

Diagnostic Imaging Pathways - Neck Pain (Non-Traumatic)

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with non-traumatic neck pain.

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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 (RRL) 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: August 2013
 Please note that this pathway is subject to review and revision

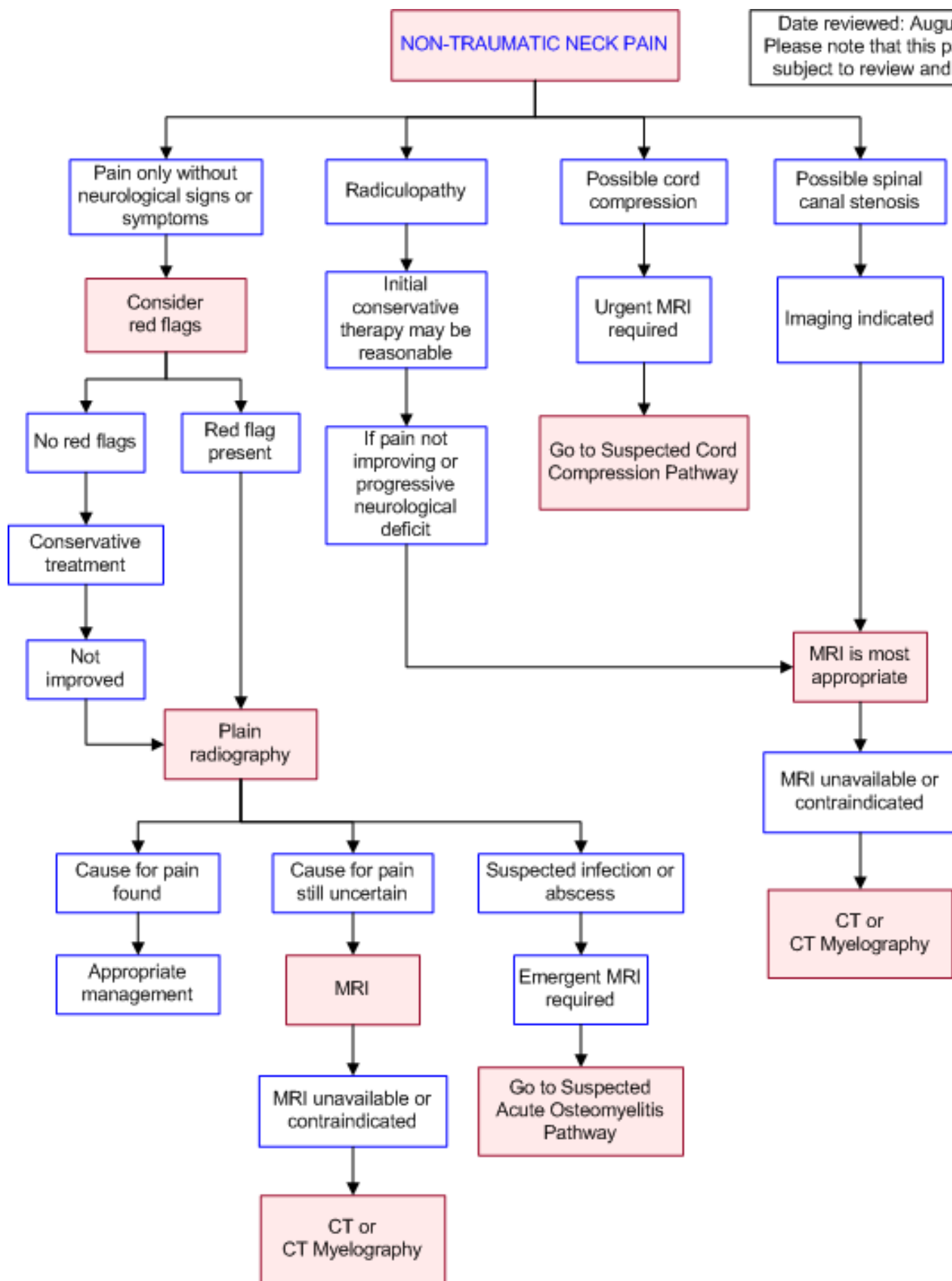


Image Gallery

Note: These images open in a new page

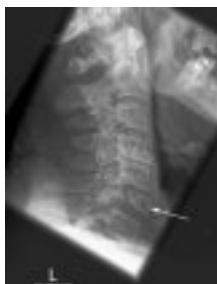
1a



Osteoarthritis

Image 1a and 1b (Plain Radiograph): Degenerative changes are seen in the mid cervical spine most marked at C4,5,6 with anterior and posterior osteophytes and loss of disc height. There is marked collapse of the C6 vertebral body (arrow) with approximately one third loss of vertebral body height. There is no subluxation on flexion or extension.

1b



Teaching Points

- 'Red flags' that prompt imaging are signs and symptoms that suggest neurological conditions, infection, malignancy, fracture or haemorrhage and include the development of neurologic signs and symptoms, unexplained weight loss, fever, history of malignancy or immunosuppression, intravenous drug use, presence of a rheumatological condition, age > 50, severe headaches, dysphagia, nausea and vomiting
- The diagnostic yield of plain radiography for the assessment of non-traumatic neck pain is low
- If there are neurological symptoms or signs, MRI is indicated
- Multidetector CT or CT myelography are alternatives to MRI when it is contraindicated or unavailable

Neck Pain

- Neck pain is extremely common. It is the second most common musculoskeletal presenting complaint [1](#) and the twentieth most common overall presenting complaint [2](#) in the primary care setting
- The evidence base mainly studies imaging modalities in the evaluation of traumatic neck pain and whiplash-associated disorders, outside the scope of this review

Red Flags for the Investigation of Non-Traumatic Neck Pain

- These clinical features may help to increase the yield of cervical spine radiography and have been adapted from criteria proposed for low back pain, as many risk factors are common to both presentations [3-5](#)
 - Constitutional symptoms e.g. fever, night sweats



- Immunosuppression
 - Intravenous drug use
 - History of malignancy or unexplained weight loss of insidious onset
 - Age >50 years
 - Prolonged use of corticosteroids, osteoporosis
 - Suspected or diagnosed rheumatological condition
 - Neurological signs or symptoms e.g. headache, dysphagia, vomiting, focal neurologic deficit
- There is no convincing evidence that the sensitivity and specificity of these red flags is sufficient to exclude serious underlying disease but they may help to reduce unnecessary use of plain radiography

Plain Radiography

- Plain radiography serves poorly either as a diagnostic or screening test in non-traumatic neck pain. Most patients with non-traumatic neck pain have either normal cervical spine radiographs or age-related degenerative changes that are often unrelated to symptoms [3,6-8](#)
- Plain radiography is not indicated for the investigation of non-traumatic neck pain unless 'red flag' features suggestive of serious underlying disease are present or symptoms have persisted for more than 6 weeks [3,6,7,9](#)
- A normal radiograph should not preclude further work-up if 'red flag' features are present [10](#)

Magnetic Resonance Imaging

- Preferred first-line advanced imaging for the patient with non-traumatic neck pain
- MRI should be performed if there are neurologic signs or symptoms, regardless of radiographic findings [7](#)
- There is a paucity of evidence for the appropriate timing of MRI, but emergent MRI is suggested for suspected cord compression, cauda equina syndrome, abscess or infection. It may be appropriate to trial a period of conservative care prior to MRI for patients with cervical radiculopathy [11,12](#)
- Advantages [10](#)
 - Better soft tissue contrast - allows for evaluation of soft tissue and osseous abnormalities in one test
 - No ionising radiation
- Disadvantages compared to CT include [10](#)
 - Cortical bone lesions are not as well visualised – if bony anatomy is critical, CT may be preferred
 - Claustrophobia
 - Longer scanning time needed
 - Contraindicated in the presence of a ferromagnetic substance, e.g. Pacemaker, aneurysm clip, cochlear implant, ocular foreign body, spinal cord stimulator and some stent materials
- MRI is recommended for vertebral inflammatory and infectious processes. It can detect osteomyelitis as early as 3-5 days after onset of infection and is reported to have a sensitivity of 96% and a specificity of 92% for the detection of spinal infections, more accurate than both plain radiography and bone scan [13,14](#)
- The sensitivity of MRI to detect cervical soft disc herniation is 94% [15](#)
- MRI is the most accurate modality for detecting suspected malignancy and vertebral metastasis, and determining disease extension around the spinal cord [16,17,18](#)



- High accuracy, sensitivity and specificity in detecting vertebral compression fractures and can provide clues to differentiate malignant, osteoporotic and infective causes [19-21](#)
- Abnormalities such as disc degeneration, spondylosis, disc herniation, bulging disc and foraminal stenosis can be seen on MRI in asymptomatic individuals and any causal attribution should be made after strict correlation with clinical signs and symptoms, particularly in older patients [22-26](#)
- Diffusion-weighted imaging, diffusion tensor imaging and fibre tractography show added sensitivity in detecting intrinsic cord damage and are a developing area of research [10](#)

Computed Tomography, CT Myelography

- CT provides superior bony detail compared to MRI [27](#) and is less sensitive to patient movements, but is associated with ionising radiation. It can be useful where bony anatomy is critical or in surgical planning
- Like other imaging tests, CT abnormalities including herniated discs and degenerative changes are detected in asymptomatic individuals, reducing its specificity
- CT myelography is an invasive procedure that involves injecting the thecal sac with iodinated contrast material allowing accurate measurements of central and foraminal canal diameters. When MRI is contraindicated or unavailable, CT myelography is an alternative investigation for patients with suspected cord involvement, radiculopathy or spinal stenosis [4,7](#)

Cervical Discography

- Cervical provocation discography, which includes disc stimulation and morphological evaluation, has been occasionally used to distinguish a painful cervical disc from other potential sources of pain
- There is limited evidence for the diagnostic accuracy of cervical discography [28](#)
- A recent study suggested that discography may cause accelerated degenerative changes in tested discs [29](#)

References

Date of literature review: April 2013

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. Ferrari R, Russell AS. **Neck pain**. Best Pract Res Clin Rheumatol. 2003;17(1):57-70. (Review article)
2. Pace WD, Dickinson LM, Staton EW. **Seasonal Variation in Diagnoses and Visits to Family Physicians**. Ann Fam Med. 2004;2(5):411-7. (Level I evidence)
3. Australian Acute Musculoskeletal Pain Guidelines Group, National Health and Medical Research Council. **Evidence-based Management of Acute Musculoskeletal Pain** [online publication]. Brisbane: Australian Academic Press Pty Ltd; 2003 [cited 2013 February 26]. (Systematic review; Evidence based guidelines) [View the reference](#)
4. Nordin M, Carragee EJ, Hogg-Johnson S, Weiner SS, Hurwitz EL, Peloso PM, et al. **Assessment**

of neck pain and its associated disorders - Results of the bone and joint decade 2000-2010 task force on neck pain and its associated disorders. Spine [Review]. 2008;33(4):S101-22. (Review article; Best evidence synthesis)

5. Expert Panel on Neurologic Imaging:, Davis PC, Franz JW, Cornelius RS, Angtuaco EJ, Broderick DF, et al. **American College of Radiology Appropriateness Criteria: Low back pain** [online publication]. Reston, VA; 2011 [cited 2013 April 4]. (Evidence based guidelines) [View the reference](#)
6. Johnson MJ, Lucas GL. **Value of Cervical Spine Radiographs as a Screening Tool.** Clin Orthop Relat Res. 1997;340:102-8. (Level III evidence)
7. Expert Panel on Musculoskeletal Imaging:, Daffner RH, Weissman BN, Angevine PD, Arnold E, Bancroft L, et al. **American College of Radiology Appropriateness Criteria: Chronic neck pain** [online publication]. Reston, VA: American College of Radiology; 2010 [cited 2013 26 February]. (Evidence based guidelines) [View the reference](#)
8. Vanderdonk J, Schouten J, Passchier J, Vanromunde LKJ, Valkenburg HA. **The associations of neck pain with radiological abnormalities of the cervical spine and personality traits in a general population.** J Rheumatol. 1991;18(12):1884-9. (Level II evidence)
9. Heller CA, Stanley P, Lewisjones B, Lewis Jones B, Heller RF. **Value of x ray examinations of the cervical spine.** Brit Med J (Clin Research Ed). 1983;287(6401):1276-8. (Level IV evidence)
10. Laker S, Concannon L. **Radiologic evaluation of the neck: a review of radiography, ultrasonography, computed tomography, magnetic resonance imaging, and other imaging modalities for neck pain.** Phys Med Rehabil Clin N Am. 2011;22(3):411-28, vii. (Review article)
11. Pompan D. **Appropriate use of MRI for evaluating common musculoskeletal conditions.** Am Fam Physician. 2011;83(8):883-4. (Editorial)
12. Bono C, Ghiselli G, Gilbert T, Kreiner DS, Reitman C, Summers J, et al. **An evidence-based clinical guideline for the diagnosis and treatment of cervical radiculopathy from degenerative disorders.** Spine J. 2011;11(1):64-72. (Evidence based guideline)
13. Modic MT, Feiglin DH, Piraino DW, Boumphrey F, Weinstein MA, Duchesneau PM, et al. **Vertebral osteomyelitis: assessment using MR.** Radiology. 1985;157(1):157-66. (Level III evidence)
14. Pineda C, Vargas A, Rodríguez AV. **Imaging of Osteomyelitis: Current Concepts.** Infect Dis Clin North Am. 2006;20(4):789-825. (Review article)
15. Van de Kelft E, van Vyve M. **Diagnostic imaging algorithm for cervical soft disc herniation.** Acta Chir Belg. 1995;95(3):152-6. (Level III evidence)
16. Colletti PM, Dang HT, Deseran MW, Kerr RM, Boswell WD, Ralls PW. **Spinal MR imaging in suspected metastases: correlation with skeletal scintigraphy.** Magn Reson Imaging. 1991;9(3):349-55. (Level III evidence)
17. Algra PR, Bloem JL, Tissing H, Falke TH, Arndt JW, Verboom LJ. **Detection of vertebral metastases: comparison between MR imaging and bone scintigraphy.** Radiographics. 1991;11(2):219-32. (Level II evidence)
18. Chiewvit P, Danchaivijitr N, Sirivitmaitrie K, Chiewvit S, Thephamongkhol K. **Does magnetic resonance imaging give value-added than bone scintigraphy in the detection of vertebral metastasis?** J Med Assoc Thai. 2009;92(6):818-29. (Level III/IV evidence)
19. Abdel Wanis ME, Solyman MTM, Hasan NMA. **Sensitivity, specificity and accuracy of magnetic resonance imaging for differentiating vertebral compression fractures caused by malignancy, osteoporosis, and infections.** J Orthop Surg (Hong Kong). 2011;19(2):145-50. (Level III evidence)
20. Thawait SK, Marcus MA, Morrison WB, Klufas RA, Eng J, Carrino JA. **Research synthesis: what is the diagnostic performance of magnetic resonance imaging to discriminate benign from malignant vertebral compression fractures? Systematic review and meta-analysis.** Spine [Meta-Analysis Research Support, Non-U.S. Government Review]. 2012;37(12):E736-44. (Level I evidence)



21. Pozzi G, Garcia Parra C, Stradiotti P, Tien TV, Luzzati A, Zerbi A. **Diffusion-weighted MR imaging in differentiation between osteoporotic and neoplastic vertebral fractures.** Eur Spine J. 2012;21 Suppl 1:S123-7. (Level III evidence)
22. Boden SD, Davis DO, Dina TS, Patronas NJ, Wiesel SW. **Abnormal magnetic-resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation.** J Bone Joint Surg Am. 1990;72(3):403-8. (Level III evidence)
23. Teresi LM, Lufkin RB, Reicher MA, Moffit BJ, Vinuela FV, Wilson GM, et al. **Asymptomatic degenerative disk disease and spondylosis of the cervical spine: MR imaging.** Radiology. 1987;164(1):83-8. (Level III evidence)
24. Siivola SM, Levoska S, Tervonen O, Ilkko E, Vanharanta H, Keinänen-Kiukaanniemi S. **MRI changes of cervical spine in asymptomatic and symptomatic young adults.** Eur Spine J. 2002;11(4):358-63. (Level II evidence)
25. Lehto IJ, Terti MO, Komu ME, Paajanen HE, Tuominen J, Kormano MJ. **Age-related MRI changes at 0.1 T in cervical discs in asymptomatic subjects.** Neuroradiology. 1994;36(1):49-53. (Level III evidence)
26. Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. **Magnetic resonance imaging of the lumbar spine in people without back pain.** N Engl J Med. 1994;331(2):69-73. (Level III/IV evidence)
27. Beltran J, Noto AM, Chakeres DW, Christoforidis AJ. **Tumors of the osseous spine: staging with MR imaging versus CT.** Radiology. 1987;162(2):565-9. (Level III evidence)
28. Onyewu O, Manchikanti L, Singh V, Geffert S. **An Update of the Appraisal of the Accuracy and Utility of Cervical Discography in Chronic Neck Pain.** Pain Physician. 2012;15(6):E777-806. (Level II evidence)
29. Carragee E, Don A, Hurwitz E, Cuellar J, Carrino J. **2009 ISSLS Prize Winner. Does discography cause accelerated progression of degeneration changes in the lumbar disc: a ten-year matched cohort study.** Spine (Phila Pa. 1976). 2009;34(21):2338-45. (Level III evidence)

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