

Studying a Case of Dementia Associated with Thoracic Kyphoscoliosis and Potential Implications on CSF Clearance

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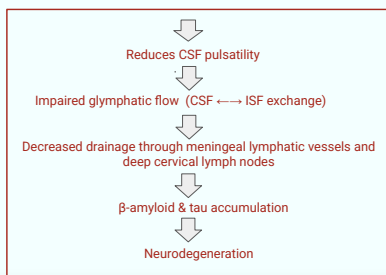
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Background

- Alzheimer's disease is caused by accumulation of β -amyloid & hyperphosphorylated tau¹
- The glymphatic system is critically implicated in Alzheimer Disease pathogenesis¹
- CSF-ISF drainage channels are directly connected to the dorsal and ventral lymphatic drainage compartments²
- Movement of CSF and elimination of metabolic waste in the brain is dependent on physiologic respiratory mechanics³
- Scoliotic patients show decreased movement of the thoracic spine and chest cage during deep breathing³

Hypothesis: Severe thoracic kyphoscoliosis disrupts respiratory-driven pressure gradients and lymphatic drainage, impairing CSF circulation and glymphatic clearance, thereby contributing to neurodegeneration.

Kyphoscoliosis



Methods

An 81-year-old male cadaver with upper thoracic kyphoscoliosis and reported senile dementia was examined. The brain was removed for gross observation. Histologic samples were taken from the cingulate gyrus, insular lobe, frontal lobe, choroid plexus, occipital lobe, parietal lobe, ventral tegmental area, entorhinal cortex, hippocampus, midbrain, ventral pons, and medulla. H&E slides were reviewed; Grocott Methenamine Silver-stained sections from the prefrontal cortex (right/left), entorhinal cortex, and cerebellum.

Results

Histopathological analysis of the choroid plexus demonstrated ependymal cell hyperplasia and extravascular calcifications consistent with impaired cerebrospinal fluid dynamics and chronic oxidative stress. The entorhinal cortex revealed granulovacuolar degeneration (GVD) associated with tau pathology, highlighting early pathogenesis of dementia. Silver staining confirmed chronic cerebellar white matter degeneration processes characterized by demyelination and associated with neuronal loss, gliosis, and loss of purkinje cells.

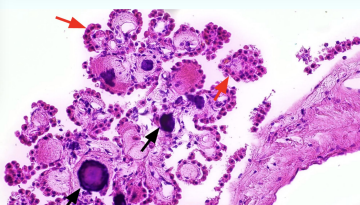


Image 1: H&E section of the choroid plexus with arrows indicating hyperplasia of the ependymal cells lining the ventricles (red arrows) and extravascular calcifications (black arrows) at 100x

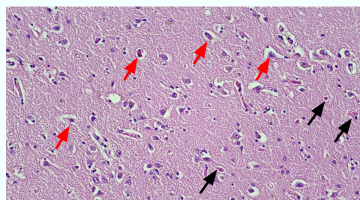


Image 2: H&E section of the Entorhinal Cortex showing dystrophic, necrotic neurons (black arrows) and red neurons (red arrows) at 200x

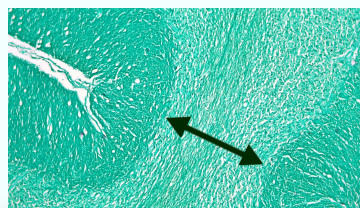


Image 3: Left Cerebellum with Grocott Methenamine Silver Stain indicating myelin loss and reactive gliosis (within the black double headed arrow) at 100x

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Discussion & Conclusion

Discussion

- Histologic findings demonstrate advanced neurodegenerative changes in a patient with severe thoracic kyphoscoliosis.
- Choroid plexus abnormalities suggest dysfunction of cerebrospinal fluid regulatory structures.
- With the known effect of scoliosis on deep breathing³ and the impact of glymphatic dysfunction in the pathogenesis of Alzheimer's disease¹
- These findings support a plausible mechanistic link in which impaired respiratory mechanics and lymphatic drainage may reduce CSF clearance and contribute to neurodegeneration.

Osteopathic Relevance

- Biomechanical model: thoracic restriction may result in lymphatic congestion
- Neurological model: dysfunctions in the thoraco-lumbar region can result in a facilitated segment and autonomic dysfunction
- Respiratory model: kyphoscoliosis prevents normal expansion and contraction of the thoracic cavity during each respiratory cycle
- Metabolic model: changes in spinal tension result in hyper/hyposecretion of proteins within fascia
- Behavioral model: breathing modification and sleeping modifications

Future Directions

- Mechanical stimulation of cervical lymph nodes has been shown to increase CSF flow through the lymphatic system⁴
- Evaluate the use of Osteopathic Manipulative Treatment (OMT) as a non-invasive, adjunctive approach in neurodegenerative disease
- Investigate the effects of lymphatic techniques on meningeal lymphatic flow using diffusion tensor image analysis along the perivascular space (DTI-ALPS)¹. Techniques may include cranial, cervical, thoracic, and soft tissue manipulation targeting the autonomic nervous system

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