Al-Mustaqbal University

College of Health and Medical Technique

Radiology Techniques Department

Third class

By

Assist. lecture
Mustafa kamel muneam

lecture : 5

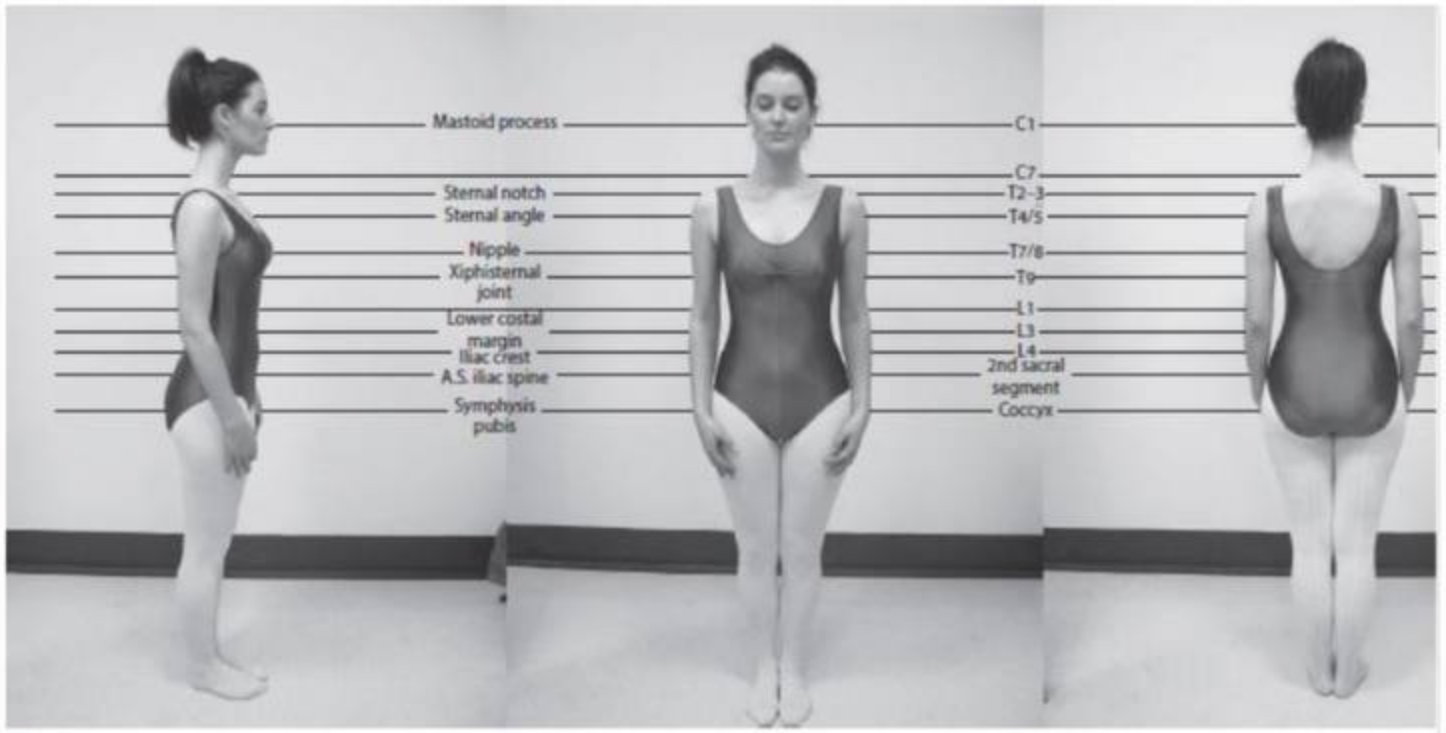
Vertebral levels

The photographs below and Fig. 6.3 illustrate the surface markings of the vertebral levels, which are useful in radiographic positioning. The relative positions may vary according to the patient's build and posture.

Useful landmarks (Fig. 6.2)

The easily palpated tip of the mastoid process indicates the level of C1.

- The spinous process of C7 produces a visible protuberance on the posterior aspect of the inferior part of the neck. Below this, the spinous process of the thoracic spine can be palpated.
- The inferior angle of the scapula indicates the level of T7 when the arms are placed by the side.
- The sternal notch lies at the junction between T2 and T3.
- T4 is indicated by the sternal angle with T9 corresponding to the xiphisternal joint, although the size of this structure is variable.
- The lower costal margin indicates L3 and is located easily. This is a very useful aid to positioning in spinal radiography.
- A line joining the most superior parts of the iliac crests indicates the level of L4, whilst the tubercle of the iliac crest discloses the location of L5.
- The anterior and posterior iliac spines lie at the level of the second sacral vertebra.



6.2 Useful surface landmarks.

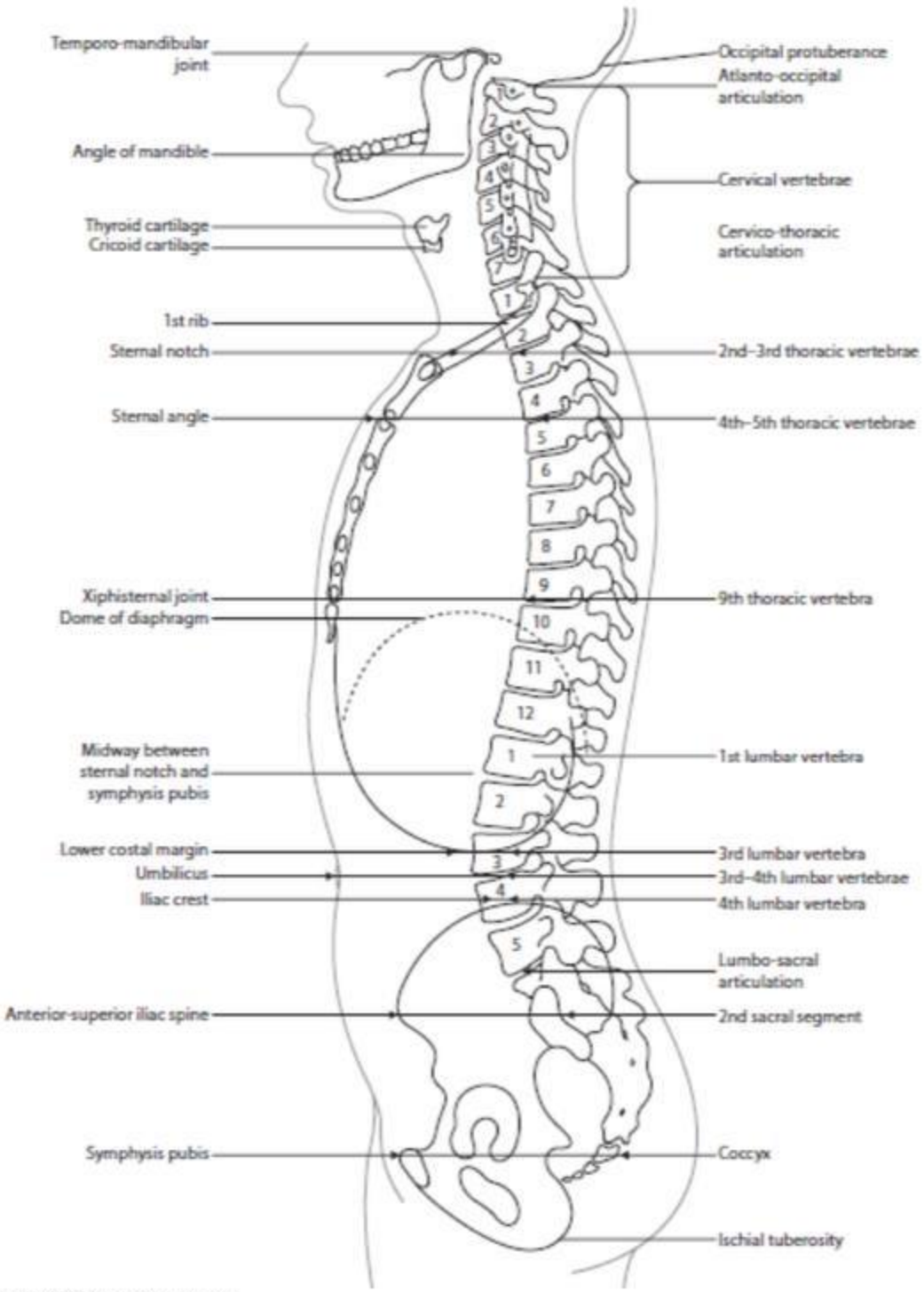


Fig. 6.3 Vertebral levels

Cervical vertebrae

Basic projections

Many centres perform an antero-posterior (AP) and a lateral projection, with the addition of a further AP image to demonstrate the C1/2 region if the patient has a history of trauma. CR, 18 × 24 cm image receptor size cassettes are employed routinely, but 24 × 30 cm cassettes are often used in difficult cases.

Lateral erect (Basic) (Figs 6.4a–6.4c)

Position of patient and image receptor

- The patient stands or sits with either shoulder against the CR cassette or vertical Bucky.
- The median sagittal plane should be adjusted such that it is parallel with the image receptor.

• The head should be adjusted such that the angle of the mandible is not superimposed over the upper anterior cervical vertebra or the occipital bone does not obscure the posterior arch of the atlas.
• To aid immobilisation, the patient should stand with the feet slightly apart and with the shoulder resting against the cassette stand.
• In order to demonstrate the lower cervical vertebra, the shoulders should be depressed, as shown in the photograph. This can be achieved by asking the patient to relax their shoulders downwards. The process can be aided by asking the patient to hold a weight in each hand (if they are capable).

Direction and location of the X-ray beam

• The collimated horizontal beam is centred over a point vertically below the mastoid process at the level of the prominence of the thyroid cartilage.

Fig. 6.4a Positioning of erect patient for cervical lateral projection

Essential image characteristics

• The whole of the cervical spine should be included, from the atlanto-occipital joints to the top of the first thoracic vertebra.
• The mandible or occipital bone does not obscure any part of the upper vertebra.
• Soft tissues of the neck should be included.
• The contrast should produce densities sufficient to demonstrate soft tissue and bony detail.

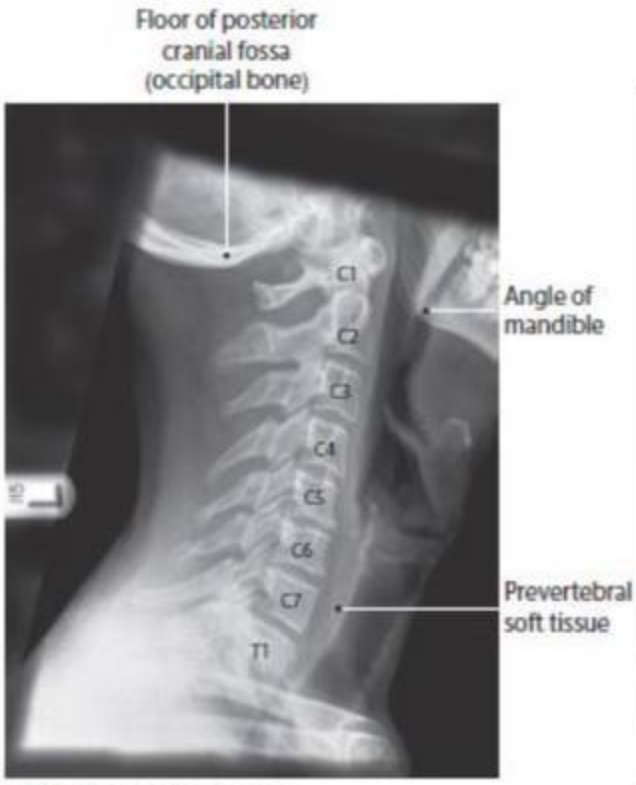


Fig. 6.5b Annotated cervical spine.


Fig. 6.5a Lateral image of cervical spine showing good technique.

Common faults and solutions

• Failure to demonstrate C7/T1: if the patient cannot depress the shoulders, even when holding weights, then a swimmers' projection should be considered.

Lateral supine (Figs 6.6a, 6.6b)

For trauma cases, the patient's condition usually requires the examination to be performed on a trolley. The lateral cervical spine projection is taken first, without moving the patient. The resulting radiographic image must be examined by a medical officer to establish whether the patient's neck can be moved for other projections.

Position of patient and image receptor

• The patient will normally arrive in the supine position.
• It is vitally important for the patient to depress the shoulders.
• A CR cassette can be either supported vertically or placed in the erect cassette holder.


Fig. 6.6a Patient positioning on trolley using a vertical detector system.

Fig. 6.6c Lateral supine projection showing fracture dislocation of C5/C6.

Antero-posterior – first and second cervical vertebrae (open mouth)
(Fig. 6.7a)

Position of patient and image receptor

• The patient lies supine on the Bucky table or, if erect positioning is preferred, sits or stands with the posterior aspect of the head and shoulders against the vertical Bucky detector system.

• The medial sagittal plane is adjusted to coincide with the midline of the image receptor, such that it is at right-angles to the image receptor.

• The neck is extended, if possible, such that a line joining the tip of the mastoid process and the inferior border of the upper incisors is at right-angles to the cassette. This will superimpose the upper incisors and the occipital bone, thus allowing clear visualisation of the area of interest.

• The receptor is centred at the level of the mastoid process.

Direction and location of the X-ray beam

• The collimated beam is directed with the perpendicular central ray along the midline to the centre of the open mouth.

Fig. 6.7a Patient positioning for AP cervical projection.

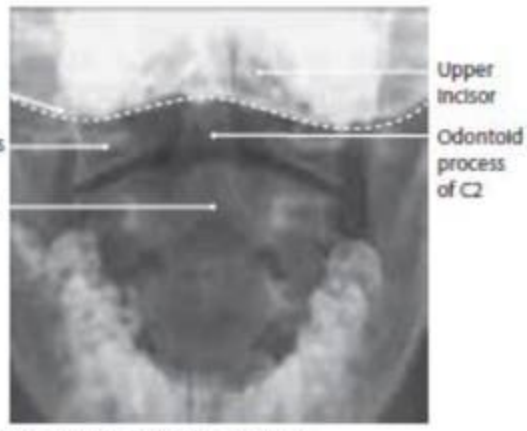


Fig. 6.7c Annotated AP cervical spine radiograph.

Common faults and solutions

• Failure to open the mouth wide enough: the patient can be reminded to open their mouth as wide as possible just before the exposure.

• Check for rotation during positioning.

• If the front teeth are superimposed over the area of interest, then the image should be repeated with the chin raised (Fig. 6.8a).

Fig. 6.8a Incorrect positioning – upper teeth superimposed.

Antero-posterior – third to seventh cervical vertebrae (Basic) (Figs 6.9a–6.9c)

Position of patient and image receptor

• The patient lies supine on the Bucky table or, if erect positioning is preferred, sits or stands with the posterior aspect of the head and shoulders against the vertical Bucky detector system

• The median sagittal plane is adjusted to be at right-angles to the image receptor and to coincide with the midline of the table or Bucky.

• The neck is extended (if the patient's condition will allow) so that the lower part of the jaw is cleared from the upper cervical vertebra.

Direction and location of the X-ray beam

• The collimated beam is directed with a 5–15° cranial angulation, such that the inferior border of the symphysis menti is superimposed over the occipital bone.

• The beam is centred in the midline towards a point just below the prominence of the thyroid cartilage through the fifth cervical vertebra.

Pretest: الاختبار القبلي:

Q What is Lateral – flexion and extension position

Radiographic techniques *Assistant lecturer. Dunya Ali*

Lateral – flexion and extension (Figs 6.13a, 6.13b)

These projections may be required, but only at the request of a medical officer, to supplement the basic projections in cases of trauma, e.g. subluxation, or pathology, e.g. rheumatoid arthritis (and often before surgery to assess movement in the neck for insertion of an endotracheal tube). The degree of movement and any change in the relationship of the cervical vertebrae can also be assessed. If an injury is suspected or is being followed up, then an experienced trauma doctor must be present to supervise flexion and extension of the neck.

Position of patient and image receptor

- The patient is positioned as for the lateral basic or lateral supine projections; however, erect positioning is more convenient. The patient is asked to flex the neck and to tuck the chin in towards the chest as far as is possible.
- For the second projection, the patient is asked to extend the neck by raising the chin as far as possible.
- Immobilisation can be facilitated by asking the patient to hold on to a solid object, such as the back of a chair.
- The image receptor is centred to the mid-cervical region and if using a CR cassette this may have to be placed transversely, depending on the degree of movement and the cassette size used.
- If imaged supine, the neck can be flexed by placing pads under the neck. Extension of the neck can be achieved by placing pillows under the patient's shoulders.

Direction and location of the X-ray beam

- The collimated horizontal beam is centred over the mid cervical region (C4).

Fig. 6.13a and b Patient positioning for flexion and extension projections.

Essential image characteristics (Figs 6.13c)

• The final image should include the entire cervical vertebra, including the atlanto-occipital joints, the spinous processes and the soft tissues of the neck.

Fig. 6.13c Radiographs showing flexions and extension.