

Neurogenic Shock in an Acute Stroke Patient: A Case Study

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Objectives

1. Examine the signs and symptoms of brainstem infarction.
2. Review brainstem anatomy.
3. Relate brainstem injury to neurogenic shock.



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Presentation

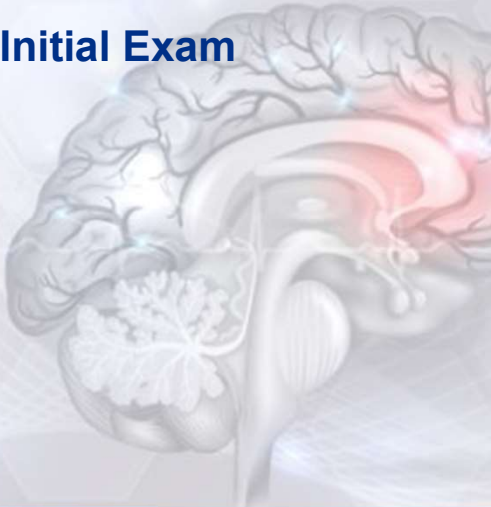
72 yo male arrives by PV @ 18:21
CC: right sided weakness and numbness, drooling, right gaze

Last known normal: 14:00
Sudden onset dizziness and inability to see in both eyes

PMH: CAD, CHF, HLD, HTN, stable angina, GERD, AIS 2018, on Eliquis for unknown dx




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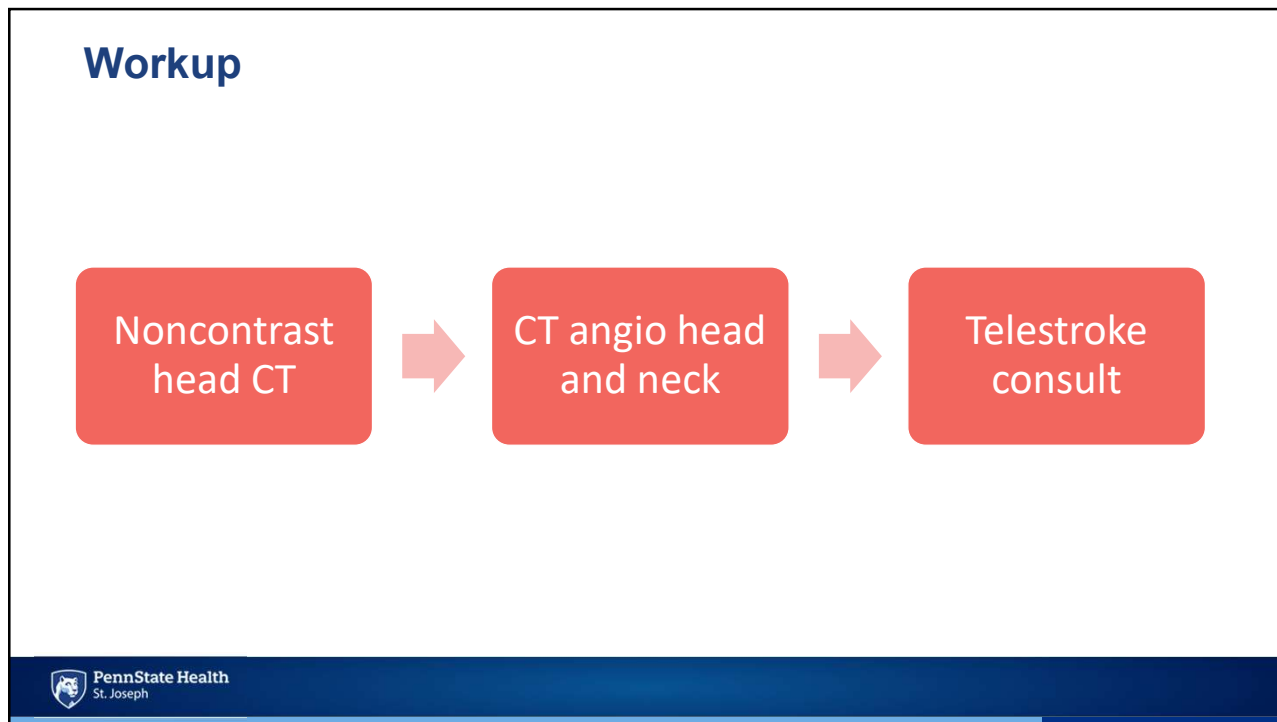


Initial Exam

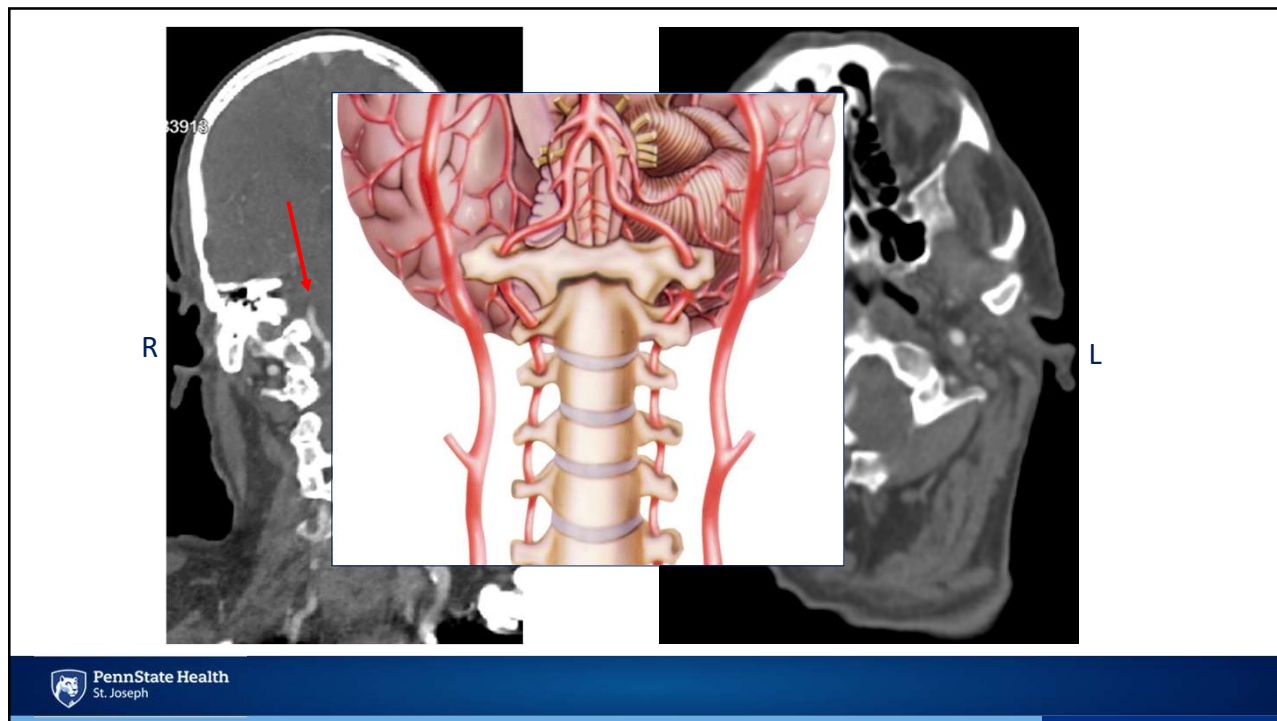
- Alert, mild distress
- PERRL, EOM intact
- CV- Regular rate and rhythm
- Resp- clear to auscultation, non-labored
- Neuro- tries to mumble name, off-on difficulty clearing secretions



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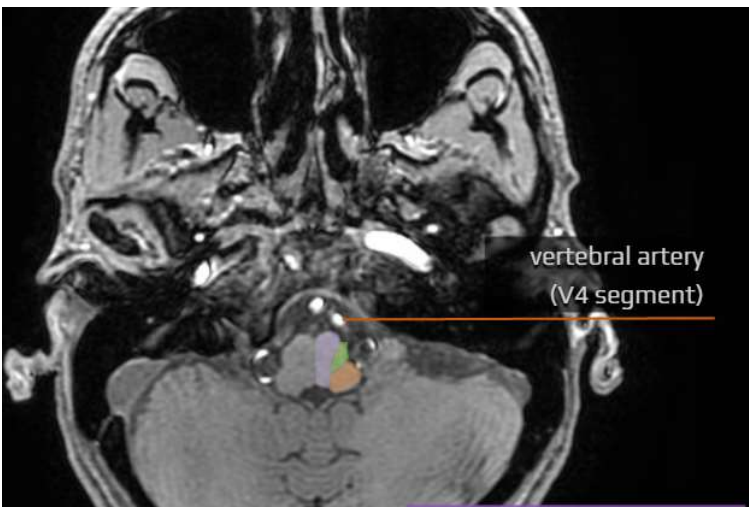
Vertebral Artery Circulation

Anterior medullary branches

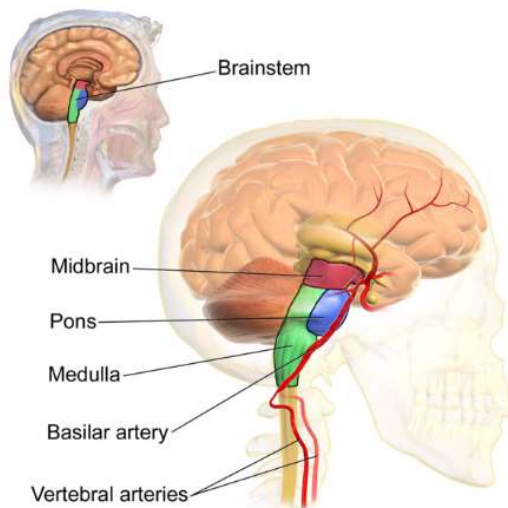
Corticospinal tract,
reticular formation,
hypoglossal nucleus,
pyramidal tract,
medial lemniscus

Lateral medullary branches

Spinothalamic tract,
spinocerebellar tract,
vestibulocochlear
nucleus, trigeminal
nucleus



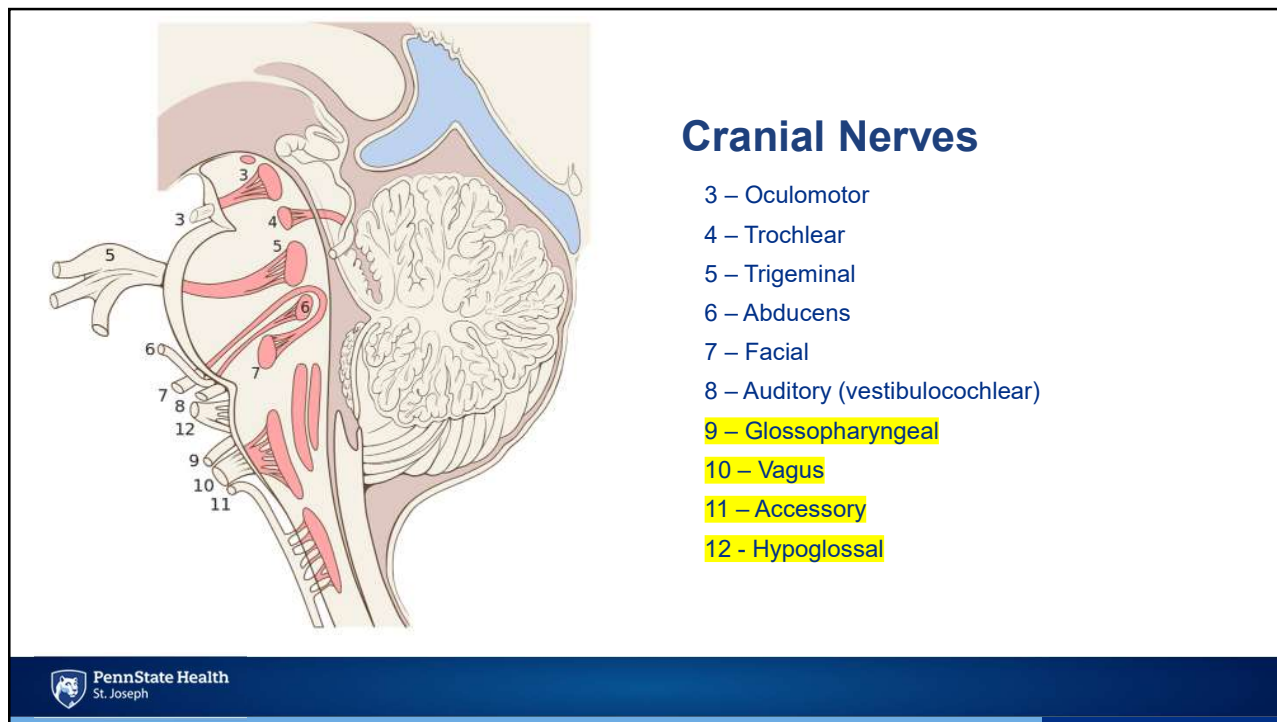
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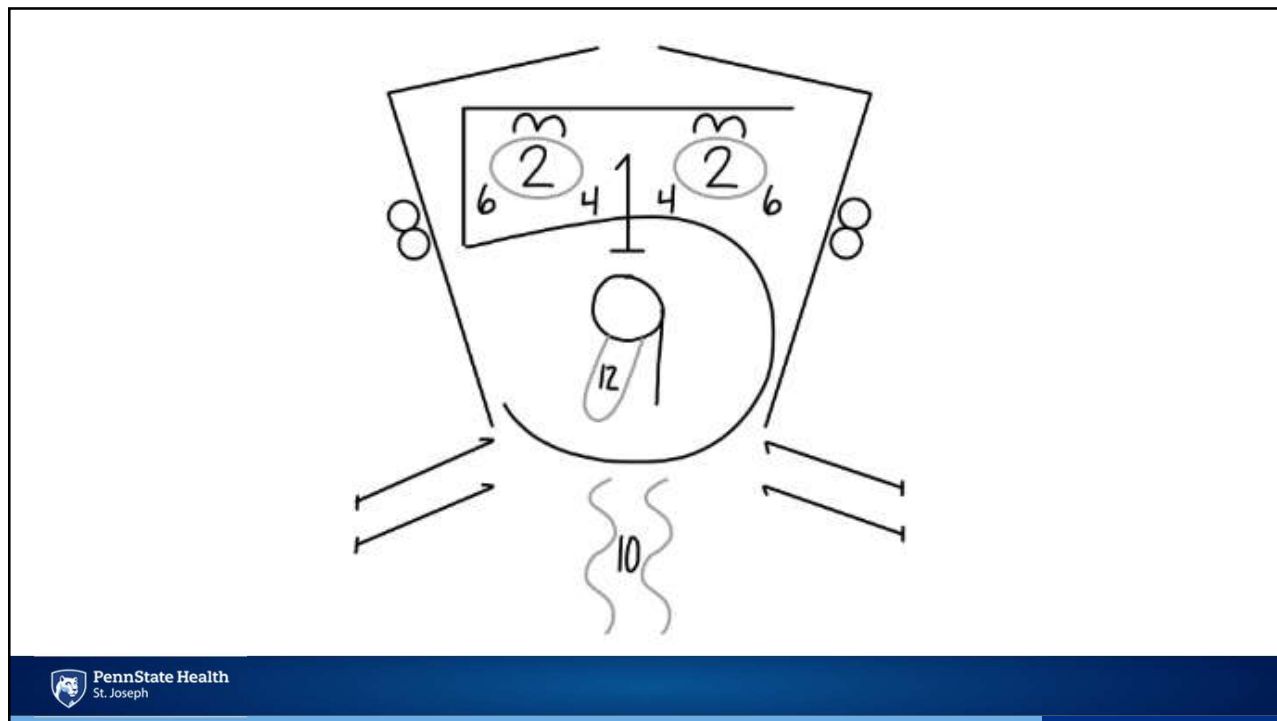
Medulla Essential Functions

1. Cardiovascular-respiratory regulation
2. Descending motor tracts
3. Ascending sensory tracts
4. Origin of cranial nerves IX, X, XI, XII

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Neurology Evaluation

NIHSS = 7

Gaze deviation

Partial hemianopia

Minor facial asymmetry (left facial droop)

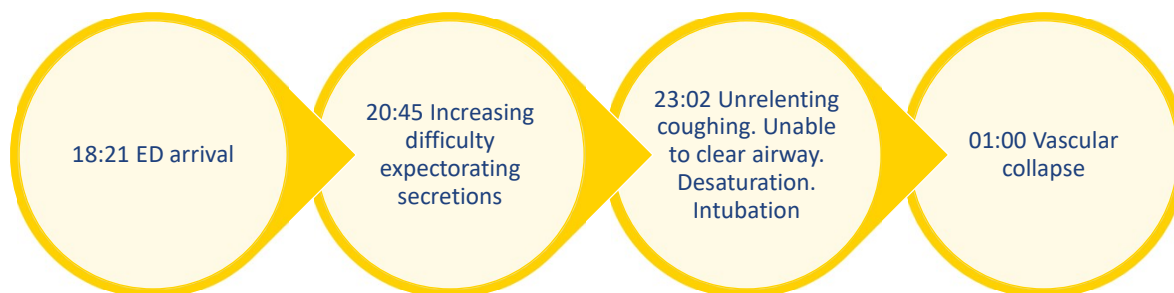
Mild aphasia

Unintelligible speech

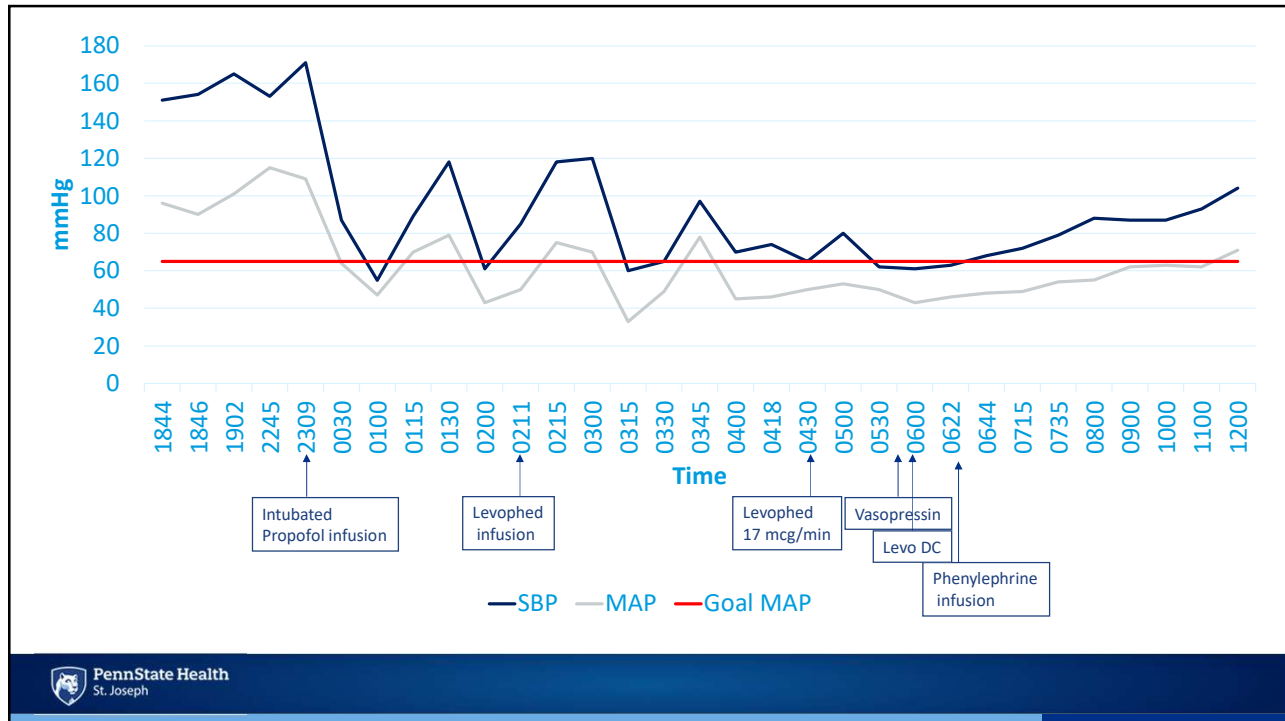
Impaired closure of the right eye compared to the left. Frequent coughing during exam.

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The decline



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Distributive Shock

- “State of relative hypovolemia resulting from pathological redistribution of absolute intravascular volume...”
- Causes:
 1. Loss of regulation of vascular tone
 2. Disordered permeability

Neurogenic Shock

- “state of imbalance between sympathetic and parasympathetic regulation of cardiac action and vascular smooth muscle”

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            graph TD
            A[Loss of sympathetic tone] --> B[Massive vasodilation]
            B --> C[Venous dilation]
            B --> D[Arteriolar dilation]
            C --> E[↓ Venous return]
            E --> F[↓ Stroke volume]
            F --> G[↓ Cardiac output]
            G --> H[↓ Tissue perfusion]
            D --> I[↓ Peripheral vascular resistance]
            I --> H
            
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<h2 style="color: #0056b3; margin: 0;">Sympathetic</h2> <div style="background-color: #f1c232; height: 20px; width: 100%; margin-bottom: 10px;"></div> <div style="background-color: #fff9c4; width: 10%; height: 15px; margin-bottom: 10px;"></div> <ul style="list-style-type: none"> <input type="checkbox"/> Fight or flight <input type="checkbox"/> Preganglionic fibers arise from thoracic and lumbar region forming the thoracolumbar outflow <input type="checkbox"/> Secretes adrenaline or noradrenaline <input type="checkbox"/> Nerves are adrenergic <input type="checkbox"/> Result is excitatory 	<h2 style="color: #0056b3; margin: 0;">Parasympathetic</h2> <div style="background-color: #f1c232; height: 20px; width: 100%; margin-bottom: 10px;"></div> <div style="background-color: #fff9c4; width: 10%; height: 15px; margin-bottom: 10px;"></div> <ul style="list-style-type: none"> <input type="checkbox"/> Rest and digest <input type="checkbox"/> Preganglionic fibers arise from midbrain and sacral regions forming the craniosacral outflow <input type="checkbox"/> Secretes acetylcholine <input type="checkbox"/> Nerves are cholinergic <input type="checkbox"/> Result is relaxation
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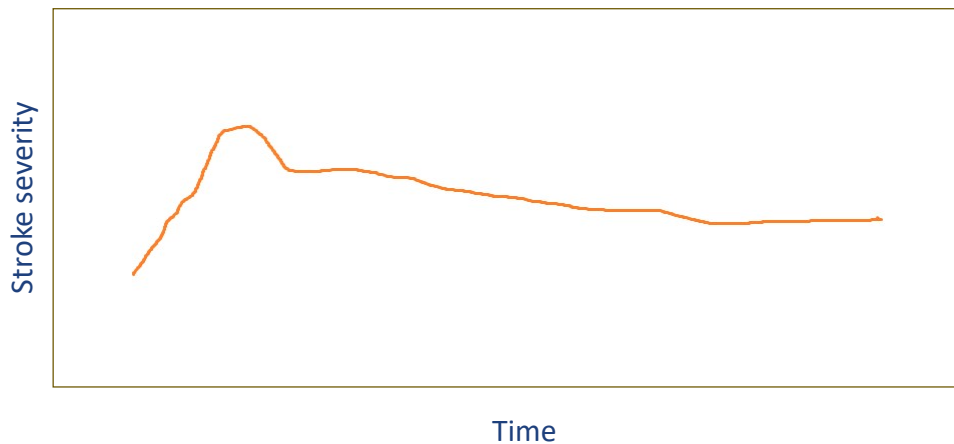
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Vasopressor options

Drug	Indication	Main effect	Important adverse effects
Norepinephrine	All types of shock with reduced vascular resistance	Alpha1 and Beta1 receptor agonist. Alpha1 dominates at doses > 3 mcg/min.	peripheral ischemia, reflex bradycardia, cardiac arrhythmias
Vasopressin	Shock states, especially septic shock, when norepi does not achieve goal and volume has been replaced	V1-mediated (catecholamine-independent) vasoconstriction	ischemia, reduced cardiac output, bradycardia, tachyarrhythmia, hyponatremia
Phenylephrine	Hypotension primarily attributed to vasodilation	Alpha-1 adrenergic receptor agonist resulting in raised MAP via vasoconstriction in both veins and arteries enhancing preload	Baroreceptor mediated reflex bradycardia

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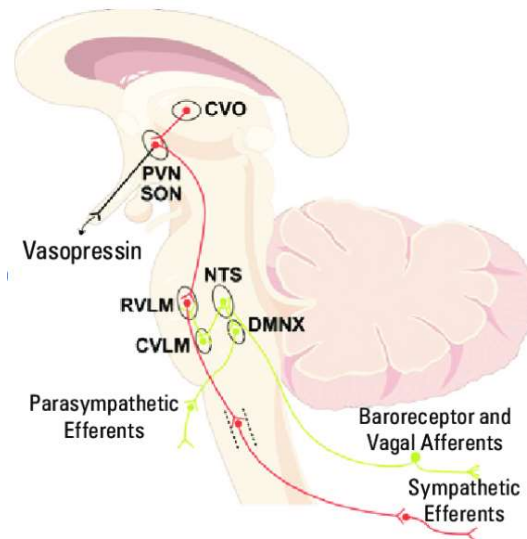
Stroke Evolution



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Patho-mechanism

- NA- nucleus ambiguus
 - cluster of motor neurons innervating the pharynx, larynx and soft palate
 - Result: swallowing and speaking
- RVLM- rostral ventrolateral nucleus
 - controls blood pressure and blood distribution
- NTS- nucleus tractus solitarius
 - sensory nucleus receiving and processing visceral afferent signals from the body
 - Result: vomiting response



Autonomic regulation of BP. Key CNS nuclei: Nucleus tractus solitarius (NTS), caudal ventrolateral medulla (CVLM) and rostral ventrolateral medulla (RVLM), and the dorsal motor nucleus of the vagus (DMNX). Peripheral stimuli can influence BP through interactions with circumventricular organs (CVO), paraventricular nucleus (PVN), and supraoptic nucleus (SON).

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The final diagnosis



References

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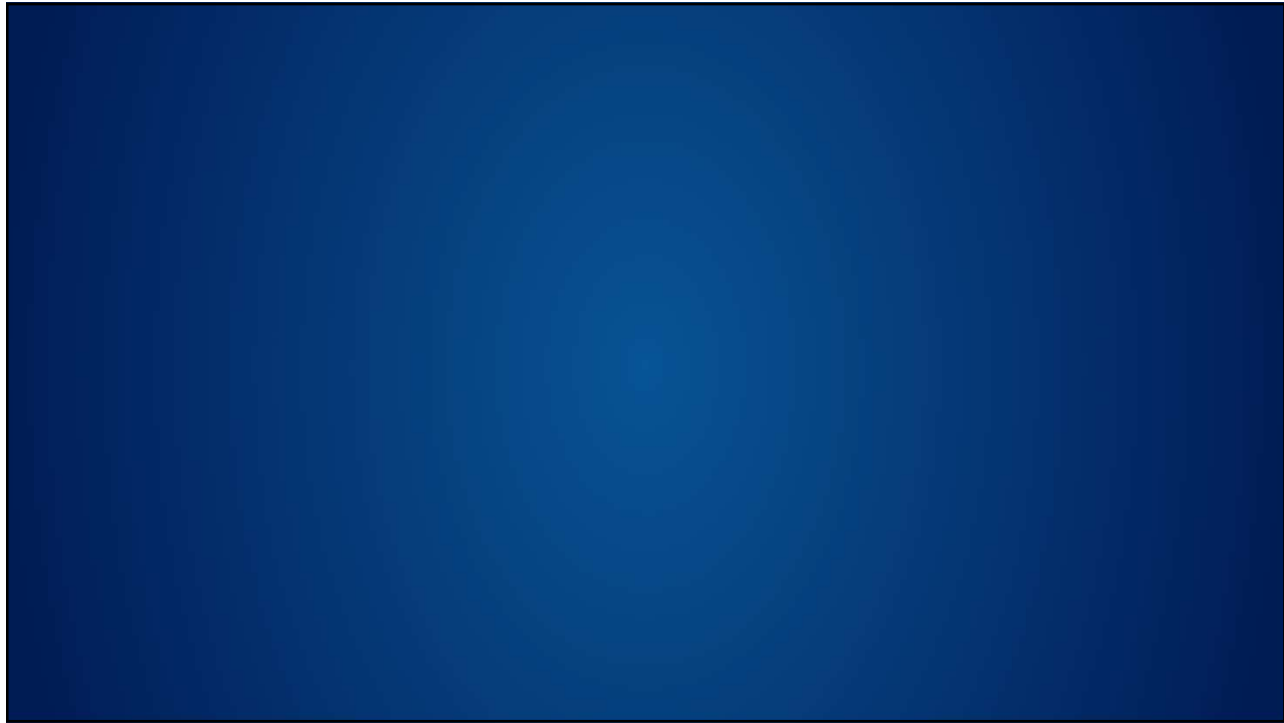
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