CERVICAL SPINE—II

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The lateral view is the routine radiograph for examining the cervical spine

In addition to the lateral cervical radiograph discussed last week, further views are commonly requested in trauma patients. However, the patient usually has to be moved to the radiology department for these radiographs to be taken. This should not be done until resuscitation is completed and the patient is stable from a respiratory and haemodynamic point of view.

The radiographs must be examined using the same principles described for the lateral view. Therefore once the adequacy of the film has been assessed the ABCs are inspected.

Anteroposterior cervical radiograph

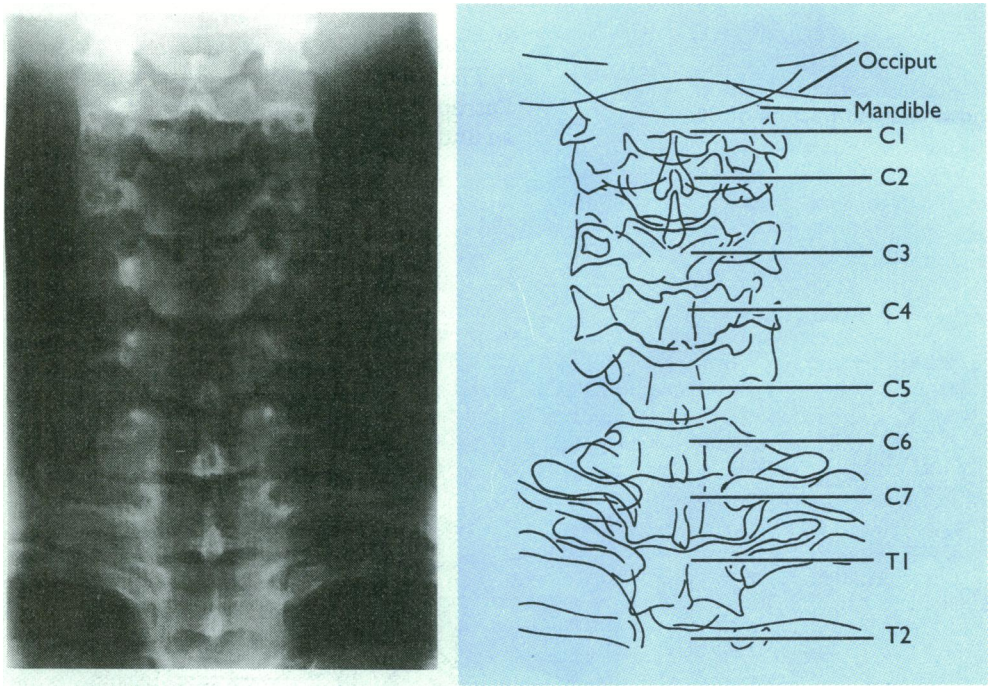

FIG 1—Anteroposterior radiograph and line diagram showing T2-C2. The spinous processes are aligned normally.

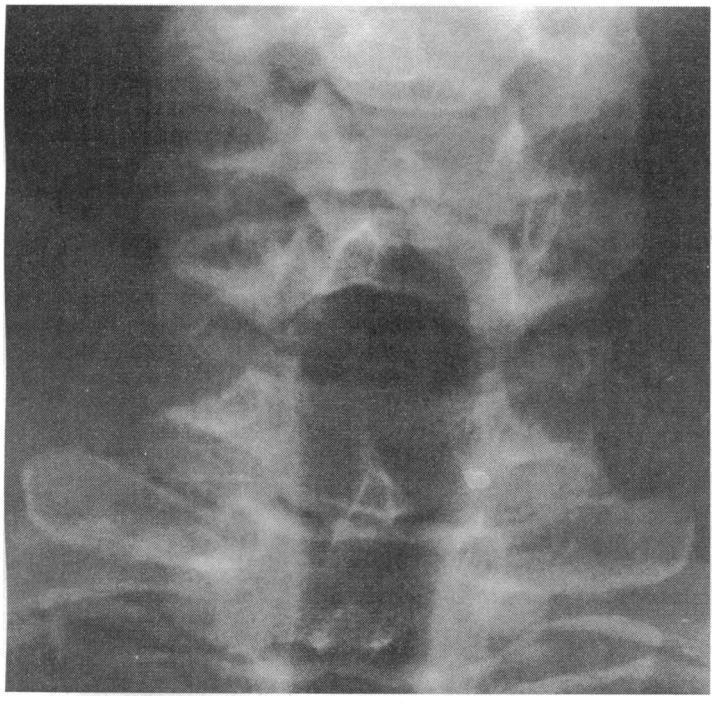

FIG 2—Anteroposterior radiograph showing unifacet dislocation of C6. The spinous process of C6 is rotated to the right and the C6/7 intervertebral space is widened.

Adequacy

Ensure that T1 to C3 are visible. The mandible and occiput overlies C1-3 in this projection and may obscure them from view.

Alignment

Check alignment of spinous processes. Malalignment may indicate a unifacet dislocation or a fracture of the lateral articular surface. These injuries cause the spinous processes to rotate to the side of the injury.

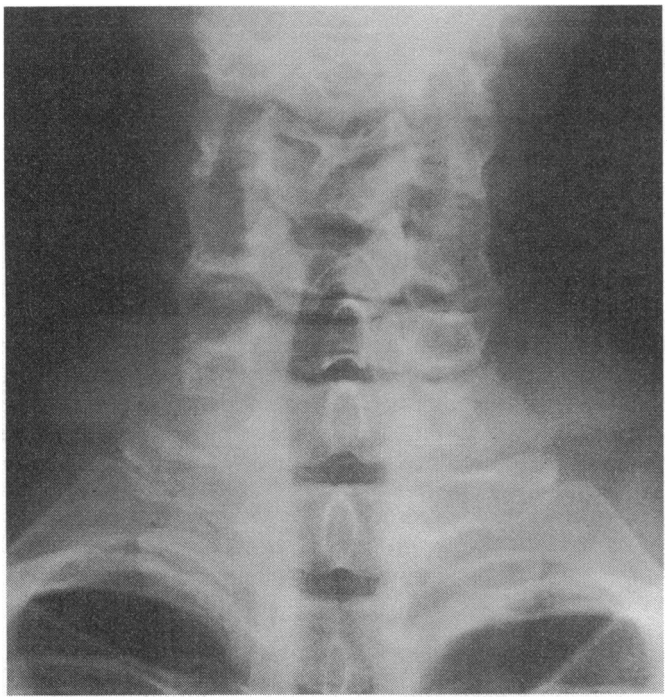

FIG 3—Anteroposterior radiograph showing crush fracture of C6. The height of C6 is reduced.

Bones

The cortical surface of each vertebra must be inspected for steps, breaks, or abnormal angulations. Start at the right inferior corner of the vertebra and then proceed clockwise around the whole of the surface. Vertebral bodies should be rectangular. A careful inspection will reveal any compression, vertical fissures, and steps in the end plates.

The rest of the vertebra is then inspected for alterations in the internal trabecular pattern, lucencies, and increases in density indicating a possible overlap of bone fragments.

Cartilage and joints

Check each intervertebral joint space. The height should be similar to that found at adjacent vertebral levels and the articulating surfaces should be parallel to one another (compare figs 1 and 3).

Soft tissues

The paravertebral tissue must be assessed. Disruption of the normal air shadow may indicate an underlying fracture or dislocation.

Open mouth view

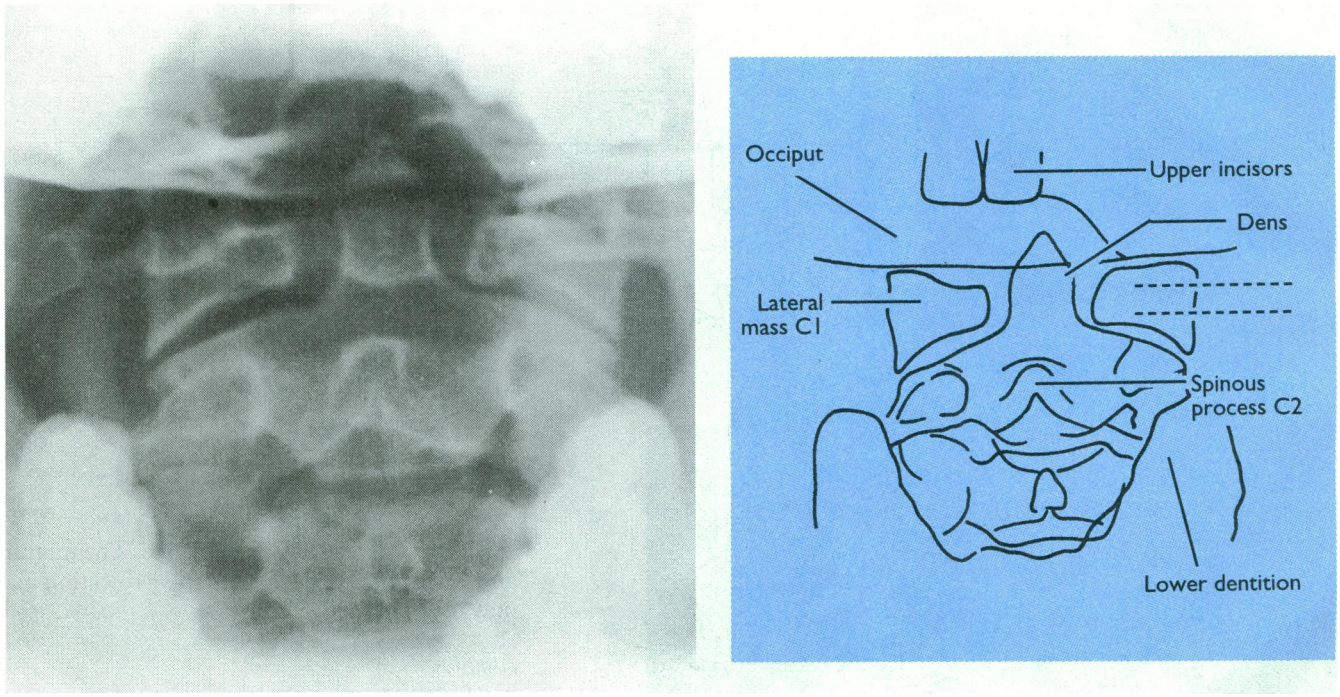

FIG 4—Left: Open mouth view. The dens and the spinous process of C2 are aligned normally, there is no lateral overriding of C1 on C2, and the dens is symmetrically placed between the two lateral masses of C1. Notice the artefact created by the occiput overlying the dens. This can be mistaken for a fracture. Right: Line diagram of the radiograph.

Adequacy

Check that the open mouth view shows the C1/C2 articulation.

Alignment

Check the alignment of the odontoid peg and C1/C2. Normally the dens and spinous process of C2 are in the same vertical line as are the lateral borders of C1 and C2. In adults there should be less than 2 mm lateral overriding between C1 and C2. The distances between the lateral masses of the atlas and the odontoid peg (dens) are normally symmetrical.

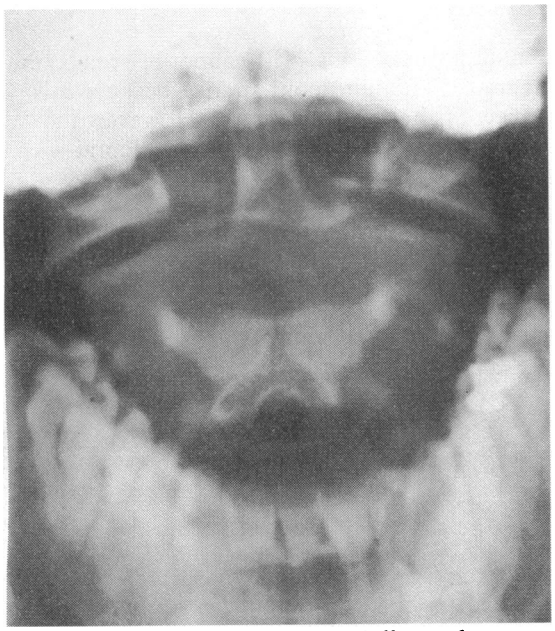

FIG 5—Open mouth view showing a Jefferson fracture. Both lateral masses of C1 are overlapping the lateral borders of C2. Notice the artefact created by the incisors overlapping the dens.

Jefferson fractures are often seen clearly in this view. Rotatory subluxation of the odontoid in children is also best shown by the open mouth view. Up to the age of 8, incomplete ossification of the dens and ligamental laxity allows up to two thirds of the anterior arch of C1 to lie above the odontoid peg.

Bones

Check the odontoid peg and examine the dens carefully. Fractures can occur in the peg itself (type 1) or at its base (type 2) or can extend into the body of C2 (type 3). Type 2 fractures are the commonest and lead to instability of the cervical spine. The dark shadow of either the overlying teeth or the epiphyseal plate is often mistaken for fracture (fig 4). The epiphysis is V-shaped and should have fused by 12 years of age. Non-union of this secondary ossification centre leads to formation of an os odontoideum, which appears as a characteristic smooth convex border at the tip of the dens.

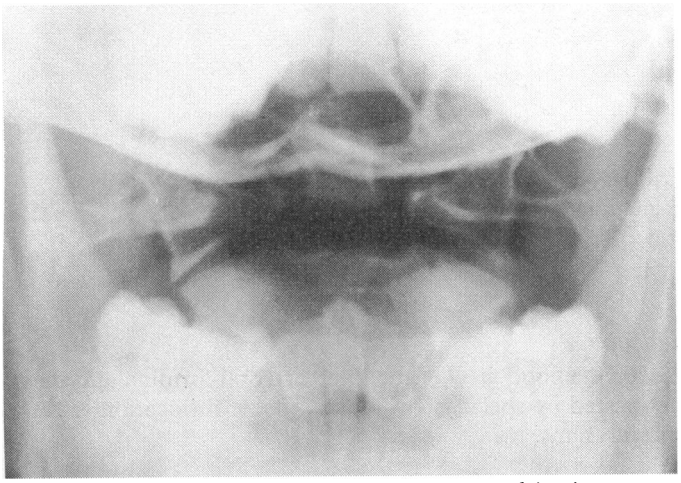

FIG 6—Open mouth view showing a type 2 fracture of the dens.

Cartilage and joints

Check the joint space between C1 and C2. The articulating surfaces should be parallel to one another.

Soft tissues

The paravertebral tissue must be assessed. Normally soft tissue shadows are not evident on this view.

Special views

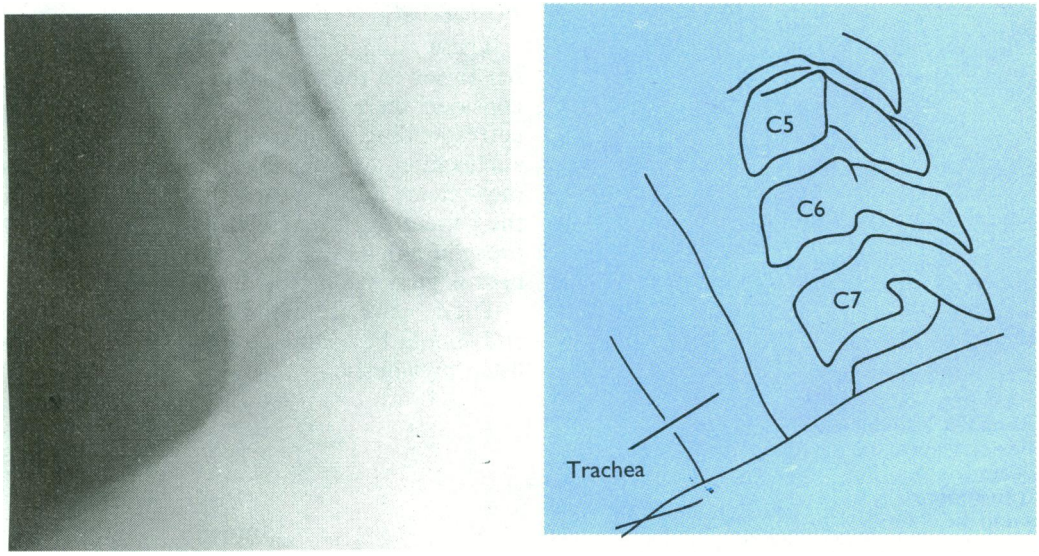

FIG 7—Swimmer's view and line diagram showing C5-T1. The anterior longitudinal line is broken because of the forward slip of C7 on T1. This resulted from a unifacet dislocation. A normal air shadow caused by the trachea is clearly seen.

Swimmer's view

The swimmer's view should be requested if C7/T1 cannot be seen on the normal lateral cervical radiograph. The film looks strange because it is showing a focused oblique view of the C7/T1 junction. However, the feature to concentrate on is the anterior alignment of the vertebral bodies.

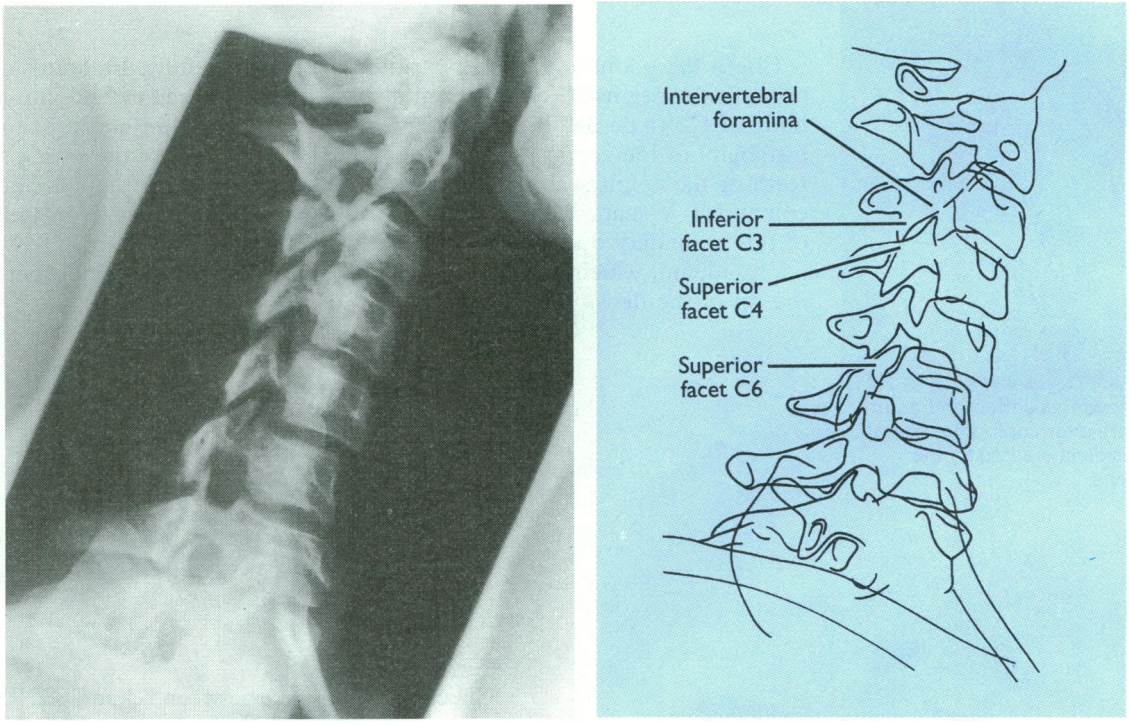

FIG 8—Oblique view and line diagram of the cervical column. The superior facet of C6 is fractured and displaced into the intervertebral foramina. This view clearly shows the facet joints and intervertebral foramina.

Oblique view

This gives a good view of the intervertebral formina and the facet joints. It is requested by specialists when a unifacet dislocation is suspected from the routine films.

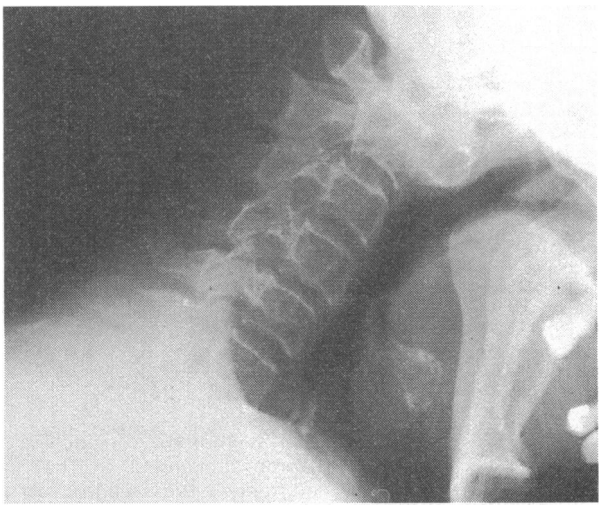

FIG 9—Lateral radiograph showing a flexion view of the cervical spine. The standard view appeared normal, but on flexion C1 subluxates forward and an abnormally wide gap develops between the dens and the anterior arch of C1.

Flexion and extension views

These radiographs are taken when a specialist has reviewed the standard radiographs and considers there is cervical malalignment with no corresponding significant soft tissue swelling, subluxation, or widening of facet joints. All neck movements must be carried out by a doctor and the patient must be conscious. This allows the procedure to be stopped immediately any pain or neurological symptoms develop.

These views are modified lateral radiographs and should be examined using the ABC system listed previously.

Catches to avoid

The emergency clinician must be aware that the absence of radiological abnormality reduces the chances of spinal injury but does not exclude it. About 8% of patients have injuries to the cervical spine in more than one place and 15% of patients with cervical injury also have a thoracolumbar injury

Make sure all seven cervical vertebrae and the C7/T1 junction are visible. The spinous processes may not be clear. If you suspect an injury obtain a further view.

Physiological subluxation of the bodies of C2 on C3 (seen in a quarter of cases) and C3 on C4 (seen in 15% of cases) occurs up to 8 years of age. However, the posterior spinal line is maintained.

Artefactual shadows can sometimes cause confusion. In the open mouth view the vertical cleft between the upper two incisor teeth may be mistaken for a vertical fracture of the peg. Do not forget to examine the soft tissue shadows; these may be the only clues to an underlying fracture.

Summary

Adequacy and quality
Ensure that the vertebrae C1-C7 and the C7/T1 junction are visible

Alignment
Assess the contours of the cervical spine and appendages

Bones
Check each vertebra for shape, height, and fractures
Check the shape of the odontoid peg
Check spinal canal size

Cartilage and joints
Check the intervertebral disc spaces
Check the facet joints
Check the interspinous distance
Check the C1/C2 distance

Soft tissues
Check the precervical and paracervical spaces

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The line drawings were prepared by Mary Harrison, medical illustrator.

Economic Evaluation and Health Care

Cost-utility analysis

Ray Robinson

This is the fourth in a series of articles that describes the ways in which methods of economic evaluation may be used to assess the economic costs and consequences associated with different forms of health care intervention

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Decisions have to be made about allocating health resources. Currently the best economic evaluation method for doing this is cost-utility analysis. This compares the costs of different procedures with their outcomes measured in "utility based" units—that is, units that relate to a person's level of wellbeing. The most commonly used unit is the quality adjusted life year (QALY). QALYs are calculated by estimating the total life years gained from a procedure and weighting each year to reflect the quality of life in that year. To compare outcomes of different programmes the Rosser index is one measure that is widely used to assign quality of life scores to patients. Combined with a measure of life years gained from a procedure, this enables QALYs to be calculated and procedures ranked according to cost per QALY gained. In this article Ray Robinson explains the measures used and discusses how QALY league tables can be used to guide decisions on resource allocation.

Cost-utility analysis is a form of economic evaluation in which the outcomes of alternative procedures or programmes are expressed in terms of a single, "utility based" unit of measurement. Utility is a term used by health economists to refer to the subjective level of wellbeing that people experience in different states of health. The most widely used utility based measure in cost-utility analysis is the quality adjusted life year (QALY). To calculate the number of QALYs resulting from a particular intervention, the number of additional years of life obtained are combined with a measure of the quality of life in each of these years to obtain a composite index of outcome. Comparison between alternative procedures or programmes can then be based on the marginal cost per QALY gained.

Measuring quality

Measuring a person's quality of life is, of course, difficult. None the less, it is important to have some means for doing so because many modern health care programmes are concerned primarily with improving the quality of a patient's life rather than extending its length. For this reason various quality of life scales have been developed in recent years. These seek to measure quality on a number of different dimensions.

The Nottingham health profile is one quality of life scale that has been used quite widely in Britain.[1] This comprises two parts. The first measures health status by asking for yes or no responses from patients to