Clinical examination of the spine

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Abstract

Clinical examination of the spine is an essential skill to master that will benefit you throughout your medical and surgical career. This article describes the basic anatomy and surface markings of the spine that will aid your examination and also discusses diagnostic tests for common pathologies. The special tests in the spine examination allow clinicians to tailor the examination to the pathology that they are trying to confirm or refute. Details of the tests for scoliosis, myelopathy, cervical and lumbar radiculopathy are also included.

Keywords Anatomy; examination; spine

Introduction

Spinal pathology affects patients of all ages. Furthermore, spinal manifestations are common in numerous medical and surgical patients, such as those with inflammatory arthropathies and oncology patients. In addition, because of the ageing population, primary and secondary care consultations for symptomatic degenerative spine pathologies are increasingly common. Consequently, competence in the clinical assessment of spinal patients is required by all doctors. A thorough history and examination of the axial skeleton and associated neurology can accurately diagnose many pathologies and direct the requesting of appropriate imaging. The generic spine examination follows the Apley approach of look, feel, move and special tests.

Anatomy

The spine is made up of 33 vertebrae. 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4 coccygeal. The sacral and coccygeal vertebrae are fused and provide little to no movement. The cervical, thoracic and lumber vertebrae are separated by intervertebral discs that act as shock absorbers and allow movement. Movement throughout the spine is regulated by the presence and orientation of the facet joints, ligamentous constraints, surrounding musculature and the neurological systems. The normal spine has a cervical lordosis (30–35°), thoracic kyphosis (40°) and lumbar lordosis (45°) in the sagittal plane. Running down the vertebral canal is the spinal cord, which terminates at L1/2, caudal to this is the cauda equina. Pairs of spinal nerves leave the spinal cord or cauda equina at each vertebral level.

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The surface markings of the spine and their corresponding vertebral level are detailed in Table 1. C7 is also known as vertebra prominens as it can be palpated easily.

Pathology

In the history, prior to examining a patient, you will have very likely elicited many salient points that will help guide your examination. Infection, trauma, tumour and inflammatory arthropathy can affect the spine in patients of all ages; however, the age of the patient significantly narrows the differential diagnosis (Table 2).

Inspection

It is vital to adequately expose the patient to assess the alignment of the spine in both the sagittal and coronal planes. When the head is centred over the pubic symphysis in stance in the coronal plane and over the femoral heads in the sagittal plane, the spine is said to be balanced. This head position, in relation to the pelvis, is optimal for normal function in life. If patients have spinal deformity which displaces their head, they may compensate for the deformity by flexing a hip or knee to bring the head back over the optimal centre of gravity (compensating for the deformity). Typically, with increasing age, due to a loss of disc hydration and height, humans become increasingly kyphotic (head in front of femoral heads in sagittal plane). It is possible to compensate for this mechanical disadvantage by increasing lumbar lordosis and by flexing the hips and knees (compensated sagittal imbalance). When these measures are exhausted, sagittal imbalance becomes increasingly evident on inspection and results in increasing disability. Kyphosis, for example due to ankylosing spondylitis, is encountered in children; however, coronal plane deformities predominate in this age group. Idiopathic scoliosis is the most common diagnosis. Inspection may assist in assessment of the severity of the deformity, and provides the clinician with an opportunity to observe features that are associated with non-idiopathic aetiologies (Table 3).

Scoliosis is a three-dimensional deformity characterized by vertebral rotation. Asking the patient to bend forward from the hips while inspecting from behind (Adam's forward bend test)

Surface anatomy of the spine

Surface Marking	Vertebral Level
Posterior	
Vertebra prominens	C7
Spine of scapula	T3
Inferior angle of scapula	T7
Iliac crests	L4
Posterior superior iliac spines	S2
Anterior	
Angle of mandible	C2
Hyoid bone	C3
Thyroid cartilage	C4–5
Cricoid cartilage	C6

Table 1

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Common spinal presentations at different stages of life

- Children
  - Scoliosis
  - Spondylolisthesis
  - Infection
- Adolescents
  - Scheuermann's kyphosis
  - Scoliosis
  - Infection
- Young adult
  - Mechanical back pain
  - Prolapsed intervertebral disc
  - Spondylolisthesis
  - Fracture
  - Ankylosing spondylitis
  - Infection
- Middle-Age
  - Mechanical back pain
  - Osteoarthritis
  - Spinal stenosis
  - Paget's disease
  - Spinal metastases
  - Infection
- Old age
  - Myelopathy
  - Osteoarthritis
  - Osteoporosis
  - Osteomalacia
  - Spinal metastases
  - Spinal stenosis

Table 2

Features seen on inspection of children with spinal deformity and indication of aetiology

Inspection of the spine	Associated pathology
Alignment	
Shoulder asymmetry	Scoliosis
Waist asymmetry	Scoliosis
Trunk shift	Scoliosis
Iliac crest height	Scoliosis
Description of the deformity	
Rib prominence – Adams forward bend test	Scoliosis
Skin	
Scars	Previous surgery
Hairy patches at base of spine	Spina bifida
Café au lait spots	Neurofibromatosis
Neurofibromas	Neurofibromatosis
Muscle	
Wasting	Neuromuscular
Asymmetry	Scoliosis
Feet	
Asymmetrical foot size	Spinal dysraphism
Cavovarus feet	Neuromuscular

Table 3

gives a better appreciation of the curvatures and allows easy comparison of each side of the patient's posterior trunk (Figure 1). Thoracic curvatures are associated with rib prominences, while lumbar curves can result in waistline asymmetry. Shoulder balance is assessed by comparing acromial or scapular height (Figure 2). Asymmetry of the top of the pelvis or the 'dimples of Venus' indicates pelvic obliquity. The obliquity of the pelvis can be due either to a leg length discrepancy, or could be driven by the spinal deformity. It is important to measure true leg length formally in patients with scoliosis. If there is a leg length discrepancy, the scoliosis may be compensatory for the difference in limb length. In such patients, asking them to sit on the examination couch, or placing an appropriately sized block under the short leg will correct the scoliosis. Severe spinal deformities are associated with an inability of other portions of the spine to compensate and result in displacement of the thorax and head. This is referred to as truncal decompensation. Truncal shift is when the chest is deviated laterally beyond a line subtended up from the lateral extent of the pelvis. 'Listing' is when there is deviation of the vertebra prominens from a vertical line centred on the sacrum.[1] To identify listing clinically, hold a piece of string with a weight attached to the free end, against the C7 spinous process. If the string does not overlie the natal cleft, listing is present (Figure 3).

Ask the patient to walk and observe their gait. Patterns of gait are associated with certain pathologies (Table 4).

Palpation

The spinous process of each vertebra should be palpated for tenderness working from the occiput all the way down to the coccyx. Along with tenderness you are also feeling for any steps in the vertebral column or possibly a fullness to palpation or a mass. Use your free hand to support the patient while palpating to prevent the falling forward. Steps in the spinous processes is suggestive a spondylolisthesis. Next palpate the facet joints on each side of the spine. Tenderness is suggestive of facet joint pathology, which is usually due to degenerative disease.

Movement

While the patient is still standing you can perform Schoeber's test to objectively measure lumbar flexion. Make a mark at the level of the posterior superior iliac spines or dimples of Venus and a further mark 10 cm proximal to this. On forward bending the space between the two marks should increase to 15 cm. The normal range of spinal movements are detailed in Table 5.

To assess other cervical spine movements, ask the patient to put their chin on their chest, look up to the ceiling, put their ear onto their shoulder and look over their shoulder. Rotation of the thoracic spine is best tested with the patient seated to eliminate any rotation at the pelvis, with their arms held up at shoulder height so you can use them as a goniometer. In the lumbar spine ask the patient to touch their toes and slide their hand down the side of each leg and then lean backwards as far as they can.

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