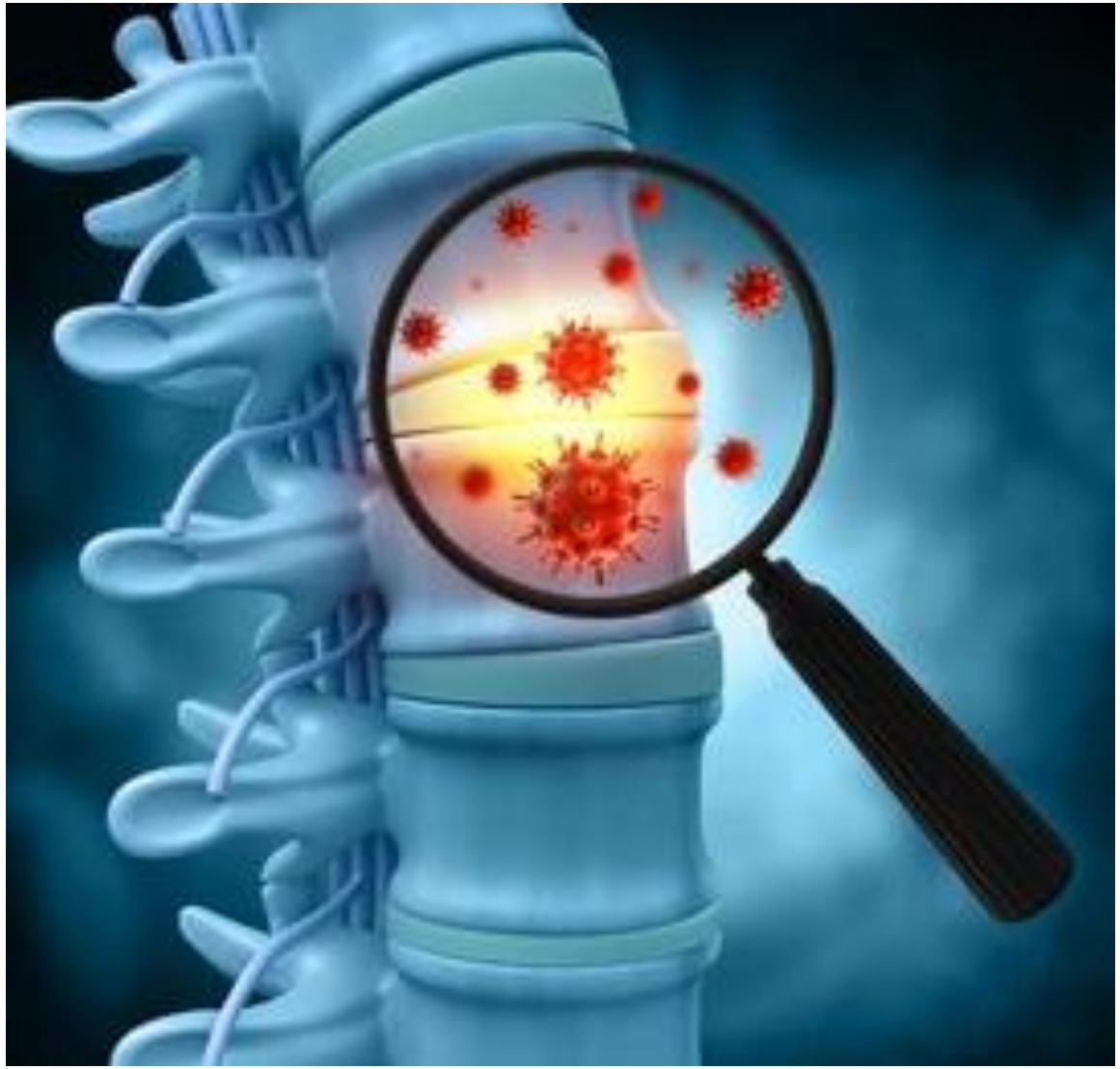
PLESAE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

https://www.youtube.com/watch?v=Qs1ibg_R5Zc&list=PLuBRb5B7fa_embZp8jWG_hG8_o1JXLEeo&index=8

Metastatic Diseases of the Spine



Presented by: Dr Fares Ababneh

Objectives

- **Identify the most common cancers that can manifest as metastases to the spinal column.**
- **Review the diagnostic modalities most commonly used in a workup for spinal metastases.**
- **Describe treatment strategies for spinal metastasis, both with and without spinal cord involvement.**
- **Summarize the significance of coordination among the members of the interprofessional team in providing pain and palliative care to improve the quality of life for patients.**

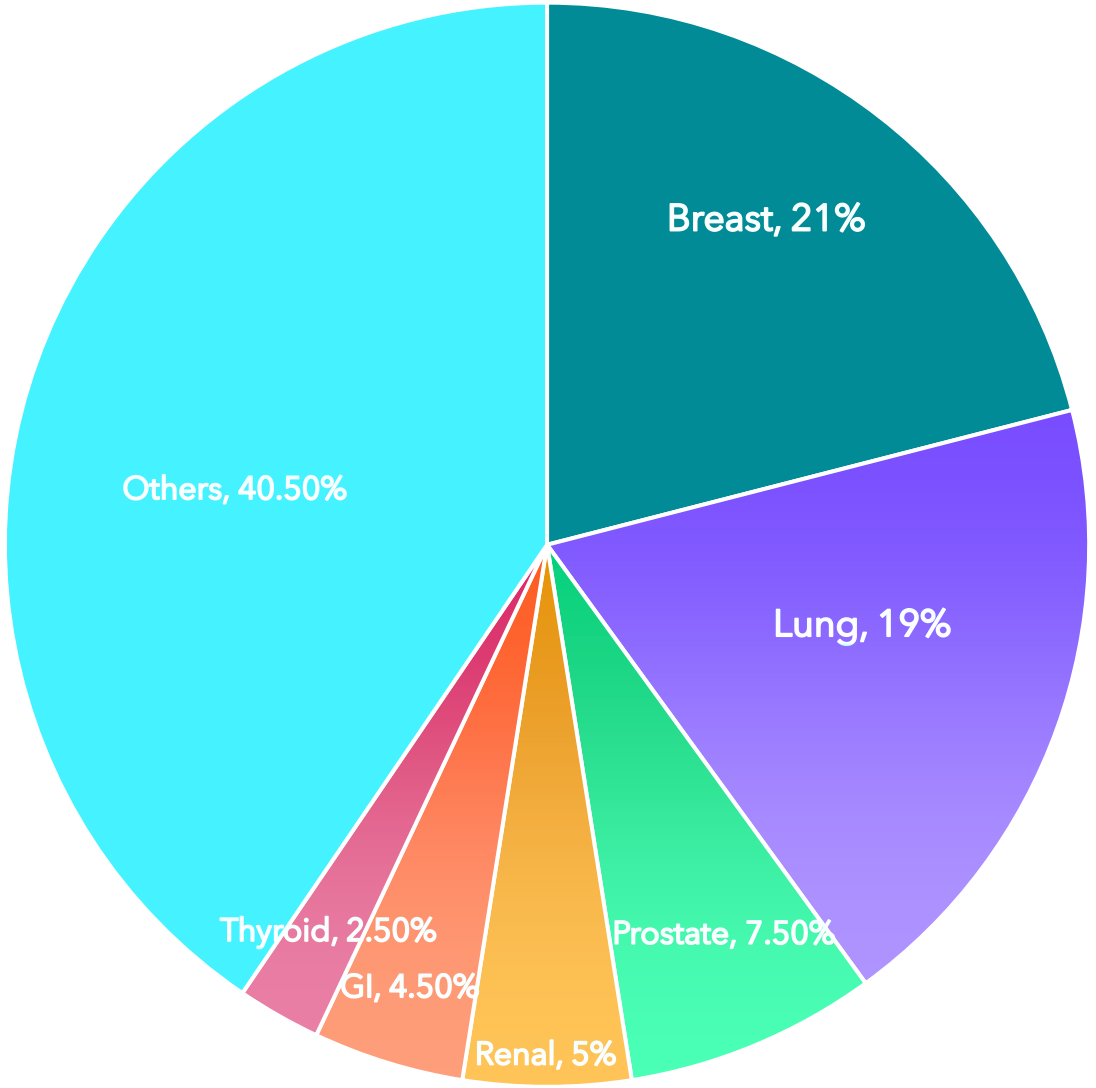
1.9 million new cancer per year in USA.

40% of all patients will develop metastatic spinal disease

- 10-20% of these patients will develop spinal cord compression

Spinal metastases in the initial presentation of malignancy in 20% of patients

The most common primary malignancies that metastasize to the spine are breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%) cancers. These cancers spread to the spinal column early in the disease process, leading to significant morbidity.



While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process

Epidemiology

Bone is the 3rd most common site for metastatic disease (behind lung and liver)

up to 90% of patients with metastatic cancer have spinal disease, but only 10-20% are symptomatic

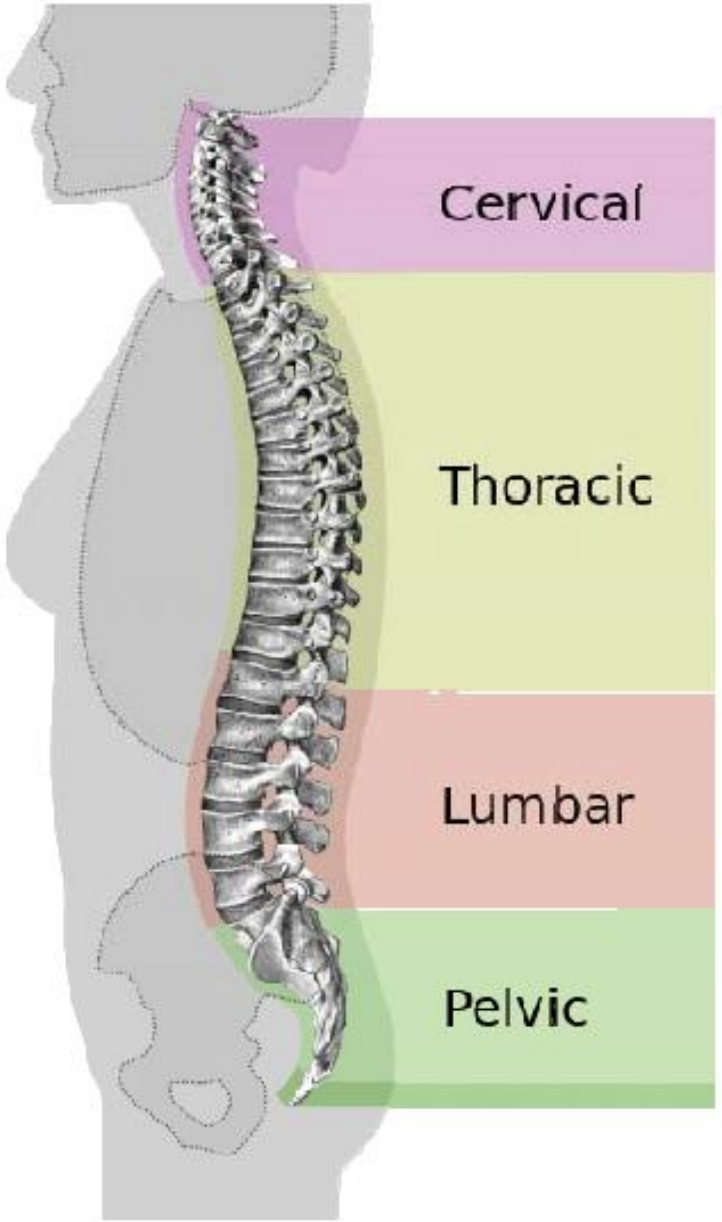
Common sites of metastatic lesions include *SPINE>PROXIMAL FEMUR>HUMERUS*

- most common site of mets is spine
- Thoracic spine is most common site of bony metastasis
- Vertebral body affected first

Approximately 70% of patients who die of cancer, have evidence of vertebral metastases on autopsy

Location:

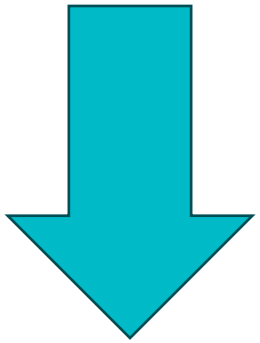
- Thoracic Spine (60-80%)
- Lumbar Spine (15-30%)
- Cervical Spine (<30%)



Future

Population ages

Better adjuvant therapy



Patients surviving longer

More patients developing metastatic disease

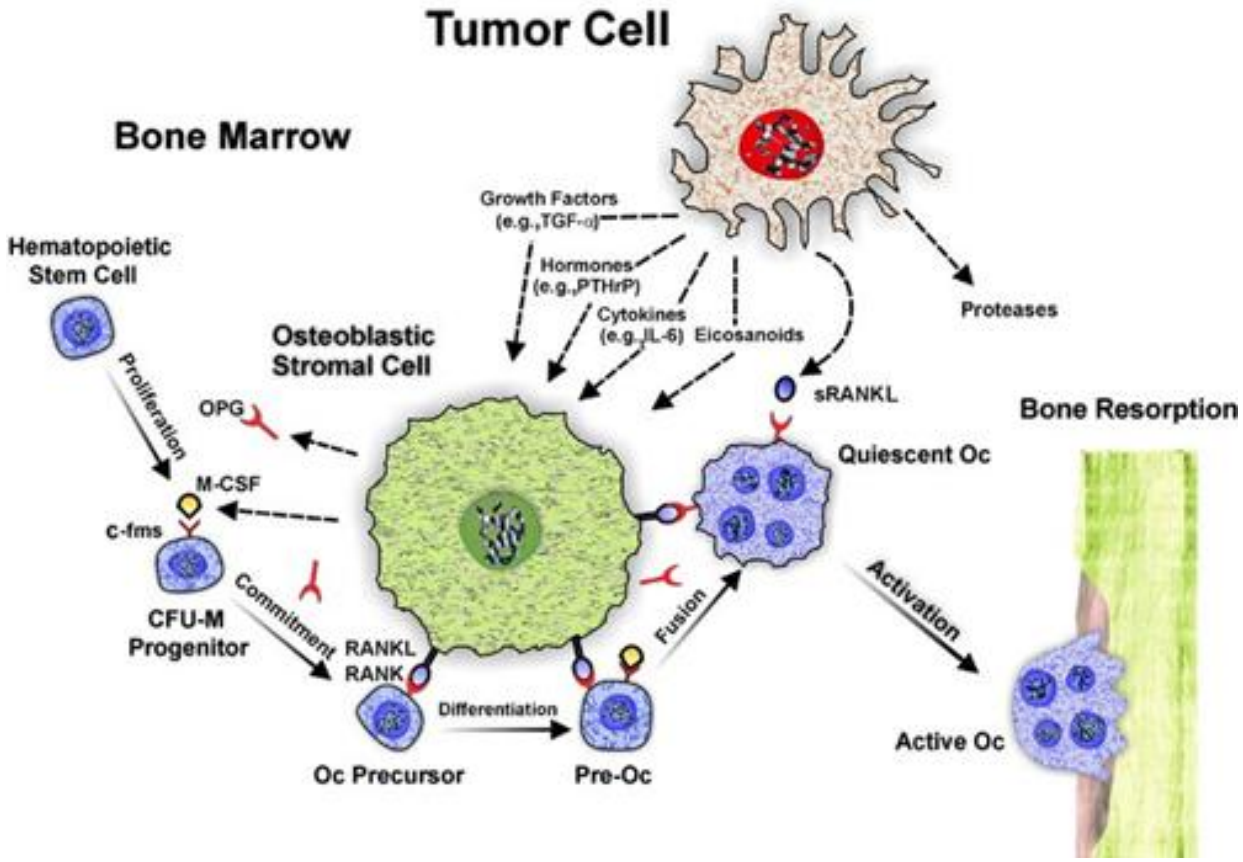
Pathophysiology

Mechanism of bone destruction (osteolysis):

Osteolytic bone lesions are caused by **tumor-induced activation of osteoclasts**

- occurs through the RANK, RANK ligand (RANKL), osteoprotegerin pathway
- PTHrP positive breast cancer cells activate osteoblastic RANKL production

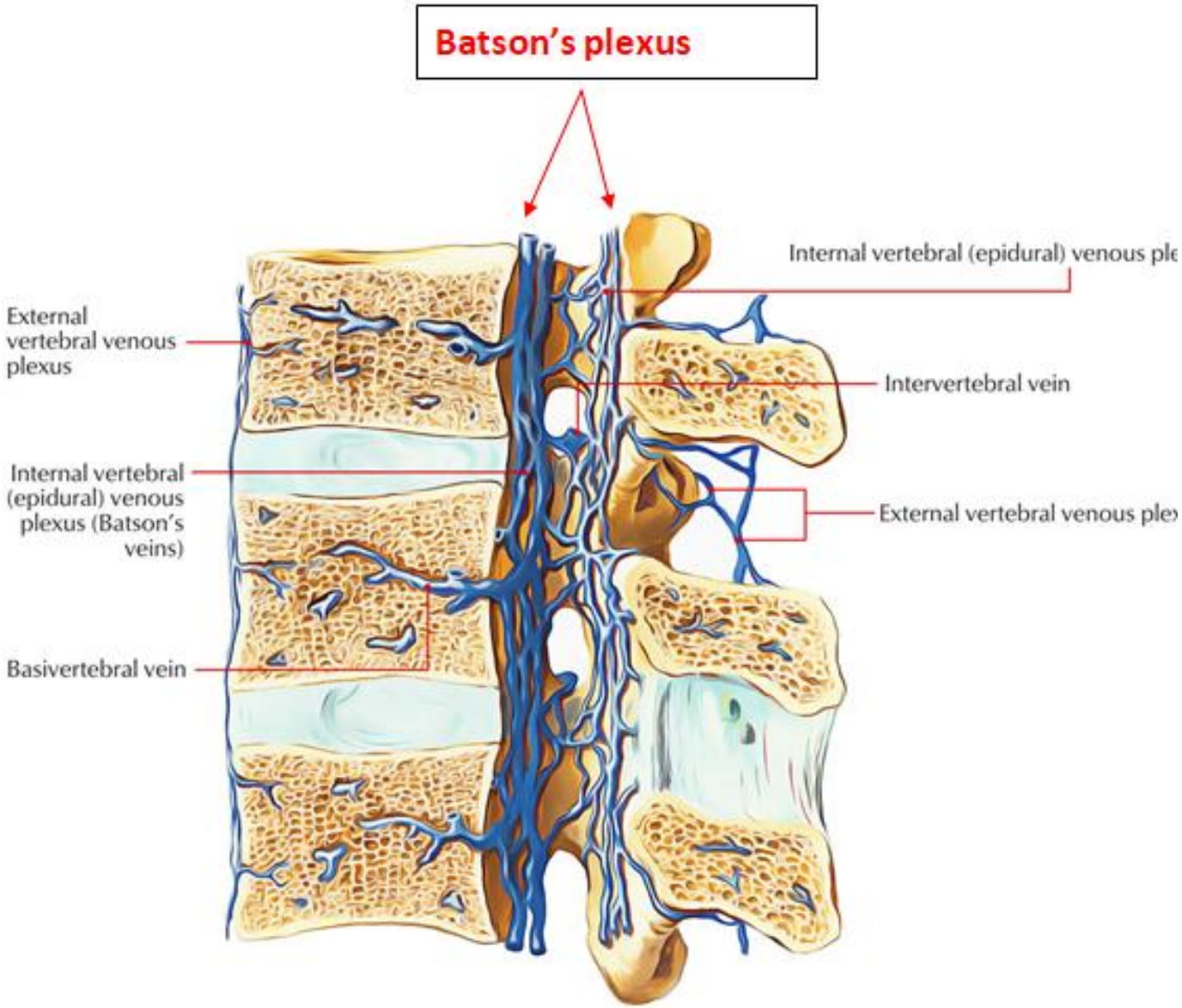
Osteoblastic bone metastases are due to **tumor-secreted endothelin 1**



Principles of Metastases

Two hypotheses for the mechanism of metastasis:

- Seed and soil Theory: tumor cells grow in compatible end-organ environments
- Circulation theory: tumor spread is primarily influenced by blood flow from the primary site
- Direct Invasion



Vascular spread:

Batson's vertebral plexus

- valveless venous plexus of the spine that provides a route of metastasis from organs to axial structure including vertebral bodies, pelvis, skull, and proximal limb girdles

Classification

Tokuhashi Score

- prognostic score based on 6 elements: general condition, extraspinal bony metastasis, number of vertebral bodies with metastasis, visceral metastasis, primary tumor, neurologic compromise

Characteristic	Score
General condition (performance status [PS])	
Poor (PS 10%-40%)	0
Moderate (PS 50%-70%)	1
Good (PS 80%-100%)	2
No. of extraspinal bone metastases foci	
≥3	0
1-2	1
0	2
No. of metastases in the vertebral body	
≥3	0
1-2	1
0	2
Metastases to the major internal organs	
Unremovable	0
Removable	1
No metastases	2
Primary site of the cancer	
Lung, osteosarcoma, stomach, bladder, esophagus, pancreas	0
Liver, gallbladder, unidentified	1
Others	2
Kidney, uterus	3
Rectum	4
Thyroid, breast, prostate, carcinoid tumor	5
Palsy	
Complete (Frankel A, B)	0
Incomplete (Frankel C, D)	1
None (Frankel E)	2

score of 0-8: <6 months; 9-12 > 6 months, 12-15 >1 year

Spine Surgeon's Role

In approximateely 20% of patients, the first presentation of a malignancy is a spinal problem

Evaluation

- History
- Physical exam
- Laboratory:
- Radiological
- Biopsy

History

- unexplained rest pain or mechanical back/neck pain in cancer patients
- constitutional symptoms (weight loss, fatigue, malaise)
- risk factors of common cancers (smoking, hematuria, shortness of breath, breast mass, goiter)
- current and/or prior chemotherapy treatment

Symptoms

- Pain (85%): The most common presenting complaint

  - Biologic: local release of cytokines, periosteal irritation, stimulation of intraosseous nerves, increased pressure of mass effect from tumor tissue in the bone

  - Mechanical: nerve compression, pathologic fractures, instability

- Axial night pain
- Weakness (34%)
- Mass (13%)
- Constitutional symptoms

Physical Exam

- neurologic deficits
- caused by compression of the spinal cord with metastatic disease to the spine
- important to differentiate between root level and cord level injury
- gait abnormalities

Laboratory Evaluation

- CBC with differential
- ESR
- basic metabolic panel
- LFTs, Ca, Phos, alkaline phosphatase
- serum and urine immunoelectrophoresis (SPEP, UPEP)
- thyroid function test
- parathyroid hormone
- PSA

Rdiological Evaluation

- **X-Ray:**

The simplest test often available to evaluate an oncologic patient presenting with neck or back pain is an x-ray of the spinal column. Plain anterior and posterior (AP) and lateral images are often non-sensitive or specific and require at least 30-50% of trabeculae involvementbefore an abnormality can be observed.

- **Bone scan:** screening, cold in MM

- **CT:** Bony architecture

- **MRI:**

the gold standard for evaluating these lesions. MRI would show extension, levels involved, and canal compromise, as well as provided clues to the etiology of the metastasis


A
B

Staging:

- CT chest, abdomen and pelvis with oral and IV contrast
- Bone scan
- Mammogram

- Angiogram:

- Pre-operative embolization

- Renal cell, thyroid

Biopsy

in patients where a primary carcinoma is not identified, obtaining a biopsy is necessary to rule out a primary bone lesion

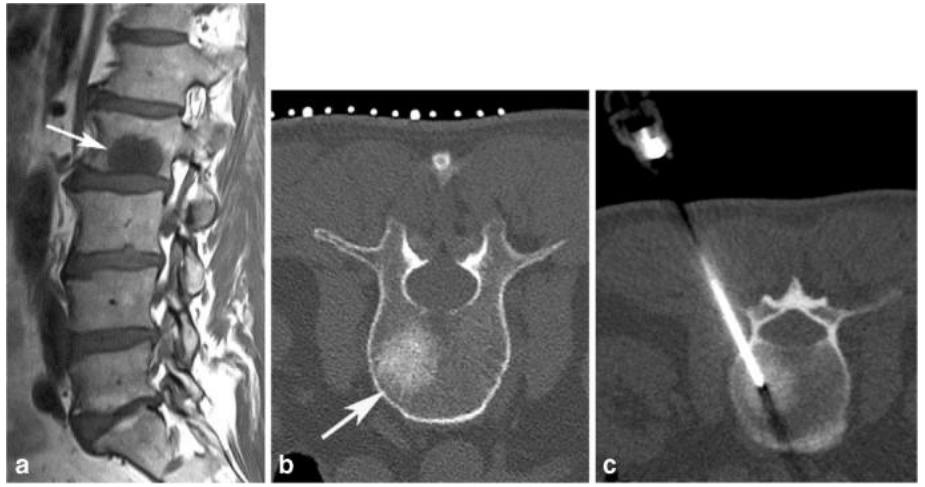
- should not treat a bone lesion without tissue diagnosis of the lesion

Options:

-Ct guided: most accessible lesions, minimal morbidity

Accuracy : 93% for lytic lesions, 76% for sclerotic lesions

-Open: cost, delay, definitive for benign tumors



<u>Technique</u>

- posterior-based transpedicular approach
- increased risk of vertebral artery injury with posterior approach
- wide-gauge Jamshidi cannula
- coring needle
- imaging guidance (fluoroscopy, CT, or navigation)

Culture every tumor and Biopsy every infection

Goal of management

Maximize quality of life

Curative in certain solitary metastasis

To Achieve the Goal

- Provide pain relief
- Improve or maintain neurologic function
- Restore of maintain the structural integrity of the spinal comumn

Treatment options

- Supportive: Orthotic, steroids, Bisphosphonates
- Chemotherapy and Hormonal Therapy
- Rdiotherapy
- Surgery
- Comination

Multi-disciplinary approach

Treatment

General considerations

NOMS framework: neurologic, oncologic, mechanical instabili systemic illness

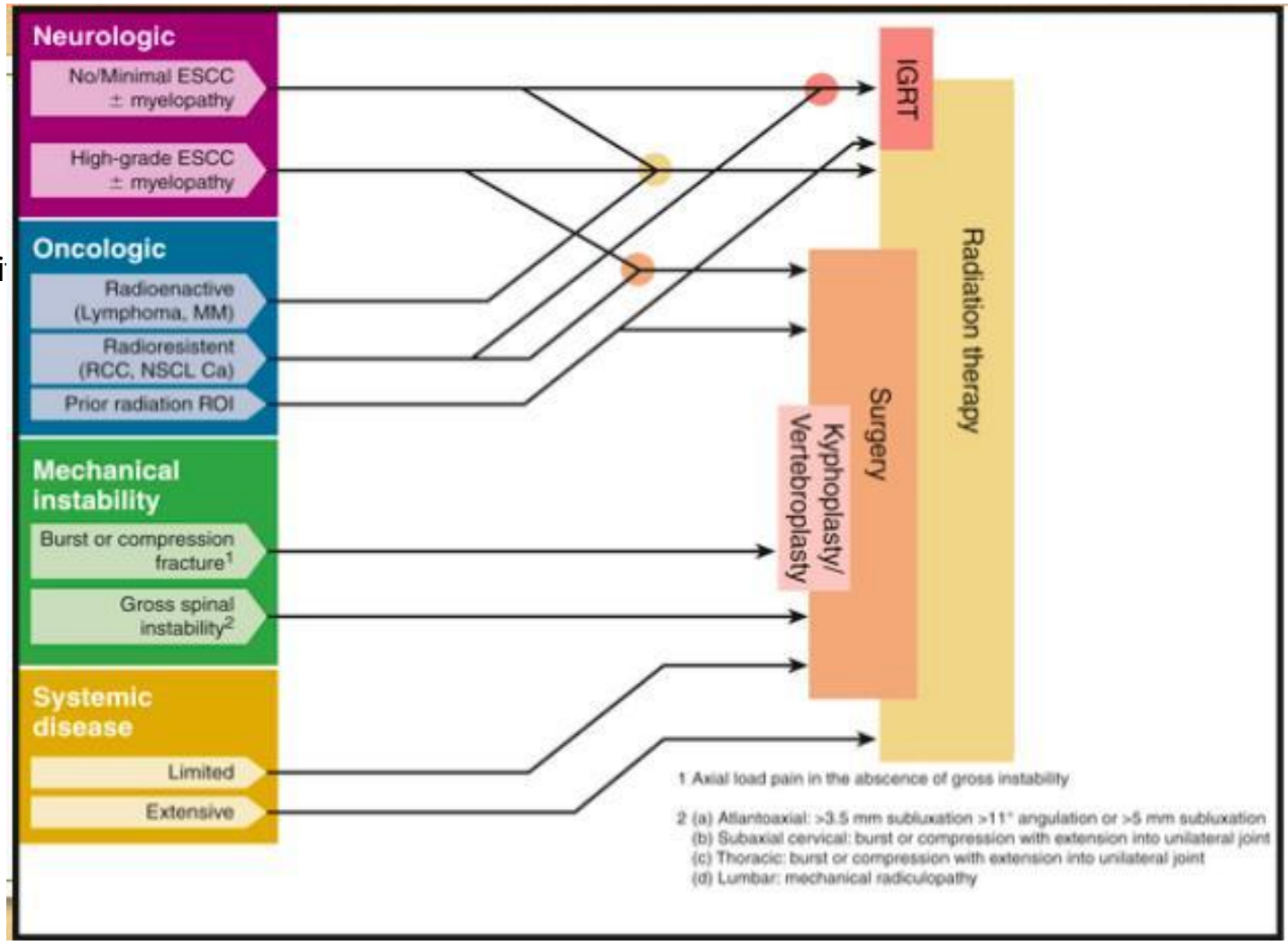
- *Neurologic:* measure of epidural spinal cord compression (ESCC)

  0-1 low grade, 2-3 high grade

- *Oncologic:* responsiveness to radiation
- *Mechanical instability*: spinal instability neoplastic score (SINS)

SINS: 0-6 no surgical consultation required, 7-18 surgical consultation advisable

- *Systemic illness:* formulation of prognosis from disease burden, medical comorbidities, functional status



Treatment options

Pain management and bracing

indications

- stable fractures
- no neurologic deficits
- life expectancy of < 6 months (Tokuhashi scoring system)

Treatment options

Operative

Kyphoplasty/vertebroplasty, ablation, and radiation

- no fracture or stable fracture
- no signs of neural compression, neurologic deficit, or instability
- outcomes
- 88% chance of local control after stereotactic radiosurgery in tumors not causing instability or cord compression

Treatment options

Operative

Neurologic decompression, spinal stabilization, and postoperative radiation

- metastatic lesions to spine with neurologic deficits in patients with life expectancy of > 6 months
- intractable pain
- technique
- preoperative embolization indicated in metastatic renal and thyroid CA to spine
- outcomes
- 95% local control after surgery and radiation
- 16% of ASIA E patients with high grade epidural cord compression have neurologic decline even with surgery

Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: a randomised trial

Roy A Patchell, Phillip A Tibbs, William F Regine, Richard Payne, Stephen Saris, Richard J Kryscio, Mohammed Mohiuddin, Byron Young

Summary

Background The standard treatment for spinal cord compression caused by metastatic cancer is corticosteroids and radiotherapy. The role of surgery has not been established. We assessed the efficacy of direct decompressive surgery.

Methods In this randomised, multi-institutional, non-blinded trial, we randomly assigned patients with spinal cord compression caused by metastatic cancer to either surgery followed by radiotherapy (n=50) or radiotherapy alone (n=51). Radiotherapy for both treatment groups was given in ten 3 Gy fractions. The primary endpoint was the ability to walk. Secondary endpoints were urinary continence, muscle strength and functional status, the need for corticosteroids and opioid analgesics, and survival time. All analyses were by intention to treat.

Findings After an interim analysis the study was stopped because the criterion of a predetermined early stopping rule was met. Thus, 123 patients were assessed for eligibility before the study closed and 101 were randomised. Significantly more patients in the surgery group (42/50, 84%) than in the radiotherapy group (29/51, 57%) were able to walk after treatment (odds ratio 6·2 [95% CI 2·0–19·8] p=0·001). Patients treated with surgery also retained the ability to walk significantly longer than did those with radiotherapy alone (median 122 days *vs* 13 days, p=0·003). 32 patients entered the study unable to walk; significantly more patients in the surgery group regained the ability to walk than patients in the radiation group (10/16 [62%] *vs* 3/16 [19%], p=0·01). The need for corticosteroids and opioid analgesics was significantly reduced in the surgical group.

Interpretation Direct decompressive surgery plus postoperative radiotherapy is superior to treatment with radiotherapy alone for patients with spinal cord compression caused by metastatic cancer.

Deterrence and Patient Education

- 1. The patient should be aware of the possibility of a pathological collapse of the involved vertebrae, and therefore bracing or external immobilizers may sometimes be recommended (apart from surgical stabilization procedures) by the treating clinicians. Strict compliance with physician recommendations is very important in such scenarios.
- 2. The prognosis for neurological recovery is dependent on the duration and severity of deficit; and therefore in situations of compromised neurological status, the importance of early consultation with specialist spine surgeons can not be understated.

Enhancing Healthcare team outcomes

- Patients with spinal metastases are best managed with an interprofessional team that includes an oncologist, radiation consultant, radiologist, pathologist, pain specialist, neuro/orthopedic surgeon, and palliative care nurses. Most of these patients have a shortened life expectancy and aggressive procedures are usually not warranted. Both pain service and palliative care should be involved early in the care. The key is to ensure that the patient has a good quality of life