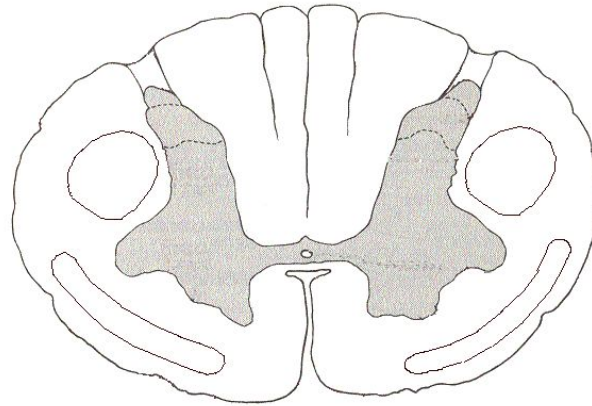


Lesions of the Spinal Cord



Learning Module

[Click to Begin](#)

Main Menu

Overview *describes the module content & learning objectives*

Please complete this section first!

Contents *houses the 9 interactive lesion lessons and directions for completing them.*

Patient Cases *provides practice with feedback using patient cases.*

Overview

Introduction

Learning Objectives

Introduction

- This module reviews lesions of the spinal cord
- Module organization consists of three components. **Overview** consists of this Introduction and the Learning Objectives. **Contents** consists of Navigation Instructions, a Legend, and 9 interactive lesion lessons. **Cases** consists of Instructions and 3 interactive patient cases with feedback.
- At the bottom of each page a navigation bar contains options to move throughout the module.
- Material is presented at both the behavioral level and the neuroanatomical level.
- The behavioral level is presented first and depicts a patient's clinical presentation.
- The neuroanatomical level depicts the detailed anatomy of first-order, second-order and third-order neurons.
- The neuroanatomical level accounts for the patient's behavioral presentation on examination under normal and lesioned conditions.

Learning Objectives

After completing this module you should be able to:

1. describe the signs and symptoms caused by a lesion of the spinal cord (fasciculus gracilis and fasciculus cuneatus, lateral corticospinal tract, and lateral spinothalamic tract).
2. given a patient case (examination results and chief complaint), identify the functional systems causing the sensory and motor impairments.
3. correlate neurology information between the behavioral and neuroanatomical levels.

Contents

[Read these Instructions!](#)

Legend: symbols used throughout the module

Review of the Spinal Cord ([Under Construction](#))

Lesion lessons

[Dorsal column lesion](#)

[Fasciculus cuneatus lesion](#)

[Lateral corticospinal tract lesion](#)

[Lateral spinothalamic tract lesion](#)

[Transverse cord lesion](#)

[Hemicord lesion](#)

[Central cord syndrome](#)

[Anterior cord syndrome](#)

[Posterior cord syndrome](#)

Instructions

- This module contains 9 interactive lesion lessons with animation.
- Lesson lessons begin with a question about the symptoms produced by that particular lesion.
- Clicking the answer button will reveal the answer to the question.
- Clicking the explanation button will lead to both behavioral and neuroanatomical explanations of the lesion.
- Each presentation is launched by clicking the animation button. The same button serves to replay the animation if desired.
- Any of the lessons may be accessed by simply clicking on the lesion title on the Contents page.
- Please refer to the Legend that defines the symbols used throughout the module.

Legend



Mechanism of injury



Lesion



Pain stimulus



Light touch stimulus



Function intact



Function lost



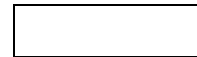
First-order neuron



Second-order neuron

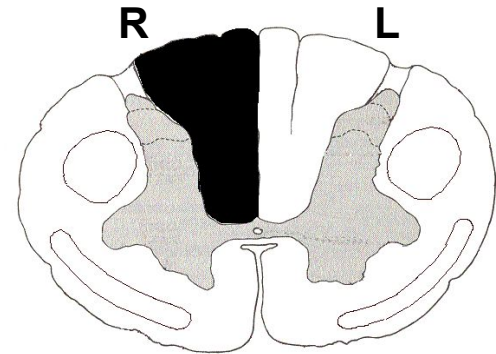


Third-order neuron



Sensory impairment

Lesion of the right dorsal column at L1 produces what impairment?



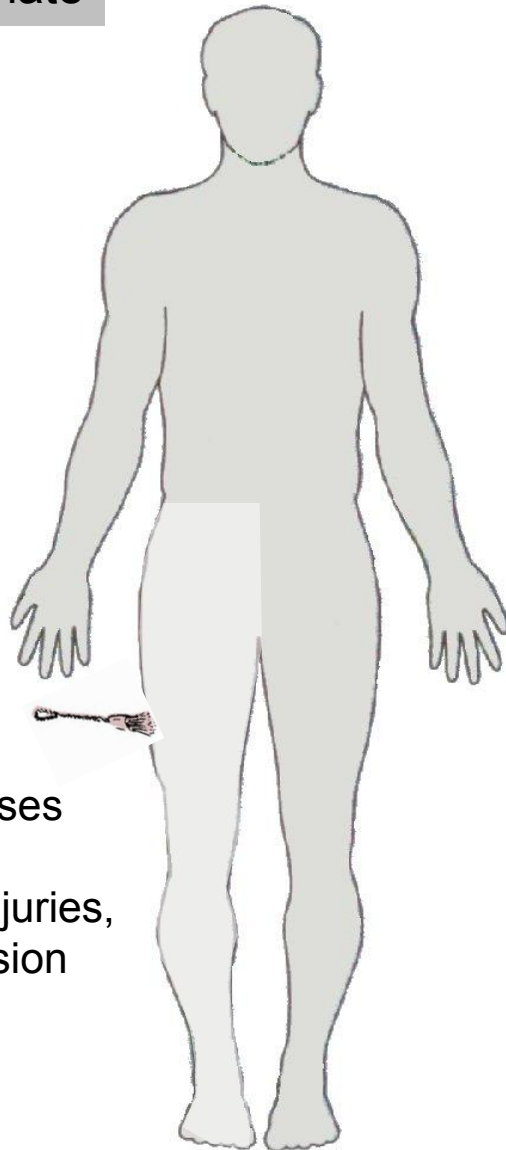
Click for answer

Damage to the **right** dorsal column at L1 causes the absence of light touch, vibration, and position sensation in the **right** leg. Only fasciculus gracilis exists below T6.

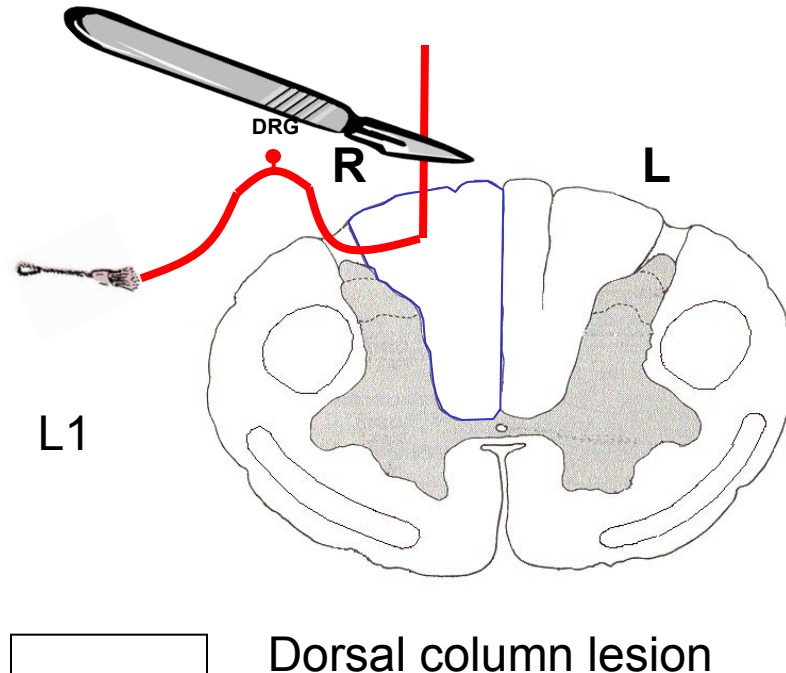
Click for explanation

Right Dorsal Column Lesion

Click to animate



Common causes include MS, penetrating injuries, and compression from tumors.

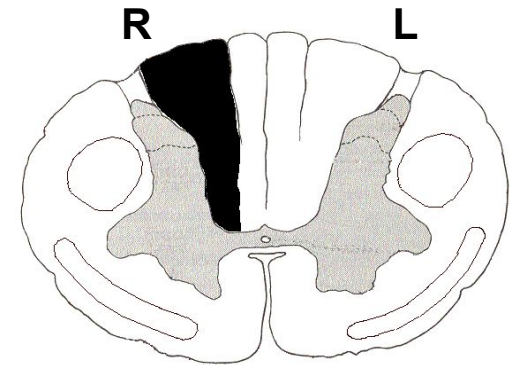


Dorsal column lesion

Ipsilateral loss of light touch, vibration, and position sense generalized below the lesion level

Below T6 only the fasciculus gracilis is present.

Lesion of the right fasciculus cuneatus at C3 produces what impairment?



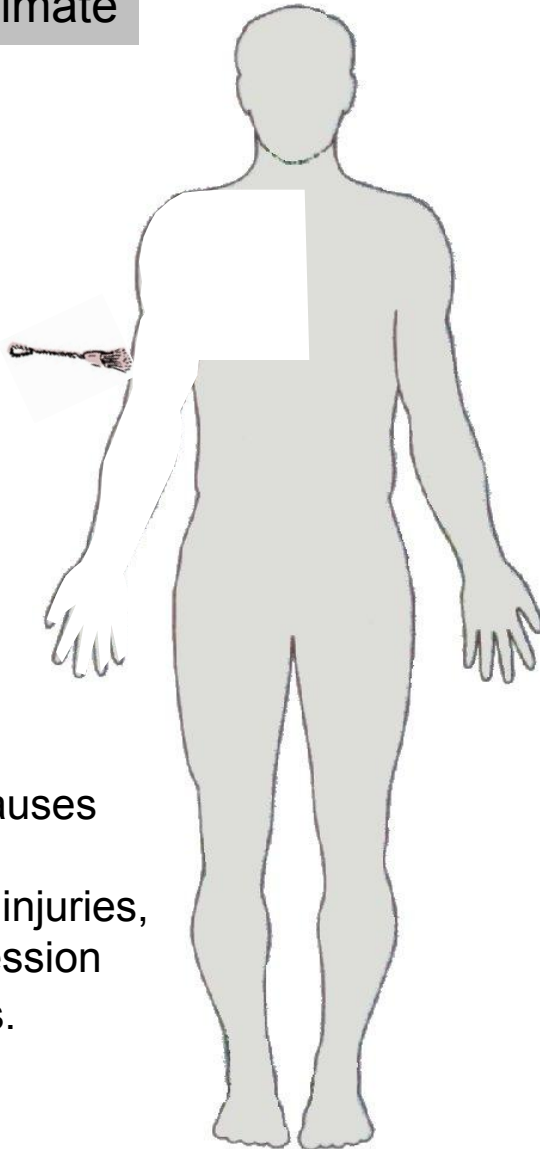
Click for answer

Damage to the **right** fasciculus cuneatus at C3 causes the absence of light touch, vibration, and position sensation in the **right** arm and upper trunk.

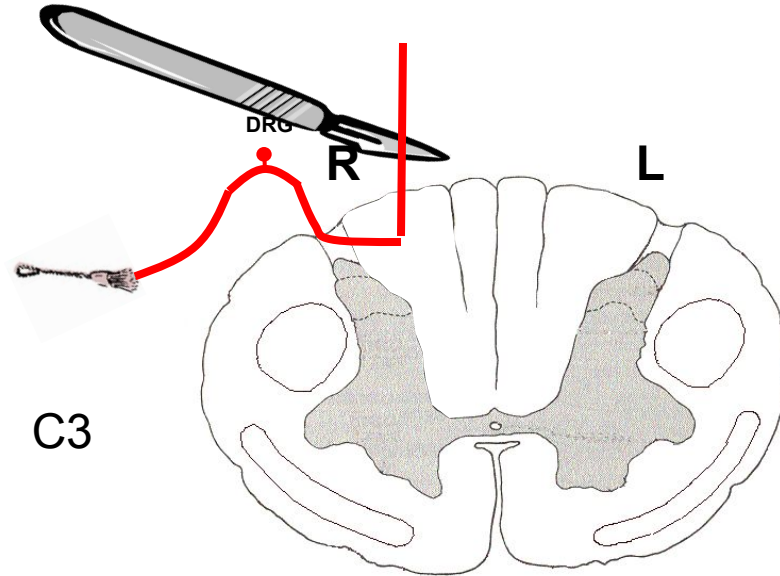
Click for explanation

Right Fasciculus Cuneatus Lesion

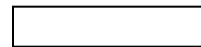
Click to animate



Common causes include MS, penetrating injuries, and compression from tumors.

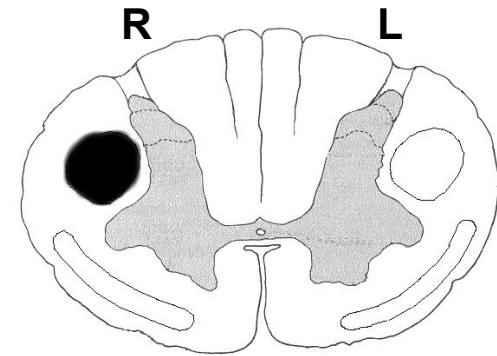


C3



Fasciculus cuneatus lesion
Ipsilateral loss of light touch,
vibration, and position sense
In the right arm and upper trunk

Lesion of the right lateral corticospinal tract at L1 produces what impairment?



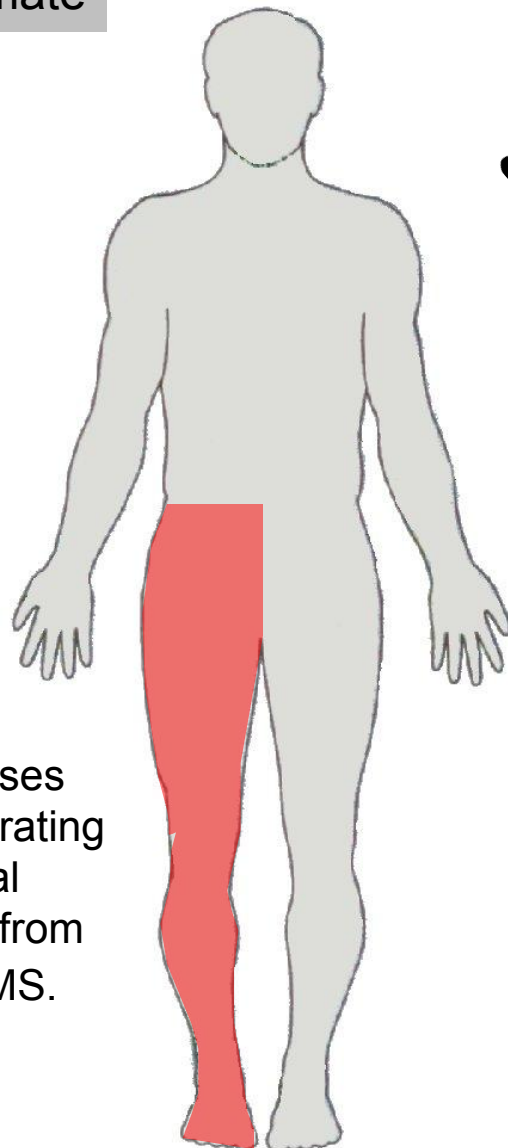
Click for answer

Damage to the **right** lateral corticospinal tract at L1 causes upper motor neurons signs (weakness or paralysis, hyperreflexia, and hypertonia) in the **right** leg.

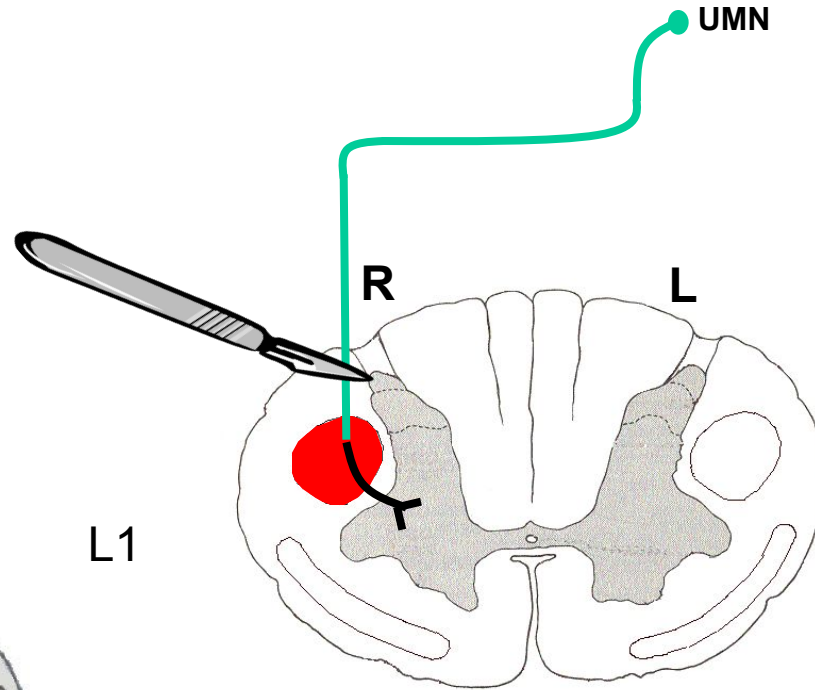
Click for explanation

Right Lateral Corticospinal Tract Lesion

Click to animate



Common causes include penetrating injuries, lateral compression from tumors, and MS.



Lateral corticospinal tract lesion
Ipsilateral upper motor neurons signs
generalized below the lesion level

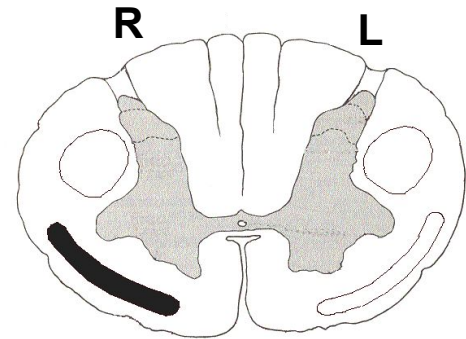
UMN signs

Weakness (Spastic
paralysis)

Hyperreflexia (+ Babinski,
clonus)

Hypertonia

Lesion of the right lateral spinothalamic tract at L1 produces what impairment?



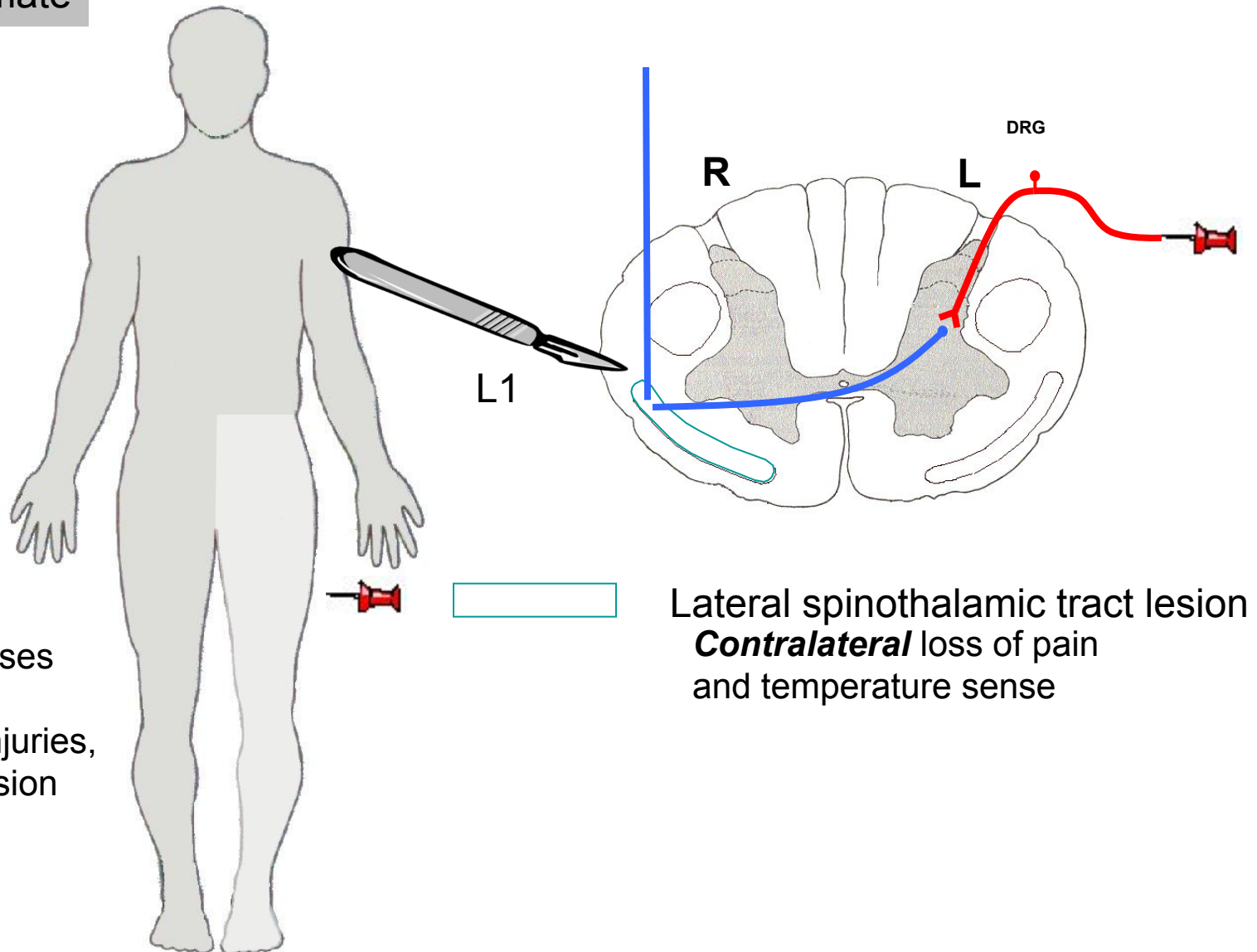
Click for answer

Damage to the **right** lateral spinothalamic tract at L1 causes the absence of pain and temperature sensation in the **left** leg.

Click for explanation

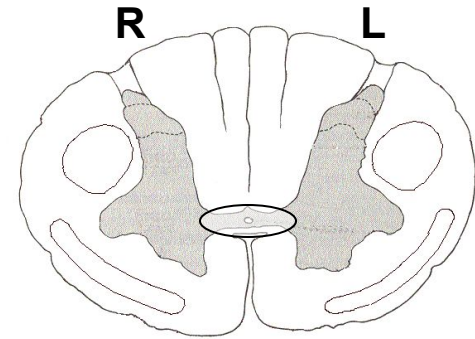
Right Lateral Spinothalamic Tract Lesion

Click to animate



Common causes include MS, penetrating injuries, and compression from tumors.

Lesion of the anterior gray and white commissures (central cord syndrome) at C5-C6 produces what impairment?



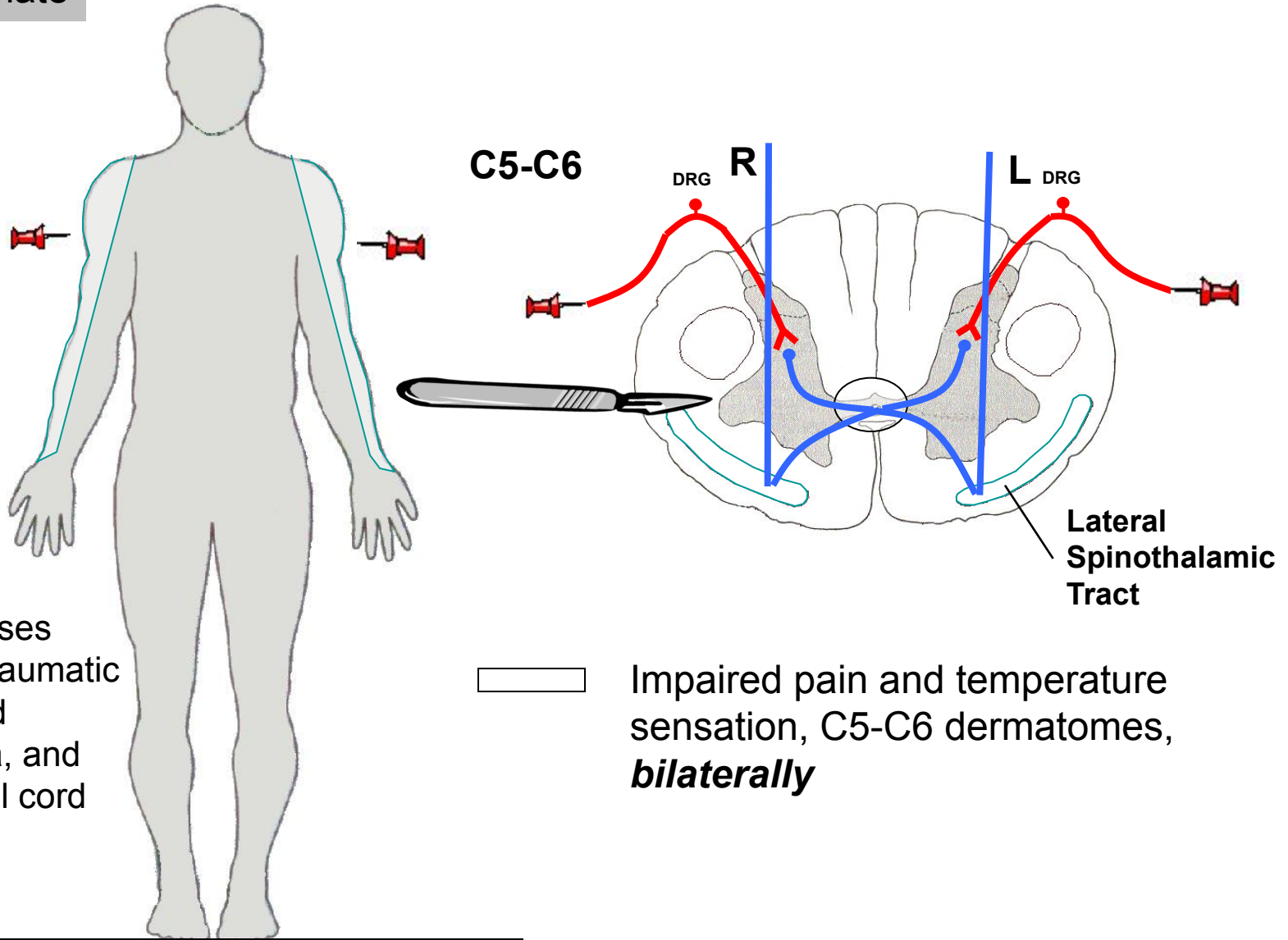
Click for answer

Damage to the anterior gray and white commissures at C5-C6 causes the absence of pain and temperature sensation in the C5 and C6 dermatomes in **both** upper extremities.

Click for explanation

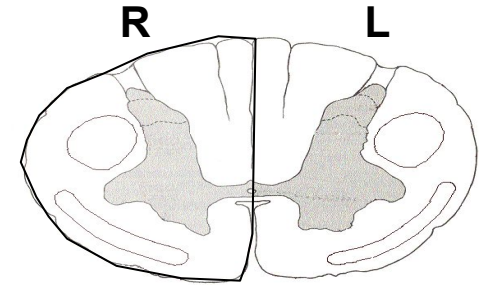
Central Cord Syndrome

Click to animate



Common causes include posttraumatic contusion and syringomyelia, and intrinsic spinal cord tumors.

Complete transection of the right half the spinal cord (Hemicord or Brown-Sequard syndrome) at L1 produces what impairments?



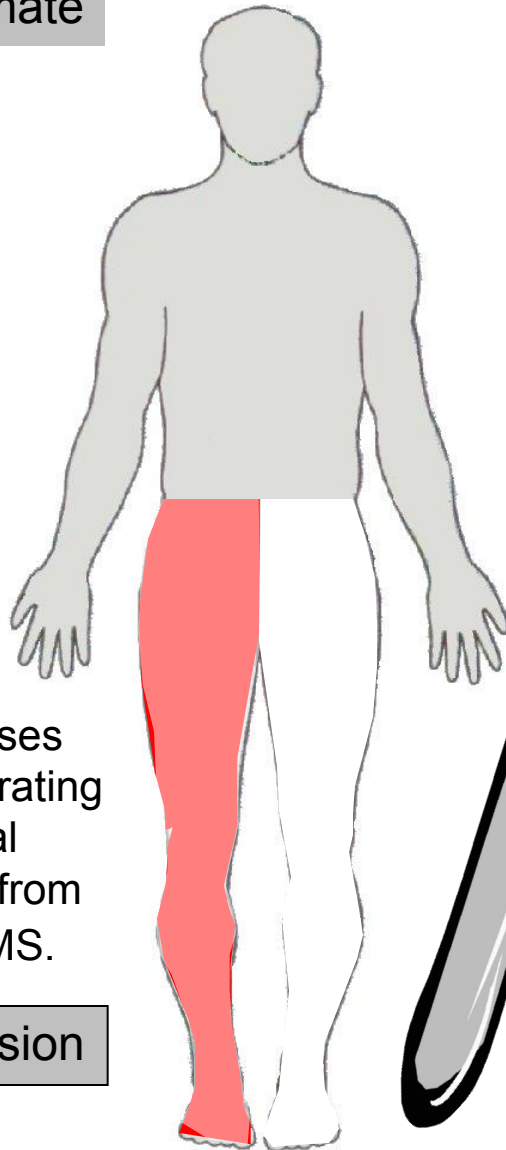
Click for answer

Damage to the **right** dorsal columns at L1 causes the absence of light touch, vibration, and position sense in the **right** leg. Damage to the lateral corticospinal tract causes upper motor neuron signs in the **right** leg (Monoplegia), and damage to the lateral spinothalamic tract causes the absence of pain and temperature sensation in the **left** leg.

Click for explanation

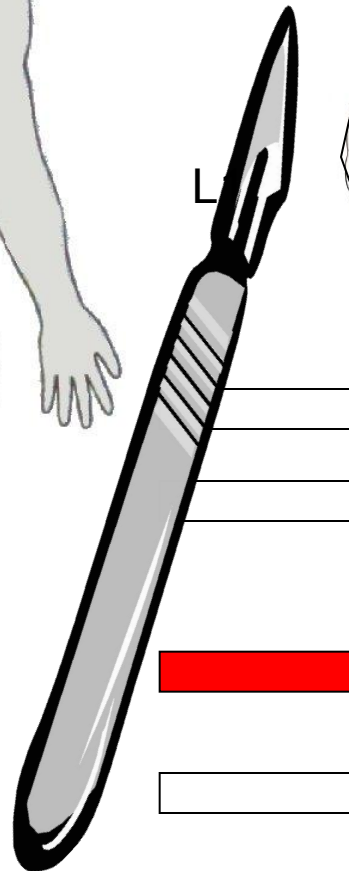
Hemicord Lesion (Brown-Sequard Syndrome)

Click to animate



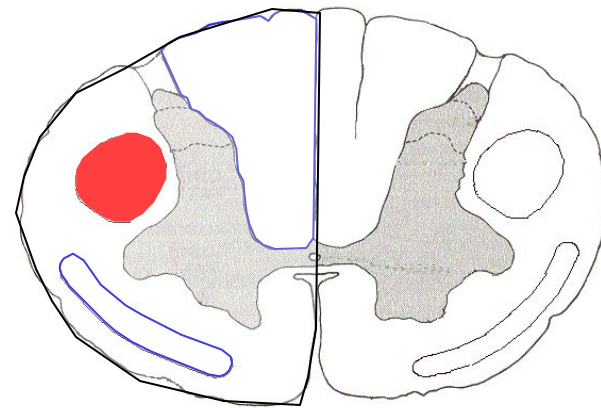
Common causes include penetrating injuries, lateral compression from tumors, and MS.

Build the lesion



R

L



Hemicord lesion

Dorsal column lesion

Ipsilateral loss of light touch, vibration, and position sense

Lateral corticospinal tract lesion

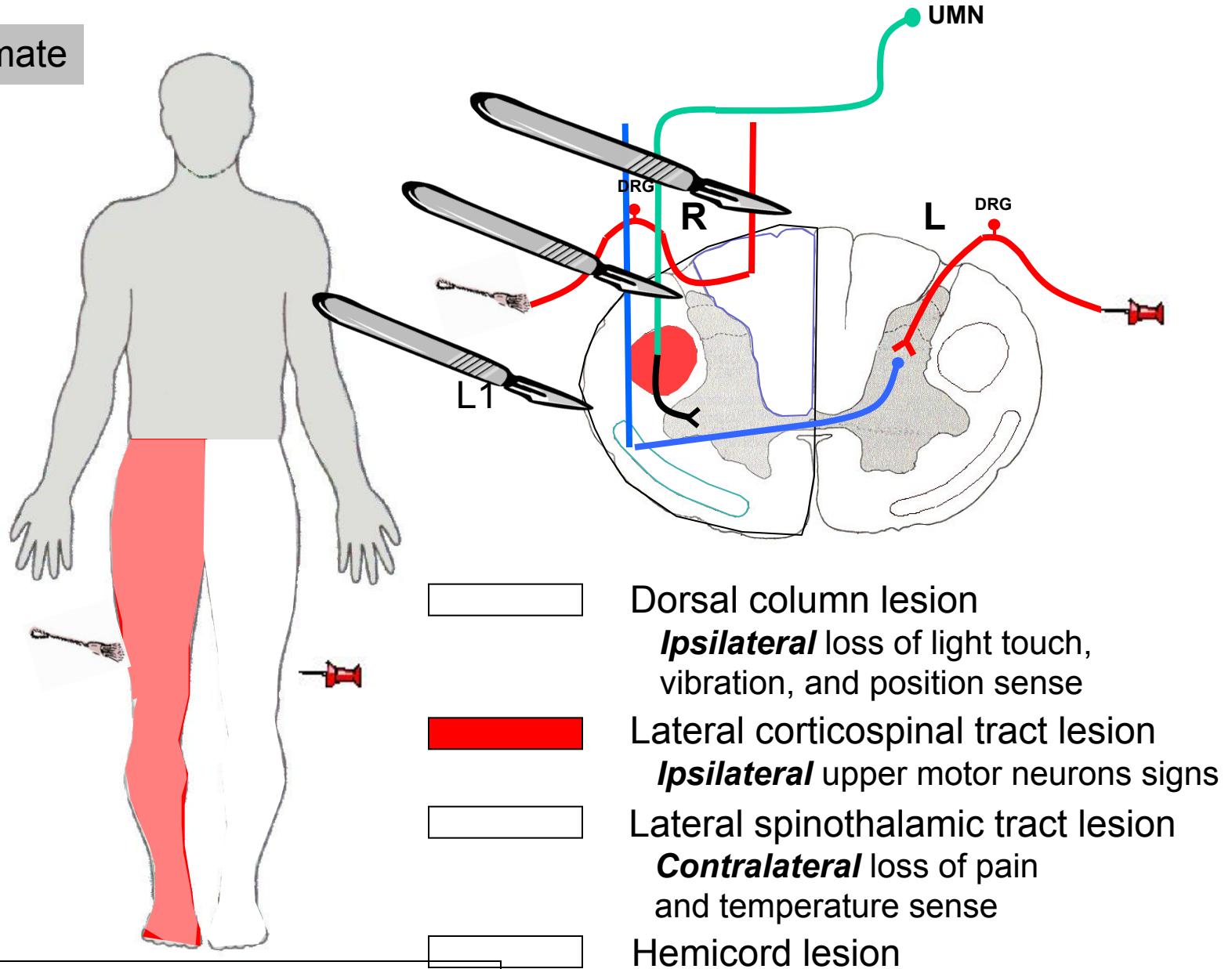
Ipsilateral upper motor neurons signs

Lateral spinothalamic tract lesion

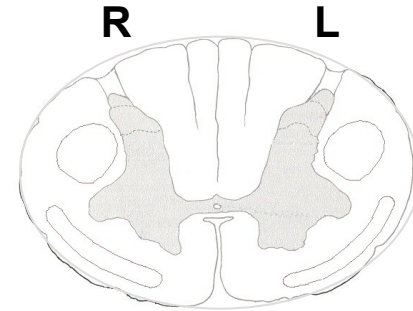
Contralateral loss of pain and temperature sense

Hemicord Lesion (Brown-Sequard Syndrome)

Click to animate



Complete transection of the spinal cord (Transverse cord lesion) at L1 would produce what impairments?



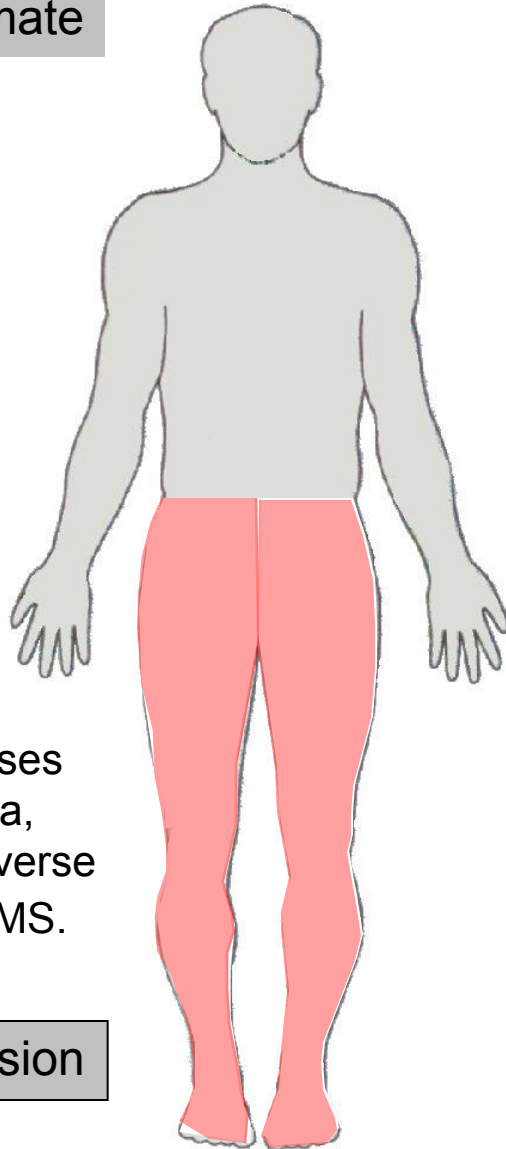
Click for answer

Damage to the dorsal columns, bilaterally, causes the absence of light touch, vibration, and position sense in the **both** legs. Damage to the lateral corticospinal tracts, bilaterally, cause upper motor neuron signs in the **both** legs (Paraplegia), and damage to the lateral spinothalamic tracts, bilaterally, cause the absence of pain and temperature sensation in the **both** legs.

Click for explanation

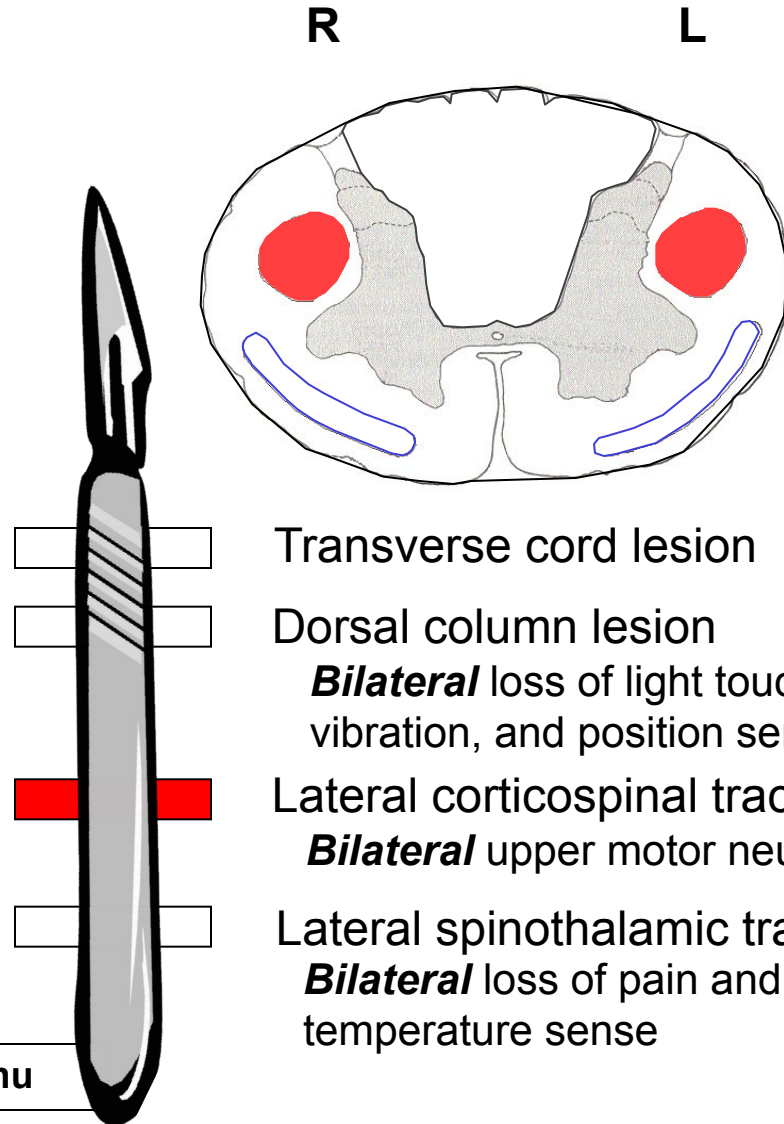
Transverse Cord Lesion

Click to animate



Common causes include trauma, tumors, transverse myelitis, and MS.

Build the lesion



Transverse cord lesion

Dorsal column lesion

Bilateral loss of light touch, vibration, and position sense

Lateral corticospinal tract lesion

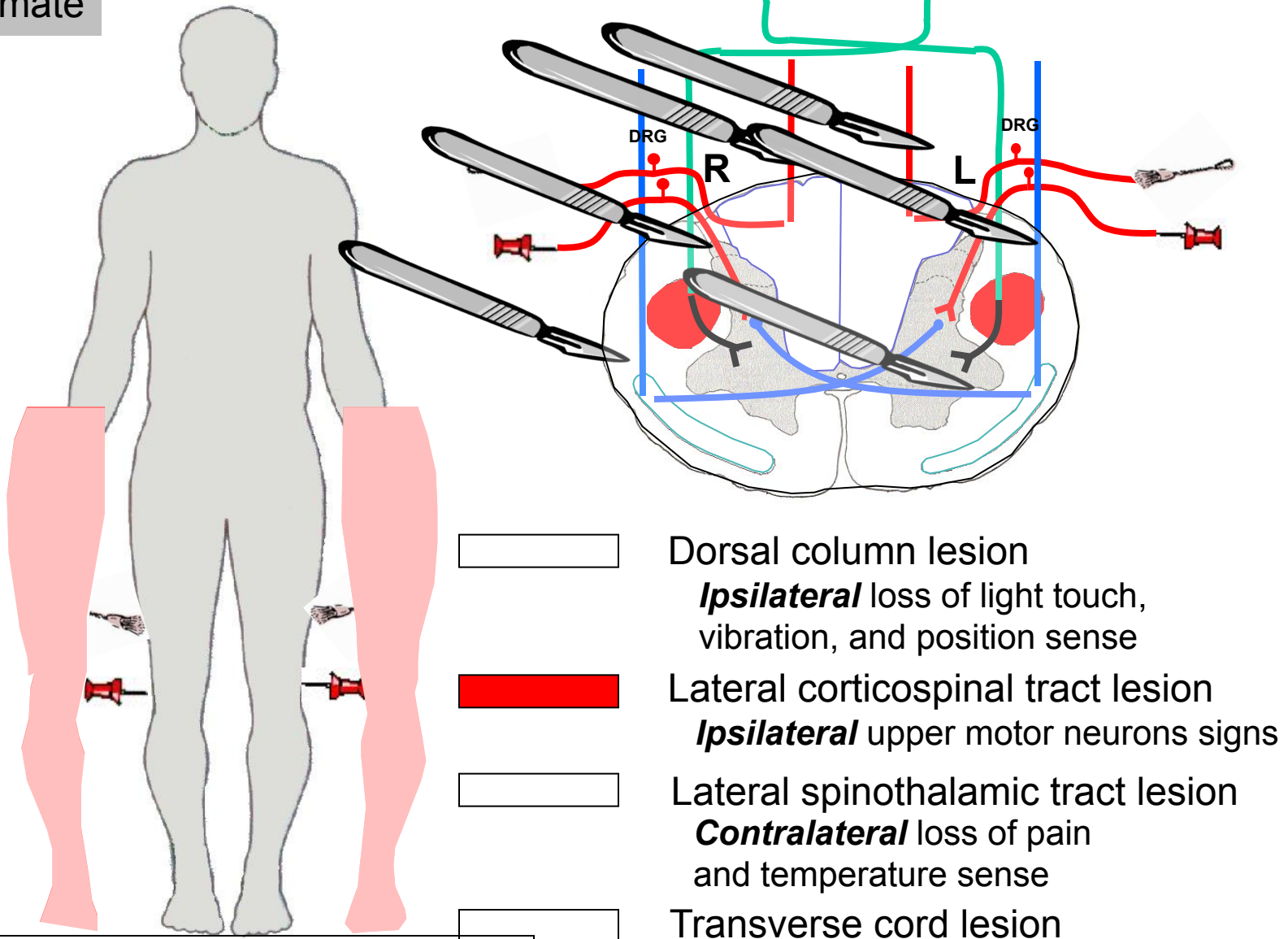
Bilateral upper motor neurons signs

Lateral spinothalamic tract lesion

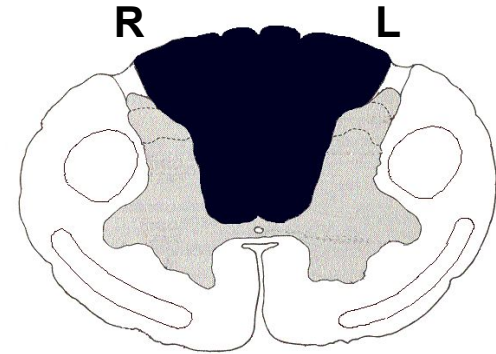
Bilateral loss of pain and temperature sense

Transverse Cord Lesion

Click to animate



Complete transection of the dorsal columns, bilaterally, (posterior cord syndrome) in the cervical region would produce what impairments?



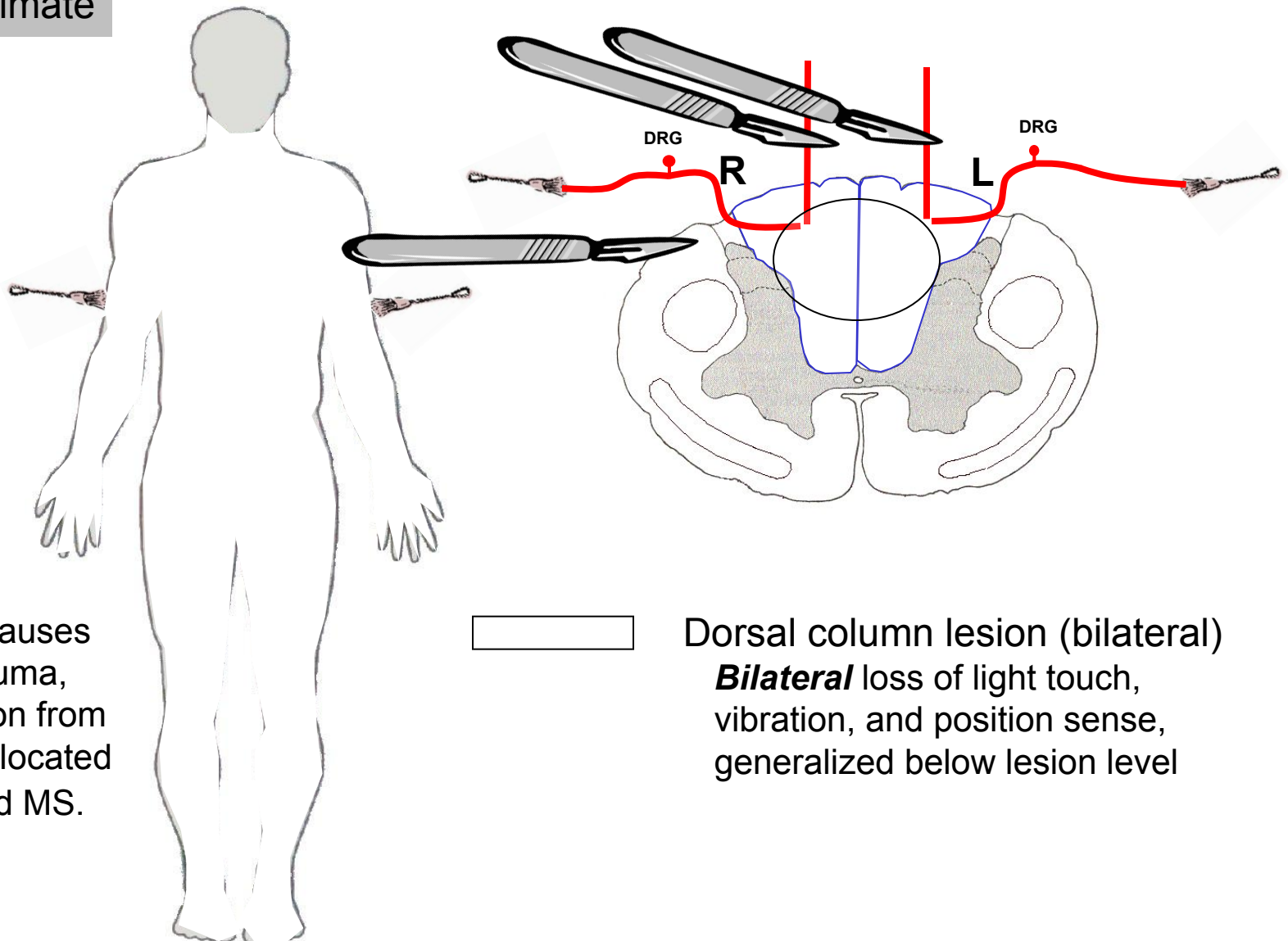
Click for answer

Damage to the dorsal columns (fasciculus gracilis and cuneatus), bilaterally, causes the absence of light touch, vibration, and position sense, **bilaterally**, from the neck down (below the lesion level).

Click for explanation

Posterior Cord Syndrome

Click to animate

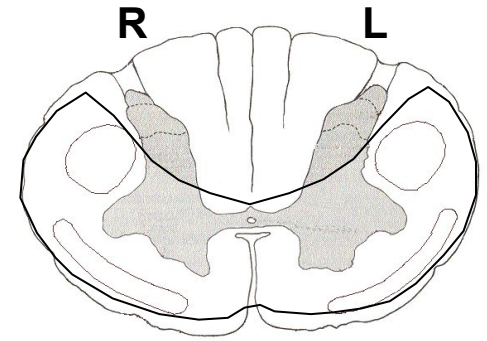


Common causes include trauma, compression from posteriorly located tumors, and MS.



Dorsal column lesion (bilateral)
Bilateral loss of light touch, vibration, and position sense, generalized below lesion level

Complete transection of the lateral corticospinal and lateral spinothalamic tracts with sparing of the dorsal columns, bilaterally, (anterior cord syndrome) in the cervical region would produce what impairments?



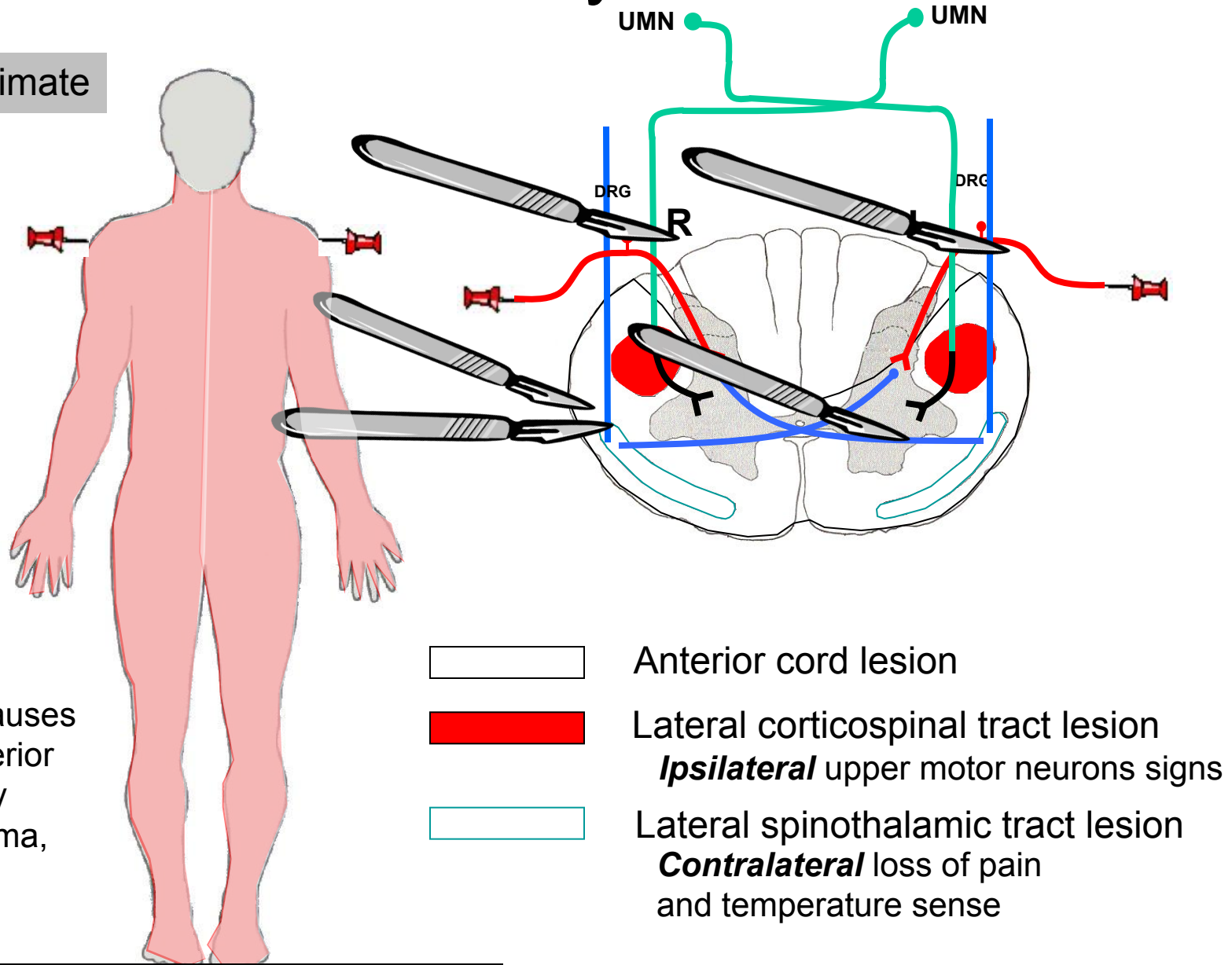
Click for answer

Damage to the lateral corticospinal tracts cause upper motor neuron signs, **bilaterally**, below the lesion level. Damage to lower motor neurons in the ventral horns cause lower motor neuron signs, **bilaterally**, at the lesion level. Damage to the lateral spinothalamic tracts cause absence of pain and temperature sensation, **bilaterally**, below the lesion level. Sparing of the dorsal columns leaves light touch, vibration, and position sense **intact throughout**.

Click for explanation

Anterior Cord Syndrome

Click to animate



Common causes include anterior spinal artery infarct, trauma, and MS.

Case-based Practice

Read these instructions!

Patient Case #1

Patient Case #2

Patient Case #3

Case Instructions

- These patient cases are intended to facilitate the integration and clinical application of information about lesions of the spinal cord by coupling the findings on examination and patient interview with their neuroanatomical correlates.
- Cases are presented from two perspectives. What lesion would account for a given set of examination results and patient history? For a given lesion, what signs and symptoms would be expected on examination?
- Click on a Case number to begin the exercise.

Review Questions: Case 1

The patient complains of “clumsiness” of her left leg due to uncertainty of the limb’s position in space. Active and passive ROM and strength are within normal limits (WNL) throughout. Light touch, two-point discrimination, proprioception, and vibration sense are intact in the right lower extremity but absent in all dermatomes below the umbilicus in the left lower extremity. She is able to distinguish sharp from dull WNL in lower extremities, bilaterally.

Damage to what system(s) is causing this patient’s problems?

Answer

Lesion of the left dorsal column (fasciculus gracilis) at approximately T10.

Lateral corticospinal tracts are intact, bilaterally: AROM and strength are WNL

Lateral spinothalamic tracts are intact, bilaterally: sharp/ dull is WNL

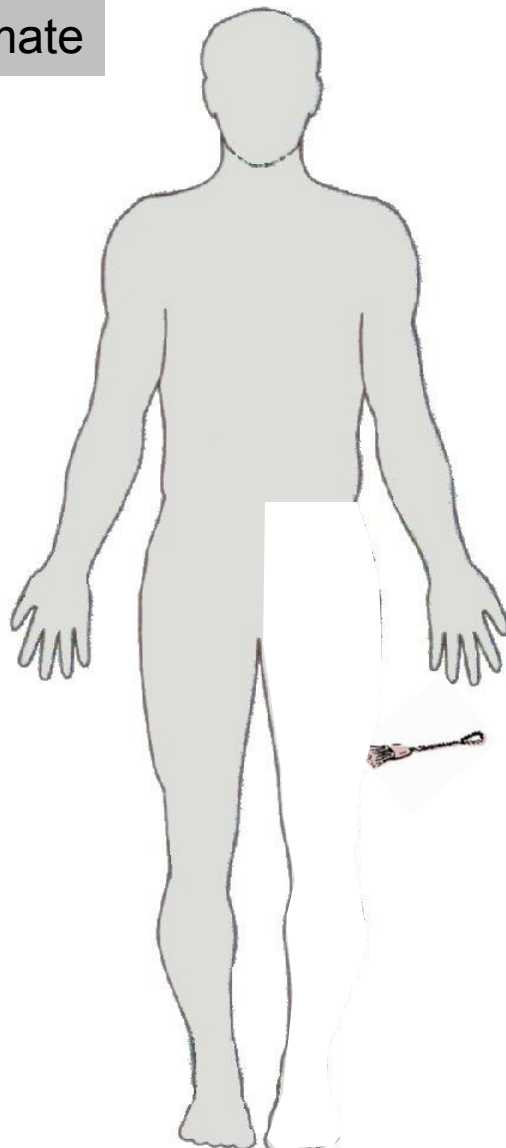
Dorsal column is intact on the right: light touch, two-point discrimination, proprioception, and vibration are WNL

Dorsal column is absent on the left: light touch, two-point discrimination, proprioception (limb position in space), and vibration are absent in all dermatomes below the umbilicus

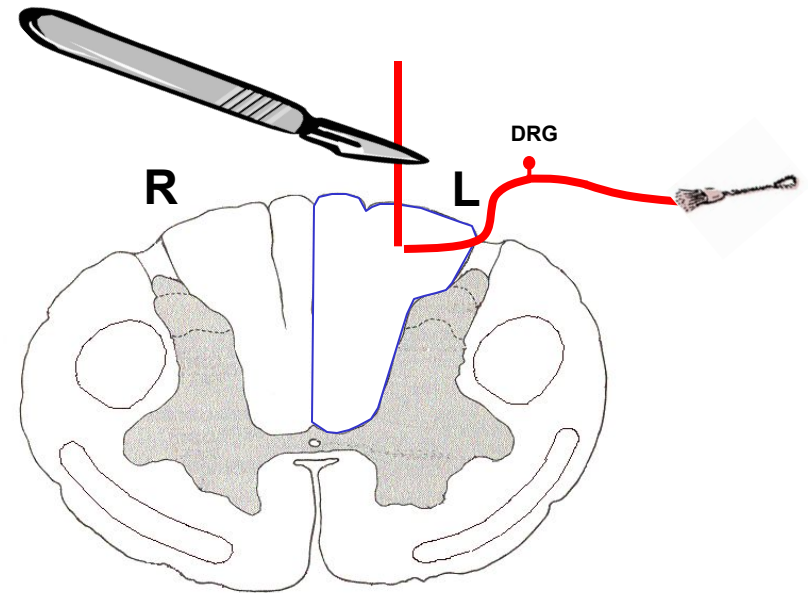
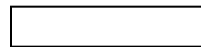
Lesion level, T10: the umbilicus is located in the T10 dermatome

Left Dorsal Column Lesion

Click to animate



T10



Dorsal column lesion

Ipsilateral loss of light touch,
vibration, and position sense

Review Questions: Case 2

After a fall from his horse, the patient was alert and oriented but unable to move anything but his head. He was unable to sense light touch or pain from the neck down. He could turn his head but shoulder shrug was weak. Speech was normal but respiration was labored and required a respirator.

Damage to what system(s) is causing this patient's problems?

Answer

Complete transection of the spinal cord (transverse lesion) at approximately C3 (Tetraplegia, Christopher Reeve)

Lateral corticospinal tracts absent, bilaterally, below C3: unable to move any body part except head and shoulder shrug (C3-5)

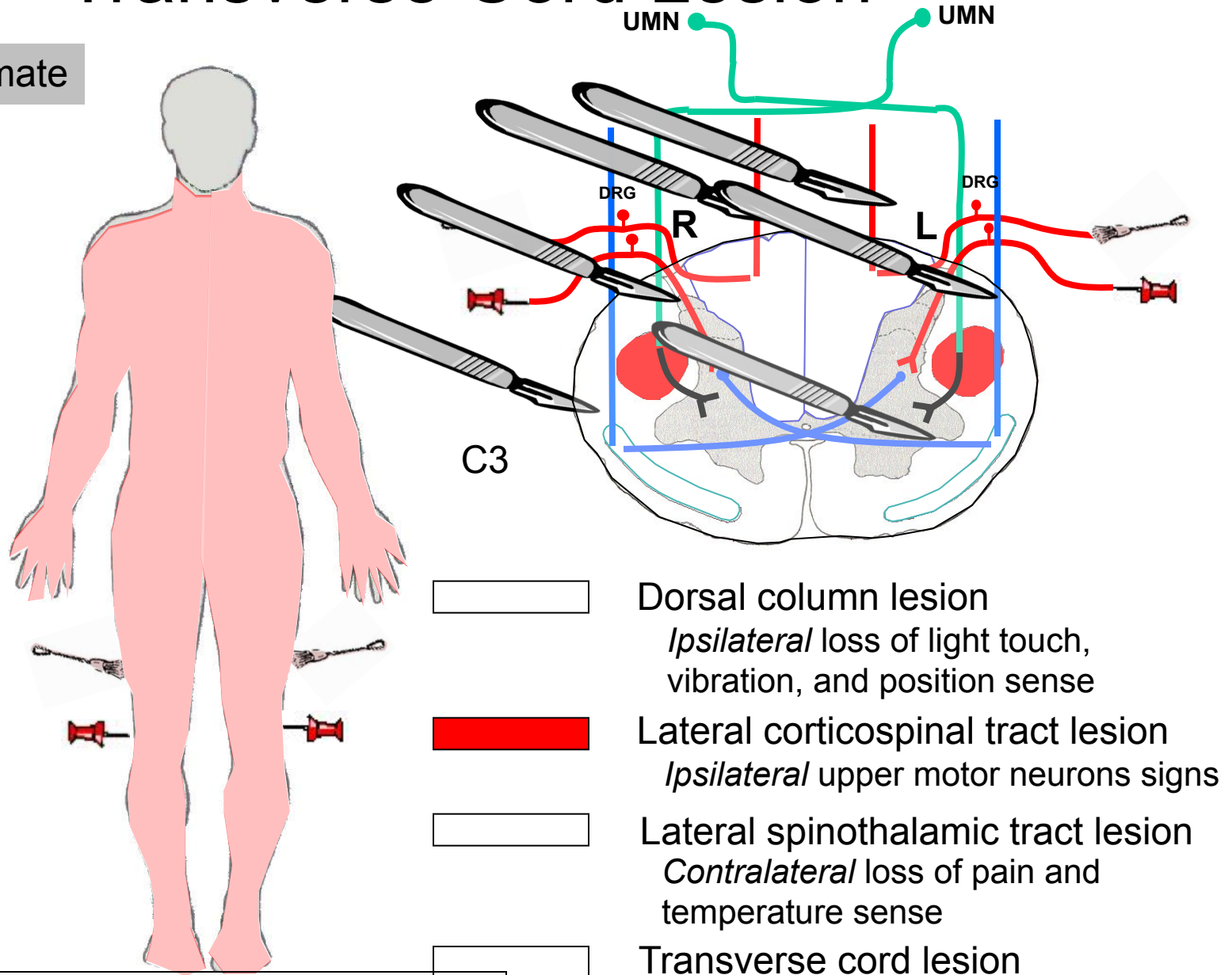
Dorsal columns absent , bilaterally, below C3: unable to sense light touch below neck

Lateral spinothalamic tracts absent, bilaterally, below C3: unable to sense pain below neck

Lesion level, C3: patient was alert and oriented (cortex and reticular activating system intact), he could turn his head (spinal accessory nerve), shoulder shrug and respiration were weak (shoulder elevator and respiratory muscles C3-5)

Transverse Cord Lesion

Click to animate



Review Questions: Case 3

Following surgical repair of a knife wound the patient is unable to stand or walk because he is unable to move or bear weight on his right leg. Light touch, position and vibration sense are WNL in the left lower extremity but absent in the right below the crest of the ilium. Active range of motion and strength are normal in the left lower extremity but absent in the right (hip, knee, and ankle). Pain and temperature sensation are intact in the right lower extremity but absent in the left below T12.

Damage to what system(s) is causing this patient's problems?

Answer

Hemisection of the spinal cord on the right at approximately L1

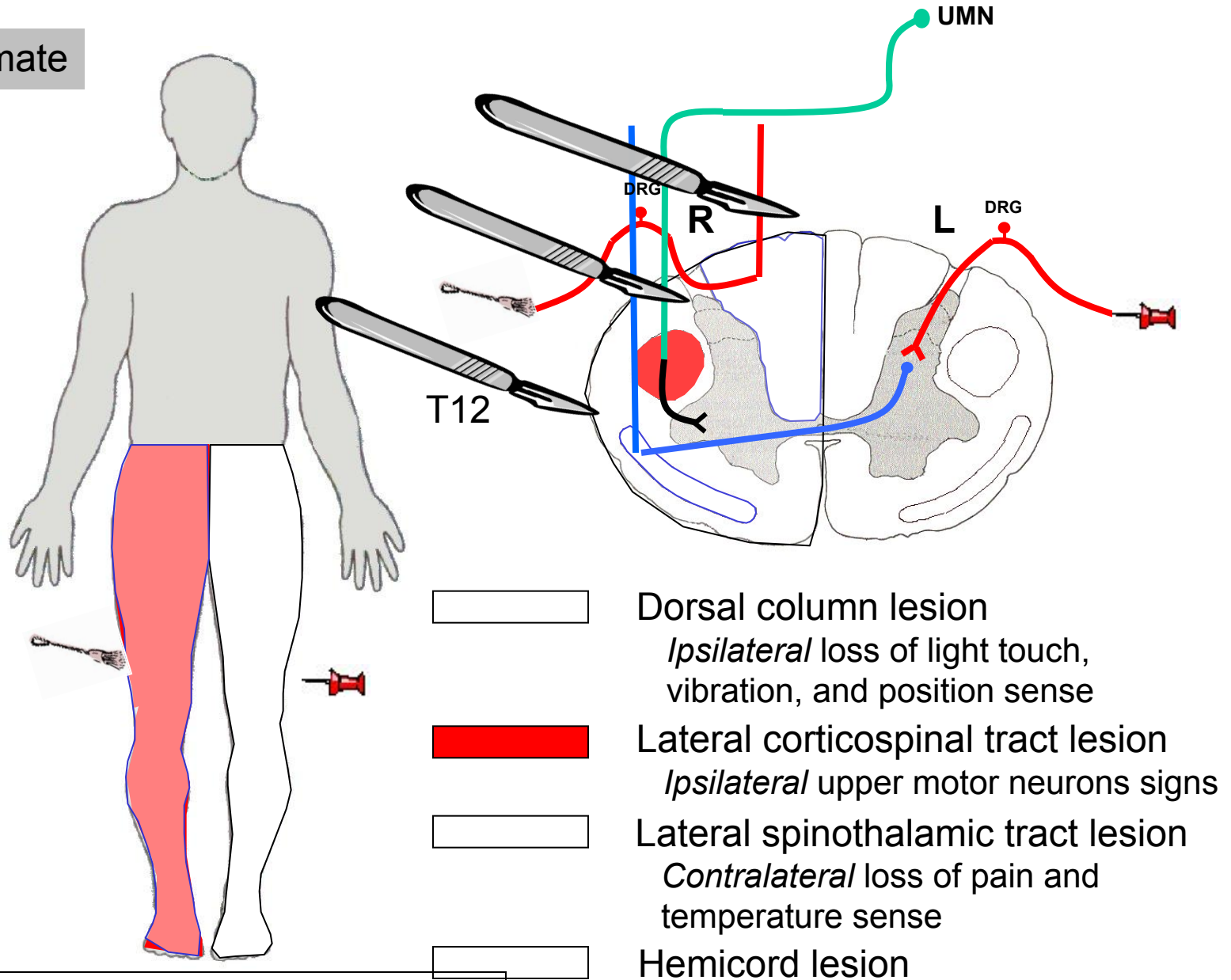
Dorsal column is intact on the left but absent on the right: light touch, position and vibration sense are WNL in the left lower extremity but absent in the right
Lateral corticospinal tract is intact on the left but absent on the right: active range of motion and strength are normal in the left lower extremity but absent in the right

Lateral spinothalamic tract is intact on the left but absent on the right: pain and temperature sensation are intact in the right lower extremity but absent in the left

Lesion level, approximately L1: hip flexion absent on right (L2), pain and temperature sense absent below T12

Hemicord Lesion (Brown-Sequard Syndrome)

Click to animate



The End

D. Michael McKeough, PT, EdD
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