Allied Health Media OccupationalTherapy.com

If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.

Allied Health Media OccupationalTherapy.com

This handout is for reference only. It may not include content identical to the powerpoint.
Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date..

Applied Neuroanatomy: Motor Tracts for Occupational Therapy Practice

Andrew Persch, PhD, OTR/L, BCP

Presenter

Andrew C. Persch, PhD, OTR/L, BCP

Assistant Professor
Division of Occupational Therapy
The Ohio State University

andrew.persch@osumc.edu

4

Learning Objectives

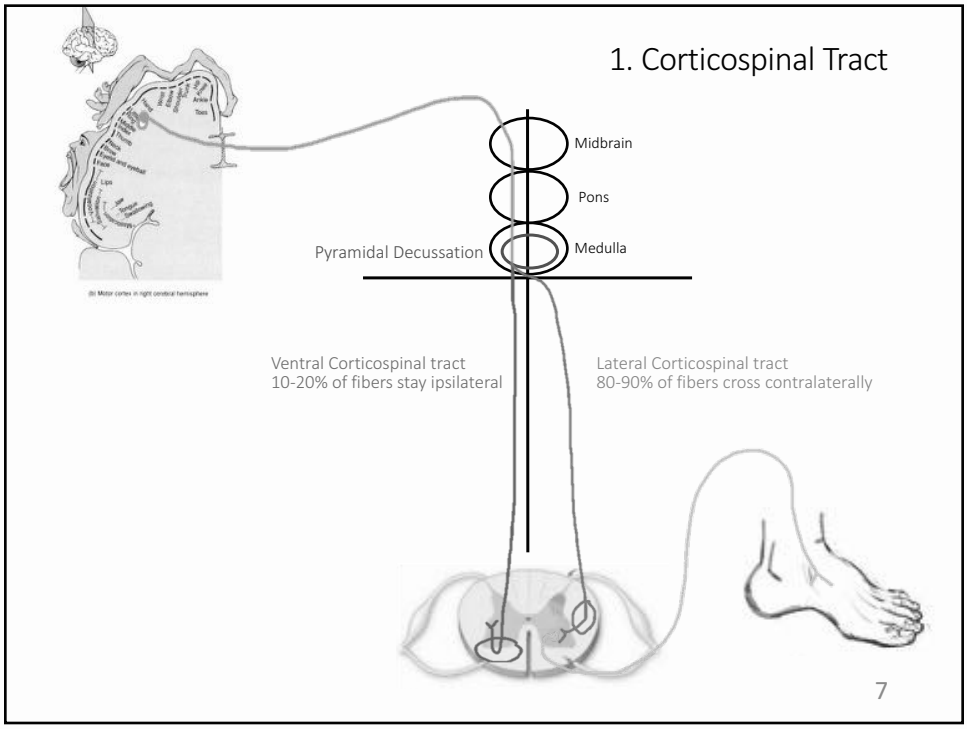
1. Define the neuroanatomical pathway of motor tracts in the human nervous system.
2. Identify the functions of individual motor tracts
3. Explain the functional relevance of individual motor tracts to occupational therapy practice

5

Agenda

Time Increment	Topic	Instructional Method
0-10	Introduction	Lecture
10-20	Corticospinal	Lecture
20-30	Vestibulospinal	Lecture
30-40	Reticulospinal	Lecture
40-50	Rubrospinal	Lecture
50-60	Conclusion, Q and A, Summary	Lecture

6



Corticospinal Tract Overview

- Responsible for voluntary motor control
  - Allows ***fractionation*** of movement – the ability to activate individual muscles independent of other muscles
- 1° neuron: Motor Cortex → Medulla
  - Passes through the corona radiata internal capsule
  - Tract splits at the pyramidal decussation
- Two pathways for 2° neuron:
  - Medulla → Lateral Corticospinal Tract
    - 80-90% of fibers **cross the midline** and descend as lateral corticospinal tract
  - Medulla → Ventral Corticospinal Tract
    - 10-20% of fibers continue on the **same side** and descend as the ventral corticospinal tract
  - These pathways both terminate in the ventral horn of the spinal cord at the level of the myotome
- 3° neuron: Ventral horn → Effectors

8

Corticospinal Tract Case Study

- Claude is a 65 y/o farmer who recently suffered a right-sided MCA stroke.
- The stroke resulted in left-sided hemiparesis, mild sensory deficits, and impaired sequencing and problem-solving.
- He was recently discharged from the acute care hospital and is being transferred to an inpatient rehabilitation setting for further evaluation and treatment.
- Claude is eager to return to his farm, where he hosts a fall festival every year for the local community.
- Before going home, however, he needs to improve his cognitive function and the strength and mobility of his left side.

9

Corticospinal Tract Case Study

Evaluation

- Active range of motion to determine what movements are affected and need to be targeted in therapy
- Manual Muscle Test to assess strength
- Fugl-Meyer Assessment to assess motor functioning, balance, strength, and joint functioning
  - Assessment that is specific to the stroke population
  - Allows the clinician to observe isolated muscle movements or presence of pathological synergies
- Functional skills assessment and observation

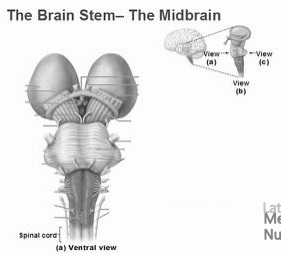
10

Corticospinal Tract Case Study

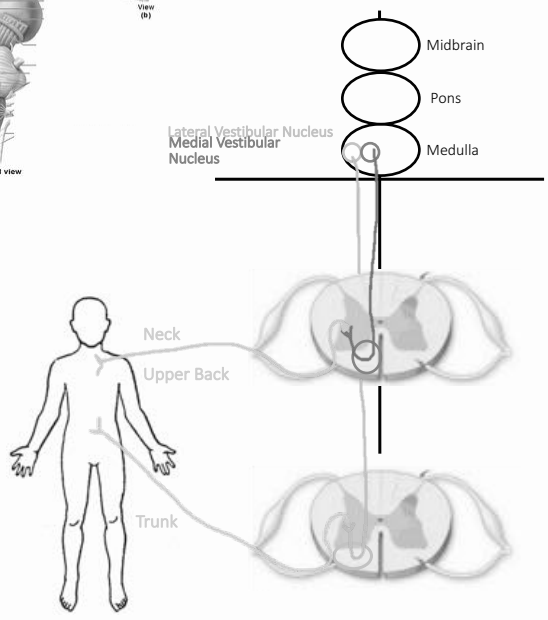
Treatment Options

- Neuro-reeducation
  - PROM exercises to maintain mobility and reduce risk of contractures
  - AROM exercises to improve movement and strength
  - Functional skills training
    - Dressing, feeding, grooming, setting the table, etc.
    - What are some activities that are needed for farming that can be simulated in a therapy setting?
- Compensation
  - Adaptive techniques for donning clothes, bathing, opening containers with limited use of one hand
  - Adaptive equipment, such as elastic laces, long-handled sponge, shower chair to improve independence in self-care
- Safety training
  - Ensure that Claude knows his limitations when it comes to balance, mobility, and functioning

11



2. Vestibulospinal Tract



12

Vestibulospinal Tract Overview

- Controls balance, posture, and head stabilization
- Two separate pathways
  - Medial Vestibulospinal Tract
    - Medial Vestibular Nucleus in Medulla → Descends medially → Synapses with LMN in ventral horn
    - Control of neck and upper back
  - Lateral Vestibulospinal Tract
    - Lateral Vestibular Nucleus in Medulla → Descends anteromedially → Synapses with LMN in ventral horn
    - Control of trunk and lower back (posture)

13

Vestibulospinal Tract Case Study

- Heather is a 37 y/o woman who was involved in a motor vehicle accident.
- She sustained several bone fractures and was in a coma for 3 weeks following the crash.
- During this time, she scored an 8 on the Glasgow Coma Scale, indicating severe brain injury.
- Heather has now regained consciousness and she is preparing to transfer to an inpatient rehabilitation unit.
- When occupational and physical therapy most recently assessed her, they noted that she has difficulty maintaining her balance during transfers and sudden changes in position.
- She has good static balance when seated, but she has a very slumped posture and needs assistance to achieve a fully upright position.
- She chooses to walk around her hospital room independently, but the therapists observed that she is unsteady on her feet.
- Although she has not fully lost her balance, they are concerned about her risk for falls.

14

Vestibulospinal Tract Case Study

Evaluation

- Postural assessment
  - Observe Heather's posture when she is seated and when she stands
    - Use a postural grid if necessary
  - Get a better understanding of her perception of her posture
    - Is her poor posture due to weakness or lack of body awareness?
    - Can she correct her posture with prompting?
- Balance assessments
  - Berg Balance Scale - gold standard of functional balance tests
  - Functional Reach Test (seated and standing)
  - Timed Up and Go (TUG)
  - Functional assessment of sitting and standing balance - static and dynamic
    - Make it measurable using FIM language or amount of time the individual is able to maintain position independently

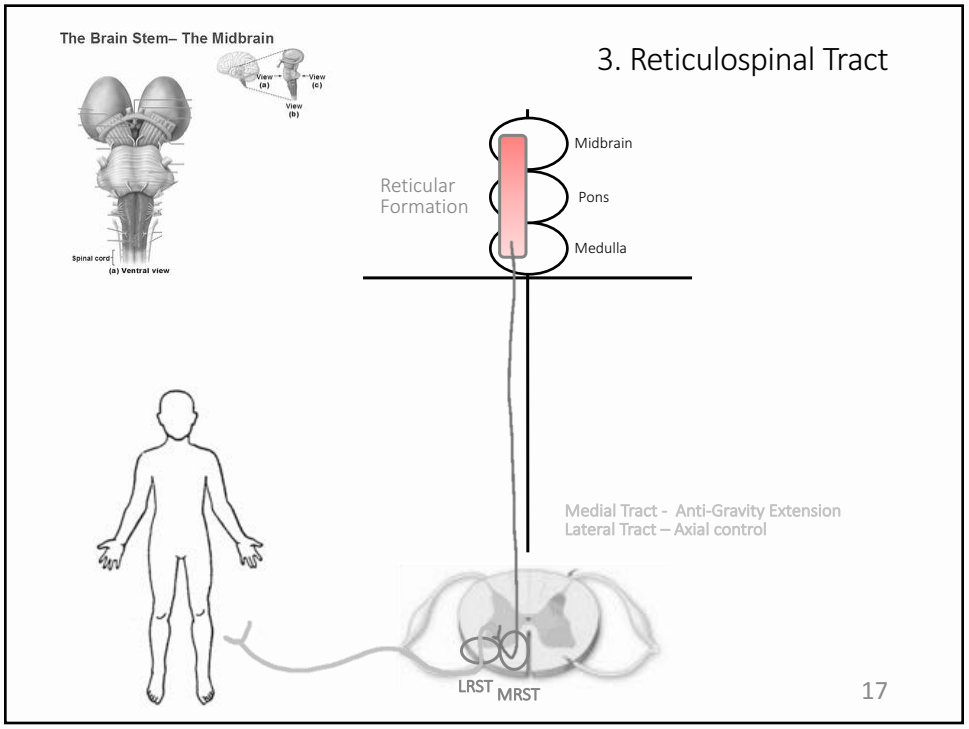
15

Vestibulospinal Tract Case Study

Treatment

- Postural control
  - Begin all activities in neutral, upright alignment
  - Use visual input (mirror, aligning self with straight edge) to encourage Heather to correct her posture on her own
- Seated weight shifting and balance activities
  - Plan activities that encourage Heather to reach to out front, to either side, to the floor, and over each shoulder
  - Ex. Sorting laundry from left to right side, picking up dropped cards, reaching for food items across a large table
- Standing weight shifting and balance activities
  - Plan activities that encourage Heather to reach in all directions from a standing position
  - Ex. Making the bed, putting away dishes on high shelves, picking up dropped laundry
- Introduce adaptive equipment, such as a walker or shower chair, to promote Heather's safety

16



Reticulospinal Tract Overview

- Postural control, overall muscle tone, bilateral motor control
- Two separate pathways
  - Medial Reticulospinal Tract
    - Reticular formation → descends medially → synapses with LMN in ventral horn
    - Control of antigravity extension = posture
  - Lateral Reticulospinal Tract
    - Reticular formation → descends laterally → synapses with LMN in ventral horn
    - Control of axial extension = bilateral gross motor control, stepping pattern generator

18

Reticulospinal Tract Case Study

- Jamie is a 4 y/o girl with myelomeningocele spina bifida that affects the function of her trunk and lower limbs.
- She is a very active child, and she loves to have play dates with her neighborhood and preschool friends.
- She is able to walk around her home and classroom with modified independence using a walker.
- Her parents used to use a stroller for longer distances, but Jamie has been needing this less and less in the last few months as she gains strength and endurance.
- Jamie also uses a special supportive chair during mealtimes and seated activities to help her maintain her posture.
- This fall, Jamie will be enrolled in kindergarten.
- Her parents want her to be able to participate in the classroom and on the playground at recess as much as possible.

19

Reticulospinal Tract Case Study

Evaluation

- Postural assessment
  - Observation – Look at Jamie's posture and positioning as she uses her seating aide at home and at a desk in school
- Environmental assessment
  - Assess the school environment including the classroom, hallways, and playground to determine how Jamie can get around with her walker

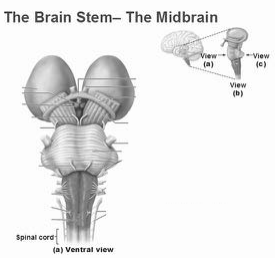
20

Reticulospinal Tract Case Study

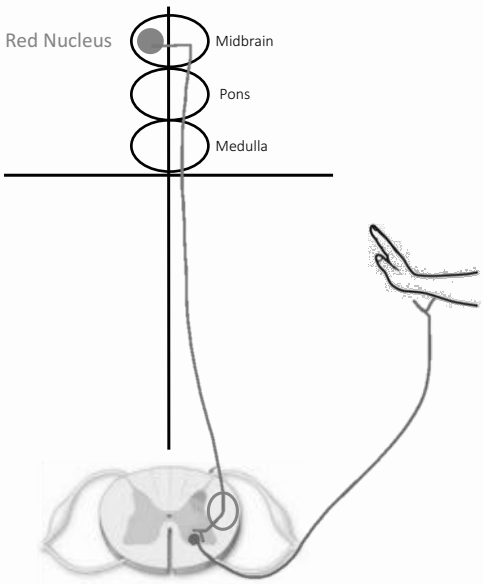
Treatment

- Positioning
  - Make recommendations for seating aids that can be used in Jamie's desk chair at school to promote her participation in desk work.
  - If Circle Time is a big part of her kindergarten classroom, what sort of seat will best support Jamie while still letting her engage with her classmates?
- Environmental modifications
  - Work with the teacher to rearrange the classroom's set up so Jamie can safely and easily navigate the space with her walker.
- Help facilitate play between Jamie and her classmates during free time in the classroom and at recess.

21



4. Rubrospinal tract



22

Rubruspinal Tract Overview

- Extends wrist and fingers
- Pathway
  - Red Nucleus in the midbrain → Ventral Horn → LMN to wrist and fingers
  - Crosses the midline immediately in the midbrain, then descends contralaterally all the way down to the lateral column space of the spinal cord

23

Rubrospinal Tract Case Study

- Jamal is a 17 y/o high school student.
- He is a very involved student both academically and in his extra curricular activities.
- He has good grades, plays piano for the school's musical productions, and he is the co-captain of the tennis team.
- A few weeks ago as Jamal was biking home from tennis practice, he collided with another biker and sustained a fracture his right humerus.
- The fracture occurred in the shaft of the humerus and caused damage to his radial nerve.
- Now Jamal has wrist-drop and has difficulty extending his right wrist and fingers.
- He is worried about how this will affect his ability to write and play piano in the school's spring musical, Cats.
- His physician referred him to an a certified hand therapist for further evaluation and treatment.

24

Rubrospinal Tract Case Study

Evaluation

- Pain assessment
- Measure active range of motion in elbow, wrist, and fingers to see if any residual movement is present
- Assess pinch and grip strength
  - Mechanical pinch gauge
  - Hydraulic hand dynamometer

25

Rubrospinal Tract Case Study

Treatment

- Primary treatment goal is to facilitate the return of function as the nerve regenerates
  - Nerves regrow at a rate of 1 mm per day (1 inch per month)
- Range of motion
  - Passive and active assisted range of motion exercises to maintain mobility
  - Try movements in a gravity eliminated position to make them easier for the patient
- Wrist-drop splint to promote function as the nerve regenerates
  - Have Jamal practice functional tasks with this splint on

26

Questions?

andrew.persch@osumc.edu

27