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Volume Change Theory for Syringomyelia: A New Perspective

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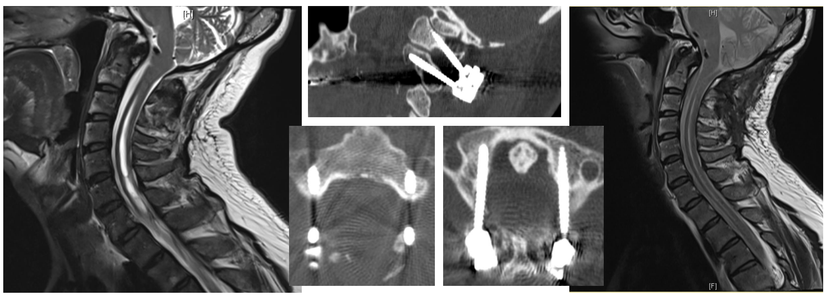
Background

The etiopathogenesis of syringomyelia is still an enigma. Many theories attempted to explain syringomyelia formation. A novel theory based on fluid dynamics postulated the effect of fluctuations in volume of spinal canal and the craniocervical junction during spinal movement can propagate syringomyelia formation.

Blockage at foramen magnum does not permit CSF exchange, this results in cavitatory/cystic change at regions with propensity for maximum deformation i.e. cervical and lumbar spine. Augmentation of posterior fossa volume by decompression helps by relieving CSF obstruction. **It is now suggested that immobilizing spinal movement will cease any dynamic volume changes, minimizing the destructive influence of fluid exchanges on the cord**.

History

Mr. Cheng has history of Chiari I malformation with syringomyelia. She underwent posterior fossa decompression, C1 laminectomy and duroplasty in 2003. Mr. Cheng reported worsening symptoms. She subsequently underwent C1/2 fixation. Postoperatively Mr. Cheng reports improvement in right upper limb numbness.



Left: MRI 2019 showing enlarging syrinx from C3 to C8, basilar invagination
Middle: Postop CT showing C1 lateral mass and C2 pedicle screws inserted for atlantoaxial stabilization and segmental arthrodesis
Right: Post arthrodesis 6-month MRI showing reduction in size of syrinx

Discussion

A review of previous theories of syringomyelia formation:

	Pros	Cons
Hydrodynamic	• Supported by animal studies • Ventricular shunting resulted in syrinx resolution	• Hydrocephalus in some patients only • Foramen Luschka patent in some • Obex rarely communicated with syrinx
Craniospinal dissociation	• Experimental evidence showed significant CS pressure difference	• Only 10% communicating syrinx • Myelography showed cord compression not dilatation during Valsalva
Oldfield	• MRI phase contrast confirmed FM CSF obstruction • Intraoperative USG confirmed cord compression during systole	• Unexplained how CSF able to fill syrinx against pressure gradient
Intramedullary pulse pressure	• Explained syrinx formation by spinal microcirculation pulse pressure differences	• Unexplained why patients have persistent syrinx post decompression (failure rate 20-50%)

Our patient demonstrated atlantoaxial instability is a cause of syrinx formation. It has been suggested that segmental arthrodesis could be considered as first-line treatment for patient's with Chiari malformation and syringomyelia. This could potentially be extrapolated to scoliosis, post-infection or post-trauma patients whose syringomyelia formation may be a result of spinal instability.

Conclusion

Atlantoaxial instability could be the cause of syringomyelia in Chiari patients. Management of syringes should be carefully thought through aiming at treating underlying etiopathology.

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