Spinal tracts

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Spinal cord overview







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Motor (descending) tracts





Tracts high yield

- Does it decusate? Where?
- What anatomical structures does it run through?
- Where in internal capsule does it run?
- Where in the spinal cord does it run?
- What fasciculus? What lemniscus?
- Any nucleuses involved?

• Where does it synapse?



CORTICOSPINAL TRACT

THE MOTOR SYSTEM











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Corticospinal Tract





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Descending monoamine axons (noradrenergic, serotongergic) Descending fibers from hypothalamus and brain stem to spinal cord



Corticobulbar

- Innervates brainstem LMN
- <u>Genu</u> of internal capsule
- Provides both ipsi <u>and</u> contralateral innervation except for lower half of the facial nucleus (contralateral only)
- CN V, VII, IX, X, XI, XII



SPINAL CORD	MEDULLA	PONS	MIDBRAIN	DIENCEPHALON	TELENCEPHALON
Lower Motor Neurons	XII (X IX n. ambiguus)	VII V motor			
Corticobulbar Tract					
	$\langle \langle \langle \rangle$	\prec \prec	Cerebral Peduncle	Genu Internal Capsule	1°and 2° Motor Cortex Lateral Portion
	11	11			



Muscles of facial expression

Facial nerve lesion:
Ipsilateral upper and lower muscle paralysis

 Corticobulbar tract lesion:
Ipsilateral: nothing
Contralateral: Lower facial muscles weakness



Facial nerve lesion



Corticobulbar tract lesion

• Usually from a stroke



Facial Weakness

Lower motor neuron (Bulbar palsy)

- Bell palsy (CN VII lesion)
- Weakness of *ipsilateral upper and lower face*
- Usually due to a viral infection of CN VII

Upper motor neuron (Pseudobulbar palsy)

- Weakness of *contralateral lower face*
- Usually due to a stroke in the contralateral motor cortex or genu of the internal capsule



Upper motor neuron lesion vs lower motor neuron lesion

UMN:

- Weakness (paresis)
- Spasticity (increased muscle tone)
- Hyperreflexia (exaggerated reflexes)
- Positive Babinski sign
- Clonus (involuntary muscle contractions)
- No muscle atrophy (except in chronic cases)
- Muscle strength decreased, but muscle bulk generally preserved

LMN:

- Flaccid paralysis (weakness)
- Hypotonia (decreased muscle tone)
- Hyporeflexia or areflexia (absent reflexes)
- Severe muscle atrophy (muscle wasting)
- *Fasciculations* (muscle twitches)



Lower Motor Neurons

NUCLEUS	NERVE	TARGET
Ventral horn of SC	Spinal nerves	Limb and trunk musculature
Oculomotor	CN III	Extraocular muscles: SR, IR, MR, IO, Levator palpebrae
Trochlear	CN IV	Superior oblique muscle
Abducens	CN VI	Lateral rectus muscle
Trigeminal motor	CN V	Muscles of mastication
Facial	CN VII	Muscles of facial expression
Ambiguus	CN IX, X	Pharyngeal and laryngeal muscles
Spinal accessory	CN XI	Sternocleidomastoid and trapezius muscles
Hypoglossal	CN XII	Tongue musculature



SENSORY TRACTS



Sensory (ascending) tracts

SENSORY SYSTEM – GENERAL SCHEME





Epicritic (dorsal column)

- Fine touch, position sense, vibration
- Dorsal column
- Medial lemniscus in brain stem
- Nucleus VPL in thalamus
- Postcentral gyrus (medial)
- Also called medial lemniscus dorsal column pathway



THE SENSORY SYSTEM









Protopathic (spinothalamic)

- Pain (fast and slow) and temperature
- Ventro-lateral funiculus of SC
- Spinal lemniscus in brain stem
- Nucleus VPL of thalamus
- Post central gyrus (medial)
- Also called the spinothalamic pathway

Slow pain: C fibers

Fast pain: Alpha fibers



THE SENSORY SYSTEM





THE SENSORY SYSTEM



Protopathic Somatosensory System





Trigeminal sensory system



THE SENSORY SYSTEM



Other tracts



Taste

CRANIAL NERVE	GANGLION	REGION OF INNERVATION
VII	Geniculate	Anterior 2/3 of tongue
IX	Petrosal	Posterior 1/3 of tongue
X	Nodose	Epiglottis



THE SENSORY SYSTEM





Auditory







Primary auditory cortex

- Medial geniculate
- Inferior colliculus
- Superior olive
- Cochlear nucleus



Vestibular system









Visual Field Defects



Visual Field Defects

LESION	VISUAL FIELD DEFECT
Optic nerve	Ipsilateral monocular blindness
Optic chiasm	Bitemporal hemianopsia
Optic tract (very rare)	Contralateral homonymous hemianopsia
Lateral geniculate nucleus	Contralateral homonymous hemianopsia
Temporal optic radiations	Contralateral superior quadrantanopsia
(Meyer's loop)	(pie-in-the-sky defect)
Parietal optic radiations	Contralateral inferior quadrantanopsia (pie-in-the-floor defect)
Occipital cortex	Contralateral homonymous hemianopsia



Clinical relevance



Brown-Sequard Syndrome





Brown-Séquard Syndrome Effects

- Ipsilateral (Same Side) Effects:
 - Motor paralysis/weakness (hemiparesis) Corticospinal tract
 - Spasticity Upper motor neuron involvement
 - Loss of fine touch, proprioception, vibration Dorsal column
- Contralateral (Opposite Side) Effects:
 - Loss of pain, temperature, crude touch Spinothalamic tract







Stroke

- A patient presents to the emergency department with signs of a stroke
- Symptoms: Acute onset of weakness in upper limbs>lower limbs
- He is sent for a CT to exclude hemorrhage





Can we predict the artery occluded?

Lateral Brain



Medial Brain







Homunculus



Occlusion of the MCA





