

Diagnostic Imaging Pathways - Paediatric, Neck or Back Pain

Population Covered By The Guidance

This pathway provides guidance on imaging children with neck or back 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

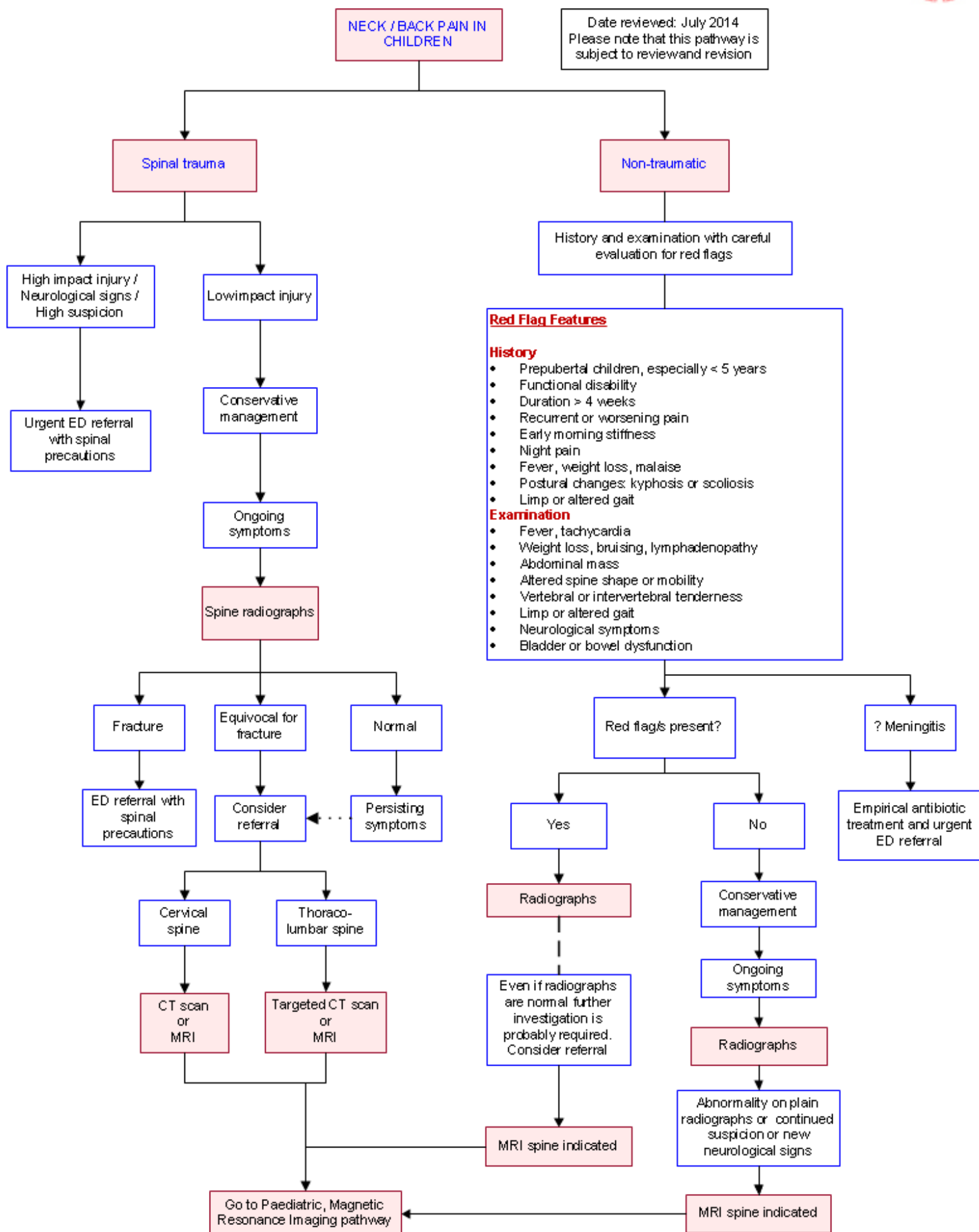


Image Gallery

Note: Images coming soon

Teaching Points

- Neck pain in children and adolescents is reported to have a prevalence rate between 20% -40%. Neck pain with disability is relatively less common [1](#)
- Prevalence of back pain in children was reported in one study to be between 28% - 48%. The exact prevalence is unknown [2,3](#)
- An important distinction to be made while evaluating a patient with neck or back pain is to note whether the pain is associated with trauma or otherwise and to identify the duration of symptoms as acute, sub-acute or chronic
- In the majority of acute traumatic presentations, plain radiography followed, if necessary, by Computed Tomography (CT) would be ideal to rule out any major bony injury. For most other non-acute and chronic presentations, Magnetic Resonance Imaging (MRI) should be the preferred choice of imaging
- It should be noted that in the absence of trauma and red flags, evidence to support other diagnostic imaging is lacking, especially in non-emergency presentations [1](#)
- Cervical spine injury is less common in children compared to adults. Young children suffer spinal injury mainly from motor vehicle accidents where as older children from sports related injuries [4](#)
- The main aim of imaging children with suspected cervical injury is to rule out spinal cord injury, assess the extent of injury to spinal cord, and prevent further damage if any or to avoid it completely with timely spinal precautions or spinal surgery. Morbidity and mortality from significant spinal cord injury can be high. Also, it is worth noting that young children can have cord injury without any radiographic evidence of bony or ligamentous injury owing to the laxity of ligaments in this age group [4](#)
- Clinical Decision Rules (CDRs) like Nexus criteria and Canadian C-Spine rules have been well validated in adults but their application in children has not been positive. Caution should be applied when these are used in young children (<10 years old) especially [4](#)
- **Red-flags** that have been associated with increased risk of having a serious organic pathology in the absence of trauma [2,5,6,7,8,9](#)
 - *History-related* – Prepubertal age especially when below 5 years of age, loss of function, pain of more than 4 weeks duration, recurrent or worsening pain, early-morning stiffness, night pain, fever, weight loss, malaise, kyphosis or scoliosis, altered gait
 - *Clinical examination-related* – Fever, tachycardia, weight loss, bruising, lymphadenopathy, abdominal mass, altered shape of the spine, vertebral or intervertebral tenderness, limp, neurological deficits, bladder or bowel dysfunction
- In one study it was found that radicular pain and abnormal neurological examination had 100% specificity for a specific diagnosis whereas night pain had a specificity of 95%. Sensitivity was the highest at 67% for lumbar region pain [5](#)

Plain Radiography

- Plain radiography is an excellent initial imaging test in all traumatic causes of neck or back pain as

it provides good structural imaging with relatively low radiation exposure [2](#)

- In one study more than 65% diagnoses were made on plain radiography alone. Hence, can be used as a screening examination [5](#)
- Plain radiography was reported to have a sensitivity of 73% and a specificity of 92% for cervical spine injuries in which CT was the reference standard. Lateral view radiographs alone were reported to have similar sensitivity and specificity. Flexion-extension views do not add to the accuracy in the acute setting [4](#)

Magnetic Resonance Imaging (MRI)

- First choice cross-sectional imaging in the majority of institutions when back pain is sub-acute or chronic or when the cause of back or neck pain is suspected to be of nonosseous origin [10](#)
- Excellent at detecting spinal contents, bone marrow changes, intervertebral disc disease, spinal tumours, infections and congenital anomalies [11](#)
- Superior to CT in detecting ligamentous injuries in acute spinal trauma [4,12](#)
- Major advantage of lack of ionising radiation but can be time consuming and a significant number of children may require sedation/anaesthesia which carries their own risk
- MRI of spine is the imaging modality of choice for spondylosis, spondylolisthesis, disc degeneration, disc herniation, discitis, vertebral osteomyelitis, Langerhans cell histiocytosis and Ewing's Sarcoma [2](#)
- Reported to have a sensitivity ranging from 56% - 96% for sub-acute causes of spinal pathology and a specificity ranging from 43% to 100% [13](#)

Nuclear Medicine Scans

- Single-Photon emission CT (SPECT) scans were used frequently in evaluating non-acute back pain but for the lack of specificity, MRI has replaced them as the initial imaging of choice with a SPECT bone scan reserved for negative MRI but with continued suspicion due to on-going pain [2, 11](#)

Computed Tomography (CT)

- Excellent at detecting fractures and is generally accepted as being superior to MRI in this area [8, 11](#)
- Several studies report higher rates of detection for fractures in spinal injuries on CT scans compared to those detected on MRI alone [12,14,15](#)
- More widely available than MRI, quicker to perform and does not require sedation but has a major disadvantage of radiation exposure, particularly relevant in children who are more radiation-sensitive than adults. Whenever possible, targeted CT scans should be done for the level of interest (e.g. L3 and L4 instead of lumbar spine) reducing the effective radiation dose
- Can be the imaging modality of choice for traumatic vertebral fractures (following plain radiography), disc calcification and osteoid osteoma [2](#)
- Less sensitive than MRI in detecting ligamentous injuries in acute trauma situations [4](#)
- Pooled sensitivity of around 98% for bony spinal injury in a meta-analysis comparing 3-view plain radiography and CT scan for cervical spine injury [16,17](#)

References

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

1. Haldeman S, Carroll L, Cassidy JD. **Findings from the bone and joint decade 2000 to 2010 task force on neck pain and its associated disorders.** J Occup Environ Med. 2010;52(4):424-7. (Level II evidence)
2. Rodriguez DP, Poussaint TY. **Imaging of back pain in children.** AJNR Am J Neuroradiol. 2010;31(5):787-802. (Review article)
3. Kjaer P, Wedderkopp N, Korsholm L, Leboeuf-Yde C. **Prevalence and tracking of back pain from childhood to adolescence.** BMC Musculoskelet Disord. 2011;12:98. (Level III evidence)
4. Booth TN. **Cervical spine evaluation in pediatric trauma.** AJR Am J Roentgenol. 2012;198(5):W417-25. (Review article)
5. Feldman DS, Straight JJ, Badra MI, Mohaideen A, Madan SS. **Evaluation of an algorithmic approach to pediatric back pain.** J Pediatr Orthop. 2006;26(3):353-7. (Level III evidence)
6. Jones GT, Macfarlane GJ. **Epidemiology of low back pain in children and adolescents.** Arch Dis Child. 2005;90(3):312-6. (Review article)
7. Bernstein RM, Cozen H. **Evaluation of back pain in children and adolescents.** Am Fam Physician. 2007;76(11):1669-76. (Review article)
8. Curtis C, d'Hemecourt P. **Diagnosis and management of back pain in adolescents.** Adolesc Med State Art Rev. 2007;18(1):140-64, x. (Review article)
9. Rubinstein SM, van Tulder M. **A best-evidence review of diagnostic procedures for neck and low-back pain.** Best Pract Res Clin Rheumatol. 2008;22(3):471-82. (Level II evidence)
10. Davis PJ, Williams HJ. **The investigation and management of back pain in children.** Arch Dis Child Educ Pract Ed. 2008;93(3):73-83. (Review article)
11. Dunn AJ, Campbell RS, Mayor PE, Rees D. **Radiological findings and healing patterns of incomplete stress fractures of the pars interarticularis.** Skeletal Radiol. 2008;37(5):443-50. (Level III evidence)
12. Holmes JF, Mirvis SE, Panacek EA, Hoffman JR, Mower WR, Velmahos GC. **NEXUS Group. Variability in computed tomography and magnetic resonance imaging in patients with cervical spine injuries.** J Trauma. 2002;53(3):524-9; discussion 530. (Level III evidence)
13. Jarvik JG, Deyo RA. **Diagnostic evaluation of low back pain with emphasis on imaging.** Ann Intern Med. 2002;137:586-97. (Level I evidence)
14. Ganiyusufoglu AK, Onat L, Karatoprak O, Enercan M, Hamzaoglu A. **Diagnostic accuracy of magnetic resonance imaging versus computed tomography in stress fractures of the lumbar spine.** Clin Radiol. 2010;65(11):902-7. (Level III evidence)
15. Klein GR, Vaccaro AR, Albert TJ, Schweitzer M, Deely D, Karasick D, Cotler J. **Efficacy of magnetic resonance imaging in the evaluation of posterior cervical spine fractures.** Spine. 1999;24:771-4. (Level III evidence)
16. Tilt L, Babineau J, Fenster D, Ahmad F, Roskind CG. **Blunt cervical spine injury in children.** Curr Opin Pediatr. 2012;24(3):301-6. (Review article)
17. Holmes JK, Akkinapalli R. **Computed tomography versus plain radiography to screen for cervical spine injury: a meta-analysis.** J Trauma. 2005;58:902-5. (Level I / II evidence)
18. Pharisa C, Lutz N, Roback MG, Gehri M. **Neck complaints in the pediatric emergency department: a consecutive case series of 170 children.** Pediatr Emerg Care. 2009;25(12):823-6. (Level III evidence)
19. Jeffries LJ, Milanese SF, Grimmer-Somers KA. **Epidemiology of adolescent spinal pain: a systematic overview of the research literature.** Spine (Phila Pa 1976). 2007;32(23):2630-7. (Level II evidence)

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