The Answer is in the Anatomy: How OMM Altered the Course of Recovery from Recurrent Subdural Hemorrhages

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Relevant to the content of this activity, the speakers indicate they have no financial relationships with commercial interest companies to disclose.
Objectives

Review relevant anatomy of the parasympathetic and sympathetic nervous systems.

Identify anatomy of venous and lymphatic drainage from the head and neck.

Draw connections between clinical symptoms, somatic dysfunctions, & relevant anatomy.

Identify how treatment of somatic dysfunctions affected the function of the patient and led to clinical improvement of symptoms.
Outline

- Initial History and Physical Exam
- Symptom of **Constipation**
  - Related OSE (Osteopathic Structural Exam) findings
  - Applied Anatomy
- Symptom of **Restlessness**
  - Related OSE findings
  - Applied Anatomy
- Symptoms of **Dysarthria & Behavior change**
  - Related OSE findings
  - Applied Anatomy
HPI

- Male > 50 years old
- Cc: restlessness (tossing, turning, waking and physically getting up at night) following multiple subdural hematomas after repeated falls
- 1\textsuperscript{st} fall hit left forehead on concrete
  - initial CT head negative
  - Word finding difficulty (Anomic dysphasia), right leg weakness, difficulty speaking in sentences (expressive dysphasia)
- Repeat CT 3 weeks later showed new and old subdural bleed
- 2 intracranial surgeries to stop bleeding
- 1 month ICU, then hospital floor and rehab for total 2.5 months
HPI

- 2nd fall
  - 4 months after first fall
  - Fell out of bed and hit back of head on carpeted floor
  - CT showed more subdural bleeding, in light of being on anticoagulants
  - No Surgery, given plasma
  - Hospital 2 weeks, then skilled nursing facility with rehab, then home PT, OT, and ST

- First office visit 7 months after 1st fall, 3 months after 2nd fall
HPI

- **Function**
  - LE weakness, UE strong
  - Able to groom self, use bathroom, dress himself, help with bathing
  - Cognition and speech: understands most things, difficulty focusing, speech slow, difficulty forming sentences
  - Memory: difficulty identifying family members, address
  - Difficulty with swallowing (dysphagia)
  - + constipation, no incontinence
HPI

- Restlessness
  - Started after 1st fall, worse after 2\textsuperscript{nd} fall
  - Getting out of bed “dozens” (multiple an hour) of times 3-4 nights a week
    - Increased fall risk given nighttime darkness, sleepiness, etc
  - Attendant that watches him at night
Physical Exam: key findings

- Gen: chronically ill appearing, ambulation with walker
- Psychiatric: poor insight, flat affect, confused, unable to articulate history/dysarthria, recent and remote memory abnormal
- MSK: bilat hip flexion weakness (4/5), bilat knee flexion weakness (4/5), ankle dorsiflexion weakness right (4/5) and left (3/5), great toe extension weakness right (4/5) and left (3/5)
- Neuro: shuffling gait, asymmetric left smile (CN VII)
MRI MRA Head w/wo Contrast

completed ~1 month after 1st fall & post craniotomy
6 mos prior to first office visit

MRA brain
80 % stenosis of right posterior cerebral artery
mild medial displacement left middle cerebral artery branches 2/2 LEFT subdural hemorrhage

MRI Brain
-Large left frontal parietal craniotomy
-LEFT SUBDURAL hemorrhage 6 mm thickness deep to craniotomy over L temporal pole
-Simple subdural fluid & pneumocephalus (air or gas within the cranial cavity) over bilateral frontal poles
-2 mm L to R subfalcine shift at the level of the lateral ventricles
-Subdural hemorrhage over R occipital pole
-Petechial hemorrhage at L sylvian fissure
-small foci diffusion restriction left middle frontal gyrus and left parietal cortex, lateral aspect left superior temporal gyrus and left frontal lobe. No diffusion restriction or acute infarct of the right cerebral hemisphere, brainstem or cerebellum
-Areas of abnormal signal/subacute infarcts with brain edema left frontal and parietal lobes, small focus lateral left temporal lobe.
CT brain without contrast

4 mos after 1\textsuperscript{st} fall
<1 mo after 2nd fall
2 months prior to 1\textsuperscript{st} office visit

- small right frontal subdural fluid collection, likely chronic subdural hematoma with tiny foci of new or blood product
- stable postsurgical changes of left frontoparietal temporal craniotomy with stable underlying dural thickening
- old infarct of left frontal lobe
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  - Related OSE findings
  - Applied Anatomy
Constipation

1. Treatment 2:
   BM every other day at best, hard

2. Treatment 4:
   Rec stop Metamucil and only take a stool softener, BM are now daily

3. Treatment 9:
   BM continued to be daily only a stool softener
Constipation: 
OSE (Osteopathic Structural Exam) findings

- Sacral patterns
- OA (Occipito-atlantal) Joint restriction and condylar compression
- Thoracic & Lumbar spine
Constipation: related OSE findings

- **Sacral Somatic Dysfunction Findings**
  - Tx 1: L Unilateral Flexion
  - Tx 2: R Unilateral Extension
  - Tx 4, 8: R on R Forward Sacral Torsion

- **OA Joint Somatic Dysfunction Findings**
  - Tx 1: OA ESrRI
  - Tx 3: OA FSrRI
  - Tx 7: OA FSrRI (CCP)

- **Viscerosomatic Somatic Dysfunction Findings**
  - Tx 1: T12 FRSrI, compressed
  - Tx 4: Htn bilat paraspinal L1-3
  - Tx 8: Htn L1-3 on L, L1 FRSr, T12 FRSr
Drawing connections

Constipation affected by Sacrum and OA joint affecting Parasympathetic nervous system affecting

Constipation affected by Thoracic and Lumbar spine restriction Sympathetic nervous system affecting
Anatomy of Parasympathetic and Sympathetic Nervous System & Constipation

- Parasympathetics, Craniosacral outflow
  - What cranial nerves involved with patient symptom?
  - What spinal nerves involved with patient symptom?
- Sympathetics, Thoracolumbar outflow
  - Key finding, hypertonicity in paraspinal muscles L1-L3, how would this affect sympathetics.
Anatomy of Parasympathetic and Sympathetic Nervous System & Constipation: **Parasympathetics**

- OA extended, sidebent right, and rotated left
- Pressure on jugular foramen, CN X; Vagus; been a chronic condition, what was the timeframe. See inhibition of Vagus
- Sacral findings, Sacral restriction affect S2, 3, 4 levels carrying parasympathetics, inhibitory?
  - How do parasympathetics affect constipation?
Anatomy of Parasympathetic and Sympathetic Nervous System & Constipation:
Parasympathetics, Vagus at OA junction
Anatomy of Parasympathetic and Sympathetic Nervous System & Constipation: Parasympathetics at Sacrum (S2, 3, 4)

Termination of Dural Sac at S2 vertebrae
Flum terminale Externum (Coccygeal Lig)

Spinal Cord In Situ
Enlargement of Cauda Equina

Termination of Dural Sac at S2 vertebrae
Flum terminale Externum (Coccygeal Lig)
Anatomy of Parasympathetic and Sympathetic Nervous System & Constipation:

**Sympathetics - Thoracolumbar**

- Key finding, Constipation and Paraspinal hypertonicity between L1-L3, also T5-9.
- Symptoms may be driving sympathetics! What organs are innervated by these levels?
- Action of the internal anal sphincter, which system contracts it? Sympathetics or Parasympathetics.
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  - Applied Anatomy
Restlessness

1. Initial visit:
   Wakes up from sleep dozens of times, at least 4 nights per week. Has attendant that watches him sleep.

2. Treatment 3: sleeping well 4 nights a week
   Treatment 4: Waking up 1 time per night, sleep is more restful.

3. Treatment 7:
   Slept most of the night for the last two weeks, thinking they will no longer need the sitter at night

4. Treatment 9:
   No longer needs sitter, wife sleeping in same bed as him again.
Restlessness: OSE findings

- OA restriction
- Condylar compression
- Inlet restriction/scalene, SCM
Restlessness: related OSE findings

**OA Joint Somatic Dysfunction Findings**
- **Tx 1:** OA ESrRI
- **Tx 3:** OA FSrRI
- **Tx 7:** OA FSrRI

**Condylar Somatic Dysfunction Findings**
- **Tx 1:** Right Condylar Compression
- **Tx 4:** Right Condylar Compression
- **Tx 5-9** No notable dysfunction

**Thoracic Inlet Somatic Dysfunction Findings**
- **Tx 1:** T1RSr, Compressed
- **Tx 3, 4, 5** Right 1st rib elevated, tight SCM R & scalene b/l
- **Tx 8** T1FRSI
Restlessness affected by:

- OA joint affecting Parasympathetic nervous system
- Inlet restriction impeding venous and lymphatic drainage from the head
Anatomy of Autonomic Nervous System & Restlessness

- Sympathetic Overdrive due to chronic subdural hemorrhage
- Key finding is at OA Junction and Compression; Sidebent right, rotated left
- Jugular Foramen
  - Dural venous sinuses and internal jugular vein-restricting venous return
  - Compression on Vagus
Anatomy of Venous and Lymphatic drainage from the head & Restlessness:

Thoracic Inlet Restriction

Muscles of Neck: Anterior View

- Carotid Sheath
  - Deep to SCM
Anatomy of Venous and Lymphatic drainage from the head & Restlessness: Thoracic Inlet Restriction
Anatomy of Venous and Lymphatic drainage from the head & Restlessness
Anatomy of Venous and Lymphatic drainage from the head & Restlessness
Anatomy of Venous and Lymphatic drainage from the head & Restlessness: Dural Venous Sinuses and Bridging Veins
Anatomy of Venous and Lymphatic drainage from the head & Restlessness - Dural Venous Sinuses and Bridging Veins

Dural Venous Sinuses
Sagittal section

Faix Cerebri

Bridging Veins

Dural Venous Sinuses
Cranial Floor - Superior View

Tentorium Cerebelli
Anatomy of Venous and Lymphatic drainage from the head & Restlessness - CSF circulation reabsorbed into Venous System
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Dysarthria & Behavior

1. Initial Visit:
   Patient unable to articulate history (obtained from wife), has issues identifying family members, does not know address. Dysarthria, mumbles. Understands most words.

2. Treatments 3, 4:
   Wife notes less mumbling. Patient is able to give history, wife notes that his old self is starting to come back. Writes his name legibly. Less flat affect.

3. Treatment 9:
   Returning to social engagements (going to church, watching football with friends and family), and engaging as normal self.
Dysarthria & Behavior: OSE findings

- OA restriction
- Condylar compression
- Bilat Tentorium Cerebelli restriction
Dysarthria & Behavior: related OSE findings

OA Joint Somatic Dysfunction Findings

Tx 1:
OA ESrRI

Tx 3:
OA FSrRI

Tx 7:
OA FSrRI

Condylar Somatic Dysfunction Findings

Tx 1:
Right Condylar Compression

Tx 4:
Right Condylar Compression

Tx 5-9
No notable dysfunction

Tentorium Cerebelli Somatic Dysfunction Findings

Tx 1:
Dural strain bilat tent

Tx 4:
Dural strain with inferior pull

Tx 5:
Less dural strain, right tent restricted
Dysarthria and behavior affected by:

OA joint restriction affecting jugular foramen, CN IX, X, XII (hypoglossal foramen)

Tentorium cerebelli restriction impeding venous drainage from the brain. Decreased venous drainage = congestion = decreased perfusion of arterial blood to brain
Anatomy of OA restriction effects on jugular foramen, CN IX, X, XII (hypoglossal foramen) & Speech

- Reduced congestion at jugular foramen, improve function CNs
Anatomy of tentorium cerebelli & speech/behavior

- Tent restriction impacts venous sinus drainage from the brain
- Venous congestion affects dysarthria and behavior through
- Decreased venous drainage = congestion = decreased perfusion of arterial blood to brain
Anatomy of tentorium cerebelli & speech/behavior:
Anatomy of tentorium cerebelli & speech/behavior
Falx was deviated to the right. Impinge medial surface of the cortex.

- What were reflex findings?
- What were behaviors and memory issues?
Did Tentorium disturbance lead to Sympathetic overdrive? Referred Pain?

- Subdural bleeds and previous surgery stretched and scarred Tentorium?
- CN V, Trigeminal, innervates Tentorium Cerebelli with afferent fibers. Referred back to brainstem.
- Information deemed by body life threatening to drive sympathetics?
Thank you!

Questions?