Al-Mustaqbal University
College of Health and Medical Technologies
Radiological Techniques Department

Magnetic Resonance Imaging

First Semester

Lecture 15 : MRI of cervical spine

By

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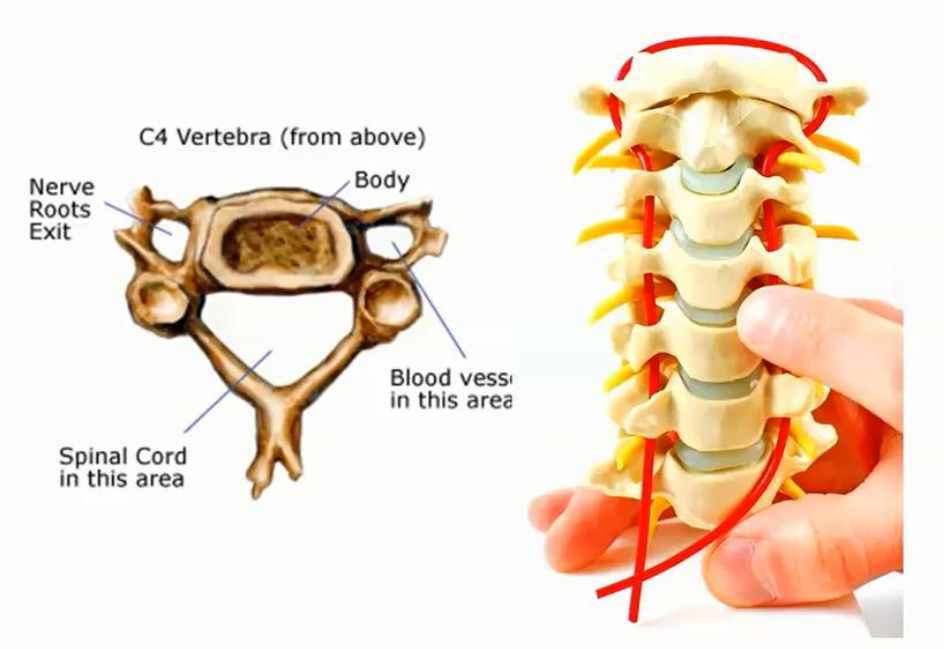
Introduction :

Learning about cervical spine MRI is essential for MRI technologist to

1. perform MRI exams effectively,
2. interpret MRI results accurately,
3. ensure patient safety,
4. understand anatomy and pathology, and
5. collaborate with other healthcare professionals.

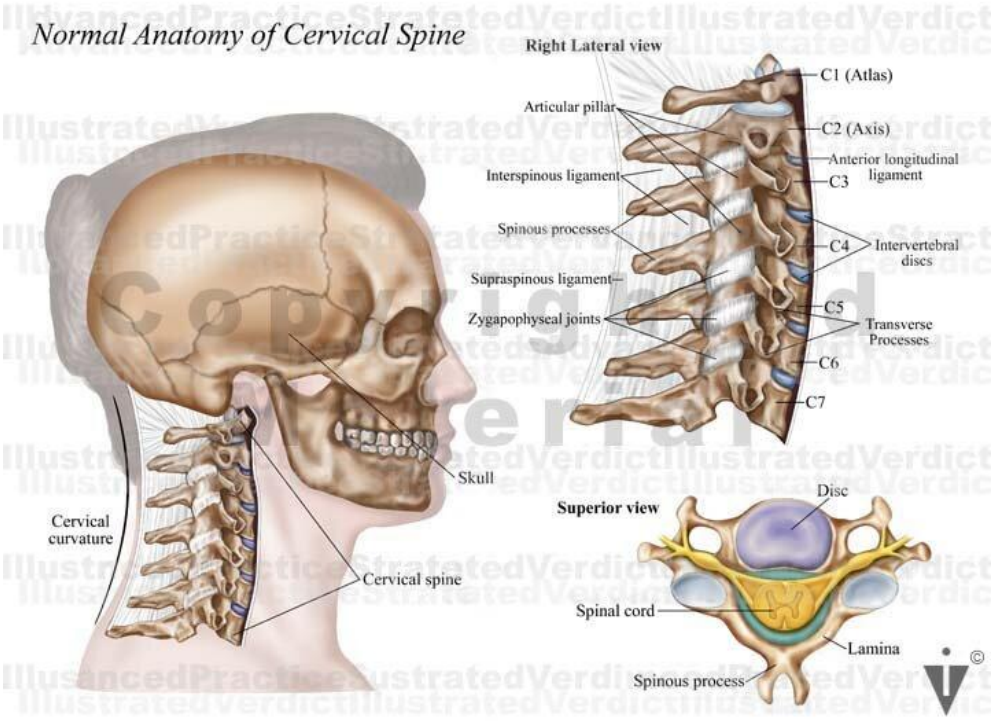
Anatomical overview: -

Exiting the cranium via the foramen magnum, the spinal cord is contained within the vertebral column. It gives off **nerves** on each side between each of the bones in the spine, commencing with the first cervical nerve root between the base of the skull and the first cervical vertebra.



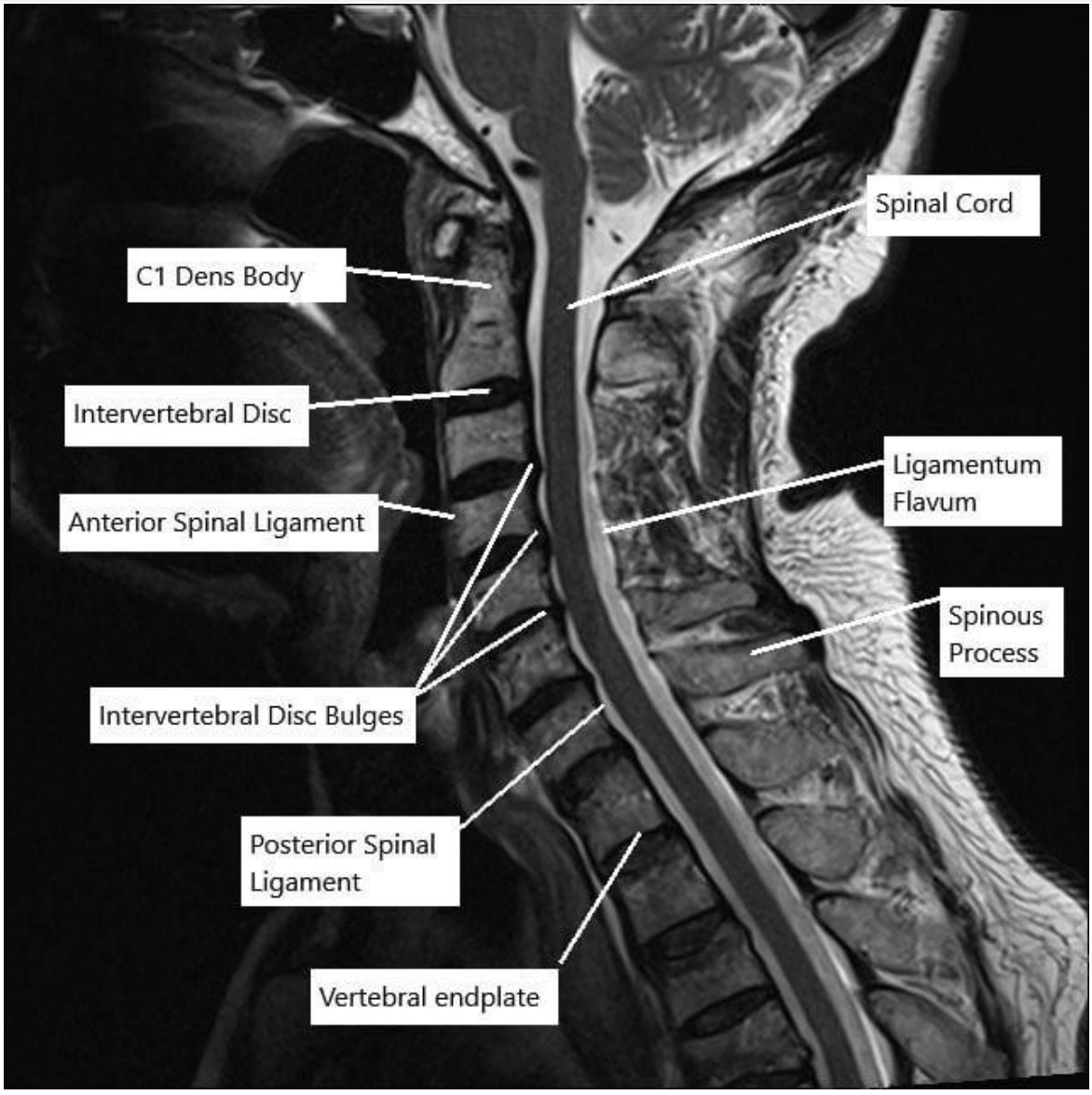
Intervertebral discs between each vertebra, commencing at the **C2/3 level**, facilitate flexibility of movement, cushion the bones from shock, and assist in maintaining alignment.

Ligaments supporting the spine include the anterior and posterior longitudinal, intimately attached to the bodies of the vertebrae. Connecting the laminae of each of the vertebral bodies from C2 to S1 are the **ligamentum flava**. **The intertransverse and interspinous ligaments** connect the transverse processes and spinous processes of the vertebrae, respectively. Finally, **the nuchal ligament** extends from the occiput to the spinous process of the seventh cervical vertebra. **The vertebral arteries** course through the transverse foramen of the sixth to first cervical vertebra. (fig.1)



(Fig.1)

Normal anatomy of cervical spine



-MRI of cervical spine: The MRI cervical spine protocol encompasses a set of MRI sequences for the routine assessment of the cervical spine.

- Indications of cervical spine MRI: -

1- Degenerative disc disease which include:

-Disc herniation and radiculopathy.

is a medical condition that occurs when a nerve root in the cervical (neck) spine is compressed.

- stenosis.

2-Spinal trauma, suspected C.S fractures, spinal epidural hematoma.

3-Spinal tumors or vertebral metastasis.

4-Inflammation and autoimmune conditions which include:

-Multiple sclerosis.

-Inflammatory arthritis.

5-Spinal infection such as vertebral osteomyelitis.

6-Spinal vascular malformation.

7-Spinal cord infarction.

8-Congenital spinal malformation.

9-Suspected complications of spinal surgery.

10-Follow up of findings on other examinations.

-MRI procedure:

- Patient position:

•Place the coil on the magnet table and plug it in.

•Place patient supine, head first.

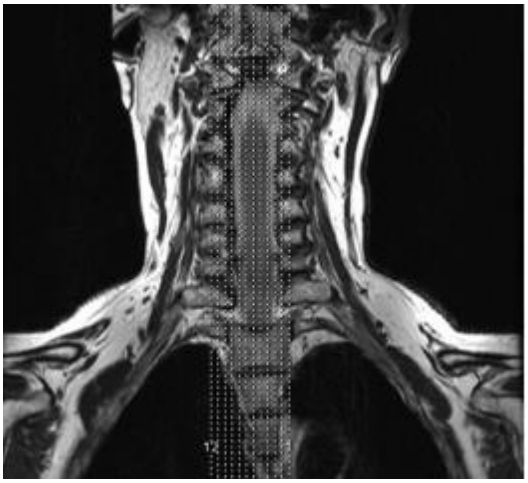
•Rest the head and neck in the coil.

•Position the superior end of the coil at the base of the skull. **This position should include C1 on a sagittal image so that you can count vertebra for localization purpose**. (fig.2)

Fig.2 patient position (cervical-spine MRI)

•Scout slice placement: -

1-Coronal localizer to obtain sagittal slices.



- Alignment:

Parallel to the long axis of the spinal cord.

- Coverage:

A-Superior to inferior: Craniocervical junction to second thoracic vertebra.

B-Lateral to medial: Vertebral pedicles on each side.

C-Posterior to anterior: Spinous processes to prevertebral tissues.

- Sagittal slices can be used to demonstrate the following:

1-Vertebral alignment.

2-Bony integrity and end plate disruption.

3-Herniated disc.

4-Space occupying lesions within the spinal canal and spinal canal stenosis.

5-Ligamentum flavum.

6-Syrinx.

2-Sagittal localizer to obtain axial slice

-Alignment:

Perpendicular to the long axis of the cervical cord.

- Coverage:

A-Superior to inferior: Pedicle of the third cervical vertebra to the pedicle of the first thoracic vertebra. Post trauma, scans should commence at the base of the skull.

B-Lateral to medial: Intervertebral foramina on each side.

C-Posterior to anterior: Spinous processes to prevertebral tissues.

- Axial slices can be used to demonstrate the following:

1-Herniated disc.

2-Paravertebral extension of masses into the soft tissue.

3-Sagittal localizer to obtain coronal slice:

-Alignment:

Parallel to the long axis of the spinal cord. Some obliquity will most likely be required to achieve this.

- Coverage:

A-Superior to inferior: Craniocervical junction to the second thoracic vertebra.

B-Lateral to medial: Transverse processes on each side.

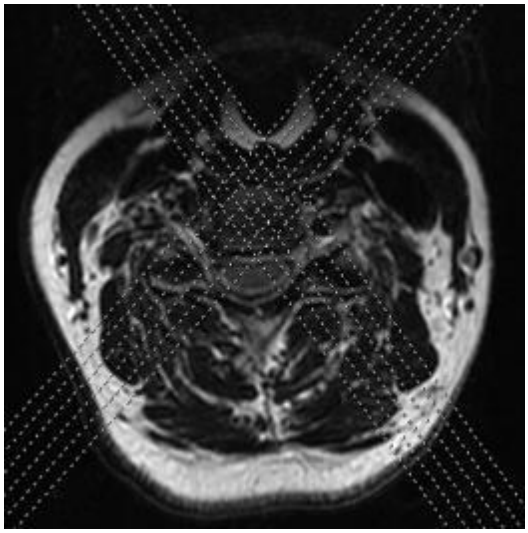
C-Posterior to anterior: Entire vertebral foramen to midway through the vertebral bodies.

- Coronal slices can be used to demonstrate the following:

1- Space occupying lesions within the spinal canal.

2- Lateral compression of nerve roots.

4-Axial localizer to obtain sagittal oblique slice:



-Alignment:

A-Perpendicular to the nerve roots as they exit the cervical canal in the mid cervical spine. An angle of approximately 45° should be expected.

B-Verify that the slices will cover the nerve roots and foramina on each side at the superior and inferior cervical spine.

C-Bilateral scans may be performed simultaneously or separately.

-Coverage:

A-Superior to inferior: Craniocervical junction to the first thoracic vertebra.

B-Lateral to medial: Nerve root origins at the edge of the cervical cord to the lateral aspect of the spinal foramen.

C-Posterior to anterior: Entire vertebral foramen to midway through the vertebral bodies.

-Note: Complementary to the axial images, this view assists in demonstrating the severity of foraminal impingement.

MRI Sequences (Cervical spine)

Sequence	TR	TE	FA	ETL	Slice thickness
Sagittal (T2) (FSE)	3400	102	-	14	3mm
Sagittal (T1) (FSE)	450	14	-	4	3mm
Sagittal (STIR)	2888	60	-	10	3mm/TI=110
Corona (T1) (FSE)	575	13	-	2	3mm
Axial (T1) (FSE) (post GAD)	625	Min	-	3	4mm
Sagittal (T1) (FSE) (post GAD)	450	4	-	4	3mm

-Optional sequences:

1- Sagittal (DWI): evaluation of spinal cord ischemia.

2- Sagittal or axial MR-perfusion: evaluation of tumors for their vascularization.

Sagittal Short Tau Inversion Recovery (STIR) Imaging:

Use: Suppresses fat signal and enhances **the visibility of edema and inflammatory changes**, making it valuable for detecting **bone marrow disorders and infection**.