

1. SPINAL CORD

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In the first part, we explore the overall structure and organization of the spinal cord. This includes a detailed examination of its gross anatomy, such as the spinal cord’s segments, the protective meninges, and the surrounding vertebral column. We will also cover common spinal procedures, offering insights into standard practices and techniques used in spinal surgeries. Understanding these foundational elements is crucial for grasping the complexities of spinal cord functions and pathologies.

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Case 1

Presentation

A patient presents with a complaint of severe back pain. He is a student who recently completed a period of intensive studying, involving prolonged sitting at his desk. The patient acknowledges being in poor physical condition. On the day following his exams, he decided to clean his room, which he had neglected during his study period. While attempting to lift and move his desk to vacuum the floor, he experienced a sudden, sharp back pain that radiated to his right lower leg. In distress, he called 911. Paramedics responded promptly and transported him to the neurological department, fortunately you are the neurosurgeon on call.

Relevant Anatomical Background

This is the case of lumbar disk herniation. Now to understand these terms, we need to first learn more about the general structure of the spinal cord and its organization.

The spinal cord is situated within the vertebral canal of the vertebral column and is surrounded by three coverings known as the meninges. The spinal cord is like a cylinder begins at the end of the brain and ends in the lumbar region of the vertebral column.¹

The spinal cord is organized into nerve roots each of which exit from the gaps within the vertebral column. One such gap is visible in Figure 1

Along the entire length of the spinal cord, 31 pairs of spinal nerves consist of the anterior or ventral or motor roots and the posterior or dorsal or sensory roots. Each root also contains the dorsal root ganglion, the cells of which give rise to peripheral and central nerve fibers visible in Figure 2

Lumbar Disk Herniation

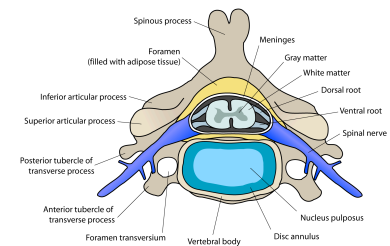


Figure 1. This is a little figure in the sidenotes.

¹ Difference between the vertebral column, vertebral canal and the spinal cord.

Vertebral column: the bony structure that houses the spinal cord.

Vertebral canal: the space inside the vertebral column that contains the spinal cord.

The spinal cord is the nervous tissue itself.

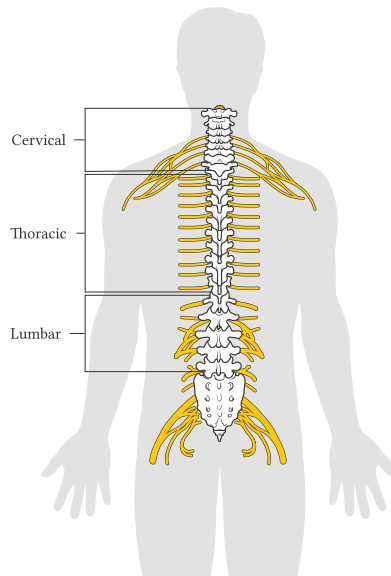


Figure 2. The vertebral column and spinal nerves exiting from it.

Now coming back to the question of the medical student's injury, the herniation occurred on the right side and was relatively small. This herniation occurred between L5 and S1 spinal cord levels and the posterior (dorsal) roots of the spinal cord were compressed. Figure 3 shows the different severities of disk herniations.

It is clearly visible how the contents of the intervertebral disks may compress the spinal nerves. See Figure 4 for a visualization. The symptoms may be motor or sensory function abnormalities.

Lumbar disk herniations occur most commonly in the lumbar region² as a relatively mobile part of the spinal cord meets the relatively immobile sacral part of the spinal cord. This area is also more common as the entire weight of the head and the thorax and the weight lifted by the upper limb is transmitted towards the legs through this region.

Figure 3 shows the pathology. The blue part in the intervertebral disk is the nucleus pulposus while the white part is the annulus fibrosus. The nucleus pulposus can be seen being squeezed into the cavity of the spinal cord where it compresses the nerves.

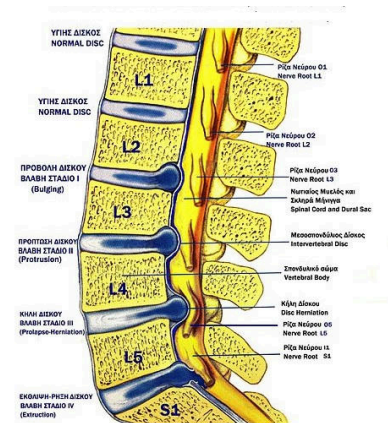


Figure 3. Lumbar Disk Herniation visualization

² see Figure 2

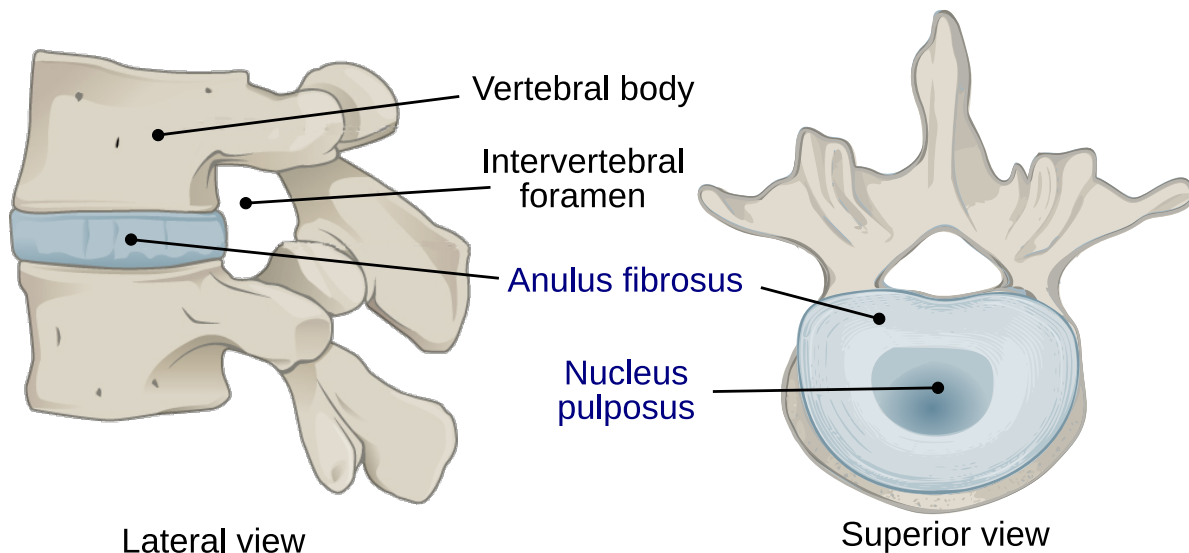


Figure 4. Views of the Intervertebral disk. The substance that can cause hernia (nucleus pulposus) is clearly visible and labelled.

This can lead to pain being felt in the leg on the side where the nerve is being compressed. As was the case of our student, his spinal nerves L5 and S1 were most probably compressed leading to him experiencing the pain. His condition is known as 'Sciatica'³.

³ Compression of the sensory roots will lead to pain being felt while compression of the motor roots will produce weakness of the muscles.

Case 2

Presentation

A man was involved in a motor car accident. The car hit the person head-on. First responders noticed that the person's breathing was severely affected. What is the major muscle controlling respiration?

Relevant Anatomical Background

The major muscle controlling respiration is the Diaphragm. It is located below the lungs and can be seen in Figure 5. Its contraction leads to the increase in volume of the thoracic cavity which causes the lungs to fill up with air⁴.

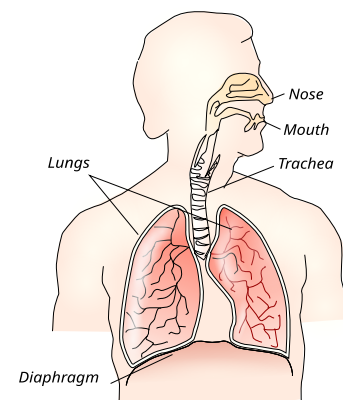


Figure 5. Diagram showing the position of the diaphragm.

⁴ Further anatomical details of the diaphragm are beyond the scope of this book but more information can be found in Gray's Basic Anatomy section on Thorax and the heading is Diaphragm

