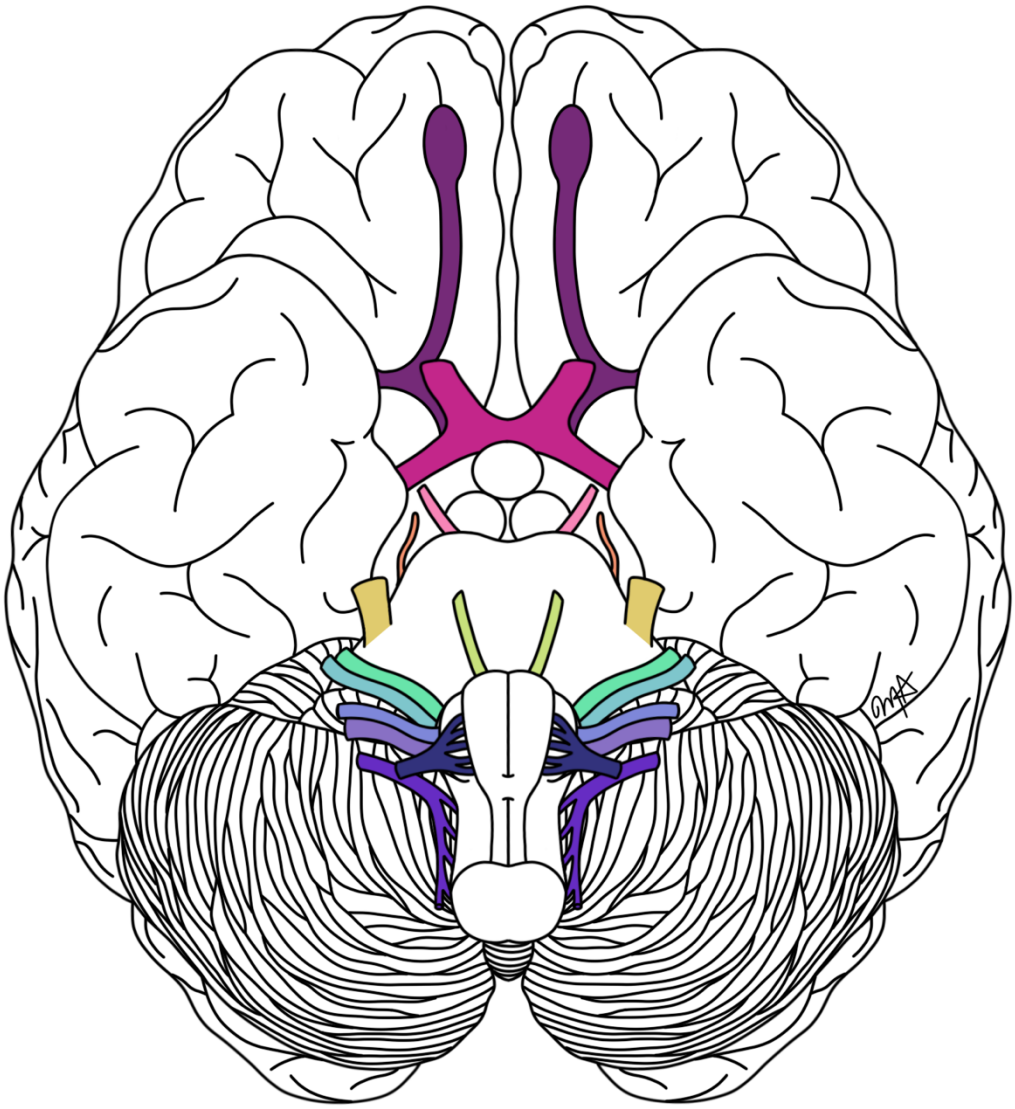
Clinical Neuroanatomy 🧠

ANAT 323 – Fall 2023

Lab Manual (Lab 4)



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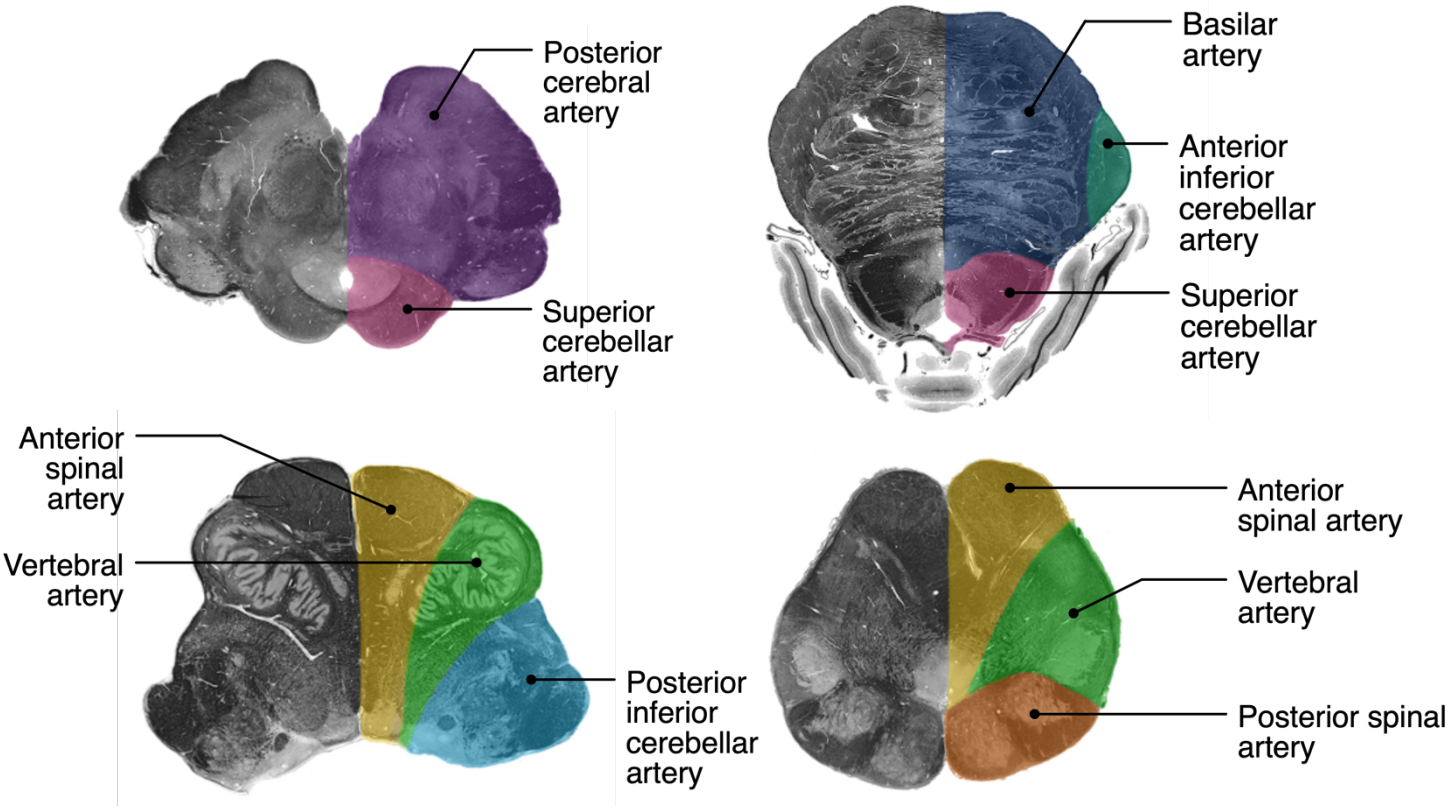
Lab 4: Sensory Clinical Cases & Pain

Learning Outcomes

- Relate blood supply patterns / perfusion areas to ascending pathway structures
- Apply your understanding of the principles of pain (e.g., pathways, modulation, referred pain, chronic pain) by explaining these concepts in patient-friendly language
- Apply your understanding of somatotopic organization & dermatomes to solve clinical scenarios
- Apply your understanding of major somatosensory pathways to solve clinical scenarios

Blood Supply and Ascending Pathways

Review these brainstem cross-sections and their associated blood supply from Lecture 5. Today, we will begin by making explicit connects between the perfusion areas of major arteries supplying the CNS and key structures within the dorsal column–medial lemniscus & spinothalamic pathways.



Hopefully the perfusion areas of the spinal cord, major subcortical structures, and cerebral cortex are still fresh in your minds from Lab 3, but you may also want to pull up those notes for reference!

Before we hop into the conscious somatosensory pathways, which artery (or arteries) supplies blood to the spinocerebellar tracts in the spinal cord?

Dorsal Column–Medial Lemniscus Structure	Blood Supply	Spinothalamic Pathway Structure	Blood Supply
Dorsal Roots / Rootlets		Dorsal Roots / Rootlets	
Dorsal Horn & Dorsal Column		Dorsal Horn	
Nucleus Gracilis + Nucleus Cuneatus		Anterior White Commissure	
Internal Arcuate Fibers		Spinothalamic Tracts	
Medial Lemniscus (Rostral Medulla)		Spinal Lemniscus (Rostral Medulla)	
Medial Lemniscus (Pons)		Spinal Lemniscus (Pons)	
Medial Lemniscus (Midbrain)		Spinal Lemniscus (Midbrain)	
Thalamus (Ventral Posterior Nuclei)		Thalamus (Ventral Posterior Nuclei)	
Posterior Limb of Internal Capsule		Posterior Limb of Internal Capsule	
1° Somatosensory Cortex (Lower Limb Area)		1° Somatosensory Cortex (Lower Limb Area)	
1° Somatosensory Cortex (All Other Areas)		1° Somatosensory Cortex (All Other Areas)	

Before we move on, let's try applying this knowledge by creating some hypothetical ischemic strokes and predicting the associated somatosensory deficits. Select two different arteries to 'block' (i.e., cut off blood supply) and then swap with a partner:

Artery #1:

Somatosensory deficit(s):

Artery #2:

Somatosensory deficit(s):

*Don't forget to specify the affected **modality / modalities**, **distribution**, and **side** in each answer!*

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Principles of Pain: Role-Play

For this short role-playing activity, you will be working in pairs (or groups of 3 if necessary). One of you will act as the healthcare professional (PT, OT, MD, DO, RN… entirely up to you!) and the other will act as the patient. Your challenge as the medical professional is to select one of the core principles of pain discussed during L8 and explain it to your patient without using any jargon or terminology that they do not understand. As the patient, it is your job to ask questions and catch your partner if any jargon does slip in.

> **Example:** if the healthcare professional says "… because they synapse on the same neurons," the patient might ask them to explain what a "synapse" is and what "neurons" are.

This is a fantastic exercise, not only for preparing for a career in healthcare where you are bound to encounter patients with different background knowledges, but also for preparing for the upcoming midterm exam. Being able to explain complex concepts in a way that a lay person with little or no background in the subject area can understand is a clear indicator that you know your stuff!

Here are some tips to get you started:

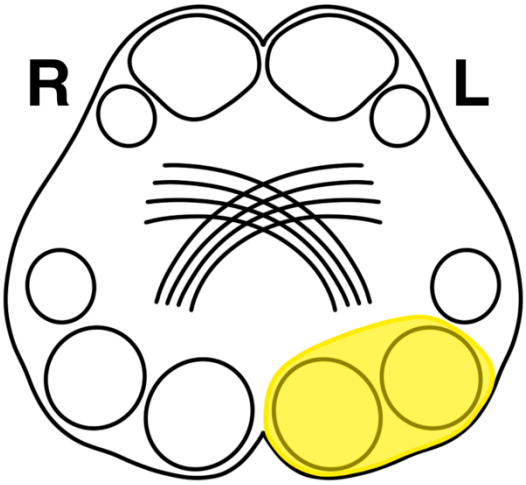
- **Meet your audience where they are**! Try not to make assumptions about what they do or do not know — don't be afraid to ask questions
- Harness the power of **real-life examples** (e.g., desensitization of mechanoreceptors → we don't feel our socks all day long) and **analogies** (e.g., white matter tracts vs peripheral nerves → highways vs on-/off-ramps)
- Break things up into **"bite-sized" pieces** — too much information in one go can easily become over-whelming (… remember Lecture 3?? 🙈)

Use the space below for notes:

More Somatosensory Clinical Cases

Case #1

A patient presents with a localized lesion to the yellow region shaded in the image to the right.



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a) What level of the brainstem is lesioned?

b) What vascular perfusion area is affected?
(i.e., what artery supplies the affected area)

c) Describe the somatosensory deficits that would result from this lesion.

Case #2

A 78-year-old, right-handed individual presented with mild confusion and some difficulty combining words correctly into sentences. They complained that they couldn't feel things (light touch, pin pricks, cold vs warm water, etc.) with their right arm—often finding it difficult to pick things up—and that the arm itself felt tingly at times. There were no sensory or motor deficits in the face, trunk, or legs. In which of the following locations is the lesion likely located?

a) Right superolateral aspect of the post-central gyrus
b) Right dorsal horns from spinal levels C5–T1
c) Left dorsal columns at the C5 spinal level
d) Left posterior limb of internal capsule
e) Left superolateral aspect of the post-central gyrus

Select TWO of the other options and thoroughly explain why they are incorrect:

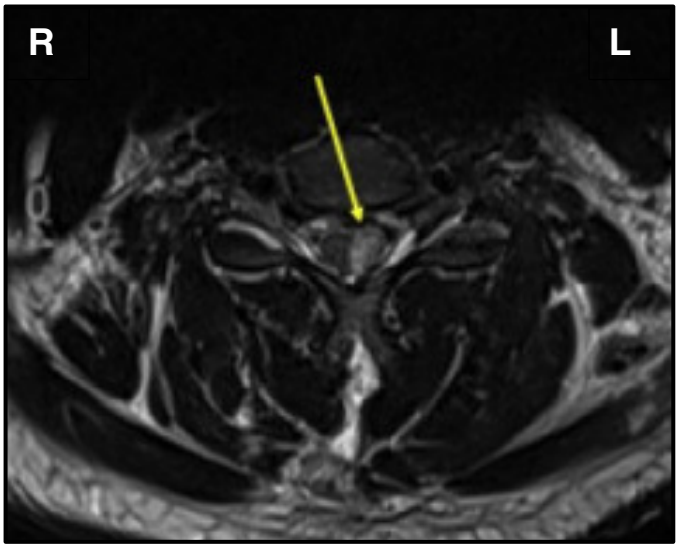
-
-

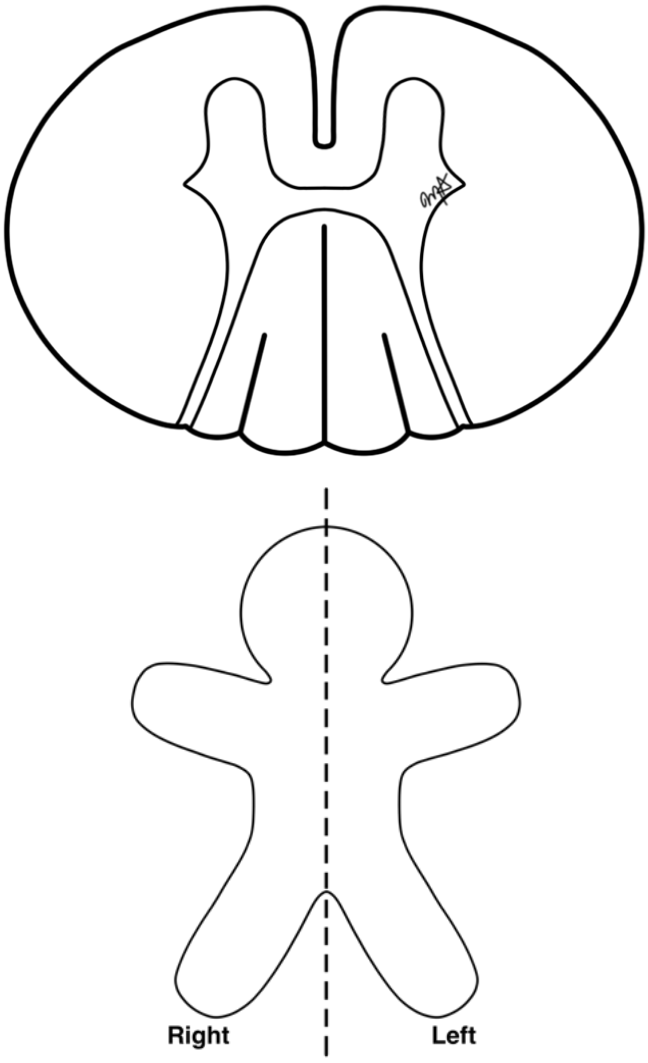
Case attribution: Cases 5-7 adapted from "Neuroanatomy through Clinical Cases", 2nd ed by Hal Blumenfeld, MD, PhD

Case #3

Hemicord syndrome (a.k.a., Brown-Séquard syndrome) is a syndrome in which one half (left or right) of the spinal cord is damaged at one or more spinal levels. Possible causes include traumatic injury or pressure exerted on the spinal cord by a growing tumour. The MRI image to the right shows the results of a perpendicular wound to the spinal cord resulting in a left hemicord transection (yellow arrow) at the T2 spinal level.

Use the template provided to illustrate the structures that have been damaged and describe the conscious sensory deficits with which this patient would present. There is also a little gingerbread person template to help you keep track of the symptoms!





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Case #4

Central cord syndrome is a common type of spinal cord injury with numerous possible etiologies, including the development of a fluid-filled cyst (called a syrinx), often within the central canal. This condition is known as syringomyelia, and a classic example is illustrated below:

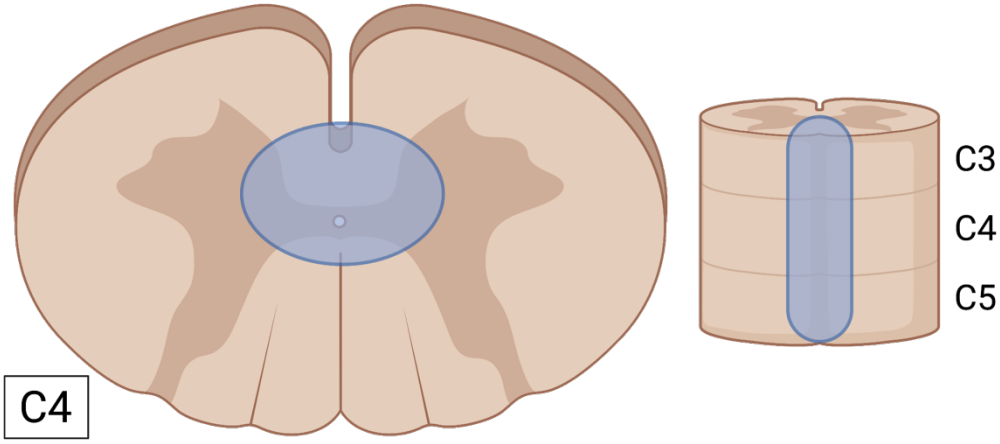

Image attribution: Created with BioRender.com

Based on the damage (shaded in blue), identify the major structure(s) affected by the syrinx and describe the resulting conscious sensory deficits with which a patient would present.

Extra credit: Applying your knowledge of somatotopic organization, how would outward expansion of the syrinx affect the spinothalamic tracts as the disorder progresses?

Extra Notes

Warning: Punny neuroanatomy joke below!

What did the doctor say to their patient who had an elephant sitting on their brain?

Answer: "It looks like you've got a lot on your mind!"