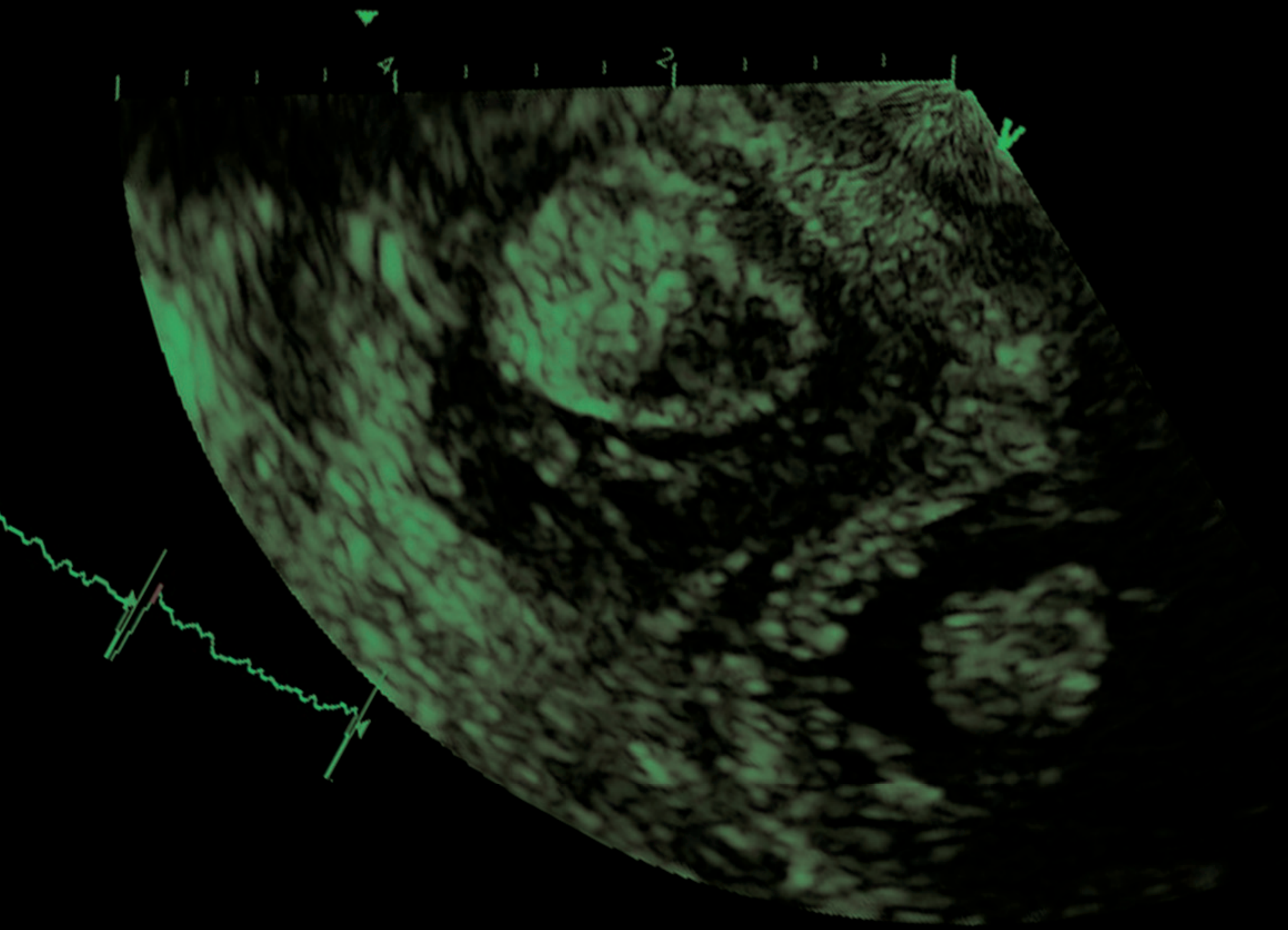
British Society of Echocardiography



Spring edition

The journal of the British Society of Echocardiography

ECHO

ISSUE 133 / March 2026

It's time to renew your BSE membership!

All memberships are due for renewal by Wednesday 1 April 2026.

As we approach the 2026 renewal date, this is a reminder that there will be a fee increase for 2026. Fees will be £111.50 for Standard members, £79.50 for Pre-accreditation members, £58.50 for International members, £164.00 for Fellowship members and £37.00 for Retired members.

We hope that you will continue to recognise the value of your BSE membership and look forward to supporting you again next year. Our accredited members are reminded that membership must be kept up to date to maintain accredited status.

It is easy to renew, simply log in to your profile and make payment via credit or debit card or set up a direct debit – more details below.

For more information, email membership@bsecho.org

Renew today to ensure seamless membership benefits.

Take the hassle out of renewing by setting up a Direct Debit!

We are delighted to be able to offer our members the opportunity to set up a Paperless Direct Debit for payment of membership fees. Paying by Direct Debit ensures that your membership fees are paid on time, guaranteeing that you won't lose access to your membership benefits! Setting up a Paperless Direct Debit is simple – log in to your BSE account and follow the instructions on your profile.

No paper forms, no postage, no fuss!

From your membership team

2025 ADVISORY COUNCIL

CONTENTS

FSC www.fsc.org MIX Paper | Supporting responsible forestry FSC® C106427

PLEASE RECYCLE

Design & production www.verdicottsdesign.com

PRESIDENT'S MESSAGE

Hopefully by the time you read this Spring will be well and truly here with brighter and warmer days to look forward to!

Speaking of things to look forward to, at the time of writing this message, we believe that the funding from NHSE for the Level 3 programme is imminent. This is brilliant and long-awaited news and means that shortly, if we haven't already, we will go out for expressions of interest. As well as the NHSE money, we have secured additional funds which will allow us to recruit sites in the devolved nations as well. I believe that as well as improving the patient pathway, our Level 3 pilot project will have a huge impact on the careers of our physiological and cardiac scientist colleagues, enabling them to demonstrate their wealth of knowledge and the value that they bring to services. Ultimately this project should help us retain our most experienced colleagues, by highlighting their full potential and expanding the career potential of this irreplaceable workforce. With 43% of the last 21 BSE guidelines being led by physiologists or scientists and with ERP publishing a collection on Scientist-Led clinics, the BSE is well aware of the potential of this skilled and knowledgeable workforce and are determined that they are appropriately recognised and remunerated.

This edition of ECHO Journal is jam packed with fascinating case reports and news on BSE activities such as updated resources in the Resource Hub and the recently launched Level 1 Library. If you haven't yet had a chance to check this out, please do. It is an outstanding resource and feedback across the board is telling us that not only will it play a vital role in assisting our emergency care colleagues, but also that it is an incredible training tool for us all. I have said it before, but I really cannot thank Dr Richard Fisher and Dr Jennifer Gosling enough, as well as everyone who contributed. I know that blood, sweat and tears have gone into the production of this resource, and I hope that the resulting success and feedback is making it feel worthwhile.

Thank you too to our Membership Resource Committee who continue to develop and source resources and articles for the Hub and this journal to share best practice and save us all time. Your efforts are genuinely appreciated.

As it is March, our membership fees are due again. We appreciate you will all have competing priorities when it comes to the bills to pay. We, the board, advisory council, committees and BSE team, put an immense amount of effort into ensuring we offer value to our membership. We continue to advocate for all members, to collaborate to achieve the best outcomes for you and patients and to produce resources to make your working life as productive and positive as we can. We hope that you see the value in your membership and look forward to working with and supporting you over the next 12 months.

On page 28 we have printed a thank you to our past president, Dr Claire Colebourn. Claire has achieved so much for the Society, and her kindness and leadership qualities have shone through everything she has done. We are very grateful for her continued dedication to the Society.

Best wishes

Professor Dan Augustine

President, British Society of Echocardiography

INSTRUCTIONS TO AUTHORS

ECHO is published four times per year. It is the official publication of the British Society of Echocardiography. The contact address is: BSE Administration, Unit 111, The Print Rooms, 164-180 Union Street, London SE1 0LH, email admin@bsecho.org. Members of the Society are invited to submit articles, case reports, audits, service improvement projects, or letter correspondence. Submission should be sent to 'The Editor', ECHO and forwarded by email to: editor@bsecho.org. The format should be text as a normal Word document and images supplied as high resolution (300dpi) jpeg, tiff, eps or pdf files. Other formats including PowerPoint or of web image construction may result in reduced resolution and may be unacceptable. Articles should contain appropriate references. References to be constructed in the Vancouver style with the first two authors, thereafter abbreviate to 'et al', then article title, followed by journal reference.

Submissions to ECHO are currently not peer reviewed. The Editor has discretion on acceptance. All submissions to ECHO should be anonymised to protect patient privacy. Written patient consent is required for all case reports and case series, both for patients living and no longer living. It is the responsibility of the author to obtain written consent and the author will be asked to sign a BSE consent document confirming that written consent has been obtained. BSE editors may call on authors to provide evidence of patient consent. As such we would encourage patient consent to be recorded within patient notes.

If the submitted article (or a very similar version) has been submitted to or been published by another journal, the submitting author(s) should clarify this at the time of submission to ECHO with a justifiable reason for requesting re-publication. Additionally, permission from the previous publisher should be obtained and authors are required to seek permission to use images from other sources. It should be noted that opinions expressed in articles or letters are the opinions of the author(s) and not that of the Council of the British Society of Echocardiography (BSE). Official BSE Council views or statements will be identified as such. Information with respect to advertisements can be obtained from events@bsecho.org.

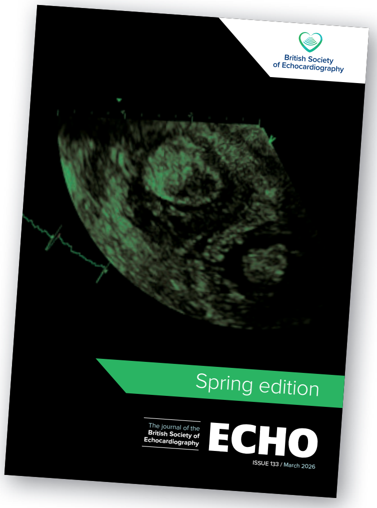
ECHO NEWS

Ryan McCoy

Front cover image: Image of the Year

We were delighted to run the inaugural Image of the Year competition last year. The 2026 front covers of ECHO will feature the images of the top four entries.

This issue has an image submitted by Ryan McCoy, Chief Cardiac Physiologist at Ulster Hospital, South Eastern Health and Social Care Trust. The image is from a TTE performed on a 96 year old lady who was referred after a stroke. The echo demonstrated two intra cardiac masses (LV and RV) in the presence of severe LV and RV dysfunction.



Dr Liam Ring

Next BSE Vice President Announced

We are delighted to announce that Dr Liam Ring was elected to be the next Vice-President of the BSE. Liam now holds the position of Vice-President Elect to support the President Elect, Ms Wendy Gamlin, as she prepares to take on the role of President in October 2026.

Liam said, *"I'm super excited and honoured to have been elected as Vice-President and look forward to working with Wendy for the benefit of our members. Having gained a perspective on the hard work of the Trustees over the last few years, I'm ready to support them as we move towards the future of the Society."*

Wendy said, *"Liam will be a fantastic Vice-President; his enthusiasm and dedication are truly motivational. I look forward to alongside him to ensure the Society continues to evolve in the support of our members and ultimately the patients we serve."*

Did you know you can claim tax relief from HMRC on BSE membership subscriptions?

The British Society of Echocardiography (BSE) is an organisation with the primary aim of promoting education, knowledge and developing professional standards for echocardiography in the UK. As such, the BSE is recognised by His Majesty's Revenue and Customs (HMRC) as a professional body and members may be able to claim tax relief on their annual subscriptions. This can be done through a self assessment tax return*.

You will find more information on how to do this at https://www.gov.uk/self-assessment-tax-returns

Please note: The ability to claim tax relief on BSE subscriptions and other expenses will depend on your personal circumstances and the BSE is unable to give you specific tax advice.

*Our name on the HMRC listing is stated as "Echocardiography British Society of "

Don't forget

BSE membership fees are due by 1 April.
See inside front cover for more details.

Call for STP equivalence mentors

We're launching a new STP equivalence buddy system to better support members undertaking STP equivalence. The scheme will pair those on the equivalence pathway with an arms-length peer mentor who has already completed the process, offering guidance around portfolio evidence and interview preparation.

We are now seeking expressions of interest from members willing to act as STP equivalence mentors. The role is light-touch, not time-intensive, and open to colleagues from all regions and types of centres.

Find out more at bsecho.org/STP-mentors

Echocardiographer of the Year

We've launched a new Echocardiographer of the Year award, delivered in partnership with the Advancing Healthcare Awards. The award recognises a healthcare scientist who has made an outstanding contribution to the profession, demonstrating leadership, service improvement and a clear impact on patient care, while championing high-quality practice and professional development.

Nominations are open to practising echocardiographers in the UK and may be submitted for yourself or a colleague. We encourage members to recognise those making a real difference in echocardiography, or to put themselves forward. Submissions close Monday 16 March 2026.

Find out more at bsecho.org/EOTY26

New guidance on adult congenital echocardiography

Our newest guidance on adult congenital echocardiography in hospitals without congenital heart disease surgery is endorsed by the British Congenital Cardiac Association. The position statement is designed to support echocardiographers working in non-specialist settings, helping ensure echocardiograms are allocated appropriate time without compromising patient access or clinic flow.

The guidance includes recommendations on scan times, clinical support and training, alongside a suggested framework for adult congenital heart disease clinics. Members involved in performing or managing ACHD echocardiography in non-surgical centres are encouraged to read and apply the guidance to support safe, high-quality practice for this growing patient population. Read the guidance at bsecho.org/PUF009

Upcoming events...

Advanced imaging 2026

This will be the inaugural advanced imaging conference run solely by the BSE, and we are excited to offer this event both in person and on demand. The conference is aimed at consultants, registrars, and allied healthcare professionals with an interest in valvular heart disease.

It will be held in London on Wednesday 15 April 2026.

Book now: bsecho.org/AIG001

BSEcho 2026

Save the date for BSEcho 2026, taking place in Manchester on Friday 16 and Saturday 17 October 2026. With clinical and personal development topics to suit every stage in your career, our 35th annual conference is not one to miss!

Find out more at bsecho.org/BSEcho2026

Online learning...

Catch-up content

If you have missed a webinar recently, you can now find the content on catch-up and still avail of BSE points. Access the webinars on our website under bsecho.org/webinars

You can also find the recordings of all the sessions from BSEcho 2025 on our website under bsecho.org/past-presentations

Level 1 Library

The level 1 Library contains 150 real-world Level 1 echocardiograms, enabling the user to generate a report using the Level 1 reporting template and then providing feedback on performance with a suggested 'ideal' answer. The first 30 cases can be accessed free of charge. Once the first 30 cases have been completed, a further 120 cases can be purchased for a fee of £50 for BSE members and £70 for non-members.

You can find more information on the Library by turning to the feature on 7.

Log on to the Library at bsecho.org/L1-library

Exam preparation course – Spring 2026

Preparing for the Spring written exam? It's not too late to gain access to our eLearning-based exam preparation course – the best way to ensure you've covered all the right topics in your revision.

Find out more at bsecho.org/examprep

Proposed new echocardiographer profiles

Our workforce surveys show that many of our members feel capped at a band 7 level although they undertake roles that have band 8a profiles in other occupational groups.

The Job Evaluation Group (JEG) is a subgroup of the NHS Staff Council and consists of representatives from NHS trade unions and NHS organisations, including NHS Employers and it is the responsibility It is the responsibility of the JEG to manage and maintain the national job profiles.

The JEG can accept requests for new national profiles from professional or other bodies representing occupational groups and therefore we have submitted a group of proposed echocardiography profiles (including 8a profiles), with evidence to support our request, example job descriptions for each role, and details of the impact that the lack of specific profiles is having on our workforce.

At the time of writing, our request has been acknowledged and will be reviewed by the JEG at their next profile subgroup meeting, which is held monthly. They will let us know an outcome once all our submitted evidence has been considered.

See p9 for more details.

Resource Hub Expanded

You can now find some ECHO articles on the BSE Resource Hub. Listed under Clinical Articles in the Clinical Guidance heading, you can find the Cardio-Oncology series, plus articles on quality assurance, STP equivalence and left-handed echo and advice on recent BSE guidelines.

Visit bsecho.org/resourcehub

Handheld cardiovascular ultrasound

We're supporting the SCAN-EF study, a national research project exploring whether AI-enabled handheld cardiovascular ultrasound can support earlier diagnosis of heart failure in the community. The study will assess whether limited cardiac imaging, delivered by trained non-specialist practitioners and compared against full level-2 echocardiography, can help patients enter diagnostic pathways sooner without compromising safety or quality. With growing pressure on echocardiography services, the project focuses on governance, training, equity and scalability. Importantly, this work is intended to support - not replace - comprehensive echocardiography and the echocardiographer's role.

Find out more at bsecho.org/SCAN-EF

BSE N-STEP calls for further project proposals

We've issued a renewed call for research proposals using the BSE National review of Stress Echocardiography Practice (BSE N-STEP) dataset. Established in partnership with the Cardiovascular Clinical Research Facility at the University of Oxford, the project builds on the EVAREST study to examine real-world stress echocardiography practice across the UK. The dataset includes clinical, outcome and workforce data from over 12,000 participants across more than 30 NHS trusts. Proposals must demonstrate potential to inform and improve UK stress echo practice. Expressions of interest close on Thursday 30 April 2026.

Find out more at bsecho.org/BSENSTEP

Level 1 Library: A transformative learning resource for emergency echo practitioners

British Society of Echocardiography

The British Society of Echocardiography (BSE) recently launched the Level 1 Library, a paradigm-shifting educational platform designed to consolidate the learning of those who practise emergency echocardiography. It is accessible to members via our website and over 500 users have engaged with it so far.

The Library contains 150 real-world Level 1 echocardiograms, each enabling the user to generate a report using the Level 1 reporting template and then providing feedback on performance with a suggested 'ideal' answer, and a short commentary. The first 30 cases are accessible free of charge and a further 120 cases can be accessed for a fee of £50 for BSE members and £70 for non-members. There is no time limit on completion (those wishing to use it as self-reported CPD activity may have institutional requirements).

Importantly, the Library does not replace the L1 accreditation pathway as a marker of competence. The intention is to help learners work towards the expressed purpose of Level 1: [the ability to rule in] life-threatening and immediately reversible pathology in a time frame appropriate to the acute emergency patient. The average user may come from any acute specialty and will usually have performed no previous echocardiography.

An advantage of the Level 1 Library is that it provides data to inform understanding about the acquisition process of image interpretation skills and the relationship between confidence in reporting and accuracy. These may contribute to future developments in education and accreditation processes.

The Library was developed by a team at King's College London led by Dr Richard Fisher, Consultant in Intensive Care Medicine. In 2023, they published a study in Echo Research and Practice[1] demonstrating the validity of an approach proposed to the British Society of Echocardiography Advisory Council; a Level 1 Library to provide a self-learning opportunity to all of those involved in emergency echo, particularly those from emergency and acute medicine, intensive care medicine or anaesthesia backgrounds.

Dr Fisher's team identified a need for this resource based upon a number of considerations. The last five years has seen a rapid increase in the use of echocardiography in acutely unwell patients and limited access to face-to-face training provides a barrier to determining competency via accreditation processes such as BSE Level 1. This contributes to a widening geographical disparity in emergency echo provision (as shown in the 2024 NEAT-ECHO study to which the BSE contributed).

Dr Fisher's study established that serial image interpretation tasks as a distinct learning tool improved the ability of beginner echocardiographers to accurately identify potentially life-threatening pathology from focused scans and paved the way for the BSE Level 1 Library.

The Level 1 Library is designed for users to go through cases at their own pace in no particular order. They will review the cases, identify key pathologies then receive feedback immediately afterwards, telling them what they detected and what they missed by comparing the user's answer with a model answer. The Library tracks the user's progress and highlights which topics they need to work on. It gives their reporting a confidence rating and an accuracy level helping users to understand their level of competency.

When asked how the Library helps to ensure consistency in a high standard of reporting as the marking is based on our Level 1 accreditation system, Dr Fisher explained: *"The video cases in the Library are designed specifically to be identically marked and scored in exactly the same way as video cases station in the national examination so you know that if you are routinely getting a pass mark in the Library then you would be able to pass the national examination. If you know what's in the Library, then you know what someone who's BSE Level 1 accredited can tell you, what pictures they've taken, what measurements they've made, what level of interpretation they might be able to make."*

Dr Jen Gosling, Consultant in Intensive Care Medicine and Anaesthesia at King's College Hospital NHS Foundation Trust, who played an instrumental role in the development of this resource, hopes the Level 1 Library will have a positive impact on those across the emergency echocardiography field and improve patient care:

"We hope that everybody who's involved in emergency echo in some way will benefit from it, people from critical care medicine, anaesthetics, acute medicine, emergency medicine, potentially pre-hospital as well as those training individuals from specialties including physiology, clinical science backgrounds and cardiology. The Library might be useful for practitioners training echocardiographers in Level 1 Accreditation. Ultimately, we hope that the people who will benefit from it will be patients."

The resource has received effusive praise from other echocardiography experts. Dr Liam Ring, Consultant Cardiologist at West Suffolk NHS Foundation Trust and BSE Trustee said: *"We have to thank Dr Richard Fisher and Dr Jen Gosling for creating this. It is a phenomenal piece of work, an amazing educational resource. It's super intuitive and I hope you guys are going to love it and we thank them greatly for their work."*

Fig 1. Level 1 Library

In turn, we have had some very promising feedback from users. One emergency medicine (EM) consultant said: *"We used the L1 video Library for our EM SpR teaching yesterday - they found it really useful and I'm going to build it in to echo teaching from now on. I will go ahead and get the 150 cases package. I love the case mix - really useful for acute and emergency medicine."*

Mr Michâel Purdon, Head of Cardiac Investigations for North West Anglia NHS Foundation Trust, said he thought that the resource was outstanding, and had immediately shared it with his emergency care colleagues, along with all the echocardiographers on his team who will recommend it as a training tool.

Ms Grace Ward, Senior Cardiac Physiologist at Midlands Regional Hospital Portlaoise, commented *"The BSE Level 1 Library is an exceptional learning hub, offering exposure to the challenging everyday cases we encounter in practice – but may struggle to find during training. From effusions to reduced ventricular function, the use of video cases with clinical background builds confidence by demonstrating a structured decision-making process that rapidly sharpens reporting skills. The detailed explanations following each reported case complement and reinforce the learning process."*

"As an experienced physiologist, I found myself genuinely enjoying the resource – appreciating it as an effective educational experience."

The BSE would like to thank Dr Richard Fisher and Dr Jennifer Gosling for their tireless work on this project and King's College Hospital NHS Foundation Trust for their collaboration.

We strongly encourage emergency echocardiography professionals to engage with this groundbreaking new resource. Please share any comments or feedback by emailing events@bsecho.org.

You can access the Level 1 Library at bsecho.org/L1-library

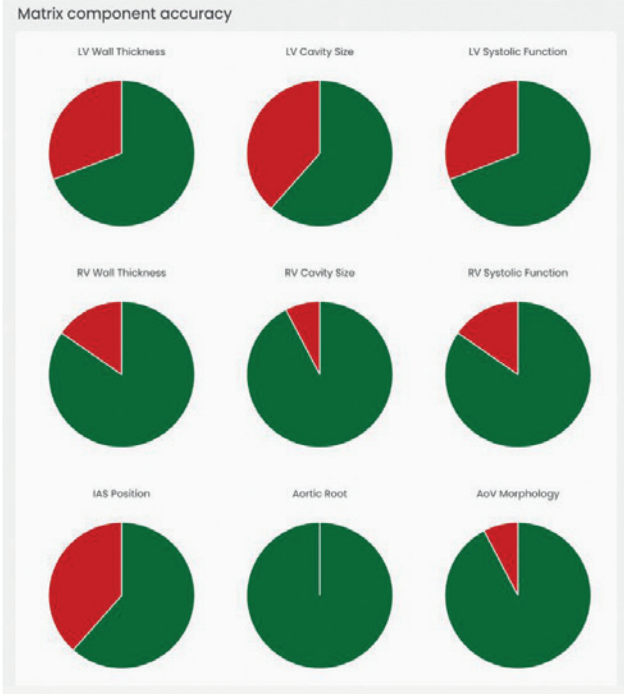


Fig 2. Accuracy charts

Reference

1. Fisher R, Zayan A, Gosling J, Ramos J, Mahmoud Nasr, Garry D, et al. Serial image interpretation tasks improve accuracy and increase confidence in Level 1 echocardiography reporting: a pilot study. Echo Research and Practice. 2023 Apr 6;10(1).

Influencing for change:
Proposed new echocardiographer profiles

JUDE SKIPPER
ON BEHALF OF THE BSE WORKFORCE COMMITTEE

Jude Skipper

Agenda for Change was introduced in October 2004 to provide a unified grading and pay structure for non-medical jobs in the NHS.

When the NHS was established in 1948, it adopted the Whitley system, which was used in the civil service and local government. In 1997 an eleven-year-long landmark legal case for equal pay in the NHS, decided that the pay of speech therapists, mostly women, was of equal value to higher paid clinical psychologists, mostly men. The differences in pay were because the two groups bargained separately under the Whitley system.

Negotiations on a new system began in February 1999, when the White Paper Agenda for Change (AfC) was published. It aimed to address the issues of the Whitley system, and highlighted the need for a change of pay, career structure and terms and conditions of employment within the NHS. It stated that any new pay system must deliver equal pay for work of equal value.

The AfC system allocates posts to set pay bands by giving consideration to various aspects of the job, such as the skill involved, under an NHS Job Evaluation Scheme. A set of job profiles based on information from job descriptions, person specifications and additional information were agreed to assist in the process of matching posts to pay bands. All non-medical posts are either matched to a national job profile, or the job is evaluated locally. AfC is designed to evaluate the job rather than the person in it, and ensure equity between similar posts in different areas.

Echocardiographers fall under the occupational group of Healthcare Science (HCS). While other occupational groups have profession specific NHS Employers job profiles (e.g. under AHPs there are profiles for fifteen separate professions including Radiography, Physiotherapy and Occupational Therapy), the generic HCS profile descriptors used by NHS Employers are historic and orientated towards Biomedical Science. Consequently, the profiles in use today have not kept up with the developing job roles of a Healthcare Scientist, particularly in Echocardiography, that have evolved over time.

Our workforce surveys show that many of our members feel capped at a band 7 level although many undertake roles that have band 8a profiles in other occupational groups.

The BSE strongly believes that updating the NHS job profiles that sit within Healthcare Science to include specific Echocardiographer profiles will provide opportunities for recruitment and retention and recognise the bespoke and pivotal role that our members undertake.

It is the responsibility of the Job Evaluation Group (JEG) to manage and maintain the national job profiles. JEG is a subgroup of the NHS Staff Council and consists of representatives from NHS trade unions and NHS organisations, including NHS Employers. JEG has an ongoing commitment to review and refresh national profiles where necessary to ensure they are up-to-date and fit for purpose.

JEG can accept requests for new national profiles from professional or other bodies representing occupational groups and therefore the BSE has submitted a group of proposed Echocardiography profiles (including 8a profiles) to JEG, including evidence to support our request, example job descriptions for each role and details of the impact that the lack of specific profiles is having on our workforce.

At time of writing our request has been acknowledged and will be reviewed by JEG at their next profile sub-group meeting, which are held monthly. They will let us know an outcome once all our submitted evidence has been considered.

We will keep you updated with the progress!

STP equivalence mentor opportunities

Are you:

- A current BSE member?
- BSE level 2 accredited?
- Someone who's successfully completed STP equivalence via the AHCS?
- Keen to support colleagues and contribute to workforce development?

We need you!

Our new STP equivalence buddy programme will pair members undertaking equivalence with an arms-length peer-support mentor who has already been through the process and can offer guidance when needed.

Find out more at bsecho.org/STPMentor

Loeffler's Endocarditis Critical Case

MR NUNO GUEDELHA, *CHIEF CARDIAC PHYSIOLOGIST, PETERBOROUGH CITY HOSPITAL, NORTH WEST ANGLIA TRUST*

Mr Nuno Guedelha

Introduction

Loeffler's endocarditis, also known as eosinophilic endomyocardial disease or eosinophilic endocarditis, is a rare form of restrictive cardiomyopathy occurring in the setting of persistent eosinophilia.[1,2,3,4] First described by Wilhelm Loeffler in 1936, this condition is characterised by eosinophilic infiltration of the myocardium, followed by myocardial necrosis, mural thrombus formation, and ultimately endomyocardial fibrosis.[1,2,3,5]

The disease is often part of the hypereosinophilic syndromes (HES), which encompass idiopathic, primary (clonal), and secondary causes of eosinophilia. An example of HES is eosinophilic leukaemia, which will be the discussed cause in this clinical review. These syndromes are rare with an incidence of around 0.36 to 6.3 per 100,000 patients. However, cardiac involvement occurs in approximately half of HES cases and is a major contributor to morbidity and mortality.[1,3,4] Clinically, Loeffler endocarditis may present in its early (necrotic) stage with non-specific symptoms, progressing over time through thrombotic to fibrotic stages. The fibrotic stage is associated with restrictive physiology, ventricular filling impairment, possible valve involvement, and risk of systemic thromboembolism[1,2,3]

Early recognition is challenging due to the rarity of the disease, the heterogeneity of presentations, and the possibility of asymptomatic stages. Multimodal imaging (including echocardiography and cardiac magnetic resonance imaging) and histopathology remain central to diagnosis.[2,3,4,5] Treatment typically involves immunosuppression (often corticosteroids), management of complications such as thrombus formation, and in some cases surgical intervention. Outcomes are better when therapy is initiated before irreversible fibrosis.

Case Report

A 51-year-old male patient followed up by haematology for investigation of leucocytosis, primarily eosinophilia. This first appointment occurred in December 2024.

In August 2025, the patient mentioned shortness of breath on exertion. Investigations revealed mild emphysematous changes and mild interstitial lung changes, for which he was reviewed by the respiratory team. Blood results at this time showed eosinophilia with mild anaemia. The blood tests also revealed a raised N-terminal pro-B-type natriuretic peptide (proBNP) of 1000pg/mL, which has triggered a transthoracic echocardiogram (TTE) follow up as an outpatient with the initial suspicion of eosinophilic myocarditis.

The TTE was scheduled for September 2025 but, before it could be performed, the patient presented to the Emergency Department (ED) reporting "feeling extremely unwell" with symptoms including "pounding headache", blurred vision, numbness in his right hand and worsening shortness of breath. This occurred within three weeks of symptom onset. A no-contrast CT head scan immediately prior to admission showed no significant changes, ruling out ischaemic cerebral event. At the time of admission, he was noted to be hypertensive (BP 150/100mmHg) and tachycardic (HR 100bpm). At the time of admission there was suspicion of eosinophilic leukaemia, which was later confirmed by bone marrow biopsy. New findings of kidney failure were also present. Blood tests during the admission revealed a raised of proBNP to 6000pg/mL alongside raised Troponins of 102. The presentation along with the blood test trend triggered the TTE to be expedited, which was performed within 24 hours from admission.

Initial TTE revealed normal left ventricle (LV) in size and systolic function. There was evidence of impaired diastolic function with elevated filling pressures. Global longitudinal strain was normal. The TTE was unable to rule out intraventricular thrombus or masses due to suboptimal image quality associated with significant near field artifact. The right ventricle (RV) was normal size with impaired function. There was moderate mitral regurgitation due to myxomatous valve disease with mild anterior leaflet prolapse. The tricuspid valve appeared apically displaced (visually) with moderate regurgitation. The TTE was reviewed by a consultant cardiologist who agreed with the findings and raised suspicion of eosinophilic endocarditis, given the impression of excessive biventricular apical thickening without being able to rule out thrombus given the limitations.

These findings triggered a contrast echo, performed the following day. The contrast echo revealed normal LV size and systolic function. There was no evidence of filling defects, ruling out left ventricular masses. The RV was confirmed to be impaired and there was a large filling defect from the mid segment of the ventricular chamber to the apex, compatible with large mass. These findings were in keeping with the differential diagnosis of eosinophilic endocarditis.

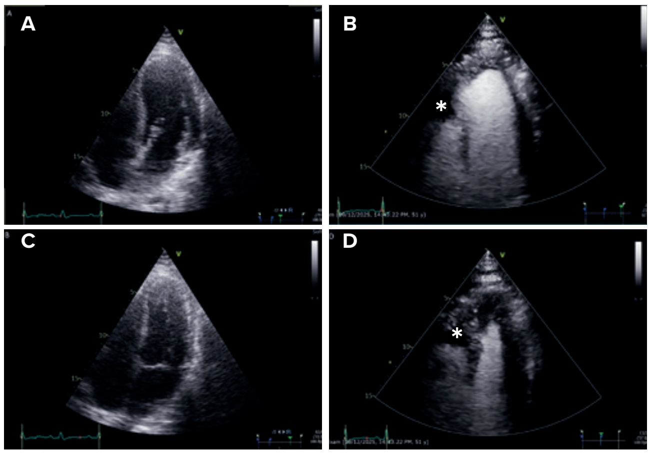


Fig 1. Comparison between initial echocardiogram and contrast echo – **a)** Initial echo apical 4 chamber in diastole; **b)** Contrast echo apical 4 chamber in diastole; **c)** Initial echo apical 4 chamber in systole; **d)** Contrast echo apical 4 chamber in systole; *) filling defect in the right ventricle

The contrast echo results were reviewed by the on-call team at the local tertiary cardiac centre who advised for continued observations at the hospital with likely need for MRI when patient was clinically stable to undergo it.

Within the next 48 hours, the patient deteriorated clinically, becoming "unable to talk due to breathlessness", as was quoted on the patient's notes by the critical care outreach team who reviewed him. It was agreed he should be transferred to the intensive care unit at this point.

Subsequent standard TTE was performed in intensive care. This scan was limited by poor quality images due to the patient's position and inability to cooperate whilst in critical care context. From the limited images it was possible to see a dilatation of the RV and further deterioration of the LV relaxation, with the assessment of the LV inflow showing a E/A ratio of 2.73 (initial TTE 1.45), deceleration time of 132msec (initial TTE 210msec) and a left atrium reservoir strain of 10.7% and contractility strain of 7.7% (22.7% and 8.3% respectively in the initial TTE), suggesting a further deterioration of the diastolic function and left ventricular relaxation and showing signs compatible with restrictive cardiomyopathy. This TTE also showed moderate mitral regurgitation, agreeing with the initial TTE findings.

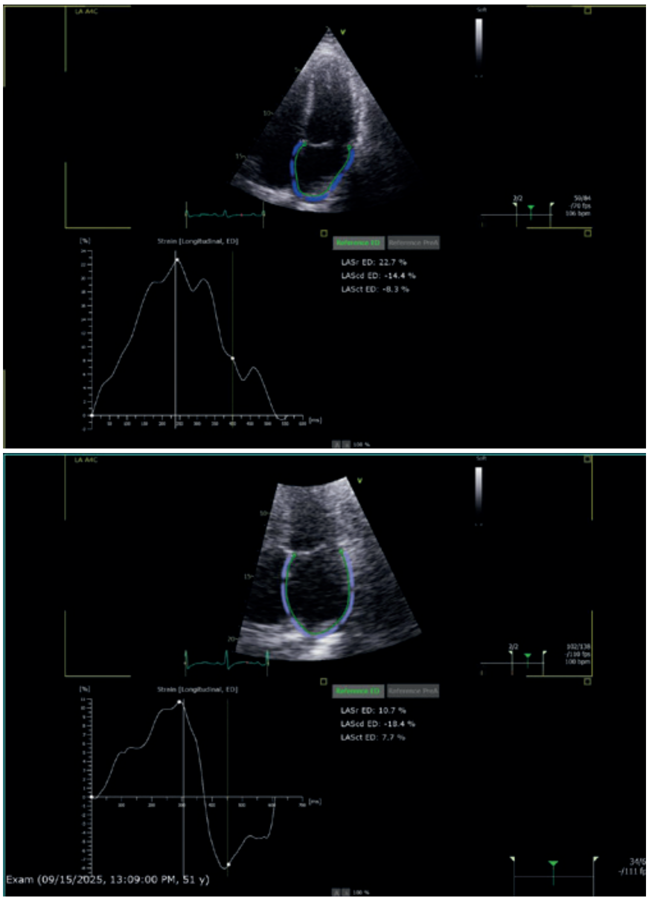


Fig 2. Left atrial strain comparison. At the top – initial echo; at the bottom – repeat echo 4 days later

Some hours after the TTE was performed the patient deteriorated clinically and the decision was made by the critical care consultant to intubate him.

To further assess the concomitant findings of moderate mitral regurgitation, particularly to reassess severity and mechanism, a transoesophageal echocardiogram (TOE) was performed in critical care. The TOE confirmed severe mitral regurgitation, most likely due to a cleft mitral valve—a congenital abnormality unrelated to the patient's primary diagnosis of leukaemia, so to be considered an incidental finding. The LV continued to maintain good contractility.

On the same day, the haematology consultant has indicated an excellent prognosis from the oncology perspective with recommendation for aggressive management of any end organ damage, in this case cardiac management.

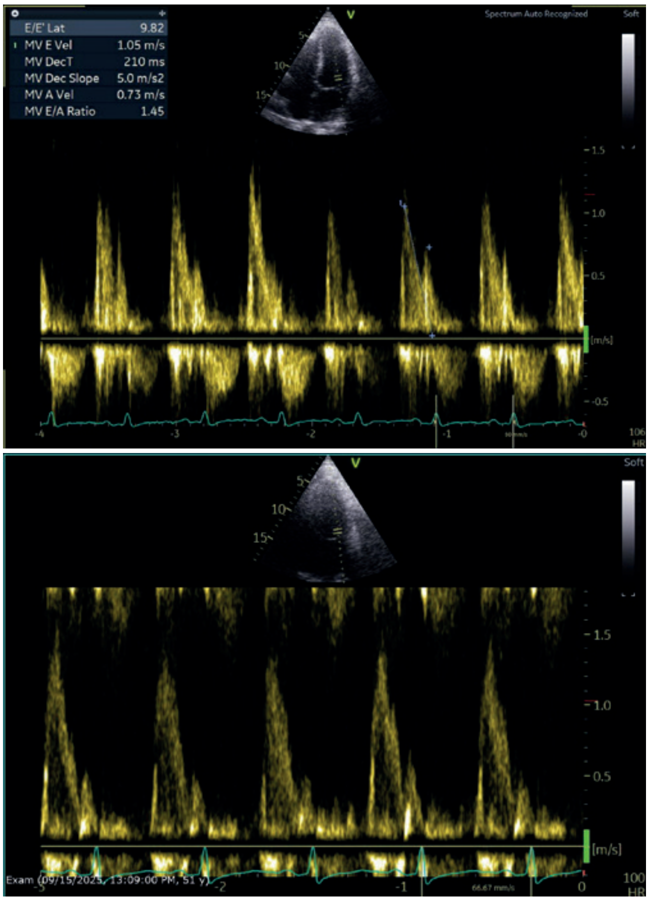


Fig 3. Left ventricle inflow comparison - At the top – initial echo; at the bottom – repeat echo 4 days later

The case was presented the following day at the MDT with the local tertiary cardiac centre for further discussion and management planning. The agreed outcome from the MDT was to perform an ITU-to-ITU transfer with review and potential mitral valve replacement at the tertiary centre.

Within the following five days the patient's condition improved which allowed for him to be extubated. Following extubating, the patient underwent a CT scan which showed mild coronary artery disease, bilateral lower lobe changes and moderate pleural effusion. The reporting radiologist also stated a compatible phenotype with eosinophilic cardiomyopathy with obliteration of the RV inf wall and apex and likely chronic thrombus/fibrosis, corroborating the TTE suspicion.

Fig 4. CT image showing obliteration of the right ventricular apex and likely chronic thrombus.

A cardiac MRI was performed the following day revealing diffuse endocardial enhancement of the right ventricular apex extending to involve RV free wall and RV side of the septum, with a triangular low signal focus in keeping with a thrombus. Endocardial and trabecular enhancement of the LV apex. No convincing atrial enhancement. Overall, based on clinical history, the MRI findings were consistent with hypereosinophilic endomyocardial fibrosis involving both ventricles, more pronounced in the right ventricle, where there is RV apical thrombus formation. The LV showed mild apical involvement.

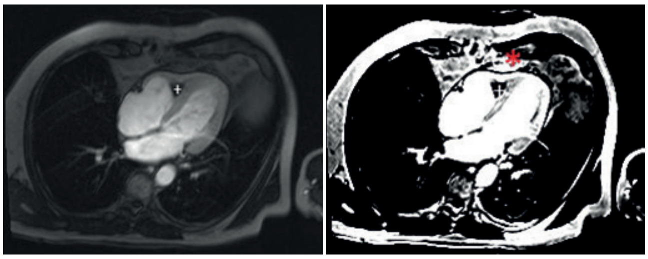


Fig 5. Snapshots from cardiac MRI. *RV apex endocardial enhancement; +Low signal keeping with thrombus

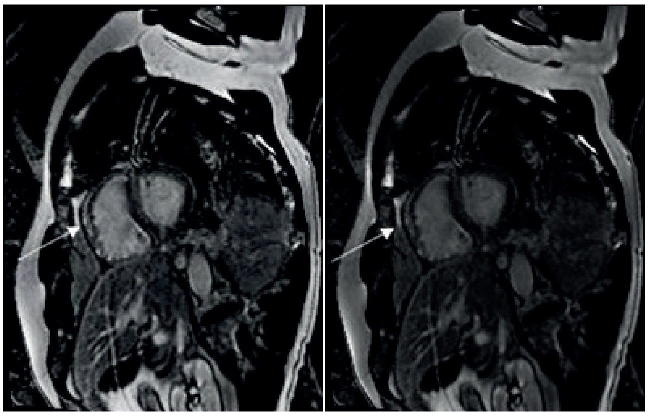


Fig 6. Cardiac MRI images showing late gadolinium enhancement (LGE) seen throughout the right ventricular (RV) free wall (arrow)

With the confirmed diagnosis of Loeffler's endocarditis the priority on the patient's management shifted to treat the underlying eosinophilia with corticosteroid therapy, and managing the heart failure with aggressive diuresis with intravenous furosemide alongside fluid restriction. Anticoagulation was also started given the RV thrombus, and continued post discharge as a preventive measure. Ongoing plan also includes reassessment of the degree of valvular regurgitation after stabilization of the acute heart failure.

Discussion

Eosinophilic leukaemia is a rare haematological malignancy characterised by sustained eosinophilia and tissue infiltration leading to multi-organ damage. Cardiac involvement represents one of the most serious complications, as eosinophilic infiltration can progress to endomyocardial fibrosis and restrictive cardiomyopathy, known collectively as Loeffler's endocarditis. Early recognition is crucial, as timely intervention can prevent irreversible myocardial damage and improve prognosis.

In this case, the patient's presentation with new-onset dyspnoea prompted cardiac evaluation with transthoracic echocardiography. The TTE provided the first clue toward an eosinophilic cardiac process, demonstrating features suggestive of endocardial thickening and possible mural thrombus of the right ventricle. This investigation was pivotal in guiding further work-up and expediting referral to a specialist centre. Cardiac MRI subsequently confirmed the diagnosis, highlighting the complementary role of multimodal imaging in establishing Loeffler's endocarditis.

Although Loeffler's endocarditis is uncommon, it should remain a differential diagnosis in patients with unexplained heart failure and known eosinophilia. The condition evolves through three overlapping stages (acute necrotic, thrombotic, and fibrotic) and may be under-recognized until advanced disease occurs. Reported literature emphasises that prompt initiation of corticosteroids and targeted therapy against the underlying eosinophilic disorder can halt progression and, in some cases, partially reverse cardiac dysfunction.

Conclusion

This case reinforces the importance of maintaining a high index of suspicion for eosinophilic cardiac involvement in patients with hypereosinophilic syndromes or eosinophilic leukaemia. It also underlines the central role of echocardiography as an initial, accessible, and non-invasive diagnostic tool, which can direct patients rapidly toward the correct management. This case also outlines how echocardiography was essential in the follow up of the patient raising the early suspicion of clinical deterioration.

Early detection through echocardiography and subsequent confirmation with cardiac MRI enabled timely treatment in this case, leading to a favourable clinical outcome.

References

1. Sohail A Hassan, MD, *Loeffler Endocarditis.* Medscape. 2020.
2. Mubarik A, Iqbal AM. *Loeffler Endocarditis.* StatPearls. 2024. NCBI
3. Su S, Liang L, Lü L, Wan Z. "In-Depth Review of Loeffler Endocarditis: What Have We Learned ..." *PMCID*. 2024. PMC
4. Gao M, et al. "Loeffler endocarditis as a rare cause of heart failure ..." *Medicine.* 2018. Lippincott Journals
5. Zhang Q, Si D, Zhang Z, et al. "Loeffler endocarditis with intracardiac thrombus: case report and literature review." *BMC Cardiovascular Disorders,* 2021. BioMed Central

BSE Members Resource Hub Update 2026

PROF. MARTIN STOUT, DR. KELLY VICTOR, MS DAWN BRADY
ON BEHALF OF THE MEMBERSHIP RESOURCES COMMITTEE

British Society of Echocardiography

Sometimes and quite rightly, a lot of our time during the working day is taken up by the excellent care we deliver to our patients. After all, we are a highly skilled, talented and dedicated workforce of Echocardiographers. We do however, need time to develop ourselves and the teams we work in, improve our health and wellbeing particularly when there is so much demand on our skills and expertise, initiate new ways of working, develop novel and high level roles for Echocardiographers, engage in research and audit, and also keep our services at the forefront of current guidance or novel ways of working. Fitting this into such busy schedules can be difficult and often overwhelming leaving many of us just piling up an increasing amount of 'to do' notes.

Thankfully, the BSE are here to help. The development of the Members Resource Hub by the Membership Resource Committee back in 2023 has allowed our members to upload so much useful information so that we can get a much-needed head start on some of these tasks that previously just seemed ominous. To say this Resource Hub has had impact is an understatement. The engagement figures below prove this point. Since its inception we now have sufficient material to categorise into six important areas:

1. Workforce
2. Wellbeing
3. Publications
4. Clinical Guidance
5. Service Development
6. Templates and Examples

Within these Resource Hub sections, not only will you find great examples of how others have managed to develop things like organisation charts, create effective audit material, write detailed job descriptors for a variety of Echo related roles and more, but also a one-stop point for our new guidelines, posters, educational material and excerpts from ECHO. No longer do we need to spend time staring blankly at our computer screens not knowing where to look or start – we have it all right there in one repository.

Dawn Brady, our Membership Officer, together with Dr Kelly Victor, the previous Chair of Membership Resources and now Co-chair of Education, are no doubt known to most, if not all,

Fig 1. Summary of Resource Hub Engagement Metrics.

of our membership. Perhaps less known to you all are the voluntary members of the Membership Resources Committee who have played a pivotal role alongside Dawn and Kelly. I would like to congratulate and thank them all for their tireless work in getting this resource off the ground and continually pushing for content to assist our membership. There is no doubt that they have successfully achieved the initial objective which was to build a comprehensive collection of templates, tools and resources to save you time. This hub really does demonstrate the expression – 'there is no need to reinvent the wheel'.

As usual, I wouldn't be Martin without asking something from you all. Please do engage with the Hub. You will find so much useful content. Even if you use example templates as a starting point for your own work or just can't find a particular article, clinical discussion or guideline then this is the place for you to go. Of course, if you have any useful documents that would fit into the categories mentioned earlier then please do submit them to Dawn or myself. We would be most grateful for as much content as you all can provide, remember whatever you provide is going to help the wider Echo community and we are so good at looking after each other. With your help, we will continue to expand the Resource Hub. Please look out for new and updated sections such as the soon to come Career Development.

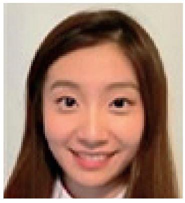
Our aims continue to grow. We understand that Echocardiographers come from diverse backgrounds and are truly multi-disciplinary. Echo in itself has diversified so much since its inception with multiple techniques in multiple environments and therefore, such variety in the patients we deliver our services to. We have to adapt our ways of working to accommodate this and the Resource Hub is the place to access the information you need to keep abreast of it all. As our field continues to grow and diversify, I hope you will be able to utilise the resources we provide to ensure you don't have to reinvent the wheel. Contact us at membership@bsecho.org

Minimally Invasive Resection of Left Atrial Myxoma using Endoscopic Technique - A Case Report

MARLENE MONTEIRO;[1] ZHAOYI MENG;[1] DR. KELLY VICTOR;[1] MR RANJIT DESHPANDE;[1] MR MAX BAGHAI[1]

[1]HEART, VASCULAR ANDTHORACIC INSTITUTE, CLEVELAND CLINIC LONDON, UNITED KINGDOM

Marlene Monteiro



Zhaoyi Meng

Dr. Kelly Victor

Mr Ranjit Deshpande

Mr Max Baghai

Introduction

Left atrial myxomas are benign cardiac tumours that require surgical resection.[1,2] Traditional surgical approaches, while effective, are associated with increased postoperative morbidity. Additionally, due to frailty, a portion of patients may be considered ineligible for traditional surgical approaches. Following analysis of 82 patients undergoing surgical resection of atrial myxoma, Vroom and colleagues reported that half of the population developed postoperative atrial fibrillation (AF), six percent of the population required pacemaker implantation, and one to two percent of the patients developed neurological complications post operatively.[3] Reoperation due to mediastinitis or cardiac tamponade was also observed in previous literature.[3,4] Minimally invasive techniques have emerged as a promising alternative to reduce surgical trauma leading to a faster recovery as well as improving availability to those patients once considered unsuitable for traditional resection.[5]

Case Presentation

A 46-year-old female with a recent diagnosis of breast cancer presented to our institution for a formal surgical review after an incidental finding of an atrial mass (?Myxoma) on a pre-chemo transthoracic echocardiogram (TTE). Baseline TTE revealed a large, echo-dense, left atrial mass of at least 4cm attaching to the interatrial septum via a peduncle. The mass was mobile with no evidence of obstruction to diastolic filling of the left ventricle. This appearance was consistent with atrial myxoma (Figure. 1A - D). Clinically, the patient was well with no cardiovascular symptoms. Physical examination revealed no peripheral oedema, or signs of congestion, and normal heart sounds with no audible murmur or diastolic plop. The electrocardiogram showed sinus rhythm (HR 81bpm). Her blood pressure was 117/66mmHg, and her height and weight were 159cm and 55kg respectively. Further workup, including transoesophageal echocardiogram (TOE) (Figure. 2A - C) and computed tomography (CT) angiography (Figure. 3A-B) further supported the diagnosis. Multidisciplinary team meeting confirmed suitability for endoscopic excision which aligned with patient wishes.

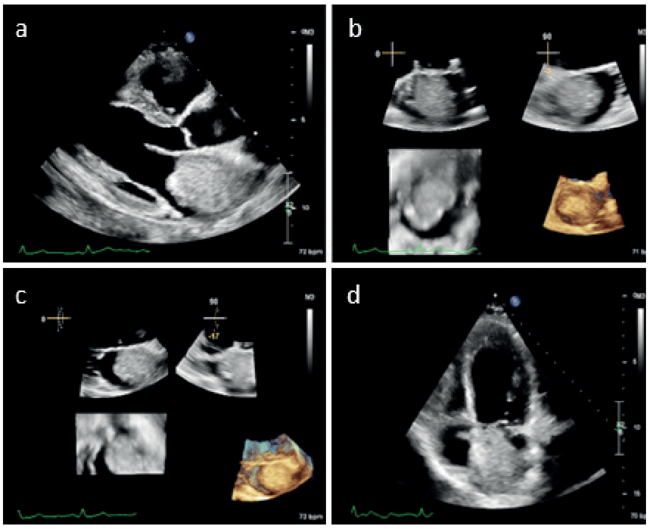


Fig 1. Transthoracic echocardiography images. **A)** Parasternal long axis view with a large echo density in the left atrium suggestive of a myxoma. **B)** Three-dimensional (3D) view of the myxoma in the parasternal short axis view combined with orthogonal view. **C)** Parasternal long axis view 3D view of the myxoma in the left atrium combined with orthogonal view. **D)** Apical 4 chamber view of the myxoma in the left atrium.

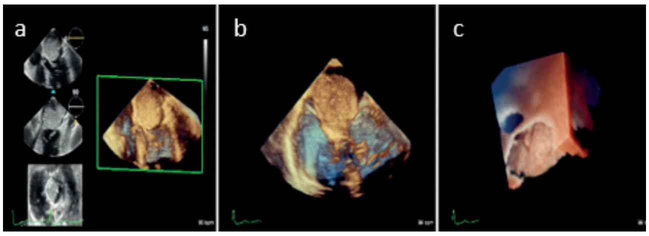


Fig 2. Transoesophageal echocardiography images. **A)** Midoesophageal 0-degree view of the mass **B)** Midoesophageal 0 degrees 3D view of the mass **C)** Midoesophageal 4-chamber 3D True View cropped looking at the myxoma peduncle.

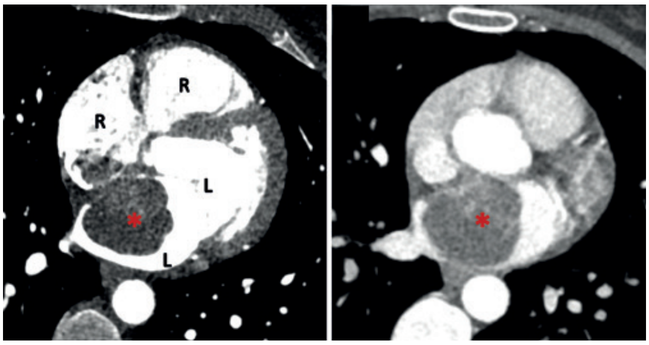


Fig 3. A and B) Computed tomography (CT) cardiac images. Contrast enhanced axial CT scan showing inferior enhancement of the mass occupying most of the left atrium volume in keeping with myxoma. Red asterisk indicates the mass in the left atrium.

General anaesthesia was commenced, and cardiopulmonary bypass was established via left femoral artery, left femoral vein and right jugular vein. The heart was approached via a small incision at the right 4th thoracotomy space using endoscopic technique.

The left atrium was carefully opened and the myxoma visualised (Figure. 4A). An endo catch bag was inserted into the left atrium through the trocar cannula (Figure. 4A). The bag was opened by pushing the transparent handle. The myxoma was captured into the bag with a grasper prior to detachment from the fossa ovale (Figure. 4B/C). The bag was closed completely and pulled back (Figure. 4C). A patent foramen ovale was identified and

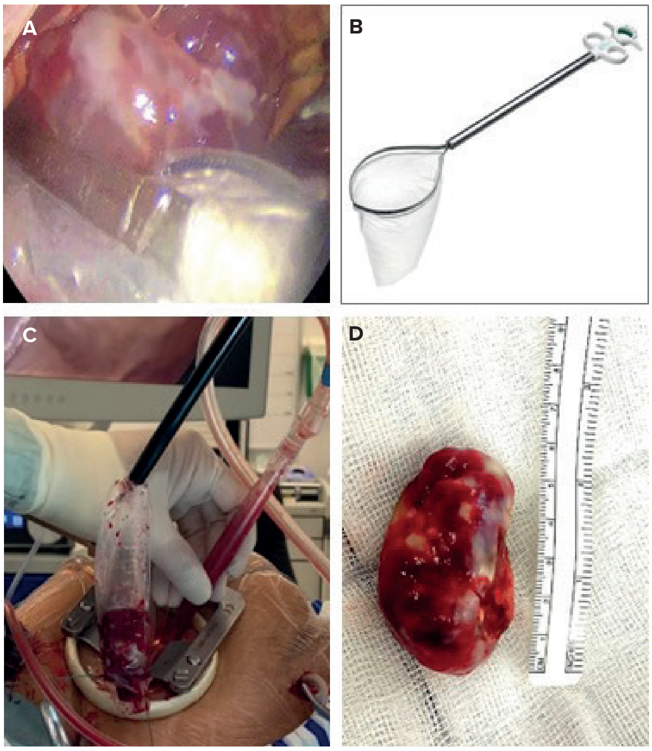


Fig 4. A) Endo Catch Bag Specimen Pouch inserted. **B)** Endo Catch Bag Specimen Pouch. Figure adapted from wholesale medical supplies images provided by https://www.ciamedical.com/covidien-173050g-endo-catch-gold-10-mm-specimen-pouch-6-bx. **C)** Myxoma inside the endo catch bag after it was pulled back. **D)** Myxoma size.

closed with 4/0 prolene and CorMatrix patch. The heart was de-aired via the root. CPB was weaned with the patient in sinus rhythm, requiring no inotropic support. Two chest drains were placed prior to routine closure. The excised mass was sent for histology (Figure. 4D).

The patient's postoperative course was uneventful, with no complications during her hospital stay. One day post op, the thoracic and pericardial drains were removed. Echocardiography confirmed complete resection of the myxoma.

The patient was discharged on the third postoperative day. The histology report confirmed the features were consistent with benign myxoma. No evidence of malignancy.

Discussion

The introduction of the Endo Catch bag technique in minimally invasive video-assisted cardiac surgery represents a significant advancement in the management of myxomas.[6]

Traditional sternotomy surgery for myxoma resection,[2] while effective, carries risks such as prolonged recovery time, greater surgical trauma, higher postoperative morbidity[4] and increased chances of complications like infection and embolization due to tumour fragmentation.

The Endo Catch bag technique addresses these concerns by enabling the complete and intact removal of the myxoma through a minimally invasive approach. By using a specimen retrieval device to encapsulate the tumour, the risk of cell dissemination or fragmentation is markedly reduced. This is particularly important in preventing embolization.

In this case, the patient was discharged after only three days, following a successful minimally invasive surgical approach which importantly aligned with patient preference.

It is the opinion of the authors that the utilisation of an Endo Catch bag provided further protection by ensuring the contents of the specimen remained contained on removal. However, it also opens up the discussion for further research into the long-term outcomes of patients treated with this technique and its applicability to other types or cardiac tumours and conditions improving patient safety and outcomes.

The Endo Catch bag technique represents a promising development in the journey for less invasive, yet highly effective surgical solutions.

Statement of Consent

Direct written consent was obtained by the patient for this manuscript in accordance with the Committee on Publication Ethics (COPE) guideline.

References

1. Hung LW, Lee CY, Hii HP, Wu NC, Cheng BC. Robot-assisted endoscopic removal of a huge tricuspid valve myxoma: case report. Journal of Cardiothoracic Surgery. 2022 Oct 6;17(1):258.
2. Lyon AR, López-Fernández T, Couch LS, Asteggiano R, Aznar MC, Bergler-Klein J, Boriani G, Cardinale D, Cordoba R, Cosyns B, Cutter DJ. 2022 ESC Guidelines on cardio-oncology developed in collaboration with the European Hematology Association (EHA), the European Society for Therapeutic Radiology and Oncology (ESTRO) and the International Cardio-Oncology Society (IC-OS) Developed by the task force on cardio-oncology of the European Society of Cardiology (ESC). European Heart Journal-Cardiovascular Imaging. 2022 Oct 1;23(10):e333-465.
3. Vroomen M, Houthuizen P, Khamooshian A, Soliman Hamad MA, van Straten AH. Long-term follow-up of 82 patients after surgical excision of atrial myxomas. Interactive cardiovascular and thoracic surgery. 2015 Aug 1;21(2):183-8.
4. Lee HP, Cho WC, Kim JB, Jung SH, Choo SJ, Chung CH, Lee JW. Surgical outcomes of cardiac myxoma: right minithoracotomy approach versus median sternotomy approach. The Korean journal of thoracic and cardiovascular surgery. 2016 Oct;49(5):356.
5. Hoang NN, Cong HN, Thuy NT, Van TH, Do Duc T, Thanh HN, Thanh DP, Le Ngoc T, Huu UN. Totally endoscopic resection of atrial myxoma: early results of 26 patients in E hospital. Tạp chí Phẫu thuật Tim mạch và Lồng ngực Việt Nam. 2021 Jul 26;33:38-43.
6. Panos A, Myers PO. Video-assisted cardiac myxoma resection: basket technique for complete and safe removal from the heart. The Annals of thoracic surgery. 2012 Apr 1;93(4):e109-10.

Quality assurance audit assessing left ventricular dimensions for reproducibility in echocardiography

Helen Ghebremedhin

HELEN GHEBREMEDHIN, *ECHO TRAINEE PHYSIOLOGIST, CENTRE IS EPSOM AND ST HELIER UNIVERSITY HOSPITAL NHS TRUST*

Introduction

Echocardiography plays an important role in the diagnosis and assessment of cardiovascular disease. Additionally, data obtained from echocardiography are used to evaluate the severity of the illness, monitor its progression over time, and assist in choosing the most effective treatment plan. The reliability, repeatability, and reproducibility of echocardiogram measurements are therefore clinically important.[1,2,3] Echocardiography is important for guiding treatment and improving patient outcomes, making strict quality assurance protocols necessary to ensure accurate and consistent results.[4,5] Echocardiogram results are reliable when accuracy and consistency are prioritised through strict Quality Assurance (QA) procedures. Thus, trust between patients and healthcare providers increases, enhancing patient care. As a result, maintaining high standards is not just a goal but also essential. Maintaining high standards is essential to cardiovascular medicine because it strengthens the validity of research findings, encourages inter-institution benchmarking, and forms the basis of quality.[6,7] Furthermore, the British Society of Echocardiography (BSE) highlights the significance of measurements, providing thorough instructions to standardise echocardiograms, thereby improving their dependability. Furthermore, the BSE's minimum dataset promotes effective communication between healthcare providers and ensures reliable and superior treatment for patients.

Inter/Intra Operator Reliability Testing

The precision of echocardiographic measurements relies on inter- and intra-operator reliability. Intra-operator reliability assesses consistency in repeated measurements by the same operator under similar conditions, often quantified using the Intraclass Correlation Coefficient (ICC), which indicates high reliability with a strong ICC or variability with a low ICC.[8] Intra reliability testing evaluates the consistency of a single rater's data recording across several trials. This is employed to ascertain whether a diagnostic test is valid. The same operator performs several assessments and consistency across tests is ensured by using a standardised set of patients for measurements. The BSE standard dataset is used to record left ventricular linear metrics, including inter-ventricular septal thickness in diastole (IVSd), left ventricular internal diameter in diastole (LVIDd), and left ventricular posterior wall in diastole (LVPW) to evaluate each operator's performance.

On the other hand, inter-operator reliability evaluates consistency across different operators, ensuring reproducibility in clinical and research settings.[9] High inter-operator reliability minimises personal bias, validates findings,[10, 11] and standardises results across observers. The ICC is also used here to measure agreement in continuous data. Inter-rater reliability (IRR), which is essential in studies with multiple raters, ensures consistency across data collection - though achieving high IRR can be challenging. Identifying factors affecting rater consistency helps improve reliability and data accuracy.

Six echocardiographers in this instance took part in the testing. The echocardiography team involved represented a range of backgrounds, abilities, and specialities. A standardised group of patients is used for measurements, guaranteeing consistency between testings. To capture left ventricular linear metrics, such as IVSd, LVPWd, and LVIDd, echocardiographic assessments were performed on the designated patients using the BSE standard dataset. Each operator recorded their accurate measurements separately for further analysis. Additionally, the image and the cardiac cycle are selected and used for the control measurement.

Audit Methodology

The process of conducting a thorough audit in echocardiography to evaluate inter- and intra-operator reliability; this overview outlines the crucial procedures, approaches, and standards necessary for a thorough assessment.

Objective Definition

The aim of the audit is to evaluate the intra- and inter-operator reliability of echocardiogram measurements. To assess six patients' left ventricular (LV) linear parameters: Interventricular septal end diastole (IVSd), left ventricular internal diameter end diastole (LVIDd), left ventricular posterior wall end diastole (LVPWd), and left ventricular internal diameter end-systole (LVIDs).

Operator Selection

Operators are trained echocardiographers with BSE accreditation who have a range of clinical backgrounds and experience at different levels.

Patient Selection

Six patients with different heart conditions were chosen randomly. Ensuring proper representation of different age groups, genders, and disorders was crucial. Additionally, patients' conditions or image quality for a comprehensive echocardiogram had to be verified.

Data Collection Methods

Every operator is required to use the same echocardiography methodology, which ought to be founded on accepted standards (such as the BSE minimum dataset). The patients were selected based on relevant data from our earlier investigation, which included patient demographics, clinical history, and imaging conditions.

Inter-Operator Reliability Assessment

Each operator measurement is compared with the group mean, upper limit, and lower limit of 5%.

Intra-Operator Reliability Assessment

Comparing the overall mean measurement to the consistency of measurements made by the same operator is the assessment process.

Statistical Analysis

The objective was to determine whether the technicians' measurements coincided by 5%. The data processing method included comparing the echocardiographers' measurements for each parameter. In addition to assessing the degree of agreement, the audit calculated the percentage divergence.

Results and Analysis

This audit aimed to investigate LVIDs, LVPWd, and IVSd accuracy and reproducibility. The results are shown and explained below.

Identifying differences between intra- and inter-operator readings is essential to ensure the accuracy and consistency of echocardiography methods. Inter-operator variability refers to the variations in measurements taken by several operators evaluating the same patients, intra-operator variability describes discrepancies in measurements made by the same operator on different occasions. Bland-Altman plots and other statistical studies are used to assess bias and identify outliers, providing a visual representation of disparities in measurements. Agreement levels are evaluated using the Intraclass Correlation Coefficient (ICC); values greater than 0.75 signify strong reliability. Furthermore, mean and standard deviation aid in measuring the variability between repeated measurements. These disparities can significantly impact on clinical judgement and patient care, making it essential to examine them careful.

The mean value for each measurement (IVSd, LVPWd, LVIDd) was determined for every operator. Each echocardiographer's measurement was then examined to see if it was within ±5% of the mean. If so, the measurement is regarded as uniform. Strong dependability in the measures across operators and patients was indicated by the majority of values being within the allowed 5% range of the mean. Notably, there were a few rare cases of readings that were outside of the allowed range, even though the majority of the numbers were within it. In metrics with greater variability, such as LVIdD, these disparities were more prevalent. In PT (Patient) A, with very minor exceptions, measurements in all dimensions were mostly within the acceptable range. In PT B, LVPWd and IVS demonstrated high dependability. A small number of LVIdD readings, meanwhile, came close to or surpassed the 5% cutoff. With sporadic variations, especially in LVIdD, the results of PT C (IVSD, LVIdD, and LVPWd) were generally consistent. PT D (IVSD, LVIdD, LVPWd) showed strong agreement in general, but LVPWd varied a little more than the other parameters. For PT E (IVSD, LVIdD, LVPWd), measurements were mostly within range, with only a few minor outliers observed in IVSD. On the other hand, all measurements for PT F (IVSD, LVIdD, and LVPWd) fall within the range. The standard deviation for each parameter was comparatively low across all patient groups, indicating low operator variability. To determine the acceptable ±5% range, mean values for each parameter were computed and used as a benchmark for comparison. Patterns of variability in larger measurement parameters, such as LVIdD, showed more variability because of their wider acceptable range (±5% of the mean).

Overall, within intra-operator reliability testing, the operator performed well, exhibiting low variability across the majority of patients and strengths in measuring IVSD and LVPWd. Notably, PT F readings showed remarkable precision and were very consistent across all dimensions. The measurement of LVIdD, where variability was greatest, presented difficulties, especially for PT B (SD = 0.3880) and PT D (SD = 0.2965). This raises the possibility of handling greater size with difficulty, which could be brought on by patient-specific circumstances or inconsistent technique. The highest overall variability was seen in PT B, suggesting that additional investigation is necessary to determine the underlying components. The operator should focus on standardising procedures for LVIdD measurements to improve, especially for patients with complex anatomy, and ensure that the probe is positioned and calibrated consistently. Frequent performance assessments and targeted training will help address these problems while highlighting the operator's capabilities in IVSD and LVPWd measures.

Conclusions and Recommendations for Improvement

This study demonstrates the accuracy and consistency of echocardiographic measures for left ventricular dimensions,

Patient A			
	IVSD	**LVIdD**	**LVPWd**
Operator 1	0.94 within range 0.92225	4.58 within the range of 4.893	4.58 within the range of 4.893
Operator 2	0.84 within-range 0.8344166667	5.02 out of range of 4.893	5.02 out of range of 4.893
Operator 3	0.81 within-range 0.8344166667	4.7 within the range of 4.893	4.7 within the range of 4.893
Operator 4	0.91 within-range 0.92225	4.73 within the range of 4.893	4.73 within the range
Operator 5	0.9 within range 0.92225	4.67 within the range of 4.893	4.67 within the range of 4.893
Operator 6	0.87 within-range 0.92225	4.26 within the range of 4.427	4.26 within the range of 4.427

Patient B			
	IVSD	**LVIdD**	**LVPWd**
Operator 1	0.71 within range within range 0.7536666667	4.4 within range 4.439666667	0.74 within range 0.73625
Operator 2	1.02 within range 0.833	5.01 within range 4.907	0.9 within range 0.81375
Operator 3	0.76 with range 0.7536666667	4.99 within range 4.907	0.7 within range 0.73625
Operator 4	0.7 with range 0.7536666667	4.51 within range 4.907	0.72 within range 0.73625
Operator 5	0.83 within range 0.833	5.02 within range 4.907	0.78 with in-range 0.81375
Operator 6	0.74 with range 0.7536666667	4.11 within range 4.439666667	0.81 within range 0.81375

Patient C			
	IVSD	**LVIdD**	**LVPWd**
Operator 1	0.78 within range 0.7665	4.36 within range 4.211666667	0.64 within range of 0.644
Operator 2	0.73 within range 0.6935	4.58 within range 4.655	0.56 within range of 0.5826666667
Operator 3	0.75 within range 0.7665	4.3 within range 4.211666667	0.63 within range of 0.644
Operator 4	0.77 within range 0.7665	4.53 within range 4.655	0.63 within range of 0.644
Operator 5	0.63 within range 0.6935	4.49 within range 4.655	0.61 within range of 0.644
Operator 6	0.72 within range 0.6935	4.36 within range 4.211666667	0.61 within range of 0.644

Patient D			
	IVSD	**LVIdD**	**LVPWd**
Operator 1	0.88 within range of 0.85225	4.42 within range of 4.5109	4.42 within range of 4.5109
Operator 2	0.81 within the range of 0.85225	5 within the range of 4.98575	5 within the range of 4.98575
Operator 3	0.71 within the range of 0.77108	5 within the range of 4.98575	5 within the range of 4.98575
Operator 4	0.78 within range of 0.77108	4.59 within the range of 4.98575	4.59 within the range of 4.98575
Operator 5	0.92 within the range of 0.85225	4.44 within range of 4.5109	4.44 within the range of 4.5109
Operator 6	0.77 within range of 0.77108	5.04 within range of 4.98575	5.04 within range of 4.98575

Patient E			
	IVSD	**LVIdD**	**LVPWd**
Operator 1	1.13 within range of 1.18475	4.13 within range of 4.168916667	0.99 within range of 0.893
Operator 2	1.1 within range of 1.18475	4.47 within range of 4.60775	1.02 within range of 0.987
Operator 3	1.1 within range of 1.18475	4.46 within range of 4.60775	0.9 within range of 0.987
Operator 4	1.13 within range of 1.18475	4.6 within range of 4.60775	0.8 within range of 0.893
Operator 5	1.06 within range of 1.071916667	4.57 within range of 4.60775	0.92 within range of 0.987
Operator 6	1.25 within range of 1.18475	4.13 within range of 4.168916667	1.01 within range of 0.987

Patient F			
	IVSD	**LVIdD**	**LVPWd**
Operator 1	0.74 within the range of 0.76825	4.37 within the range of 4.191083333	0.67 within the range of 0.6825
Operator 2	0.76 within range of 0.76825	4.44 within the range of 4.63225	0.62 within the range of 0.6175
Operator 3	0.73 within range of 0.76825	4.35 within the range of 4.191083333	0.7 within range of 0.6825
Operator 4	0.79 within range of 0.76825	4.35 within range of 4.191083333	0.68 within the range of 0.6175
Operator 5	0.7 within range of 695083	4.47 within the range of 4.63225	0.61 within the range of 0.6175
Operator 6	0.67 within the range of 695083	4.49 within the range of 4.63225	0.62 within the range of 0.6175

including IVSD, LVIdD, and LVPWd, taking place across many operators. With most measures falling within the acceptable range of ±5% of the mean, the results show the reliability of the echocardiographer's techniques and good inter-operator agreement. There was little measurement variability, as indicated by the comparatively low computed overall standard deviations for each parameter. As demonstrated by the IVSD's overall SD of 0.0260, LVIdD's SD of 0.1084, and LVPWd's SD of 0.0245, most operators carried out measurements with a high degree of precision. The total means also match anticipated physiological values, confirming the techniques' accuracy. Minor variations in certain metrics, however, highlight the necessity of ongoing quality improvement. Accuracy and dependability can be further improved by routinely calibrating equipment, standardising measurement procedures, and providing operator training. Improved patient care outcomes and consistent results can also be achieved by establishing a culture of quality assurance and carrying out frequent intra- and inter-operator audits. In conclusion, echocardiographic measurement is reliable, whilst identifying areas requiring improvement. By addressing these areas, echocardiography departments can maximise their diagnostic accuracy, thereby improving patient outcomes and clinical decision-making. The majority of operators' measurement fell within the permissible range (±5% of the mean), demonstrating strong inter-operator reliability across all patients and parameters (IVSd, LVIDd, and LVPWd). Although there was little variation in some of the parameters, the results show that operators' echocardiogram measures were very consistent overall. Intra- and inter-reliability testing procedures, which ensure the precision and consistency of echocardiographic measurements, form the cornerstone of quality assurance (QA). The goal of the current investigation was to ascertain whether the measurements made by a group of technicians were within a 5% variable range. The results showed that while most of the metrics were within the expected range, some were not. The audit highlights the importance of continuous quality improvement programs for the echocardiography industry. Healthcare professionals can increase the precision and dependability of echocardiographic assessments, which will ultimately lead to better patient care and results, by improving standards, training procedures, and operational procedures.

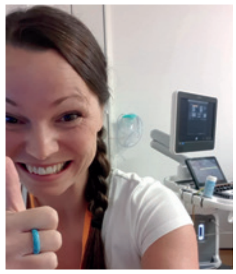
Finally, continuous improvement of echocardiography techniques is necessary to improve the accuracy and reliability of the outcomes. This calls for regular evaluation and improvement of measurement techniques, operator training, and equipment calibration to lessen uncertainty and discrepancies in results. By implementing standard operating procedures and conducting regular audits, echocardiography departments can provide a quality assurance environment that promotes consistent results (Bunting et al., 2019). Furthermore, fostering a culture of continuous learning and feedback among echocardiographers enhances their skills and understanding of best practices, which eventually leads to improved patient care. By focusing on continuous improvement and ensuring accurate results, echocardiography can greatly improve clinical judgment and patient outcomes.

References

1. Robinson, S. et al. (2020) 'A practical guideline for performing a comprehensive transthoracic echocardiogram in adults: The British Society of Echocardiography Minimum Dataset', *Echo Research & Practice,* 7(4). doi:10.1530/erp-20-0026.
2. Otto, C.M., 2007. *'The Practice of Clinical Echocardiography;* Elsevier Health Sciences.
3. Otto, C.M., 2013. *'Textbook of Clinical Echocardiography'.* Elsevier Health Sciences.
4. Skinner, H.J. et al. (2012) 'An investigation into the causes of unexpected intra-operative transoesophageal echocardiography findings*', *Anaesthesia,* 67(4), pp. 355–360. doi:10.1111/j.1365-2044.2011.07022.x.
5. Popescu, B.A. et al. (2009) 'European Association of Echocardiography Recommendations for training, competence, and quality improvement in echocardiography', *European Journal of Echocardiography,* 10(8), pp. 893–905. doi:10.1093/ejechocard/jep151.
6. Cohen, G.I. (2019) 'A practical guide to graphic communication for Quality Assurance, education, and patient care in echocardiography', *Echocardiography,* 36(9), pp. 1747–1754. doi:10.1111/echo.14464.
7. Kossaify, A. (2021) 'Quality Assurance and Improvement Project in Echocardiography Laboratory', *Heart Views,* 22(1), pp. 35–44. doi:10.4103/heartviews.heartviews_112_20.
8. Bunting, K.V. et al. (2019) 'A practical guide to assess the reproducibility of echocardiographic measurements', *Journal of the American Society of Echocardiography,* 32(12), pp. 1505–1515. doi:10.1016/j.echo.2019.08.015.
9. Fox, K.F. and Popescu, B.A. (2011) 'Quality assurance in echocardiography', *Oxford Medicine Online* [Preprint]. doi:10.1093/med/9780199599639.003.0028.
10. Ghilardi, S. et al. (2023) 'A study of the inter- and intra-operator variability on selected echocardiographic measurements in dogs', *Veterinary Research Communications,* 47(4), pp. 2323–2331. doi:10.1007/s11259-023-10154-6.
11. Baron, T. et al. (2019) 'Test–retest reliability of new and conventional echocardiographic parameters of left ventricular systolic function', *Clinical Research in Cardiology,* 108(4), pp. 355–365. doi:10.1007/s00392-018-1363-7.

The importance of routinely using pulsed echo Doppler flowmeter in the assessment of aortic stenosis and the value of face-to-face interactions between echocardiographers and patients.

STACEY MURRAY, *SENIOR ECHOCARDIOGRAPHER. THE GRANGE UNIVERSITY HOSPITAL, ANEURIN BEVAN UNIVERSITY HEALTH BOARD, SOUTH WALES.*



Stacey Murray

Case presentation

A 69-year-old male presented at an outpatient echocardiography clinic for monitoring of his known moderate-to-severe asymptomatic aortic stenosis (AS). His previous echocardiogram, performed eight months earlier, recorded a peak velocity of 4.1 m/s, peak pressure gradient (PPG) 70mmHg, mean pressure gradient (MPG) 43mmHg, aortic valve area (AVA) via continuity velocity time integral (VTI) 1.05cm2 and a dimensionless index (DI) 0.23 in the setting of normal indexed stroke volume (SVi) > 35ml/m2 and left ventricular ejection fraction (LVEF) >55%. The left ventricular outflow tract diameter (LVOTd) measured 2.35cm. The report stated that the patient continues to visit the gym regularly.

The patient's cardiology consultant was considering scheduling an exercise tolerance test if the echocardiogram results remained consistent with those from eight months earlier.

The patient, a former military member and an exceptionally fit individual, frequented the gym daily and reported no symptoms during rest or exercise previously or at the start of the echocardiogram on the day. As a senior cardiac physiologist, I found it hard to reconcile his asymptomatic status with the images of his aortic valve, which appeared heavily calcified and showed limited movement. My experience suggests that patients with such aortic valve characteristics typically exhibit symptoms.

During echocardiograms, we have the advantage of time, allowing us to engage with patients for at least 20 minutes in a personal setting, where they often share valuable insights that can inform our findings.

This patient had not previously undergone pulsed echo Doppler flowmeter (PEDOF) assessment. Using conventional continuous wave Doppler at the apical five-chamber view, I recorded similar parameters to the previous echo with a maximum velocity of 4.1 m/s, PPG 70mmHg, but experience indicated this was likely not the true peak, as the Doppler trace seemed to lacked the expected density and clarity. However, when employing non-image Doppler at the right sternal edge, I obtained a peak velocity of 4.9 m/s in sinus rhythm and 5.1 m/s following a ventricular ectopic beat. PPG calculated to 104mmHg, MPG 52mmHg, AVA (continuity VTI) caluated 0.89cm2, LVOTd measured at 2.05cm and normal SVi >35ml/m2, calculated Biplane LVEF 74%. Although the patient initially stated that he was asymptomatic, after some probing, he revealed that he had been experiencing shortness of breath on exertion (SOBOE) and had modified his gym workouts accordingly.

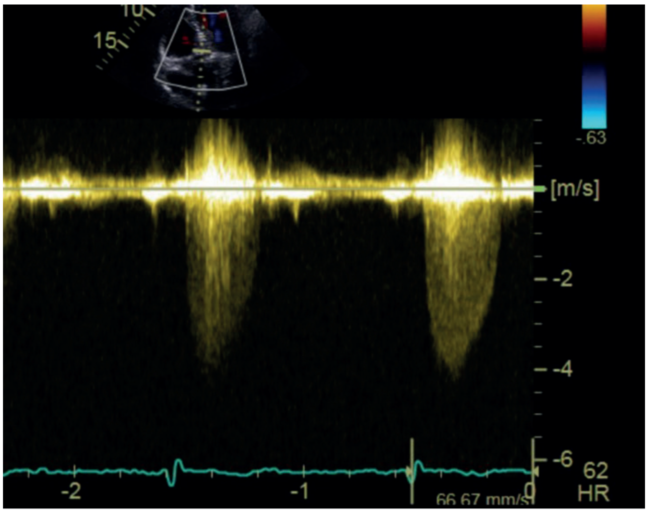


Fig 1. Continuous wave Doppler (CWD) from an apical five chamber window. GE M5Sc probe on Vivid S70 machine.

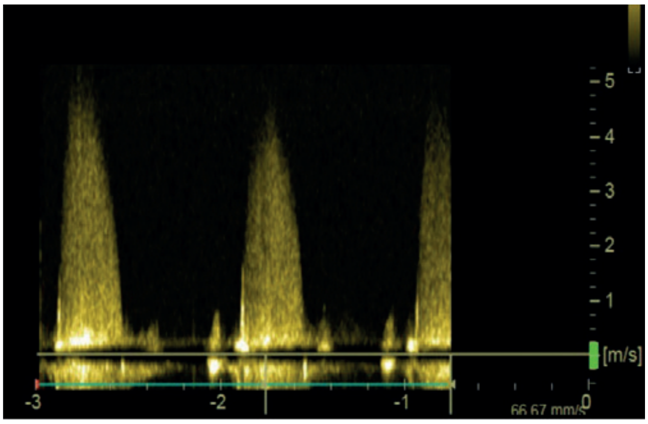


Fig 2. PEDOF from the right parasternal edge (RSE). GE Doppler P2D probe on Vivid S70 machine.

The patient was Red Flagged to the cardiology consultant and initiated the pathway for a referral to the surgical team at the local tertiary centre, given that this was now classified as critical symptomatic aortic stenosis.

Discussion

Assessment of aortic stenosis can be relatively simple when high-quality 2D images and Doppler data are obtained, aligning with the severity indicated by the physiologist's visual evaluation. However, physiologists often encounter significant challenges, such as dealing with immobile patients, suboptimal echo windows, misaligned Doppler readings, and conflicting data. Additionally, assessing valve severity can be complicated by varying flow states and coexisting valve conditions or altered left ventricular function.[1]

It is essential for physiologists to accurately differentiate between severities, but especially between moderate and severe aortic stenosis. When severe aortic stenosis is detected, physiologists may be the first healthcare professional to recognise this condition, making it crucial to communicate effectively with the patient to document any symptoms in the echocardiogram report. Furthermore, it is important for healthcare facilities to have a red flag system in place to ensure timely referral to a cardiology consultant for patients diagnosed with new severe aortic stenosis.

Identifying these patients is vital, especially given the aging population, advancements in transcatheter aortic valve implantation (TAVI), and the increasing financial pressures on the national health service (NHS). Early identification and referral of patients for aortic intervention, that remain fairly well and as an elective procedure, can minimise procedural complications, shorten hospital stays, reduce costs, and ultimately lead to better patient outcomes.

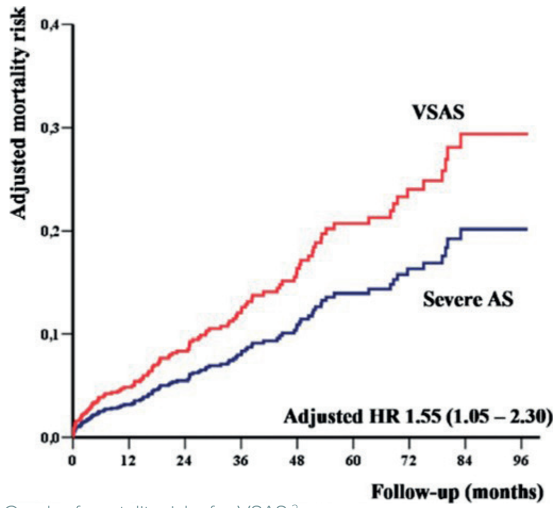
It is crucial for both the NHS and patients to reduce the number of individuals presenting to the department with newly diagnosed severe aortic stenosis, pronounced symptoms, and compromised left ventricular function.

Obtaining PEDOF can be achieved in high number of patients, usually at a higher velocity, which aids in assessing the severity of aortic stenosis.

It is essential for physiologists to engage patients in discussions about their symptoms and to document these findings in the echocardiogram report. Questions regarding chest pain, shortness of breath at rest or during exertion, modifications to exercise or daily activities, and experiences of dizziness should be included to provide a comprehensive understanding of the patient's condition. As consultant waiting lists soar to unprecedented levels nationwide, and with some consultations now being conducted via phone, it is crucial for physiologists to meticulously record their observations and patient interactions. Aneurin Bevan UHB is fortunate to have a developed physiologist-led valve service that offers comprehensive care with staff trained in clinical diagnostic skills. However, a significant number of patients outside these specialised clinics could greatly benefit from straightforward symptom documentation.

When evaluating cases that are near-severe aortic stenosis threshold or present with conflicting data, several factors warrant careful consideration. It is crucial to ensure accurate measurement of the LVOT diameter, consider the cardiac rhythm, and if uncontrolled hypertension is present. The AVA should only be indexed for individuals of small or large stature, while it should be excluded in obese patients. The DVI can be instrumental in distinguishing true severe AS from elevated parameters that may occur in the absence of severe AS, particularly in patients experiencing high cardiac output states such as sepsis, hyperthyroidism, or anaemia. Additionally, it is important to assess the overall context of the heart, including left ventricular function and any concurrent valvular conditions. When the parameters do not align, the physiologist should consider three potential diagnoses: non-severe AS, low flow low gradient AS, or paradoxical low flow low gradient AS.

It is crucial to obtain, or at least attempt and document if unsuccessful, PEDOF, even in cases with severe parameters. Accurately identifying very severe aortic stenosis (VSAS) is essential, as patients in this category, even if asymptomatic, face a significantly poor prognosis without aortic valve intervention. Conservative management carries a high mortality for these individuals.[2]



Graph of mortality risks for VSAS.[2]

It is common practice, to average a minimum of three Doppler measurements obtained during irregular rhythms or to utilise similar R-R intervals. However, in certain situations, we might view ventricular ectopic beats as beneficial rather than detrimental. The temporary rise in myocardial contractility following a premature beat can increase stroke volume due to the Frank Starling Law,[3] resembling the effects of low-dose dobutamine stress echocardiography. This phenomenon may aid in differentiating between varying severities, particularly in distinguishing true from pseudo-severe aortic stenosis in cases of left ventricular dysfunction.[4]

Apical Window

Using 2D imaging at the A5C view, visually mark the spot on the patient while switching to PEDOF.
Angle the transducer foot upwards between the patient's right shoulder and neck
Tiny movements of the probe will provide audio and Doppler signals.

Doppler flows will be **BELOW** the baseline

Right Sternal Edge

This is the best window to obtain the highest AV velocities due to the angle of the ultrasound beam, in relation to the aortic valve.

Doppler flows will be **ABOVE** the baseline.

Roll the patient onto their right side with the right arm up behind by their head.
Place probe around the 3rd right intercostal space & angle medially (towards patients' sternum)
Don't be afraid to move up or down an intercostal space, every patient is different.

Suprasternal notch window

Move the patient's pillow lower down between their shoulder blades, patient's head tilted back and off the pillow.
Turn patient's head to the right to make room for the transducer
Angle the PEDOF probe towards the aortic root
Making small movements, angle the probe to bring desired Doppler.

Look for Doppler flows **ABOVE** the baseline

Fig 3. Aortic stenosis workshop Stacey Murray ABUHB, focusing on perfecting PEDOF.

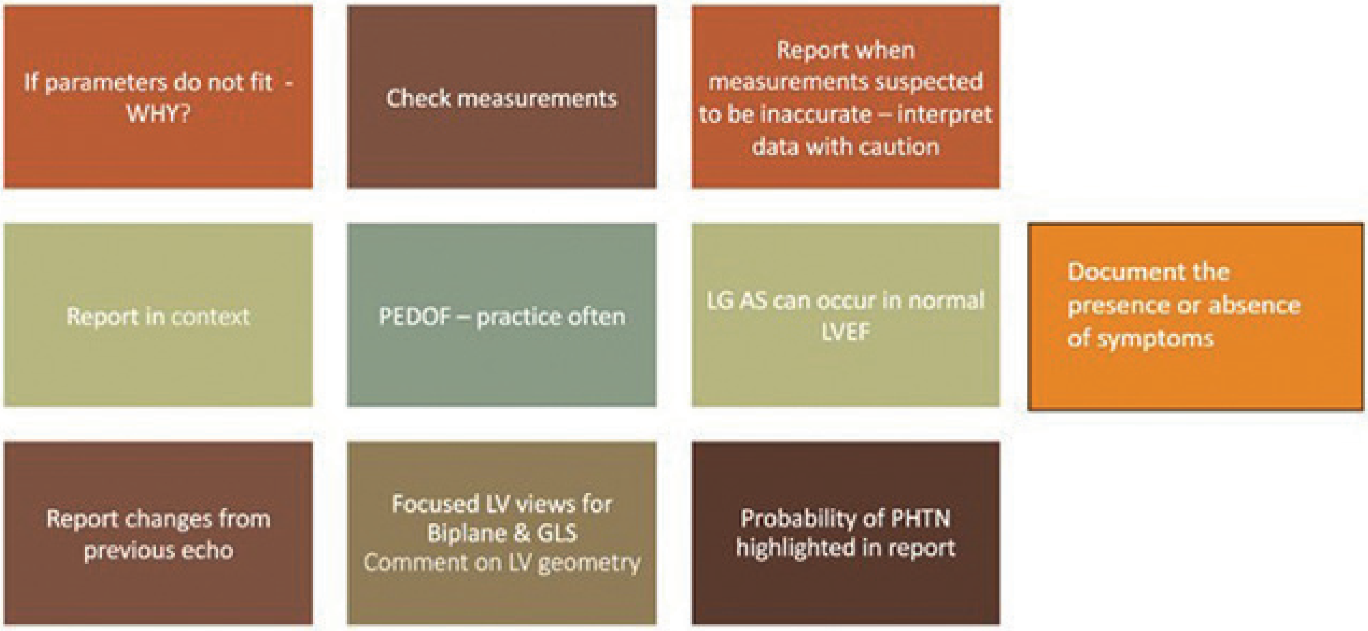


Fig 4. Aortic stenosis workshop Stacey Murray ABUHB, summary.

Summary

Recognising the importance of the final echocardiogram report and its impact on patient care is vital. A solid understanding of the pathways and treatments associated with valvular heart disease enhances the appreciation for a precise and comprehensive echocardiogram report.

The invaluable face-to-face interactions that echocardiographers have with patients deserves recognition, and it may be beneficial to promote the documentation of patient symptoms outside of the valve clinic setting.

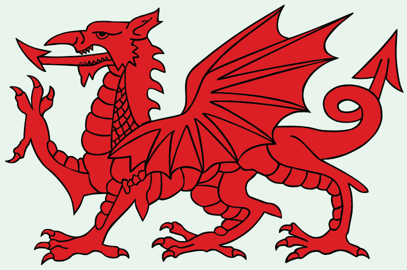
The practice of non-image Doppler should be routinely encouraged for patients with aortic stenosis, even if severe parameters are obtained via conventional Doppler.

It is also vital that all physiologists, including those in temporary positions, are allotted sufficient time for thorough evaluations, aligning with the BSE-recommended time slots for echocardiography.

A recent workshop at Aneurin Bevan UHB, which focused on aortic stenosis and allowed staff to practice non-image Doppler techniques on actual patients, demonstrated the benefits of such training, indicating that similar workshops could be valuable for other healthcare facilities.

References

1. Kim H, Lee H, Lee S, Kim I. Spectral Doppler imaging of post-ectopic beat and low-dose dobutamine stress echocardiography. Sonography. 2024 May 29;11(4):429–32.
2. Tribouilloy C, Rusinaru D, Bohbot Y, Maréchaux S, Vanoverschelde J, Enriquez-Sarano M. How Should Very Severe Aortic Stenosis Be Defined in Asymptomatic Individuals? Journal of the American Heart Association. 2019 Feb 5;8(3).
3. Delicce AV, Makaryus AN. Physiology, Frank Starling Law [Internet]. Nih.gov. StatPearls Publishing; 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470295/
4. 2021 ESC/EACTS Guidelines for the management of valvular heart disease [Internet]. www.escardio.org. Available from: https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Valvular-Heart-Disease-Guidelines
5. Ring L, Shah B, Bhattacharyya S, Belham M, Harkness A, Oxborough D, et al. Echocardiographic assessment of aortic stenosis: a practical guideline from the British Society of Echocardiography. Echo Research and Practice. 2021 Mar;8(1).
6. Wang L, Mody P, Banerjee S. Aortic Stenosis Severity: Rhythm Makes a Difference. CASE. 2022 Jun;



Welsh Physiology Echocardiography Network / Rhwydwaith Echocardiograffeg Ffisioleg Cymru

2025 marked a successful inaugural year for the Network following its establishment in October 2024. The network agreed its priorities for 2025 would be to enhance educational opportunities across Wales, support professional development, and provide inclusive networking for all echocardiographers. To achieve these aims, the network organised a BSE-accredited educational meeting in the Autumn, which was held at the Princess of Wales Hospital, Bridgend and sponsored by Bristol Myers Squibb. The meeting adopted a hybrid format to ensure accessibility for colleagues unable to travel, particularly those based in mid and North Wales. The meeting theme focussed on current 'Hot Topics' in echocardiography. Sessions covered the BSE myosin inhibitor guidelines, scientist-led mavacamten clinics, the BSE sports cardiology guidelines, echo assessment of transcatheter edge-to-edge repair (TEER) and the BSE aortic regurgitation guidelines. The meeting achieved good in-person and online attendance and received positive feedback. All attendee suggestions have been noted and will inform planning for future events. The Network extends its thanks to everyone who contributed towards the success of the meeting, including the meeting sponsor, the speakers for their excellent presentations, and all those who attended. The next meeting is planned for Spring 2026 and will be organised by network representatives from mid and North Wales. Further details will be circulated in the coming months.

Strengthening and standardising echocardiography quality assurance (QA) processes across Wales continues to be a key priority for the Network. Collaborative working has played a central role in this progress, with health boards actively sharing ideas, learning, and practical tools to enhance their local QA frameworks. One particularly successful initiative has been the adoption of a digital QA form, developed and refined using the echo study and echo reporting scoresheets available through the BSE's quality assurance resources. This shared tool has helped streamline QA activities, offering a more consistent and efficient approach to collecting, reviewing, and presenting QA data across the region.

The establishment of the Network has clearly strengthened communication and ensured that all health boards across Wales remain informed about echocardiography developments both nationally and beyond. The inclusion of two BSE regional representatives in the Network has been invaluable, providing an effective mechanism for disseminating key updates from BSE meetings to all echocardiography leads, while also enabling concerns or queries from within Wales to be communicated directly back to the BSE.

The Network welcomes anyone who wishes to speak to the group in confidence about any echo related matters or concerns within Wales to please get in touch. Additionally, the network also invites anyone who may be interested in delivering talks or presentations to the group or who wish to participate in the next educational event to contact the network Chair Catrin.williams2@wales.nhs.uk or Vice-Chair Caren.Hobrough-Harris@wales.nhs.uk to discuss.

Echocardiography in Cardio-Rheumatology: A Cornerstone in Early Detection and Monitoring of Cardiovascular Involvement

DR. THA HTET NYI[1,2], DR SANJEEV BHATTACHARYYA[1,2,3,4], DR GUY LLOYD[1,2,3,4], DR JIANMIN CHEN [1,5], DR NAY AUNG[1,2]

Dr. Tha Htet Nyi[1,2]

Dr Sanjeev Bhattacharyya[1,2,3,4]

Dr Guy Lloyd[1,2,3,4]

Dr Jianmin Chen[1,5]

Dr Nay Aung[1,2]

[1] William Harvey Research Institute, Queen Mary University of London, Charterhouse Square, London EC1M 6BQ, United Kingdom
[2] Barts Heart Centre, St Bartholomew's Hospital, Barts Health NHS Trust, London EC1A 7BE, UK.
[3] Institute of Cardiovascular Science, University College London, London WC1E 6BT, UK.
[4] NIHR University College London Hospitals Biomedical Research Centre, London NW1 2PB, UK.
[5] Centre for inflammation and Therapeutic Innovation, Queen Mary University of London, Charterhouse Square, London EC1M 6BQ, United Kingdom

Introduction

Autoimmune rheumatic diseases (ARDs) including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), systemic sclerosis (SSc), ankylosing spondylitis, and vasculitis impact almost 2 billion individuals globally and are associated with a significant morbidity and mortality burden.[1,2] These patient groups are at 1.4-3.6 times higher risk of cardiovascular disease (CVD), comparable to that of type 2 diabetes. Their cardiovascular implications span across the full spectrum of CVD, extending beyond atherosclerosis, to include heart failure, aortic and valve disease, driven by complex inflammatory and fibrotic mechanisms.[3,4]

These manifestations can include systolic and diastolic dysfunction, clinical heart failure, and arrhythmia, all of which contribute to increased cardiovascular comorbidity and mortality.[4,5] Importantly, cardiac involvement in ARDs is often subclinical,[6,7] and may have an atypical presentation. Therefore, it is usually recognized at only an advanced stage and is associated with poor prognosis, underscoring the need for timely and sensitive diagnostic tools.[8]

Non-invasive cardiovascular imaging is being increasingly utilized for early identification and evaluation of CVD in patients with ARDs and the importance of regular screening beyond the conventional cardiovascular risk factor management was highlighted by the European League against Rheumatism (EULAR).[9] Indeed, multimodality CV imaging is vital in evaluating cardiac involvement in systemic inflammatory diseases, offering improved diagnostic accuracy, detailed phenotypic assessment, and disease monitoring.[8] Echocardiography remains the cornerstone imaging tool for assessing cardiac structure and function and it is the first-line imaging modality of choice for investigating CVD in patients with ARDs.[10]

This review aims to provide an overview of the role of echocardiography in investigation of cardiovascular implications in ARDs by integrating evidence from observational studies, consensus statements, and expert recommendations.

Cardiac Manifestations in ARDs

ARDs can lead to a range of cardiovascular complications, driven by heterogenous mechanisms including immune-mediated inflammation, accelerated atherosclerosis, and microvascular dysfunction. The following is an overview of key cardiac manifestations across major ARDs:

1. Systemic inflammatory arthritis including RA and Spondyloarthropathies (SpA)

RA is associated with up to 2-fold increased risk of coronary artery disease (CAD), stroke, heart failure, and peripheral arterial disease (PAD) compared with the general population[11] leading to increased cardiovascular morbidity and mortality. Systemic inflammation in RA is thought to be related to myocardial inflammation contributing to myocardial fibrosis, ventricular stiffness and cardiac hypertrophy, which could directly cause diastolic dysfunction, and heart failure with preserved ejection fraction (HFpEF).[4] Interestingly, about 40% of RA patients have asymptomatic left ventricular diastolic dysfunction with or without systolic impairment.[12] Valvular heart disease is likewise common in RA but is frequently underestimated.[13]

SpA are linked to valvular heart disease with potential myocardial involvement presenting as myocarditis, and/or heart failure, while pericardial disease is less common.[14] Aortic regurgitation due to aortic root inflammation, dilatation and aortic annular to commissural thickening occurs in up to 80% of SpA patients.[15,16] When adjusted for cardiovascular risk factors, age, sex, and duration of disease, the incidence of CVD in patients with SpA is comparable to that of RA.[17]

2. SLE

In SLE, CVD is a major cause of morbidity and mortality, driven mainly by CAD, vasculitis, and myocarditis. The risk of CAD is up to eightfold higher than in the general population, while clinically apparent myocarditis occurs in 3-15% of cases, often accompanied by concurrent pericarditis.[18] Autoimmune valvular disease can occur in both SLE and secondary antiphospholipid syndrome,[19] posing a significant stroke risk.[20] Valvular regurgitation, typically caused by immune-mediated vegetations (Libman–Sacks endocarditis), is more common than stenosis, which rarely occurs. When these manifestations lead to heart failure, they can significantly impair both quality of life and prognosis.[21]

3. SSc

SSc is a complex autoimmune condition and commonly affects the cardiovascular system. Although frequently subclinical, cardiac involvement is a marker of poor prognosis and major contributor to a nearly 3-fold increase in mortality in patients with SSc.[22,23] The cardiac presentations can be variable and are either caused by primary myocardial inflammation, and/or secondary adverse remodeling caused by pulmonary hypertension and interstitial lung disease.[24,25] Myocarditis can quickly progress to myocardial fibrosis, often accompanied by concurrent microvascular involvement.[25]

5. Systemic vasculitis

Diagnosing cardiac involvement in systemic vasculitis can be challenging, particularly at the early subclinical stages and therefore frequently overlooked.[26] Involvement of the myocardium, pericardium, valves, and coronary arteries can result in pericardial effusion, diastolic dysfunction, heart failure, and accelerated atherosclerosis. Myocardial inflammation from micro- and macrovascular disease[27] can present as fulminant myocarditis in eosinophilic granulomatosis with polyangiitis.[28] Coronary vasculitis is most prevalent in polyarteritis nodosa (PAN; 4–10 per million annually), affecting up to 50% of PAN and 30% of Takayasu arteritis (TAK) cases,[27] while aortic valve disease occurs in up to 35% of TAK patients.[29] Inflammatory aortitis is an important clinical feature of TAK requiring prompt diagnosis and timely treatment[30] although echocardiography is not the standard modality in its diagnosis.

Role of Echocardiography in ARDs

(A) Diagnostic Techniques

Echocardiography is the first-line imaging modality for cardiovascular assessment in patients with ARD due to its wide availability, safety, and affordability. A range of echocardiography techniques useful for a range of clinical purposes are described as follows.

Standard Echocardiographic Techniques

- **2D Echocardiography (2DE):** Assesses chamber-level systolic function, myocardial thickness, detects valvular disease, and identifies pericardial abnormalities.
- **Doppler Echocardiography:** Evaluates diastolic function, chamber hemodynamics, and detects constrictive pericarditis or tamponade and assesses pulmonary vasculature.
- **Transoesophageal Echocardiography (TOE):** Provides detailed imaging in suspected valvulitis and complex valvular lesions.

Stress Echocardiography: Supports CAD risk stratification, including assessment of microvascular dysfunction, exercise-induced pulmonary hypertension, and contractile reserve and unmasks exercise-induced diastolic dysfunction and elevated LV filling pressures in symptomatic patients.[31]

Advanced Echocardiographic Techniques

- **3D Echocardiography (3DE):** Enables volumetric evaluation of left and right ventricular (RV) ejection fraction and characterisation of complex valvular disease.
- **Speckle-Tracking Echocardiography (STE):** Measures global and regional myocardial strain for detailed functional assessment.
- **Stress Echocardiography with STE:** a more precise, quantitative measure of myocardial strain compared to the standard stress echocardiography.
- **Myocardial Contrast Echocardiography (MCE):** Assesses microvascular dysfunction and myocardial inflammation.

(B) Strengths and limitations

Echocardiography provides several advantages:

- **First-line screening** for most cardiac conditions in ARDs
- **No radiation exposure,** making it safe for repeated use.
- **Low cost and wide availability,** suitable for various clinical settings.
- **Real-time interpretation,** allowing for dynamic assessment.
- **Advanced myocardial deformation analysis** (by STE) enables detection of subclinical dysfunction.

Despite its utility, echocardiography has notable limitations:

- **Limited tissue characterization** and inability to directly detect inflammation in the pericardium or myocardium
- **Inter-observer variability** affecting reproducibility
- **Poor acoustic windows** (especially for RV) in certain body habitus
- Advanced techniques (STE, 3DE) are **not uniformly available** across all institutions.

Echocardiography Applications in ARDs : Disease-Specific Insights

Echocardiography is a foundational imaging modality across various ARDs to detect structural and functional cardiac abnormalities. Additionally, it offers value in monitoring of treatment response and impact of the cardiac and disease modifying therapy in ARDs.[32]

In RA, echocardiography is valuable for detecting common cardiac manifestations such as diastolic dysfunction-which may precede systolic impairment-as well as myocardial disease and pericardial effusion. A prospective study by Dal Piaz et al. (2019) reported that in asymptomatic RA patients without evident cardiac disease, a lower E/A ratio on TTE, older age, and elevated systolic blood pressure were predictors of developing new onset left ventricular diastolic dysfunction.[33] A prospective tissue Doppler echocardiography study by Cioffi G, et al showed impaired mitral annular peak systolic velocity (S') present in 45% of RA patients vs 20% of controls, despite similar left ventricular ejection fraction and diastolic parameters, indicating subclinical longitudinal left ventricular systolic dysfunction in RA without prior cardiovascular disease.[34] Additionally, RA has been associated with increased epicardial adipose tissue thickness and reduced global longitudinal strain on STE.[35]

For SpA-related aortic disease, two-dimensional echocardiography is particularly important for screening and detecting valvular or aortic root abnormalities, with aortic regurgitation being a characteristic feature of advanced stages.

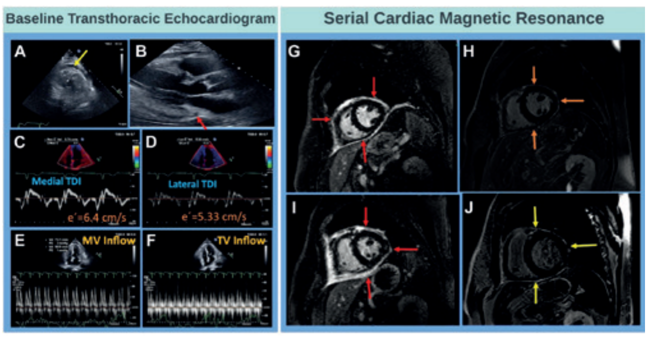


Fig 1. Multi-modal imaging in a RA patient with recurrent pericarditis - baseline echocardiogram demonstrating a small pericardial effusion (A, B), annulus reversus (C, D), and no significant respiratory variation through the mitral and tricuspid valves (E, F). Serial cardiac magnetic resonance imaging with late gadolinium enhancement demonstrating intermittent pericardial inflammation on treatment with anakinra (G, H, I, J). MV = mitral valve; TDI = tissue Doppler imaging; TV = tricuspid valve. [Reproduced from Majid et al (36). Licensed under CC BY-NC-ND 4.0]

In SLE, echocardiography is instrumental in evaluating a spectrum of complications including valvular lesions, myocarditis, pericarditis, and Libman-Sacks endocarditis. Notably, these manifestations can present acutely in up to 20% of young patients with newly diagnosed SLE.[37] In addition, STE assessments have shown reduced bi-ventricular strain parameters in SLE patients compared with healthy controls, indicating impaired bi-ventricular myocardial function.[38]

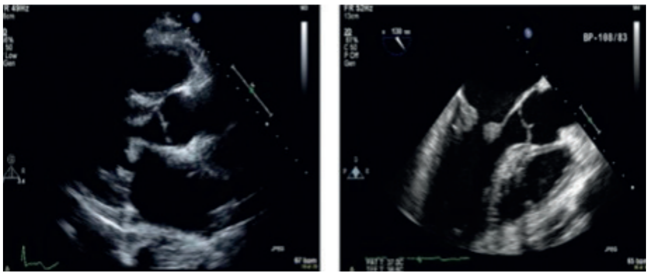


Fig 2. Echocardiographic images of a case of Libman-Sacks Endocarditis in a SLE patient demonstrating a symmetrical mass-like structure on the tips of both leaflets of mitral valve extending to the body. *[Reproduced from Al-Jehani et al,[39] under CC BY 4.0 licence]*

In SSc, two-dimensional Doppler echocardiography can be particularly helpful in the assessment of pulmonary hypertension and RV function.[40] Similar to SLE, STE demonstrates reduced strain compared with healthy controls, reflecting bi-ventricular and bi-atrial myocardial impairment.[41] Assessment of RV strain by STE can identify dysfunction before the onset of overt pulmonary arterial hypertension, and regular echocardiographic surveillance is recommended due to the progressive nature of vascular disease. Exercise echocardiography in patients with normal resting pulmonary artery pressure has revealed diminished RV contractile reserve, suggesting that exercise-induced subclinical RV dysfunction may serve as an early marker of pulmonary vascular disease.[42]

In systemic vasculitis, echocardiography is a first-line tool for identifying left ventricular dysfunction, left ventricular apical thrombus or cavity obliteration, endomyocardial fibrosis, or chronic restrictive cardiomyopathy, prior to the use of advanced imaging techniques.[26]

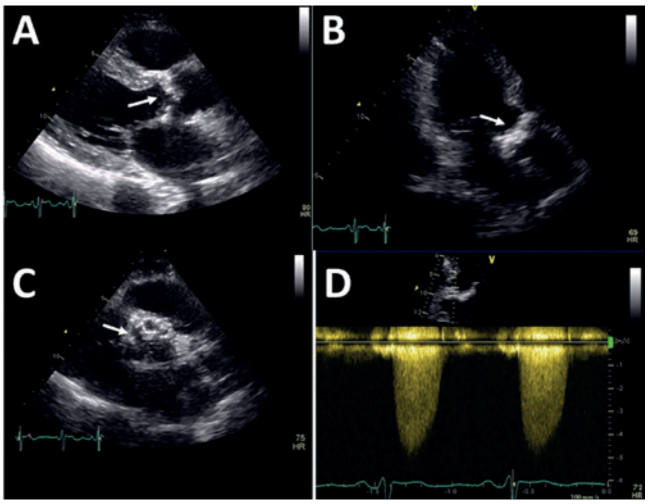


Fig 3. Transthoracic echocardiographic images of a patient with granulomatosis with polyangiitis. **(A)** parasternal long-axis, **(B)** apical 3-chamber and **(C)** parasternal short-axis views showing calcified aortic valve (arrows). **(D)** is CW-Doppler showing a peak aortic jet velocity of 4.5 m/s, consistent with severe aortic stenosis. *[Reproduced from Ali et al (43). Licensed under* ***CC BY 4.0****])*

Conclusion

Echocardiography plays a foundational role in the detection, monitoring, and management of CVD in ARDs. However, there remains a lack of standardized screening protocols and echocardiographic thresholds for subclinical cardiac dysfunction in these patient populations. With further development of integrated screening pathways, advancements in strain imaging, 3D and 4D quantification, and integration with multimodality imaging, echocardiography will continue to evolve as an essential tool in the growing field of cardio-rheumatology.

References

1. Al Maini M, et al. The global challenges and opportunities in the practice of rheumatology: white paper by the World Forum on Rheumatic and Musculoskeletal Diseases. Clin Rheumatol. 2015;34(5):819-29.
2. Vos T, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2163-96.
3. Conrad N, et al. Autoimmune diseases and cardiovascular risk: a population-based study on 19 autoimmune diseases and 12 cardiovascular diseases in 22 million individuals in the UK. Lancet. 2022;400(10354):733-43.
4. Chen J, Norling LV, Cooper D. Cardiac dysfunction in rheumatoid arthritis: the role of inflammation. Cells. 2021;10(4).
5. Zimba O, Gasparyan AY. Cardiovascular issues in rheumatic diseases. Clin Rheumatol. 2023.
6. Gerster M, et al. Deciphering cardiac involvement in systemic inflammatory diseases: non-invasive tissue characterisation using cardiac magnetic resonance is key to improved patients' care. Expert Rev Cardiovasc Ther. 2016;14(11):1283-95.
7. Prasad M, et al. Cardiorheumatology: cardiac involvement in systemic rheumatic disease. Nat Rev Cardiol. 2015;12(3):168-76.
8. Weber BN, Paik JJ, Aghayev A, Klein AL, Mavrogeni SI, Yu PB, Mukherjee M. Novel imaging approaches to cardiac manifestations of systemic inflammatory diseases: JACC scientific statement. J Am Coll Cardiol. 2023;82(22):2128-51.
9. Drosos GC, Vedder D, Houben E, Boekel L, Atzeni F, Badreh S, et al. EULAR recommendations for cardiovascular risk management in rheumatic and musculoskeletal diseases, including systemic lupus erythematosus and antiphospholipid syndrome. Ann Rheum Dis. 2022;81(6):768-79.
10. Mavrogeni S, et al. Cardiovascular magnetic resonance in autoimmune rheumatic diseases: a clinical consensus document by the European Association of Cardiovascular Imaging. Eur Heart J Cardiovasc Imaging. 2022;23(9):e308-22.
11. Mavrogeni S, et al. Imaging patterns of heart failure in rheumatoid arthritis evaluated by cardiovascular magnetic resonance. Int J Cardiol. 2013;168(4):4333-5.
12. Davis JM, et al. Five-year changes in cardiac structure and function in patients with rheumatoid arthritis compared with the general population. Int J Cardiol. 2017;240:379-85.
13. Roldan CA, et al. Characterization of valvular heart disease in rheumatoid arthritis by transesophageal echocardiography and clinical correlates. Am J Cardiol. 2007;100(3):496-502.
14. Vinsonneau U, et al. Cardiovascular disease in patients with spondyloarthropathies. Joint Bone Spine. 2008;75(1):18-21.
15. Grygiel-Górniak B, Oduah MT, Olagunju A, Klokner M. Disorders of the aorta and aortic valve in connective tissue diseases. Curr Cardiol Rep. 2020;22:70.
16. Choi E, Mathews LM, Paik J, et al. Multimodality evaluation of aortic insufficiency and aortitis in rheumatologic diseases. Front Cardiovasc Med. 2022;9:874242.
17. Lauper K, et al. Incidence and prevalence of major adverse cardiovascular events in rheumatoid arthritis, psoriatic arthritis, and axial spondyloarthritis. Arthritis Care Res. 2018;70(12):1756-63.
18. Miner JJ, Kim AHJ. Cardiac manifestations of systemic lupus erythematosus. Rheum Dis Clin North Am. 2014;40(1):51-60.
19. Mavrogeni SI, et al. Cardiac involvement in antiphospholipid syndrome: the diagnostic role of noninvasive cardiac imaging. Semin Arthritis Rheum. 2016;45(5):e.
20. Zuily S, et al. Valvular heart disease in antiphospholipid syndrome. Curr Rheumatol Rep. 2013;15(4):320.
21. Roldan CA, et al. Characterization of valvular heart disease in rheumatoid arthritis by transesophageal echocardiography and clinical correlates. Am J Cardiol. 2007;100(3):496-502.
22. Hung G, Mercurio V, Hsu S, Mathai SC, Shah AA, Mukherjee M. Progress in understanding, diagnosing, and managing cardiac complications of systemic sclerosis. Curr Rheumatol Rep. 2019;21:68.
23. Elhai M, Meune C, Boubaya M, et al. Mapping and predicting mortality from systemic sclerosis. Ann Rheum Dis. 2017;76:1897-905.

24. Ioannidis JPA, et al. Mortality in systemic sclerosis: an international meta-analysis of individual patient data. Am J Med. 2005;118(1):2-10.
25. Steen VD, Medsger TA. Changes in causes of death in systemic sclerosis, 1972–2002. Ann Rheum Dis. 2007;66(7):940-4.
26. [Author(s) unknown]. [Title unknown]. [Internet]. [cited 2025 Aug 15]. Available from: https://www.sciencedirect.com/science/article/pii/S0146280623001354?via%3Dihub#bib0027
27. Miloslavsky E, Unizony S. The heart in vasculitis. Rheum Dis Clin North Am. 2014;40:11-26.
28. Dennert RM, van Paassen P, Schalla S, et al. Cardiac involvement in Churg-Strauss syndrome. Arthritis Rheum. 2010;62:627-34.
29. Zhang Y, Yang K, Meng X, et al. Cardiac valve involvement in Takayasu arteritis is common: a retrospective study of 1,069 patients over 25 years. Am J Med Sci. 2018;356:357-64.
30. Saadoun D, Vautier M, Cacoub P. Medium-and large-vessel vasculitis. Circulation. 2021 Jan 19;143(3):267-82.
31. Nagueh SF, Sanborn D, Oh JK, Anderson B, Billick K, Derumeaux G, et al. Recommendations for the evaluation of left ventricular diastolic function by echocardiography and for heart failure with preserved ejection fraction diagnosis: an update from the American Society of Echocardiography. J Am Soc Echocardiogr. 2025;38(7):537-569. doi:10.1016/j.echo.2025.03.011
32. Makavos G, et al. Echocardiography in autoimmune rheumatic diseases for diagnosis and prognosis of cardiovascular complications. Medicina (Kaunas). 2020;56(9):445.
33. Dal Piaz EC, et al. Incidence and predictors of new onset left ventricular diastolic dysfunction in asymptomatic patients with rheumatoid arthritis without overt cardiac disease. Monaldi Arch Chest Dis. 2019;89(3).
34. Cioffi G, et al. Prevalence and factors related to left ventricular systolic dysfunction in asymptomatic patients with rheumatoid arthritis: a prospective tissue Doppler echocardiography study. Herz. 2015;40(7):989-96.
35. Wang T, Peng G, Liang H, Zhao B. Epicardial adipose tissue and left ventricular systolic function in rheumatoid arthritis assessed by two-dimensional speckle tracking echocardiography. Cureus. 2024;16(5):e60495.
36. Majid M, Agrawal A, Arockiam AD, et al. Unveiling rheumatoid arthritis: recurrent pericarditis as the sentinel manifestation. JACC Case Rep. 2024;29:102570. doi:10.1016/j.jaccas.2024.102570.
37. Chang JC, et al. Use of echocardiography at diagnosis and detection of acute cardiac disease in youth with systemic lupus erythematosus. Lupus. 2018;27(8):1348-57.
38. Di Minno MND, et al. Speckle tracking echocardiography in patients with systemic lupus erythematosus: a meta-analysis. Eur J Intern Med. 2020;73:16-22.
39. Al-Jehani F, et al. Pericardial tamponade as an initial manifestation of rheumatoid arthritis. Case Rep Cardiol. 2021;2021:5573141. doi:10.1155/2021/5573141.
40. Gopal DM, et al. Relation of novel echocardiographic measures to invasive hemodynamic assessment in scleroderma-associated pulmonary arterial hypertension. Arthritis Care Res (Hoboken). 2014;66:1386-94.
41. Qiao W, et al. Cardiac involvement assessment in systemic sclerosis using speckle tracking echocardiography: a systematic review and meta-analysis. BMJ Open. 2023;13(2):e063364.
42. Chia EM, et al. Exercise testing can unmask right ventricular dysfunction in systemic sclerosis patients with normal resting pulmonary artery pressure. Int J Cardiol. 2016;204:179-86.
43. Sparano A, et al. Cardiac involvement in systemic and local vasculitides: the value of noninvasive multimodality imaging. Curr Probl Cardiol. 2023;48:101718. doi:10.1016/j.cpcardiol.2023.101718.

The AGM at BSEcho 2025 marked the end of Dr Claire Colebourn's term in office as a trustee at the BSE after eight years of incredible service to the members.

Claire joined the Council and Trustees in 2017. She was a true trailblazer being one of the first intensivists to choose to study for their full TTE accreditation. Claire's commitment to good governance and standardised patient care, coupled with her relentless energy and drive ensured she made a mark on the BSE from the start! Commenting at the end of Claire's Presidency, Mrs Jude Skipper said *"I first met Claire at a Supervisor/Marker training session in Birmingham and was impressed by her suggestions on how to change the marking system. I should have known then that she would go on to be Chair of Accreditation and then President! It has always been a real honour and pleasure working with her".*

Claire was involved with the Accreditation Committee from 2011 and became Chair of Accreditation in 2017. She oversaw some significant changes in the way accreditation ran, including the transition to the logbook portal and launch of Level 1 accreditation, plus growth of the practical assessments across the UK and establishment of QA for assessors. Under her leadership, the committee grew extensively to ensure even more expertise, representing the broadest skillset and helping to reduce the burden on key individuals.

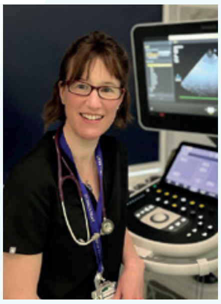
In 2020, Claire took on the Presidency, at one of the most turbulent times in the UK. The AGM at which she accepted the handover from Mr Keith Pearce had to be live-streamed, being filmed in full social distancing conditions. Only 10 people were in attendance, eight from the BSE and two film/sound crew. It was not the way anyone would want to start their Presidency, however Claire embraced it with her usual gusto! To Claire, the important thing was not the fanfare, it was protecting our members and supporting them through difficult times in whichever way we could.

The COVID period continued well into Claire's first year as President and was difficult for all, not least Claire who was supporting some of the worst affected patients by day and being President by night, not to mention caring for her own young family. The day Claire was interviewed and appointed as President, she had a three month old baby in tow! Throughout this time, Claire remained resolute, positive and determined to serve our members.

If asked to quote her battle cry, we think it would be *"We are all echocardiographers".* Claire was determined that throughout her term she would do what she could to increase the sense of community amongst the diverse members of the BSE and to raising the profile of echocardiographers. Possibly Claire's greatest wish is to see the BSE recognised as a Royal College. At one point in her Presidency we were told we were close, but frequent changes in Ministers before a change of Government have kept the Privy Council busy. We remain hopeful though.

Claire never wanted her Presidency to be defined by the fact that she was the first female President. In an interview for International Women's Day she said *"I don't want to be thought of as 'the first female President of the British Society of Echocardiography (BSE)' – although I am secretly very proud that I was, I want to be thought of as holding the role with strength and integrity and as having done a great job. Full stop."*

On behalf of all members, committees, Advisory Council and Trustees, and the BSE team, we would like to extend our thanks for all Claire has done for the Society and all she will continue to do. This piece should not be seen as a goodbye; we know that Claire will continue to work tirelessly with, and for, the BSE, however we could not let this moment pass without acknowledging her incredible contribution.



Thank You

Left Ventricular Lead in the Pulmonary Artery: Potential Mechanisms and Sequelae

EVIE JACKSON, DR CLAIRE A MARTIN, DR LYNNE WILLIAMS


Evie Jackson


Dr Claire A Martin


Dr Lynne Williams

Evie Jackson, Cardiac Clinical Scientist, Dr Claire A Martin, Consultant Electrophysiologist and Assistant Director R&D, Dr Lynne Williams, Consultant Cardiologist in Inherited Cardiac Conditions and Echocardiography. Royal Papworth Hospital

Background

A 70-year-old female underwent a transthoracic echocardiogram (TTE) for ischaemic cardiomyopathy and cardiac resynchronisation therapy defibrillator (CRT-D) device follow-up. The echocardiogram discovered abnormal positioning of the left ventricular pacemaker lead, with excess lead slack prolapsing into the main pulmonary artery (MPA). This is the first such documented case, with similar cases only identified in paediatric patients with a dual or single chamber pacemaker. This report highlights the importance of secure fixation of the suture sleeve to the lead and the underlying muscle during pacing implants, and possible sequelae of subsequent lead prolapse.

Case Presentation

This 70-year-old female, with a history of two coronary artery bypass graft (CABG) surgeries and percutaneous coronary intervention (PCI), underwent CRT-D insertion for ischaemic cardiomyopathy six years previously. The device was deemed suitable for the patient following identification of left bundle branch block (LBBB), ejection fraction (EF) of 35%, and class III New York Heart Association (NYHA) classification with symptoms of chest discomfort and breathlessness. A Boston Scientific VIGILANT X4 CRT-D G247 was implanted subcutaneously in a left pectoral chest wall position. A 95 cm Boston Scientific Acuity X4 Spiral S lead was used as the left ventricular lead, implanted using left axillary/subclavian access and placed in a posterolateral branch of the coronary sinus. No procedural complications were documented and the post-procedural chest X-ray did not show any abnormalities (Figure 1). TTE identified an improvement in EF from 35% to 54% post-implant, which was accompanied by symptom improvement.

However, a routine TTE six years post-implant, discovered what appeared to be a pacemaker lead in the MPA (Figures 2, 3). The patient's device check noted no significant changes in device thresholds or impedances that might be expected with lead displacement. The pacing check however identified an increase in premature ventricular contractions (PVCs) over the last 6 months, resulting in a reduction in biventricular pacing from 96% to 82% and accompanied by an increase in breathlessness.

A chest X-ray revealed the culprit pacemaker lead in the MPA was slack from the left ventricular lead (Figure 4), which had prolapsed into the right ventricular outflow tract (RVOT), crossing the tricuspid and pulmonic valve. The lead tip remained in the same position as when implanted.

Discussion

The phenomenon described in this case is a recognised complication of paediatric transvenous pacemaker implantation due to the presence of excessive lead slack left to account for

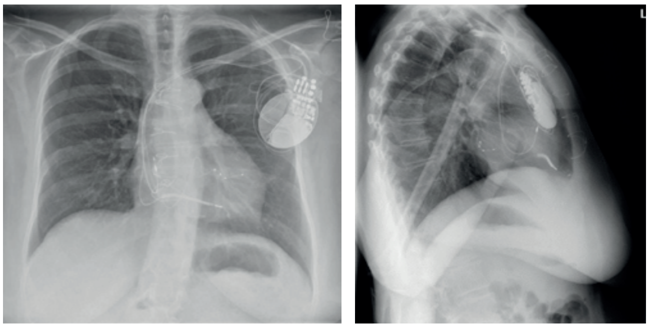


Fig 1. Post-procedural chest radiograph following CRT-D implant 8 years previously (left = posteroanterior, right = lateral projection). Three pacing leads can be seen in the expected positions: right atrial appendage, a defibrillation lead at the apex of the right ventricle, and in a posterolateral branch of the coronary sinus. Sternal wires noted in keeping with previous sternotomy for CABG surgeries.

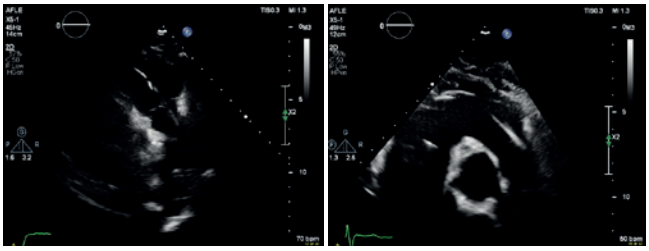


Fig 2. The left image shows the right ventricular outflow view on 2D echocardiography showing the MPA and pulmonic valve. An echogenic structure can be seen passing through the pulmonic valve between the leaflets which resembles a pacing lead. The right image shows the parasternal short axis view at the aortic level on 2D echocardiography with reduced depth to visualise the RVOT. An echogenic structure which resembles a pacing lead can be seen passing through the tricuspid valve and curving through the RVOT and into the MPA.

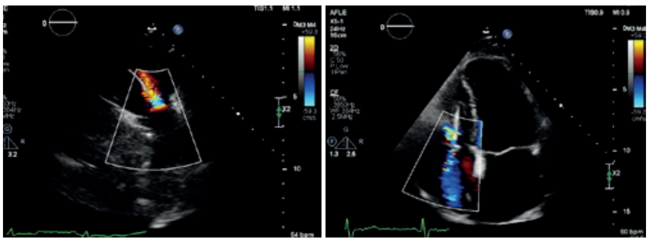


Fig 3. The left image shows the right ventricular outflow view on 2D echocardiography with colour flow mapping. The MPA and pulmonic valve can be seen, and the colour flow represents moderate pulmonary regurgitation. An echogenic structure can be seen passing through the pulmonic valve in between the leaflets which resembles a pacing lead. The right image shows the right ventricular focused view on 2D echocardiography with colour flow mapping. The right atrium and right ventricle can be seen, and the colour flow represents moderate to severe tricuspid regurgitation. An echogenic structure can be seen passing through the tricuspid valve which resembles a pacing lead.

growth.[1] However, in these cases the excess lead slack is of the right ventricular pacing lead.

In this case, the normality of the post-procedural X-ray suggests that the lead slack increased over time. The most likely mechanisms for this are a loose lead fixation sleeve, or arm movements causing rotation of the device. Yet on the most recent chest X-ray, the device appears to be at a similar orientation to post-implant. One might expect the effects of a loose suture sleeve to manifest soon after the implant, whilst late after implant the lead should be fixed through fibrosis in the pocket; however, we have no chest x-rays performed in the intervening period to determine when the lead prolapse occurred. The case highlights the importance of securely suturing the lead to the sleeve and to the underlying muscle. The patient is 156 cm tall and therefore use of an 86 cm lead would reduce the amount of spare lead in the pocket and thus the degree of prolapse possible.

The lead may be contributing to the moderate to severe tricuspid regurgitation and moderate pulmonary regurgitation, which in turn can cause symptoms and further consequences that indicate intervention. A large echocardiographic registry found severe tricuspid regurgitation to be correlated with increased mortality at 4-year follow-up.[2]

The lead prolapse may also be the cause of the patient's increased PVC burden through mechanical stimulation of the myocardial tissue. This in turn reduced biventricular pacing and resulted in increased breathlessness.[3] A 12-lead electrocardiogram (ECG) showed PVCs of at least two morphologies, one of which was consistent with an origin in the RVOT. The sensed atrial-ventricular delay (SAVD) of the patient's device was reduced to shorten the delay between a sensed atrial event and initiation of biventricular pacing, therefore permitting less opportunity for ectopic ventricular contraction. Additionally, the patient's bisoprolol dosage was increased. On subsequent device interrogation, the patient's biventricular pacing had increased from 82% to 93% and her breathlessness had improved. The multifocal PVC morphology would render PVC ablation more technically challenging.[4] The significant improvement also minimised the need for intervention on the abnormal lead positioning, which might be technically difficult given the age of the lead and the presumption that the prolapse had occurred some time previously with accompanying fibrosis, with risks of damage to the vasculature akin to that of lead extraction.[5]

Previous publications similar to this case have not been identified. Lead displacement is a recognised complication of cardiac device implantation. However, excessive lead slack appears to be significantly less commonly reported, particularly in adults. The patient's device check and chest X-ray were used to assist with the differential diagnosis.

Conclusion

This case report outlines an unexpected and novel finding of left ventricular pacemaker lead slack found in the pulmonary artery. It highlights the importance and versatility of TTE for the follow-up of patients with cardiac devices. It also emphasises the impact of reduced biventricular pacing on this subset of patients and the potential methods that can be used to increased biventricular pacing. Finally, the importance of secure fixation of the suture sleeve to the lead and the underlying muscle during pacing implants is highlighted.

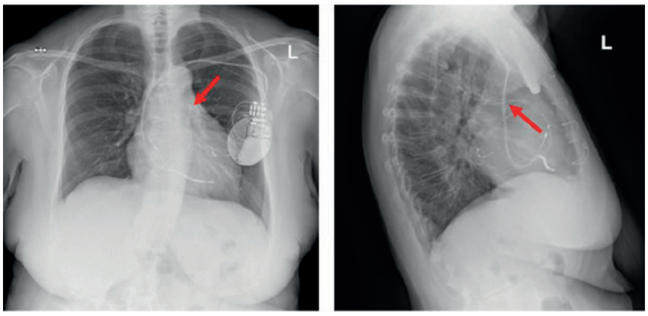


Fig 4. Chest X-ray taken 6 years post implant following suspicion of pacing lead displacement or migration (left = posteroanterior, right = lateral projection). The red arrows on the images identify the slack of the left ventricle pacing lead in the MPA. All three lead tips appear to remain in the same position as at implant, including the left ventricle lead which remains in a posterolateral branch of the coronary sinus. The generator does not appear to have rotated or shifted.

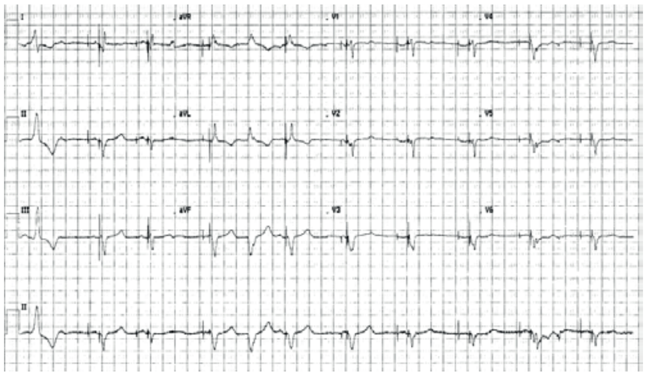


Fig 5. Electrocardiogram demonstrating PVCs of two morphologies, of which one is consistent with an RVOT origin. Pacing spikes suggest atrial and biventricular pacing with a narrow QRS complex.

References

1. Berul CI, Villafane J, Atkins DL, Cecchin F, Kirsh JA, Johns JA, et al. Pacemaker Lead Prolapse through the Pulmonary Valve in Children. *Pacing and Clinical Electrophysiology.* 2007;30(10):1183-1189.
2. Condello F, Gitto M, Stefanini GG. Etiology, epidemiology, pathophysiology and management of tricuspid regurgitation: an overview. *Reviews in Cardiovascular Medicine.* 2021;22(4):1115-1142.
3. Gasparini M, Galimberti P, Ceriotti C. The importance of increased percentage of biventricular pacing to improve clinical outcomes in patients receiving cardiac resynchronization therapy. *Current Opinion in Cardiology.* 2013;28(1):50-54.
4. Marcus GM. Evaluation and Management of Premature Ventricular Complexes. *Circulation.* 2020;141(17):1404-1418.
5. Bongiorni MG, Burri H, Deharo JC, Starck C, Kennergren C, Saghy L, et al. 2018 EHRA expert consensus statement on lead extraction: recommendations on definitions, endpoints, research trial design, and data collection requirements for clinical scientific studies and registries: endorsed by APHRS/HRS/LAHRS. EP *Europace.* 2018;20(7):1217.

A case of Immune checkpoint inhibitors induced myocarditis mimicking various echocardiographic features of cardiomyopathies

DR WESSAM SHARKAS, DR THANDAR AYE

Dr Wessam Sharkas

Dr Thandar Aye

Dr Wessam Sharkas, Cardiology Registrar, Dr Thandar Aye, Cardiology Consultant, Kings Mill Hospital, Sherwood Forest Hospitals NHS Foundation Trust

Case Presentation:

A 70-year-old female patient with a history of metastatic breast cancer involving the lungs and liver presented following the resumption of immunotherapy with pembrolizumab. She had a prior diagnosis of autoimmune-induced nephritis, resulting in chronic kidney disease (CKD) stage 3, which led to the temporary discontinuation of immunotherapy.

Upon re initiation of pembrolizumab, the patient developed increased lethargy, abdominal pain, vomiting, and diarrhoea over the course of several days. Additionally, she experienced an episode of severe chest pain on the day of admission. The patient's initial troponin level upon admission was measured at 204 ng/L (0-13 ng/L), which subsequently rose to 719 ng/L. An electrocardiogram (ECG) showed a sinus rhythm with a heart rate of 100 beats per minute and no ischemic changes. Provisional diagnoses were considered as acute coronary syndrome (ACS) versus myocarditis secondary to immunotherapy. ACS protocol was initiated while awaiting coronary angiogram.

Inpatient echocardiography revealed severely impaired left ventricular (LV) systolic function with preserved basal contraction and akinesis of the remaining LV segments. The left ventricular ejection fraction (LVEF) was calculated at 14%, with the LV nondilated and no significant valvular abnormalities noted. Echo features suggested Takotsubo/stress cardiomyopathy.

A coronary angiogram performed thereafter demonstrated unobstructed coronary arteries. Consequently, ACS medications were discontinued, and the patient was managed for a condition possibly indicative of Takotsubo cardiomyopathy versus immunotherapy-induced myocarditis. Appropriate heart failure medications were commenced.

The patient experienced persistent loose stools during admission. Clostridium difficile infection was ruled out, and a flexible sigmoidoscopy suggested resolving colitis, likely attributed to immunotherapy-induced colitis. The oncology team recommended initiating oral steroids at a dose of 60 mg once daily, to be tapered gradually over several months. A follow-up echocardiogram, performed after eight days of steroid treatment, demonstrated significant improvement in LV function (LVEF ~55%). It also revealed marked left ventricular hypertrophy (LVH) extending from the mid-cavity to the apex, with an "ace of spades" appearance and near-complete

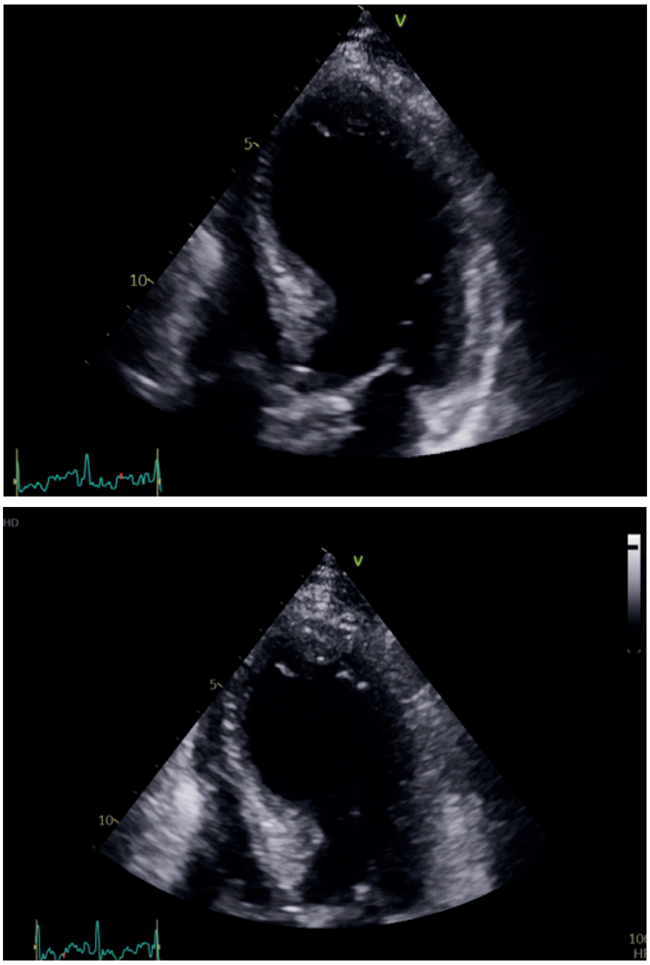


Fig 1,2. Apical 4 chamber image showing apical akinesia with preserved basal segments contraction suggestive of Takotsubo/stress cardiomyopathy.

obliteration of the apex during systole, mimicking apical hypertrophic cardiomyopathy (HCM). This was discussed in the weekly echocardiography meeting as stress cardiomyopathy can sometimes mimic HCM due to apical oedema. Consequently, a repeat echocardiogram was scheduled for three months, along with an outpatient cardiac magnetic resonance imaging (CMR) to evaluate for the presence of apical oedema. The patient was subsequently discharged.

Four weeks later, the patient re-presented with symptoms suggestive of another bout of colitis, deep vein thrombosis and acute interstitial pneumonitis confirmed from CT requiring another course of oral steroid therapy. Her echocardiogram remained normal with no evidence of cardiomyopathy during that admission, as seen previously.

Differential Diagnosis:

As the patient presented with chest pain, troponin elevation and severe LV systolic impairment, ACS was the first on the list of differential diagnoses which needed to be ruled out, non-obstructive coronary artery disease on coronary angiogram then necessitated consideration of immunotherapy-related myocarditis and stress cardiomyopathy as potential diagnoses.

Discussion:

Immunotherapy particularly immune checkpoint inhibitor (ICIs) plays a significant role in treating various malignant diseases. While these agents have shown remarkable clinical efficacy, they can activate the immune system, leading to immune-related adverse events that can involve the skin, endocrine glands, liver, lungs and heart.[1]

Myocarditis is a severe complication of ICI with a high morbidity and mortality rate that most frequently develops during the first 12 weeks of treatment, although late cases (after week 20) may also occur.[2] Recent reports have highlighted the risk of cardiotoxicity related to ICIs administration which includes dyslipidaemia, ACS, vasculitis, atrial fibrillation, AV block, supraventricular and ventricular arrhythmias, sudden death, Takotsubo cardiomyopathy, pericarditis, pericardial effusion, and ischaemic stroke.[3]

Takotsubo syndrome (TTS) or stress cardiomyopathy is increasingly being reported in patients with cancer and in those undergoing chemotherapy. It has been described in patients with cancer who were treated with ICIs, with an estimated incidence of 0.03%.[4] The clinical presentation of stress cardiomyopathy mimics that of acute myocardial infarction (chest pain, ECG abnormalities, elevated cardiac troponin) and is characterised by an acute and reversible LV dysfunction (left ventricular mid segments akinesis with apical ballooning) in the absence of angiographically evidence coronary disease or plaque rupture.[5]

In patients with cancer, the 2022 European Society of Cardiology (ESC) guidelines on cardio-oncology recommend coronary angiography and CMR to exclude ACS and myocarditis, respectively, for the diagnosis of TTS. Of note, the guidelines highlight the importance of early cardiac imaging, given the transient nature of LV involvement.[6] Early cardiac imaging using TTE and CMR is recommended in all patients with suspected ICI-associated myocarditis.

Endomyocardial biopsy has traditionally played a key role in the differential diagnosis, although the routine use of this procedure is limited by its invasive nature. It is still should be considered if diagnosis is suspected but not confirmed non-invasively.[7]

Treatment of TTS is mainly supportive involving the standard heart failure treatment, including β-blockers, angiotensin-converting enzyme inhibitors, and dapagliflozin. Interruption of the culprit cancer drug in patients with Takotsubo syndrome is recommended. In cases of ICI-associated TTS, 2022 ESC guidelines stated that the role of immunosuppression is unknown and if myocardial inflammation is present on CMR in a Takotsubo pattern then IV methylprednisolone is recommended given the overlap between ICI-induced TTS and ICI-induced myocarditis.

There is still no clear data regarding ICI rechallenge following TTS and after recovery of LV function, MDT discussion is recommended after recovery from the acute phase and if restarting ICIs is required from an oncology perspective, regular cardiac biomarker monitoring is recommended (e.g. cTn and NP measured before every ICI cycle, and TTE if a new rise in cardiac biomarkers occurs).

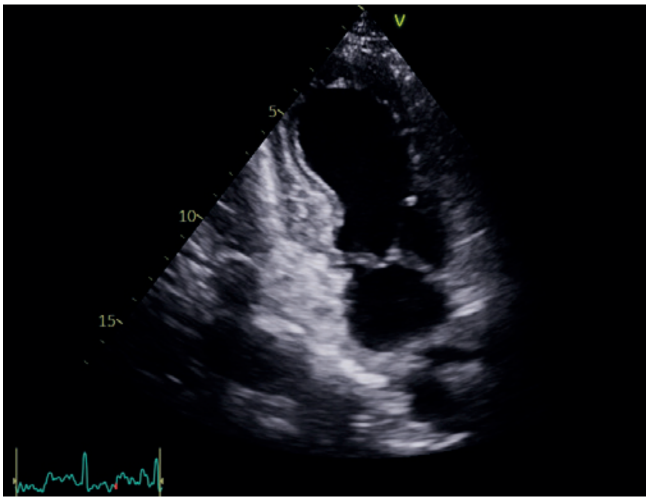


Fig 3. Apical 2 chamber image showing apical akinesia with preserved basal segments contraction suggestive of Takotsubo/stress cardiomyopathy.

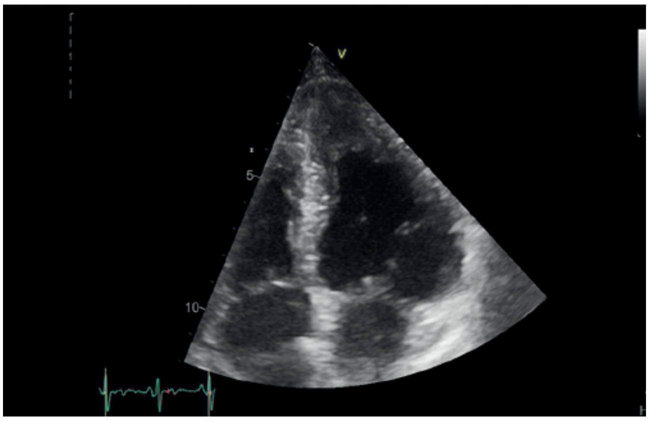


Fig 4. Apical 4 chamber image showing marked left ventricular hypertrophy extending from the mid-cavity to the apex, with an “ace of spades” appearance and near-complete obliteration of the apex during systole, mimicking apical hypertrophic cardiomyopathy due to apical oedema.

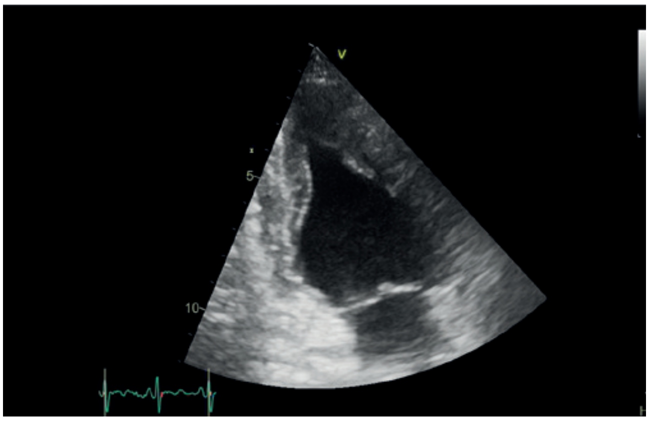


Fig 5. Apical 2 chamber image showing marked left ventricular hypertrophy extending from the mid-cavity to the apex, mimicking apical hypertrophic cardiomyopathy due to apical oedema.

Conclusion:

ICIs have significantly improved prognosis in many cancers; However, its cardiovascular toxicity adverse effects can be very serious. Hence, close cardiac monitoring is recommended in patients receiving ICIs. When cardiotoxicity is suspected, early cardiac imaging is recommended for early diagnosis and subsequently early initiation of treatment.

Our case demonstrated multiple echocardiographic features of cardiomyopathies related to ICI myocarditis, with initial TTE features of Takotsubo cardiomyopathy which later changed into apical HCM features at subacute resolution phase of myocarditis. It highlights a very important clinical reminder that a certain echocardiographic finding of cardiomyopathy should be interpreted with caution during an acute phase of illness especially in context of ICI associated myocarditis.

References

1. Berg DD, Vaduganathan M, Nohria A, Davids MS, Alyea EP, Torre M, Padera RF Jr, Moslehi JJ. Immune checkpoint inhibitor myocarditis: pathophysiological characteristics, diagnosis, and treatment. J Am Heart Assoc. 2020;9(2):e013757.
2. Brahmer JR, Abu-Sbeih H, Ascierto PA, Brufsky J, Cappelli LC, Cortazar FB, et al. Society for Immunotherapy of Cancer (SITC) clinical practice guideline on immune checkpoint inhibitor-related adverse events. J Immunother Cancer. 2021;9(6):e002435.
3. Kondapalli L, Neilan TG. Cardiovascular immunotoxicities associated with immune checkpoint inhibitors: a safety meta-analysis. Eur Heart J. 2021;42(48):4964–4972.
4. Ederhy S, Dolladille C, Thuny F, Alexandre J, Cohen A. Takotsubo syndrome in patients with cancer treated with immune checkpoint inhibitors: a new adverse cardiac complication. Eur J Heart Fail. 2019;21(7):945–947.
5. Yoshikawa T. Takotsubo cardiomyopathy, a new concept of cardiomyopathy: clinical features and pathophysiology. Int J Cardiol. 2015;182:297–303.
6. Task Force on Cardio-Oncology of the European Society of Cardiology (ESC), European Hematology Association (EHA), European Society for Therapeutic Radiology and Oncology (ESTRO), International Cardio-Oncology Society (IC-OS). 2022 ESC Guidelines on cardio-oncology developed in collaboration with the EHA, ESTRO, and IC-OS. Eur Heart J. 2022.
7. Palaskas NL, Segura A, Lelenwa L, Siddiqui BA, Subudhi SK, Lopez-Mattei J, Durand JB, Deswal A, Zhao B, Buja LM, Iliescu C. Immune checkpoint inhibitor myocarditis: elucidating the spectrum of disease through endomyocardial biopsy. Eur J Heart Fail. 2021;23(10):1725–1735.

Acute Aortic Syndrome – A Physiologist's Perspective

[1]MOSSAMAD FARHANA YASMIN,
[2]DR KASSEM SAFWAN

Mossamad Farhana Yasmin

Dr Kassem Safwan

[1]Chief Cardiac Physiologist, Kettering General Hospital NHS Foundation Trust

[2]Consultant Adult Congenital Heart Diseases, Department of Cardiology, University Hospitals of Leicester NHS Trust

Background

Acute aortic syndrome (AAS) is a broad clinical entity that encompasses a myriad of pathologies that are often overlapping. There are three core conditions with aortic dissections (AD) being the most common pathology, making up 70-80% of all AAS.[1] Aortic intramural haematoma (IMH) and penetrating atherosclerotic aortic ulcer (PAU) may not be fully appreciated in initial acute imaging, despite prominent disorders within the scope of AAS. Examples of other conditions include unstable aortic aneurysmal rupture, traumatic aortic injury and aortic aneurysmal leak.[2]

Case 1 – Aortic dissection with thrombosed false lumen

Patient presentation - an 87-year-old caucasian male referred for a routine outpatient echocardiogram (TTE) to assess for possible heart failure, complaining of shortness of breath and bilateral leg swelling. He had a background of mixed dementia and atrial fibrillation, with significantly limited mobility and was a wheelchair user. The study was technically challenging, with poor acoustic windows due to body habitus. The patient became increasingly symptomatic when positioned supine, which further complicated the examination.

On parasternal images, the aorta was noted to be significantly dilated, measuring 6.8cm, with a static echo bright linear structure suggestive of an intimal flap (Figure 1) that could easily be mistaken for a shadow artefact by an inexperienced operator due to poor image quality. Colour flow Doppler in the modified parasternal and apical five-chamber views demonstrated a clear mismatch between the width of blood flow and the diameter of the aorta, filling only approximately 30% of the proximal ascending aorta (Figure 2). Suspicion was also raised in the apical five chamber image, where there appears to be an echo dense portion of the ascending aorta (Figure 3) and in the abdominal aorta from the subcostal window (Figure 4). The aortic valve was trileaflet with mild to moderate stenosis and no significant regurgitation.

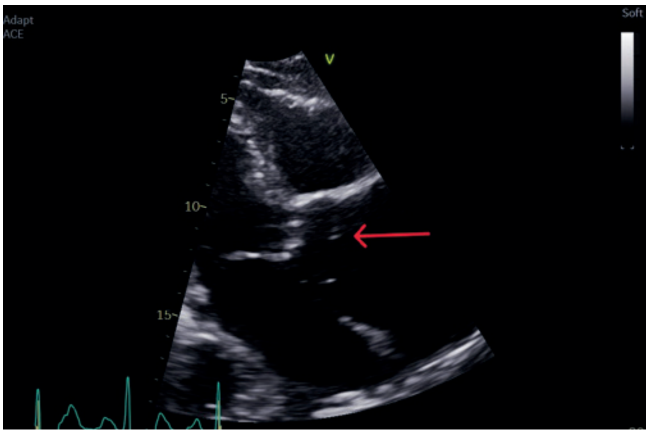


Fig 1. Parasternal long axis zoom showing intimal flap

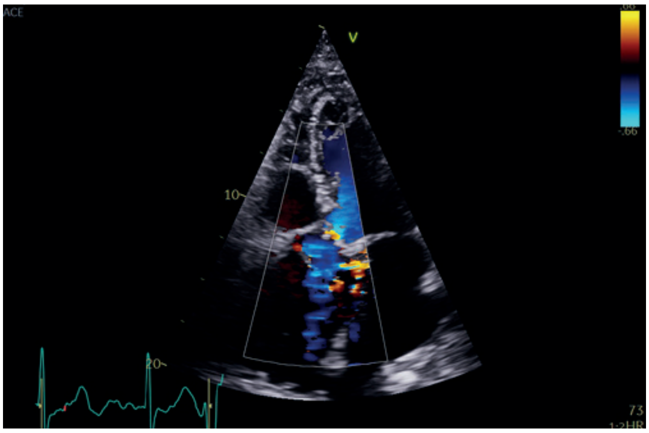


Fig 2. Apical five-chamber view with colour flow Doppler filling approximately 30% of the ascending aorta

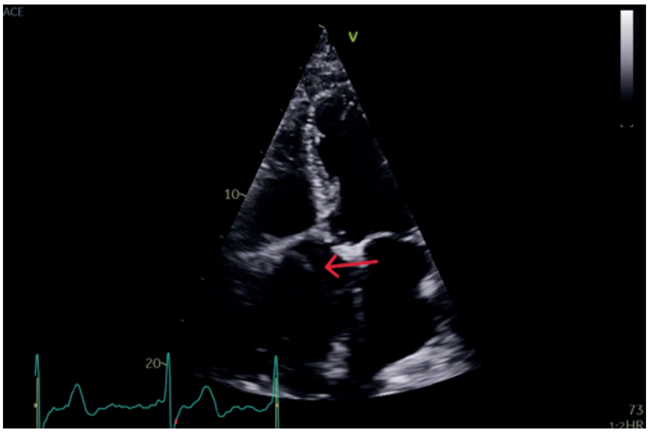


Fig 3. Apical five-chamber view showing an echogenic portion of the ascending aorta

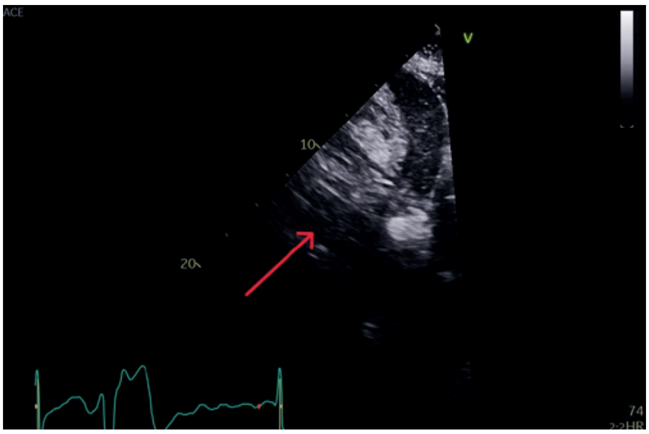


Fig 4. Subcostal view of the abdominal aorta with dissection and possible echogenic area

The report concluded that the findings were consistent with a chronic aortic dissection, with high suspicion of haematoma within the suspected false lumen. There was an urgent review of the patient by cardiology at the district general hospital at the time and he was admitted to the emergency department (ED) and referred for urgent further imaging.

CT Aorta confirmed the dilatation at 6.8cm, agreeing with the TTE, and revealed a Stanford type A aortic dissection extending from the root to involve the arch, descending thoracic and abdominal aorta with a partially thrombosed larger false lumen (Figures 5,6,7). The cardiac vessels originated from the true lumen, along with the celiac axis, superior mesenteric artery and right renal arteries. The left renal artery originated from the false lumen with nonenhancement of the left kidney.

Although urgent vascular review and operative management were recommended at the time, the patient declined any surgical intervention. After discussion involving the cardiac surgeons from a tertiary centre, he was referred for conservative medical management and discharged from the general hospital. The patient and his family demonstrated a clear understanding of the condition and its poor prognosis, and six months on he celebrated turning 88.

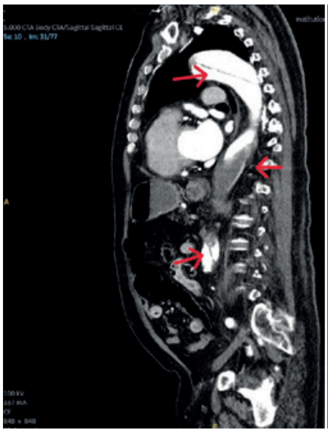


Fig 5. Subcostal view of the abdominal aorta with dissection and possible echogenic area

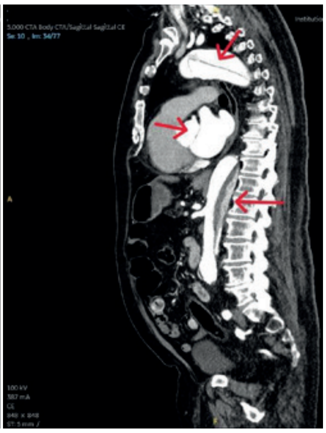


Fig 6. CT Aorta sagittal cut showing the dissection in the aortic arch and partially thombosed descending Aorta

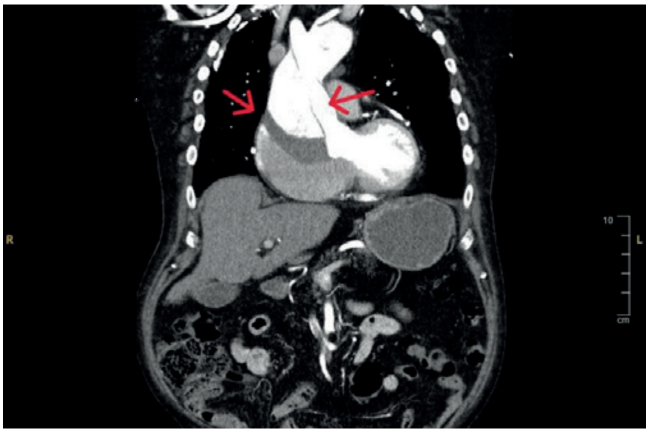


Fig 7. CT Aorta coronal cut showing the LV and Ascending aorta with dissection and partially thombosed false lumen

Case 2 - Penetrating atherosclerotic aortic ulcer with intramural haematoma and haemopericardium

Patient presentation - A 63-year-old caucasian female presented to the ED with episodes of collapse and pleuritic chest pain, reporting a general sense of being unwell with increasing shortness of breath. She was usually fit and healthy, though one week earlier she had experienced a pre-syncopal episode accompanied by a headache. She is an active smoker with a 30 pack-year history.

A CTPA was performed in the ED to rule out pulmonary embolism (PE) in the context of an elevated D-dimer of 1600ng/mL. The scan excluded an acute PE and instead demonstrated bilateral basal inflammatory changes and a modest pericardial collection. The reporting radiologist suggested the appearances were in keeping with pericarditis. A troponin level of 6 ng/L was noted, which was within the normal range and not suggestive of myocardial injury. The aorta showed modest enhancement but no overt lesion.

Cardiology were asked to review the patient due to the suspicion of pericarditis/pericardial effusion. Bedside transthoracic echocardiogram (TTE) conducted by a cardiology registrar and a cardiac physiologist showed normal biventricular systolic function with no significant valvular disease, a small global pericardial effusion without features of tamponade and a dilated aorta. After obtaining focused images with further optimisation (Figure 8), the aortic wall appeared thickened and echo lucent. These findings, combined with the patient's clinical presentation, prompted an urgent CT to assess for an acute aortic dissection.

CT revealed evidence of tiny outpouchings (Figure 9, 10) involving the junction of the ascending aorta and aortic arch, and irregular contours with associated periaortic soft tissue thickening with small volume pericardial effusion. The outpouching was contrast-filled, such protrusions are often said to resemble a mushroom[3] and can appear similar to an ulcerated plaque. The distinguishing features being ulcerated plaques have an undulating interface with overlying thrombus whereas PAU has a smooth interface.[4]

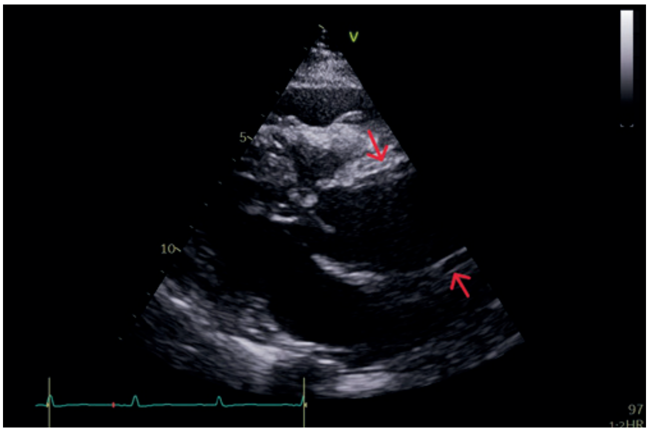


Fig 8. Parasternal long axis showing the abnormal appearance of the aortic walls

Fig 9. CT Aorta axial cut showing the outpouching

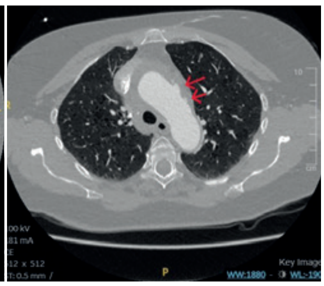


Fig 10. CT Aorta axial cut showing the outpouching

The summary of the report stated the appearances are suggestive of PAU with IMH and haemopericardium.

An immediate surgical opinion was obtained, and the patient was transferred to a tertiary centre for emergency intervention. Intraoperative findings revealed an intimal tear without a dissection flap in the ascending aorta, along with extensive intimal haematoma extending from the aortic root into the arch. The patient underwent replacement of the ascending aorta and aortic arch, with rerouting of the innominate and left common carotid arteries using the Lupiae technique. The procedure and subsequent recovery were uneventful.

Discussion

The two most widely used classification systems for aortic dissection are the DeBakey and Stanford classifications. Similarly, IMH and PAU are also classified in the same way.

The three main layers of the aortic wall, (from inside to out) the tunica intima, tunica media and tunica adventitia, cannot usually be differentiated by transthoracic echocardiography in normal circumstances,[5] The layer of the aortic wall most susceptible to injury and the site for atherosclerosis and calcification is the intima, it may become thickened, calcified or ulcerated.[5]

Penetrating atherosclerotic aortic ulcer makes up approximately 5-7.5% of all AAS cases[6] and is a chronic condition where crater-like ulcers invade the internal elastic lamina. The condition is associated with hypertension and typically occurs secondary to plaque buildup due to systemic atherosclerosis,[1] causing the portion of the aorta to weaken, leading to penetrating erosion of the aortic wall. Propagation of this condition gives weight to its severity as it can progress, leading to a pseudoaneurysm by breaking through into the adventitia, or rupture.[7]

TTE is generally not indicated for diagnosing PAU due to the small size of the ulcers (up to 2.5 cm in diameter and 3 mm in depth),[8] however transoesophageal echocardiography (TOE) may be able to identify asymmetrical outpouching of the aortic wall.[9]

Intramural haematoma makes up 10-25% of all AAS cases.[10] Causes may be traumatic (direct physical injury) and nontraumatic (hypertension or PAU). As with PAU, traditionally there is no evidence of intimal tear, with the condition characterised by the presence of haemorrhage within the aortic wall,[11] propagating along the media layer of the aorta without communication with the true aortic lumen. The underlying pathophysiology mechanism is still a matter of discussion, traditionally it was thought to be caused by spontaneous bleeding from the vasa vasorum into the aortic media.[1] In some cases, a micro intimal tear can be seen without a re-entrant tear.[1]

While TOE is a reliable imaging modality to identify the 'echo-free space' / 'echo-lucent layer' of the aortic wall,[12] it is not as convenient or rapidly accessible in the emergency setting as bedside TTE.[1] Both modalities only image segments of the ascending aorta and can be prone to artefact or limited by image quality.[13] TTE as an isolated investigation is not recommended for diagnosis,[14] however the complications that occur due to the pathology can be easily detected by the modality. Pericardial effusion is present in up to 60% of patients with type A classification,[15] caused by aortic rupture or blood extra-vasation through an irritated adventitia.[16] Thirty five percent of patients have some grade of aortic regurgitation.[15]

Conclusion:

Acute aortic syndrome is a variety of acute painful and potentially life-threatening aortic pathologies that require immediate medical attention.[1] Although rare, it is essential to be informed about the presentation of these diseases, to avoid misdiagnosis and incorrect triaging. Imaging is indispensable in the diagnostic and screening process.[1] While CT is the current gold standard, TTE at bedside is a very important first imaging test to be performed in patients with high suspicion of AAS.[15] This is especially important in unstable patients for whom rapid TTE can be done in ED.[15] TTE will not only help in diagnosis of AAS but can also provide important clues even in cases where limitations of the modality pose a challenge.

References and further reading

1. Vignaraja V, Sharma S, Dindyal S. Acute Aortic Syndrome. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK576402/
2. Ahmad F, Cheshire N, Hamady M. Acute Aortic Syndrome: Pathology and Therapeutic Strategies. Postgrad Med J. 2006;82(967):305-12. doi:10.1136/pgmj.2005.043083 - Pubmed
3. Voitle E, Hofmann W, Cejna M. Aortic Emergencies-Diagnosis and Treatment: A Pictorial Review. Insights Imaging. 2015;6(1):17-32. doi:10.1007/s13244-014-0380-y - Pubmed
4. Ko J, Goldstein J, Latson L et al. Chest CT Angiography for Acute Aortic Pathologic Conditions: Pearls and Pitfalls. Radiographics. 2021;41(2):399-424. doi:10.1148/rg.2021200055 - Pubmed
5. Cheung AT, Weiss SJ. Intraoperative Echocardiography: Diseases of the Aorta. In: Practical Echocardiography Series. 2012;161-182. doi:10.1016/B978-1-4377-2698-5.00007-X
6. Evangelista A, Maldonado G, Moral S, Teixido-Tura G, Lopez A, Cuellar H, Rodriguez-Palomares J. Intramural hematoma and penetrating ulcer in the descending aorta: differences and similarities. Ann Cardiothorac Surg. 2019 Jul;8(4):456-470. doi: 10.21037/acs.2019.07.05. PMID: 31463208; PMCID: PMC6687957.
7. K. Patatas, V. Shrivastava, D.F. Ettles. Penetrating atherosclerotic ulcer of the aorta: A continuing debate. Clinical Radiology, Volume 68, Issue 8, 2013, Pages 753-759, ISSN 0009-9260, https://doi.org/10.1016/j.crad.2012.11.014.
8. Dev R, Gitanjali K, Anshuman D. Demystifying penetrating atherosclerotic ulcer of aorta: unrealised tyrant of senile aortic changes. J Cardiovasc Thorac Res. 2021;13(1):1-14. doi: 10.34172/jcvtr.2021.15. Epub 2021 Jan 30. PMID: 33815696; PMCID: PMC8007901.
9. Valente T, Sica G, Bocchini G, Romano F, Lassandro F, Rea G, Muto E, Pinto A, Iacobellis F, Crivelli P, Abu-Omar A, Scaglione M. MDCT Imaging of Non-Traumatic Thoracic Aortic Emergencies and Its Impact on Diagnosis and Management-A Reappraisal. Tomography. 2022 Jan 13;8(1):200-228. doi: 10.3390/tomography8010017. PMID: 35076599; PMCID: PMC8788571.
10. Benedetti G, Trimarchi G, Palmieri C, Paradossi U, Berti S, Rizza A. A Case Report of Aortic Intramural Hematoma: From Diagnosis to Endovascular Treatment Guided by Transesophageal Echocardiography. J Cardiovasc Echogr. 2024 Apr-Jun;34(2):85-89. doi: 10.4103/jcecho.jcecho_21_24. Epub 2024 Jun 28. PMID: 39086698; PMCID: PMC11288297.
11. Gaillard F, Silverstone L, Bell D, et al. Aortic intramural haematoma. Reference article, Radiopaedia.org (Accessed Nov 2025) doi: 10.53347/rID-919
12. Song JK. Diagnosis of aortic intramural haematoma. Heart. 2004 Apr;90(4):368-71. doi: 10.1136/hrt.2003.027607. PMID: 15020502; PMCID: PMC1768152.
13. Evangelista A, Flachskampf FA, Erbel R, Antonini-Canterin F, Vlachopoulos C, Rocchi G, et al. Echocardiography in aortic diseases: EAE recommendations for clinical practice. Eur J Echocardiogr. 2010;11:645-658. doi:10.1093/ejechocard/jeq056.
14. Erbel R, Aboyans V, Boileau C, Bossone E, Di Bartolomeo R, Eggebrecht H, et al CPG ESC. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. Eur Heart J. 2014;35(41):2873–2926. doi:10.1093/eurheartj/ehu281.
15. Ferrera C, Vilacosta I, Cabeza B, Cobiella J, Martínez I, Saiz-Pardo Sanz M, Bustos A, Serrano FJ, Maroto L. Diagnosing Aortic Intramural Hematoma: Current Perspectives. Vasc Health Risk Manag. 2020 Jun 8;16:203-213. doi: 10.2147/VHRM.S193967. PMID: 32606717; PMCID: PMC7292252.
16. Evangelista A, Maldonado G, Gruosso D, et al. The current role of echocardiography in acute aortic syndrome. Echo Res Pract. 2019;6(2):R53–R63. doi: 10.1530/ERP-18-0058

Recently accredited members list

LEVEL 1 ECHO ACCREDITATION

Saada Al Adawi University College London Hospital
Tanmay Anand Addenbrooke's Hospital
Ashli Antoine University College London Hospitals NHS Foundation Trust
Mari Boylan St James Hospital/Mater Hospital
Theodoros Christoforatos King's College Hospital
Tarek Hassan University Hospital Birmingham
Alexander Henshall Stoke Mandeville Hospital
Viacheslav Lisitskiy Glan Clwyd Hospital
Guy Miller St Richards Hospital
Karim Shahin Royal Brampton and Harefield Hospital
John Soothill Salford Royal Hospital
Chiedozie Uwakwem University College London Hospitals NHS Foundation Trust

TRANSOESOPHAGEAL ACCREDITATION

Ryan Goodland Basingstoke and North Hampshire

CONGENITAL ACCREDITATION

Juan Felipe Ortega Restrepo Royal Brompton & Harefield Hospitals
Rui Da Silva Mota King's College Hospital

TRANSTHORACIC ACCREDITATION

Abdelhakim Abdalla Barnet Hospital
Mathews Abraham Northumbria Healthcare NHS
Reda Abuhassan West Middlesex University Hospital
Emma Adamson University Hospital of North Tees
Aaminah Afzal University Hospital Lewisham
Seema Arokiaraj Salford Royal Hospital
Jack Bell Aintree University Hospital
Rosie Bennett Basildon Hospital
Richard Blake Swansea Bay Health Board
Jennifer Blears Fairfield General Hospital
Mhairi Bolland Hammersmith Hospital
Philip Brinksman University Hospital North Midlands
Maxwell Cameron Castle Hill Hospital
Jarred Camm Jersey General Hospital
Emma Campbell Golden Jubilee National Hospital
Niall Carlin Royal Infirmary of Edinburgh
Alisha Chowdhury County Durham and Darlington Foundation Trust
Bethany Cornish South Tyneside and Sunderland
Thomas Curran The Dudley Group NHS Foundation Trust
Georgina Dean Hampshire Hospital
Ma Yurikris Dichosa Queen's Hospital
Temitayo Diya Cambridge University Hospital
Jamie Edwards St Georges Hospital
Paul Edwards Royal Glamorgan Hospital
Raneem El-Sherif Royal Papworth Hospital
Natasha Fennell Queen Elizabeth Hospital, Birmingham
Gracie Fisk Basildon Hospital
Samuel Gachie Addenbrooke's Hospital
May Marie Airiel Garce Colchester General Hospital
Rosie Geale University Hospital Dorset
Daniel Githu Xyla Healthcare Limited
Lauren Grinstead Wrexham Maelor Hospital
Ashraf Hamarneh Lagan Valley Hospital
Matthew Hammond-Haley Hammersmith Hospital
Laura Hawken Echogenicity LTD
Kyriacos Ioannides Whipps Cross University Hospital
Rinkle Jerome Cambridge University Hospital NHS
Jasmine Joly Chelsea and Westminster
Beverley Jones Imperial College NHS
Mary June Jordan East and North Hertfordshire - Lister Hospital
Sandhra Joy Royal Preston Hospital
Madhu Karthick InHealth Echotech
Rebecca Lola University Hospital Derby and Burton
Chantelle Malcolm Guy's and St Thomas' NHS Foundation Trust
Alison Miller Aberdeen Royal Infirmary
Sean Miller University Hospital Southampton
Nikitha Mohan Addenbrooke's Hospital
Vina Gayle Angela Molina Frimley Health NHS
Tha Nyi Barts Health NHS
Thomas Oswald University Hospitals Sussex NHS Foundation Trust
Marthuri Partheban Leeds Teaching Hospitals
Sonu Paulose Heartlands Hospital (University Hospital Birmingham)
Rhiannon Peters Leeds Teaching Hospitals
Sadaf Raza Manchester Royal Infirmary
Doreen Ronald Basildon Hospital
Irish Joy Rosario St Bartholomew's Hospital
Charley Sanford Queen Alexandra - Portsmouth Hospital
Ferdinand Sawer Basildon Hospital
Chloe Sendall Pilgrim Hospital
Shivam Shelke North Cumbria Integrated Care
Abhishek Shetye St Bartholomew's Hospital
Alexander Stevenson Harefield Hospital
Ally Sugathan Healthshare Ltd
Marin Sunny Dartford and Gravesham
Caelan Taggart Royal Infirmary of Edinburgh
Awais Tahir The Royal Wolverhampton Hospitals NHS Trust
Saranya Thavarajah Homerton Healthcare
Eaint Thein Buckinghamshire Healthcare NHS Trust
Farisha Venmarath Colchester General Hospital
Kay Wilson The Royal Shrewsbury Telford
Mela Tsehaie Woldai Northwick Park Hospital
Amy Woodgate Royal Hampshire County Hospital
Supriya Yadav University Hospital of Leicester

STRESS ECHO ACCREDITATION

Jonathan Fewster Leeds Teaching Hospitals
Marlene Monteiro Cleveland Clinic London
Leigh-Ann Wakefield Northwick Park
Gary Zealand York Hospital

Accreditation Clinic

The accreditation clinic is a great opportunity to meet with the accreditation team to discuss anything from written exams to practical exams and even departmental accreditation.

The clinic is run on the first Thursday of every month at 1pm.

Sign up for the next clinic by visiting the events webpage

bsecho.org/events

Accreditation Clinic dates

Thursday 2 April 2026	Thursday 02 July 2026	Thursday 01 October 2026
Thursday 07 May 2026	Thursday 06 August 2026	Thursday 05 November 2026
Thursday 04 June 2026	Thursday 03 September 2026	Thursday 03 December 2026

Exam Dates 2026

Practical Assessments

Saturday 28 March and Sunday 29 March 2026, Stoke-on-Trent (TTE, ACCE, L1, TOE & CHD)
Registration closed

Sunday 17 May, Oxford (TTE, ACCE, L1)
Registration opens - 19 February 2026 and closes 19 March 2026

Saturday 20 June 2026 – Stress Echo
Registration opens 25 February 2026 and closes 21 April 2026

Saturday 12 September 2026 and Sunday 13 September 2026 – Manchester (TTE, TOE, L1, Stress and CHD)
Registration opens 19 May 2026 and closes Monday 29 June 2026

Sunday 15 November 2026 – Basildon (TTE, TOE, L1 and ACCE)
Registration opens 25 August 2026 and closes 29 September 2026

Written exams

Spring Written (31 March 2026) – TTE, ACCE and Congenital Echo
Registration closed

Autumn written exam (November – date TBC)

Endorsed Courses

Course: Millbrook Medical Conferences The Cardiff Echocardiography Course **Date:** 20 - 22 April 2026
BSE Points Awarded: 9 (3 per day) **Location:** Cardiff

Course: Critical Care Echo Education Advanced Critical Care Echocardiography Course **Date:** 17 & 18 April 2026
BSE Points Awarded: 4 (2 per day) **Location:** Dublin

British Society of Echocardiography
ADVANCED IMAGING
2026
Wednesday 15 April 2026
22 Duchess Mews, London
5 BSE points
Multi-modality imaging
Insights into valve disease and interventions
Multi-disciplinary case discussion
Expert speakers
Registration open now
bsecho.org/AIG001