Cervical radiculopathy*

• GREEN

• Intro:
- Compression or impairment of the nerve root, causing px & Ssx that extend beyond the neck
- Px in one or both UL which corresponds to the dermatome of the corresponding affected nerve
- Muscle weakness & impaired deep tendon reflexes are common due to nerve impingement
- Neck pain is a common issue, up to 40% of work absenteeism attributed to it

• Aetiology (risk factors):
- Conditions causing compression or irritation of spinal nerve root lead to radicular Ssx
- In younger pts (30-40s), disc trauma & herniation are most common causes
- In older pts, degenerative changes become more prevalent
- 50-60s - disc degeneration is most common cause
- 70s - foramina narrowing due to arthritic change is a frequent cause
- Cx radiculopathy less frequent than Lx radiculopathy
- Incidence rate: approx. 85 / 100,000
- **C7** nerve root most commonly affected, flooded by **C6**
- **Risk factors:** manual labour w/ heavy lifting, driving, operating vibrating equipment
- Chronic smoking Hx increases risk of radiculopathies

• Pathophysiology:
- Primarily involves inflammation
- Inflammation often caused by *acute herniation* of a Cx disc pressing on the nerve root
- Inflammation can worsen degenerative changes, such as osteophytes or disc dehydration, affecting the nerve root
- Direct compression of the nerve root causes px, numbness, tingling, & weakness

• Clinical presentation:
- Pts present w/ radicular px or weakness
- Inquire: occupational risk factors, Hx of trauma, & px patterns
- Typically unilateral, but B cases are rare
- B presentations can complicate physical Dx
- Cases of trauma or B involvement necessitate advanced imaging for accurate Dx

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Cervical radiculopathy* (cont)

• **Physical examination:**	- Reflexes, compare B - Reflexes usually reduced - Reduced muscle strength, innervated by the affected nerve (major sign) - **Spurling test:** compresses foramina to Dx radiculopathy (px radiates down ipsilateral side) - **Cx distraction:** in some cases may relieve Ssx
• **Diagnosis:**	- X-rays are first step - CT used in traumatic scenarios - MRI is the preferred modality - Electromyography is useful in confirming dysfunction of the affected nerve
• **Management:**	- Around 85% resolve within 8-12 weeks - NSAIDs - Cx pillows - Acupancture - Nerve flossing - SMT / STW
• **Ddx:**	- Brachial plexus injury in sports - Cx disc injuries - Cx discogenic px s. - Cx facet s. - Cx spine sprain - RC injuries - Strain injuries

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Pancoast syndrome

• YELLOW

•	- Pancoast s. should be distinguished from Pancoast tumour itself
Intro:	- Entails: ipsilateral shoulder & arm px, paresthesia, paresis, atrophy of the thenar muscles, & Horner's s. (ptosis, miosis, anhidrosis) - 1° bronchogenic carcinoma is the most frequent cause of Pancoast s. - Manifests as radiating parascapular px, atrophy of intrinsic hand muscles, & a lung apex density w/ localised rib & vertebrae destruction

Pancoast syndrome (cont)	
• **Aetiology (risk factors):**	- 1° caused by tumours in the superior sulcus of the lung, mostly non-small cell lung cancer (NSCLC) - NSCLC accounts for 80-85% of all lung cancer cases, w/ Pancoast s. making up 3-5% of these - Squamos cell carcinoma used to be most common type of NSCLC associated w/ Pancoast s. - Other malignancies can also cause it - Rarely, being tumours cause it - Lung cancer is 2nd most common cancer & is the leading cause of oncological mortality globally
• **Pathophysiology:**	- Pancoast or superior sulcus tumours cause Pancoast s. - Ssx inc. shoulder & arm px due to compression of the brachial plexus - Initial Ssx often misDx as MSK - Tumour extension can lead to C8-T1 radiculopathy (px & paresthesia of the dermatomes) - Weakness of intrinsic hand muscles affects fine motor skills & handgrip - Involvement of sympathetic trunk & Cx ganglion can cause facial flushing & sweat - Harlequin s. may occur w. contralateral flushing & sweating due to hyperactive sympathetic reaction
• **Clinical presentation:**	- Encompasses Ssx related to tumours affecting the lung apex - Ssx arise due to brachial plexus & associated structures involvement - **1° Ss:** shoulder or arm px & paresthesia along the medial half of the 4th & 5th finger, hand, arm, & forearm (C8-T1 radiculopathy) - Pulmonary Ssx, e.g. SOB, develop as the tumour progresses to involve more of the lung
• **Physical examination:**	- Ipsilateral facial flushing & sweating due to involvement of sympathetic trunk & Cx ganglion - Horner s. (ptosis, miosis, anhidrosis) may also develop w/ further disease

Pancoast syndrome (cont)

• **Diagnosis:**	- **Chest x-ray:** initial screening, shows increased size of apical cap or lung mass - **CT:** provides additional info on tumour extent, satellite nodules, mediastinal adenopathy; crucial for staging - **MRI:** done after Dx & before surgery to identify vascular, brachial plexus involvement - **CT-guided core biopsy:** Dx test of choice due to outer tumour location
• **Complications:**	- **Surgical:** atelectasis (partial lung collapse), px, chest wall deformity, frozen shoulder, CSF leak, prolonged air leak, injury to the brachial plexus - **Chemotherapy:** side effects of the drugs - **Radiation:** alopecia, nausea, vomiting, leathery skin, poor wound healing
• **Management:**	- Good prognosis: early-stage Dx - Poor prognosis: advanced disease, poor performance status, & weight loss - **Standard care procedure:** chemo-radiation followed by surgical resection **Contraindication to surgical resection:** - Presence of mets - Involvement of ipsi/contralateral mediastinal nodes or supraclavicular nodes - Involvement of VB >50% - Involvement of oesophagus &/or trachea - Involvement of brachial plexus above T1 nerve root
• **Ddx:**	- Other malignancies either 1°, or even being tumours are known to cause Pancoast s. - Even apical lung infections or abscesses can cause Pancoast s. if they involve the chest wall & surrounding structures

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Thoracic outlet syndrome (TOS)*

• GREEN

• **Intro:**	- Encompasses various conditions involving compression of neurovascular structures in the Tx outlet - **5 types:** venous, arterial, traumatic, true neurogenic, disputed neurogenic - **Tx outlet:** 1st rib, scalenes, & clavicles - Imaging helps in Dx

Thoracic outlet syndrome (TOS)* (cont)	
• **Aetiology (risk factors):**	- Caused by increased pressure in Tx outlet, often due to anatomical abnormalities, e.g. Tx ribs, space-occupying lesions (e.g. tumours, cysts), or fibrous muscular bands from overuse - Past trauma & neck positioning are common causes, leading to impingement of vessels or nerves - 2° causes: trap deficiency or clavicle #, which can decrease the outlet space & increase pressure - Neurogenic TOS: most prevalent variant, constituting over 90% of cases - F>M & individuals w/ poor muscle development or posture - Incidence rate: 3-80 / 1000
• **Pathophys-iology:**	- Caused by compression of structures in the Tx outlet - Extra ribs from 7th vertebrae are common culprits - Neck trauma preceded 80% of neurological TOS cases, while 20% were 1° caused by anatomic variants - B TOS reported w/ B Cx ribs as 1° cause - Soft tissue components (fibrous muscular bands & tumours/cysts), also contribute to TOS - Athletes w/ repetitive motions inv. extreme ABD & ER (swimmers) are susceptible to TOS - Classic presentation in swimmers inc. px, tightness, or numbness in the neck or shoulder area when their hand enters the water - Other susceptible athletes: baseball, water polo, & tennis players
• **Clinical presentation:**	- Manifests w/ variety of Ssx depending on its cause - Common complaints inc. nebulous px regardless of etiology - Venous obstruction Ssx may inc. UL swelling, venous distention, & px from hand to forearm - Persistent venous TOS can lead to UL DVTs - Arterial TOS may show colour changes in the UL & diminished pulses - Ssx may appear gradually due to collateral blood flow, exacerbated by certain positions - Neurogenic TOS (most common) results from brachial plexus compression - Ssx inc. vague px, hand muscle atrophy, weakness, & sensory deficits

Thoracic outlet syndrome (TOS)* (cont)

• **Physical examination:**	- Quick overview of pt's posture - Check symmetry & ROM of both arms initially **Special tests:** - Neurological exam to evaluate n. compression - Brachial plexus compression test - Spurling's test - Adson maneuver for suspected arterial compression - Roo's stress test - Costoclavicular test
• **Diagnosis:**	- Physical exam 1st, further imaging confirms Dx - **Chest or Cx x-ray:** 1st imaging step, providing crucial anatomical info - **US** only for venous TOS - **Venous dopplers** for detecting compression of subclavian / other veins
• **Complications:**	- Rare complications - Ischemic change could manifest if vascular compromise occurs - Most complications arise from surgical intervention (iatrogenic n. injury, pneumothorax, bleeding complications)
• **Management:**	- Excellent prognosis (90% of cases resolve Ssx w/ conservative care) - Lifestyle modifications - avoiding repetitive postural stress & workstation modification - SMT - Cx, Tx, & 1st rib - STW - scalenes & pec minor - Exercises phase 1: Cx retractions, ulnar n. floss, scalene stretch, corner pec stretch - Exercises phase 2: resisted shoulder retraction - Surgery in case of severe compression not responding to conservative care
• **Ddx:**	- Pec minor s. (PMS) - commonly confused w/TOS - Brachial plexus injuries - Cx spine injuries - Cx radiculopathy - SIS - Elbow or forearm overuse injuries - AC joint injury - Nondescript px disorders (due to vague nature of TOS Ssx)

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Complex regional pain syndrome (CRPS)*

• **YELLOW**

• **Intro:**	- Neuropathic px disorder w/ persistent, disproportionate px beyond typical healing times - Ssx inc. sensory, motor, & autonomic abnormalities - Often follows trauma, #, or surgery, but spontaneous cases also occur - Diagnostic criteria: Budapest criteria - **2 types:** no nerve trauma & known nerve trauma (clinically indistinguishable, favouring distal extremities)
• **Aetiology (risk factors):**	- CRPS can occur due to various types or degrees of tissue trauma, inc. even w/o injury or due to prolonged immobilisation - Common causes: #, surgery, sprains, contusions, crush injuries, & seemingly minor interventions like intravenous line placement - Psychological distress during physical injury may influence the severity & prognosis - Incidence varies (higher rates in Netherlands compared to US) - F>M, peak incidence 61-70 age group - Upper extremities are more frequently involved than lower extremities - # are the most common trigger (44-46% of cases) - Vasomotor Ssx, e.g. swelling, temperature, & colour changes, are common - **Dx tests:** 3-phase bone scans & autonomic testing - **Risk factors:** asthma, ACE inhibitor use, menopause, osteoporosis, Hx of migraine, & smoking
• **Pathophysiology:**	- Multifactorial mechanisms - Inflammatory changes - Immunological changes - Peripheral sensitisation - Central sensitisation & neuroplasticity - Autonomic changes
• **Clinical presentation:**	- **Allodynia:** non-painful stimuli causing px - **Hyperalgesia:** exaggerated px from usually painful stimuli - **vasomotor dysfunction:** skin colour & temperature changes - **Sudomotor dysfunction:** swelling & sweating changes - **Motor Ssx:** weakness, reduced ROM, tremor, dystonia in affected extremity

Complex regional pain syndrome (CRPS)* (cont)

• Physical examination:

- **Neuropsychological deficits:** executive functioning, memory, word retrieval
- **Constitutional Ssx:** lethargy, weakness, disruptions in sleep architecture
- **Cardiopulmonary inv.:** neurocardiogenic syncope, atypical chest px, chest wall muscle dystonia leading to SOB
- **Endocrinopathies:** low serum cortisol, hypothyroidism
- **Urologic dysfunction:** increased urinary frequency & urgency, urinary incontinence
- **GI dysmotility:** nausea, vomiting, diarrhoea, constipation, indigestion

Psychosocial factors:

- Associated w/ worsening depression & anxiety
- Poor function & diminished quality of life
- No specific personality or psychopathology predictors
- Px-related behaviour & catastrophic thinking in pts w/ significant comorbid psychological burden or poor coping mechanisms

Complex regional pain syndrome (CRPS)* (cont)

• **Diagnosis:**	**Budapest criteria** **A. They should report continuing px disproportionate to the inciting event** **B. They should report at least 1 Ssx in 3/4 following categories:** - Sensory: reports of hyperalgesia &/or allodynia, - Vasomotor: reports of temperature asymmetry &/or skin colour changes &/or skin colour asymmetry, - Sudomotor/edema: reports of edema &/or sweating changes &/or sweating asymmetry, - Motor/trophic: reports of decreased ROM &/or motor dysfunction (weakness, tremor, dystonia) &/or changes (hair, skin, nails) **C. Additionally, they must display at least 1 sign at the time of evaluation in 2 or more of the following categories:** - Sensory: evidence of hyperalgesia (to pinprick) &/or allodynia (to light touch or deep somatic pressure), - Vasomotor: evidence of temperature asymmetry &/or skin colour changes &/or asymmetry, - Sudomotor/edema: edema &/or sweating changes &/or sweating asymmetry, - Motor/trophic: evidence of decreased ROM &/or motor dysfunction (weakness, tremor, dystonia) &/or trophic changes (hair, skin, nails) **D. Finally, there is no other Dx that better explains the Ssx & Sx**
• **Complications:**	- Dystonia - Cognitive executive dysfunction - Adrenal insufficiency - Gastroparesis - IBS
• **Management:**	- Early treatment may improve prognosis - Reported cases of spontaneous improvement - **Treatment goal:** px & discomfort improvement, functional restoration, & disability prevention - PT & exercise improve ROM, function & reduce disability through endorphin release - Px education - NSAIDs / pharmacotherapy - Behavioural therapy (related to depression) - Invasive interventions

Complex regional pain syndrome (CRPS)* (cont)

• **Ddx:**	- Arterial insufficiency - Gillian-Barre s. - Hysteria - Monometric amyotrophy - Multiple sclerosis - Peripheral atherosclerotic disease - Phlebothrombosis - Porphyria - Poliomyelitis - Tabes dorsalis

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Bummer or Stinger*

• **YELLOW**

• **Intro:**	- Common injury in contact sports - Reflects upper Cx root or peripheral nerve dysfunction injury - Occurs due to over-stretching of upper trunk of brachial plexus or compression of C5/C6 nerve root - Recurrences ar frequent & can result in permanent neurological deficits - Typically graded as Grade I or Grade II nerve injury
• **Aetiology (risk factors):**	- 1° observed in collision or contact sports (e.g. American football, ice hockey, & rugby) - Affects 50-65% of collegiate American football players - High recurrence rate requires attention to minimise the problem
• **Pathophysiology:**	**3 primary mechanisms:** - Forceful blow causing depression of shoulder & lateral FX of the neck to the contralateral side, leading to traction of the upper roots of the brachial plexus - A direct blow to supraclavicular fossa or Orb's point causing a percussive injury - Head forced into hyperEXT, ipsilateral side FX towards trauma side → narrowing of intervertebral foramen at Cx spine, nerve root compression (common in high-level athletes)

Bummer or Stinger* (cont)	
• **Clinical presentation:**	- Immediate, acute traumatic onset of px/ burning/paresthesia/pins & needles/weakness - Typically presents w/ Ssx circumferentially radiating down the arm - Reports recent Hx of trauma to the area - Common in young athletes competing in contact sports - Previous Hx of burners
• **Physical examination:**	- Shacking of the upper extremity - Holding upper extremity close to their body - Atrophy or asymmetry in the neck - Shoulder depression - Atrophy of deltoid or supraspinatus - Altered motor patterns when using the shoulder - **Palpation:** tenderness, muscle spasm, vertebral tenderness - **ROM:** possible decrease in neck & shoulder mobility - **Strength:** deltoid (ABD), supraspinatus (ABD - full can), infraspinatus (ER), biceps (elbow FX), pronator teres (forearm pronation), triceps (elbow EXT), & ADD digits minimi (ABD of 5th digit) - **Sensation:** burning, paresthesia, pins & needles (usually present circumferentially) - **Reflexes:** triceps & brachioradialis - **Special tests:** Spurling's test & Tinel test (supraclavicular fossa)
• **Diagnosis:**	- Usually through clinical examination & past medical Hx - **EMG & NCS:** able to determine where the lesion is & its severity - **X-rays:** indicate or rule out bone injuries
• **Management:**	- Length determined by severity of injury - For some recovery may take minutes, for other weeks to months - Commonly reoccur (up to 87%)

Bummer or Stinger* (cont)

• **Ddx:**
- Necessary to rule out Cx #, dislocation, or spinal cord injury

Alternative/associated Cx injuries inc:
- Assessment & management of concussion
- Transient quadriplegia - B Ssx
- Muscular strain/ligament strain - unlikely to have neurological involvement
- Brachial neuritis - insidious onset
- Radiculopathy - differences in acute presentation

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