Oncologic Emergencies

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Medical Oncologist
Saint John Regional Hospital
NBIMU
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Conflicts of Interest

- No disclosures.
Learning Objectives

• Review presentation and management of Malignant Epidural Spinal Cord Compression (MESCC)

• Introduce immune checkpoint inhibitors

• Provide a brief overview of the management immune related adverse events.
Three Key Messages

- MRI is the gold standard for diagnosis of malignant epidural spinal cord compression.
- If a patient is on an immune checkpoint inhibitor, drug induced autoimmunity should ALWAYS be included in the differential diagnosis.
- PO/IV corticosteroids the preferred method for managing moderate to severe immune related adverse events.
Outline

• Oncologic Emergencies
  • Malignant Epidural Spinal Cord Compression
• Introduction to Immune Checkpoint Inhibitors
  • Immune related adverse events
Oncologic Emergencies
Oncologic Emergencies

- Any complication related to cancer or anticancer therapy that requires immediate intervention.
Oncologic Emergencies

• Classic List
  • Febrile Neutropenia (High and Low Risk)
  • Malignancy Associated Hypercalcemia
  • Malignant Epidural Spinal Cord Compression
  • Superior Vena Cava Obstruction
  • Tumour Lysis Syndrome
# Oncologic Emergencies

<table>
<thead>
<tr>
<th>Classic List</th>
<th>Extended List</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Febrile Neutropenia (High and Low Risk)</td>
<td>• Hyperviscosity Syndrome</td>
</tr>
<tr>
<td>• Malignancy Associated Hypercalcemia</td>
<td>• Bleeding in the Cancer Patient</td>
</tr>
<tr>
<td>• <strong>Malignant Epidural Spinal Cord Compression</strong></td>
<td>• GI Bleeding, Hematuria, Hemoptysis</td>
</tr>
<tr>
<td>• Superior Vena Cava Obstruction</td>
<td>• Increased ICP, Seizures from Brain Mets</td>
</tr>
<tr>
<td>• Tumour Lysis Syndrome</td>
<td>• DIC</td>
</tr>
<tr>
<td></td>
<td>• Malignant Airway Obstruction</td>
</tr>
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<td></td>
<td>• SIADH</td>
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</tbody>
</table>
Oncologic Emergencies

Classic List

- Febrile Neutropenia (High and Low Risk)
- Malignancy Associated Hypercalcemia
- Malignant Epidural Spinal Cord Compression
- Superior Vena Cava Obstruction
- Tumour Lysis Syndrome

Extended List

- Hyperviscosity Syndrome
- Bleeding in the Cancer Patient
  - GI Bleeding, Hematuria, Hemoptysis
  - Increased ICP, Seizures from Brain Mets
- DIC
- Malignant Airway Obstruction
- SIADH

New Oncologic Urgency/Emergency

- Immune Related Adverse Events
Malignant Epidural Spinal Cord Compression
Disclosures

- I am not a Radiation Oncologist, Neurosurgeon, Orthopaedic Surgeon, Neurologist or a Radiologist.

- Hmm … why did I choose this topic?
Malignant Epidural Spinal Cord Compression

- T9 Lesion, CT on left, MRI 7 days later on right.

- It can be missed!!
Malignant Epidural Spinal Cord Compression

- **Definition:** Any radiologic evidence of indentation of the thecal sac

- Affects 5% of all adult cancer patients (2.5% may be more accurate).

- 20% of cases occur as the initial presentation of malignancy.
Malignant Epidural Spinal Cord Compression

Ropper AE, Ropper AH. N Engl J Med 2017;376:1358-1369
Malignant Epidural Spinal Cord Compression

Distribution among cancers

- Breast 15-20%
- Prostate 15-20%
- Lung 15-20%
- Non Hodgkin Lymphoma 5-10%
- Multiple Myeloma 5-10%
- Renal Cell Ca 5-10%
- Others: Colorectal Ca, Cancer of Unknown Primary and Sarcoma
Malignant Epidural Spinal Cord Compression

Anatomic Distribution

• 60% Thoracic
• 30% Lumbosacral
• 10% Cervical
Malignant Epidural Spinal Cord Compression

Signs/Symptoms

• Back Pain 83-95% (Local, referred or radicular)

• On average, pain precedes other neurologic symptoms of ESCC by seven weeks.

• Pain is often worse with recumbency and at night

• Weakness is present in 60 to 85 percent of patients with ESCC at the time of diagnosis

• ESCC generally produces fairly symmetric lower extremity weakness.

• Sensory findings are less common than motor findings but are still present in a majority of patients at diagnosis
Malignant Epidural Spinal Cord Compression

Delay in Diagnosis

• Median time from onset of to diagnosis = 2 months

• 10-day delay between the onset of neurologic symptoms and the start of therapy. The majority of patients had deterioration of motor or bladder function during the delay.
Outcomes

• The ability to ambulate must be assessed – this is a highly predictive finding of the chance of recovery:

  • >80% of SCC patients who were ambulatory prior to SCC treatment will be ambulatory post-treatment

  • <50% of SCC patients who experienced weakness prior to SCC treatment will be ambulatory post-treatment

  • <10% of SCC patients who experienced paraplegia prior to SCC treatment will be ambulatory post-treatment
Malignant Epidural Spinal Cord Compression

JAMA: Back Pain

• Malignancy accounts for less than 1% of episodes of low back pain

• Previous history of cancer in the patient: (Sensitivity 31%: Specificity 98%)

• Most patients with back pain due to cancer report unrelieved by bed rest. (Sensitivity >0.9)

• In a study of nearly 2000 patients; No cancer was found in any patient under 50 years old without

  • a history of cancer,

  • unexplained weight loss or

  • a failure of conservative therapy (Sensitivity 100%)

  Deyo The Rational Clinical Exam 1994
Malignant Epidural Spinal Cord Compression

Investigations

- MRI is gold standard (Sen 93%, Spec 97%)
  - CT Scan is often used but beware of false positives
- If no signs/symptoms to suggest C-Spine involvement then MRI Thoracic and Lumbosacral spine
- In patients with symptomatic thoracic or lumbar epidural lesions 21% had a second lesion that would have been missed if T and L spine not imaged together.

Schiff et al Cancer 1998
Management

1) Steroids

• A bolus of 8 to 10 mg dexamethasone (or equivalent) can be given, followed by 16 mg/day (usually in BID or QID for tolerance).

• Patients with dense paraparesis should be considered for higher bolus (100 mg) and maintenance doses (up to 96 mg per day) (Done in consultation with Radiation Oncology or Neurosurgery)

2) Pain Management

• Opioids (Bowel Regimen) +/- Neuropathic pain adjuvants +/- bisphosphonates

ASTRO Guidelines
Malignant Epidural Spinal Cord Compression

Management

3) Consult Radiation Oncology
   • Did you know that there is 24/7 Radiation Oncology coverage?

4) Consult Spine Service/Neurosurgery
   • Ask the opinion about all patients but especially when there is:
     • No tissue diagnosis
     • Vertebral Column instability
     • Radio-resistant tumours (lung, colon, renal cell)
     • Intractable pain unrelieved by radiotherapy

Decompressive surgery followed by postoperative radiotherapy has been shown to be superior to radiotherapy alone for select patients with malignant epidural SCC.

ASTRO Guidelines
Malignant Epidural Spinal Cord Compression

Take Home points:

• All new-onset back or neck pain in a patient with a history of cancer should increase suspicion of malignant epidural SCC.

• A True Emergency! As soon as SCC is suspected corticosteroids should be administered.
  
  • IV bolus of dexamethasone at 10 to 20 mg, followed by 4-6 mg every 4 hours. Dexamethasone rapidly reduces spinal cord edema and back pain, and may also improve neurologic functioning.

• MRI is the preferred imaging study.

• Urgent radiation oncology consult +/- Spine Surgeon Assessment

References: CCNS Oncologic Emergencies/AHS CPG
Malignant Epidural Spinal Cord Compression

- Start Steroids and call Radiation Oncology!
Introduction to Immune Checkpoint Inhibitors
Disclosures

- Immunology was one of my least favourite courses in medical school.
Immune Checkpoint Inhibitors

- Immune system relies on multiple checkpoints to avoid over activation.
- Tumour cells hijack these checkpoints to escape detection.
- CTLA-4 (cytotoxic T-lymphocyte-associated protein) and PD-1 (Programmed Cell Death) receptors serve as two of these checkpoints.
Immune Checkpoint Inhibitors

- Inhibition of CTLA-4 and PD-1 receptors on activated T-lymphocytes allows for increased T-lymphocyte activation leading to improved anti-tumour immune responses.

- Simplistically, CTLA-4 inhibition occurs in the lymph node while PD-1 inhibition occurs in the tumour microenvironment.
In Pictures
Would a poorly drawn cartoon help?
Hey, I recognize that flag.
Before I make a mistake let me check with my team, PD-1 what do you think?
PD-1: Sorry T-Cell, no cytotoxic killing today.
T Cell

Tumour

PD-L1

PD-1

T Cell

PD-L1 or PD-1 Inhibitor

PD-1: We are good to go!
Cytotoxic killing begin!
What are the names of these drugs?

<table>
<thead>
<tr>
<th>Name</th>
<th>Drug Class</th>
<th>Indications (Canada)</th>
<th>Location of T-Cell Activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipilimumab (Yervoy)</td>
<td>CTLA4 Inhibitors</td>
<td>Metastatic Melanoma</td>
<td>Lymph Nodes</td>
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<tr>
<td>Nivolumab (Opdivo)</td>
<td>PD-1 Inhibitors</td>
<td>Metastatic Melanoma, Metastatic NSCLC (2nd Line), Metastatic Renal Cell Ca (2nd Line)</td>
<td>Tumour Tissue</td>
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<tr>
<td>Pembrolizumab (Keytruda)</td>
<td>PD-1 Inhibitors</td>
<td>Metastatic Melanoma, Metastatic NSCLC (2nd Line)</td>
<td>Tumour Tissue</td>
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In Clinical Trials - No Health Canada Indication as of April 12, 2017

<table>
<thead>
<tr>
<th>Name</th>
<th>Drug Class</th>
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<tbody>
<tr>
<td>Atezolizumab</td>
<td>PD-L1 Inhibitor</td>
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<td>Tumour Tissue</td>
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<tr>
<td>Durvalumab</td>
<td>PD-L1 Inhibitor</td>
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<td>Tumour Tissue</td>
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<td>BMS-936559</td>
<td>PD-L1 Inhibitor</td>
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<td>Avelumab</td>
<td>PD-L1 Inhibitor</td>
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<tr>
<td>Tremelimumab</td>
<td>CTLA4 Inhibitor</td>
<td></td>
<td>Lymph Nodes</td>
</tr>
</tbody>
</table>
Why is this exciting?
Metastatic Melanoma

A Intention-to-Treat Population

No. at Risk

<table>
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<td>Nivolumab plus ipilimumab</td>
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<tr>
<td>Ipilimumab</td>
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Maio JCO April 1, 2015
2nd Line Squamous Non-Small Cell Lung Cancer
Overall Survival

Presented By David Spigel at 2015 ASCO Annual Meeting

Number of Patients at Risk

<table>
<thead>
<tr>
<th></th>
<th>Nivolumab</th>
<th>Docetaxel</th>
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<tr>
<td>n</td>
<td>135</td>
<td>137</td>
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<td>OS (%)</td>
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</tbody>
</table>

Symbols represent censored observations

SLIDES ARE THE PROPERTY OF THE AUTHOR. PERMISSION REQUIRED FOR REUSE.

Presented By David Spigel at 2015 ASCO Annual Meeting
Tip of the iceberg?
Immune Checkpoint Inhibitors-The Future

Figure 3 | T cell targets for immunoregulatory antibody therapy. In addition to specific antigen recognition through the TCR, T-cell activation is regulated through a balance of positive and negative signals provided by co-stimulatory receptors. These surface proteins are typically members of either the TNF receptor or B7 superfamilies. Agonistic antibodies directed against activating co-stimulatory molecules and blocking antibodies against negative co-stimulatory molecules may enhance T-cell stimulation to promote tumour destruction.
Toxicity
Toxicity Grading

• National Cancer Institute Common Terminology Criteria for Adverse Events
  • mild (Grade 1),
  • moderate (Grade 2),
  • severe (Grade 3),
  • life-threatening (Grade 4)
• Specific Parameters exist for each organ system.
Immune Related Adverse Events (irAE)

- Adverse effects result from “un-inhibited” immune response (ie. irAE)
  - T-cell mediated
  - Can theoretically effect any organ system
  - Toxicity can be fatal if not treated
Potential Immune Related Adverse Events

**Skin**
- Dermatitis exfoliative
- Erythema multiforme
- Stevens Johnson Syndrome
- Toxic Epidermal Necrolysis
- Vitiligo
- Alopecia

**Endocrine**
- Hypothyroidism
- Hyperthyroidism
- Adrenal insufficiency
- Hypophysitis

**Pulmonary**
- Pneumonitis
- Interstitial lung disease
- Acute interstitial pneumonitis

**Neurologic**
- Autoimmune neuropathy
- Demyelinating Polyneuropathy
- Guillain-Barré
- Myasthenia Gravis-like syndrome

**Eye**
- Uveitis
- Iritis

**Hepatic**
- Hepatic, autoimmune

**Gastrointestinal (GI)**
- Colitis
- Enterocolitis
- Necrotizing colitis
- GI perforation

**Renal**
- Nephritis, autoimmune
- Renal failure

Figure courtesy of Glenn Myers
Toxicity

CTLA-4 Inhibitors

• Greater toxicity due to more “global” T-cell activation

PD-1/PD-L1 inhibitors

• Less toxic compared to CTLA-4 class
Common Side Effects of PD-1 Inhibitors

- Fatigue
- Decreased Appetite
- Rash
- Diarrhea
irAE

- Diarrhea/Colitis
- Pneumonitis
- Endocrinopathies
  - All axis of the pituitary gland (*ie. Hypophysitis*)
  - Thyroid gland (*ie. Hypo- or hyperthyroidism*)
  - Adrenal glands (*ie. Adrenal suppression*)
  - Pancreas (*ie. Diabetes Mellitus*)
- Dermatologic
- Liver Toxicity
More irAE…. 

- Myocarditis (<1%) 
- Nephritis (1-3%) 
- Pancreatitis (<1-2%) 
- Ocular toxicity 
- Neurological (<1%)
Kinetics of appearance of immune-related adverse event

- Rash, pruritis
- Liver toxicity
- Diarrhea, colitis
- Hypophysitis

Toxicity grade vs. Time (weeks)

irAE Management - General Principles

- Grade 1: Supportive Care; +/- withhold drug

- Grade 2: withhold drug, consider re challenge if toxicity resolves to <= Grade 1. **Corticosteroids** (prednisone 1mg/kg/day or equivalent tapered over a MONTH)

- Grade 3-4: discontinue drug; **high dose corticosteroids** (Methyprednisilone 1-2 mg/kg/day or equivalent) tapered over 1 month or greater once toxicity resolves to <= Grade 1

- Communicate with Oncology/Hematology for all Toxicities
# PD-1 vs Chemo Toxicity 2nd Line NSCLC

## PD-1 Checkpoint Inhibition Phase III Trials - Toxicities

<table>
<thead>
<tr>
<th>Trial</th>
<th>Agent</th>
<th>Rx-Related AEs– All &amp; Grade 3/4</th>
<th>Most Common Rx-Related AEs</th>
<th>Pneumonitis Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checkmate 017</td>
<td>Nivolumab</td>
<td>58% 7%</td>
<td>Fatigue – 16%</td>
<td>All – 5%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Appetite – 11%</td>
<td>Gr 3/4 – 0%</td>
</tr>
<tr>
<td></td>
<td>Docetaxel</td>
<td>86% 55%</td>
<td>Neutropenia – 33%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fatigue – 33%</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Nausea 23%</td>
<td></td>
</tr>
<tr>
<td>Checkmate 057</td>
<td>Nivolumab</td>
<td>69% 10%</td>
<td>Fatigue – 16%</td>
<td>All – 3%</td>
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<td>Appetite – 10%</td>
<td>Gr 3/4 – 1%</td>
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<tr>
<td></td>
<td>Docetaxel</td>
<td>88% 54%</td>
<td>Neutropenia – 31%</td>
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<td></td>
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<td>Fatigue – 29%</td>
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<td>Nausea – 26%</td>
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<tr>
<td>Keynote 010</td>
<td>Pembrolizumab 2 mg/kg dose</td>
<td>63% 13%</td>
<td>Fatigue – 20%</td>
<td>All – 5%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Pruritis – 11%</td>
<td>Grade 3-5 – 2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Appetite – 11%</td>
<td>2 deaths</td>
</tr>
<tr>
<td></td>
<td>Docetaxel</td>
<td>81% 35%</td>
<td>Fatigue – 25%</td>
<td>0%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Diarrhea 18%</td>
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<tr>
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<td></td>
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<td>Appetite – 16%</td>
<td></td>
</tr>
</tbody>
</table>

Presented By Jean-Charles Soria at 2016 ASCO Annual Meeting
Prolonged Steroid Course

- Adjunct therapies for steroid tapers to consider
  - Pneumocystis jirovecii (PCP) prophylaxis
    - >4 weeks @ >20mg/day
  - GI ulceration prophylaxis in patients on NSAIDS or ASA
  - Calcium + vitamin D for bone health
Take Home Points

- Drug induced autoimmunity ALWAYS included in differential, often diagnosed by exclusion
  - Rule out other Etiologies
  - Can affect ANY organ system
  - Early Recognition, evaluation and treatment are critical.
- Communicate with Oncology/Hematology for all Toxicities
- PO/IV corticosteroids the preferred method for managing moderate to severe immune related adverse events.
And something to take home ...
<table>
<thead>
<tr>
<th>Generic Name (Brand)</th>
<th>Drug Class</th>
<th>Approved Indication</th>
<th>Off-Label</th>
<th>Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipilimumab (Yervoy®)</td>
<td>CTLA-4 Inhibitors</td>
<td>Metastatic Melanoma (single or combo), Adjuvant melanoma</td>
<td>N/A</td>
<td>3mg/kg IV q3 weeks X 4 doses (30mg/kg/adjuvant)</td>
</tr>
<tr>
<td>Nivolumab (Opdivo®)</td>
<td>PD-1 Inhibitors</td>
<td>Metastatic Melanoma, mNSCLC (2nd line), mCC, Head and Neck</td>
<td>Hodgkin’s Lymphoma</td>
<td>3mg/kg IV q2 weeks; 1mg/kg q3 weeks in combination with ipilimumab</td>
</tr>
<tr>
<td>Pembrolizumab (Keytruda®)</td>
<td>PD-1 Inhibitors</td>
<td>Metastatic Melanoma, mNSCLC (1st or 2nd line), Head and Neck</td>
<td>N/A</td>
<td>2mg/kg IV q4 weeks</td>
</tr>
</tbody>
</table>

**Mechanism of Action**: Inhibition of CTLA-4 and PD-1 receptors on activated T-lymphocytes allows for increased T-lymphocyte activation in the lymph nodes and tumor tissue, respectively, to improve anti-tumor immune responses. This is not the same mechanism utilized by conventional cytotoxic chemotherapy or other targeted anti-cancer therapy.

**Immune related adverse events (irAE)**: Inhibition of T-lymphocyte deactivation increases risk for immune related toxicities that resemble that of autoimmune presentation. **The preferred method of managing grade 2 irAE is PO/IV corticosteroids**.

### Grade 1 Adverse Event (mild, asymptomatic or minimally symptomatic)

<table>
<thead>
<tr>
<th>Dermatologic Toxicity</th>
<th>Grade 1</th>
<th>Topical corticosteroid (ie. Betadine) +/- antihistetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maculopapular rash &lt;10% of BSA (+/- pruritus)</td>
<td>No therapy required;</td>
<td>Communicate with Oncology/Hematology</td>
</tr>
<tr>
<td>Gastrointestinal Toxicity</td>
<td>&lt;4 stools/day, no colitis symptoms</td>
<td>Anti-motility agent X 24-48hrs; Monitor by oncology</td>
</tr>
<tr>
<td>Hepatic Toxicity</td>
<td>AST/ALT ≤2.5x ULN OR bilirubin ≤1.5x ULN</td>
<td>No therapy required; Monitor by oncology</td>
</tr>
<tr>
<td>Nephrotic Toxicity</td>
<td>SCR ≤1.5x ULN</td>
<td>No therapy required; Monitor by oncology</td>
</tr>
<tr>
<td>Pulmonary Toxicity</td>
<td>Asymptomatic, Radiographic changes only</td>
<td>No therapy required; Monitor q3 days by oncology</td>
</tr>
<tr>
<td>Endocrine Toxicity</td>
<td>Asymptomatic</td>
<td>No therapy required; Monitor by oncology</td>
</tr>
</tbody>
</table>

### Grade 2 Adverse Event (Moderate severity toxicity that requires corticosteroids)

<table>
<thead>
<tr>
<th>Dermatologic Toxicity</th>
<th>Maculopapular rash 10-30% of BSA</th>
<th>Communicate with Oncology/Hematology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal Toxicity</td>
<td>4-6 stools/day, mild colitis symptoms</td>
<td>Start prednisone 1mg/kg PO OR methylprednisolone 1mg/kg IV daily</td>
</tr>
<tr>
<td>Hepatic Toxicity</td>
<td>AST/ALT &gt;2.5-5x ULN OR bilirubin &gt;1.5-3x ULN</td>
<td>Consider consultation of disease site specialist (ie. Gastrointestinal toxicity → Gastroenterologist)</td>
</tr>
<tr>
<td>Nephrotic Toxicity</td>
<td>SCR &gt;1.5-6x ULN</td>
<td></td>
</tr>
<tr>
<td>Pulmonary Toxicity</td>
<td>New mild to moderate symptoms</td>
<td>Same as above; CT Chest</td>
</tr>
<tr>
<td>Endocrine Toxicity</td>
<td>Symptomatic hypothyroidism, hyperthyroidism or hypophysitis with laboratory changes</td>
<td>TSH, T4, cortisol and puituary blood panel; Brain MRI If hypophysitis</td>
</tr>
</tbody>
</table>

### Grade 3/4 Adverse Event (Severe toxicity that requires admission and aggressive corticosteroids)

<table>
<thead>
<tr>
<th>Dermatologic Toxicity</th>
<th>Maculopapular rash &gt;30% of BSA</th>
<th>Communicate with Oncology/Hematology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal Toxicity</td>
<td>&gt;7 stools/day, moderate/severe colitis symptoms</td>
<td>Prednisone 1-2mg/kg PO daily as outpatient</td>
</tr>
<tr>
<td>Hepatic Toxicity</td>
<td>AST/ALT &gt;5x ULN OR bilirubin &gt;3x ULN</td>
<td>Admission to hospital</td>
</tr>
<tr>
<td>Nephrotic Toxicity</td>
<td>SCR &gt;6x ULN</td>
<td>Communicate with Oncology/Hematology</td>
</tr>
<tr>
<td>Endocrine Toxicity</td>
<td>Adrenal crisis; Severe symptomatic hypophysitis</td>
<td>Start methylprednisolone 1-2mg/kg IV daily</td>
</tr>
<tr>
<td>Pulmonary Toxicity</td>
<td>New severe symptoms and worsening hypoxia</td>
<td>Consultation with disease site specialist (ie. Gastrointestinal toxicity → Gastroenterologist)</td>
</tr>
</tbody>
</table>

1=Abdominal pain, hematochezia, mucous stool; 2=Abdominal pain with ileus or peritoneal signs, fever and potential life threatening consequences
Learning Objectives

- Review presentation and management of Malignant Epidural Spinal Cord Compression (MESCC)
- Introduce immune checkpoint inhibitors
- Provide a brief overview of the management immune related adverse events.
Three Key Messages

- MRI is the gold standard for diagnosis of malignant epidural spinal cord compression.

- If a patient is on an immune checkpoint inhibitor, drug induced autoimmunity should ALWAYS be included in the differential diagnosis.

- PO/IV corticosteroids the preferred method for managing moderate to severe immune related adverse events.
• Special thanks to Glenn Myers for the IO toxicity handout and access to his slides.
Thank you
Questions
Oncologic Emergencies
Links

- Alberta: A Guide for Family Physicians
- Nova Scotia
Horizon Guidelines

- Febrile Neutropenia
- Penicillin Allergies
- Chemotherapy Induced Toxicity
British Columbia Cancer Agency (BCCA) Guidelines

- Hypercalcemia
- Febrile Neutropenia
Immune Checkpoint Inhibitors Links

- Ipilimumab
- Nivolumab
- Pembrolizumab