

SUPPORTING THORACIC ULTRASOUND TRAINING

March 2023

The following paper summarises how BTS will provide ongoing support for training in thoracic ultrasound.

You will find information on the following areas:

1. [Background](#)
2. [What will BTS provide](#)
3. [Audience](#)
4. [Supporting the theory of ultrasound](#)
5. [Supporting practical training](#)
6. [Signposting learners to practical training](#)
7. [Appendix 1 – BTS learning objectives for training in theory of ultrasound](#)
8. [Appendix 2 - BTS minimum standards for practical ultrasound training](#)

1. Background:

In 2021 the BTS Board supported a strategic decision to change the way the Society supports training in thoracic ultrasound, in recognition and support of the emergence of various training models that exist regionally.

A task and finish group was convened with the aim of producing a sustainable model that would reduce unnecessary variation and support all learners as they progress through the training as Primary Level Operator, as detailed in the BTS Training Standard for Thoracic Ultrasound, published in May 2020 and available here: <https://www.brit-thoracic.org.uk/workforce/specialty-respiratory-trainees/respiratory-curriculum-and-related-resources/>

The task and finish group met for the first time in April 2021. This group was chaired by Dr Ian Forrest and Dr Andrew Stanton, and included representation from Regional Training Programme Directors (TPDs) and the BTS Education and Training Committee (ETC).

2. What will BTS provide:

The task and finish group has provided expert guidance to ensure the Society:

- provides all learners with relevant information on the theory of ultrasound
- provides providers of practical courses with agreed minimum standards

- continues to have strong links with providers of regional practical courses, and assists learners to find details of training

BTS will not provide practical training courses, nor will it seek to offer an accreditation scheme for courses. The Society recognises the important role local and regional centres have in providing training and we are keen to ensure both those delivering and those attending these courses have the necessary information and support to enable them to provide high quality education and training.

3. Audience:

This work is relevant to:

- all those members of the multi-professional team who are working to achieve primary operator status, as outlined in the BTS Training Standards.
- members of training faculties as they plan and deliver locally based thoracic ultrasound courses – these documents cover learning objectives for the theory of ultrasound, and minimum standards for a practical course. A bank of images is also provided.

We are pleased to have strong links with the Respiratory SAC and TPDs and we will ensure that we continue to foster close collaboration that enables us to respond where appropriate to the needs of learners.

We will continue to invite feedback from learners, as delegates attending our educational events, via our specialist advisory groups and as individual BTS members.

4. Supporting the theory of thoracic ultrasound

BTS is committed to supporting education in the theory of thoracic ultrasound to ensure that learners have suitable knowledge and preparation for attending a practical course.

BTS will provide a series of online modules that cover the theory of TUS. The intention is that learners will access this online resource prior to attending a local practical course.

The TUS online theory content will be open to all healthcare professionals seeking knowledge of ultrasound techniques. It is intended to equip learners with the appropriate theory to maximise benefit from a practical course.

The content will be relevant to the full multi-professional team and to BTS members and non-members. BTS members will be afforded access the online content as part of membership and a nominal fee will be charged to non-members.

This learning will be made available to all those who book access for a period of twelve months.

The learning modules are based on the learning objectives BTS has published (Appendix 1). We have published these to assist those centres who are planning and delivering practical courses and who may want to offer an expanded programme that includes elements of theory.

Feedback will be collected in relation to the learning presentations through an annual evaluation form.

5. Supporting practical training

BTS has produced a set of minimum standards for practical training (see Appendix 2). The standards outline the key considerations for planning and delivering a course that will provide learners with the necessary practical experience to achieve primary operator status.

The task and finish group has also put together a bank of images that can be used by those providing practical courses.

These standards set out the requirements for delivering a half day course. They were piloted successfully at two practical courses run in Newcastle and North Tees at the end of 2021.

We encourage all providers of practical training to note and adopt these standards.

6. Signposting learners to practical training

There will be no BTS accreditation scheme for practical courses, but practical TUS courses that are provided by other (non commercial) centres can be advertised on the BTS website.

Disclaimer:

The online resources are intended as educational tools for you to use to support your own learning and there is no formal certificate of completion.

BTS March 2023

APPENDIX 1:

BTS TUS THEORY MODULES - LEARNING OBJECTIVES

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Chapter 1: Physics of Ultrasound

At the end of this module, learners will be able to:

- Describe the behaviour of sound waves through different densities i.e. air, fluid, solid tissue, consolidated lung
- Explain how different probe frequencies influence sonographic appearances and relationship to structure / pathology
- Recognise and explain normal artefacts, specifically A-lines, B-lines and mirror imaging
- Explain the Doppler effect and its relevance to TUS
- Describe the rationale and practical reasons to vary gain / depth / focal point

Chapter 2: Ultrasound technique - Normal anatomy / demonstration

At the end of this module, learners will be able to:

- Demonstrate how to approach the patient and position them for TUS examination, including optimal probe orientation
- Identify how to vary gain / depth / focal point
- Recognise the normal sonographic appearance of thoracic and upper abdominal structures, specifically lung, heart, liver, spleen, kidneys, the pleural line, ribs with acoustic shadow and lung sliding, diaphragm

Chapter 3: Thoracic ultrasound in context: pleural procedure safety

At the end of this module, learners will be able to:

- Describe the evidence base justifying the requirement of TUS to guide and to reduce risk of complications from pleural intervention
- Explain the role TUS has in both in and out-patient settings in informing the diagnostic and treatment pathway
- Discuss the role and limitations of TUS in identification of pneumothorax

Chapter 4: Chest ultrasound pathology

At the end of this module, learners will be able to:

- Recall and recognise the sonographic appearances of the following pathologies:
 - Simple, free flowing effusion.
 - Complex / septated effusion.
 - Consolidated lung
 - Pleural thickening and nodularity.
- Recognise how varying echogenicity of pleural fluid can relate to different pathology
- Recognise how ultrasound can be used in the assessment of diaphragmatic paralysis

Chapter 5: Legal issues, clinical governance, and risk management

At the end of this module, learners will be able to:

- Recall key features that need to be documented with any TUS report
- Understand the critical importance of having systems allowing storage / archiving of images from TUS examinations, in particular those leading to intervention
- Discuss the importance of avoiding remote “X-marks the spot” approach to guiding pleural intervention.
- Recognise the need for documenting scope of TUS practice and how to demonstrate maintenance of capability.
- Recognise the need to be aware of capability limitations and how to seek review of TUS examinations / ongoing mentorship.

APPENDIX 2:

BTS MINIMUM STANDARDS FOR PRACTICAL THORACIC ULTRASOUND TRAINING

March 2023

Purpose

The following document sets out the BTS minimum standards for practical thoracic ultrasound training. These standards do not offer a framework for BTS to accredit practical courses. They seek to outline the key elements that a practical course should include to support trainers to plan and deliver practical, skills-based courses to assist all learners to achieve Primary TUS Operator status, as detailed in the British Thoracic Society Training Standards for Thoracic Ultrasound (1).

The standards also provide a guide for delegates to ensure they are able to select a course that will support their training to achieve Primary TUS Operator status.

The relevant theory is covered by the BTS online education resources.

Practical course aims

A face-to-face practical course should provide hands-on, supervised practical experience in ultrasound of varied pleural pathology. This will support delegates to gain confidence to identify and characterise pleural fluid in a variety of clinical scenarios as required for Primary TUS Operator status.

While there is no requirement for this course to cover pleural procedure training, it is accepted that some centres may combine this training. Some centres, depending on needs of learners, may also wish to include other aspects of TUS covered by other syllabuses eg FAMUS but any additional requirements for this remain out of the scope of this document.

Intended audience:

Primary TUS operators are the backbone of TUS services, and this level of training and experience will be expected to be achieved by many learners.

A key audience will be specialty respiratory trainees, but nurses, physician associates, advanced clinical practitioners and others will also be working towards this standard.

Trainers need to ensure that the content of the course is relevant to all learners.

Course faculty:

The course faculty should:

- Be drawn from the multi-disciplinary team.
- All be practising with at least all CiP level 5 Primary TUS Operator status and include a minimum of one member with at least CiP level 4 /5 Advanced TUS Operator status or radiologist with equivalent experience (Figure 1).
- Provide a positive learning environment that supports interaction with delegates and allows delegates the opportunity to ask any questions they may have.
- Ensure a range of patients, and a healthy volunteer are involved in the course.

Delegates:

Those attending should:

- Complete the BTS online modules covering the theory related to TUS before attending.

Course content and objectives:

The practical course should support delegates in achieving the learning outcomes in the Primary TUS Operator pathway. At the end of the course, delegates should be able to:

- Differentiate between a simple and complex effusion
- Differentiate pleural fluid from “solid” pathology such as pleural thickening
- Classify more complex effusions, including identifying features suggestive of an exudate.
- Characterise septations and loculations.
- Recommend an appropriate site for aspiration or drainage in both simple and complex effusions, including effusions less than 5cm depth.

All delegates should have the opportunity to scan:

- A healthy volunteer
- A minimum of 6 patients with varied pleural pathology to ideally include as a minimum:
 - o Small effusion
 - o Moderate to large effusion
 - o Complex (i.e. septated / loculated) effusion
 - o Pleural thickening, to allow demonstration of its differentiation from fluid
- It may be necessary to include a varying number of patients with IPC’s in situ in order to meet above requirement
- Practical demonstration should involve hands on practice in varying gain, depth and how appearance varies with patient positioning.
- Inclusion of a station with a collection of images and clips demonstrating further examples of the pathologies expected to be identified by primary operators would be encouraged, particularly where some pathologies (eg gross pleural and diaphragmatic nodularity) may be hard to secure for live demonstration

Format:

The course should be delivered face to face. It is reasonable to deliver the course in half a day.

Consider the number of delegates that can attend to ensure all get hands-on practical experience of all available pathology.

25 minute stations with 18 delegates rotating in groups of no more than 3, supported by 7 faculty members (with one acting as facilitator guiding delegates) works well.

The course faculty should consider the use of simulation, but this is not a requirement. If available, simulation can offer a useful learning experience for those new to ultrasound and can provide a useful environment for learners to ask questions away from a patient.

Table 2 Proposed levels of thoracic ultrasound (TUS) operator and relevant learning objectives

AIM	Objectives
2a: Emergency TUS operator pathway	
To be able to practice independently in emergency TUS to enable safe intervention in context of an emergency life threatening situation due to large, simple pleural effusion	<p>By the end of training and entrustment at CIP level 4 emergency operators will:</p> <ul style="list-style-type: none"> ▶ Have completed a local introductory TUS session, focusing on: <ul style="list-style-type: none"> – The basics of ultrasound examination – Familiarity with the local ultrasound machine(s) including depth, gain and probe orientation ▶ Be able to correctly identify normal structures (lung, heart, hemi diaphragm, liver, kidneys, spleen and ribs) ▶ Be able to correctly identify a clinically large free flowing pleural effusion of greater than 5 cm on ultrasound ▶ Accurately measure depth of any pleural fluid identified ▶ Appropriately identify a sonographically safe site for safe aspiration / drainage of fluid in a large effusion ▶ Recognise when ultrasound appearances are atypical for large, simple, free flowing pleural effusion and where onward referral to a more expert practitioner is made before any intervention ▶ Be aware of own limitations and subsequent onward referral rate ▶ Demonstrate annual review and appraisal of practice
2b: Primary TUS operator pathway	
To be able to practice independently in TUS to allow identification and characterisation of pleural fluid in a variety of clinical scenarios and to enable a safe pleural procedure where applicable.	<p>By the end of training and entrustment at CIP level 4, primary TUS operators will:</p> <ul style="list-style-type: none"> ▶ Demonstrate they have met all objectives within the emergency operator pathway ▶ Have completed a structured TUS training course covering: <ul style="list-style-type: none"> – Basic understanding of the principles of ultrasound – Modes of ultrasound – Sonographic anatomy of thoracic cavity – Training with supervised practical (hands on) ultrasound experience ▶ Be able to correctly identify free flowing pleural fluid of all depths ▶ Be able to accurately differentiate pleural fluid from other 'solid' pathology such as pleural thickening/tumour nodules or mass/consolidated lung ▶ Correctly assess presence of normal lung, as evidenced by normal lung sliding and A lines ▶ Correctly identify features associated with exudative pleural effusions (echogenic fluid, septations) ▶ Characterise the degree of pleural fluid septations and loculations ▶ Correctly identify gross malignant changes for example, pleural/diaphragmatic nodularity ▶ Recognise the potential for the role of ultrasound in the assessment of diaphragmatic paralysis ▶ Appropriately identify site for safe aspiration/drainage of pleural fluid in the context of a complex, non-free flowing pleural effusion ▶ Recognise when ultrasound appearances are atypical for pleural fluid and where onward referral is made before any intervention ▶ Be aware of own limitations and subsequent onward referral rate ▶ Demonstrate annual review and appraisal of practice
2c: Advanced TUS operator	
To be able to demonstrate independent practice and expertise in more advanced ultrasound techniques and practice independently in more complex cases of pleural disease	<p>By the end of training and entrustment at CIP level 4, Advanced TUS operators will be able to:</p> <ul style="list-style-type: none"> ▶ Demonstrate they have met all objectives within emergency and primary TUS pathway ▶ Demonstrate a minimum of 2 years practice at Primary TUS level with ongoing practice ▶ Correctly identify and characterise pleural thickening ▶ Correctly determine the absence of lung sliding in the context of pneumothorax or pleurodesis using B and M mode ▶ Be able to identify TUS artefacts including B-line and be aware of the potential relation to pathology ▶ Develop an awareness of the assessment of diaphragm paralysis on ultrasound using the sniff test ▶ Perform real-time ultrasound-guided or direct visualisation pleural aspiration and chest drain insertion when required ▶ Use ultrasound to guide the site for indwelling pleural catheter insertion (scanning patients in lateral decubitus position) ▶ Be aware of own limitations and subsequent onward referral rate ▶ Demonstrate annual review and appraisal of practice including standardised outcome measures
2d: Expert TUS operator	
To be able to demonstrate independent practice at an expert level of TUS using more complex adjuncts to imaging and more invasive diagnostic interventions	<p>By the end of training and entrustment at EPA level 4, expert TUS operators will be able to:</p> <ul style="list-style-type: none"> ▶ Demonstrate they have met all objectives within emergency, primary and advanced pathways ▶ Demonstrate ongoing practice of over 70 TUS examinations per year ▶ Correctly use and interpret findings using advanced modes, that is, M-mode, colour and Doppler ▶ Accurately assess diaphragm function on ultrasound—to identify movement impairment rather than frank paralysis ▶ Safely and accurately obtain pleural biopsies under direct ultrasound guidance and maintain an awareness of the benefits and limitations of TUS guided pleural biopsy versus CT-guided biopsy. ▶ Use ultrasound to establish if pneumothorax induction at thoracoscopy is possible and safe ▶ Be aware of own limitations and subsequent onward referral rate ▶ Demonstrate annual review and appraisal of practice including standardised outcome measures

CIP, capabilities in practice; EPA, entrustable professional activity.

Figure 1 – Capabilities of each level of TUS operator as per BTS training standards (BMJORR 2020) [British Thoracic Society Training Standards for Thoracic Ultrasound \(TUS\) \(bmj.com\)](https://www.bmj.com)