www.rcr.ac.uk

Clinical Radiology
The Royal College of Radiologists

Recommendations for cross-sectional imaging in cancer management, Second edition

Lymph nodes

Faculty of Clinical Radiology

Contents

Clinical background **3**
Who should be imaged? 3
Staging objectives 4
Staging 4
Follow-up 4
Tips 4

References **6**

Clinical background

Staging of lymph nodes is an integral part of the TNM staging classification because nodal involvement is a powerful adverse prognostic indicator which often determines patient management, frequently distinguishing surgical candidates from those best suited to non-surgical management. In most cases, the incidence of nodal involvement increases with tumour bulk and stage, and is dependent on histological type and grade. In order to provide the best possible assessment of the nodal status of patients, radiologists are required to:

- Have detailed knowledge of tumour histology and stage of the primary tumour to determine the probability of nodal involvement (see Tips below)
- Know of pattern of spread (see Tips below) and the prevalence of micro- as opposed to macroscopic nodal spread
- Be familiar with the criteria for nodal involvement on ultrasound (US)/magnetic resonance imaging (MRI)/computed tomography (CT) at various anatomical sites (see below), recognising pitfalls in diagnosis
- Have an idea of the accuracy of imaging observations and understand the impact of positive and negative imaging results on patient management
- Be familiar with new imaging methods for evaluating nodal disease.

The TNM system emphasises regional nodal involvement in the N category, but nodal involvement at other than regional sites is classified as distant metastases (that is, belongs in the M category). It is, therefore, important for radiologists to know where regional and metastatic sites reside for each tumour site and these details can be found in staging manuals such as the American Joint Committee on Cancer (AJCC) *Cancer Staging Manual*.[1] Sometimes, the same organ may have differing regional nodal groups; thus, the retroperitoneum is a metastatic site for cervical tumours but is defined as 'regional' for endometrial cancer.

The TNM emphasises different aspects for nodal involvement depending on the primary tumour; thus for the bladder and head and neck cancers, nodal size is part of the N category. In other tumours (such as colorectal, gastric and bladder cancers and melanoma), the N subcategory is dependent on the number of nodes involved. For many tumours, the location of nodes determines the N subcategory (for example, breast, lung or anus cancers). For many adenocarcinomas, the presence or absence of microscopic metastatic disease, regardless of primary tumour burden, is emphasised whereas nodal involvement sometimes does not alter staging category at all (for example, for well-differentiated follicular/papillary thyroid cancers in patients less than 45 years old).

Currently, the only widely available criterion for assessing lymph nodes by imaging techniques is nodal size assessed in the axial short-axis; nodal size criteria are set out in Table 1. This assessment method is very limited in its accuracy because it is unable to detect microscopic disease in normal size nodes (false-negative result) and to distinguish enlarged, hyperplastic (benign) from malignant lymph nodes (false-positive results). This limitation has important clinical implications for patients; for example, those with lung cancer, where the only hope for cure is surgery and where operability is determined largely by the lymph node status in the mediastinum. As imaging has limited accuracy to stage mediastinal lymph nodes, patients with tumours that are considered potentially resectable often undergo another operation (mediastinoscopy with lymph node sampling) to assess pathologically the lymph nodes before definitive resection is performed. This situation has improved with the more widespread introduction of metabolic imaging.[2]

Who should be imaged?

All patients undergoing staging investigations that involve imaging for diagnosed or suspected cancer should have nodal status assessed.

Table 1. Lymph node size at various anatomic sites: short axis diameter, upper limits of normal

Site	Group	Short axis size (mm)
Head and neck[3,4]	Facial	Not visible
	Cervical	8 (10 jugulodigastric nodes) (<10 with central necrosis)
Axilla		10
Mediastinum[5–7]	Subcarinal	12
	Paracardiac	8
	Retrocrural	6
	All other sites	10
Abdomen[7]	Gastrohepatic ligament	8
	Porta hepatis	8
	Portacaval	10
	Coeliac axis to renal artery	10
	Renal artery to aortic bifurcation	12
Pelvis[8]	Common iliac	9
	External iliac	10
	Internal iliac	7
	Obturator	8
Inguinal		10

Staging objectives

- To identify presence/extent of regional nodal metastases with a view to assigning an N-staging category.
- To identify whether the extent of nodal disease will significantly alter the proposed therapeutic approach. For example, by increasing the extent of surgical exploration required for the placement of vascular grafts.
- To determine whether the presence of metastatic nodal involvement designates M-stage disease.
- To identify presence/extent of regional nodal enlargement with a view to planning biopsy.
- To distinguish between nodal enlargement due to malignancy and that due to benign hyperplasia.
- To attempt to detect the presence of microscopic disease in normal size nodes (only currently possible with PET-CT using tracers such as ^{18}Fluoro-deoxy-glucose [^{18}FDG] and Fluorocholine [^{18}FCH]).

Staging

Nodal assessment forms part of the TNM assessment and should be undertaken using CT or MRI, as appropriate, using nodal size criteria. The areas to be examined are as appropriate for the primary tumour.

Staging the primary tumour should be undertaken according to the guidelines within this document.

Follow-up

As appropriate for individual tumour sites.

Tips

- Morphological criteria that can be useful for nodal assessment include:
  - Nodal size (see above)

  - Nodal shape (round or elliptical)
  - Nodal contour (to identify extracapsular spread)
  - Nodal clustering
  - Nodal density (particularly cystic or necrotic regions)
  - Enhancement characteristics following intravenous contrast medium administration (homogeneity/ heterogeneity/central necrosis).
- Although not required for the TNM staging, it is sometimes necessary to classify in detail the anatomic sites of regional nodal involvement using standard designations in order to facilitate surgical exploration (for example, for head and neck tumours and in lung and breast cancer – see relevant sections for details).
- There is often confusion about the precise anatomical location of nodal sites on cross-sectional imaging, particularly when planning radiotherapy. It is recommended that a standard nodal atlas is used (such as Martinez-Monge *et al* 1999).[9]
- Assessment of the probability of nodal involvement according to the histology, clinical extent and serum tumour marker levels for a number of different tumours can be found in the literature for some tumours (such as breast, prostate and renal). These prediction tools/nomograms can sometimes help radiologists make a reasonable assumption about the likelihood of nodal involvement when evaluating individual patients and can be found at http://www.mskcc.org/cancer-care/prediction-tools[10]
- Ultrasound evaluations using nodal size, echogenicity, ratio of long to short axis diameters and vascularity on Doppler studies can be useful to evaluate for metastatic disease at a number of anatomic locations including the neck, breast, groins and also the mediastinum and upper abdomen (the latter using endoscopic methods for access).

It must be remembered that the sensitivity of metabolic imaging with ^{18}FDG PET-CT is dependent on tumour type (for example, less sensitive in prostate cancer when ^{18}FCH is preferred), tumour biology in terms of rate of growth (less efficacious in non-seminomatous germ cell tumours), on histological type (less good for evaluating mucinous or colloidal neoplasms), tumour size and other factors. However, in several tumour types, 18FDG PET-CT is an accurate modality for detecting nodal involvement.[11] Inflammatory conditions can lead to false-positive findings.

Approved by the Clinical Radiology Faculty Board: 31 October 2013

References

1. Edge S, Byrd DR, Compton CC, Fritz AG, Greene FL, Trotti A (eds). *AJCC Cancer Staging Manual*, 7th edn. New York: Springer, 2010.

2. The Royal College of Physicians and The Royal College of Radiologists. *Evidence-based indications for the use of PET-CT in the United Kingdom 2013*. London: Royal College of Physicians, 2013.

3. Tart RP, Mukherji SK, Avino AJ *et al.* Facial lymph nodes: normal and abnormal CT appearance. *Radiology* 1993; **188:** 695–700.

4. van der Brekel MWM, Stel HV, Castelijns JA *et al.* Cervical lymph node metastasis: assessment of radiological criteria. *Radiology* 1990; **177:** 379–384.

5. Glazer GM, Gross BH, Quint LE, Francis IR, Bookstein FL, Orringer MB. Normal mediastinal lymph nodes: number and size according to American Thoracic Society mapping. *AJR Am J Roentgenol* 1985; **144:** 261–265.

6. Dorfman RE, Alpern MB, Gross BH, Sandler MA. Upper abdominal lymph nodes: criteria for normal size determined with CT. *Radiology* 1991; **180:** 319–322.

7. Callen PW, Korobkin M, Isherwood I. Computed tomography evaluation of the retrocrural prevertebral space. *AJR Am J Roentgenol* 1977; **129:** 907–910.

8. Vinnicombe S, Norman A, Nicolson V, Husband JE. Normal pelvic lymph nodes: evaluation with CT after bipedal lymphangiography. *Radiology* 1995; **194:** 349–355.

9. Martinez-Monge R, Fernandes PS, Gupta N, Gahbauer R. Cross-sectional nodal atlas: a tool for the definition of clinical target volumes in three-dimensional radiation therapy planning. *Radiology* 1999; **211**(3): 815–828.

10. http://www.mskcc.org/cancer-care/prediction-tools (last accessed 30/1/14)

11. The Royal College of Radiologists. *iRefer: Making the best use of clinical radiology,* 7th edn. London: The Royal College of Radiologists, 2012. (www.irefer.org.uk)

Author:

Professor Anwar R Padhani, Consultant Radiologist and Professor of Cancer Imaging, Paul Strickland Scanner Centre, Mount Vernon Cancer Centre and The Institute of Cancer Research, London

Citation details

Padhani AR. Lymph nodes. In: Nicholson T (ed). *Recommendations for cross-sectional imaging in cancer management*, Second edition. London: The Royal College of Radiologists, 2014.

Ref No. BFCR(14)2

The Royal College of Radiologists
63 Lincoln's Inn Fields, London WC2A 3JW
Tel: +44 (0)20 7405 1282
Email: enquiries@rcr.ac.uk **www.rcr.ac.uk**

A Charity registered with the Charity Commission No. 211540

Clinical Radiology
The Royal College of Radiologists

Faculty of Clinical Radiology