

Guidelines for Endoscopic Ultrasonography

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Introduction

This guideline addresses the use of endoscopic ultrasound (EUS) as part of the diagnostic evaluation of certain conditions. In addition, issues of training and credentialing in EUS and complications of this procedure are also dealt with, within these guidelines. EUS combines features of endoscopy and ultrasonography in order to obtain structural information about organs within and without the gastrointestinal tract. This is accomplished through the use of a scanning transducer, which is built into the distal tip of the endoscope. The technique originated just after the Second World War when newly obsolete naval ultrasound equipment became available. Wild and Reid modified the equipment and developed a mechanical ultrasound transducer which they inserted into the rectum of several healthy volunteers in order to obtain endoluminal ultrasound images of the rectal wall. The upper gastrointestinal tract was first examined by Rasmussen and colleagues who passed the ultrasound catheter probe down the biopsy channel of an early endoscope and measured the thickness of the gastric wall. EUS became a useful clinical tool in the early 1980s with the development of dedicated endoscopes. They were initially used for diagnostic procedures of upper gastrointestinal tract with circumferential overview of the gastrointestinal wall and its surroundings. Some 10 years later, longitudinal or linear electronic scanners were developed which allow biopsies and other interventions.^{1,2} Subsequent technological improvements such as the ability to perform EUS-guided fine needle aspiration (EUS-FNA), EUS-guided injection and EUS-guided endoscopic drainage have increased the diagnostic and therapeutic potential of this procedure. Endoscopic ultrasonography is available in all the major public and private hospitals in Singapore. As the number of EUS practitioners increases yearly, a group of experienced EUS gastroenterologists under the auspices of the Academy of Medicine, Singapore decided to come together to formulate a guideline on the training, credentialing and performing quality control of this procedure. This document is formulated based on the scientific evidence available and where there is a lack of

such data, decisions are made on the basis of expert opinion from the working group.

Clinical Indications

The clinical indications of EUS are varied and will continue to increase. However, these are the currently accepted indications:

Oesophagus

- Staging of oesophageal carcinoma.
- Evaluation of suspected malignant invasion of the oesophagus or of mediastinal lymph nodes from head and neck cancers.
- Diagnosis by EUS-guided FNA of computed tomographic (CT) scan detected mediastinal lymphadenopathy of the posterior mediastinum, aorto-pulmonary window, or sub-carinal region where prior conventional bronchoscopic/transbronchial methods have been non-diagnostic.
- Biopsy of intramural/submucosal wall lesions.
- Staging of non-small cell carcinoma of the lung with evidence of lymphadenopathy in the posterior mediastinum, aorto-pulmonary window or sub-carinal region where bronchoscopic/transbronchial methods have been negative.

Gastric and Duodenum

- Staging of gastric carcinoma.
- Biopsy of intramural/submucosal wall lesions.

Hepatobiliary and Pancreas

- Diagnosis (including FNA) and/or staging of pancreatic carcinoma (can assess portal venous involvement and detect lymph node metastases).
- Localisation of neuroendocrine or islet cell tumours of the pancreas.
- Staging ampullary and distal common bile duct carcinoma.
- Evaluation of chronic or unexplained, recurrent, acute pancreatitis (when the cause of ductal obstruction is not

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found on prior imaging tests).

- Localisation and aspiration of pancreatic cysts and inflammatory fluid collections in and around the pancreas.
- Evaluation of abnormalities of the biliary tree in patients who are surgical candidates (when a small localised and potentially resectable tumour is suspected, but not yet confirmed on prior imaging tests).
- Evaluation of choledocholithiasis when the indication for alternative intervention may depend on endoscopic ultrasonography findings.
- Performing coeliac plexus neurolysis (as a palliative treatment of intractable pain associated with pancreatic malignancies).
- Drainage of walled-off pancreatic fluid collections as well as other intra-abdominal collections that are accessible endoscopically.
- Drainage of obstructed pancreatico-biliary systems in the context of failed endoscopic retrograde cholangio-pancreaticography (ERCP).

Anorectal

- Detecting pararectal abscess and fistulae associated with inflammatory bowel disease.
- Evaluation/detection of anal sphincter defects associated with incontinence.
- Staging of anorectal cancer.

Guidelines for Training and Credentialing in Endoscopic Ultrasonography

Endoscopic ultrasound is an imaging technique that requires a level of training well beyond that of basic endoscopy. These guidelines are provided to assure a high level of competence among the trained endosonographers. Training should be accomplished in institutions with an established endoscopy unit performing a large number of procedures under the direction of a highly skilled and competent EUS gastroenterologist. The minimum number of procedures required to achieve competency in EUS varies according to individual skills, knowledge of ultrasound principles and overall quality of the training experience. In addition to standard diagnostic EUS, the trainee should have the knowledge and understanding of the new diagnostic applications such as catheter-based probes (mini-probes) used for evaluating submucosal masses, pancreatic and biliary lesions.

Competency in EUS requires both cognitive and technical aspects, with the endosonographer having a thorough understanding of the indications, contraindications and risk-benefit considerations of this procedure. Based on the nature of training received, endosonographers may

be credentialed according to 3 broad categories which are further defined below.

- Competency to perform diagnostic EUS without FNA.
- Competency to perform diagnostic EUS with FNA as well as EUS-guided injection therapies.
- Competency to perform diagnostic EUS with FNA, EUS-guided injection therapies and EUS-guided drainage procedures.

In general, for comprehensive competence in all aspects of diagnostic EUS, at least 150 supervised cases should be performed, with at least 75 pancreatico-biliary cases. For those interested in mucosal and submucosal lesions but not pancreatico-biliary imaging, a minimum of 75 supervised cases should be completed.^{3,4} For competency in diagnostic EUS with FNA, apart from meeting the criteria of 150 cases, there must also be supervised training of 50 EUS-guided FNA (Table 1). Endosonographers who wish to perform EUS-guided injection therapies should have assisted in or viewed such procedures performed previously and have clinical competency in EUS-FNA.

Recent years have also witnessed the development of therapeutic EUS in which EUS is used to guide the endoscopic drainage of the walled-off fluid collections⁵ and the pancreatico-biliary systems.⁶ Endosonographers who wish to perform such EUS-guided therapeutic drainage procedures should have a background in therapeutic endoscopy and ERCP, because such procedures utilise many of the principles of therapeutic endoscopy and ERCP such as balloon dilatation, guide-wire exchanges and stent insertion. There are, at present, no minimum numbers for credentialing in these therapeutic procedures. However, prior to performing these complex procedures, the endoscopist should have assisted in these procedures and after commencement should maintain a log to demonstrate competency and good outcomes of cases.

Recredentialing and Renewal of EUS Privileges

The goal of re-credentialing is to assure continued clinical competency, promote continuous quality improvement and maintain patient safety. Continued competency requires documentation of an adequate procedure case load.⁷ There is, at present, no consensus on the minimum number of cases needed to maintain competency. For endoscopists who have not been performing EUS regularly, a period of proctorship is advised prior to the recommencement of an independent practice.

Complications of Endosonography (Table 2)

It is essential that practising endosonographers are cognizant of the complications, able to handle them expeditiously if any occur and able to minimise the risks to the patients. Echoendoscopes have an overall larger

Table 1. Training and Credentialing in EUS

Competency level	Minimum no. required
Level 1	
Diagnostic EUS	150
• Pancreatobiliary	75
• Mucosal/Submucosal lesions	75
Level 2	
EUS-guided FNA & FNI (including coeliac plexus neurolysis)	50
Level 3	
EUS-guided drainage	<ul style="list-style-type: none"> • Currently undefined • Competence in therapeutic endoscopy and ERCP • Prior supervision/assistance • Continual auditing

ERCP: endoscopic retrograde cholangiopancreatography;
EUS: endoscopic ultrasound; FNA: fine needle aspiration;
FNI: fine needle injection

Each increasing level of competence requires the fulfilment of the lower level.

diameter and limited tip flexibility, as compared to standard endoscopes; hence, the risk of perforation has been theoretically more of a concern.

Anatomic sites of increased concern include the cervical oesophagus and the duodenal sweep. The reported procedural perforation rate of EUS is, however, similar to standard endoscopy ranging from 0.03% to 0.15%.^{9,10} Even post-dilation EUS staging of oesophageal cancer strictures is considered safe with no complications in a total of 123 patients.^{11,12}

There is a 0.29% risk of acute pancreatitis for EUS-FNA of solid pancreatic masses. This experience comes from a pooled analysis of 4909 EUS-FNA procedures.¹³ In general, EUS-FNA of solid pancreatic masses revealed postprocedure pancreatitis rates ranging from 0.85% to 2.0%.¹⁴⁻¹⁶ The risk of infectious complications following aspiration of a pancreatic cyst is 14%.¹⁷ However, with the institution of prophylactic antibiotics, the risk decreases to 0.3%.¹⁸ EUS-FNA of mediastinal cystic lesions carries a significant risk of mediastinitis and such procedures should be avoided.¹⁹ The risk of haemorrhage following EUS-FNA is 4.4% but is generally self-limited and no transfusion is required.²⁰

Tumour seeding following EUS-FNA is exceedingly rare with 2 case reports of needle track metastases in the gastric wall following by the transgastric EUS-FNA: one involving metastatic melanoma of a coeliac node and the other involving adenocarcinoma in the tail of the pancreas.^{21,22} Other rare complications include bile peritonitis following EUS-guided bile aspiration of the gallbladder²³ and massive pneumoperitoneum following by the EUS-FNA of the pancreas.²⁴ EUS-FNA of unconventional sites, namely the

Table 2a. Procedural Risks of EUS (Without Intervention)

Risk	Complication rate
Perforation	0.03% to 0.15%
Cervical oesophagus ⁸ perforation	0.06%
Aspiration ²	0.3% to 5.1%*
Transient bacteraemia ²	0.6%*

Table 2b. Procedural Risk of EUS-FNA (With Intervention)

Risk	Complication rate
Post-FNA pancreatitis	0.85% to 2%
Infectious	
Transient bacteraemia	0.6%
Infection/sepsis (with prophylactic antibiotics for cysts)	0.2% to 0.6%
Post-FNA haemorrhage	
Mild intraluminal	<4%
Mild extraluminal	1.3%
Mild intracystic	6%
Needle track metastases	Case reports
Bile peritonitis	Case report
Pneumoperitoneum	Case report

EUS: endoscopic ultrasound; FNA: fine needle aspiration

Table 2 summarises the procedural risks of EUS & EUS-FNA.*

liver, spleen and lung parenchymal masses, have shown a low complication rate although the number in these studies is small.

Whereas EUS-FNA can provide tissue for diagnosis by way of the cytologic analysis, a larger sample of tissue may occasionally be needed to obtain a definitive diagnosis such as in patients with suspected lymphoma. In such instances, a 19-gauge trucut biopsy needle may be required. In a large study involving 96 patients undergoing EUS-guided trucut biopsy, only 1 had a mild complication (abdominal pain requiring analgesia), yielding a complication rate of 0.6%.²⁵

EUS-guided coeliac plexus block for the treatment of pain in chronic pancreatitis and EUS-guided coeliac plexus neurolysis for the management of intractable pain from pancreatic cancer offer the advantage of an anterior approach and may limit the risk of spinal injury and allow a much shorter distance that the needle must traverse as compared to the anterior percutaneous approach. Complications following EUS-guided coeliac plexus neurolysis for pain attributed to pancreatic cancer include transient (<48 hours) abdominal pain (9%), transient diarrhoea (17%), and a decrease in diastolic blood pressure of 10% to 15% for 30 minutes or less (20%), with no major complications.²⁶ EUS-guided coeliac plexus block for the treatment of pain from chronic pancreatitis reported 3 minor complications

of transient diarrhoea and 1 major complication of a peripancreatic abscess in 90 patients.²⁷

Conclusion

EUS, EUS-FNA and EUS-guided interventions have become important tools in the management of patients who have various gastrointestinal and non-gastrointestinal disorders, and are being increasingly utilised at many centres. It is, therefore, essential that endosonographers are properly trained and credentialed to ensure these procedures are carried out safely and minimise the complications that may arise.

REFERENCES

1. Roberts SA. Endoscopic ultrasound. In: Halligan S, Fenlon HM, editors. *New Techniques in Gastrointestinal Imaging*. New York: Marcel Dekker, 2004.
2. Jassen L. Longitudinal EUS anatomy. In: Christoph Frank Dietrich, editor. *Endoscopic Ultrasound: An Introductory Manual and Atlas*. Stuttgart: Gramlich, Pliezhansen, 2006.
3. Van Dam J, Brady PG, Freeman M, Gress F, Gross GW, Hassall E, et al. Guidelines for training in endoscopic ultrasound. *Gastrointest Endosc* 1999;49:829-33.
4. Eisen GW, Dominitz JA, Faigel DO, Goldstein JA, Petersen BT, Raddawi HM, et al. Guidelines for credentialing and granting privileges for endoscopic ultrasound. *Gastrointest Endosc* 2001;54:811-4.
5. Seewald S, Ang TL, Kida M, Teng KY, Soehendra N; EUS 2008 Working Group. EUS 2008 Working Group document: evaluation of EUS-guided drainage of pancreatic-fluid collections (with video). *Gastrointest Endosc* 2009;69(2Suppl):S13-21.
6. Itoi T, Yamao K; EUS 2008 Working Group. EUS 2008 Working Group document: evaluation of EUS-guided choledochoduodenostomy (with video). *Gastrointest Endosc* 2009;69(2 Suppl):S8-12.
7. Renewal of endoscopic privileges: guidelines for clinical application. From the ASGE. American Society for Gastrointestinal Endoscopy. *Gastrointest Endosc* 1999;49:823-5.
8. Eloubeidi MA, Tamhane A, Lopes TL, Morgan DE, Cerfolio RJ. Cervical esophageal perforations at the time of endoscopic ultrasound: a prospective evaluation of frequency, outcomes, and patient management. *Am J Gastroenterol* 2009;104:53-6.
9. Bournet B, Miguères I, Delacroix M, Vigouroux D, Bournet JL, Escourrou J, et al. Early morbidity of endoscopic ultrasound: 13 years' experience at a referral center. *Endoscopy* 2006;38:349-54.
10. Mortensen MB, Frstrup C, Holm FS, Pless T, Durun J, Ainsworth AP, et al. Prospective evaluation of patient tolerability, satisfaction with patient information, and complications in endoscopic ultrasonography. *Endoscopy* 2005;37:146-53.
11. Pfau PR, Ginsberg GG, Lew RJ, Brensinger CM, Kochman ML. Esophageal dilation for endosonographic evaluation of malignant esophageal strictures is safe and effective. *Am J Gastroenterol* 2000;95:2813-5.
12. Wallace MB, Hawes RH, Sahai AV, Van Velse A, Hoffman BJ. Dilation of malignant esophageal stenosis to allow EUS-guided fine-needle aspiration: safety and effect on patient management. *Gastrointest Endosc* 2000;51:309-13.
13. Eloubeidi MA, Gress FG, Savides TJ, Wiersema MJ, Kochman ML, Ahmad NA, et al. Acute pancreatitis after EUS-guided FNA of solid pancreatic masses; a pooled analysis from EUS centers in the United States. *Gastrointest Endosc* 2004;60:385-9.
14. Eloubeidi MA, Tamhane A, Varadarajulu S, Wilcox CM. Frequency of major complications after EUS-guided FNA of solid pancreatic masses: a prospective evaluation. *Gastrointest Endosc* 2006;63:622-9.
15. Gress FG, Hawes RH, Savides TJ, Ikenberry SO, Lehman GA. Endoscopic ultrasound-guided fine-needle aspiration biopsy using linear array and radial scanning endosonography. *Gastrointest Endosc* 1997;45:243-50.
16. Gress F, Michael H, Gelrud D, Patel P, Gottlieb K, Singh F, et al. EUS-guided fine-needle aspiration of the pancreas: evaluation of pancreatitis as a complication. *Gastrointest* 2002;56:864-7.
17. Wiersema MJ, Vilmann P, Giovannini M, Chang KJ, Wiersema LM. Endosonography-guided fine-needle aspiration biopsy: diagnostic accuracy and complication assessment. *Gastroenterology* 1997;112:1087-95.
18. Williams DB, Sahai AV, Aabakken L, Penman ID, Van Velse A, Webb J, et al. Endoscopic ultrasound guided fine needle aspiration biopsy: a large single centre experience. *Gut* 1999;44:720-6.
19. Wildi SM, Hoda RS, Fickling W, Schimulewitz M, Varadarajulu S, Roberts SS, et al. Diagnosis of benign cysts of the mediastinum: the role and risks of EUS and FNA. *Gastrointest Endosc* 2003;58:362-8.
20. Voss M, Hammel P, Molas G, Palazzo L, Dancour A, O'Toole P, et al. Value of endoscopic ultrasound guided fine needle aspiration biopsy in the diagnosis of solid pancreatic masses. *Gut* 2000;46:244-9.
21. Shah JN, Fraker D, Guerry D, Feldman M, Kochman ML. Melanoma seeding of an EUS-guided fine needle track. *Gastrointest Endosc* 2004;59:923-4.
22. Paquin SC, Garipey G, Lepanto L, Bouvdages R, Raymond G, Sahai AV. A first report of tumor seeding because of EUS-guided FNA of a pancreatic adenocarcinoma. *Gastrointest Endosc* 2005;61:610-1.
23. Jacobson BC, Waxman I, Parmar K, Kanffman JM, Clarke GA, Van Dam J. Endoscopic ultrasound-guided gallbladder bile aspiration in idiopathic pancreatitis carries a significant risk of bile peritonitis. *Pancreatolgy* 2002;2:26-9.
24. Andrews AH, Horwhat JD. Massive pneumoperitoneum after EUS-FNA aspiration of the pancreas. *Gastrointest Endosc* 2006;63:876-7.
25. Wittmann J, Kocjan G, Sgouros SN, Deheragoda M, Pereira SP. Endoscopic ultrasound-guided tissue sampling by combined fine needle aspiration and trucut needle biopsy: a prospective study. *Cytopathology* 2006;17:27-33.
26. Gunaratnam NT, Sarma AV, Norton ID, Wiersema MJ. A prospective study of EUS-guided celiac plexus neurolysis for pancreatic cancer pain. *Gastrointest Endosc* 2001;54:316-24.
27. Gress F, Schmitt C, Sherman S, Ciaccia D, Ikenberry S, Likhman G. Endoscopic ultrasound-guided celiac plexus block for managing abdominal pain associated with chronic pancreatitis: a prospective single center experience. *Am J Gastroenterol* 2001;96:409-16.