Oncologic Emergency Management
Superior Vena Cava Syndrome and Spinal Cord Compression

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Disclosures

• Grant funding from Varian (maker of linear accelerators)
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• Production company used my front porch to film a commercial – turns out it was for PCV13 pneumococcal vaccine (Pfizer)
Further Disclosures

• “If you copy from one book, that’s plagiarism; if you copy from many books, that’s research.” Wallace Notestein

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  – Paris Ingledew & slides from the Rad Onc lecture series
  – Chad Lund and Andra Krauze
  – (For aiding my “research”)
Outline of the Talk

1. Describe Spinal Cord Compression, the workup and potential treatments
2. Outline SVC, the main causes and potential treatments
3. Emphasize that you will probably see these (and then treat them appropriately)
Objectives

• Give you an understanding of the spinal cord compression and SVCO
• Ensure that you will be able to recognize them
• Give you an algorithm or schema of how to go about managing them (in conjunction with the oncology team)
What is a Radiation Oncology Emergency?

• “A medical condition arising from a reversible threat to organ function requiring radiation treatment within a few hours of diagnosis.”
  – Cancer Care Ontario, 2004
Very Limited Categories meeting the Definition

**Emergencies**
- Cord Compression
- Any tumor blocking an essential organ (trachea, main stem bronchi)

**Urgencies**
- SVCO
- Bleeding tumor
- Tumor blocking organ (e.g. ureteric obstruction)
- Brain Metastases
Spinal Cord Compression
Clinical Case

• 61 yo woman – Hep C, HCC. Prior TACE x 2. Previous Sorafenib. No further chemo options. Disease throughout liver with some bone mets. (Child’s Pugh – A6)

• PMHx – Peripheral neuropathy from diabetes, +/- ETOH?
Clinical Case – part 1

• 3-4 months ago - increasing back pain
• Fall in November – to ER, imaged, pain treated and discharged. CT report disease at T11 with invasion into canal.
• Falls x 3 in December. Back to Emerg twice and admitted on 3rd ER visit.
Spinal Cord Compression

Epidemiology

- 40% of cancer patients have spinal metastasis
  - 20% of patients with spinal metastasis develop symptomatic spinal cord compression

<table>
<thead>
<tr>
<th>Site</th>
<th>5 yr incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myeloma</td>
<td>8</td>
</tr>
<tr>
<td>Prostate</td>
<td>7</td>
</tr>
<tr>
<td>NPX</td>
<td>6.5</td>
</tr>
<tr>
<td>Lung</td>
<td>6</td>
</tr>
<tr>
<td>Breast</td>
<td>5.5</td>
</tr>
<tr>
<td>Kidney</td>
<td>5</td>
</tr>
<tr>
<td>Cervix</td>
<td>2.5</td>
</tr>
<tr>
<td>HN</td>
<td>0.9</td>
</tr>
<tr>
<td>Colorectum</td>
<td>0.8</td>
</tr>
<tr>
<td>Stomach</td>
<td>0.6</td>
</tr>
</tbody>
</table>
Epidemiology

• **Location**
  – Thoracic 60%
  – Lumbar 30%
  – Cervical 10%
Spinal Cord Compression
Pathophysiology

1. Growth and expansion of the vertebral bone metastasis into the spinal canal/epidural space
2. Neural foramina extension by para-spinal mass
3. Destruction of vertebra causing collapse and displacement of bony fragments, tumor or vertebral discs - into the spinal canal/epidural space
Spinal Cord Compression

“The compression of the dural sac and its contents (spinal cord or cauda equina or both) by an extradural tumor mass.

The minimum radiologic evidence for cord compression is indentation of the thecal sac, at the level of the clinical features.”
The Spinal Cord

- Between the bony vertebrae and the dural sheath is a large epidural space filled with a soft padding of fat and a network of veins.
- Cerebrospinal fluid fills the subarachnoid space.
Pathophysiology

Problems caused by:

- Damage is mainly vascular:
  - Increased arteriole pressure
  - Venous plexus compression
  - Lack of capillary blood flow

- Leads to...
  - Spinal cord EDEMA

- And then...
  - White matter ischemia and infaction
  - Permanent Cord damage
Pathophysiology – Take Home

• Symptoms often start with pain (tumor disrupting the bone)

• Nerve compromise starts with loss of blood flow due to vessel constriction – it is not often transection of the nerves but ischemia, infarction
Symptoms

• First symptom (in 90% of cases) is BACK PAIN
• Weakness is the most common symptom that leads to medical attention (and is often assoc. with sensory loss too)
• Sphincter dysfunction (Bowel/Bladder) can occur, but rarely in isolation
Spinal Cord Compression

Symptoms – Sensory

• Pain is most common
  – Often precedes other neuro deficits by months
• Localized
• Most severe over involved vertebra
  – “Tightness, gripping sensation”
• Radicular
  – Around trunk
  – Down limb
• Can have numbness/paresthesia (usually a later finding)
## Symptoms - Motor

<table>
<thead>
<tr>
<th>Sign</th>
<th>UMN Lesion</th>
<th>LMN Lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weakness</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Atrophy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fasciculations</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reflexes</td>
<td>Increased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Tone</td>
<td>Increased</td>
<td>Decreased</td>
</tr>
</tbody>
</table>

**Bladder dysfunction** – Urinary retention and need for Foley Catheter

**Bowel dysfunction** – Reduced anal tone
Prognostic Factors

Good Prognostics
• Tumor type responsive to chemo/radiation
• Gradual onset of symptoms
• Good general health / survival
• Vertebral body intact
• Able to walk

Poor Prognostics
• Tumor type resistant to chemo/radiation
• Acute onset with rapid progression
• Poor general health / survival
• Vertebral body collapse
• Unable to walk
Treatment

- Steroids
- Surgery
- Radiotherapy
- (Chemotherapy)

Ambulatory status pre-treatment is related to outcomes post-treatment

Therefore, the earlier the treatment the better
Treatment - Steroids

• (Dexamethasone)
  – Best 1\textsuperscript{st} step
  – Aim is to reduce edema and pressure on vasculature / spinal cord
  – Helps maintain motor function
  – No evidence for doses $>16$ mg/day
Treatment - Surgery

• Surgery benefits
  – Tissue / Diagnosis
  – Can debulk tumor quickly
  – Can stabilize vertebral body instability
  – Can help with pain
  – Can be given prior to radiation
Treatment - Radiotherapy

• Radiotherapy
  – Generally for those who are not surgical candidates based on health, survival, multiple levels
  – Relieves pain and can reduce compression symptoms
  – Fractionated treatments (usually 5-10)
Treatment: Surgery vs. Radiotherapy

• Uncontrolled series – differing results

• Surgery has a couple of advantages
  – Can remove bone from spinal canal
  – Can provide stability

• Disadvantages
  – Surgical risks, Inpatient stay and post op course
Spinal Cord Compression
Work Up Algorithm

• Clinical scenario of someone with back pain +/- radicular, sensory or motor loss

1. Is there a cancer diagnosis? (and what is the treatment history)

2. Can you document motor, sensory or sphincter dysfunction? (was the patient “normal” recently?)
3. Imaging ordered (usually start with Xrays or CT scan) - minimum is CT.

4. Call RO/MO/Neurosurg
   – Can you get an MRI?
   – Are they on Steroids?
   – How bad is the motor loss and how long has it been?
Treatment Decisions

Surgery
- Spinal instability
- Bony compression
- Patients with no/remote cancer diagnosis
- Neurological progression on RT

Radiation
- Medically inoperable
- Ambulatory
- Diffuse disease
Radiation and Surgery are not mutually exclusive

• There are times where surgery is done 1st
  – Provide stability
  – Remove tumor (debulk) immediately against spinal cord

• Radiation next
  – Treat any remaining gross or microscopic disease
  – Aim for long term local tumor control
Review – Cord Compression

• Decisions regarding treatment need to consider: medical status, structural factors, anticipated outcomes and treatment goals
• Aim to maintain and improved quality of life by reducing pain and restoring function
• Early management is BEST
Multiple Interventions
Post Operative MRI
Post Op MRI fusion
Superior Vena Cava Syndrome
CASE - SVC

• 43 yo woman, non-smoker, dry cough up/down, GP, Antibiotics, GP, worsening cough then pressure in head and swelling in neck, to ER.

• CT scan (SVCO)
Epidemiology

• Much rarer than cord compression
• Most common in lung cancer (small cell > non-small)
Pathophysiology

• SVC can become obstructed by:
  – External compression
  – Invasion
  – Internal blockage

• Causes:
  – Benign (thrombus, goitre, aneurysm, sarcoid)
  – Malignant (Lung cancer 75%, lymphoma, germ cell, thyroid or metastatic disease)
Superior Vena Cava (SVC) Obstruction

Symptoms

• **Dyspnea**
• **Distension**
  – Edema of face (with erythema/plethora)
  – Edema of arms
• **Dilated chest wall vessels**
SVC - Symptoms

- Often Asymptomatic
- Dyspnea
- Distension
- Dilated vessels
- (occasionally headaches)
Prognostic Factors

• This is entirely dependent on the underlying histology and how it responds to treatment
  – Lymphoma will melt away
  – Germ cell tumors will respond to chemo
  – Small Cell lung cancer will shrink quickly (and often only temporarily)
  – Non-Small lung cancer – not good
Treatment

• Steroids
  – You need a diagnosis 1st!
  – Less evidence for this vs. Cord Compression
• Chemo – Small cell or lymphoma
• Radiotherapy – Nonsmall lung cancer
• Interventional – endovascular stent
Superior Vena Cava (SVC) Obstruction

Treatment

• Radiotherapy
  – Unless patient is very unwell, wait for tissue confirmation before treating

  – Takes days/weeks to work

  – Relief of symptoms in most cases (although this doesn’t always correlate with imaging)

Therefore, not really an emergency...more of an urgency
Workup Algorithm

• Commonly this is just going to be seen on a CT report (no clinical symptoms)
• Hx – Px: Previous cancer diagnosis, previous treatments and ongoing general health
• Any current symptoms (flushing/HA/veins)
  – Particularly note if there is SOB
Workup Algorithm

• If there hasn’t been a scan then really need CT chest at minimum
• Send to ER (rule out PE, clots, masses...)
• If there has been a scan and diagnosis, essentially your job is done and can refer on
  – Start steroids, LMWH if thrombosis
Back to our case
What to do now?

• Need diagnosis before treatment.
• Hope it is Lymphoma.
  – Don’t give steroids! Don’t give XRT yet!
• She underwent a Bronch
• Came back Non-small (Adeno) lung cancer
• Sent onto treatment ASAP with pall XRT (she had bone mets too)
Review SVCQ

• Often Emergency treatment isn’t needed:
  1. Ensure there is a diagnosis
  2. Ensure there is a CT scan
  3. Ask about sx / signs
  4. Refer on for urgent treatment
SVCO Radiation plan
Conclusions

• Spinal Cord Compression
  – Common
  – Watch for pain and neurologic symptoms
  – Image and refer early
Conclusions

• Superior Vena Cava Obstruction
  – Symptoms are usually mild
  – Less of an emergency (but urgent tx needed)
  – Image and make diagnosis
  – +/- Anticoagulate, steroids and refer for definitive treatment
The End
Radiation Dose Distribution

CONVENTIONAL

STEREOTACTIC
Investigations

• Plain X-rays
• CT scan
• MRI
  – Test of choice
• Tissue confirmation?
The normal spinal cord
The ABnormal spinal cord
Radiation planning scan
Radiation Planning with Dose