



Royal College
of Physicians

JAG

Joint Advisory Group
on GI Endoscopy

JETS

EUS – JAG training pathway and certification standards

Supplementary files

Effective from: 8 August 2023

Review date: 8 August 2024

Supplementary file 1

Authorship

A list of authors can be found in the EUS – JAG training pathway and certification standards [document](#) on our website.

Supplementary file 2

Key anatomical landmarks (stations)

Thoracic stations

The posterior mediastinum

Important for chest disease, mediastinal mass on cross-sectional imaging, upper GI (UGI) referrals such as mediastinal/duplication cyst, lesions intrinsic to the oesophageal wall and UGI cancer staging.

Cricopharynx from 15 to 18 cm, then cervical oesophagus from 18 to 25 cm

- Azygous
- Superior vena cava
- Great vessels above arch of the aorta

Mid thoracic oesophagus from 25 to 32cm

- Arch of the aorta, eg upper border 23cm, lower border 25 cm
- Aorta ascending and descending
- Aortopulmonary (AP) window, station 4L on lung cancer staging
- Left atrium 30 cm and pulmonary veins
- Trachea bifurcation
- Subcarinal (SC) space 29 cm, station 7

Lower thoracic from 32 to 38 cm

Cardiac chambers

- Left atrium level, right outflow tract
- Mitral valve, left ventricle
- Aortic root, pulmonary outflow tract
- Right atrium, tricuspid valve, right pulmonary artery
- Vena cava

Oesophagus

- 4 wall layer structure (serosa absent)

Abdominal oesophagus lies approximately from 38 to 40 cm



Key landmarks for EUS clinicians and photo documentation from the following:

- Aortic arch, descending aorta
- AP window
- Bifurcation of the trachea
- Subcarinal space
- Lymph node stations
- 4x wall layer structure of the oesophagus
- Right atrium and inferior vena cava and superior vena cava,
- Left atrium and aortic valve, aortic root

Further reading/video

M Sharma, RS Chittapuram, P Rai. Endosonography of the normal mediastinum: the experts approach.

Video J Encycl. GI Endosc 2013;1:1

<https://www.sciencedirect.com/science/article/pii/S2212097113700268>

Abdominal stations (gastric)

Station 1: Cardia

Station 1: Cardia (fundus of the stomach/OG junction) liver to midline

'Base station' 40 cm at the gastro-oesophageal junction (GOJ) to 41 cm; 1 cm beyond (40–41 cm)

- Left lobe of the liver
- Inferior vena cava (IVC)/right atrium
- Intra hepatic portion of the IVC
- Confluence of the hepatic veins into the IVC (common variability of right hepatic vein)
- Caudate process

Clockwise rotation at this juncture brings the echoendoscope onto the aorta/crus; *however*, forward progression by 2–3 mm following the intrahepatic IVC brings the echoendoscope to the liver hilum.

Liver hilum

- (Right) hepatic artery in cross section
- Portal vein confluence
- Common hepatic duct (CHD) – bile duct
- Intrahepatic left and right bile ducts and intrahepatic portal venous branches

Clockwise rotation at this juncture brings the echoendoscope onto the aorta/crus and the following:

- Descending aorta and crus of the diaphragm
- Origin of coeliac artery in longitudinal view
- Origin of superior mesenteric artery (SMA) in longitudinal view
- Left renal vein in cross section
- Coeliac ganglia

Progression of the echoendoscope by 3–5 mm following the course of the coeliac artery (40.5–41 cm):

- Mid body of the pancreas parenchyma
- Main pancreatic duct (MPD)
 - Rotation anticlockwise brings the echoendoscope back towards liver hilum or...
 - Rotation clockwise brings the echoendoscope toward the L adrenal (see next page)
- Adjacent mesenteric vessels
 - Splenic artery (courses in and out of view around pancreas)
 - Splenic vein (unlike SA, usually has a straight course) and superior mesenteric vein

Anticlockwise torque

- Portal venous confluence
- SMA
- MPD as it courses into the pancreatic neck (genu) then head/ampulla
- CHD as it courses deeper towards the head of pancreas and the ampulla
- Confluence of the superior mesenteric vein (SMV) and splenic vein (SV) into the portal vein
- Pulling back onto the portal vein by 3–6 mm: brings echoendoscope back to the...
- Left lobe of the liver

Key landmarks for EUS clinicians and photo documentation

- L lobe liver, intrahepatic portion of the IVC and hepatic veins
- Liver hilum with PV confluence, hepatic artery (in cross section) and common hepatic duct
- Aorta/crus and origins of the coeliac and superior mesenteric arteries

- Pancreas parenchyma and MPD
- Confluence of SMV and SV to PV as it courses to the liver hilum

Station 1 (continued): Cardia (fundus of the stomach/OG junction) midline to spleen

'Base station': 40 cm at the GOJ to 41 cm; 1 cm beyond. Find the following:

- Left lobe of the liver, intrahepatic portion of the IVC
- Liver hilum, then clockwise torque to...
- Aorta/origins of CA and SMA

Rotate echoendoscope clockwise by 5–10 degrees

- Left adrenal gland

Inferiorly (push in) and brief clockwise torque

- Left kidney
- Renal hilum

Superiorly (withdraw and 'tip up') with additional clockwise torque

- Spleen
- Splenic hilum
- Tail of pancreas
- MPD

Anticlockwise torque to follow pancreas tail, to distal and mid body

- Body of pancreas parenchyma
- MPD
- Splenic artery and splenic vein
- Pancreatic genu
- Santorini duct
- MPD entering into the papilla with the common bile duct (CBD)

Continue

Anticlockwise torque

- Portal venous confluence
- SMA
- MPD as it courses into the pancreatic neck (genu) then head/ampulla
- CHD as it courses deeper towards the head of pancreas and the ampulla
- Confluence of the SMV and SV into the portal vein
- Pulling back onto the portal vein by 3-6 mm: brings echoendoscope back to the...
- Left lobe of the liver

Key landmarks for EUS clinicians and photo documentation

- Pancreas parenchyma and MPD
- Spleen and splenic hilum
- Left adrenal
- Left kidney and renal hilum
- Splenic artery and splenic vein
- Aorta/crus and origins of the coeliac and superior mesenteric arteries
- Confluence of SMV and SV to PV as it courses to the liver hilum
- Liver hilum with PV confluence, hepatic artery (in cross section) and common hepatic duct

Abdominal stations (gastric)

Stations: Body and antrum

Insertion of the echoendoscope towards but not intubating the pyloric canal

Scope is in a 'long' position

- Gall bladder and wall layer structure
- Lower 1/3 of the bile duct (common bile duct)
- Portal venous confluence
- IVC
- Body of pancreas
- Common hepatic artery

Gastric wall

- 5x layered structure

Lymph node stations

- Hepatic/porta hepatis
- Left gastric
- Gastrohepatic ligament
- More superiorly: splenic, coeliac

From D1 bulb: the echoendoscope slips back into the stomach.

Scope is in a 'short position'

Similar anatomical findings

Key landmarks for EUS clinicians and photo documentation

- Gall bladder
- Gastric wall layer structure
- Pancreas parenchyma and MPD
- Portal vein and PV confluence (SMV and SV)
- IVC
- Location of lymph node stations
- Liver hilum with PV confluence, hepatic artery (in cross section) and common hepatic duct

Further reading

Sharma M, Pathak A, Shoukat A et al. Imaging of the common bile duct by linear endoscopic ultrasound. *World J Gastrointest Endosc* 2015;7:1170–80.

www.ncbi.nlm.nih.gov/pmc/articles/PMC4613806

Abdominal stations (duodenum)

Station 3: Duodenal bulb

'Base position'

Intubate D1/bulb

- Gall bladder
- Cystic duct

Insert scope further

- Common bile duct (CBD) – mid duct
- Pancreas duct
- Pancreas parenchyma
- Portal vein

From base position: torque clockwise

- Scope veers inferiorly and right of midline towards D2
- Trace the lower 1/3 of the CBD
- CBD and MPD converge towards the major papilla
- Confluence of the SV and SMV into the PV
- Head of pancreas
- Intraduodenal part of the CBD within the papilla itself
- Ampulla (from D1)
- Uncinate process (from D1)

From base position: torque anticlockwise

- Cystic duct and its insertion point into the CBD
- GB
- The upper 1/3 of the common hepatic bile duct (above the cystic duct insertion point)
- Liver hilum
- PV confluence enters liver parenchyma at the liver hilum
- Hepatic artery in cross section
- Division of the CHD into the right and left hepatic ducts

Key landmarks for EUS clinicians

- Common hepatic and common bile duct
- GB and cystic duct including insertion point into CBD
- Portal vein confluence and feeding veins: SMV and SV
- Pancreas parenchyma and MPD
- Confluence of SMV and SV to PV as it courses to the liver hilum
- Liver hilum with PV confluence, hepatic artery (in cross section) and common hepatic duct

Abdominal stations (duodenum)

Station 4: D2 and D3

'Base position' D3

- Bifurcation of the aorta and common iliacs
- Abdominal aorta
- IVC and portal vein
- Para aortic lymph node stations
- Inferior pole of right kidney

Slow withdrawal back into D2

From D3 into D2

- Uncinate process of the pancreas
- Accessory pancreatic duct
- MPD as it enters the papilla
- CBD as it enters the papilla
- Ampulla
- Right kidney
- IVC
- Duodenal wall layer structure

Further withdrawal

- Trace CBD up towards CHD
- Division of the CHD into the right and left hepatic ducts
- PV confluence
- Trace MPD into the pancreatic neck (genu)
- Liver hilum

Key landmarks for EUS clinicians

- Aorta
- IVC
- Uncinate process
- MPD and CBD coursing into the major papilla
- Common bile duct traced into the common hepatic
- Liver hilum
- Portal vein confluence and feeding veins: SMV and SV
- Pancreas parenchyma
- MPD can be traced into the pancreatic neck (genu)

Supplementary file 3

Syllabus for training in EUS: Domains 1–3

Domain 1: Novice phase of training 0–75 cases

Aims of training

At induction, *if available*:

- Attend ultrasound and CT lists with HPB/GI/thoracic radiologist
- ‘Hands off’ scope: 50 recommended but 100 is advantageous
- Begin regular attendance at HPB / GI MDT

Background knowledge of EUS

Appreciation of indications, reviewing imaging, preparation and equipment checks prior to each procedure (echoendoscope, ultrasound console, monitoring and sedation planning, anticoagulation)

- Contemporary knowledge of local and national guidelines, GMC guidance on consent
- Assessment of ‘personalised risk’ for each patient and potential for adverse events
- Limitations of EUS in comparison to other imaging modalities
- 1x DOPS / 10 cases min for ‘hands on’ EUS procedures: minimum 7-8 in novice phase

Scope handling

- Introduction to oblique viewing linear echoendoscope (radial EUS is optional)
- Agreed language of training in endoscopic ultrasound within the training unit
 - STOP
 - Pull back (withdraw) and push in (insert)
 - Blow (insufflate) and suck (deflate)
 - Clockwise torque and anti-clockwise torque
 - Tip up (big wheel down) and tip down (big wheel up)
 - Tip right (small wheel clockwise torque) and tip left (small wheel anti clockwise)
 - Slow down/slowly
- Importance of small movements
- Introduction to ergonomics
 - room set up, table height, console position to the bed, optimal upright posture
 - free umbilical console and endoscopic cables
 - scope positions, scope handling
 - creating good habits at start of training (eg left-hand dominance)
- Intubation of cricopharynx, GOJ, cardia, pylorus, D1/bulb, D2/D3
- Introduction to problem solving when an image cannot be achieved despite following the instructed movements
- Importance of avoiding insufflation, attention on U/S screen rather than endoscope LCD

Ultrasound console

Introduction to ultrasound and physics of ultrasound

Introduction to ultrasound console or machine: ultrasound knobology

- Depth penetration
- Zoom
- Transducer frequency
- Brightness
 - Overall gain control
 - Time gain compensation
- Focal zones
- Dynamic range, tissue harmonic imaging
- Basic functions: freeze and annotation functions, video loop function

Document up to two static images per procedure and introduction to annotation functions

Further reading

‘The influence of ultrasound equipment knobology in abdominal sonography’ in Ali Abdo Gamie S, Mahmoud Foda E, editors. *Essentials of Abdominal Ultrasound*. IntechOpen, 2019.

<https://www.intechopen.com/chapters/65515>

Lexicon of ultrasound imaging and reporting

Examples:

Artefact: low attenuation, distal enhancement, attenuating, distal acoustic shadowing, dirty shadowing, edge shadowing, ringdown

Echogenicity: anechoic, hypoechoic, low level internal echoes, isoechoic, echogenic, hyperechoic, highly echogenic

Location: superficial/deep, inferior/superior, lateral/medial, anterior/posterior

Structure: size, shape, contour

Proximity: abutting, close proximity to, adjacent to, separate from, scattered

Borders: well or poorly defined, distinct, indistinct, subtle

Contour: smooth, irregular, lobulated, microlobulated

Masses: round/spherical, irregular, lobulated, polypoid, crescent shaped, invading

Mass size: atrophic, small, normal size, enlarged, hypertrophied, large, organomegaly, swollen, bulky

Degrees of severity: trivial, negligible, mild, moderate, severe

Solid: homogeneous/heterogeneous, uniformly echogenic, hypo/hyper echoic, smooth, heterogeneous, coarse echotexture, internal nodularity, patchy echotexture, calcified/calcification

Ducts: prominent, dilated, ectatic, tortuous, transition points

Fluid: free fluid, fluid level, loculated fluid, fluid collections, walled-off, clear, turbid

Cysts: unilocular, multilocular, septated, multiseptated, thick/thin, papillary projection

Vascularity: avascular, low vascularity (hypovascular, hypoperfused). Isovascular, hypervascular, highly vascular. Perfusion pattern: uniform, non-uniform, regional hypoperfusion

Effects on surrounding structures: separate, displacing, indenting, compressing, distorting, protruding, communicating, herniating, invaginating, crossing tissue planes, surrounding, encasing, extending from,

Anatomy encountered at EUS: introduction to key EUS imaging stations

- Posterior mediastinum
- Abdominal structures in stations I–IV
 - Station 1: Cardia/OG junction: *Liver to midline* and separately, *Midline to spleen*
 - Station 2: Antrum
 - Station 3: Pyloric canal, D1/duodenal bulb
 - Station 4: D2 and D3

Introduction to normal anatomy and to certain structures

- Mediastinum: aorta, oesophageal wall, lymph node stations, cardiac chambers, GOJ
- Abdominal: L lobe liver and hilum, IVC,
- Biliary tree: intra hepatic ducts, common hepatic, cystic duct with GB, common bile duct
- Aorta and origins of CA and SMA, SMV and SV with PV confluence
- Pancreas, main pancreatic duct
- Gastrointestinal wall layer structure
- Spleen, left and right kidney, L adrenal

Introduction to pathology

- Mass lesions, benign and malignant tumours, cystic lesions
- Abnormalities of gastrointestinal wall, GISTs, Leiomyomas
- Vascular abnormalities
- Common bile duct stones, CBD wall thickening
- GB wall abnormalities, GB stones, sludge, microlithiasis
- Appreciation of expected duct calibres, abnormal calibres and transition points

Interpretation of ultrasound images

- Introduction to use of ultrasound and radiological language
- Build up experience of 'normal' for multiple structures
- Appreciation of imaging characteristics for:
 - Air
 - Cyst
 - Solid
 - Fluid

The EUS procedure

- An appreciation of the workflow of running an EUS list
- Introduction to certain aspects of endoscopic non-technical skills (ENTS)
- Introduction to report writing

Domain 2: Intermediate phase of training 76–150 cases

Aims of training

Background knowledge of EUS

- Knowledgeable and competent in pre-procedure preparation: indications etc
 - Ability to distil referrals to ascertain the key clinical question(s)
- Familiarity with assessing previous imaging (U/S, CT, MR, ERCP, EUS etc) and reports
- Knowledgeable on assessment of role of antibiotics
- Proficiency in use of ultrasound lexicon and scope training language
- 1x DOPS per 10 cases; minimum 15c total uploaded to JETS around case number 150

Introduction to remit of the procedure

- EUS is performed for different indications
- The measurement of key performance indicators (KPIs) is dependent on selecting, and successfully fulfilling, each remit.

Scope handling

- Knowledgeable on troubleshooting the echoendoscope where problems occur:
 - Electrical connections
 - Valves
 - Air/water and CO²
 - Optional: use of the balloon if required
- Adept at with intubation of cricopharynx, GOJ, cardia, pylorus, D1 bulb, D2/D3
- Increasing appreciation of scope handling required to achieve imaging for each station
 - Mediastinum
 - Abdominal stations I – IV: awareness of the different planes the echoendoscope can adopt within each station
- Ability to manoeuvre scope to optimise images (eg 'tip up' to improve coupling)
- Introduction to scope positioning to evaluate sub epithelial lesions in the following:
 - Oesophagus
 - Stomach
 - Pyloric canal and D1 bulb
 - D2/D3
- Awareness of strategies to hold scope in the correct position for FNA
- Importance of left-hand dominance
- Proficient at avoiding air insufflation and performing small fine movements

Ultrasound console

Continuing appreciation of ultrasound parameters

- Transducer frequency, depth of penetration, zoom
- Focal zone, gain, time gain compensation (TGC), tissue harmonic imaging
- Freeze and loop function, distance measurement, store function and transfer to PACS

Increasing knowledge for optimising an image

Capturing and annotation of images: ability to capture 2 to 5 images *with* annotation

Anatomy encountered at EUS

Introduction to normal anatomy and to certain structures

- Increased recognition of anatomical structure: demonstrated to teacher by pointing
- Wall layer structure of the gastrointestinal tract (and differences within the oesophagus)
- Increased understanding of vasculature in:
 - Mediastinum and abdomen, eg around pancreas, liver hilum, D2
- Increased exposure to studies examining each station

Increasing awareness of techniques to evaluate

- Whole organ
- Pancreas: uncinata, head and neck, body and tail
- Hepatobiliary tree
- Complexity of the mesenteric vessels

Introduction to pathology

Detection of fluid: ascites, pleural effusion, pancreatic fluid collections

Introduction to tumour staging: oesophagus, pancreas, lymph node assessment, examining for metastatic disease

Characterisation of a tumour: size, shape, echogenicity, vascular involvement, TNM staging

Evaluation of cysts

Interpretation of ultrasound Images

- Introduction and appreciation of ultrasound artefact
- Introduction to image optimisation
- Use of Doppler to assess vascular structure
- *Optional and where available*: introduction to contrast

Fine needle aspiration (FNA/FNB)

- Introduction to tissue acquisition, FNA/FNAB needle
- Appropriate areas to biopsy
- Different types of needle
- Techniques of FNA and different suction techniques
- Awareness of the importance of a secure stable position of scope prior to acquisition

The EUS procedure

- Introduction to report writing, example:
 - Background: imaging results and indication for EUS, risks
 - Remit: type of study
 - Findings: key findings including unexpected ones
 - Intervention: tissue acquisition: needle type, where/how/number of passes, judgement on adequacy for assessment
 - Conclusion: correlation (or variance) with previous imaging, findings relevant to clinical care, assessment of diagnosis and possible differential.
 - Recommendations: further studies or imaging, review in relevant MDT
 - Post-procedural care: recommencement of anticoagulation date/time
- Introduction to certain aspects of endoscopic non-technical skills (ENTS)

Domain 3 Advanced phase of training 151–250 cases

Aims of training

Background knowledge of EUS

- Competent in pre procedural work up per case
- Demonstrates regular attendance at HPB/UGI MDT
- Ability to troubleshoot the scope set up

Scope handling

- Ability to handle the echoendoscope, intubate and navigate in all stations
- Can manoeuvre echo endoscope to optimise an image; (aspiration: left hand dominant)
- Competent in placement of echoendoscope to 'follow anatomical structures' consistently
- Consistently controls scope position to record finding and undertake biopsy

Ultrasound console

- Can troubleshoot and optimise an ultrasound imaging consistently
- Records 7x key annotated static images relevant to each procedure remit

Anatomy encountered at EUS

Normal

- Can appreciate normal and its variants, consistently finds anatomical landmarks
- Proficiency in identifying key structures at each of the stations
- Ability to record challenging anatomical landmarks such as:
 - Mediastinum: AP window, above aortic arch
 - Station 1: Spleen, splenic hilum, left renal vein, PV confluence, liver hilum
 - Station 2: GB fundus
 - Station 3: Cystic duct, trace bile duct from papilla to hilum and back
 - Station 4: Bifurcation of the aorta, major papilla, pancreas divisum

Trainee now moves from appreciation of 'static' anatomical stations to manoeuvring the echoendoscope allowing continuous real time ultrasound when examine whole organs, tracing whole vessels and ductal systems and evaluating pathological lesions. The trainee becomes competent in real time U/S with the ability to 'follow the anatomy'.

- Evaluate a whole organ
- Follow vascular or ductal structures along their respective course such as:
 - Descending aorta after the arch
 - Course of the SMA after the origin from aorta
 - Course of the hepatic artery to the liver hilum
 - Trace the bile duct completely from ampulla to liver hilum
 - Trace main pancreatic duct continuously from tail to papilla
- Knowledgeable in appreciation of an incomplete exam, and recognises structures to be avoided during tissue acquisition

Pathology

- Ability to detect and assess pathological lesions

- Stage cancer (TNM): an appreciation of staging facilitates and consolidates knowledge of anatomical landmarks, pathological lesion assessment and anatomical variants
- Oesophageal and oesophagogastric cancer
- Pancreatic cancer
- Biliary
- Ability to discern small pathological lesions
 - Small pancreatic cyst and tumours of 3–5 mm
 - Trace of ascites
 - Sub centimetre pathological lymph nodes
 - Characterise and describe pancreatic lesions: neuro endocrine tumours (NETs), cysts, intraductal papillary mucinous neoplasm (IPMN)

Interpretation of ultrasound images

Proficiency in identifying, and documenting in descriptive ultrasound language, studies of different organs:

- Pancreas
 - Evaluation of normal pancreas
 - Autoimmune disease eg IgG4 related disease involving the pancreas
 - Stigmata of chronic pancreatitis
 - Phases of pancreatitis: inflammatory changes to walled off pancreatic necrosis
 - Ductal calibre changes and transition points
- Extrahepatic bile duct and ampulla and pathology
- GB and abnormalities of structure, presence of pathology
- L lobe liver, intra hepatic bile ducts
- *Optional, where available:* Contrast EUS
 - Indications for routine clinical use:
 - Neuroendocrine tumours and other lesions not appreciated on cross-sectional imaging
 - Indeterminate liver lesions in the liver eg haemangioma
 - Cystic lesions with large intra mural nodule
- Morphology of lymph nodes

Fine needle aspiration (FNA/FNB)

- Competent in undertaking safe tissue acquisition
- Techniques, eg fanning
- Awareness of different types of needle suction:
 - vacuum, low suction, water suction, slow pull technique of stylet, no suction
- Excellent knowledge when *not* to biopsy key structures to avoid doing harm
- Familiarity and confident at tissue bx of sub epithelial lesions when required
- Understanding of differences in tissue preparation of slides for cytology, and preparation for tissue for cyto block, immunohistochemistry, histology and molecular biology such as flow cytometry
- Ability to prepare slides and preparations for cyto block and histopathology
- Knowledge of strengths and weaknesses of needle types E.G.
- FNA for solid pancreatic lesions
- FNB for some of the following
 - Lymph nodes
 - Autoimmune pancreatic pathology: IgG4 related disease
 - Sarcoma
 - Lymphoma

The EUS procedure

- Adequate knowledge in discerning normal findings from pathology
- Consistent in optimising images: scope handling and via ultrasound console
- Ability to carry out an EUS procedure in a suitable time frame while also taking charge of the room, communicates with all team members and the patient, demonstrating leadership and ability to make clear decisions
- Competent in endoscopic non-technical skills (ENTS)
- Consistently creates a structured EUS report
- Documents procedure remit
- Consistently addresses the clinical question (not all questions can be adequately answered)
- Good communication with relevant stakeholders: referring clinicians, multidisciplinary teams (MDTs) etc

Supplementary file 4

Formative DOPS EUS

Please find the formative DOPS for EUS in the [JAG download centre](#) or linked below:

- [Formative DOPS EUS](#)



Royal College
of Physicians

JAG

Joint Advisory Group
on GI Endoscopy

For further information please contact:

JAG office
Accreditation Unit
Care Quality Improvement Directorate
Royal College of Physicians
11 St Andrews Place
London NW1 4LE
0203 075 1222
askjag@rcp.ac.uk
www.thejag.org.uk

Document control	
Version	1.0
Effective from	August 2023
Review date	August 2024
Owner	RCP Accreditation Unit

Version	1.0
Effective from	August 2023
Review date	August 2024
Owner	RCP Accreditation Unit