DEFINITION

• Cervical radicular pain is pain perceived in the upper limb that is shooting or electric in quality
• Caused by irritation and/or injury of a cervical spinal nerve
• IASP defines it as pain caused by ectopic activation of nociceptive afferent fibers in a spinal nerve or its roots or other neuropathic mechanisms
history

- Condition first described in literature by Parkinson in 1817, as a “rheumatic disease of the deltoid muscle”
- A century later (1914) Dejerine formulated the concept of cervical radiculitis
radiculopathy

• Distinguished from radicular pain as a condition in which objective loss of sensory and/or motor function is present

• Radicular pain is caused by ectopic impulse generation
Causes

• Narrowing of intervertebral foramen
• Disc herniation
• Radiculitis due to arteritis, infection or inflammatory exudates
Bogduk summarised the pain distribution as follows:

- C4: restricted to neck and suprascpular regions
- C5: extends into the upper arm
- C6&C7: extends from the neck and shoulder into the forearm and hand
Epidemiology

• Mayo clinic calculated in a popn btn 13 & 91yrs an annual incidence of cervical radiculopathy of 83 per 100,000
• Adjusted figures, males 104/100,000, females 64/100,000
• Highest incidence: age 50-54; 203/100,000
• 15% of pts, hx of trauma preceded Sx
• 41% had hx of lumbar radiculopathy
Epidemiology

- C7 was most freq involved level 45-60%
- C6: 20-25%
- C5 & C8: represent about 10%
- C5 was the most treated level
Diagnosis

• If cerv radic pain is unresolved spontaneously in 3 mths r/o CA, infection, shoulder pathology, etc

• Neuro exam includes strength, sensation and reflexes
Diagnostic Tests

• Spurlings test: Spine extended with head rotated to affected shoulder while axially loaded. Reproduction of pts shoulder or arm pain is positive.

• Shoulder Abd test: pt lifts hand above head, disappearance of radicular Sx is positive

• Axial Manual Traction test: Pt in supine position, an axial traction force of 10-15kg is applied decrease of Sx is positive
Diagnostic Tests

• The 3 tests have a high specificity 81-100%
• Low sensitivity 26-50%
• Spurlings test validated with EMG showed specificity 93% & sensitivity 30%
Imaging/EDx testing

- MRI modality of choice
- No diagnostic gold standard
- Abnormal MRI’s in 19%-28% of asymptomatic pts
- CT good for cortical bone structures
- EMG is the most sensitive method
- SNRB’s can aid in diagnosis
Pathophysiology

- Nucleus pulposus material leaking onto the nerve root
- Compression of the nerve root by anatomic abnormalities
- Either/Or of the above induce; inflammatory reaction, changes in ion channel functioning
- This leads to hyperexcitability & spontaneous activity in the DRG interpreted as pain
- Howe et al in 1977 recognized repetitive firing in the DRG after minimal compression of a normal DRG
Inflammatory Process

- Nuclear Material Exposure to DRG
- Release of Arachidonic Acid, then Cox 1&2 enzymes induce the Release of Cytokines, i.e. Prostaglandins (PG), Nerve Growth Factor (NGF), TNF-alpha, Interleukins, MAPK and Brain Derived neurotropic Factor (BDNF)
- NGF and BDNF are key players in the cascade of events in the inflammatory process
Ion Channel Modulation

- Voltage gated Na,K and Ca channels are modified.
- Increased Na channel plasticity & gene expression in the DRG after injury.
- K role in ectopic d/c generation not clear, redn in K currents after injury.
- Na channel blockers inhibit ectopic d/c.
- Ca channel blockers eg verapamil (L-type) and contoxin (irreversible blocker N-type) reduced rate of d/c.
Spontaneously firing DRG

- Key players are;
- Modulation of ion channels in the DRG
- Increased expression of BDNF shown to directly and rapidly gate Na channels resulting in firing of action potentials.
- In the future, Gene arrays, analyze gene expression, proteomic technologies used to determine genome sequences may help encode proteins involved in radicular pain.
Therapies

• Anti-inflammatory: NSAIDS, corticosteroids, future TNF-a Inhibitors.

• NSAIDS have not been investigated for radicular pain

• Corticosteroids: Inhibits PLA-2

• IM Vs epidural injections: 68% showed good pain relief in one year in the epidural grp compared to 11% in the IM grp
Evidence for treatment of Cervical Radicular Pain

- Transforaminal ESI (fluoro Guided): Vallee Et al; NC prospective. 53% success after 6 mths.
- Transforaminal ESI (CT guided): Cyvetal et al; NC prospective. 60% success after 6 mths.
- RF Cervical DRG (Van Cleef et al PRDB; Sig pain redn at 8mths compared to sham
- RF Cervical DRG Slappendal PRDB; RF40deg Vs 67 deg; sig pain redn in both grps at 3 mths
- Pulsed RF DRG Van Zundert, NCP 72% success at 8 wks, 33% at 1 yr
- Neck Surgery: Parson PR Surgery Vs physio Vs Collar, surgery not more effective as C-collar ot PT at 12 mths
TNF alpha inhibitors: may provide pain relief in nucleus pulposus (NP) induced nerve injury.

Open label trials show systemically injected TNF-I have potential benefit for lumbar radicular pain.

TNF –I attenuate elevated BDNF levels induced by NP application to nerve root.
Sodium Channel Blockers

• Anticonvulsants: carbamezapine, oxacarbazepine used for central and peripheral neurogenic pain.
• Valproic Acid; not superior to placebo in tx of polyneuropathy.
• Mexilitene: effective in a variety of neuropathic syndromes, however questionable efficacy of oral mexilitene making it difficult to draw conclusions
Future Treatment Modalities

• MAPK pathway: Mast cell stabilizers could potentially ablate some effects of NGF in pain originating from the DRG. Targets specific downstream p38MAPK using tyrosine kinase inhibitors.

• Vanilloid Receptors: resiniferatoxin (ultrapotent capsaicin analog) has been used in pts with hypersensitive lower urinary tract
Future Treatment Modalities

• Long-acting local anesthetics: block Na channel and play a major role in identification of causative nerve structure.

• Animal experiments with butamben suspension given epidurally to rats with nerve injury induced allodynia indicate that multiple doses were required for several days to give prolonged analgesia.

• Tonicaine was injected intrathecally in rats producing a sensory blockade longer than mercaine. Has a narrow therapeutic index with substantial neurotoxicity in rats that may limit its clinical value. Must be confirmed in human subjects.
Future Treatment Modalities

• TCA’s; mode of action classically attributed to blockade or serotonin and norepinephrine reuptake. Elavil may be a potent blocker of sodium channels.
• Literature shows a possible role of TCA’a as long acting anesthetics
• Prelim studies: Elavil showed no better nerve blockade than local anesthetics
Future Treatment Modalities

- Gene therapy: subcutaneous innoculation of herpes simplex virus vectors can be used to transduce neurons of the dorsal root ganglion to provide therapeutic effect in models of polyneuropathy and chronic regional pain.

- In human trials; direct injection of replication-competent HSV into brain tumors has been safe, and HSV gene transfer by SQ innoculation for the treatment of chronic intractable pain is about to commence.
References

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