

Diagnostic Imaging Pathways - Oesophageal Cancer (Staging)

Population Covered By The Guidance

This pathway provides guidance on imaging patients with proven oesophageal cancer, indicating how imaging helps determine management.

Date reviewed: March 2015

Date of next review: 2017/2018






Published: July 2015

Quick User Guide

Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram



Date reviewed: March 2015
 Please note that this pathway is subject to review and revision

What do I need to know?

1. The depth of invasion (T), nodes involved (N), metastases (M) should be initially assessed with CT chest, abdomen and pelvis
2. If resectable disease, confirm with a PET-CT
3. When would endoscopic ultrasound be useful?

OESOPHAGEAL CANCER (STAGING)

CT chest, abdomen and pelvis

Resectable disease (< T4) and no detectable distant metastasis (M0)

Locally advanced tumour (T4) and / or distant metastasis (M1)

PET-CT

No metastatic disease (M0)

Metastatic disease (M1)

T4

M1 (with / without FNA)

Endoscopic ultrasound (EUS) provides a more accurate assessment of the tumour and EUS-FNA increases the accuracy of N-staging (in selected patients)

Endoscopic ultrasound + FNA (fine needle aspiration)

T1 N0

T1 N1
T2 N0/N1

T3 N0/N1

T4

M1

Endoscopic therapy if possible

Neoadjuvant chemoradiotherapy (squamous cell carcinoma: more radical neoadjuvant chemoradiotherapy required especially for proximal lesions)

Individualised therapy

Chemotherapy

Surgery if the margins are positive

Surgery

Surgery (if responding)

May require:

- Stent
- Radiotherapy (for local symptoms)
- Occasional resection post therapy

With / without further:

- Stent
- Radiotherapy (for local symptoms)

Image Gallery

Note: These images open in a new page

1a



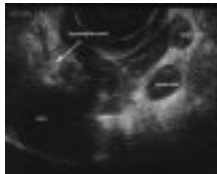
Oesophageal Carcinoma

Image 1a and 1b (Barium Swallow): Malignant stricture located at the junction of the middle and distal third of the oesophagus, over a length of 2-3cm. Immediately distal to this is a segment of normal calibre oesophagus, followed by a further segment of narrowing immediately proximal to the gastro-oesophageal junction which has herniated above the diaphragm.

1b



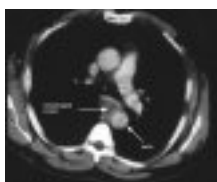
2a



Oesophageal Carcinoma

Image 2a (Endoscopic Ultrasound) and 2b (Computed Tomography): Images from the same patient showing oesophageal carcinoma with aortic involvement.

2b



3a



Oesophageal Carcinoma

Image 3a, 3b and 3c (Computed Tomography): Images from the same patient showing oesophageal carcinoma. There is thickening of the distal oesophagus with enlarged para-aortic, para-oesophageal, retrocrural and coeliac axis lymph nodes (arrows). Multiple metastatic lesions are also present in the liver.

3b



3c



Oesophageal Carcinoma

Image 4a (H&E, x2.5) and 4b (H&E, x10): Histological sections of a poorly differentiated squamous cell carcinoma of the oesophagus. There are sheets and nests of malignant squamous cells infiltrating through the oesophageal wall. Note the extensive lymphovascular space invasion (arrows). The cells demonstrate marked nuclear atypia with frequent mitotic figures at high power.

4a



4b



Teaching Points

- Staging of oesophageal malignancy is aimed at assessing the extent of local invasion of the primary tumour and for the presence or absence of nodal / distal metastatic disease
- CT chest, abdomen and pelvis is suitable initial staging modality
- If this initial investigation demonstrates a lesion that is amenable to potential curative resection, further staging should include a PET-CT scan
- If a PET-CT scan shows no distal metastatic disease, endoscopic ultrasound (EUS) is indicated for local staging

Computed Tomography (CT) Chest, Abdomen and Pelvis

- Initial staging test of choice for oesophageal cancer [2,3](#)
- A positive CT finding enables stratifying patients with unresectable disease due to locally advanced tumour and / or with distant metastasis. If CT shows advanced local disease or distant metastases, no further staging is required, as palliative treatment is the only option [6](#)
- CT is specific in assessing local unresectability with a specificity for T4 tumours >90% but a low sensitivity of 25%. Furthermore, CT is moderately sensitive and is specific for metastatic disease (M1) [7-13](#)
- The importance of N-staging in recent years has also seen a drop following the introduction of neoadjuvant therapy
- Limitations
 - Less sensitive in differentiating the layer of the oesophageal wall (T-staging) resulting in
 - Under staging of T3 and T4 tumours [14](#)
 - Unreliable to distinguish T1 from T2 and T2 from early T3 tumours [14](#)
 - Inaccurate assessment of regional lymph node disease (N-stage) [7](#)

Endoscopic Ultrasound ± Fine Needle Aspiration (FNA)

- EUS has shown to be the most accurate modality for loco-regional tumour and lymph node staging. Accuracy of EUS alone without fine needle aspiration (FNA) is approximately 70%



- High frequency catheter probe (HFCP) is useful for distinguishing between mucosal cancer and cancer invading the submucosa, with an accuracy of 81-100%. However despite using a higher frequency, it has been difficult to distinguish between tumour invasion and inflammatory cell infiltration [25](#)
- Hence employing FNA in the same setting, in selected cases increases the accuracy of N-staging to >90 per cent [7,8,26,27](#)
- Indicated in patients with oesophageal cancer in whom a CT scan has ruled out T4 and M1 disease [13](#)
- 30% of PET node negative (N0) patients were EUS node positive (N+) emphasizing the prognostic value of EUS has for nodal staging in this group of patients [28](#)
- The low number of false-negative results for EUS meant that a negative EUS result will be in most patients a truly negative one. [7](#) Other advantages include assisting in patient selection for endoscopic therapy [7,8,26](#)
- Limitations [27](#)
 - Incomplete examinations due to impassable stenosing tumours (which may be overcome by the use of miniprobes) [10,29](#)
 - Difficulties with specificity for nodal involvement (reactive versus malignant). However, it can be overcome by the ability to combine fine needle aspiration with EUS, allowing histological verification of identified lymph nodes (e.g. coeliac lymph nodes) [7,8](#)
- Note: suspicion of tracheo-bronchial involvement may require bronchoscopy or bronchoscopic ultrasonography [30](#)

Staging of Oesophageal Cancer

- Accurate staging of cancer is important for prognostication and directing further therapy. The most common staging system used for oesophageal malignancy is the American Joint Committee on Cancer tumour-node-metastases (AJCC TNM) score [1,2](#)

Site	Description	Significance
Mid	25-30cm *	-
Lower	30-40cm *	-
Gastro-oesophageal junction (GOJ)	Includes tumours whose epicentres are in the distal thoracic oesophagus, GOJ or within the proximal 5cm of the stomach (cardia) that extends into the GOJ or distal thoracic oesophagus (Siewert III). These stomach cancers are stage grouped similarly to adenocarcinoma of the oesophagus	Important for the nature of surgery in resectable disease. GOJ carcinomas are less accurate for local staging

* distance from the incisors

Primary tumour (T) stages

T0 - No evidence of primary tumour

Tis - High grade dysplasia



T1a - Tumor invades lamina propria or muscularis mucosae

T1b - Tumor invades submucosa

T2 - Tumour invades muscularis propria

T3 - Tumour invades adventitia

T4a - Resectable tumour invades adjacent structures (e.g. pleura, pericardium, diaphragm)

T4b - Unresectable tumour invades adjacent structures (e.g. aorta, vertebral body, trachea)

Regional lymph node (L) stages

A regional lymph node is defined as any perioesophageal lymph node from the cervical nodes to the celiac node

N0 - No regional lymph node metastasis

N1 - 1-2 positive regional lymph nodes

N2 - 3-6 positive regional lymph nodes

N3 - ≥7 positive regional lymph nodes

Metastases stages

M0 - No distant metastases

M1 - Distant metastases

Stage	Tumour	Nodes	Metastases	Grade	Location
IA	1	0	0	1	Any
IB	1	0	0	2-3	Any
	2-3	0	0	1	Lower
IIA	2-3	0	0	1	Upper / middle
	2-3	0	0	2-3	Lower
IIB	2-3	0	0	2-3	Upper / middle
	1-2	1	0	Any	Any
IIIA	1-2	2	0	Any	Any
	3	1	0	Any	Any
	4a	0	0	Any	Any
IIIB	3	2	0	Any	Any
IIIC	4a	1-2	0	Any	Any
	4b	Any	0	Any	Any
	Any	3	0	Any	Any
IV	Any	Any	1	Any	Any

- Plain chest radiographs can be used to identify pulmonary or mediastinal disease [4](#)

Positron Emission Tomography-Computed Tomography (PET-CT)

- PET-CT is more sensitive than CT for metastatic disease (M1) and is moderately specific [12,15](#)
- It is more accurate compared to the combination of CT and EUS [16-19](#)
- PET-CT can detect occult metastases in up to 13% and change management in 38% of patients [20](#) and have been shown to be of prognostic value independent of TNM stage [21,22](#)
- Improves diagnostic specificity for lymph node staging [15-17,19](#)
- Co-registration of PET and CT images using PET-CT systems may be more accurate than PET alone. [23, 24](#) PET-CT offers additional information over conventional CT and EUS for the staging of oesophageal cancer [24](#)
- Limitations [7,8,16,17](#)
 - Inability to determine T-stage of the oesophageal tumour
 - Inaccurate in the detection of local lymph node metastases
 - Lack of anatomical detail
 - Expensive and limited availability

Treatment

T1N0

- Surgery with curative intent is still considered the criterion standard treatment for resectable oesophageal cancer [4](#)
- However mortality and morbidity rates associated with oesophageal surgery is notable thus minimally invasive endoscopic therapy is favoured if available, particularly in suspected T1N0 staged tumours diagnosed with EUS [4](#)
- Depth of tumour invasion, tumour free margins, lymphatic and venous invasion, and grade of differentiation can be assessed with EUS [8](#)
- Endoscopic mucosal resection (EMR) specimens of T1 oesophageal carcinoma identified positive lymph node rates of <5% in T1a and between 12-46% in T1b. [31](#) Accuracy of EUS in staging of superficial oesophageal carcinoma, differentiating T1a from T1b is as high as 85% [8](#)

T1N1 or T2-3 N0-1

- T1N1 or T2-3 N0-1 staged tumours with no evidence of metastatic disease benefited from preoperative chemoradiotherapy (five courses of carboplatin and paclitaxel and 41.4 Gy via external beam radiation) followed by surgery [13](#)
- Not only was it safe but the therapy improved survival among patients with potentially curable adenocarcinoma or squamous cell carcinoma (SCC) of the oesophagus or esophagogastric-junction. [32](#) However SCC would require a more radical chemoradiotherapy especially for proximal lesions

References

Date of literature search: March 2015

The search methodology is available on request. [Email](#)

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

1. Edge S, Byrd D, Compton C, Fritz A, Greene F, Trotti A. **AJCC Cancer staging manual**. 7th ed. New York: Springer-Verlag; 2010. (Guideline)
2. Compton C, Byrd D, Garcia-Aguilar J, Kurtzman S, Olawaiye A, Washington M. **Esophagus and esophagogastric junction. AJCC Cancer staging atlas**. 2nd ed. New York: Springer-Verlag; 2012. (Guideline)
3. Mine S, Sano T, Hiki N, Yamada K, Kosuga T, Nunobe S, et al. **Thoracic lymph node involvement in adenocarcinoma of the esophagogastric junction and lower esophageal squamous cell carcinoma relative to the location of the proximal end of the tumor**. *Ann Surg Oncol*. 2014;21(5):1596-601. (Level III evidence). [View the reference](#)
4. Lightdale CJ. **Esophageal cancer**. *Am J Gastroenterol*. 1999;94(1):20-9. (Guideline). [View the reference](#)
5. Hadzijahic N, Wallace MB, Hawes RH, VanVelse A, LeVeen M, Marsi V, et al. **CT or EUS for the initial staging of esophageal cancer? A cost minimization analysis**. *Gastrointest Endosc*. 2000;52(6):715-20. (Level III evidence). [View the reference](#)
6. Fockens P, Kisman K, Merkus MP, van Lanschot JJ, Obertop H, Tytgat GN. **The prognosis of esophageal carcinoma staged irresectable (T4) by endosonography**. *J Am Coll Surg*. 1998;186(1):17-23. (Level III evidence). [View the reference](#)
7. van Vliet EP, Heijenbrok-Kal MH, Hunink MG, Kuipers EJ, Siersema PD. **Staging investigations for oesophageal cancer: a meta-analysis**. *Br J Cancer*. 2008;98(3):547-57. (Level II evidence). [View the reference](#)
8. Thosani N, Singh H, Kapadia A, Ochi N, Lee JH, Ajani J, et al. **Diagnostic accuracy of EUS in differentiating mucosal versus submucosal invasion of superficial esophageal cancers: a systematic review and meta-analysis**. *Gastrointest Endosc*. 2012;75(2):242-53. (Level II evidence). [View the reference](#)
9. Lowe VJ, Booya F, Fletcher JG, Nathan M, Jensen E, Mullan B, et al. **Comparison of positron emission tomography, computed tomography, and endoscopic ultrasound in the initial staging of patients with esophageal cancer**. *Mol Imaging Biol*. 2005;7(6):422-30. (Level III evidence). [View the reference](#)
10. Wu LF, Wang BZ, Feng JL, Cheng WR, Liu GR, Xu XH, et al. **Preoperative TN staging of esophageal cancer: comparison of miniprobe ultrasonography, spiral CT and MRI**. *World J Gastroenterol*. 2003;9(2):219-24. (Level III evidence). [View the reference](#)
11. Weaver SR, Blackshaw GR, Lewis WG, Edwards P, Roberts SA, Thomas GV, et al. **Comparison of special interest computed tomography, endosonography and histopathological stage of oesophageal cancer**. *Clin Radiol*. 2004;59(6):499-504. (Level II evidence). [View the reference](#)
12. Romagnuolo J, Scott J, Hawes RH, Hoffman BJ, Reed CE, Aithal GP, et al. **Helical CT versus EUS with fine needle aspiration for celiac nodal assessment in patients with esophageal cancer**. *Gastrointest Endosc*. 2002;55(6):648-54. (Level III evidence). [View the reference](#)
13. Rice TW. **Clinical staging of esophageal carcinoma. CT, EUS, and PET**. *Chest Surg Clin N Am*. 2000;10(3):471-85. (Review article). [View the reference](#)
14. Ba-Ssalamah A, Matzek W, Baroud S, Bastati N, Zacherl J, Schoppmann SF, et al. **Accuracy of hydro-multidetector row CT in the local T staging of oesophageal cancer compared to postoperative histopathological results**. *Eur Radiol*. 2011;21(11):2326-35. (Level II evidence).

[View the reference](#)

15. van Westreenen HL, Westerterp M, Bossuyt PM, Pruijm J, Sloof GW, van Lanschot JJ, et al. **Systematic review of the staging performance of ^{18}F -fluorodeoxyglucose positron emission tomography in esophageal cancer.** J Clin Oncol. 2004;22(18):3805-12. (Level II evidence). [View the reference](#)
16. Flamen P, Lerut A, Van Cutsem E, De Wever W, Peeters M, Stroobants S, et al. **Utility of positron emission tomography for the staging of patients with potentially operable esophageal carcinoma.** J Clin Oncol. 2000;18(18):3202-10. (Level II/III evidence). [View the reference](#)
17. Meltzer CC, Luketich JD, Friedman D, Charron M, Strollo D, Meehan M, et al. **Whole-body FDG positron emission tomographic imaging for staging esophageal cancer comparison with computed tomography.** Clin Nucl Med. 2000;25(11):882-7. Level III evidence). [View the reference](#)
18. Lerut T, Flamen P, Ectors N, Van Cutsem E, Peeters M, Hiele M, et al. **Histopathologic validation of lymph node staging with FDG-PET scan in cancer of the esophagus and gastroesophageal junction: A prospective study based on primary surgery with extensive lymphadenectomy.** Ann Surg. 2000;232(6):743-52. (Level II evidence). [View the reference](#)
19. Kato H, Miyazaki T, Nakajima M, Takita J, Kimura H, Faried A, et al. **The incremental effect of positron emission tomography on diagnostic accuracy in the initial staging of esophageal carcinoma.** Cancer. 2005;103(1):148-56. (Level II evidence). [View the reference](#)
20. Turkington RC, Parkes E, Kennedy RD, Eatock MM, Harrison C, McCloskey P, et al. **Clinical tumor Staging of adenocarcinoma of the esophagus and esophagogastric junction.** J Clin Oncol. 2015;33(9):1088. (Level IV evidence). [View the reference](#)
21. Hong D, Lunagomez S, Kim EE, Lee JH, Bresalier RS, Swisher SG, et al. **Value of baseline positron emission tomography for predicting overall survival in patient with nonmetastatic esophageal or gastroesophageal junction carcinoma.** Cancer. 2005;104(8):1620-6. (Level II evidence). [View the reference](#)
22. Choi JY, Jang HJ, Shim YM, Kim K, Lee KS, Lee KH, et al. **^{18}F -FDG PET in patients with esophageal squamous cell carcinoma undergoing curative surgery: prognostic implications.** J Nucl Med. 2004;45(11):1843-50. (Level II evidence). [View the reference](#)
23. Bar-Shalom R, Guralnik L, Tsalic M, Leiderman M, Frenkel A, Gaitini D, et al. **The additional value of PET/CT over PET in FDG imaging of oesophageal cancer.** Eur J Nucl Med Mol Imaging. 2005;32(8):918-24. (Level II evidence). [View the reference](#)
24. Gillies RS, Middleton MR, Maynard ND, Bradley KM, Gleeson FV. **Additional benefit of ^{18}F -fluorodeoxyglucose integrated positron emission tomography/computed tomography in the staging of oesophageal cancer.** Eur Radiol. 2011;21(2):274-80. (Level III evidence). [View the reference](#)
25. Murata Y, Napoleon B, Odegaard S. **High-frequency endoscopic ultrasonography in the evaluation of superficial esophageal cancer.** Endoscopy. 2003;35(5):429-35; discussion 36. (Review article). [View the reference](#)
26. van Zoonen M, van Oijen MG, van Leeuwen MS, van Hillegersberg R, Siersema PD, Vleggaar FP. **Low impact of staging EUS for determining surgical resectability in esophageal cancer.** Surg Endosc. 2012;26(10):2828-34. (Level III evidence). [View the reference](#)
27. Kelly S, Harris K, Berry E, Hutton J, Roderick P, Cullingworth J, et al. **A systematic review of the staging performance of endoscopic ultrasound in gastro-oesophageal carcinoma.** Gut. 2001;49(4):534-9. (Level II evidence). [View the reference](#)
28. Foley KG, Lewis WG, Fielding P, Karran A, Chan D, Blake P, et al. **N-staging of oesophageal and junctional carcinoma: is there still a role for EUS in patients staged N0 at PET/CT?** Clin Radiol. 2014;69(9):959-64. (Level III evidence). [View the reference](#)
29. Bowrey DJ, Clark GW, Roberts SA, Maughan TS, Hawthorne AB, Williams GT, et al. **Endosonographic staging of 100 consecutive patients with esophageal carcinoma:**



introduction of the 8-mm esophagoprobe. Dis Esophagus. 1999;12(4):258-63. (Level II evidence). [View the reference](#)

30. Nishimura Y, Osugi H, Inoue K, Takada N, Takamura M, Kinoshita H. **Bronchoscopic ultrasonography in the diagnosis of tracheobronchial invasion of esophageal cancer.** J Ultrasound Med. 2002;21(1):49-58. (Level II/III evidence). [View the reference](#)
31. Kodama M, Kakegawa T. **Treatment of superficial cancer of the esophagus: a summary of responses to a questionnaire on superficial cancer of the esophagus in Japan.** Surgery. 1998;123(4):432-9. (Level III evidence). [View the reference](#)
32. van Hagen P, Hulshof MC, van Lanschot JJ, Steyerberg EW, van Berge Henegouwen MI, Wijnhoven BP, et al. **Preoperative chemoradiotherapy for esophageal or junctional cancer.** N Engl J Med. 2012;366(22):2074-84. (Level I evidence). [View the reference](#)

Information for Consumers

Information from this website	Information from the Royal Australian and New Zealand College of Radiologists' website
<p>Radiation Risks of X-rays and Scans</p> <p>Computed Tomography (CT)</p> <p>Positron Emission Tomography (PET)</p> <p>Ultrasound</p> <p>Chest Radiograph (X-ray)</p>	<p>Computed Tomography (CT)</p> <p>Contrast Medium (Gadolinium versus Iodine)</p> <p>Gadolinium Contrast Medium</p> <p>Iodine-Containing Contrast Medium</p> <p>Plain Radiography/X-rays</p> <p>Radiation Risk of Medical Imaging During Pregnancy</p> <p>Radiation Risk of Medical Imaging for Adults and Children</p> <p>Ultrasound</p> <p>Nuclear Medicine</p> <p>PET Scan</p>

Copyright

© Copyright 2015, Department of Health Western Australia. All Rights Reserved. This web site and its

content has been prepared by The Department of Health, Western Australia. The information contained on this web site is protected by copyright.

Legal Notice

Please remember that this leaflet is intended as general information only. It is not definitive and The Department of Health, Western Australia can not accept any legal liability arising from its use. The information is kept as up to date and accurate as possible, but please be warned that it is always subject to change

File Formats

Some documents for download on this website are in a Portable Document Format (PDF). To read these files you might need to download Adobe Acrobat Reader.



[Legal Matters](#)