Thanks to:

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Proposal of a Classification System for Patients With Neck Pain

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“Existing classification systems designed to identify pathoanatomic mechanisms have largely failed”.


Mobility
- Recent onset of symptoms
- No radicular/referred symptoms in the upper quarter
- Restricted range of motion with side-to-side rotation
- and/or discrepancy in lateral flexion range of motion
- No signs of nerve root compression or peripheralization of symptoms in the upper quarter with cervical range of motion

Interventions
- Cervical and thoracic spine mobilization/manipulation
- Active range of motion exercises
**Centralization**
- Radicular/referred symptoms in the upper quarter
- Peripheralization and/or centralization of symptoms with range of motion
- Signs of nerve root compression present
- May have pathoanatomic diagnosis of cervical radiculopathy

*Interventions*
- Mechanical/manual cervical traction
- Repeated movements to centralize symptoms

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**Conditioning and increase exercise tolerance**
- Lower pain and disability scores
- Longer duration of symptoms
- No signs of nerve root compression
- No peripheralization/centralization during range of motion

*Interventions*
- Strengthening and endurance exercises for the muscles of the neck and upper quarter
- Aerobic conditioning exercises

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**Pain control**
- High pain and disability scores
- Very recent onset of symptoms
- Symptoms precipitated by trauma
- Referred or radiating symptoms extending into the upper quarter
- Poor tolerance for examination or most interventions

*Interventions*
- Gentle active range of motion within pain tolerance
- Range of motion exercises for adjacent regions
- Physical modalities as needed
- Activity modification to control pain

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**Reduce Headache**
- Unilateral headache with onset preceded by neck pain
- Headache pain triggered by neck movement or positions
- Headache pain elicited by pressure on posterior neck

*Interventions*
- Cervical spine manipulation/mobilization-where?
- Strengthening of neck and upper quarter muscles
- Postural education
Very non-specific with little clinical reasoning

Proficient use of the pathoanatomical model requires exceptional knowledge of anatomy, biomechanics, and pain science. Also requires analysis, evaluation, synthesis, and integration of this knowledge — CLINICAL REASONING

Cervical Spine Differential DX

A clinically reasoned approach based on the patho-anatomical model and higher levels of learning

What cervical spine structures could cause a patient to experience symptoms for which they may be referred to PT?
Use of illness scripts to assist in a clinically reasoned patho-anatomical approach

Using Illness Scripts to Teach Clinical Reasoning Skills to Medical Students
Anna Lee, PhD; Gavin M. Joynt, MB, BCh; Alex K.T. Lee, MPhil; Anthony M.H. Ho, MD; Michele Groves, PhD; Alexander C. Vlantis, MB, BCh; Ronald C.W. Ma, MB, BChir; Colman S.C. Fung, MB, BS; Cindy S.T. Aun, MD. Family Medicine. 2010, 42(10):255-261

The illness script forms the logical construct underlying the symptoms and signs making up the recognizable patterns for making a diagnosis.

Illness Script Example

VBA dissection prior to actual stroke

HX Features
• Recent trauma (MVA)
• Older age with hx of prolonged extension or rotation prior to symptoms
• Hx of cardiovascular disease
• Recent manipulation involving non-specific rotation of the CS

Symptoms
• HA
• Phrase: Worse HA ever experienced
• Dizziness
• Lip paraesthesia’s
• Transient cardinal signs and symptoms
• Symptoms provoked by head/neck motions especially extension and rotation
VBA dissection prior to actual stroke

Signs
- Progressive cervical ROM tests increase worrisome symptoms
- Cranial nerve tests +
- Spinal cord tests +
- Ataxia tests +

To complete the illness script, PT can add best referenced treatments for the condition which includes referral back to MD or specific PT interventions

Why is this necessary?
- The upper C spine and lower C spine are designed differently; are innervated differently and thus will BEHAVE differently when there is pathology affecting them.
- The treatment that is appropriate for the lower C spine will not correct problems associated with the upper C spine.

Remainder of this discussion...

Illustrate the use of a sound clinically reasoned approach using the patho-anatomical model and illness scripts for the differential diagnosis of upper versus lower cervical spine dysfunction
Neuroanatomy

In studying this, it will become apparent that the symptoms from pathology in the upper CS will be very different than the symptoms from pathology in the lower CS.

Sensory Neuroanatomy Craniocervical Region

- C1 dorsal ramus
  - AO joint
  - C1 sinuvertebral nerve blends with those of C2 and C3 to supply the median AA joint and the dura of the posterior cranial fossa

Sensory Neuroanatomy C1 continued......

- C1 also joins with hypoglossal nerve to form recurrent meningeal branches that supply the dura at the base of the occipital condyles

Sensory Neuroanatomy

- C2 dorsal ramus
  - Occipital skin
  - Lateral AA joint

- C2 also connects with hypoglossal and vagus nerve via the cervical plexus to form meningeal branches that supply the posterior cranial fossa
Greater and Lesser Occipital Nerves

Greater Occipital Nerve - derived from C2 primary ramus

Innervates the skin along the posterior part of the scalp to the vertex. It innervates the scalp at the top of the head, over the ear and over the parotid glands.

Lesser Occipital Nerve - Also C2 derivation.

It innervates the scalp in the lateral area of the head behind the ear.

Sensory Neuroanatomy

C3 dorsal ramus

Forms the 3rd occipital nerve - which pierces the trapezius and ends in the skin of the lower part of the back of the head.

Also supplies the C2/C3 Z joint

Application of Clinical Reasoning

C2/C3 neurologically goes with the upper cervical spine – ie symptoms from C2/C3 joint dysfunction will be the same as AO and AA joint.

With the anatomy just learned, where can the pain be felt from AO, AA or C2/C2 dysfunction or injury?

Peripheral and Central Sensitization

• Will occur in significant acute pathology or more frequently, in chronic cases
• Creates hyper-sensitivity
  ○ Sensory
  ○ Motor
  ○ ANS
• Can affect any neurons that are joined together is specific synapses
• The spinal nucleus of the trigeminal nerve has 3 parts
  • Pars oralis
  • Pars interpolaris
  • Pars caudalis
• Terminals of the TN and C1-3 nerves come together in pars caudalis.
• Portion that receives both TN and cervical afferents is one functional nucleus
  • **Trigeminocervical Nucleus**

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**Ophthalmic nerve**

• Divides to supply **sensation** to the **eyeball**, lachrymal glands, conjunctiva, cornea, part of the nasal mucosa, skin of the nose, eyelid, and forehead.
• The **somatic** afferent supply to the eye that is both sensory and proprioceptive, is the domain of the trigeminal complex.

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**Clinical Reasoning Application**

What would the symptoms be if the ophthalmic branch was affected by central sensitization?
The Maxillary Nerve
Main trunk continues anteriorly in the orbital floor giving off branches and emerges onto the face as the infraorbital nerve to innervate the middle third of the face and upper teeth.

Clinical Reasoning Application
What would the symptoms be if the maxillary branch was affected by central sensitization?

Mandibular Nerve
As the mandibular nerve enters the masticator space, it divides into several sensory branches to supply sensation to the lower third of the face and the tongue, floor of the mouth, and the jaw.

The motor root of the mandibular nerve innervates the four muscles of mastication (masseter, pterygoids, temporalis), the mylohyoid, the anterior belly of digastric, the tensor muscle of the tympanic membranes of the eardrum, and tensor muscle of valum palatinum (soft palate).

Clinical Reasoning Application
What would the symptoms be if the mandibular branch was affected by central sensitization?
Symptom Portion: Illness Script
Upper Cervical Spine Dysfunctions

Clarification:
• Non life threatening pathology
• Include both acute and chronic problems

Lower Cervical Spine Neuroanatomy
Remember, due to AO and AA joint, the number of the nerve root corresponds with the LOWER bone of the segment.
IE: At C5/C6 intervertebral foramen, it is the C6 nerve that is exiting

Lower CS neuroanatomy continued...
Each joint and surrounding ligaments and joint capsule are innervated by the primary sensory rami of the corresponding nerve root.
Thus, the symptom distribution will follow specific dermatomes.

What about acute symptoms?
Posterior view of cervical dermatomes

Symptom Portion: Illness Script
Lower Cervical Spine Dysfunction

Neural Pathology
Joint Pathology
Chronic Pathology

Upper C Spine Joint Anatomy
AO joint and AA Joint

Biomechanics of the AO joint
CV Flexion: anterior roll;
POSTERIOR GLIDE
CV Extension: posterior roll;
ANTERIOR GLIDE
Rotation: Dens serves as a pivot
Joint motion is flexion of one joint;
extension of the other
Rotate head to the R: R condyle gliding posteriorly (flexion); L condyle is gliding anteriorly (extension)
Clinical Reasoning Application

The anatomy of the AO and AA joint requires a **different ROM examination** than the lower cervical spine.

Motions: CV flexion/extension
CV rotation (first 60 degrees)
CV sidebending
Clinical ?- are symptoms reproduced by these motions.

Biomechanics of the AA joint

Flexion/Extension- 2 convex surfaces rocking on one another; research shows 10-30 deg.

Rotation
- One slope goes downward and forward
- Other slope goes downward and backward

**NOTE:** Coupling in the AO and AA joint is **CONTRALATERAL** with regards to rotation and sidebending

EXAMPLE: Rotate head to the R

The inferior surface of the R atlas is moving downwards and backwards

The inferior surface of the L atlas is moving downwards and forwards

Continued.......

If you believe in specificity of assessment, when considering joint glide assessment, there are specific glides in different planes for both the AO joint and the AA joint. This will also affect the mobilizations and manipulations that will be performed at these joints.
**Lower cervical spine**

**Z JOINTS**: Lie in a plane about 45 degrees between the frontal and transverse planes; lower joints closer to 65 degrees.

**NAMING THE GLIDES**: Flexion – superior, anterior and lateral or **SAL**
Extension – inferior, medial and posterior or **IMP**

**U JOINTS**: Same glides; Different plane

**Clinical Reasoning Application**

When assessing ROM of the lower cervical spine, need to control for CV motion.

When manually assessing the lower cervical spine, the glides will be different for the Z joints and U joints

**Ligamentous Differences Upper and Lower C Spine**

**Ligaments of the lower CS**

- Ant Longitudinal Ligament
- Posterior Longitudinal Lig
- Supraspinus Ligament (nuchal)
- Interspinous Ligament
- Ligamentum Flavum
**CV Ligaments**

**Specific Symptoms**

Specific Tests: in literature

Serious Consequences!

Lower CS Ligaments

Different symptoms

NAIOMT has generalized tests - not yet validated

Less serious consequences

Clinical Challenge: Can you extrapolate this information to develop specific illness scripts for conditions of the upper and lower cervical spine?

Usually spend 1-2 days teaching this material including all of the tests and then treatment recommendations

This presentation has hopefully given insight on the value of using specificity in examination and treatment of the cervical spine
DIFFERENTIAL DIAGNOSIS
CERVICAL SPINE

Clinical excellence in all that we do

IMPLICATIONS
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Doctor of Physical Therapy

Orthopedic Manual Therapy Specialist