems with their repair?	4.36
What causes aortic dissection, and can the risk be picked up and/or prevented before it happens?	4.36
What causes an aneurysm or is associated with aneurysm formation and how can we prevent one developing?	4.36
What causes aneurysms to grow and/or rupture?	4.36
How common are complications after aneurysm repair and how can the chances of developing such complications be minimised?	4.34
How can the risk of another aneurysm or other long-term aortic complications after aneurysm repair be minimised?	4.34
Can we develop a test that could diagnose patients at risk of aortic aneurysm/dissection?	4.31
Does having an aneurysm affect life expectancy, how can any effect of having an aneurysm be minimised and how can the patient and doctor achieve this?	4.25
What is the rate of aneurysm growth or aortic growth after dissection?	4.19
Can keyhole techniques and robotics make operations to repair aneurysms safer?	4.18
Can small aneurysms that are not at risk of causing harm to be prevented from growing into larger high-risk aneurysms?	4.16
How do we effectively diagnose and treat those with a genetic cause to their aortic aneurysm?	4.14
How can we encourage more men to attend screening?	4.04
How do we reduce the time it takes to recover from aortic operations?	4.00
Should women be screened for AAA?	3.97
Aneurysms behave differently in women compared to men but both men and women are treated the same way. Should we develop sex-specific pathways to care for people with aneurysms?	3.94
How often are other problems detected when performing scans for an AAA and is there any benefit in doing anything about these findings?	3.90
Should siblings be screened for AAA when there is a family history of aneurysm?	3.86
Should genetic testing be carried out on everyone with an aortic condition?	3.85
What is the optimal age to screen for aneurysms?	3.83

AAA, abdominal aortic aneurysm; EVAR, endovascular aneurysm repair.

Final prioritisation workshop

The final prioritisation process was conducted via a virtual online meeting on 13 April 2021. It was attended by four patients and carers and eight healthcare professionals, with an additional five observers. The final prioritisation resulted in a final 'top 10' research priority list (Table 5). The priorities are ordered according to importance as determined by the workshop. There was general consensus that the list correctly represented the discussions and viewpoints which occurred in the breakout groups.

Discussion

Summary

Ranked research priorities in aortic disease have been clearly highlighted in a way that combines the opinions of all those involved. This robust method is designed to ensure alignment of priorities between clinicians and patients, mitigating disparity between what is deemed important by different perceptions.

Strengths and limitations

The JLA process is acknowledged to be a snapshot in time, and a different group of participants may have determined an alternative collection of priorities. To mitigate the impact of this, it is important that not all aortic research is limited to addressing the top 10 priorities. Additionally, in order to add new voices and thoughts, it is essential to include patients and representatives at all stages of research planning and delivery. The use of virtual platforms for the prioritisation workshops had potentially both positive and negative

Table 4 Pooled clinician and patient/carer research priorities: assigned letter rather than numbers regarding randomised order

ID	Research priority
A	How can the risk of another aneurysm or other long-term aortic complications after aneurysm repair be minimised?
B	How do we make aneurysm surgery safer and reduce the risk of complications?
C	When should people with aneurysms be offered an operation to repair their aneurysm and how quickly should this be done if this is required?
D	What is the optimum medical therapy for patients with AAA to minimise expansion/rupture?
E	What methods can be used to ensure that people with acute aortic conditions such as aneurysm rupture or dissection are diagnosed quickly and treated without delay?
F	How do we reduce the time it takes to recover from aortic operations?
G	How do surgeons decide which treatment is best for aneurysms and are these decisions based on the latest evidence available?
H	What is the optimal management of patients with aortic aneurysm disease using individualised risk:benefit ratios?
I	Aneurysms behave differently in women compared to men but both men and women are treated the same way. Should we develop sex-specific pathways for aneurysms?
J	What causes an aneurysm or is associated with aneurysm formation and how can we prevent one developing?
K	What is the best way to monitor people after treatments to repair aneurysms to make sure they don't develop problems with their repair?
L	Does having an aneurysm affect life expectancy, how can any effect of having an aneurysm be minimised and how can the patient and doctor achieve this?
M	Should siblings be screened for AAA when there is a family history of aneurysm?
N	What causes aneurysms to grow and/or rupture?
O	Can keyhole techniques and robotics make operations to repair aneurysms safer?
P	What is the best treatment option for 'complex' AAA (eg, not suitable for standard stent grafts) or low-risk standard operations (eg, short neck, iliac pathologies, juxtarenal)?
Q	Can we develop a test that could diagnose patients at risk of aortic aneurysm/dissection?
R	What is the rate of aneurysm growth or aortic growth after dissection?

AAA, abdominal aortic aneurysm

Table 5 Final ordered list of top 10 research priorities in aortic disease

Rank	ID	Research priority
1	H	What is the optimal management of patients with aortic aneurysm disease using individualised risk:benefit ratios?
2	N	What causes aneurysms to grow and/or rupture?
3	Q	Can we develop a test that could diagnose patients at risk of aortic aneurysm/dissection?
4	G	How do surgeons decide which treatment is best for aneurysms and are these decisions based on the latest evidence available?
5	D	What is the optimum medical therapy for patients with AAA to minimise expansion/rupture?
6	J	What causes an aneurysm or is associated with aneurysm formation and how can we prevent one developing?
7	K	What is the best way to monitor people after treatments to repair aneurysms to make sure they don't develop problems with their repair?
8	B	How do we make aneurysm surgery safer and reduce the risk of complications?
9	F	How do we reduce the time it takes to recover from aortic operations?
10	M	Should siblings be screened for AAA when there is a family history of aneurysm?

AAA, abdominal aortic aneurysm
This table demonstrates the final rank of the research priorities. Ranking was established through consideration of both the arithmetic and geometric scoring methods. For priorities K and B the geometric method resolved the tie between 7 and 8.

impacting factors by both facilitating and hindering participation. Travel challenges (eg, frail patients, large geographical distances) were essentially negated by this process. Technical literacy requirements and access may have limited certain participation. Workshop feedback gathered from a follow-up survey was positive overall. Most participants expressed that they enjoyed the process and found it provided an opportunity to learn from others. Some participants highlighted their personal preference for priorities that were excluded from the final top 10 or a preference for a different order; however, this is not uncommon for PSPs that use a consensus approach. There were comments regarding requests to further edit and merge some of the priorities due to perceived overlap. This was addressed directly during the workshops where emphasis was placed on respecting the methodology that had gone before in summarising priorities for the workshop. Most participants found the online format and length of the workshop acceptable, but it was suggested that the final session could have been longer to allow the new groups to fully discuss the rearranged priorities.

Implications for future research

Each of the top 10 priorities identified through this extensive process must now be scrutinised to determine the appropriate related research priorities, how these relate to existing evidence and current research, and what research design best addresses these priorities. Finally, it is hoped that funding bodies and decision makers will direct funding towards these priorities and increase investment in the delivery of new studies in these areas of greatest need and highest impact.

KEY MESSAGES

- Establishing relevant patient priorities through collaborative decision making.
- Top 10 priorities addressing a need for improved post-operative care, better understanding of the natural history of aortic disease and personalised intervention strategies.

Table 6 Patient perspective

What is the optimal management of patients with aortic aneurysm disease using individualised risk:benefit ratios?
The main blood vessel in the body (the aorta) may become dilated (an aortic aneurysm). As this dilation gets larger the risk of it rupturing increases. Rupture is usually associated with fatal bleeding. Aortic aneurysm surgery aims to prevent an aortic rupture. The risks of aortic surgery are not insignificant and vary from patient to patient, therefore not every patient with an aortic aneurysm benefits from surgery. However, those patients who would have gone on to rupture their aneurysm will. Some people with aneurysms don't ever come to harm from it and, in these people, surgery puts them at risk without being of benefit. Currently, the surgeon will consider a patient for surgery when the aneurysm has reached a certain size. However, some people who might benefit from surgery don't get offered surgery because they are considered too unfit to survive the operation. We need more research to assess in depth the implications, risks and benefits of surgery and no surgery for individual patients with aortic aneurysms.

What causes aneurysms to grow and/or rupture?
Aortic aneurysms form very slowly over time. When an aneurysm is small, they don't cause a problem. As they get bigger they can rupture, which is often fatal. People found to have small aneurysms are therefore usually monitored to check their aneurysm hasn't grown to a dangerous size. This period of monitoring is an opportunity to offer treatment to prevent aneurysms growing, and prevent rupture and the need for surgery. Currently, there is no proven treatment to slow aneurysm growth. The only things we do know about aneurysm growth is that aneurysms in smokers grow faster and those in people with diabetes grow slower. Research is required to determine what factors cause aneurysms to grow or rupture. This may then allow us to identify treatments to prevent aneurysm growth and rupture.

Can we develop a test that could diagnose patients at risk of aortic aneurysm/dissection?
The only way to find out if someone has an aneurysm or not is to scan them using ultrasound, CT or MRI scans. This can pick up aneurysms and abnormalities of the aorta. In some people the aorta can appear normal before they suffer from an aortic tear (dissection). For this reason, a scan cannot always predict aortic problems. A test such as a blood test to identify people at risk of aneurysm or dissection would reduce the amount of imaging scans that need to be done. For people at risk of dissection without any previous signs of aortic dilation, a blood test may be the only way to identify this risk.

How do surgeons decide which treatment is best for aneurysms and are these decisions based on the latest evidence available?
When treating people with aneurysms, medical and surgical teams rely on information obtained from clinical experiments where new methods and treatments have been tested. Clinical experiments are those tests and research priorities that are answered by looking at the outcome of practices within the care of patients. Deciding which treatment is best relies on individual teams having the latest information available to them and on these teams interpreting this information properly. We don't know if this happens or if it has any effect on the treatment patients receive. Research to investigate this is important as it will ensure that all patients receive the latest and best treatment for their aneurysm.

What is the optimum medical therapy for patients with abdominal aortic aneurysm (AAA) to minimise expansion/rupture?
The only treatment available to prevent aortic aneurysm rupture is surgery. There are significant risks of harm with this surgery. Therefore treatments that prevent a small aneurysm from increasing to the point where surgery is required would prevent patients being exposed to these risks. Research is required to investigate which medical therapies slow down or stop progressive aneurysm dilation and its associated complications.

What causes an aneurysm or is associated with aneurysm formation and how can we prevent one developing?
Most aneurysms are detected once they have already formed. What causes an aneurysm to start and when this happens in life is unknown. If this could be identified, then treatment could be started early in those people at risk to prevent them ever forming an aneurysm. Research is needed to understand the process of an aneurysm forming and to investigate drugs to stop the process from happening.

What is the best way to monitor people after treatments to repair aneurysms, to make sure they don't develop problems with their repair?
The aim of surgery to repair an aneurysm is to prevent the rupture of the aneurysm. Surgery can either be open surgery (with a cut) or minimally invasive 'keyhole' surgery where the aneurysm is lined with a stent. Following surgery, a small number of patients develop complications (more commonly after stenting) and therefore it is important to monitor patients after surgery usually with follow-up scans. We need more research to determine the optimum follow-up scan regime in terms of safety, effectiveness and value for money.

How do we make aneurysm surgery safer and reduce the risk of complications?
Aneurysm repair is a relatively high-risk operation. This is particularly the case where the repair is done for an aneurysm that has burst (ruptured). For planned surgery the risk of major complications is about 10% and the risk of dying is about 2–3%. For emergency surgery these risks are much higher; about one in three people don't survive. Research is required to assess what can be done before, during and after surgery to improve these outcomes.

How do we reduce the time it takes to recover from aortic operations?
Recovery from aortic surgery, especially open surgery, can be prolonged. Research is required to investigate ways to reduce this recovery time.

Should siblings be screened for AAA when there is a family history of aneurysm?
AAA can run in families, and it is known that people's genetics can increase the risk of developing an aneurysm. If someone has a first-degree relative with an AAA, their risk of developing an AAA is about 5–10 times greater than usual. Screening for AAA involves an ultrasound scan to look for an AAA in individuals at risk but who have not specifically requested the scan. Research is required to assess whether screening for AAA in brothers and sisters of patients with AAA is acceptable, safe, effective and value for money.

Conclusion

This collaborative effort between healthcare professionals and patients has identified the top 10 research priority areas focused on aortic disease which will guide researchers, clinicians and funders for the foreseeable future.

The patient perspective

In Table 6 each priority has been presented using terminology to improve clarity and understanding.

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ORIGINAL RESEARCH

Short-term effects of the COVID-19 pandemic on vascular surgical training in Scotland: a trainee's perspective

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Plain English Summary

Why we undertook the work: The COVID-19 pandemic has affected surgery in many ways. Firstly, the NHS had to stop all routine non-urgent operations for patient safety, to maximise space for hospitalised COVID-19 patients and to minimise transmission of the virus. This has meant that surgeons in training have had less exposure to surgical procedures and this could cause potential problems in providing enough surgeons in the future.

What we did: We sent a survey to all training surgeons in vascular surgery in Scotland to compare their experiences in operating between two different time periods, before and during COVID-19. We examined the data and looked for significant changes in operating for the trainees for different key vascular operations. We also looked to see if other parts of the job were affected, such as examinations and courses.

What we found: We found that there was no significant change in the type and number of operations in which trainees were involved. They were affected by redeployment, rota changes, cancellation of examinations and courses..

What this means: Vascular surgical trainees have not had a significant change to their work, especially compared with other surgical trainees. All trainees have been able to progress through their year and reach their targets and requirements. This is promising for the future to provide enough consultant surgeons.

Abstract

Background: The COVID-19 pandemic has caused significant disruption to surgical training worldwide due to several factors, including the postponement of elective operating. This study aimed to evaluate the impact of the COVID-19 pandemic on vascular surgery trainees in Scotland.

Methods: A voluntary questionnaire was offered to all specialty trainees in vascular surgery in Scotland, comparing two one-year periods before (period A, 1 March 2012 to 28 February 2020) and during (period B, 1 March 2020 to 28 February 2021) the COVID-19 pandemic. The questionnaire assessed multiple areas including demographics, annual review of competence and progression (ARCP) outcome, logbook completion and supervision level of eight index procedures.

Results: All of the 11 eligible trainees completed the survey (100% response rate). No trainee had their ARCP outcome affected by the pandemic. Six (54.5%) had courses affected and seven (63.6%) were subject to rota changes. Of the eight index procedures, five procedures (62.5%) trended towards fewer procedures performed in period B (emergency open aneurysm repair (OAR), emergency endovascular aneurysm repair (EVAR), carotid endarterectomy (CEA), vascular access, percutaneous transluminal angioplasty (PTA)) and three (37.5%) trended towards more procedures performed in period B (elective OAR, elective EVAR, lower limb bypass), though these trends did not reach statistical significance. Four (50%) of the index procedures were performed more frequently as primary operator.

Conclusions: The pandemic has forced changes in surgical training but vascular trainees in Scotland have had minimal negative impact. This needs to be maintained for the trainees to progress in their surgical training, achieve required experience and competencies, in turn providing optimal patient care.

Key words: COVID-19, vascular surgery, training, medical education

Introduction

The COVID-19 pandemic has caused major disruption to clinical practice across the entire health service. Major changes to service delivery occurred across all specialties with the introduction of the national lockdown in the UK in March 2020. At the peak of the pandemic, overwhelming pressure caused staff shortages in all areas, reduced intensive care capacity and depleted theatre resources, leading to a government-mandated suspension of all non-urgent elective surgery for a minimum of three months.[1] Doctors of all grades and specialties were redeployed to critical areas, whilst outpatient clinics and multidisciplinary meetings (MDM) were significantly reduced and delivered virtually where possible.[2] Many courses and conferences were cancelled, and professional examinations postponed or restructured.[2] Some of these developments may show long-term benefit to service delivery – for example, the use of telemedicine and virtual clinics. However, these organisational changes have been anecdotally reported as causing detrimental effects on surgical training and trainee progression across all specialties, with 66% fewer training opportunities for surgical trainees.[3] This effect of the COVID-19 pandemic is significant as it may affect future recruitment and retention of surgical trainees and have a negative impact on those currently in training, hampering progression towards completion of training and certification.[2,4]

Vascular surgery has a large volume of cases categorised as urgent or emergency.[5] Like all other surgical specialties, elective operating in vascular surgery was also restricted based on local resources and guidance from the Vascular Society of Great Britain and Ireland (VSGBI), which is the basis of many training opportunities for trainees.[5,6] For vascular trainees in the UK, the total number of elective procedures fell significantly from an average of 3000 to an average 1000 cases between March and June 2020 on the online surgical logbook used in the UK, *elogbook*.[7]

The aim of this study was to assess if and how the training opportunities for current vascular trainees in Scotland have been affected by the COVID-19 pandemic.

Methods

A survey of all specialty surgical trainees with a national training number (NTN) in vascular surgery in Scotland was carried out with a voluntary questionnaire using Microsoft Word (Appendix 1 online at www.jvsgbi.com). The trainees were at least three years into their surgical training in the UK (ST3+). The survey assessed training over two time periods: before COVID (period A, 1 March 2019 to 28 February 2020) and during the COVID pandemic (period B, 1 March 2020 to 28 February 2021). A total of 14 trainees were invited to complete the survey. The survey was sent to trainees via email and subsequently returned directly and analysed by one of the authors (AW). The questionnaire consisted of drop-down options and trainees clarified further information where required in email responses. The survey was voluntary but, in order to maximise the response rate, up to five reminders were sent to individual trainees who had not responded between 18 February and 18 April 2021.

The questionnaire assessed multiple areas including demographics; logbook entries and operative supervision levels; redeployment; rota changes; access to outpatient clinics; access to MDM; impact on Intercollegiate professional examinations (Fellowship of the Royal College of Surgeons, FRCS), annual review of competence and progression (ARCP) outcomes, out of programme plans and consultant appointment. Logbook completion was specifically assessed in relation to case numbers at each supervision level for eight index procedures: elective open aneurysm repair (OAR), emergency OAR, elective endovascular aneurysm repair (EVAR), emergency EVAR, lower limb bypass, carotid endarterectomy (CEA), vascular access and lower limb percutaneous transluminal angioplasty (PTA). Initially, the questionnaire grouped the number of operations into five separate groups; however, we proceeded to update our methodology in order to collect raw numbers. These were collected by the Scottish Training Programme Director (TPD) via the e-logbook and were anonymised. This allowed more accurate analysis as some procedures were performed in small numbers. Trainees were subgrouped by seniority into 'Senior' (at 7th year of specialty training (ST7) or above during any part of the study period) and 'Junior' (below ST7 level for the entire study period) for analysis. These subgroups were decided due to the split in the new intercollegiate surgical curriculum programme (ISCP) which determines competency in early and late stages of training, respectively. Supervision levels were subgrouped into 'Operator' (performed, supervised-trainer unscrubbed, supervised-trainer scrubbed) and 'Assistant' (assisted) for analysis.

Paired t-tests were used to assess the difference between trainees' operative exposure in the two study periods and a χ^2 test was used to assess the difference between the supervision level of the procedures during the two study periods. Statistical significance was defined as $p \leq 0.05$. Statistical analyses were carried out using SPSS Statistics v27.0 (IBM, New York, USA).

Results

Of the 14 trainees invited to complete the survey, 11 were eligible and the remaining three were ineligible as they did not rotate through vascular surgery during the study period. Survey completion rate was 100%. There were four senior trainees and seven junior trainees. In total, the trainees reported their experience from five different vascular units across Scotland: three units in East Scotland and two units in West Scotland. No trainee had their ARCP outcome affected by the COVID-19 pandemic. One trainee (9.1%) had to alter plans for a fellowship prior to certificate of completion of training (CCT) (cancelled plans but successful at substantive consultant level appointment) and in one case (9.1%) the plans to sit the FRCS examinations were disrupted due to postponement of Part B of the examination. Six trainees (54.5%)

Table 1 Mean number of procedures performed per trainee in the study period for all trainees (n=11).

Procedure	Period	Mean (range) number performed	Difference	P value
Elective OAR	A	3.7 (0–11)	+0.2	0.914
	B	3.9 (0–13)		
Emergency OAR	A	2.6 (0–9)	−0.9	0.440
	B	1.7 (0–6)		
Elective EVAR	A	3.5 (0–12)	+0.1	0.893
	B	3.6 (0–14)		
Emergency EVAR	A	1.3 (0–5)	−0.9	0.138
	B	0.4 (0–1)		
Lower limb bypass	A	12.4 (0–33)	+2.2	0.646
	B	14.6 (0–32)		
CEA	A	12.9 (0–25)	−5.8	0.064
	B	7.1 (2–15)		
Vascular access	A	7.6 (0–32)	−1.8	0.599
	B	5.8 (1–15)		
PTA	A	13.9 (0–59)	−3.1	0.597
	B	10.8 (0–26)		

CEA, carotid endarterectomy; EVAR, emergency endovascular aneurysm repair; OAR, open aneurysm repair; PTA, percutaneous transluminal angioplasty.

Table 2 Mean number of procedures performed per trainee in the study period: senior trainees (n=4).

Procedure	Period	Mean (range) number performed	Difference	P value
Elective OAR	A	7.5 (4–11)	−2.2	0.58
	B	5.3 (1–13)		
Emergency OAR	A	3.3 (1–9)	0.0	1.00
	B	3.3 (1–6)		
Elective EVAR	A	6.8 (1–12)	−2.3	0.43
	B	4.5 (0–14)		
Emergency EVAR	A	2.8 (0–5)	−2.3	0.17
	B	0.5 (0–1)		
Lower limb bypass	A	17.8 (5–33)	−2.5	0.82
	B	15.3 (0–32)		
CEA	A	18.3 (10–25)	−10.5	0.10
	B	7.8 (6–12)		
Vascular access	A	5.0 (0–10)	−0.7	0.798
	B	4.3 (1–8)		
PTA	A	19.0 (4–33)	−10.2	0.18
	B	8.8 (0–19)		

CEA, carotid endarterectomy; EVAR, emergency endovascular aneurysm repair; OAR, open aneurysm repair; PTA, percutaneous transluminal angioplasty.

had plans for courses disrupted, one (9.1%) was redeployed to intensive care for three weeks to provide cover for COVID-19 specific services and seven trainees (63.6%) experienced changes to their working pattern in the form of a new rota without redeployment to providing non-vascular cover. Two (18.2%) trainees found this rota change worse than their original, one (9.1%) found it was improved and four (36.4%) did not feel it made a significant difference to their working pattern. Outpatient clinic activity appeared to be minimally affected, and all trainees attended at least one face-to-face clinic during both time periods with no significant difference between the two periods (period A 14 vs period B 15, p=0.91). There was no significant difference in MDM attended between periods A and B (11 vs 11, p=0.05), but seven (63.6%) trainees reported a shift from in-person to virtual meetings.

Table 1 shows the mean number of cases performed per trainee in periods A and B across the entire trainee cohort. There was a trend towards fewer CEA procedures being performed in period B (12.9 vs. 7.1, p=0.064), although this did not reach statistical significance. Of the eight index procedures, there was a trend towards fewer procedures being performed in five of the index procedures (62.5%) in period B (emergency OAR, emergency EVAR, CEA, vascular access, PTA) and three (37.5%) showed a trend towards more procedures being performed in period B (elective OAR, elective EVAR, lower limb bypass), although these trends did not reach statistical significance.

Tables 2 and 3 show the mean number of cases performed per trainee in periods A and B across the senior (n=4) and junior (n=7) trainee subgroups. In the senior trainee subgroup, seven (87.5%) of the index procedures trended towards fewer procedures performed in period B (elective OAR, elective EVAR, emergency EVAR, lower limb bypass, CEA, vascular access, PTA) and one (12.5%) was unchanged (emergency OAR). In the junior trainee subgroup, four (50.0%) of the index procedures trended towards fewer procedures performed in period B (emergency OAR, emergency EVAR, CEA, vascular access) and four (50.0%) trended towards more procedures performed in period B (elective OAR, elective EVAR, lower limb bypass, PTA). These subgroup trends did not reach statistical significance.

In order to adjust the analysis to account for the effect of trainees being out of programme during part of the study, the number of months each trainee spent in training during periods A and B was recorded. The number of procedures per month of training was calculated and results compared between periods A and B, as shown in Table 4. The results were largely similar to the unadjusted analysis, with the same five index procedures showing a decrease in numbers performed. Two procedures (elective OAR and lower limb bypass) increased in frequency in the unadjusted analysis and one (elective EVAR) decreased slightly in frequency compared with an increase in the unadjusted analysis. Despite these trends being observed, none of the comparisons reached statistical significance (p>0.05 for all comparisons).

Table 5 shows the number of procedures performed in the two study periods and the supervision level at which they were performed. Significantly fewer PTA procedures were performed as

Table 3 Mean number of procedures performed per trainee in the study period: junior trainees (n=7).

Procedure	Period	Mean (range) number performed	Difference	P value
Elective OAR	A	1.6 (0–4)	+1.5	0.34
	B	3.1 (0–8)		
Emergency OAR	A	2.1 (0–5)	−1.3	0.25
	B	0.9 (0–3)		
Elective EVAR	A	1.6 (0–8)	+1.5	0.29
	B	3.1 (0–8)		
Emergency EVAR	A	0.4 (0–2)	−0.1	0.69
	B	0.3 (0–1)		
Lower limb bypass	A	9.3 (0–30)	+4.8	0.34
	B	14.1 (4–30)		
CEA	A	9.9 (0–22)	−2.2	0.39
	B	6.7 (2–15)		
Vascular access	A	9.0 (0–32)	−2.3	0.66
	B	6.7 (1–15)		
PTA	A	11.0 (0–59)	+1.0	0.91
	B	12.0 (2 – 26)		

CEA, carotid endarterectomy; EVAR, emergency endovascular aneurysm repair; OAR, open aneurysm repair; PTA, percutaneous transluminal angioplasty.

Table 4 Mean number of procedures performed per trainee in the study period, adjusted for months spent in vascular surgery.

Procedure	Period	Mean (range) number performed	Difference	P value
Elective OAR	A	0.39 (0.00-0.83)	+0.07	0.77
	B	0.46 (0.00-1.86)		
Emergency OAR	A	0.37 (0.00–1.13)	−0.18	0.27
	B	0.19 (0.00–0.86)		
Elective EVAR	A	0.39 (0.00–1.00)	−0.03	0.89
	B	0.36 (0.00–1.17)		
Emergency EVAR	A	0.18 (0.00–0.63)	−0.15	0.06
	B	0.03 (0.00–0.14)		
Lower limb bypass	A	1.45 (0.00–2.75)	+0.10	0.85
	B	1.55 (0.00–3.00)		
CEA	A	1.44 (0.00–2.71)	−0.69	0.07
	B	0.75 (0.17–1.71)		
Vascular access	A	1.13 (0.00–4.57)	−0.50	0.36
	B	0.63 (0.08–1.25)		
PTA	A	1.76 (0.00–4.92)	−0.58	0.33
	B	0.63 (0.08–1.25)		

CEA, carotid endarterectomy; EVAR, emergency endovascular aneurysm repair; OAR, open aneurysm repair; PTA, percutaneous transluminal angioplasty.

Table 5 Total procedures performed and supervision level in the two study periods: all trainees.

	Elective OAR		Emergency OAR		Elective EVAR		Emergency EVAR	
	A	B	A	B	A	B	A	B
Operator	30 (73.2%)	23 (54.8%)	15 (53.6%)	12 (63.2%)	19 (50.0%)	27 (67.5%)	9 (64.3%)	1 (25.0%)
Assistant	11 (26.8%)	19 (45.2%)	13 (46.4%)	7 (36.8%)	19 (50.0%)	13 (32.5%)	5 (35.7%)	3 (75.0%)
Total	41	42	28	19	38	40	14	4
P value	0.110		0.561		0.167		0.274	

	Lower limb bypass		CEA		Vascular access		PTA	
	A	B	A	B	A	B	A	B
Operator	100 (76.9%)	125 (85.0%)	99 (73.9%)	53 (73.6%)	67 (80.7%)	55 (85.9%)	124 (80.0%)	81 (68.1%)
Assistant	30 (23.1%)	22 (15.0%)	35 (26.1%)	19 (26.1%)	16 (19.3%)	9 (14.1%)	31 (20.0%)	38 (31.9%)
Total	130	147	134	72	83	64	155	119
P value	0.091		1.000		0.508		0.025*	

CEA, carotid endarterectomy; EVAR, emergency endovascular aneurysm repair; OAR, open aneurysm repair; PTA, percutaneous transluminal angioplasty. *p<0.05.

primary operator in period B than in period A (68.1% vs 80.0%, p=0.026). Of the remaining index procedures, three (37.5%) were less frequently performed by trainees as primary operator in period B (elective OAR, emergency EVAR, CEA) and four (50.0%) were more frequently performed by trainees as primary operator in period B (emergency OAR, elective EVAR, lower limb bypass, vascular access). Other than PTA procedures, these trends did not reach statistical significance.

Discussion

A significant impact of the COVID-19 pandemic on surgical services is the suspension of non-urgent elective operating. In response to this, VSGBI published further guidance with instructions to defer all elective arterial and venous surgery, treat asymptomatic carotid artery disease with best medical therapy where clinically appropriate, and change the threshold of aneurysm repair for >7 cm or imminent rupture.[6,8,9] This initial reduction was shown by the NVR report, which found that only 8–12% of elective abdominal aortic aneurysm (AAA) repairs were performed in April 2020 compared with April 2019 and 20% of lower limb bypass and 28% of CEA procedures were performed.[10] In addition, units were advised to place consideration on endovascular options where possible to reduce morbidity, minimise occupancy of intensive care beds and length

of inpatient stay.[6,8,9] This was echoed by a slight national increase in the use of EVAR over OAR for elective and ruptured aneurysms of up to 18.2%.[10,11] However, vascular surgery involves many procedures performed on an urgent or emergency basis, and the progressive nature of common vascular conditions such as AAA and chronic limb-threatening ischaemia means any delays to treatment will have both limb- and life-threatening consequences and will result in a significant burden to the services once capacity returns.

As the first lockdown lifted, VSGBI published further guidance on the resumption of these less urgent and elective cases.[8] Although vascular units across the UK are still not back at normal operating capacity, changes such as preoperative self-isolation, uptake of vaccination and increased preoperative COVID-19 testing has allowed the resumption of most urgent and semi-urgent cases.[8,12]

Moreover, the pandemic has caused numerous short-term effects for surgical trainees such as redeployment, cancelled courses, reduced experience in operating, outpatient clinic and MDM, which will have implications for the future surgical workforce.[2,4] The Vascular and Endovascular Research Network (VERN) showed that 29.0% of clinics were cancelled and up to 79.1% adopted the use of the 'hot' clinic to assess acute/urgent clinic patients.[11] Our study has shown that trainees are still attending outpatient clinics, but does not comment on the type of clinic attended. Likewise, the Scottish trainees still had regular access to MDM, although globally they have reduced by 59.5%.[11] In a comparative study of logbook numbers of surgical trainees in the UK, Clements *et al* showed that vascular surgery has been one of the least affected major surgical specialties for overall operative experience.[7] As may be predicted, the number of urgent and emergency cases in vascular surgery recorded on elogbook have remained similar to pre-pandemic levels.[7] Our results corroborate this and show that vascular trainees continued to gain good exposure to index procedures, which may be due to the emergency nature of vascular surgery.

In addition, Munro *et al* found that there has been a reduction of 50% in trainees as primary operators across all surgical specialties, which may substantially reduce their opportunities to achieve procedure competencies.[4] The data described in our study show that Scottish vascular trainees are maintaining their exposure to procedures as primary operator. The exception to this is a statistically significant reduction in PTA as primary operator, despite total numbers remaining the same. This may be due to competition for training with interventional radiology (IR) trainees, reduction in IR room capacity and associated with guidance for increased consultant operating.[1] Munro *et al* also suggest that senior trainees have been more affected than their junior counterparts, which becomes an obstacle to completing training.[4] Although overall fewer cases were performed by the senior trainees in this study, they were not of statistical significance and this has not affected their ARCP/CCT (certificate of completion of training) outcome.

KEY MESSAGES

- Research has shown that COVID-19 has negatively impacted surgical trainees due to less elective operating, redeployment and cancellation of courses and examinations.
- Despite the reduction in elective operating, vascular surgical trainees in Scotland have continued to achieve similar operating levels as they did before the pandemic.
- It is important to seek out training opportunities for surgical trainees in order to retain the future surgical workforce.

Despite retention of operating levels, Scottish vascular trainees have been subject to other disruptions to training due to the COVID-19 pandemic.[4] Around two-thirds of trainees were subject to rota changes and redeployment whilst others had courses and professional examinations affected. Despite this, and the reduction in elective operating, vascular trainees in Scotland achieved satisfactory ARCP outcomes. Although the COVID-19 pandemic has resulted in fewer formal training opportunities, there have been notable positive effects. Several teaching webinars have been held, accessible to all trainees, as they are able to attend in their own time or watch retrospectively if recorded. With lack of formal courses and conferences, the trainees' study leave budget (with trainees' permission) was used to develop regional training opportunities such as cadaveric courses and a non-technical skills course.[2] In addition, the pandemic has provided unique opportunities in audit and research. Further, the recognition of the impact on training has encouraged training bodies to adapt to and overcome the problems that have and may continue to arise in the future.[4,5]

Study limitations

The limitations of this study were that some trainees were out-of-programme or on a different specialty during part of the data capture periods, so true numbers may be slightly different. Both data capture periods were over annual changeover, where there is often service disruption due to changing shift patterns irrespective of the COVID-19 pandemic. Finally, the survey did not evaluate the mental health impact on trainees and therefore does not take into account whether they have taken time off due to self-isolation, shielding or burn-out, which many healthcare staff have been subject to during this time. We will need to continue to be vigilant of staff well-being as surgical services will be expected to catch up on the continually increasing workload in order to resume normal operating. We are yet to see the long-term effects on training and the surgical workforce.

Conclusions

Although the COVID-19 pandemic has had detrimental effects to

healthcare worldwide and particularly to surgical training, vascular trainees in Scotland have not been as severely affected with training opportunities for index procedures remaining similar to pre-pandemic levels. The long-term impact of the pandemic on surgical training in the UK remains unknown; however, our data show some promise that training programmes can continue to deliver high-quality training in what has been an undoubtedly more hostile period for the provision of surgical services.

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ORIGINAL RESEARCH

The first virtual ASPIRE 7 and 8 programs: preparing senior vascular trainees for FRCS and consultancy using a Post-Graduate Virtual Learning Environment

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Plain English Summary

Why we undertook the work: The COVID-19 pandemic has significantly hindered face-to-face education in medical and surgical specialties. Prior to the COVID-19 pandemic, vascular trainees preparing to sit their final exam would be given the opportunity to attend a two-day face-to-face revision course. Following this, trainees would then attend a two-day course to prepare for consultant interviews and a career as a consultant. The COVID-19 pandemic prevented the delivery of these two important courses in a face-to-face format.

What we did: Health Education England West Midlands developed a Post-Graduate Virtual Learning Environment which, in collaboration with the ASPIRE program organisers, was used to create two two-day purely virtual courses: ASPIRE-7, an FRCS exam preparation course; and ASPIRE 8, a consultant interview and future career development course. Feedback was gathered from both trainees and trainers.

What we found: The majority of candidates attending the virtual courses rated the supporting software and overall course content as excellent or good. Faculty found the software easy to use to deliver the candidates' educational requirements. Both courses were supported by pre-course guides.

What this means: Learning Management Systems such as that developed in the West Midlands can be used in post-graduate education to deliver high quality teaching. It can provide a central hub for resources, be used to manage educational programs and for web conferencing purposes.

Abstract

Background: The COVID-19 pandemic has resulted in significantly reduced educational opportunities for vascular trainees in the UK. Senior trainees preparing for their FRCS exam and future consultant interviews could not attend the usual preparation courses due to the pandemic. Learning Management Systems (LMS) have been used to good effect in undergraduate education, but to a lesser degree in post-graduate studies. Health Education England West Midlands (HEEWM) has developed a Post-Graduate Virtual Learning Environment (PGVLE). The aim of this study was to establish and evaluate a model for the delivery of the ASPIRE-7 and ASPIRE-8 post-graduate vascular courses using the PGVLE.

Methods: The national two-day ASPIRE 7 and 8 courses were developed by the faculty in collaboration with the PGVLE team. Pre-course PGVLE guides for faculty and resources for candidates were generated on the PGVLE. Centralised feedback using integrated PGVLE software was gathered which, once completed, allowed autogenerated candidate and faculty certificate distribution. A quantitative and qualitative analysis of previous PGVLE use, pre-course materials/guides and the in-course lectures and mock scenarios was completed.

Results: ASPIRE-7: 39 candidates attended ASPIRE-7, which was supported by 27 faculty of which 92% and 78% completed feedback, respectively. Pre-course lectures, overall educational course value and PGVLE good/excellent ratings were 91%, 100% and 97%, respectively. 90% of ASPIRE-7 faculty found the PGVLE easy to use for delivering education, despite 76% being new to using the software. ASPIRE-8: 14 candidates attended with 14 faculty, of which 79% and 36% completed feedback, respectively. The overall educational value, PGVLE and BigBlueButton (BBB) good/excellent scores were 100%. 100% of faculty found the PGVLE easy to use for delivering the educational aims.

Conclusions: This study shows that the PGVLE can be used to provide robust, high quality post-graduate education programs for vascular surgeons nearing the end of their training. Its

key uses are as web conferencing software, as an information repository and to both support and automate much of the governance that surrounds the administrational management to develop complex educational programs.

Key words: PGVLE, HEEWM, ASPIRE, vascular, education

Background

The COVID-19 pandemic has had catastrophic effects in the UK. The death toll in the UK currently stands at over 170,000.[1] The COvid-19 Vascular sERvice (COVER) study highlighted the significant impact of the pandemic on both elective and emergency vascular surgery provision, with the focus on minimising exposure and therefore cross-infection of COVID-19 and its associated morbidity and mortality.[2] The effect of COVID-19 on vascular surgery operative training and Annual Review of Competency Progression (ARCP) is also well documented. A 40% reduction in elective operating and 5–10% reduction in emergency operating was reported when comparing 2019 to 2020 elogbooks. The number of outcome 1s recorded in vascular ARCPs reduced by more than 17% in absolute terms and one in five trainees received an outcome 10. Whilst the majority of these were an outcome 10.1 (not requiring an extension to training), the attainment gap that exists for those trainees still needs to be addressed.[3] A key progression point in surgical training is the Fellowship of Royal College of Surgeons (FRCS) exam. During 2020 FRCS exams were cancelled due to the COVID-19 pandemic. These were then re-introduced in vascular surgery, initially in a remote delivery format without patients.[4] Once trainees have completed this exam and enter their final year of training, it is of key importance to prepare them for both the clinical and non-clinical aspects of a consultant's working career. Prior to the pandemic, the national ASPIRE-7 and ASPIRE-8 courses run by the Vascular Society would support trainees in preparing for the FRCS exam and consultant life, respectively. These would be face-to-face two-day courses. The COVID-19 pandemic therefore required a new strategy for supporting trainees near the end of their training. Learning Management Systems (LMS) have been used commonly in undergraduate education. In Health Education England West Midlands (HEEWM), a strategy for not just maintaining but enhancing the delivery and governance of teaching programs in multiple specialties across the West Midlands was developed. A Post-Graduate Virtual Learning Environment (PGVLE)[5] using Moodle™/BigBlueButton (BBB) open source but commercially hosted software was established to support local/regional teaching programs in the West Midlands. This, however, had not been used to support national training schemes. The ASPIRE program organisers, in collaboration with HEEWM, looked to evaluate the utilisation of the PGVLE in delivering the first purely virtual ASPIRE-7 and ASPIRE-8 national courses.

Aim

The aim of this study was to both establish and evaluate a model for the delivery of the ASPIRE-7 and ASPIRE-8 post-graduate vascular trainee courses using the PGVLE.

Methods

PGVLE

A course page for both ASPIRE-7 and ASPIRE-8 was created in collaboration with the HEEWM PGVLE team. Faculty and candidates were given log-in details, a pre-course guide for navigating the PGVLE and links to two video tutorials on how to use the BBB as a trainer and a trainee, respectively. Timetables for the courses were uploaded to the PGVLE course pages for faculty and candidates to view. Pre-course materials were developed by the faculty and made available to candidates on the PGVLE course pages. Restricted access faculty areas were created on each course for resources that would be used for the mock scenarios, to prevent candidates seeing the resources while being freely accessible to faculty. Separate anonymised feedback forms for candidates and faculty were created on the PGVLE for both courses. Once completed, this unlocked separate candidate and faculty certificates which autogenerated the details of the candidate/faculty member. BBB conference rooms and BBB small group seminar rooms were created to deliver the virtual teaching sessions.

ASPIRE-7

In March 2021 a two-day virtual course was planned by the organising faculty that looked to outline the structure of the new virtual FRCS exam using mock stations. Twenty key vascular articles on aortic disease, carotid disease, venous disease, secondary prevention, peripheral vascular disease, diabetic foot and amputation were made available on the PGVLE course for candidates to access prior to the course. Eight pre-course lectures for candidates were also developed by the faculty, for which the topics were:

- What the exam entails
- How to pass the FRCS
- Managing infected grafts
- Carotids – who, what, when and why
- Deep venous intervention
- Vascular trauma
- Vascular access
- Abdominal aortic aneurysm management

Both days started and finished with an introduction session in a main BBB conference room, which included a briefing and opportunity for questions and answers (Q&As). Time was also allocated at the end of each day for a consolidation and Q&A session. Day 1 included 6 hours and 20 minutes of short and long case mock sessions split into a morning and afternoon session. Ten breakout seminar BBB rooms were created, each containing two faculty members with candidates in groups of four rotating around short and long case stations. Day 2 included a morning group session of half the course candidates in a 'Journal Club' with two faculty, discussing the 20 key papers in a BBB seminar. The other half of the candidates were split into groups of twos or threes and rotated around oral viva sessions with two faculty in each of the eight BBB breakout seminar rooms. Both sessions lasted 3 hours and 10 minutes and the two groups swapped for the second half of the day. In order to allow faculty to converse in breaks, a faculty BBB 'common room' was also created with access restricted to faculty only.

ASPIRE-8

A two-day virtual course was developed and delivered in June 2021. Several important lectures were delivered in a BBB conference room which included:

- Becoming a consultant and the application process/job planning
- Developing non-clinical roles within consultant practice
- Understanding equality and diversity challenges
- A medical directors' perspective on "What I want from a consultant vascular surgeon"
- A chief operating officer's perspective on "What management wants from a consultant vascular surgeon"
- Becoming a consultant trainer
- Legal pitfalls and consent
- The future of vascular surgery
- NHS interaction with industry
- How to survive the first year
- Introducing a new service
- How to run an MDT and aortic practice
- Private practice now and in the future
- Who got the job?

Candidates each underwent a mock interview and delivered a pre-prepared mock presentation on a variety of topics in a BBB interview room.

Analysis

Quantitative and qualitative data were collected from candidates and faculty on both ASPIRE-7 and ASPIRE-8 using the PGVLE integrated feedback system. Faculty and candidates' previous use of the PGVLE was assessed. A 5-point Likert scale (1=unsatisfactory, 2=below average, 3=average, 4=good, 5=excellent) was used to evaluate the candidates' perceptions of the course lectures, mock stations and overall evaluation of the two ASPIRE courses. Candidates were also free to give qualitative feedback on the mock scenarios and overall impressions of the courses. The same Likert scales were used to evaluate the candidates' evaluation of the PGVLE and BBB. Faculty were asked how strongly they agreed with statements pertaining to the ease of use of the BBB and PGVLE as teachers, with data gathered using a 5-point Likert scale (1=strongly disagree, 2=disagree 3=neither agree nor disagree, 4=agree, 5=strongly agree). The same scales were used to assess their perceptions of the pre-course preparation materials and whether a pre-course induction of using the PGVLE/BBB would have benefited them. Qualitative data on faculty experiences were also gathered. Data gathered from the PGVLE users were gained with their consent as an agreement in the terms and conditions of the PGVLE and were compliant with General Data Protection Regulations.

Results

ASPIRE-7

Candidate quantitative results

Thirty-nine UK FRCS vascular candidates attended the two-day virtual course; 36 (92%) completed feedback, of which 26 (72%) were new PGVLE users. Pre-course lectures received a 91% good/excellent mean rating when those who did not watch these lectures were excluded (Figure 1). The four small group mock stations all received a 100% good/excellent rating and the journal club 94% (Figure 2). The overall educational value of the course received 100% good/excellent rating, as did the BBB, and the PGVLE received a 97% rating (Figure 3).

Candidate qualitative results

The key themes were as follows:

Level and pitch: five trainees commented that the 'pitch' or 'level' was correct: "Well structured and pitched at the right level".

Variety of content and examination style: seven candidates stated that the course had a good variety of cases, four stated that there was repetition and one stated "Good short cases and varied, however multiple repetitions in scenarios".

Technology and virtual format: Four comments were made regarding technical issues such as: "The image quality was compromised". However, several highlighted positive experiences of the virtual format such as: "I was pleasantly surprised at the fact that it seemed to work very well virtually and I think this is probably a feasible model moving forward" and "I would be happy to have future courses in this platform as I saved on travel time, having to make family arrangements and cost. I would like this platform to continue".

Faculty quantitative results

The course was supported by 27 consultant vascular surgeons spread across the UK, 21 (78%) of whom completed feedback. Sixteen (76%) were new PGVLE users. 100% of faculty felt that the

Figure 1 Mean ASPIRE-7 pre-course lecture rating

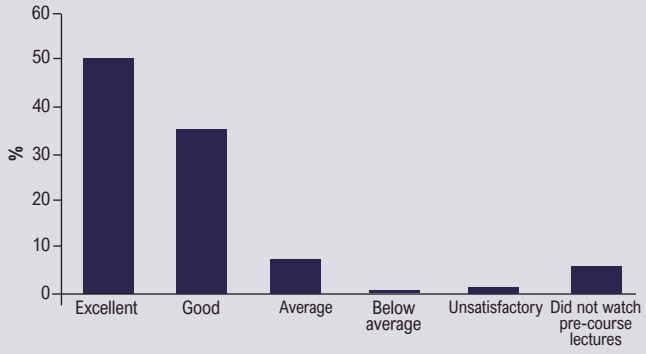


Figure 2 ASPIRE-7 mock sessions ratings

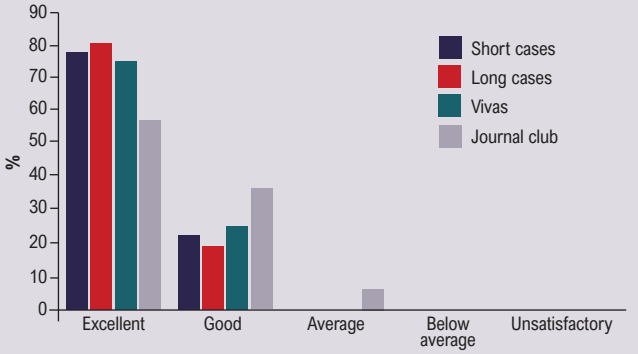


Figure 3 ASPIRE-7 PGVLE, BBB & overall course educational value

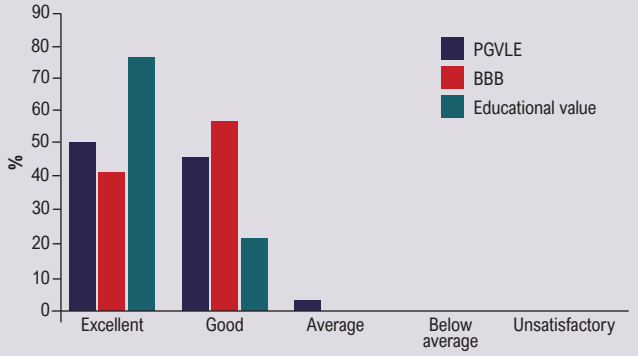


Figure 4 ASPIRE-7 faculty ease of use of the PGVLE and BBB

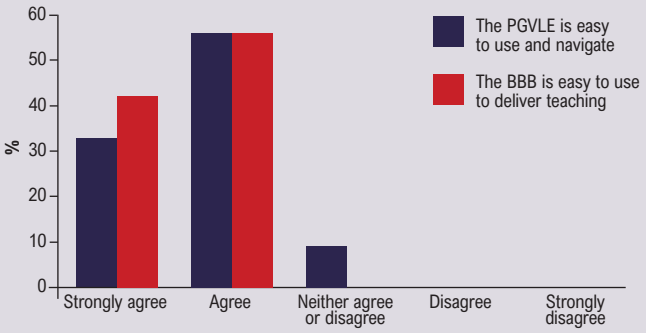


Figure 5 ASPIRE-7 faculty pre-course guides and pre-course induction

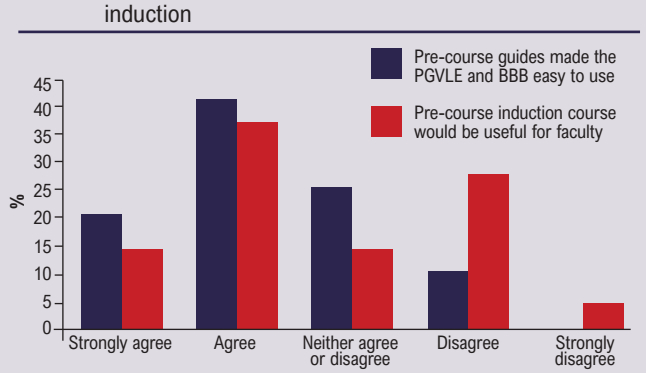


Figure 6 Mean ASPIRE-8 lecture rating

BBB was easy to use for delivering virtual teaching and 90% agreed that the PGVLE was easy to use and navigate (Figure 4). 90% of the faculty used the pre-course guides on the PGVLE and BBB. Of these, 63% found the pre-course guides useful and 52% felt that a PGVLE/BBB faculty induction course would be useful (Figure 5).

Faculty qualitative results

Several consultants gave positive views on the PGVLE and BBB such as: "This course worked very well in this format". There were a couple of comments asking "bring back face-to-face". There were 14 positive comments regarding the course from faculty: "I think it was perfectly executed" and "I can't see how it can be better".

ASPIRE-8

Candidate quantitative results

Fourteen UK vascular trainees in the final year of training attended, of which 11 (79%) completed feedback. Seven had previously used

Figure 7 ASPIRE-8 mock presentation and interview candidate ratings

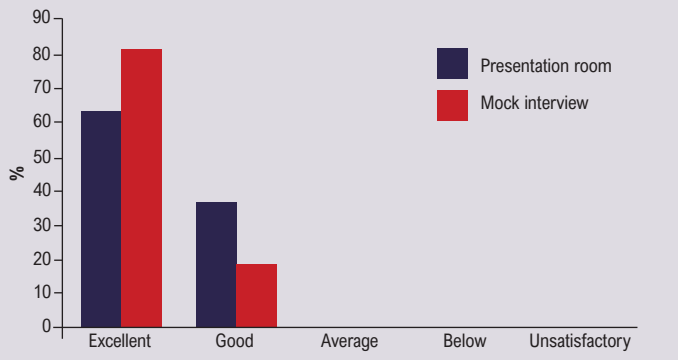


Figure 8 ASPIRE-8 educational value, BBB and PGVLE candidate ratings

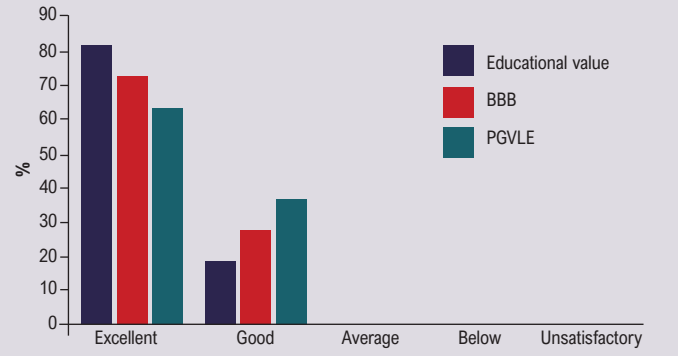


Figure 9 ASPIRE-8 faculty ease of use of the PGVLE and BBB

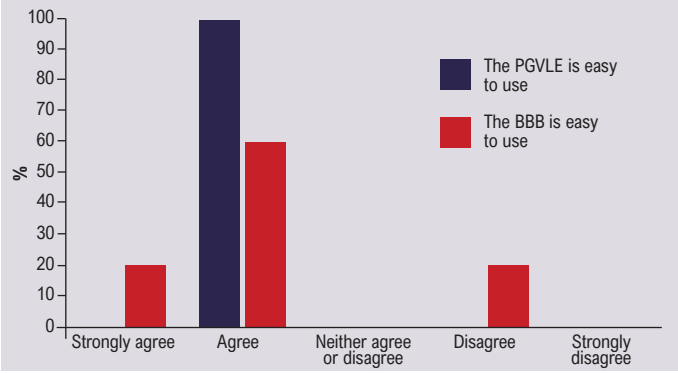
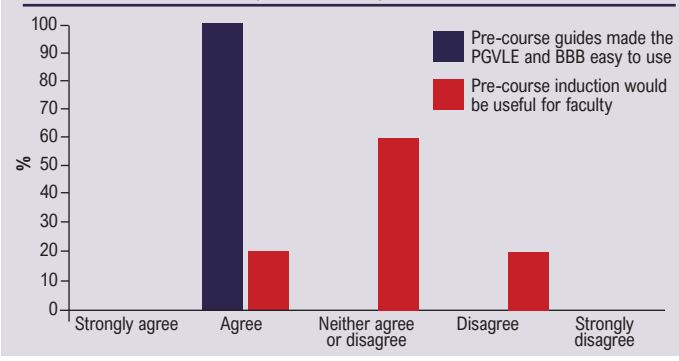


Figure 10 ASPIRE-8 faculty pre-course guides and pre-course induction



the PGVLE (64%). Mean lecture good/excellent rating was 95% and the mock interviews and presentation sessions received a 100% rating (Figures 6 and 7). The ASPIRE-8 course received a 100% good/excellent rating for educational value, the BBB and the PGVLE (Figure 8).

Candidate qualitative results

Technology and virtual format: There were six positive comments regarding the technology used to support the course including "thought the tech was excellent" and "easy to use". There were also comments of 'glitches' but also an understanding from trainees regarding issues; for example: "Although there were technical issues with slide control, I believe this is expected with new platforms and will get better with time".

Content: There were 13 separate positive comments such as: "It would definitely help my preparation to become a consultant" and "It has highlighted several areas for me to work on which I would not have previously considered".

Faculty quantitative results

ASPIRE-8 was supported by 14 faculty members which included vascular consultants, a NHS medical director, a NHS chief operating officer, a legal director and vascular industry marketing manager. Of the faculty, five (36%) completed the feedback and, of these, four (80%) had used the PGVLE before. 80% of faculty found the BBB easy to use and 100% found the PGVLE easy to use (Figure 9). 100% of faculty agreed that the pre-course materials were useful but there was a mixed response regarding the requirement for a pre-course induction (Figure 10).

Faculty qualitative results

There were minimal faculty comments but key points included the future need for a virtual 'waiting room'. One faculty member stated that "Pre-course training not essential but would be useful".

Discussion

The COVID-19 pandemic has fast-tracked the uptake and the development of virtual learning and online resources. From an organisational perspective, the PGVLE supports several key aspects for delivering national education programs such as ASPIRE. Firstly, it acts as a central point for faculty and trainees to interact, whether that be through integrated web conferencing software such as the BBB, online forums or through resource sharing/development. In the ASPIRE programs, pre-course materials were developed by the faculty and uploaded to the PGVLE for trainees. Collaborating enthusiastic educationalists over time can go on to accumulate a significant information repository for their learners without the difficulties that can be met with sharing on cloud-based

storage systems that commonly fall under the care of a single education lead. This can then be used for future iterations of education programs. Another key advantage of using a LMS such as the PGVLE is reducing the administration around attendance, feedback and certification. This course was set up such that once the course was complete, feedback was made available for a short period of time (to reduce recall bias) and only once this was completed were template certificates that autogenerated faculty/candidate names able to be accessed by the candidates/faculty. For frequent courses/programs, this saves time and therefore allows more of a focus on course development rather than administration tasks. Feedback can then be automatically downloaded for review by the faculty and graphs of the data autogenerated by the LMS, which again reduces the administrative burden of running large-scale education programs. Lastly, the virtual nature of running national courses means that candidates can stay at home, for which the advantages were highlighted by one candidate on this course: "I would be happy to have future courses in this platform as I saved on travel time, having to make family arrangements and cost".

Limitations

Firstly, this course was developed during the second COVID-19 wave, when-face-to face interaction was not an option. Educational opportunities may have been sparse and so results could be overtly positive. Whilst there were no comments from trainees stating that they preferred the face-to-face format, there were multiple faculty comments stating face-to-face was a better format. In this iteration of the ASPIRE 7 and 8 programs, it was not possible to perform a comparative analysis of face-to-face versus virtual teaching, but this should be considered in the future. Another methodology that could be considered is a hybrid approach, where pre-course reading/resources are viewed by candidates, meaning that focused educational sessions that some may consider better or easier to deliver face-to-face can be provided. Response bias could also result in skewed positive findings, as candidates feel pressured into giving feedback, particularly as this is associated with auto-certification. Finally, in the ASPIRE-8 program, the faculty response rate was low (36%) whereas, in all other aspects of the course, feedback completion was above 75%. This could lead to non-response bias, particularly as the majority of the ASPIRE-8 faculty (80%) had used the PGVLE before and therefore may have found the experience of using the PGVLE much easier than new users.

KEY MESSAGES

- The PGVLE supported the delivery of a high-quality and well received virtual education program for vascular surgeons nearing consultancy.
- A PGVLE can act as a central virtual hub for both trainers and trainees.
- Future research should look to compare face-to-face versus virtual versus hybrid delivery of education programs within vascular surgery.

Conclusion

Using a collaborative approach between HEEWM and the ASPIRE program organisers, the PGVLE was used to support two novel virtual national vascular education programs. Results from candidates and faculty showed that the pre-course materials, functionality of the software and content of the courses were highly rated.

Conflict of Interest: The authors declare no conflicts of interest.

Funding: None.

Acknowledgements: Our sincere thanks go out to all the faculty who supported the ASPIRE-7 and ASPIRE-8 programs in 2021.

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ORIGINAL RESEARCH

Tenotomy for diabetic foot ulcers: a scoping survey of current practice

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Plain English Summary

Why we undertook the work: Diabetes is very common and one of the major problems is foot ulcers. Many foot ulcers fail to heal. Tenotomy describes cutting tight foot tendons to redistribute pressure in the foot. This may help ulcers heal faster and stop them coming back. This study aims to see who uses tenotomy and how it is performed.

What we did: The study was an online survey of doctors, nurses, podiatrists and any other person involved in treating patients with diabetic foot ulcers. The study collected information on how they treat patients and if they were interested in taking part in further research.

What we found: One hundred and sixty-eight healthcare professionals completed the survey: 111 were surgeons, 48 were podiatrists and 9 were diabetes specialist doctors.

There were three scenarios in which tenotomy was offered: to reverse toe deformity, to aid ulcer healing and to prevent recurrence. Tenotomy was often performed by orthopaedic surgeons (76%). The frequency with which tenotomy was performed varied from monthly (48%) to yearly (21%). The method of undertaking tenotomy varied. Some centres perform tenotomy under local anaesthetic (51%) whereas others perform it under a general anaesthetic (6%). Surgical tenotomy was the most preferred method (68%). Prior to tenotomy there was variable assessment of blood supply to the foot and 7% of centres did not assess blood supply at all.

Eighty-three responders would like to take part in further research to further investigate tenotomy and other pressure relieving treatments in the diabetic foot.

What this means: There is variation in the reason that tenotomy is performed, pre-procedure assessment prior to tenotomy and the way tenotomy is performed. Clinicians responding to this survey are willing to take part in more research in tenotomy. The Vascular Society Specialist Interest Group in the Diabetic Foot will lead further research in this area.

Abstract

Background: Diabetes mellitus is one of the fastest growing health crises of our time. One of the major complications is diabetic foot ulcers, many of which fail to heal. Tenotomy – transection of tendon fibres – may help to redistribute pressure in the foot and therefore help ulcer healing and prevent recurrence. The aim of this survey was to explore the availability of pressure relieving adjuncts, including tenotomy, in diabetic foot services and interest in collaborating in further research studies.

Methods: An online survey was performed of healthcare professionals involved in the management of diabetic foot ulcers to explore the multidisciplinary composition of diabetic foot services, offloading therapies available and interest in collaborating in further research.

Results: The survey gained 168 responses from 10 countries. Most responders were orthopaedic surgeons (61.3%, 103/168). Of those who responded, 70.8% (119/168) had a dedicated diabetic foot clinic and 99 (58.9%) reported having an active tenotomy service. 73.8% (124/168) of responders wished to further collaborate and 82.1% (138/168) were willing to help involve their patients in a future trial.

Conclusions: The results of this survey showed the variation in tenotomy practice and an appetite for collaborative research in this area. The Vascular Society of Great Britain and Ireland Diabetic Foot Specialist Interest Group will address these uncertainties through targeted collaborative research to investigate tenotomy as a potential clinical and cost-effective treatment in diabetic foot care.

Key words: diabetic foot, tenotomy, wound healing

Introduction

Diabetes mellitus is one of the fastest growing health crises of our time. The disease is endemic in the UK, currently affecting more than 4.9 million people.[1] Diabetic foot ulcers (DFU) are a common and difficult-to-treat complication of the disease. Over a quarter of patients with diabetes will develop a DFU. Even with current best ulcer care implemented by a multidisciplinary team (MDT) following evidence-based guidelines, less than 50% of patients heal within the expected time frame.[2] Delayed healing leads to hospitalisations, life threatening infections, limb loss and mortality. This has a huge impact on patient quality of life and healthcare resources.

To tackle this health crisis, the Vascular Society of Great Britain and Ireland set up the Diabetic Foot Specialist Interest Group (DF-SIG), consisting of expert healthcare professions in DFU, vascular trainees and – importantly – patients, to address specific challenges facing patients, clinicians and healthcare systems through focused research. Foot complications of diabetes including infections, ulceration and amputation were identified in five of the top 10 clinician research priorities,[3] and a collaboration with the James Lind Alliance exercise has identified joint patient-reported research priorities.[4] The DF-SIG analysed key themes identified by patients and found new treatments to help DFU healing and prevent ulceration were the most frequently recurring themes.

DFUs occur due to a combination of factors, including peripheral neuropathy. Peripheral neuropathy is particularly problematic as it results in typical cavoid foot deformities such as claw and hammer toes. When combined with the loss of protective sensory feedback, this malposition causes increasing pressure on weight-bearing areas, predisposing patients to ulcer formation. Conservative measures to treat these ulcers include offloading casts and below knee walker boots. However, these do not correct the biomechanical deformity in the long term, predisposing to ulcer recurrence, and are poorly tolerated by patients. Tenotomy describes the transection of the tendon fibres and, in this context, relates to the flexor or extensor tendons of the toes. It is a minimally invasive procedure that can correct toe deformities to improve DFU healing and prevent recurrence.[5]

The aim of this survey was to explore the availability of toe pressure-relieving adjuncts, including tenotomy, in diabetic foot services.

Methods

The survey focus was on tenotomy of toe tendons and pressure-relieving adjuncts to standard care to inform a prospective research study.

An online survey using Google Forms was developed, reviewed and piloted by the DF-SIG in line with designing and reporting survey guidelines.[6] The questions explored the composition of the diabetic foot MDT at each centre, defined offloading therapies offered for DFU by the MDT and determined interest in collaborating in DFU research led by the DF-SIG (see Appendix 1 online at www.jvsgbi.com).

The survey was aimed at healthcare professionals involved in diabetic foot care. It was promoted through advertisement on social media platforms such as Twitter, distributed to mailing lists by the British Orthopaedic Foot and Ankle Society, College of Podiatry members and targeted invitation to lead clinicians in diabetic foot units.

Formal ethical approval was not sought as this is a survey of healthcare professionals and therefore formal informed consent was not required.

The survey ran between 13 January 2021 and 1 March 2021.

Data analysis

Raw survey data were extracted onto Microsoft Excel, cleaned and duplicate responses removed. Counts and percentages were reported for each survey item.

Results

Reach

The scoping survey had 168 responses from 10 countries. The majority of respondents were from the United Kingdom (94.6%, 159/168).

Orthopaedic specialists made up the majority of responses (61.3%, 103/168) with other specialties including podiatry (28.6%, 48/168), diabetology (5.4%, 9/168) and vascular surgery (4.8%, 8/168).

Surgeons were the most frequent responders (56%, 94/168), followed by podiatrists (19.6%, 33/168) and physicians (12.5%, 21/168). Other healthcare professionals included nurse specialists, nurses, interventional radiologists, orthotists, physiotherapists and dieticians.

Diabetic foot services

One hundred and nineteen of the 168 responders (70.8%) had a dedicated diabetic foot clinic at their centre. The clinic commonly consisted of a podiatrist (93.2%), diabetologist (81.4%), orthopaedic surgeon (62.7%) and diabetes specialist nurse (55.1%). 42.4% of clinics had an orthotist. Other specialties in attendance are shown in Figure 1.

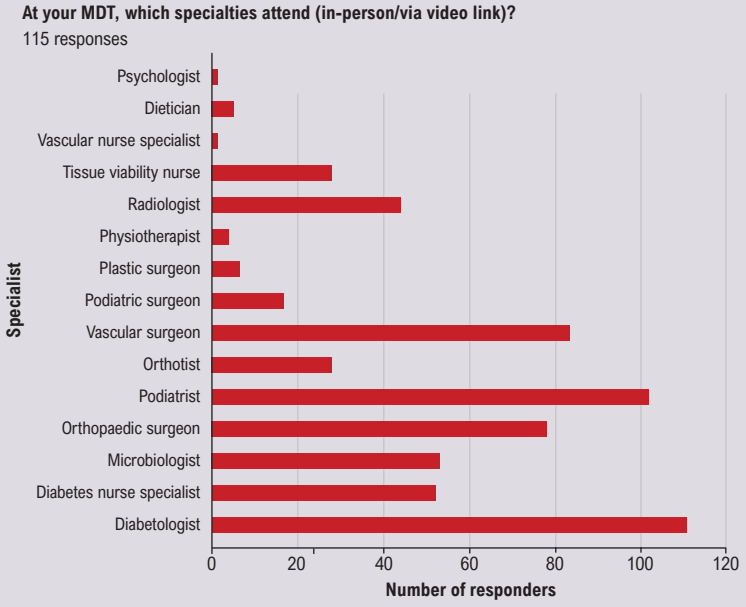
Of those who responded, 64.1% (107/167) reported having a diabetic foot MDT either at their hospital or the regional centre and 30% (50/167) did not. Other responders stated the MDT was integrated during diabetic foot clinics or they had irregular and *ad hoc* MDTs.

Tenotomy practice

Ninety-nine (58.9%) responders reported having an active tenotomy service. Indications for tenotomy included: as an ulcer prevention strategy but with appropriate reversible toe deformity (66%, 68/103), following onset of ulceration (52.4%, 54/103) and following healed ulceration to prevent recurrence (55.3%, 57/103).

Orthopaedic surgeons most commonly perform tenotomy

Figure 1 Specialities attending diabetic foot clinics



(75.7%, 78/103), followed by podiatric surgeons (24.3%, 25/103), vascular surgeons (5.8%, 6/103), podiatrists (3.9%, 4/103) and diabetologists (2.9%, 3/103). Other operators included vascular nurses and surgical care practitioners.

Of the centres offering tenotomy, 47.6% (49/103) perform tenotomy monthly and 21.4% (22/103) of centres perform tenotomies yearly. Only 4.9% (5/103) perform tenotomies weekly. Other respondents reported only doing them as part of another procedure or frequency depending on patient suitability.

Most tenotomies are undertaken in theatres in full asepsis (60.8%, 62/102). Other settings included outpatient clinic clean rooms and ward-based clean treatment rooms.

Tenotomy is performed under local anaesthetic (50.5%, 52/103), regional anaesthetic (15.5%, 16/103) or with no anaesthetic (13.6%, 14/103); 5.8% (6/103) routinely performed tenotomy under general anaesthetic. Other responders tailor the anaesthetic to the degree of neuropathy.

Surgical tenotomy was the preferred method (68%, 70/103). Needle tenotomy was used by 20.4% (21/103) of responders, and 11.7% of responders did not know the details of the technique as it was performed by a colleague.

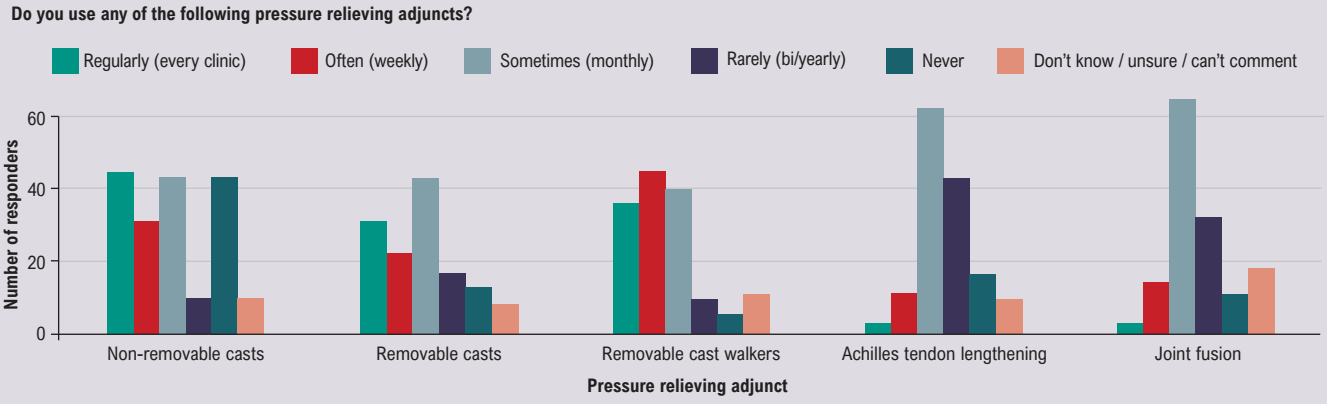
Over half of centres perform tenotomy in isolation (52.9%, 54/102). Others perform it with osteotomy/joint fusion (36.3%, 37/102), with Achilles tendon lengthening (29.4%, 30/102) or with casting (20.6%, 21/102). The frequency of use by each centre is shown in Figure 2.

Prior to tenotomy, most centres require patients to undergo an arterial assessment; 61.8% (63/102) of centres require patients to have palpable foot pulses, 42.2% (43/102) require multiphasic signals on hand-held Doppler, 21.6% (22/103) performed ankle-brachial pressure index and 8.8% (9/103) centres require a formal arterial duplex. 6.9% (7/103) of responders reported no arterial assessment was required prior to tenotomy. Other assessments included foot radiographs; 51% (52/102) of centres request a weight-bearing radiograph and 32.4% (33/103) require an anterior/posterior and lateral view foot radiographs. 57.8% (59/102) of centres assess patients for clinical evidence of a reducible foot deformity prior to tenotomy.

Future research

Of the responders, 49.4% (83/168) would be willing to take part in a trial to evaluate pressure-relieving adjuncts. 37.5% (63/168) would not want to take part as they felt tenotomy was an established treatment, they lacked research capacity or were not in equipoise. Other responders reported they would need to consult the local department or required more information about the proposed research before agreeing to engage further.

Figure 2 Use of pressure relieving adjuncts.



One hundred and twenty-four of the 168 responders (73.8%) wished to be further contacted about the project and 82.1% (138/168) of responders were willing to help involve their patients in designing a future trial.

Discussion

This predominantly UK-based tenotomy scoping survey had a good response rate, with an appropriate spread of specialists from the key relevant stakeholders. The results have demonstrated that there is clear variation in tenotomy practice. Tenotomy was not available in a third of centres who responded, and in those who did, there was little consensus on indications, preoperative assessment or how the procedure should be undertaken, with half of centres (54/102) offering it as a stand-alone procedure. In addition, despite the high prevalence of DFU, tenotomy was infrequently performed. The reason for this is unclear from this survey.

Another finding from this survey was the apparent lack of compliance with UK National Institute for Health and Care Excellence (NICE) guidance on the structure of diabetic foot services.[7] Thirty percent of responders reported no dedicated diabetic foot clinic at their centre. In centres that operated a diabetic foot clinic there was a lack of representation in certain specialities advised to be part of diabetic foot services, in particular vascular surgery, microbiology and interventional radiology. A dedicated orthotist was available in less than 50% of diabetic foot clinics.

There is some evidence that tenotomy may reduce DFU healing times and prevent ulcer recurrence. To date, two systematic reviews have reported positive outcomes associated with tenotomy and low complication and recurrence rates; however, the absolute numbers are small with heterogeneous case mixes.[5,8] The review by Bonanno and Gillies of retrospective case series reported 97% of ulcers healed postoperatively, with the postoperative ulcer healing time ranging from 21 to 40 days. The estimated ulcer recurrence rate was 6–17%.[5] The literature reports DFU healing time to range from 1 month to over 1 year and is dependent on a number of factors.[9–11] Armstrong *et al* estimates ulcer recurrence to be around 40% at 1 year.[12]

There is less evidence for tenotomy as a primary prevention intervention. A retrospective case series by Rasmussen *et al* reported no ulceration in 22 patients over 4 years.[13] A further two small retrospective case series support this finding.[14,15]

The International Working Group on the Diabetic Foot (IWGDF) published guidance on DFU offloading methods in 2020. The guidance found weak evidence to support tenotomy to promote healing if non-surgical offloading options fail in patients with neuropathic plantar or apex digital ulceration, due to non-statistically significant findings of combined randomised trials.[8,16,17] However, despite limited randomised controlled trial evidence, the IWGDF still supports offering tenotomy for non-healing digital ulcers associated with deformity as their expert opinion is that the benefit of tenotomy outweighs the harm. The cost effectiveness and patient-reported outcomes of this position are unknown.[16] This therefore supports the rationale that a properly protocolled and delivered trial is required.

KEY MESSAGES

- There is a wide variation in tenotomy practice, with no clear indications.
- There is a wide variation in tenotomy technique.
- There is need for more research into the role of tenotomy in diabetic foot care.

Most centres in this survey require patients to undergo arterial assessment to ensure adequate perfusion for healing and biomechanical assessment to screen for reducible foot deformity amenable to tenotomy. This approach was echoed in the literature where ankle pressure brachial index (ABPI) and clinical assessment of deformities amenable to tenotomy were commonly undertaken.[18]

Surgical tenotomies were preferred in this cohort of responders, with most procedures undertaken with full asepsis in an operating theatre setting. This is at odds with the literature where percutaneous tenotomy is in vogue, and is likely to be due to the high number of orthopaedic surgeons who responded to this survey. Small case series and cohort studies report percutaneous tenotomy to be safe and effective.[18–20] There is limited high quality evidence to suggest whether surgical versus percutaneous tenotomy differ in healing rates, ulcer recurrence or adverse event profiles. Supporters of the percutaneous approach argue that it can be undertaken in the outpatient setting, therefore reducing healthcare costs, and is potentially more cost effective without compromising safety. One caveat to the survey responses reported is that foot and ankle surgeons made up the majority of respondents (61%). This is without doubt a potential bias to the survey responses as approaches, settings and the use of adjuncts might differ across specialties.

This scoping survey found that nearly three-quarters of responders were willing to engage in further research on this topic and over 80% would be willing to involve their patients. However, some responders felt there was an established tenotomy practice and therefore lacked equipoise. While the step-by-step technique of tenotomy may be established, there is no high-quality level 1 evidence to support the indication for tenotomy, timing of the procedure or benefits of the procedure in patients with diabetes. These questions need to be addressed in the form of a randomised controlled trial. The first step will be to undertake a feasibility trial to ensure the proposed trial is deliverable.[21]

The potential weaknesses of this study include not capturing all tenotomy practice and reporting bias by responders. Another weakness is the high number of orthopaedic responses and relatively low number of responses from endocrinologists and vascular surgeons, who typically manage patients with DFU. This may have skewed some results.

Conclusion

The results of this survey showed the variation in tenotomy practice and an appetite for collaborative research in this area. The Vascular Society of Great Britain and Ireland Diabetic Foot Specialist Interest Group will address these uncertainties through further collaborative research to investigate the role tenotomy may have in the treatment and prevention of DFU.

Conflict of Interest: The authors declare no conflicts of interest.

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CIRCULATION FOUNDATION
The Vascular Charity

Our Vision:- is a society free of vascular disease, and its associated suffering.

Our Mission:- is to promote awareness into Vascular conditions and to support vital research.

Established in 1992 by vascular surgeons, the Circulation Foundation is the only UK Vascular charity, dedicated to vascular health. It is the charitable foundation of the Vascular Society of Great Britain and Ireland, run by a committee which are accountable to the Trustees of the Vascular Society of Great Britain and Ireland.

Research

The Circulation Foundation makes three major awards per year to fund vascular research. The value of research funds awarded is currently approximately £1/4 million per year. Like a seed bed, we fund primary research which often goes on to large scale, life transforming studies. In the last four years the Circulation Foundation has awarded over £500,000 in funds for research, pushing the boundaries in the treatment of vascular disease. Get involved and help us save more lives and limbs through our evolving research programme.

Getting involved

- Donations
- In memory and gift in your will
- Corporate support
- Ambassador Scheme
- Events – create your own personal event, or sign up for a challenge e.g. London Marathon, Great North Run, Swim the Serpentine or ride the Vitality Big Half!

Become a Foundation Ambassador

The Circulation Foundation's goal is to establish a Circulation Foundation Network by having an Ambassador in each Arterial Centre and patient representatives across the UK. We would then be able to work together to increase awareness of vascular conditions, share and repeat fundraising success, increase our research grants and make the Circulation Foundation the support centre for patients.

- Make a real difference to the lives of people who are affected by vascular disease.
- Help to raise awareness of vascular disease.
- Continue to use expertise and knowledge.
- Learn new skills.
- Be able to network with like-minded people.
- Give something back to the vascular community.
- Be part of a professional and committed charity and a valued member of the team.
- Recognition on social media, newsletter and on the website.
- Special recognitions at the Annual Scientific Meeting.

THE BODY WALK

#TheBodyWalk is a national campaign to raise awareness of vascular disease and for imperative funding. We are hoping everyone can get involved to collectively achieve the 60,000 miles that make up the circulatory system! Walk, run, cycle, swim ... it is up to you!

Join us to reach the 60,000 miles and raise funds for the Circulation Foundation.

Help support the Circulation Foundation today!

Text CIRCULATION to 70560 to donate £10

Texts will cost the donation amount plus one standard network message.

To discuss getting involved in the Circulation Foundation by fundraising, legacy donations, becoming an ambassador or corporate support, please call 020 7205 7151 or email info@circulationfoundation.org.uk

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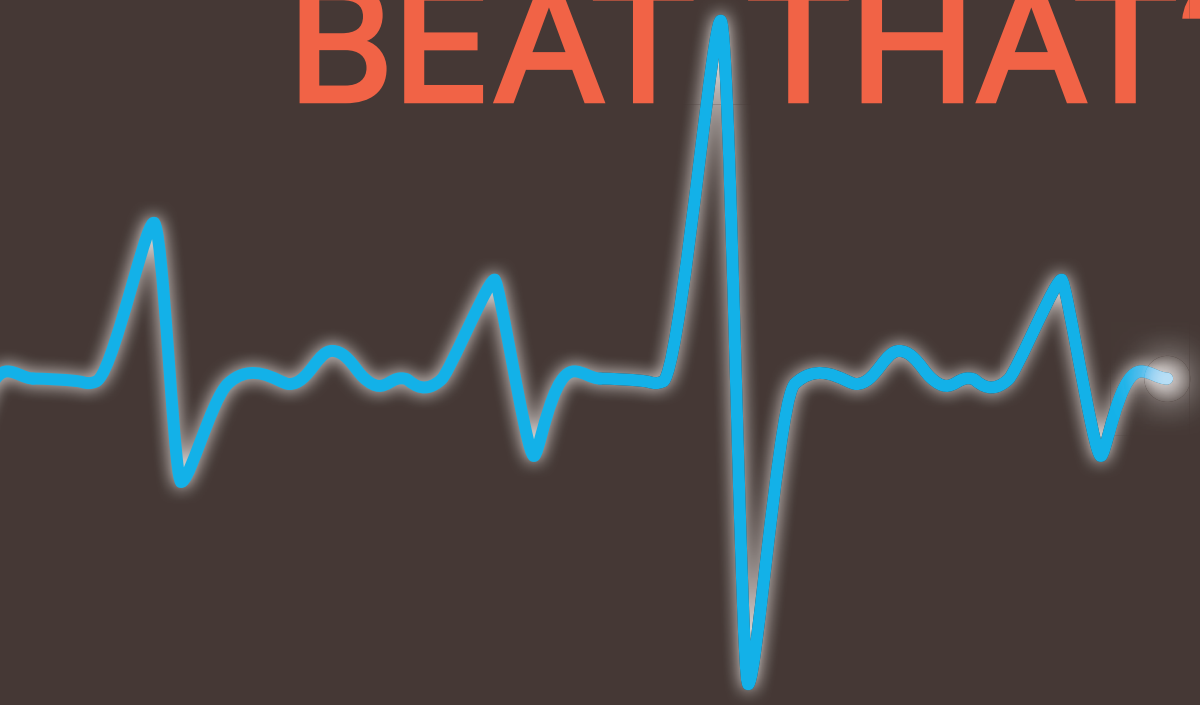

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