METASTATIC SPINAL TUMORS

- Presentation of metastatic bone cancer is growing due to increased life expectancy of cancer patients.
- The spine is the most commonly affected site for metastatic bone cancer, often migrated from breast, lung, prostate or kidney.
- Patients may experience pain that is local, mechanical, radicular or a combination of any of these.
- Certain types of tumors may be moderately radiosensitive (e.g., breast, prostate) while others radioresistant (e.g., melanoma, thyroid, colon, kidney)

Treatment goals are pain palliation and improvement in QOL achieved by:
  - Preservation of neurologic function
  - Pain relief
  - Stabilization of mechanical structure
# PAIN MECHANIZMS FOR VERTEBRAL BODY METASTASES

<table>
<thead>
<tr>
<th>Mechanical Pain</th>
<th>Biological Pain</th>
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</thead>
<tbody>
<tr>
<td>• Instability from pathologic micro-fractures</td>
<td>• Stretching/irritation of the peristeum: secondary to tumor growth</td>
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<tr>
<td>• Macroscopic Fractures</td>
<td>• Tumor growth into the surrounding nerves and tissues</td>
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<td>• Osteoclast mediated bone resorption and associated release of neuro- stimulating cytokines</td>
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</table>

Cancer diagnosis or suspicion of spine metastasis

- Asymptomatic (Incidental finding)
  - Systemic Imaging (PET, CT, MRI, bone scan)
  - Biopsy if remote cancer history
- Observation OR Surgery/focal RT or Chemotherapy are options for patients with asymptomatic epidural disease

Symptomatic, i.e., severe, new or progressive pain or neurological symptoms

- Spinal MRI (urgent with neuro symptoms) or CT myelogram if MRI not feasible

No Tumor

- Evaluate for other causes of pain and/or neurologic symptoms
- Spinal Cord Compression
- Steroids
  - Surgery followed by RT (category 1) OR Primary RT OR Primary Chemo (if chemosensitive tumor and in the absence of clinical myelopathy)
  - Surgical stabilization OR Vertebral Augmentation

No Spinal Cord Compression

- Fracture or Spinal Instability
  - RT (preferred) OR Chemo (if chemosensitive) OR Surgery (select cases) followed by RT
  - Consider surgery or SRS

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PATIENTS WHO BENEFIT FROM RADIOFREQUENCY ABLATION (RFA)

Many patients with focalized pain from metastatic spinal tumors may be candidates for Radiofrequency Ablation, several specific patient groups will likely benefit:

• Candidate for adjunctive therapies (RFA/RT)
• Radio-resistant tumors
• Persistent and/or recurrent pain after radiation therapy
• Maximum dose limit
• Focalized pain and symptoms that are preventing palliative radiation
• Concurrent systemic treatments
• Myelosuppression is of concern
Metastatic Spine Disease Multidisciplinary Working Group Algorithms for managing asymptomatic spinal metastases (A), uncomplicated painful spinal metastases (B), spinal metastases complicated by stable (C) and unstable (D) fractures, and metastatic epidural spinal cord compression (MESCC) (E).
Images from a 51-year-old woman with renal cell carcinoma (clear cell type), stage IV (T2a, NX, M1) with midback pain. (A): Sagittal computed tomography image shows osteolytic metastases involving the T11, L2, L3, and L5 vertebral bodies (white block arrows). Her life expectancy was greater than 6 months, her performance status was excellent, and she had no other evidence of metastatic disease; however, she had more than three spinal metastases. She was treated with conventional external beam radiation therapy to the thoracolumbar spine, but 3 months later her back pain continued to worsen. (B, C): T1-(B) and T2-weighted (C) magnetic resonance imaging (MRI) of the lower thoracic spine shows interval enlargement of the T11 metastasis and a new T12 metastasis (white arrowheads) with epidural extension, but no clinical or radiographic evidence of spinal cord compression. Her life expectancy was still greater than 6 months, her performance status remained excellent, and she still had no visceral metastases. Because the cumulative tolerance of the lower thoracic spinal cord had been reached, she could not receive additional radiation therapy; therefore, radiofrequency ablation and vertebral augmentation of T11 and T12 were performed, after which her back pain resolved. (D, E): Sagittal T1-(D) and T2-weighted (E) MRI obtained 3 months later shows signal void in the T11 and T12 vertebral bodies corresponding to cement (white asterisks) with retraction of previously seen epidural tumor. Fatty replacement of the T10 and L1 vertebral body marrow is related to prior radiation therapy.
Images from a 39-year-old man with neurofibromatosis and stage IV (T1b, N1, M1) malignant peripheral nerve sheath tumor.
Images from a 63-year-old man with stage IV (T4a, N3, M1c) chest wall desmoplastic melanoma and lower back pain.

Adam N. Wallace et al. The Oncologist 2015;20:1205-1215
Metastatic Epidural Spinal Cord Compression

- LE < 6 mo, poor PS, or many visceral metastases
  - cEBRT (A)

- LE > 6 mo, good PS, & few visceral metastases
  - Spinal metastases > 3
    1. Surgery (A) + cEBRT (A)
    2. cEBRT (A)
Images from a 64-year-old man with stage IV (T3a, NX, M1b) castration-resistant prostate cancer and low back pain previously treated with conventional external beam radiation therapy and systemic radionuclide therapy.

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POTENTIAL SYNERGISTIC EFFECT: Radiofrequency Ablation & Radiation Therapy

- 15 pts RFA + RT (20Gy in 5 fractions)
- 30 pts RT
- 5/15 (33%) vertebrae RFA + RT; 2/30 (6.6%) RT alone
- Pelvis accounted for Majority
- Baseline VAS 6.5 (RT) and 6.3 (RFA + RT)
- Complete response (VAS 0) at 12 weeks 16.6% (RT) and 53.3% (RFA+RT)
- Partial response (decrease VAS > 2) 43.3% (RT) and 40% (RFA+RT)
- Overall response rate at 12 weeks 59.9% (RT) and 93.3% (RFA+RT)
- Interval to response: 9 weeks (RT) and 3 weeks (RFA+RT)

RADIOFREQUENCY ABLATION AND CEMENTOPLASTY

Fifty-three combined radiofrequency ablation and cementoplasty procedures combined RFA and cementoplasty in 36 pts (53 lesions — 34 spine (64%))

Results

• Combined radiofrequency ablation (RFA) and cementoplasty procedures were performed with 100% technical success
• VAS 7.2(pre-procedure) to 3.4(post-procedure)
• Relative contraindication of posterior lesions with extension of destruction with greater than 40% AP canal dimension
• RFA up to 95 C for two 12 minute cycles with 1.0 or 2.0 cm active tips

Conclusion

• Combined RFA and cementoplasty appears to be safe, practical and effective in the palliative treatment of painful neoplastic lesions

POSTERIOR VERTEBRAL BODY METASTASES

• Single-center, retrospective review from June 2012 to June 2013 and follow up for 12 months.
• 26 patients with 47 posterior vertebral body tumors (94% cemented).

Results

• **Mean VAS score**: decreased significantly from 7.82 to 2.82 at 1 week and 3.3 at 1 month.
• **Pain Medications**: 50% patients had a decrease of pain medication intake, 23% had no changes and 27% had increase.
• **Safety**: MRI images showed progression of disease in 3 patients

Conclusion

• Targeted RFA is both feasible and safe for the treatment of painful posterior vertebral body metastatic tumors.