Accreditation in Adult Transoesophageal Echocardiography

Information Pack

This pack is for the use of all candidates undergoing the accreditation process and becomes effective as of November 2016.

This document supersedes all previous versions.
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**Welcome message from Accreditation Chair**

Dear Candidate,

The transoesophageal echocardiography accreditation process represents a joint venture between the British Society of Echocardiography (BSE) and the Association of Cardiothoracic Anaesthetists (ACTA).

The process is primarily offered as a service to the Members of both these specialist societies. It is designed to accommodate the requirements of cardiologists, sonographers, anaesthetists, intensivists and cardiac surgeons. It is important that you read all the information carefully before commencing your specific speciality logbook.

The written section of the Assessment is held up to twice each year in various venues around the UK and Republic of Ireland. The practical assessment will be held approximately 4 times per year in a variety of locations. Full details and registration forms are on the website [www.bsecho.org](http://www.bsecho.org).

We would like every BSE member to undertake the relevant Accreditation process, which has, as its ultimate aim, the achievement and maintenance of high standards of clinical echocardiography for the benefit of our patients. A list of accredited members is maintained on the BSE website. The process has to be regulated, and the standard of proficiency required for each specific Accreditation has to be set at a high enough level to command the respect of our professional colleagues. Subject to these constraints, we want to make it possible for as many members as possible to obtain Accreditation, and not to put any unnecessary barriers in their way.

Please let us know if we can assist you in this process.


Jane Lynch  
Chair, BSE Accreditation Committee
Introduction and Aims

- Accreditation is run as a service for members of the British Society of Echocardiography and is not a compulsory or regulatory certificate of competence or excellence.
- Accredited echocardiographers are expected to be able to perform and report echocardiographic studies unsupervised.
- The Accreditation process is involved predominantly with transoesophageal echocardiography. However, an understanding of transthoracic echocardiography is also necessary because the two approaches are complementary.
- Accreditation is a minimum requirement and cannot be regarded as a guarantee of competence.
- The Accreditation process comprises a written exam, (theory and case reporting sections) and a practical assessment comprising a live observed practice assessment on a simulator, review of the required logbook and a review of selected Viva echo cases performed to a high standard.
- Echo skills can only be maintained by continued education and practical involvement in echocardiography. The importance of this is underlined by limiting Accreditation to 5 years after which re accreditation must be sought.
- Ongoing BSE membership is a requirement for maintaining accreditation.

Summary of process requirements

- You must be a member of the British Society of Echocardiography
- You should address all queries regarding accreditation to:
  BSE Accreditation Administrator, address details are available on the website www.bsecho.org,
  Tel: 020 7345 5185, Fax: 020 7345 5186, Email: accreditation@bsecho.org
- You should register for the written and practical assessments using the forms found on the BSE website. This will advise the date and location of the next examination.
- Each candidate for accreditation must enrol with a suitably qualified supervisor who undertakes to train and supervise and to arrange visits to other centres if there are difficulties obtaining an adequate case-mix locally.
- One or two supervisors at each centre have been approved by the BSE based on demonstration of competence at echocardiography and evidence of continuing practice. To maintain supervisor status it will be necessary for the supervisor him or herself to pass the BSE accreditation process. The names and contact details of supervisors in a candidate’s region are available on request from the BSE administrator.
- There is no general (or ‘grandfather’) exemption from BSE TOE accreditation.
- You must pass the written assessment before attending the practical assessment (logbook and cases).
- The practical assessment cases should be collected over a period of no more than 24 months around the written examination and the practical assessment being taken at no later than 2 months after the end of the collection period. You must submit:
  - 5 full cases accompanied by reports signed by yourself
  - A logbook containing 125 reports of a specific case mix (or 75 cases if you hold BSE or European Association of Cardiovascular imaging (EACVI) TTE Accreditation.
  - The full mentor sheet -appendix 6 & 12.

- Extensions to the 24 month deadline may be granted only following periods of parental or extended sick leave or in exceptional circumstances. Extension requests must be submitted in writing to the Chair (c/o the accreditation administration office) before the case COLLECTION deadline. Extension request forms can be obtained by contacting the BSE Accreditation Administrator. Requests received after the case deadline may not be reviewed.
- EXTENSIONS ARE NOT GUARANTEED. A non-refundable charge of £100 will be made for each extension request regardless of the outcome.
A fee of £150 is charged for the complete Accreditation process. This fee is payable, in advance upon registration for the written section of the examination and will also cover the Practical assessment. Candidates who are unsuccessful in the written section of the examination will be charged a reduced fee of £75 to re-sit this section. This reduced fee only applies to candidates who re-sit the examination within two sittings of the unsuccessful attempt. A re-attempt at the Practical assessment is also subject to a fee of £75. Candidates are entitled to 1 re-attempt at the practical assessment, after which the entire process must be undertaken again.

- The full training syllabus is available in appendix 2.
- Appeals - Please see the Appeals section on the website for details.

**Details of written assessment and practical assessments**

**Written assessment**

- The written assessment is held on up to two occasions each year. The Spring and Autumn examinations are held at different locations. Full details of dates, venues and registration forms, are circulated with the BSE Newsletter and on the BSE website.
- The written assessment is conducted under formal examination conditions. It is comprised of two parts: the Theory section and the Reporting section. The suggested reading list is available in Appendix 1.
- This consists of 100 Single Best Answer Questions covering the syllabus in Appendix 2. The questions test knowledge of echocardiographic findings with some additional questions on basic cardiology and physics.
- The first 50 Multiple Choice Questions (MCQ) will be based on video clips and the next 50 MCQs will be based on theory.
- Each MCQ comprises of a main stem followed by 5 options relating to the stem. The single best answer should be chosen. Some example questions are provided in Appendix 3.
- The subject matter reflects the spectrum of clinical practice according to both frequency and technical complexity. Thus valve disease is more frequently represented than ischaemic disease since, though seen less commonly in clinical practice, it presents a greater challenge to the echocardiographer.
- Both parts of the examination will be computer marked - guidelines in Appendix 5.
- In the written assessment it is necessary to pass both the multiple choice and imaging questions at the same exam sitting. The approximate pass mark for the Theory Section is approximately 70% and 80% for the Reporting Section. These may vary at the discretion of the Chief Examiner following moderation.
- There is no bar to re-sitting the written assessment.
- Accreditation will only be awarded once a candidate has also successfully completed the practical assessment (logbook and cases). A satisfactory performance at the written assessment alone does not allow ‘partial accreditation’.

**Theory Section**

- This consists of 50 Single Best Answer MCQs covering the syllabus in Appendix 2.
- The theory section will last **1 hour 10 minutes**.
- Each MCQ comprises of a main stem followed by 5 options relating to the stem. The single best answer should be chosen. Some example questions are provided in Appendix 3.
- The Theory examination will be marked +1 for correct answers, 0 for incorrect or unanswered questions (no negative marking).
- There are no ‘trick’ questions.

**Echo Reporting section**
This will consist of 50 Single Best Answer MCQs based on an echo image. They reflect the range of clinical material seen in routine echocardiographic practice.

The Echo Reporting section will last **1 hour 30 minutes**.

Each MCQ comprises of a main stem followed by 5 options relating to the stem. The single best answer should be chosen. Some example questions are provided in Appendix 4.

The clips and stills will last 100 seconds with a 10 second gap and will contain sufficient information to answer the questions.

The Echo Reporting examination will be marked +1 for correct answers, 0 for incorrect or unanswered questions (no negative marking).

There are no ‘trick’ questions.

**Practical assessment**

- All candidates will be required to attend a Practical assessment with 26 months of beginning to collect their cases. The written examination must have been passed before attending. The Practical assessment will be held 4 times per year. Dates and locations will be published on the BSE website. Candidates will be given an appointment time and should arrive at the venue up to 30 minutes prior to this. Latecomers will only be admitted in exceptional circumstances.
- The assessment will consist of 3 Stations.

**Station 1** will assess the **Logbook**.

- Logbooks and cases must be fully anonymised – please read the BSE Policy on the Non-Anonymisation of Patient data in appendix 12. A major breach of this policy will result in a fail.
- Logbook submission: The Logbook should be submitted in **one ring binder/file folder with the different categories separated by dividers**. Any Logbooks not submitted in this format will fail.
- If the candidate is successful at this station they will progress to **Station 2**.

**Logbook**

- The Logbook should comprise details of 125 Transoesophageal echocardiography cases personally **performed and reported** by you during the specified period of 24 months (or 75 cases if you hold BSE or **EACVI TTE Accreditation**). It is not acceptable to include cases reported by you that have been performed by someone else.
- Certificate evidence of EACVI TTE accreditation, if held, must be brought with you to the examination.
- The format for the Logbook is a set of copies of actual clinical reports enclosed in a folder or binder. The reports should have the following:
  - All patient data must be removed including: full date of birth, name or address. See appendix 12.
  - All cases must be collected in accordance with local requirements for data protection i.e. your trust policy.
  - Inclusion of patient’s age, heart rate, blood pressure, cavity and Doppler measurements, objective observations and a comment - appendices 7 and 8.
  - The signature and full name of the candidate is included. At least the final 50 cases should be reported primarily by the candidate alone although they may be checked by another operator.

- The studies should reflect the normal case-load of a general adult department and should include **at least one example** of the following casemix:
  - Mitral repair
Severe mitral valve regurgitation
Endocarditis
Basic adult congenital heart disease (e.g. ASD, VSD or pulmonary stenosis)
Aortic pathology (e.g. dissection, aneurysm, intramural haematoma)
Abnormal aortic valve
Hypovolaemia/septic shock assessment
Abnormal prosthetic valve
Intracardiac mass including thrombus
Pericardial effusion
Left ventricular wall motion abnormality
Pulmonary embolism assessment/right heart dilatation

No more than 20 studies should be predominantly normal

- A tally of the primary diagnosis assigned to each case must be entered on the appropriate enclosed summary sheet - appendix 9.
- Studies performed before and after bypass i.e. during the same operation, count as one study. A study performed for the same patient on separate occasions counts as a separate study.
- More than one candidate from the same institution is permitted to study the same patient if the diagnosis is unusual but each candidate must independently scan and write their own report.
- If you have problems finding enough specific cases, discuss this with your mentor who may consider arranging for you to attend a specialised centre.
- A letter from the supervisor must be submitted with the completed log-book certifying that the studies have been recorded by the candidate. The Curriculum Based Competency Assessment Tool should also be submitted with the logbook. (Appendix 6 & 11)

Station 2 will assess the Viva case submission.
- This will consist of a viva pertaining to the digital echo cases. The digital studies must be accompanied by their reports. Each study must be submitted as digital loops and still images within a PowerPoint presentation. The dataset for a complete study are listed in appendix 1.
- Image acquisition, optimisation, measurements and interpretation will be assessed. Studies must include one normal study, one case of aortic stenosis (moderate or severe) and three other examples listed in appendix 10. The candidate must demonstrate the appropriate use of standard Doppler equations.
- A guide to getting the cases right is available in appendix 10.
- If the candidate is successful at this station they will progress to Station 3.

Viva Case Submission
- Five full studies with reports must be brought to the Practical Assessment. The cases must be anonymised. This is the section that is often done least well and is where many candidates fail. Remember that it is assumed you will submit your best cases, so it is worth
spending extra time to ensure the submission is as good as it can be. Do not choose incomplete studies or patients who are poorly echogenic. Each case should be a full study performed to the BSE minimum dataset and not a focussed study.

- Please remember we are assessing your echo skills not the pathology you are sending in. Please optimise the 2D and Doppler images. Make sure you have optimised the gain setting, sector width, depth, harmonics, focus, sweep speed, Doppler baseline and scale, colour gain. Ensure that the cursors are correctly aligned. Candidates may be failed on just this aspect. Each case should be accompanied by a full and comprehensive report. This should include a summary that can be understood by any non-echocardiographer. If these points are not done well in your submission it may be assumed that you will have poor quality images on your routine cases.

- Read the assessment sheet that the assessors will be using for the practical examination. Only include loops and stills that you wish to be assessed. Ensure that loops and stills with measurements shown match the parameters quoted in the report.

- Each case should be accompanied by a full and comprehensive report including quantitative measurements, observations and a conclusion or summary.

- The following diagnoses and minimum criteria are required:

  > A normal study demonstrating appropriate use of machine settings for optimal imaging and correct use of standard 2-D views as per BSE minimum dataset (midoesophageal, transgastric and upper oesophageal), M Mode, CW, PW and Colour Doppler to assess chambers and valves. It is essential to demonstrate accurate measurement of the LV dimensions in at least one case. This would normally be in this case but if this is not possible, it is acceptable to provide this in at least one of the other cases.

  > Moderate or severe aortic stenosis (Please include a good demonstration of the use of the CW Doppler probe in the deep transgastric view/transgastric longaxis view). You should also calculate the valve area using the continuity equation and show all measurements used in the calculation.

  > Moderate or severe mitral or aortic regurgitation which demonstrates quantification of the degree of regurgitation as per BSE guidelines.

It is essential to demonstrate accurate measurement of the LV dimensions in at least one case. These measurements must be made in diastole and systole in both midesophageal 4 chamber and 2 chamber views. Ejection fraction and regional wall motion abnormalities must be described as well.

The remaining cases should include an example of one of the following:

a) Prosthetic valve with size and type noted and reference to normal values for that specific valve
b) Mitral repair
c) Endocarditis
d) Intracardiac mass including thrombus with differential diagnoses
e) Basic adult congenital heart disease (e.g. ASD, VSD or pulmonary stenosis)
f) Aortic pathology (e.g. dissection, aneurysm, intramural haematoma)
g) Hypovolaemia/septic shock assessment
h) Pericardial effusion
i) Pulmonary embolism assessment/right heart dilatation
• There will be a limited number of PCs available to review these cases. In order to ensure that your cases play properly at the assessment it is recommended that you bring your own laptop to the centre having checked that the cases play on this.
• The studies must demonstrate all appropriate echocardiographic views and must show the methods of measuring all dimensions on M-mode or 2D and all parameters on Doppler echocardiography.
• **No** case should have any patient-identifiable data. Erasing patient data may not always be possible after the examination so please ensure due care is taken to put ‘case 1’ instead of patient’s name or patient’s personal details. Alternatively you may wish to use descriptions of pathology such as “aortic stenosis”.
• You must be able to use the common Doppler equations e.g. continuity equation, calculation of a shunt, estimation of pulmonary artery systolic pressure.
• Cases that are of high quality may be copied to be used in subsequent BSE written exams.

**Station 3** will assess the **Image acquisition skills.** (Appendix 10)

• This will include testing the haptic knowledge and image acquisition skills of the candidate on an echo simulator. Any shortcomings identified in the previous stations will be probed.
• The simulator can be loaded with different pathologies.
• The candidate will be asked to acquire a good quality image of a particular view. Not all views may be possible in the available time.
• If there are concerns with any of the images assessors should question the candidate - if they can demonstrate appropriate knowledge/competence when questioned this may be sufficient.
• If the candidate is successful in obtaining the required views to the required standard, they will be deemed to have passed the Accreditation process and will receive their certificate in the post shortly afterwards.
Appendix 1 - Suggested Reading List
The syllabus is set by the Accreditation Committee of the British Society of Echocardiography and is presented as a guide to candidates.
The reading list is provided by the Accreditation Committee of the British Society of Echocardiography. There are many excellent books on echocardiography and some examples are listed below. In addition to those listed there are many small basic texts which are a useful introduction to the subject.

Authoritative textbooks (starting with the simpler texts as a suggestion)
- A Practical Approach to Transesophageal Echocardiography by Albert C. Perrino, Scott T. Reeves ISBN 1451175604
- Perioperative Two-Dimensional Transesophageal Echocardiography: A Practical Handbook by Annette Vegas. 1441999523

Useful review articles:
- Echocardiography: Guidelines for Chamber Quantification http://www.bsecho.org/media/40506/chamber-final-2011_2_.pdf


• Guidelines for the echocardiographic assessment of the right heart in adults: a report from the ASE endorsed by the EAE, a registered branch of the ESC, and the CSE. Rudski LG, Lai WW, Afilalo J et al. J Am Soc Echocardiogr. 2010 Jul;23(7):685-713

• Safe sedation during TOE. http://www.bsecho.org/recommendations-for-safe-practice-in-sedation/

Appendix 2 - Training syllabus for BSE accreditation

Topics that maybe included in the multiple choice examination

General Concepts

1. The place of echocardiography
   - Clinical role of echocardiography and Doppler
   - Information that echocardiography can and cannot provide
   - ‘Ruling out’ pathology (sensitivity, specificity & Bayes theorem)
   - Likelihood of findings influencing patient management
   - Undesirable outcomes: inaction while waiting for results, clinical ‘red herrings’
   - Indications for echocardiography
   - Competing and complementary technology
   - Cardiac catheterisation (ventriculography and coronary angiography)
   - CT imaging
   - Magnetic resonance imaging
   - Nuclear Cardiology

1.1 Service Provision
   - Provision and indication for specialised techniques, e.g. TOE, Contrast Echo.
   - Availability and access
   - Controlling workload
   - Training & motivation of staff
   - Audit, Quality Control & Clinical Governance
   - Infection control

1.2 Relationship with patients
   - Explaining the procedure in terms relevant to the particular patient
   - Respect for patients’ dignity and cultural backgrounds
   - Relationships with colleagues
   - Handling requests for information about the study findings

1.3 Reporting and Documentation
   - Standard methods & terminology
   - Distinction between Technical and Clinical reports
   - Responsibility for reporting - Medico-legal considerations (Data Protection Act)

2. Imaging Physics & Instrumentation

2.1 Concepts and Terminology
   - Concept of compression waves
   - Definitions: frequency, wavelength, propagation velocity
   - Units of measurement: Hz and MHz
   - Decibel Comparison of Ultrasound with audible sound.

2.2 Propagation of ultrasound through tissues
   - Speed of sound in different body tissues.
   - Frequency range used for diagnostic imaging
   - Distinction between specular reflection and backscatter
   - Principles of attenuation and scattering
2.3 Ultrasound Transducers
- Piezo-electric effect
- General concepts of 2D and 3D transducer construction
- Characteristics of the ultrasound beam: Far (Fraunhofer) & Near (Fresnel) zones, side lobes
- Beam steering methods: mechanical & electronic
- Focusing methods, including dynamic receive focusing
- Focus position
- The role of intracardiac echocardiography

2.4 Imaging physics
- Factors affecting choice of imaging frequency: typical practical values for adults & children
- Broad-band imaging
- Harmonic imaging
- M Mode imaging.
- Scanning speed limitations, relationships between pulse repetition frequency, frame rate, lines per frame, field of view, depth to be imaged.
- Temporal resolution.
- Grey scale and dynamic range
- Measurement and optimisation of Resolution: axial, lateral, azimuthal and temporal
- Side lobe and grating artefacts
- Reverberation artefacts
- Limiting factors for detecting small targets

2.5 Echo Instrumentation
- Function of machine controls: Transmit power, overall gain, time gain compensation, lateral gain compensation, reject, compression, signal processing, dynamic range, pre-processing; post processing.
- Optimisation of imaging parameters, including transducer frequency, scan angle, spatial and temporal smoothing
- Optimisation of 3D volume acquisitions including cropping and manipulation of viewing plane
- The advantages of 3D echocardiography over 2D echocardiography e.g. appreciation of mitral valve pathology, elimination of geometric assumptions in cardiac chamber volume estimations

2.6 Optimising Images
- Use of gel (infection risk from transducer, operator)
- Standard views: midesophageal (4C, 5C, 30°, 60°, 90° & 120° views), bicaval, RV inflow-outflow, upper oesophageal and transgastric views
- Use of non-standard views

2.7 Storage and Display of Images
- Basic concept of digital acquisition and storage systems. Scan converters and digital memories.
- Display devices and controls, recording techniques

3. Doppler physics & fluid dynamics

3.1 Basic Fluid Dynamics
- Fluid flow: significance of peak & mean velocities
• Determination of volumetric flow by Continuity equation
• Laminar & turbulent flow: Reynolds’ equation (qualitative)
• Transition from Laminar to turbulent flow: inlet jet Bernoulli equation

3.2 Principles of Doppler
• Interaction of ultrasound waves with moving blood: the Doppler effect
• The Doppler equation: factors influencing magnitude of Doppler shift
• Spectral analysis: fast Fourier transform (qualitative)
• The spectral Doppler display: determination of mean, modal and peak velocities
• Limitation of CW Doppler caused by lack of depth discrimination
• Audible range of Doppler shift frequencies
• The effect of beam angle errors on Doppler velocities
• Aliasing: how it is caused and how it manifests in practice: the Nyquist limit
• Influence on aliasing of: transducer frequency; sample depth (range x velocity product); and beam angle
• High pulse repetition frequency (extended range) PW Doppler and the phenomenon of range ambiguity
• Relative advantages and disadvantages of CW, PW and HPRF modes
• Concept of colour flow imaging as multi-sampled PW
• Velocity estimation, by moving target indication and autocorrelation (qualitative)
• Limitations of mean velocity: use of velocity variance to show high velocities/turbulence
• Aliasing in colour Doppler
• The principles of pulse wave tissue Doppler
• Packet size, colour mode and sector size and their effect on frame rate and aliasing

4. Deformation Analysis
4.1 Principles of Myocardial Deformation
• The definition of displacement, velocity, strain and strain rate
• The cardiac ultrasound co-ordinate system for describing motion and deformation: longitudinal, radial, circumferential and rotational axes
• Quantifying myocardial deformation as opposed to velocity or displacement
• Concept of shear deformation; rotation of the base and apex of the left ventricle, and the resultant twisting deformation or torsion

4.2 Quantifying myocardial strain and strain rate by tissue Doppler
• The concept of the myocardial velocity gradient
• The concept of strain and strain rate to define deformation
• Tissue Doppler imaging for deriving strain and strain rate: practical parameters in measuring strain and strain rate (e.g. sample size and shape, offset distance, drift compensation, spatial and temporal averaging, tracking of sample volume)
• Reproducibility issues

4.3 Speckle Tracking Echocardiography/2D strain
• Familiarity with the concept of speckles and speckle tracking in greyscale 2D loops
• Speckle tracking for angle-independent derivation of velocities, displacement, strain and strain rate, in 2 dimensions
• The impact of frame rates on the quality of speckle tracking
• Speckle tracking vs. tissue Doppler techniques for assessing myocardial motion and deformation
• Speckle tracking for measuring left ventricular rotation and torsion
• Kindred technologies
5. Doppler instrumentation

5.1 Spectral Doppler Instrumentation

- Features of the spectral display: positive & negative velocities; scale & baseline controls.
- Effect of high-and low-pass filter and intensity threshold (‘reject’) settings
- Pulsed Doppler sample volume: influence of gate length and distance (beam width)
- Representation of signal strength by image intensity
- How aliasing manifests on the spectral display

5.2 Colour Flow Instrumentation

- The colour display: BART convention
- Colour maps to show velocity scales
- Image domination and additive colour modes
- Difference between velocity and power (signal amplitude) displays
- Basic principles of Tissue Doppler Imaging (TDI), including optimisation of filters for detecting tissue versus blood velocities, sample volume and size, impact of interrogation angle on measured velocities, minimising aliasing, and maximising frame rates to detect short duration myocardial motion
- Differences between colour Doppler TDI and pulsed wave TDI.
- Minimisation of myocardial translational movements during acquisition.
- The concept of tracking on colour Doppler TDI to ensure that sample volume remains in the region of interest
- Parametric (curved M-mode) display of tissue Doppler images
- The relevance of importing cardiac cycle time points, such as aortic valve closure, into tissue Doppler traces

5.3 TOE Instrumentation

- Transducer types: single plane, biplane, omniplane
- Optimising machine settings for TOE Patient monitoring for TOE and general safety considerations
- Control of infection

5.4 Safety of ultrasound

- Potential hazardous biological effects: heating, resonance and cavitation effects
- Measurement of beam intensity (SPTA)
- Practical precautions: power levels, use of colour and CW Doppler
- Thermal Index, Mechanical Index

5.5 Recording methods

- Advantages/disadvantages of recording on videotape and digitally
- Basic understanding of digital image processing and recording methods: pixel density, volume of data, the DICOM standard, concept of data compression (JPEG, AVI, etc.), archiving of echocardiographic studies on magneto-optical discs, CD/DVD, portable solid-state memories, ECG-gated acquisitions vs. continuous recording, facility to review acquired loop prior to storage, facility to choose the number and type of cardiac cycles to be recorded, facility for offline image properties adjustment and further quantitative analysis.

6. Cardiac Anatomy and Physiology

6.1 Anatomy of the thorax
• Anatomy of oesophagus
• Anatomy of the oesophagus with respect to the heart.
• Anatomy of Lungs & pleura
• Anatomy of heart, pericardium and mediastinum

6.2 Gross anatomy of the heart
• Basic cardiac embryology
• Nomenclature of chambers and valves
• Major relationships of chambers, valves and blood vessels
• Distinguishing features of valves and chambers as related to echocardiography
• The pericardial sac

6.3 Cardiac anatomy and physiology as demonstrated by echocardiography
• Detailed structural anatomy of the heart, great vessels and pericardium
• Visualisation of normal cardiac anatomy and normal variants in standard echocardiographic planes
• Normal valve function, normal Doppler parameters and normal variants
• The phases of atrial function: reservoir, conduit and contractile phases
• The LV remodelling process in response to disease: eccentric (chronically elevated preload) vs. concentric hypertrophy (chronically elevated afterload)

6.4 The Cardiac Cycle
• Temporal relationships of the ECG, chamber pressures and valve movements
• Typical values for intracardiac pressures
• Relationship of valve movements to heart sounds
• Identification of valve opening and closure signals on Doppler recordings
• The timing of aortic valve closure as a marker of end-ejection, as derived from M-mode, blood flow Doppler or tissue Doppler

7. Cardiac functional parameters
7.1 Measurements and calculations
• On-screen measurement of length, slope, area, volume and time interval, and their significance for 2-D, 3D images, M-mode and spectral Doppler displays
• Standard M-mode measurements and calculations, both using machine software and manual methods
• Derivation of Stroke Volume, Ejection Fraction and LV Mass
• Methods of measuring LV volume, including biplane area, area-length, Simpson’s rule methods and 3D.
• Limitations of single plane estimations of LV ejection fraction e.g. Teicholtz formula method
• Limitations of single plane measurements of LA size
• Geometric assumptions used in estimation of cardiac chamber volumes with M mode and 2D imaging
• The advantages of deriving volumes and ejection fraction by 3D echocardiography
• Limitations of measurement and/or calculation validity in presence of poor quality and/or off-axis images

7.2 Doppler determination of cardiac output, ejection time and velocity acceleration
• Methods of measuring diastolic dysfunction: E/A ratio, deceleration time, pulmonary venous flow patterns, the ratio of the peak early diastolic transmitral velocity and the peak early diastolic tissue velocity of the mitral valve annulus (the E/E’ or E/Ea) ratio for estimating LV filling pressures, the mitral valve Flow propagation velocity
• Peak and Mean pressure gradient measurements by Doppler and their relationship to catheterisation data
• Measurement of pulmonary pressures from tricuspid and pulmonary regurgitant flow velocities and assessment of inferior vena cava contraction during inspiration

8. Contrast Studies
• Significance of spontaneous echo contrast
• Optimisation of machine control settings for detecting contrast
• Main indications for a bubble contrast study: diagnosis of intracardiac shunts and PFO, diagnosis of left sided SVC
• Manoeuvres to provoke right –to-left passage of bubbles during assessment for PFO
• Relevance of injecting bubble contrast through upper arm vein vs. femoral vein for detecting PFO
• Technique for performing a hand-agitated contrast study
• Clinical precautions

8.1 Awareness of encapsulated contrast agents and techniques
• Interaction of ultrasound with encapsulated agents
• Generation of harmonic energy by bubble distortion and fracture
• Doppler signals generated by bubbles (Power Mode)
• Main indications for LV and RV opacification: enhancing endocardial definition for assessment of regional contractility and accurate cardiac volume estimations, detection of intracardiac masses, distinguishing thrombus from a vascular tumour, diagnosis of cardiomyopathies e.g. non-compaction, arrhythmogenic right ventricular dysplasia, Doppler enhancement
• Use of contrast in stress echocardiography for improving detection of wall motion abnormalities and for assessment of myocardial perfusion

9. Pathology

9.1 Mitral Valve Disease, 2D, 3D, M-mode and Doppler features of the normal mitral valve

9.2 Mitral Stenosis
• Mitral Stenosis
• Recognition of rheumatic mitral stenosis
• Qualitative description of valve and sub-valve calcification and fibrosis
• Measurement of orifice area by planimetry
• Factors favouring successful balloon valvuloplasty
• Doppler assessment of mean and end-diastolic gradient
• Doppler assessment of area by ‘pressure half-time’: technique and limitations
• Role of exercise echocardiography in assessing the change in transmitral gradient and pulmonary systolic pressures with exercise, as decision aid in the timing of surgery/balloon valvuloplasty
9.3 Mitral regurgitation

- Aetiologies and typical echocardiographic features of
  - Rheumatic
  - Mitral annular calcification
  - Floppy/myxomatous mitral valve
  - Ischaemic
  - Functional
  - Infective endocarditis

- Assessment of severity by
  - Chamber sizes and volume overload
  - CW Doppler – shape and density of contour of Doppler signal
  - Vena contracta, PISA and effective regurgitant orifice area
  - Size of colour jet relative to atrial size by colour flow Doppler, Regurgitant fraction, regurgitant volume
  - Pulmonary vein flow patterns
  - Indirect effects on LV and LA
  - Role of echocardiography in determining timing of surgery for primary mitral valve disease: ejection fraction, end-systolic LV diameter, EROA
  - Role of TOE in assessing mitral valve pathology and in determining likelihood of repair as opposed to replacement

10. Aortic Valve Disease

10.1 2D, 3D, M-mode and Doppler features of the normal aortic valve

10.2 Aortic Stenosis

- Aetiology and echocardiographic features:
  - Rheumatic
  - Bicuspid
  - Senile degenerative
  - Sub- and supra-valve obstruction
  - Assessment by CW Doppler
  - Peak and Mean gradients
  - Apical, right parasternal and suprasternal positions
  - Continuity equation

- Assessment of left ventricular hypertrophy and use of stress echocardiography for distinguishing fixed anatomical stenosis from pseudostenosis in low flow aortic stenosis and for assessing LV contractile reserve

- Difference between transaortic pressure gradients derived from echocardiography and from cardiac catheterisation

10.3 Aortic Regurgitation

- Aetiology and typical echocardiographic features of:
  - Rheumatic
  - Bicuspid valve
  - Aortic root disease
  - Infective endocarditis (including root abscesses)
• Assessment of severity by:
  ➢ Chamber sizes/volume overload (regurgitant volume, regurgitant fraction)
  ➢ CW Doppler – shape and density of contour of Doppler signal, pressure half time
  ➢ Colour Doppler – size of jet relative to left ventricular outflow tract diameter
  ➢ Vena Contracta
  ➢ Effective regurgitant orifice area
  ➢ Diastolic flow reversal in descending aorta
  ➢ Indirect effects on LV
  ➢ Role of echo in determining timing of surgery
  ➢ Role of TOE in assessing aetiology and severity

11. Tricuspid Valve Disease

11.1 2D, M-mode and Doppler features of the normal tricuspid valve

11.2 Tricuspid valve stenosis
• Echocardiographic features
• Assessment of severity by imaging and Doppler

11.3 Tricuspid Regurgitation
• Aetiologies and echocardiographic features of:
  ➢ Rheumatic
  ➢ Prolapse
  ➢ Congenital
  ➢ Endocarditis
  ➢ Carcinoid
  ➢ Functional
• Assessment of severity by:
  ➢ 2D imaging and M-mode
  ➢ CW Doppler – shape and density of contour of Doppler signal
  ➢ Colour Doppler
  ➢ Hepatic vein flow pattern
  ➢ Indirect effects on RV and RA

12. Pulmonary Valve Disease

12.1 2D, M-mode and Doppler features of the normal pulmonary valve

12.2 Pulmonary Valve Stenosis
• Echocardiographic features
• Assessment of severity by:
  ➢ Spectral Doppler
  ➢ Detection of infundibular obstruction by spectral Doppler

12.3 Pulmonary Regurgitation
• Aetiologies and echocardiographic features
• Assessment of severity by
- Typical echocardiographic appearance of vegetations in bacterial and fungal endocarditis
- Preferred locations for vegetations
- ‘Jet’, ‘kissing’ lesions
- Endocarditis associated with congenital disease and HCM
- Complications: abscess, fistula, perforation, valve regurgitation
- Role of TOE in suspected endocarditis
- Monitoring of IE

14. Prosthetic valves

14.1 2D, M-Mode and Doppler features of the main types of replacement valves
- Tilting Disc
- Bi-leaflet
- Ball & cage
- Bioprostheses (stented and stentless)
- Age-related deterioration of bioprostheses
- Role of TOE in examining normal and malfunctioning prosthetic valves

14.2 Prosthetic valve stenosis
- Assessment by 2D, M-mode and Doppler
- Normal ranges
- Use of Continuity Equation for aortic prostheses
- The phenomenon of pressure recovery
- The diagnosis of patient-prosthesis mismatch

14.3 Prosthetic valve regurgitation
- Trans-versus para-valvular regurgitation
- Normal versus abnormal regurgitation
- Assessment by CW, PW and Colour
- Doppler Colour artefacts from mechanical prostheses

15. Cardiomyopathies

15.1 Dilated Cardiomyopathy
- 2D, M-mode and Doppler features of dilated cardiomyopathy
  - Detection and assessment of associated lesions
  - Functional valve regurgitation
  - Thrombus in cardiac chambers
  - Pericardial effusions
  - Role of echocardiography in assessment and follow-up
15.2 Hypertrophic Cardiomyopathy
- 2D, M-mode and Doppler features of Hypertrophic Cardiomyopathy
- Differentiation from other causes of hypertrophy, e.g. hypertension, athletic heart, amyloidosis, Fabry’s disease, Friedreich’s ataxia cardiomyopathy
- Techniques for measurement of left ventricular wall thickness, detection of left ventricular outflow tract obstruction and intracavity gradient
- Assessment of right ventricular involvement
- Associated abnormalities, e.g. systolic anterior motion mitral valve

15.3 Restrictive Cardiomyopathy
- Causes e.g. primary amyloidosis, sarcoidosis, idiopathic, endomyocardial fibrosis
- 2D, Doppler & TDI features of impaired ventricular filling – increased ventricular wall thickness, dilated atria, increased E/A ratio, reduced deceleration time, increased E/E’ ratio, reduced S’ wave.

15.4 Main features of LV non-compaction

15.5 Intracardiac Masses
- Typical locations for formation of intracardiac thrombus
- Echocardiographic features of typical LA myxoma
- Differentiation of myxoma from other cardiac tumours
- Features suggestive of malignancy
- Role of TOE in assessment of intracardiac masses
- Role of contrast in the assessment of intracardiac masses

16. Pericardial Disease

16.1 Anatomy of the normal pericardium
- Relationships of serous pericardium to heart and great vessels
- Transverse and oblique sinuses of the pericardium

16.2 Echocardiographic features of pericardial fluid
- Location of fluid in relation to patient position and fluid volume
- Differentiation from pleural effusion
- Assessment of volume of pericardial fluid
- Role of echocardiography in pericardiocentesis

16.3 Features of tamponade
- Collapse of RA and/or RV walls
- Effect on IVC and hepatic vein flow pattern
- Effect on A-V valve flow velocities during respiratory cycle

16.4 Features of pericardial constriction
- Pericardial thickening/appearance
- Effect on A-V valve flow velocities
- Effect of respiration
- SVC/hepatic vein flow
• Differentiation from restrictive cardiomyopathy including use of tissue Doppler

17. Coronary Artery Disease and Systolic LV function

17.1 Anatomy of the normal coronary arteries
• Anatomy & nomenclature of the major branches of the coronary arteries
• Relationship of coronary anatomy to standard echocardiographic imaging planes
• Nomenclature for describing myocardial segments (16 & 17 segment model)

17.2 Analysis of segmental systolic myocardial function
• Use of stress echo to assess for myocardial ischaemia
• Diastolic dysfunction in coronary artery disease

17.3 Global measures of LV function:
• Ejection Fraction
• Stroke Distance
• Stroke Volume and Cardiac output
• Use of tissue Doppler and speckle tracking echocardiography for assessment of regional myocardial velocities and deformation in ischaemic heart disease, at rest and with stress
• Longitudinal function of the left ventricle, as assessed by M-mode (MAPSE) and tissue Doppler of the mitral valve annulus
• The concept of post-systolic contraction
• The concept of isovolumic acceleration by tissue Doppler
• Left ventricular torsion and its implications for systolic function of the LV

18. Diastolic function of the LV

18.1 Normal Diastology
• The 4 stages of diastolic dysfunction as assessed by transmitral flow Doppler (including DT); impaired filling pattern and restrictive flow pattern
• The limitations of transmitral flow

18.2 Doppler for assessing diastolic dysfunction:
• Effect of LA pressures and pseudonormalisation
• Effect of mitral regurgitation
• The use of Valsalva manoeuvre in reducing LA pressures to differentiate normal from pseudonormalisation
• Flow Doppler patterns
• The use of left atrial size, IVRT, tissue Doppler (diastolic longitudinal velocities of the mitral valve annulus, the E/E’ ratio), pulmonary vein flow pattern and mitral propagation velocity for assessing diastolic function
• The importance of untwisting in left ventricular filling

19. LV dyssynchrony and assessment by echocardiography
• Techniques for measuring interventricular and intraventricular dyssynchrony for predicting response to cardiac resynchronisation treatment
• Tissue Doppler quantitation of intraventricular dyssynchrony and their limitations
• Techniques for optimising settings of the cardiac resynchronisation device after implantation

20. Stress Echocardiography
• Indications and basic knowledge of techniques for exercise, Dobutamine or vasodilator stress echocardiography
• Exercise or pharmacological stress echocardiography for diagnosis of ischaemic heart disease and myocardial viability
• The concept of viable and hibernating myocardium, and the relevance of the various responses of the myocardium to stress
• The concept of contractile reserve
• The American Society of Echocardiography regional wall motion scoring system
• Dobutamine stress echo in ‘low flow’ aortic stenosis
• Exercise stress echo in valvular heart disease and pulmonary hypertension

21. Myocardial Infarction and its sequelae
• 2D, 3D, M-mode and Doppler features of: post-infarction VSD
• Mitral papillary muscle rupture
• Cardiac tamponade
• Mural thrombus
• Myocardial scarring
• Dressler’s syndrome
• Left ventricular aneurysm – true aneurysm vs. pseudoaneurysm
• Main features of stress-induced (Takotsubo) cardiomyopathy as differential diagnosis of acute myocardial infarction

22. Pulmonary Hypertension (PH) and functional assessment of RV
• 2-D, M-mode and Doppler features of pulmonary hypertension
• Aetiologies:
  ➢ primary pulmonary hypertension
  ➢ post pulmonary embolism
  ➢ secondary to left-sided lesions
  ➢ lung disease
• Assessment of global systolic function of the RV: Tricuspid annular peak systolic excursion by M-mode (TAPSE), fractional area change of the RV, tissue Doppler of the RV
• Right ventricular dysfunction in pulmonary embolism, chronic pulmonary diseases, cardiomyopathy, Eisenmenger’s syndrome, and systemic right ventricle

23. Diseases of the Aorta
• Technique for examining the ascending and descending thoracic aorta
• Echocardiographic features of the normal aortic root, sinuses of Valsalva, ascending aorta and aortic arch
• 2-D, M-mode and Doppler features of:
  ➢ Marfan syndrome
- sinus of Valsalva aneurysm
- thoracic aortic aneurysm
- aortic dissection
- additional features related to aortic dissection:
  - aortic cusp prolapse
  - aortic regurgitation
  - fluid in pericardium
- Role of transoesophageal echocardiography in the diagnosis of aortic dissection
- Assessment of aortic root for patients undergoing transcutaneous aortic valve replacement

24. Adult Congenital Heart Disease
- Anatomy, pathophysiology and natural history of common congenital lesions present in adults
- 2-D, M-mode and Doppler features of the following, pre-operatively and post-operatively, as seen in the older child or adult.
  - Ostium Secundum Atrial septal defects
  - Perimembranous and muscular ventricular septal defects
  - Partial and complete atrio-ventricular septal defects
  - Persistent ductus arteriosus
  - Bicuspid aortic valve and associated aortopathy
  - Sub-and supra-valve aortic stenosis
  - Aortic coarctation
  - Pulmonary stenosis
  - Ebstein’s anomaly
  - Tetralogy of Fallot
  - D-type Transposition of the great arteries and congenitally corrected transposition
  - Role of contrast echocardiography in evaluating shunts in adults
  - Calculation of shunts
  - Role of TOE in adult congenital heart disease intervention

25. Likely echocardiographic findings for common clinical presentations:
- Heart failure or breathlessness
- Arrhythmia
- Ejection systolic murmur
- Hypertension
- Collagen abnormalities (including systemic sclerosis)
- Renal failure
- Stroke

26. Emergency and ICU TOE

25.1 General
- Constrained environment (multiple arterial/venous lines, ventilator, lighting issues etc.)

25.2 The hypotensive/shocked patient and post cardiac arrest
- Role of focused peri-arrest study and appreciation of limited echo windows
- Evaluation of LV (systolic and diastolic) and RV function.
- Exclusion of severe valve disease (e.g. severe AS, endocarditis) and acute aortic dissection
• Assessment for pericardial effusion and cardiac tamponade, hypovolaemia and underfilling, and high output cardiac failure
• Septic shock – assess for LV systolic/diastolic dysfunction
• Value of repeated echo studies to assess any deterioration/improvement in underlying state

25.3 Suspected acute pulmonary embolus
• Echocardiographic evaluation of RV size and function, tricuspid regurgitation and pulmonary artery systolic pressure assessment, IVC size and respiratory variation, thrombus presence in IVC/RA

25.4 Blunt and penetrating cardiac trauma
• Typical echocardiographic features including pericardial effusion, right and left ventricular contusion, acute valve lesions, aortic dilation and dissection/transection, VSD, pleural effusion

25.5 TOE in the ventilated patient
• Awareness of echocardiographic findings in the presence of mechanical ventilation.
• Value of echo in difficult to wean patients
• Role in differentiating hydrostatic and inflammatory causes of pulmonary oedema
• Assessment in persistent hypoxaemia despite pulmonary recruitment strategies (e.g. exclude PFO, proximal pulmonary embolus)
• Acute arrhythmias such as fast AF (assessment for chamber abnormalities, valve disease, LV impairment, pericardial effusion)
• Cardiac source of embolus – CVA/peripheral embolic event in ventilated patients (thrombus, endocarditis, myxoma)
• Value of TOE in ventilated patients (if poor transthoracic echo window)

25.6 Post surgery patient
• Appreciation of effects of general anaesthesia and cardio-pulmonary bypass on LV function
• Assessment of post-surgical haemodynamic compromise/ acute deterioration e.g. cardiac surgery (tamponade, wall motion abnormalities, valvular dysfunction), general surgery (air/fat embolism, venous thromboembolism, acute MI, volume overload)

25.7 Assessment of filling status
• Awareness of the role of TOE in assessing filling using left and right ventricular systolic and diastolic function, IVC, limitations of SVC and hepatic vein size and reactivity, atrial septal motion, chamber sizes and variation in Doppler velocities.
• Role of repeated echo studies in assessing effects of fluid challenge and inotropes

26. Additional topics
The level of knowledge expected is that of a competent echocardiographer performing transesophageal echocardiographic studies and sustaining knowledge through the BSE and other educational resources, including issues relevant to clinical scanning and practice raised in the BSE Newsletter.
Appendix 3  Written Examination: Example Theory Questions

- There will be 50 Single Best Answer MCQs covering the syllabus.
- Each MCQ comprises of a main stem followed by 5 options relating to the stem. The single best answer should be chosen.
- The Theory examination will be marked +1 for correct answers, 0 for incorrect or unanswered questions (no negative marking).

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 When considering possible mitral valve repair there is no need to assess</td>
<td></td>
</tr>
<tr>
<td>a. the mechanism of the mitral regurgitation</td>
<td></td>
</tr>
<tr>
<td>b. left atrial size</td>
<td></td>
</tr>
<tr>
<td>c. mitral to tricuspid annular ratio</td>
<td>T</td>
</tr>
<tr>
<td>d. anterior mitral valve leaflet length</td>
<td></td>
</tr>
<tr>
<td>e. the presence of annular calcification</td>
<td></td>
</tr>
<tr>
<td>2 Doppler methods to quantify flow in clinical practice assume that</td>
<td></td>
</tr>
<tr>
<td>a. cross-sectional flow profiles are parabolic</td>
<td></td>
</tr>
<tr>
<td>b. turbulent flow profiles are being sampled</td>
<td></td>
</tr>
<tr>
<td>c. the intercept angle with flow is 15°</td>
<td></td>
</tr>
<tr>
<td>d. transmit power is kept constant</td>
<td></td>
</tr>
<tr>
<td>e. flow velocity and cross-sectional area are measured at the same point</td>
<td>T</td>
</tr>
<tr>
<td>3 Left ventricular regional wall motion abnormalities resulting from occlusion of the circumflex coronary artery may commonly be seen in the following left ventricular segments</td>
<td></td>
</tr>
<tr>
<td>a. mid anteroseptal</td>
<td></td>
</tr>
<tr>
<td>b. basal inferolateral</td>
<td>T</td>
</tr>
<tr>
<td>c. apical inferior</td>
<td></td>
</tr>
<tr>
<td>d. basal inferoseptal</td>
<td></td>
</tr>
<tr>
<td>e. apical anterior</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 4 - Written Examination: Example Echo Reporting section

- This will consist of 50 Single Best Answer MCQs based on the video/still image. They reflect the range of clinical material seen in routine echocardiographic practice.
- Each MCQ comprises of a main stem followed by 5 options relating to the stem. The single best answer should be chosen.
- The clips and stills will last 100 seconds with a 10 second gap and will contain sufficient information to answer the questions.
- The Echo Reporting examination will be marked +1 for correct answers, 0 for incorrect or unanswered questions (no negative marking).

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The arrow indicates</td>
<td>A</td>
</tr>
<tr>
<td>a. Anterior mitral valve leaflet</td>
<td></td>
</tr>
<tr>
<td>b. Posterior mitral valve leaflet</td>
<td>T</td>
</tr>
<tr>
<td>c. Coronary sinus</td>
<td></td>
</tr>
<tr>
<td>d. Mitral valve annulus</td>
<td></td>
</tr>
<tr>
<td>e. Zone of coaptation</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5: Computerised Marking Sheets – Guidance Notes

Instructions will be given on the day of the exam. However, please try to familiarise yourself with the process beforehand. The exam is marked by computer so these instructions need to be followed exactly.

Part 1 Echo Reporting section

A. **Time:** The Echo Reporting section section will last **1 hour 30 minutes.**
B. **Format:** The section will consist of 50 Single Best Answer MCQs each with 5 stems relating to it
C. **Answers:** A column for answers is provided on the question sheet but final answers must be marked on the computer marking sheet. For each question there is only one best answer.
D. **Maximum marks** 50
E. Please mark using a HB pencil as seen under marking instructions in adjoining image on Page 29
F. To cancel a response you can use an eraser
G. **Marking:** There will be NO negative marking for this paper – each correct answer will receive a score of 1. Incorrect or unanswered questions/stems will receive a score of 0.
H. **Additional Information:** You will need to write your Candidate Registration Number, with additional leading zeros if necessary to make nine digits in the box labelled Candidate No. Then code this into the boxes underneath as shown in adjoining image.
I. The College Number and the Test No for this section will be given on the day of the exam and will need to be written as above.
J. Please write the date, surname and name in the computer marking sheet as well.
K. You may use the question paper for rough working.
L. **Use the computer mark sheet for final answers**
M. The computer read mark sheets and question papers will be collected at the end of the examination.

There will be a break of 20 minutes before the Theory examination

Part 2 Theory section

A. **Time:** The theory section will last **1 hour 10 minutes.**
B. **Format:** The section will consist of 50 Single Best Answer MCQs each with 5 stems relating to it
C. **Answers:** A column for answers is provided on the question sheet but final answers must be marked on the computer marking sheet. For each question there is only one best answer.
D. **Maximum marks** 50
E. Please mark using a HB pencil as seen under marking instructions in adjoining image on page 29
F. To cancel a response you can use an eraser
G. **Marking:** There will be NO negative marking for this paper – each correct answer will receive a score of 1. Incorrect or unanswered questions/stems will receive a score of 0.
H. **Additional Information:** You will need to write your Candidate Registration Number, with additional leading zeros if necessary to make nine digits in the box labelled Candidate No. Then code this into the boxes underneath as shown in adjoining image.
I. The College Number and the Test No for this section will be given on the day of the exam and will need to be written as above.
J. Please write the date, surname and name in the computer marking sheet as well.
K. You may use the question paper for rough working
L. **Use the computer mark sheet for final answers**
M. The computer read mark sheets and question papers will be collected at the end of the examination.
Appendix 6 - Curriculum Based Competency Assessment Tool
MENTOR TO COMPLETE DURING CANDIDATE’S TRAINING PERIOD

How to use this document:
You should keep it with you throughout your training period
At each hospital, you must have a mentor who should be a senior and experienced echocardiographer.
Your mentor should initial and date each entry once he or she is satisfied that you are competent to perform and report it unsupervised. This competency checklist should be submitted with your logbook.
The theory component will be self-taught. Your department should have suitable text-books

1. BASIC ECHOCARDIOGRAPHY
Knowledge
Basic principles of ultrasound
Basic principles of spectral Doppler
Basic principles of colour flow Doppler
Basic instrumentation
Ethics and sensitivities of patient care
Basic anatomy of the heart
Basic echocardiographic scan planes: midesophageal, upper oesophageal and transgastric views
Indications for transthoracic and transoesophageal echocardiography
Normal variants and artefacts

Practical competencies
Interacts appropriately with patients
Understands basic instrumentation
Cares for machine appropriately
Can obtain standard views
Can optimise gain setting, sector width, depth, harmonics, focus, sweep speed, Doppler baseline and scale, colour gain
Can obtain standard measurements using 2D or M-mode
Can recognise normal variants: Eustachian valve, Chiari network etc
Can use Colour Flow Doppler for all valves optimising gain and box-size
Can obtain pulsed wave Doppler at
- left ventricular inflow (mitral valve)
- left ventricular outflow tract (LVOT)
- right ventricular inflow (tricuspid valve)
- right ventricular outflow tract, pulmonary valve & main pulmonary artery

2. LEFT VENTRICLE
Knowledge
Coronary anatomy and correlation with 2D views of left ventricle.
Segmentation of the left ventricle (16 and 17 segment models)
Wall motion
Measurements of global systolic function. (LVOT VTI, stroke volume, fractional shortening, ejection fraction using Simpson’s rule)
Doppler mitral valve filling patterns & normal range
Appearance of complications after myocardial infarction
Ventricular septal and papillary muscle rupture
Ischaemic mitral regurgitation
Features of dilated, and hypertrophic cardiomyopathy
Common differential diagnosis
Athletic heart, hypertensive disease
**Practical competencies**

- Can differentiate normal from abnormal LV systolic function
- Can recognise large wall motion abnormalities
- Can describe wall motion abnormalities and myocardial segments
- Can obtain basic measures of systolic function VTI, FS, LVEF
- Understands & can differentiate diastolic filling patterns
- Can detect and recognise complications after myocardial infarction
- Understands causes of a hypokinetic left ventricle
- Can recognise features associated with hypertrophic cardiomyopathy
- Can recognise hypertensive heart disease

**3. MITRAL VALVE DISEASE**

**Knowledge**

- Normal anatomy of the mitral valve, and the subvalvar apparatus and their relationship with LV function
- Causes of mitral stenosis and regurgitation
- Ischaemic, functional, prolapse, rheumatic, endocarditis

**Practical competencies**

- Can recognise rheumatic disease
- Can recognise mitral prolapse
- Can recognise functional mitral regurgitation
- Can assess mitral stenosis
- 2D planimetry, pressure half-time, gradient
- Can assess severity of regurgitation, chamber size, signal density, proximal flow acceleration & vena contracta

**4. AORTIC VALVE DISEASE and AORTA**

**Knowledge**

- Causes of aortic valve disease
- Causes of aortic disease
- Methods of assessment of aortic stenosis and regurgitation
- Basic criteria for surgery to understand reasons for making measurements

**Practical competencies**

- Can recognise bicuspid, rheumatic, and degenerative disease
- Can recognise a significantly stenotic aortic valve
- Can derive peak & mean gradients using continuous wave Doppler
- Can measure valve area using the continuity equation
- Can recognise severe aortic regurgitation
- Can recognise dilatation of the ascending aorta
- Knows the echocardiographic signs of dissection

**5. RIGHT HEART**

**Knowledge**

- Causes of tricuspid and pulmonary valve disease
- Causes of right ventricular dysfunction
- Causes of pulmonary hypertension
- The imaging features of pulmonary hypertension
- The estimation of pulmonary pressures

**Practical competencies**

- Recognises right ventricular dilatation
Can estimate PA systolic pressure
Can estimate right atrial pressure from the appearance of the IVC

6. REPLACEMENT HEART VALVES
Knowledge
Types of valve replacement
Criteria of normality
Signs of failure

Practical competencies
Can recognise broad types of replacement valve
Can recognise paraprosthetic regurgitation
Can recognise prosthetic obstruction

7. INFECTIVE ENDOCARDITIS
Knowledge
Duke criteria for diagnosing endocarditis
Echocardiographic features of endocarditis
Criteria for TOE

Practical competencies
Can recognise typical vegetations
Can recognise an abscess
Can recognise complications just on valve regurgitation

8. INTRACARDIAC MASSES
Knowledge
Types of mass found in the heart
Features of a mxyoma
Differentiation of atrial mass
Normal variants and artifacts

Practical competencies
Can recognise a LA myxoma
Can differentiate LV thrombus and trabeculation

9. PERICARDIAL DISEASE
Knowledge
Features of tamponade
RV collapse, effect on IVC, A-V valve flow velocities and respiratory variation.
Features of pericardial constriction
Differentiation of pericardial constriction from restrictive myopathy

Practical competencies
Can differentiate a pleural and pericardial effusion
Can recognise the features of tamponade
Can judge the route for pericardiocentesis
Can recognise restrictive physiology

10. ADULT CONGENITAL HEART DISEASE
Knowledge
Anatomy and echo features of basic congenital disease:
ASD, VSD, partial & complete atrio-ventricular defects
Patent ductus arteriosus
Sub and supravalvar aortic stenosis
Sub valvar, valvar and supra-valvar pulmonary stenosis
Ebstein’s anomaly
Fallot’s tetralogy
Role of contrast
Shunt calculation
Estimation of pulmonary artery pressure

Practical competencies
Can recognise a secundum ASD and identify pulmonary veins
Can calculate a shunt

Mentor
Name _____________________________________________
Signature________________________________________
Date ________________________________
Appendix 7 - Suggested format for a report

This is a basic framework for a report; Appendix 1 includes further details for candidates to look through. Guidelines are also available on the BSE website. Please see “A minimum dataset for a standard transoesophageal echocardiogram: a guideline protocol from the British Society of Echocardiography” at www.bsecho.org.

A report should have a section for objective M-mode or 2D dimensions and Doppler measurements. There should be a section for describing observations and a short conclusion.

**Measurements** - Measurements of intracardiac dimensions can be useful in monitoring disease progression. These can be made using M-mode or 2D and must be interpreted in the light of the size and sex of the patient. Many pragmatic normal ranges are outdated and modern data based on large populations include upper dimensions previously regarded as abnormal. Doppler measurements should be listed (see normal valves chart on BSE Website).

**Text** - This should include a description of observations made in a logical order. The order will vary for the operator and the study. The most important feature might be described first. Alternatively each anatomical region might be discussed in turn. Interpretation should not be a part of this section and even minor abnormalities are best described. These can be put into context in the conclusion. It is usually not advisable to describe each modality in turn or to describe findings at each window as is sometimes done. This is confusing since small differences can emerge between different windows or repetitions occur. It is better to integrate all windows and all modalities. Normal findings should also be stated and if a region could not be imaged this should also be admitted. This gives the reader the confidence that a systematic study has been undertaken rather than a study focused on only a region of interest.

**Conclusion** - This should summarize the whole study and be easily understood by a non-echocardiographer. It should identify any abnormality, its cause and any secondary effect. No interpretation should be offered that is not derived from the recorded study, and no medical advice should normally be given.
Appendix 8 – Report Format

THIS IS A SUGGESTED FORMAT FOR A REPORT WITHIN THE WORKPLACE. PLEASE NOTE – ALL REPORTS SUBMITTED IN THE LOGBOOK AND ACCOMPANYING THE CASES MUST BE ANONYMISED AS PER APPENDIX 12

The report should comprise the following sections:

Demographic and other Identifying Information
Obligatory information
Patient’s name
Medical record number, NHS number or other unique identifier
Age
Gender
Indications for test
Referring clinician identification
Interpreting echocardiographer identification
Date of study

Additional, optional information
Location of the patient (e.g. outpatient, inpatient, etc.)
Location where study was performed
Study classification (routine, urgent, emergency)
Date on which the study was requested, reported
Height and weight
Blood pressure
Medications
Videotape or disk number/identifier

Echocardiographic study
This covers the main content of the report. For each cardiac structure, the report is divided as follows:

- Descriptive terms: phrases that are used to construct the text content of a report, describing morphology (e.g. mitral leaflet - thickened tips) and function (e.g. mitral leaflet – reduced mobility of the PMVL) of cardiac structures.
- Measurements/analysis: (e.g. peak gradient, mean gradient, MVA) – recommended measurements and calculations are included in Appendix 2 of this document (also, please refer to BSE Minimum Dataset)
- Diagnostic statements: phrases that add echocardiographic interpretation to descriptive terms (e.g. appearance of rheumatic mitral valve disease, suitable for commissurotomy)

Summary
This important section should contain final comments that address the clinical question posed by the TOE request. This may comprise simple repetition of key descriptive terms from within the main part of the report (e.g. “severe LV dysfunction”). It may add clinical context to the technical aspects of the report, particularly with respect to abnormal findings. Where possible, comparison with previous echocardiographic studies or reports should be made and important differences (or similarities) highlighted. Technical limitations of the study or its interpretation should be included.
Appendix 9 – Transesophageal echocardiographic Proficiency: Summary Sheet

Complete this sheet and place it at the front of your Logbook

Name: .................................................................................................. Membership No: .............

Date of Passing Written Examination .........................................................

Date of Passing TTE Examination ..............................................................

Case collection period ..............................................................................

Only one diagnosis can be assigned to each study.

Summarise the primary diagnosis assigned to each case in your Logbook. (Note the target guidelines for case mix)

**Total cases needed 125 cases**

75 with TTE exam

<table>
<thead>
<tr>
<th>At least one example of:</th>
<th>No of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitral valve repair</td>
<td></td>
</tr>
<tr>
<td>Mitral valve regurgitation (severe)</td>
<td></td>
</tr>
<tr>
<td>Endocarditis</td>
<td></td>
</tr>
<tr>
<td>Basic adult congenital heart disease (e.g. ASD, VSD, pulmonary stenosis)</td>
<td></td>
</tr>
<tr>
<td>Aortic pathology (e.g. dissection, aneurysm, intramural haematoma)</td>
<td></td>
</tr>
<tr>
<td>Abnormal aortic valve</td>
<td></td>
</tr>
<tr>
<td>Hypovolaemic / septic shock assessment</td>
<td></td>
</tr>
<tr>
<td>Abnormal prosthetic valve</td>
<td></td>
</tr>
<tr>
<td>Intracardiac mass including thrombus</td>
<td></td>
</tr>
<tr>
<td>Pericardial effusion</td>
<td></td>
</tr>
<tr>
<td>Left ventricular wall motion abnormality</td>
<td></td>
</tr>
<tr>
<td>Pulmonary embolism assessment / right heart dilatation</td>
<td></td>
</tr>
<tr>
<td>No more than 20 studies should be predominantly normal</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

**STATION 1: Written Logbook (1/2 hour)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Candidate ID</th>
<th>Assessor ID</th>
<th>Assessor ID</th>
</tr>
</thead>
</table>

**Number of Cases:**
- 75 with TTE, otherwise 125 cases

Proof of TTE accreditation

At least one example of:
- Mitral valve repair
- Mitral valve regurgitation (severe)
- Endocarditis
- Basic adult congenital heart disease (e.g. ASD)
- Aortic pathology (e.g. dissection, aneurysm, intramural haematoma)
- Abnormal aortic valve
- Hypovolaemic / septic shock assessment
- Abnormal prosthetic valve
- Intracardiac mass including thrombus
- Pericardial effusion
- Left ventricular wall motion abnormality
- Pulmonary embolism assessment / right heart dilatation
- No more than 20 studies should be predominantly normal

**Checklist**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logbook submitted in one ring binder / file with dividers</td>
<td></td>
<td>Major breach</td>
</tr>
<tr>
<td>All cases collected within 24 month period including written exam</td>
<td></td>
<td>Automatic fail without extension being given (Proof of extension available)</td>
</tr>
<tr>
<td>75 or 125 cases performed and reported by the candidate</td>
<td></td>
<td>Automatic fail if less than required number</td>
</tr>
<tr>
<td>All cases anonymised fully</td>
<td></td>
<td>Automatic fail/minor breach (Automatic fail if &gt; 5 cases. Minor breach if &lt; 5 cases)</td>
</tr>
<tr>
<td>Correct case mix (see above)</td>
<td></td>
<td>Automatic fail if missing common conditions, minor fail for rarities</td>
</tr>
<tr>
<td>All reports with full name and signature</td>
<td></td>
<td>Automatic fail if no name or signature on majority. Minor if no signature.</td>
</tr>
<tr>
<td>Summary sheet present</td>
<td></td>
<td>Minor breach</td>
</tr>
<tr>
<td>Supervisor / mentor statement present</td>
<td></td>
<td>Automatic fail</td>
</tr>
<tr>
<td>Final check list present</td>
<td></td>
<td>Minor breach</td>
</tr>
</tbody>
</table>

Comments
Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

STATION 1: Written Logbook (1/2 hour)

Logbook cases assessment

Comments

• No conclusion = automatic fail.
• More than two No’s = fail for that case.
• 2/6 (30%) Percent of cases failed = Fail of logbook
• Complete as many as possible in time allowed
• Fill in log sheet using pass/fail criteria.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication for echo (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2D/M-Mode measurements present (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate Doppler measurements/ calculations present (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do measurements / Doppler Calculations match descriptions? (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All parts of heart described (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descriptions complete (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate to request (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conclusion (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No conclusion = automatic fail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pass or fail (P/F)

Comments

Unsuccessful candidates will be informed by Assessor after discussion with Senior Assessor
Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

**STATION 2: Viva echo cases (1/2 hour)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Candidate ID</th>
<th>Assessor ID</th>
<th>Assessor ID</th>
</tr>
</thead>
</table>

**Comments**
Candidates will bring their video cases and hopefully their own PC into the room.
- Assess **at least 2** cases (if possible 3)
- Assess aortic and mitral pathology.
- Mark the video case according to the mark sheet.
- Ask the candidate questions, if need be, to clarify any issues.
- It is permissible to pass the competencies if the candidate can convince you they understand and generally perform appropriate views and measurements.
- Assess each section and tick the boxes on sheet.
- Add feedback comments if necessary.
- If both cases satisfactory, candidate will pass the station.
- If borderline, assess a third case

<table>
<thead>
<tr>
<th>5 cases (1 normal, 1 aortic stenosis) to be present</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal – Has to be present</td>
<td></td>
</tr>
<tr>
<td>Stenosis – Has to be present</td>
<td></td>
</tr>
<tr>
<td>Mitral valve repair</td>
<td></td>
</tr>
<tr>
<td>Mitral valve regurgitation (severe)</td>
<td></td>
</tr>
<tr>
<td>Endocarditis</td>
<td></td>
</tr>
<tr>
<td>Basic adult congenital heart disease (e.g. ASD)</td>
<td></td>
</tr>
<tr>
<td>Aortic pathology (e.g. dissection, aneurysm, intramural haematoma)</td>
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<td>Pericardial effusion</td>
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<tr>
<td>Left ventricular wall motion abnormality</td>
<td></td>
</tr>
<tr>
<td>Pulmonary embolism assessment / right heart dilatation</td>
<td></td>
</tr>
<tr>
<td>Total 5?</td>
<td>Y/N</td>
</tr>
</tbody>
</table>

**Comments**

Unsuccessful candidates will be informed by Assessor after discussion with Senior Assessor
## Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

### STATION 2: Viva echo cases (1/2 hour total)

#### Case 1: Aortic valve/stenosis pathology

<table>
<thead>
<tr>
<th>Practice must be satisfactory in all areas to pass</th>
<th>Evidence of satisfactory practice</th>
<th>Tick</th>
<th>Evidence of unsatisfactory practice</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECG</strong></td>
<td>Largely present throughout without 2D image interference</td>
<td></td>
<td>ECG Unstable or frequently absent making timings inaccurate</td>
<td></td>
</tr>
<tr>
<td><strong>Optimisation</strong></td>
<td>Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion</td>
<td></td>
<td>Optimisation Frequent, repetitive optimisation errors which detract from the case conclusion</td>
<td></td>
</tr>
<tr>
<td><strong>Complete study</strong></td>
<td>Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements.</td>
<td></td>
<td>Incomplete study Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.</td>
<td></td>
</tr>
<tr>
<td><strong>2D measurements/M-mode</strong></td>
<td>Accurate throughout with minor errors only</td>
<td></td>
<td>2D measurements/M-mode Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology</td>
<td></td>
</tr>
<tr>
<td><strong>Colour Doppler</strong></td>
<td>Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly</td>
<td></td>
<td>Colour Doppler Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy</td>
<td></td>
</tr>
<tr>
<td><strong>Spectral Doppler</strong></td>
<td>Accurate use with good cursor alignment and optimised waveforms</td>
<td></td>
<td>Spectral Doppler Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment</td>
<td></td>
</tr>
<tr>
<td><strong>Pathology assessment</strong></td>
<td>Good quality CWD. No images missing which are key to pathology assessment. No measurements significantly inaccurate that are key to pathology assessment (LVOT diameter, LVOT VTI and AV VTI)</td>
<td></td>
<td>Pathology assessment Missing, poor quality CWD signal. Images missing which are key to pathology assessment. Measurements key to pathology assessment significantly inaccurate and change the categorisation of the pathology (LVOT diameter, LVOT VTI and AV VTI)</td>
<td></td>
</tr>
<tr>
<td><strong>Report is complete and accurate</strong></td>
<td>Comprehensive and accurate description of all parts of the heart. Correct categorisation of chosen pathology (NB trivial abnormalities may be included in this case) Correct interpretation of findings in the clinical context.</td>
<td></td>
<td>Report is incomplete or inaccurate Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context</td>
<td></td>
</tr>
</tbody>
</table>

#### Comments
## Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

### STATION 2: Viva echo cases (1/2 hour total)

**Case 2: Regurgitant pathology**

<table>
<thead>
<tr>
<th>Practice must be satisfactory in all areas to pass</th>
<th>Evidence of satisfactory practice</th>
<th>Tick</th>
<th>Evidence of unsatisfactory practice</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evidence of satisfactory practice</strong></td>
<td></td>
<td></td>
<td><strong>Evidence of unsatisfactory practice</strong></td>
<td></td>
</tr>
<tr>
<td>ECG</td>
<td>Largely present throughout without 2D image interference</td>
<td></td>
<td>ECG Unstable or frequently absent making timings inaccurate</td>
<td></td>
</tr>
<tr>
<td><strong>Optimisation</strong></td>
<td>Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion</td>
<td></td>
<td><strong>Optimisation</strong> Frequent, repetitive optimisation errors which detract from the case conclusion</td>
<td></td>
</tr>
<tr>
<td><strong>Complete study</strong></td>
<td>Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements.</td>
<td></td>
<td><strong>Incomplete study</strong> Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.</td>
<td></td>
</tr>
<tr>
<td><strong>2D measurements/M-mode</strong></td>
<td>Accurate throughout with minor errors only</td>
<td></td>
<td><strong>2D measurements/M-mode</strong> Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology</td>
<td></td>
</tr>
<tr>
<td><strong>Colour Doppler</strong></td>
<td>Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly</td>
<td></td>
<td><strong>Colour Doppler</strong> Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy</td>
<td></td>
</tr>
<tr>
<td><strong>Spectral Doppler</strong></td>
<td>Accurate use with good cursor alignment and optimised waveforms</td>
<td></td>
<td><strong>Spectral Doppler</strong> Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment</td>
<td></td>
</tr>
<tr>
<td><strong>Pathology assessment</strong></td>
<td>Good assessment of regurgitation. Understanding of the methods available to assess severity and accurate demonstration if appropriate (eg PISA/Vena contracta/PV flow). No images missing which are crucial to pathology assessment. No measurements significantly inaccurate that are crucial to pathology assessment.</td>
<td></td>
<td><strong>Pathology assessment</strong> Poor or inadequate assessment of severity. Failure to return Doppler baseline to normal after PISA assessment. Images missing which are crucial to pathology assessment. Measurements key to pathology assessment significantly inaccurate and change the categorisation of the pathology.</td>
<td></td>
</tr>
<tr>
<td><strong>Report is complete and accurate</strong></td>
<td>Comprehensive and accurate description of all parts of the heart. Correct categorisation of chosen pathology (NB trivial abnormalities may be included in this case) Correct interpretation of findings in the clinical context.</td>
<td></td>
<td><strong>Report is incomplete or inaccurate</strong> Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context</td>
<td></td>
</tr>
</tbody>
</table>

**Comments**


Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

**STATION 2: Viva echo cases (1/2 hour total)**

**Case 3: RWMA pathology**

<table>
<thead>
<tr>
<th>Practice must be satisfactory in all areas to pass</th>
<th>Tick</th>
<th>Evidence of unsatisfactory practice</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evidence of satisfactory practice</strong></td>
<td></td>
<td><strong>Evidence of unsatisfactory practice</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ECG</strong></td>
<td>Largely present throughout without 2D image interference</td>
<td><strong>ECG</strong></td>
<td>Unstable or frequently absent making timings inaccurate</td>
</tr>
<tr>
<td><strong>Optimisation</strong></td>
<td>Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion</td>
<td><strong>Optimisation</strong></td>
<td>Frequent, repetitive optimisation errors which detract from the case conclusion</td>
</tr>
<tr>
<td><strong>Complete study</strong></td>
<td>Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements.</td>
<td><strong>Incomplete study</strong></td>
<td>Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.</td>
</tr>
<tr>
<td><strong>2D measurements/M-mode</strong></td>
<td>Accurate throughout with minor errors only</td>
<td><strong>2D measurements/M-mode</strong></td>
<td>Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology</td>
</tr>
<tr>
<td><strong>Colour Doppler</strong></td>
<td>Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly</td>
<td><strong>Colour Doppler</strong></td>
<td>Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy</td>
</tr>
<tr>
<td><strong>Spectral Doppler</strong></td>
<td>Accurate use with good cursor alignment and optimised waveforms</td>
<td><strong>Spectral Doppler</strong></td>
<td>Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment</td>
</tr>
<tr>
<td><strong>Pathology assessment</strong></td>
<td>Appropriate measurement of Simpson's method, M-mode showing systolic and diastolic measurements in both 4C &amp; 2C view. Correlates with visual impression and other methods. No images missing which are crucial to pathology assessment. No measurements significantly inaccurate which are crucial to pathology assessment.</td>
<td><strong>Pathology assessment</strong></td>
<td>Incomplete assessment of Simpson's/M-mode or measured inaccurately and changes the categorisation of the reported EF. Images missing which are crucial to pathology assessment. Measurements crucial to pathology assessment significantly inaccurate and change the categorisation of the pathology.</td>
</tr>
<tr>
<td><strong>Report is complete and accurate</strong></td>
<td>Comprehensive and accurate description of all parts of the heart. Correct categorisation of chosen pathology (NB trivial abnormalities may be included in this case) Correct interpretation of findings in the clinical context.</td>
<td><strong>Report is incomplete or inaccurate</strong></td>
<td>Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context</td>
</tr>
</tbody>
</table>

**Comments**
Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

**STATION 2: Viva echo cases (1/2 hour total)**

**Case 3: Other pathology**

<table>
<thead>
<tr>
<th>Evidence of satisfactory practice</th>
<th>Tick</th>
<th>Evidence of unsatisfactory practice</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECG</strong> Largely present throughout without 2D image interference</td>
<td></td>
<td><strong>ECG</strong> Unstable or frequently absent making timings inaccurate</td>
<td></td>
</tr>
<tr>
<td><strong>Optimisation</strong> Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion</td>
<td></td>
<td><strong>Optimisation</strong> Frequent, repetitive optimisation errors which detract from the case conclusion</td>
<td></td>
</tr>
<tr>
<td><strong>Complete study</strong> Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements.</td>
<td></td>
<td><strong>Incomplete study</strong> Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.</td>
<td></td>
</tr>
<tr>
<td><strong>2D measurements/M-mode</strong> Accurate throughout with minor errors only</td>
<td></td>
<td><strong>2D measurements/M-mode</strong> Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology</td>
<td></td>
</tr>
<tr>
<td><strong>Colour Doppler</strong> Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly</td>
<td></td>
<td><strong>Colour Doppler</strong> Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy</td>
<td></td>
</tr>
<tr>
<td><strong>Spectral Doppler</strong> Accurate use with good cursor alignment and optimised waveforms</td>
<td></td>
<td><strong>Spectral Doppler</strong> Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment</td>
<td></td>
</tr>
<tr>
<td><strong>Pathology assessment</strong> Appropriate measurement of Simpson's method, M-mode showing systolic and diastolic measurements in both 4C &amp; 2C view. Correlates with visual impression and other methods. No images missing which are crucial to pathology assessment. No measurements significantly inaccurate which are crucial to pathology assessment.</td>
<td></td>
<td><strong>Pathology assessment</strong> Incomplete assessment of Simpson's/M-mode or measured inaccurately and changes the categorisation of the reported EF. Images missing which are crucial to pathology assessment. Measurements key to pathology assessment significantly inaccurate and change the categorisation of the pathology.</td>
<td></td>
</tr>
<tr>
<td><strong>Report is complete and accurate</strong> Comprehensive and accurate description of all parts of the heart. Correct categorisation of chosen pathology (NB trivial abnormalities may be included in this case) Correct interpretation of findings in the clinical context.</td>
<td></td>
<td><strong>Report is incomplete or inaccurate</strong> Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context</td>
<td></td>
</tr>
</tbody>
</table>

**Comments**
### Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

**STATION 2: Viva echo cases (1/2 hour)**

**Case 4: Normal case**

<table>
<thead>
<tr>
<th>Evidence of satisfactory practice</th>
<th>Tick</th>
<th>Evidence of unsatisfactory practice</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECG</strong></td>
<td></td>
<td><strong>ECG</strong></td>
<td></td>
</tr>
<tr>
<td>Largely present throughout without 2D image interference</td>
<td></td>
<td>Unstable or frequently absent making timings inaccurate</td>
<td></td>
</tr>
<tr>
<td><strong>Optimisation</strong></td>
<td></td>
<td><strong>Optimisation</strong></td>
<td></td>
</tr>
<tr>
<td>Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion</td>
<td></td>
<td>Frequent, repetitive optimisation errors which detract from the case conclusion</td>
<td></td>
</tr>
<tr>
<td><strong>Complete study</strong></td>
<td></td>
<td><strong>Incomplete study</strong></td>
<td></td>
</tr>
<tr>
<td>Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements.</td>
<td></td>
<td>Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.</td>
<td></td>
</tr>
<tr>
<td><strong>2D measurements/M-mode</strong></td>
<td></td>
<td><strong>2D measurements/M-mode</strong></td>
<td></td>
</tr>
<tr>
<td>Accurate throughout with minor errors only</td>
<td></td>
<td>Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology</td>
<td></td>
</tr>
<tr>
<td><strong>Colour Doppler</strong></td>
<td></td>
<td><strong>Colour Doppler</strong></td>
<td></td>
</tr>
<tr>
<td>Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly</td>
<td></td>
<td>Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy</td>
<td></td>
</tr>
<tr>
<td><strong>Spectral Doppler</strong></td>
<td></td>
<td><strong>Spectral Doppler</strong></td>
<td></td>
</tr>
<tr>
<td>Accurate use with good cursor alignment and optimised waveforms</td>
<td></td>
<td>Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment</td>
<td></td>
</tr>
<tr>
<td><strong>LV assessment</strong></td>
<td></td>
<td><strong>LV assessment</strong></td>
<td></td>
</tr>
<tr>
<td>Good quality M-mode of the LV and Ao/LA.</td>
<td></td>
<td>Poor quality or missing M-mode of the LV and Ao/LA. Images missing which are crucial to assessment. Measurements crucial to assessment significantly inaccurate.</td>
<td></td>
</tr>
<tr>
<td>No crucial images missing.</td>
<td></td>
<td>No measurements significantly inaccurate.</td>
<td></td>
</tr>
<tr>
<td><strong>Report is complete and accurate</strong></td>
<td></td>
<td><strong>Report is incomplete or inaccurate</strong></td>
<td></td>
</tr>
<tr>
<td>Comprehensive and accurate description of all parts of the heart. Correct categorisation of chosen pathology (NB trivial abnormalities may be included in this case) Correct interpretation of findings in the clinical context.</td>
<td></td>
<td>Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context</td>
<td></td>
</tr>
</tbody>
</table>

**Comments**

Unsuccessful candidates will be informed by Assessor after discussion with Senior Assessor.
Appendix 10 – Example of Assessment forms to be used at the Practical Assessment

STATION 3: Image acquisition skills (1/2 hour)

<table>
<thead>
<tr>
<th>Date</th>
<th>Candidate ID</th>
<th>Assessor ID</th>
<th>Assessor ID</th>
</tr>
</thead>
</table>

This station tests the haptic knowledge and image acquisition skills of the candidate. Any shortcomings identified in the previous stations should be probed.

The simulator can be loaded will different pathologies.

The candidate will be asked to acquire a good quality image of a particular view. NB no blind spot between upper oesophageal and mid oesophageal views. Not all views may be possible in available time. Image acquisition should take no more than 20 mins. (10 images at 2 mins each).

If there are concerns with any of the images assessors should question the candidate - if they can demonstrate appropriate knowledge/competence when questioned this may be sufficient. Candidates should not fail as a result of one poor image. Pass mark = 80% of acquired images are of good quality. Constructive feedback can be provided by the senior assessor in a separate room to enable direct comparison of candidate's image acquisition and the expected standards.

**Unsuccessful candidates will be informed by the assessor after discussion with the senior assessor has taken place.**

<table>
<thead>
<tr>
<th>Spend 1-2 minutes on each acquisition</th>
<th>Image</th>
<th>Satisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2D MO 4 Chamber view</td>
<td>Yes</td>
</tr>
<tr>
<td>2.</td>
<td>2D MO 5 Chamber view</td>
<td>Yes</td>
</tr>
<tr>
<td>3.</td>
<td>2D MO mitral commissural view</td>
<td>Yes</td>
</tr>
<tr>
<td>4.</td>
<td>2D MO 2 Chamber view</td>
<td>Yes</td>
</tr>
<tr>
<td>5.</td>
<td>2D MO LAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>6.</td>
<td>2D MO AV SAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>7.</td>
<td>2D MO AV LAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>8.</td>
<td>2D MO LA appendage view</td>
<td>Yes</td>
</tr>
<tr>
<td>9.</td>
<td>2D MO R/L Upper/lower pulm. veins</td>
<td>Yes</td>
</tr>
<tr>
<td>10.</td>
<td>2D RV inflow/outflow view</td>
<td>Yes</td>
</tr>
<tr>
<td>11.</td>
<td>MO Bicaval view</td>
<td>Yes</td>
</tr>
<tr>
<td>12.</td>
<td>MO modified bicaval view</td>
<td>Yes</td>
</tr>
<tr>
<td>13.</td>
<td>2D TG Basal SAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>14.</td>
<td>2D TG Mid Papillary view</td>
<td>Yes</td>
</tr>
<tr>
<td>15.</td>
<td>2D TG 2 Chamber view</td>
<td>Yes</td>
</tr>
<tr>
<td>16.</td>
<td>2D TG LAX with CWD across aortic valve</td>
<td>Yes</td>
</tr>
<tr>
<td>Spend 1-2 minutes on each acquisition</td>
<td>Image</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>17.</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>18.</td>
<td>2D TG RV inflow view</td>
<td>Yes</td>
</tr>
<tr>
<td>19.</td>
<td>2D Deep TG view</td>
<td>Yes</td>
</tr>
<tr>
<td>20.</td>
<td>Desc Aorta SAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>21.</td>
<td>Desc Aorta LAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>22.</td>
<td>UO Aortic arch LAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>23.</td>
<td>UO Aortic arch SAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>24.</td>
<td>MO Asc Aorta LAX view</td>
<td>Yes</td>
</tr>
<tr>
<td>25.</td>
<td>MO Asc Aorta SAX view</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Appendix 11 – Mentor statement to accompany the Practical Assessment

Re: (Candidate’s name) __________________________________________

Candidate Membership number_____________________________________

| I certify that the candidate has undergone a programme of training in echocardiography | Initial |
| I certify I have observed the candidate scanning and I am satisfied that he/she is competent at completing a full transoesophageal echo study. |       |
| I certify that the candidate has reached a standard of training to be able to independently perform and report a transoesophageal echocardiographic study. He/she has reached all of the mandated competencies. I have signed off the candidate’s competency sheet. |       |
| I certify that the candidate above has performed and reported the cases included in the accompanying Log Book within a 24 month period. |       |
| I certify that all cases are fully anonymised (no patients personal details such as names, full date of births or addresses) as per Appendix 12 |       |
| I certify that all cases are signed with name printed of the candidate |       |
| I certify that these cases are being handed in as per Trust policy Guidelines |       |

Mentor’s name: __________________________________________

Signature: ______________________________ Date: _______________________

I am satisfied that the candidate above has performed and reported the cases included in the accompanying Log Book within a 24 month period in this department and five cases are also enclosed.

Medical/Technical Head of Echocardiography’s name: __________________________

Signature: ______________________________ Date: _______________________


Appendix 12 – BSE Policy on the Non-anonymisation of Patient Data

Introduction

The duty of confidentiality arises out of the common law of confidentiality, professional obligations and also staff employment contracts. Breach of confidence may lead to disciplinary measures, bring into question professional reputation and possibly result in legal proceedings. Guidance is provided to NHS staff in the ‘NHS Code of Practice on Confidentiality’ (November 2003).


Patient information that can identify individual patients is confidential and must not be used or disclosed. In contrast, anonymised information is not confidential and may be used.

Key identifiable information includes: Patient’s name, address, full post code, date of birth, NHS number and local identifiable codes or anything else that may be used to identify a patient directly or indirectly. For example, rare diseases, drug treatment or statistical analyses which have very small numbers within a small population may allow individuals to be identified.

Anonymisation requires the removal of such patient-identifiable information from all reports and images submitted for the practical part of the Accreditation process.

For accreditation purposes, BSE Administrators and BSE Markers must not be able to identify the patient from see any of the identifiers listed above.

Speakers presenting on behalf of the BSE at meetings and speakers on courses/meetings awarded BSE re-accreditation points must ensure that all presentation material is anonymised.

As age is relevant to the assessment either the age or year of birth must be provided however a full date of birth must not be shown.

Reports

Please note that correction fluid may still allow data to be visible if you look at the back of the page, as does placing a sticker over the patient data. Marker pen often fades so that data may be correctly disguised at the point of collection but may be visible by the time of attending the Practical assessment.

We therefore advise:

Cutting out the patient data or

Deleting data electronically prior to printing or

Using corrective fluid or marker pen, then photocopying the sheet

Cases

In order for cases to be classed as anonymous BSE Administrators and BSE Markers must not be able to gain personal information about the patient that is not directly relevant to the echocardiogram. This means that name, address, NHS/Hospital number and full date of birth must not be visible on the report
that is enclosed with the images nor on the images themselves. If the age is not given separately the year of birth must be left visible on the report.

Please see the notes above about correctly removing patient ID from the paper report that is enclosed with the cases.

We appreciate that the removal of patient ID from cases may be difficult depending on the machine being used, we therefore advise that the cases are specifically collected for the BSE and the data inputs are made relevant to your cases.

If possible, use the hide ID button on the echo machine to anonymise data.

E.g. Patient Name could be ‘BSE Case 1’ or ‘Aortic Stenosis’, Patient Number could be your membership number followed by case number, ‘1111-1’

Explanatory notes for the inclusion of patient identifiable data in any medium are NOT acceptable.

**Breach of NHS Code of Practice on Confidentiality**

Major breach:

One or more examples of detailed patient demographics (e.g. name and address)

OR

One or more examples of patient data sufficient to allow a patient to be traced in any way

Minor breach:

Examples of patient identifiable information found within the logbook. These might include, for example, name or date of birth but insufficient information to identify the patient.

**In the event of a major breach:**

The candidate will automatically fail.

The candidate will be informed of the fail and notified of the reason for it.

The Chair of the Accreditation Committee will be notified of all major breaches and will make the decision as to whether the Head of Information Governance at the candidate’s place of employment should be notified.

**In the event of a minor breach:**

The candidate will be informed of the breach and notified of the reason for it. This will be taken into account in the marking scheme.

The final decision will be at the discretion of the Chair of the Accreditation Committee.
<table>
<thead>
<tr>
<th>Appendix 14 – Final checklist for logbooks.</th>
<th>YES</th>
<th>NO</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logbook submitted in one ring binder/file with dividers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All cases collected within 24 month period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>125 TOE reports performed and reported by the candidate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All reports with full name and signature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing TTE accreditation (75 cases only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All cases fully anonymised</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct case mix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum based assessment (Appendix 6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary sheet present (Appendix 9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mentor statement Present (Appendix 11)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>