X-ray quiz: a woman with neck pain
X 光照片猜謎：一名頸痛的女子

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Case

A 40-year-old woman attended the accident and emergency department complaining of increasing neck pain for a few weeks. She had past history of diabetes mellitus, knee osteoarthritis and rheumatoid arthritis. There was no history of recent trauma. On clinical examination, the range of movement of the neck was mildly decreased. No focal tenderness or neurological sign was demonstrated. Radiographs of the cervical spine were taken (Figures 1 & 2)

Questions

1. What is the abnormality and diagnosis?
2. What are the causes of this condition?
3. What other investigations may be helpful?

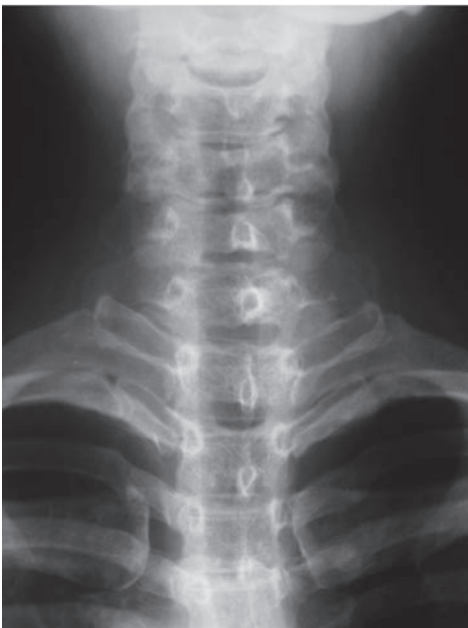

Figure 1. Frontal radiograph of cervical spine.

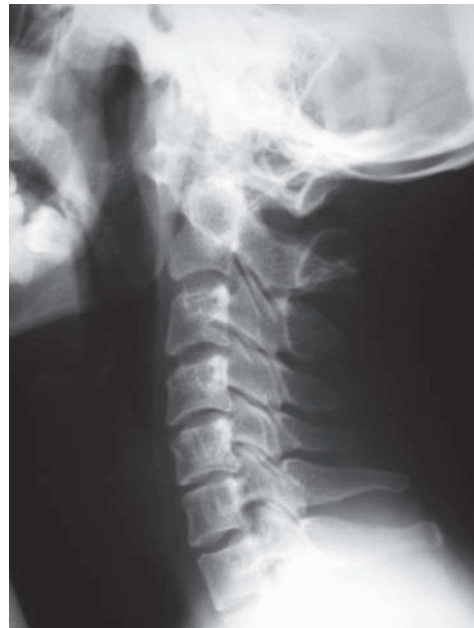

Figure 2. Lateral radiograph of cervical spine.

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Answers

1. On the lateral radiograph, there is abnormal anterior displacement of the anterior arch of C1 relative to the odontoid peg (i.e. widening of the atlanto-axial distance). The diagnosis is atlanto-axial subluxation. (Figure 3).
2. Isolated traumatic atlanto-axial subluxation is rare. Non-traumatic causes are far more common and can be categorised as follows:[1,2]
   A. Arthritis
      I. Rheumatoid arthritis
      II. Psoriatic arthropathy
      III. Ankylosing spondylitis
      IV. Systemic lupus erythematosus
   B. Infection/Inflammation
      I. Retropharyngeal abscess
      II. Cervical adenitis
      III. Mastoiditis
   C. Congenital
      I. Down's syndrome
      II. Morquio syndrome
      III. Spondyloepiphyseal dysplasia
      IV. Congenital absence/hypoplasia of odontoid process

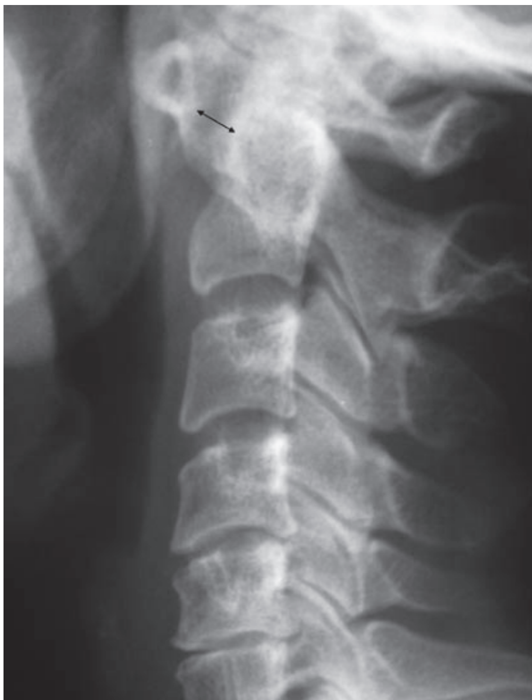

Figure 3. Lateral radiograph of cervical spine. Widening of the atlanto-axial distance is indicated by the arrow.

3. Abnormal widening of the atlanto-axial distance is usually more apparent with a flexion view of the cervical spine, especially in cases where clinical suspicion is present but standard radiographs are inconclusive (Figure 4). Computed tomography (CT) can be used for assessing the atlanto-axial interval and also presence of any fracture (Figure 5). Magnetic resonance imaging (MRI) offers an even more sensitive method for detection of atlanto-axial instability, which also allows concomitant assessment of any cord compression or injury (Figure 6).

Discussion

The dens is normally tightly bound to C1 by the transverse ligament. The transverse ligament prevents forward subluxation of the atlas on the axis with flexion of the neck. This is further reinforced by the accessory atlanto-axial ligaments and alar ligaments.[3] The normal distance between the dens and the posterior margin of the anterior arch of C1 should be less than 3 mm in

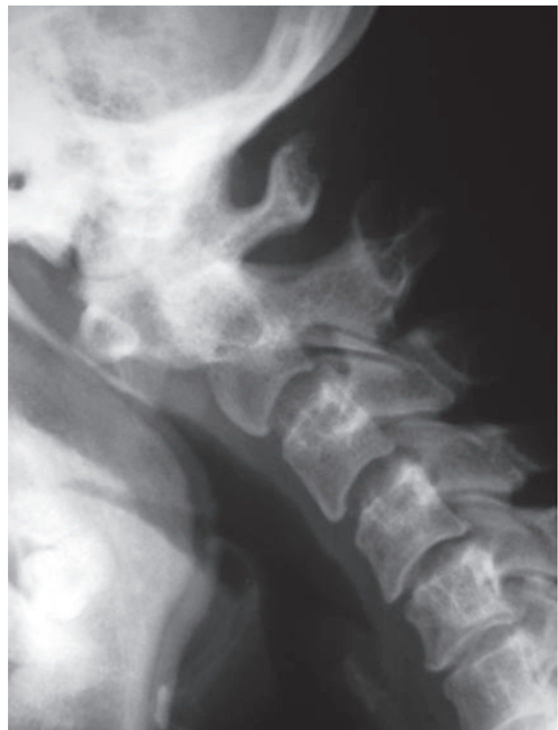

Figure 4. Flexion view of cervical spine making the widened atlanto-axial distance more conspicuous.

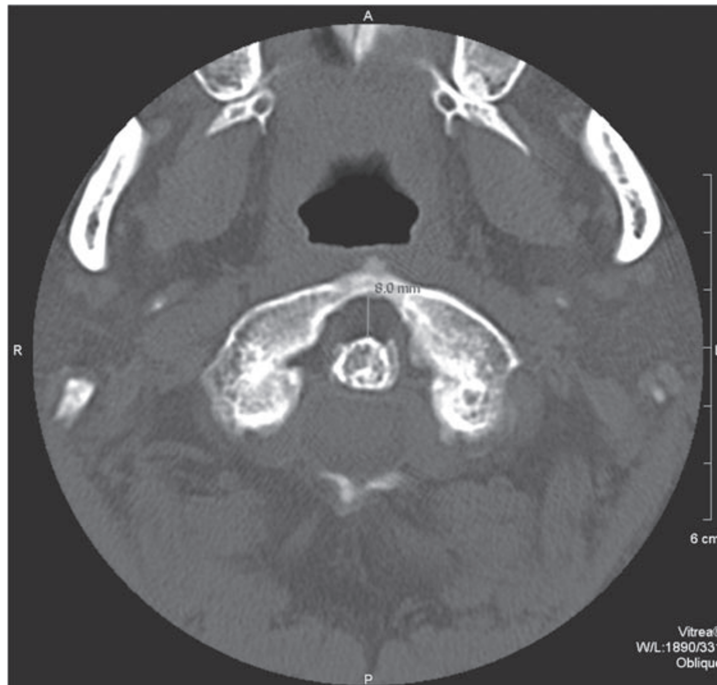

Figure 5. Transaxial CT in bone window showing an increase in atlanto-axial interval (8.0 mm). No associated bony fracture is seen.

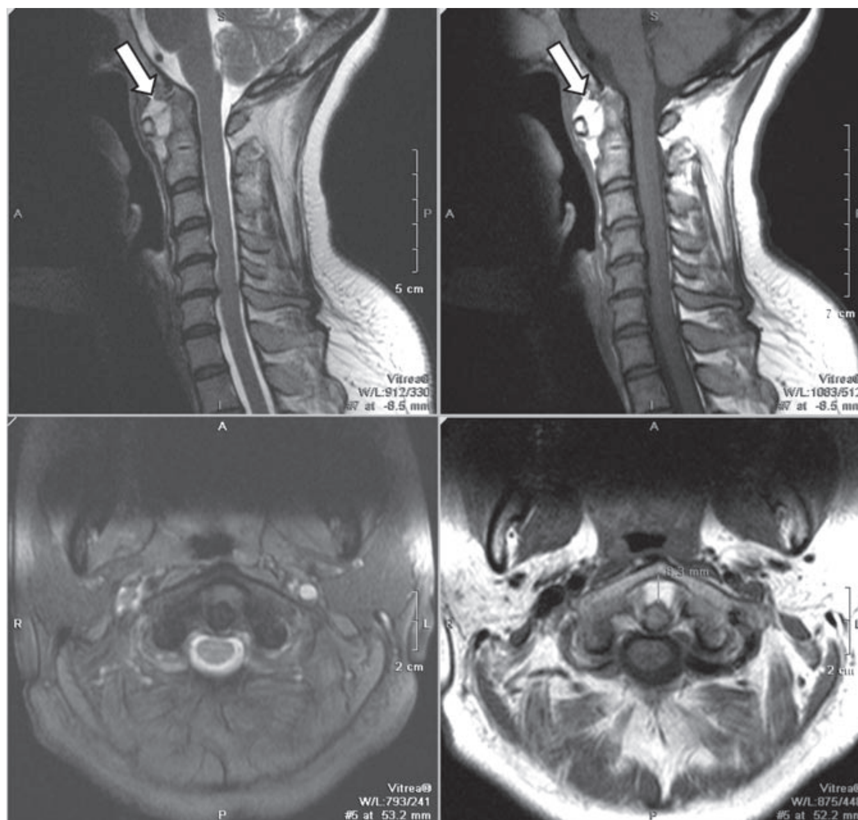

Figure 6. T2W sagittal & axial (left) and T1W sagittal & axial (right) MR images of the cervical spine. Widening of the atlanto-axial interval is seen (8.3 mm) which is filled by fatty tissue (white arrows). Incidental finding of spondylotic changes with multiple intervertebral discs protrusions are seen. No significant cord compression is detected.

adults and 5 mm in children.[1] This normal atlanto-axial distance is maintained during both flexion and extension of the neck. Any abnormal increase in this distance indicates subluxation at the atlanto-axial junction. Widening of this interval is usually more conspicuous when the cervical spine is flexed. For example, an apparently normal cervical spine can reveal considerable subluxation at C1/2 junction merely with the addition of a flexion view. Attention should also be paid to any substantial change in the atlanto-axial interval on flexion and extension, as this can be abnormal even if the interval is within normal limits.

Isolated post-traumatic atlanto-axial subluxation is rare. Non-traumatic causes including arthritides, infective/inflammatory conditions and congenital disorders are far more frequent (see above). Among these, rheumatoid arthritis probably represents the most common cause of transverse ligament incompetence.[1,2]

In patients with rheumatoid arthritis, the cervical spine is commonly affected along with peripheral joints. However, initial involvement of the cervical spine can occur without obvious clinical or radiological abnormalities at other sites. Atlanto-axial subluxation is a characteristic finding in rheumatoid arthritis. It may even be evident in an early stage of the disease, when other cervical spine abnormalities are not apparent. The frequency of atlanto-axial subluxation in rheumatoid arthritis is reported to be about 20-25%.[4] This frequency rises with increasing severity of the disease. The pathogenesis of atlanto-axial subluxation relates to the presence of transverse ligament laxity caused by synovial inflammation and hyperaemia of the adjacent articulations, especially that between the posterior surface of odontoid process and the anterior surface of the ligament.

Symptoms and signs related to cervical spine abnormalities develop in about 60-80% of rheumatoid arthritis patients at some time during their illness. Pain is the most common clinical manifestation. In patients with atlanto-axial subluxation, pain may be expressed in the temporal and retro-orbital regions. Weakness and abnormal mobility can also be evident. Neurological symptoms are uncommon until the atlanto-axial distance approaches 9 mm. Once present, symptoms may include paraesthesia, paresis, muscle wasting and in some instances, quadriplegia and even death occur. In addition, vertebrobasilar insufficiency can lead to transient blindness, nystagmus, vertigo and loss of consciousness.[3] The clinical course of patients with atlanto-axial subluxation is variable. In some persons, only mild symptoms and signs appear without significant progression. In others, clinical and radiological deterioration is evident and disabling neurological abnormalities requiring operative intervention may develop.

Besides radiographs, the atlanto-axial distance can also be assessed with computed tomography. In transaxial CT scans, the normal atlanto-axial distance appears to be less than 1 mm wide. The intact transverse ligament can also be visualised. However CT scan is usually performed in neutral or extended position, limiting its sensitivity for atlanto-axial subluxation. Therefore normal findings on a CT examination do not exclude atlanto-axial subluxation unless it is obtained with cervical flexion. Magnetic resonance (MR) imaging offers a more sensitive method for the detection of atlanto-axial instability and allows concomitant assessment of the degree of cord compression. Flexion and extension sagittal MR images have also proved to be invaluable in the evaluation of the atlanto-axial and craniocervical junctions.

References

1. Chapman S, Nakielny R. Aids to radiological differential diagnosis. 4th edition. Edinburgh: Saunders; 2003. p.81.
2. Dahnert W. Radiology review manual. 5th edition. Philadelphia: Lippincott Williams & Wilkins; 2003. p.169-70.
3. Resnick D. Diagnosis of bone and joint disorders. 4th edition. Philadelphia: Saunders; 2002. p.941-6, 2954-5.
4. Mathews JA. Atlanto-axial subluxation in rheumatoid arthritis. Ann Rheum Dis 1969;28(3):260-6.