Radical versus Palliative Resections in the treatment of Spinal Metastasis

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Conflict of interest Statement
No funds were received in support of this study.
Radical/Palliative treatment of Spinal Metastasis

Metastasic Spine Tumor (MST) cause pain, paralysis or impairment of activities of daily living (ADL)

→ GENERALIZED disorder
→ life expectancy and treatment options have many limitations
→ Treatment is primarily SYMPTOMATIC
  GOALS → relieve pain, prevent paralysis and improve ADL

Among the various treatment modalities SURGERY should be considered in the initial steps

Surgery can achieve long-term LOCAL CONTROL in SELECTED CASES

Tokuhashi Y, Ajiro Y, Oshima M. Algorithms and Planning in Metastastic Spine Tumors. OCNA 40, Jan 2009
Radical/Palliative treatment of Spinal Metastasis

Four main considerations

1. Improving trend in survival  
   Mortality rates continue to decrease year by year for the most common sites of metastatic disease.

2. Incidence of SM

3. Multispeciality involvement

4. Evidence literature

 Cáceres E. Metastatic Disease of the Mobile Spine. Eurospine 2009
Radical/Palliative treatment of Spinal Metastasis

Four main considerations

1. Improving trend in survival
   Mortality rates continue to decrease year by year for the most common sites of origin.

2. Incidence of SM
   30%-70% will have Spinal Met.

3. Multispeciality involvement
   Only 5%-14% symptomatic.

4. Evidence literature

Cáceres E. Metastasic Disease of the Mobile Spine. Eurospine 2009
Radical/Palliative treatment of Spinal Metastasis

Four main considerations

1. **Improving trend in survival**
   - Mortality rates continue to decrease year by year for the most common sites of primary cancer
   - 30%-70% will have Spinal Met
   - Only 5%-14% symptomatic

2. **Incidence of SM**

3. **Multispeciality involvement**

4. **Evidence literature**

→ Difficult to compare treatments

Cáceres E. Metastatic Disease of the Mobile Spine. Eurospine 2009
Radical/Palliative treatment of Spinal Metastasis

Four main considerations

1. Improving trend in survival
2. Incidence of SM
3. Multispeciality involvement
4. Evidence literature

Lack of random controlled studies

Quality is in general fair/poor

Moderate/Low level of Evidence

<table>
<thead>
<tr>
<th>Type of Study</th>
<th>Treatment Study</th>
<th>Prognostics Study</th>
<th>Study of Diagnostic Test</th>
<th>Cost Effectiveness Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL I</td>
<td>Randomized controlled trials with adequate randomization, patients followed in different centers; confidence intervals and differences (confidence intervals and standard deviation)</td>
<td>High-quality prospective cohort study with follow-up of all patients enrolled at same time point in disease</td>
<td>Testing previously developed criteria and a universally applied “gold” standard</td>
<td>Reasonable costs and alternatives used in study with values obtained from many studies, study used multi-way sensitivity analysis</td>
</tr>
<tr>
<td>LEVEL II</td>
<td>Lower quality randomized trials follow-up &gt;90%, improper randomization techniques, no masking</td>
<td>Lower quality prospective cohort study (&lt;80% follow-up, patients enrolled at different time points in disease)</td>
<td>Development of diagnostic criteria in a consecutive series of patients and a universally applied “gold” standard</td>
<td>Reasonable costs and alternatives used in study with values obtained from limited studies, study used multi-way sensitivity analysis</td>
</tr>
<tr>
<td>LEVEL III</td>
<td>Case-control study</td>
<td>Retrospective comparative study</td>
<td>Case-control study</td>
<td>Analysis based on a broad section of alternatives and costs, no estimates of cost</td>
</tr>
<tr>
<td>LEVEL IV</td>
<td>Case series with no comparison group</td>
<td>Case series with no comparison groups</td>
<td>Use of a poor reference standard Case control study</td>
<td>No sensitivity analysis</td>
</tr>
<tr>
<td>LEVEL V</td>
<td>Expert opinion</td>
<td>Expert opinion</td>
<td>Expert opinion</td>
<td>Expert opinion</td>
</tr>
</tbody>
</table>

Optimal Management is still controversial

Cáceres E. Metastasic Disease of the Mobile Spine. Eurospine 2009
Radical versus Palliative Resections in the treatment of Spinal Metastasis

1. How to select the Best Treatment for Spine Metastases?
2. What is the Best Management of Metastasic SCC?
3. Which is the role of Radical Surgery (TES) for Metastatic Tumors of Spine?

Is there a clear Evidence for Decision-Making?
Radical/Palliative treatment of Spinal Metastasis

Spinal metastases are only apparently similar lesions, considering the large varieties of histotypes and the spread of the primary tumor.

<table>
<thead>
<tr>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Prostate</td>
<td>Lung</td>
</tr>
<tr>
<td>Kidney</td>
<td>Uterine</td>
</tr>
<tr>
<td>Liver</td>
<td>Thyroid</td>
</tr>
<tr>
<td>Gastric</td>
<td>Gastric</td>
</tr>
<tr>
<td>Colon</td>
<td></td>
</tr>
</tbody>
</table>

The application of new adjuvant therapy increases the effectiveness for surgical treatment. Controversy exist over the most appropriate treatment for patients with metastatic disease of the vertebral column.

Tokuhashi et al. A revised scoring system for preoperative evaluation of MS tumor prognosis. Spine 30, 2005
Radical/Palliative treatment of Spinal Metastasis

Treat modalities should be evaluated with the Oncologist

- Systemic: Hormonal or chemotherapy
- Local: Radiotherapy, Bracing, or Surgery

Treat should be selected (ONC-RT-SURG) evaluating

- Pathology of cancer (histotype, aggressiveness...)
- Its Sensitivity to adjuvant treatments
- Patient general condition and expected survival

Tokuhashi Y, Ajiro Y, Oshima M. Algorithms and Planning in Metastatic Spine Tumors. OCNA 40, Jan 2009
Radical/Palliative treatment of Spinal Metastasis

Treat modalities should be evaluated with the Oncologist

✓ NOMS:
  - Neurologic Status
  - Oncologic Considerations
  - Mechanical Instability
  - Systemic Disease

Radical/Palliative treatment of Spinal Metastasis

Currently, common indications for surgery are

1. Pain and/or paralysis caused by spinal instability
2. Pain and/or paralysis caused by spinal cord invasion
3. Pain caused by radioresistant cancer
4. Sustained pain resisting conservative treatment
5. Long-term, local control in patients who have localized lesions and a life expect of at least 1y

Tokuhashi Y, Ajiro Y, Oshima M. Algorithms and Planning in Metastatic Spine Tumors. OCNA 40, Jan 2009
Common indications for surgery are

1. Pain and/or paralysis caused by spinal instability

Surgery is considered the most effective treatment for pain and paralysis caused by spinal instability → immediate relief

However → no clear evidence supporting this indication

It's important for Oncologist (Medical & Radiation), Radiologist, and Spine surgeons to recognize which situations are unstable or may lead to spinal instability and neurological injury.

This will allow proper stabilization of patients with severe mechanical pain and will hopefully prevent painful collapse, neurological consequences, and inappropriate treatment planning for patients with impending stability.

Common indications for surgery are

2. Pain and/or paralysis caused by spinal cord invasion without collapse or instability

Recovery has been considered impossible unless significant decompression is performed within 24 h after establishment of complete paralysis.

Emergency RT has been reported to be effective.

For this reason, Spinal Cord Paralysis is no longer regarded as an absolute indication for emergency surgery, but surgery may be the treatment of choice in some cases (availability of RT).

The effectiveness of decompression has been demonstrated by a randomized, controlled study comparing RT alone with RT plus Surgery (Patchell, Lancet 2005).

Tokuhashi Y, Nemoto Y, Matsuzaki H. Surgery for metastatic spine tumor at present. Orthop Surg & Tr 2003; 46
Spinal Cord Compression

Decompressive Surgery plus RT versus RT alone

Randomized, Multiinstitutional, non-blinded trial

101 patients

Direct decompressive surgery plus RT was superior to treatment with RT alone for patients with Spinal Cord Compression

<table>
<thead>
<tr>
<th>SURG+RT</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to walk</td>
<td>84%</td>
</tr>
<tr>
<td>Retained ability to walk</td>
<td>122 d</td>
</tr>
</tbody>
</table>

Decompressive Surgery plus RT versus RT alone

TABLE 1 Results of a Selection of Recent Series of Patients Surgically Treated for Spinal Metastases Followed by Radiotherapy and/or Other Forms of Adjuvant Therapy

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Huang, 2000a</th>
<th>Hirabayashi, 2002b</th>
<th>Holman, 2005c</th>
<th>Villavicencio, 2005d</th>
<th>North, 2005e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients (m/f)</td>
<td>46 (28/18)</td>
<td>81 (59/23)</td>
<td>139 (85/54)</td>
<td>58 (?)</td>
<td>61 (34/27)</td>
</tr>
<tr>
<td>Neurological improvement</td>
<td>7%</td>
<td>49.4%</td>
<td>41%</td>
<td>60%</td>
<td>?</td>
</tr>
<tr>
<td>Neurological impairment</td>
<td>0%</td>
<td>1.2%</td>
<td>5%</td>
<td>3.4%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Ambulatory preoperatively</td>
<td>29.6%‡</td>
<td>36.3%</td>
<td>71.9%</td>
<td>58.6%</td>
<td>85%</td>
</tr>
<tr>
<td>Ambulatory postoperatively</td>
<td>76.1%</td>
<td>71.3%</td>
<td>90.8%</td>
<td>77.3%</td>
<td>96.7%</td>
</tr>
<tr>
<td>Preoperative pain; number (%)</td>
<td>?</td>
<td>63 (79%)</td>
<td>133 (96%)</td>
<td>53 (92%)</td>
<td>59 (97%)</td>
</tr>
<tr>
<td>Postoperative complete or partial relief of pain</td>
<td>?</td>
<td>77%</td>
<td>96%</td>
<td>92.9%</td>
<td>56%</td>
</tr>
<tr>
<td>Complications (major)*</td>
<td>19.5% (8.7%)</td>
<td>23.5% (12.3%)</td>
<td>32.4% (12.9%)</td>
<td>20.5% (10.3%)</td>
<td>11.4% (4.9%)</td>
</tr>
<tr>
<td>Survival</td>
<td>Mean</td>
<td>Median</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td></td>
<td>20.4 months</td>
<td>10.0 months</td>
<td>14.6 months</td>
<td>10 months§</td>
<td>10 months</td>
</tr>
</tbody>
</table>

*Major complications are pneumothorax, sepsis, wound infection, wound dehiscence, pulmonary embolism, and hardware failure. Minor complications are urinary infection, pulmonary infection, and cerebrospinal fluid leaks treatable with cerebrospinal fluid diversion. Disease progression or recurrence are not considered as complications.

†No discrimination had been made between patients that improved neurologically and those whose neurological situation did not alter.

‡These are patients with only Frankel grade E. Frankel grade D (ambulator) was included in the group paraparetic or paraplegic patients.

§14 patients were still alive at the moment the article was written.

Decompressive Surgery plus RT *versus* RT alone


> **Strongly favored the combined approach of SURG + RT**

Limitations of this research:
- Included only highly selected patients account for 10%-15% of all MSCC
- It took 10 years to gather 101 patients = only small proportion of patients eligible
- Bias regarding interval from tumor diagnosis to MSCC and potential bias regarding non-neurological comorbidity


> **Results of RT alone were no significantly inferior to those of Surgery plus RT**

> **Suggest the value of performing a new randomized trial comparing Surgery followed by RT versus RT alone in patients with MSCC**
Common indications for surgery are

3. Pain caused by radioresistant cancer

Generally has been excluded as an indication for Surgery

RT is widely considered to be effective in 80-90% of cancers → has long been considered the 1st choice for Spinal Metastasis

Recently, as sensitivity to adjuvant treatment increase, PAIN caused by radioresistant cancer has become an important indication for SURGERY (Ex: Kidney = debulking+interferon/RDT)

4. Sustained pain resisting conservative treatment

Improvements in pain-control (narcotic analgesics)

→ Surgery now is performed less often than in the past when the only indication was pain resisting to conservative treatment

Decision Making and Treatment in TL Metastases – Percutaneous Treatment

Systematic Review of Literature → to determine if cement augmentation procedures should be used in painful compression fractures in MS disease without NRL compromise

There is Strong recommendation and Moderate Evidence for its use in alleviating pain and improving function

Vertebral augmentation is most commonly used to treat pain and Multiple Myeloma lesions

There is Strong recommendation and Very Low Evidence for transarterial embolization in reducing intraoperative blood loss

Further Research is required to confirm these results

Berenson J. A multicenter, prospective, randomized, controlled study to compare balloon kyphoplasty to... Unpublished
Decision Making and Treatment in TL Metastases – Percutaneous Treatment

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Decision Making and Treatment in TL Metastases – Percutaneous Treatment

Literature review: 30 relevant studies

→ Only 1 was randomized, controlled trial
→ Only 7 were prospective
→ This Systematic review reveals a paucity of good-quality, robust data available of the use of VP in malignancy
→ Risk of serious complications (2% in a total of 987 pat)

Further Research is required to have EBSS

VP and KP are used to palliate local symptoms → close observation for local progression is required

Radiotherapy and Radiosurgery for Metastatic Spine

Systematic Literature Review → to determine Options, Indications and Outcomes for CRT and Stereotactic RS

Conventional RT is safe and effective with good symptomatic response and local control particularly in radiosensitive histologies such as lymphoma, myeloma and seminoma

A Strong recommendation can be made with moderate quality evidence that conventional RT is an appropriate initial therapy option for spine metastasis in cases which no contraindication

Radiosurgery is safe and effective with durable symptomatic response and local control for even radioresistant histologies, regardless or prior CRT

A Strong recommendation can be made with low quality evidence that RS should be considered over conventional RT for the treatment of Spine Metastases in the setting of oligometastatic disease and/or radioresistant histology

Common indications for surgery are

5. Long-term, local control in patients who have localized lesions and a life expect of at least 1y

Few patients fit the indication of Long-term local control because they must have

- LOCALIZED lesions
- Life exp > 1y

Excellent levels of ADL and Local control has been achieved in patients who survived for a long period after EN BLOC RESECTION (TES)

Sudaresan et al. Surgery for solitary metastasis of the spine, rationale results of treatment. Spine 2002; 27
LIMITATIONS of Surgery for Metastatic Spine

Surgery may not be the optimal choice for all who fit the indications because INVOLVES SIGNIFICANT MORBIDITY.

PATIENT SELECTION CRITERIA
- General Condition
- Life Expectancy (Primary Ca): 3,6 months...or longer
- Other criteria: Therapeutic effects are mild in
  - patients without paralysis who respond to analgesics
  - patients who are highly responsive to RT
  - patients showing rapid progression or severe paralysis
SURGICAL PROCEDURES for MT and their selection

- **PALLIATIVE procedures**
  Posterior/Circumferential decompression & Stabilization for alleviation of pain or paralysis.

- **EXCISIONAL**
  - Intralesional/Debulking
  - En Bloc: Marginal or Wide

GSTSG proposed classification of Surgical Strategies considering tactics, methods and postoperative oncology margin


**SURGICAL PROCEDURES for MT and their selection**

En BLOC resection should be considered in patients
- involvement of a single vertebra (1-2-3)
- good prognosis
- hypervascularized lesions

PALLIATIVE procedures (post decompression ± excision of as much as possible + post inst)
- multilevel metastasis
- poor prognosis, < 1y
- performed as emergency op
PROGNOSIS of METASTASIC Spine Tumors

Predicted Prognosis before treatment is important and difficult
Helps in determine the treatment modalities (Surgical Proc)

- Natural course of Primary Ca: Approx prognosis, after initial treatment, can be predicted in most cancers.
- The appearance of symptoms by spinal metastases has not been sufficient to estimate the survival period.

→ Various Evaluation Systems have been devised to predicting PROGNOSIS ... and to determine the best therapeutic option for the patient

→ Based in multiple clinical factors

Ulmar B et al. The Tokuhashi score: significant predictive value for the life expectancy in breast ca with SM. Spine 2005
PROGNOSIS of METASTATIC Spine Tumors

→ Tokuhashi Score for preop evaluation

1. Patient general condition
2. Number extraespinal Bone Metastasis foci
3. Number of metastasis in the vertebral body
4. Metastasis to the major internal organs
5. Primary Cancer
6. Degree of Paralysis

Six parameters relatively simple to evaluate

Umar B et al. The Tokuhashi score: significant predictive value for the life expectancy in breast ca with SM. Spine 2005
PROGNOSIS of METASTASIC Spine Tumors

→ Tokuhashi Score for preop evaluation

0-8
Prognosis < 6m
Conservative

9-11
Prognosis 6-12 m
Palliative Surgery

12-15
Prognosis >12 m
Excisional Surgery

For some authors the Index does not have the expected reliability

Ulmor B et al. The Tokuhashi score: significant predictive value for the life expectancy in breast ca with SM. Spine 2005
PROGNOSIS of METASTASIC Spine Tumors

→ Tomita Surgical Strategy
Excludes "the state of paralysis"

1. Grade of Primary Tumor
2. Metastasis to vital organs (lung, liver, kidneys and brain)
3. Bone metastasis including the spine

Surgical Strategy for Spinal Metastases

PROGNOSIS of METASTASIC Spine Tumors

→ Tomita Surgical Strategy
Excludes “the state of paralysis”

1. Grade of Primary Tumor
2. Metastasis to vital organs (lung, liver, kidneys and brain)
3. Bone metastasis including the spine

Mean Survival time in 67 pat

<table>
<thead>
<tr>
<th>Grade</th>
<th>Survival Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 p</td>
<td>38.2 m</td>
</tr>
<tr>
<td>13 p</td>
<td>21.5 m</td>
</tr>
<tr>
<td>11 p</td>
<td>10.1 m</td>
</tr>
<tr>
<td></td>
<td>5.3 m</td>
</tr>
</tbody>
</table>

PROGNOSIS of METASTASIC Spine Tumors

Gasbarrini et al. Algorithm for preop evaluation in each patient

Warned against reducing the choice of treatment by using an “overly simplistic mathematical score”

Proposed to select the treatment by using an algorithm for each patient

Primary Sensitive to adjuvant treatment ++

Decision for surgery should not be based alone on a prognostic score, but should take symptoms like Pain of NRL status into account

Radical/Palliative treatment of Spinal Metastasis

RT is the primary treatment

Indications of Surgery
- Spinal Instability
- Progressive NRL deficit from neural compression
- Enlarging radioresistant tumor
- Need for open biopsy
- Intractable pain

Only for life expectancy >3 to 6 m

Sciubba D, Nguyen T, Gokaslan Z. Solitary Vertebral Metastasis. OCNA 40, 2009
Decision Making and Treatment in TL Metastases

Systematic Review of Literature to determine whether surgical approach (Ant, Post, AP) and technique to be used in TL metastases

5176 abstracts → 161 “acceptable” → 60 fulfill criteria → 32 articles included

- No level I study
- 1 level II study


- 5 level III studies
- 26 level IV studies

Case-control and Case-series

Polly DW, Chou D, ... Tomita T. An Analysis of Decision Making and Treatment in Thoracolumbar Metastases. Spine 2009
Does spinal surgery improve the quality of life for those with extradural (spinal) osseous metastases? An international multicenter prospective observational study of 223 patients

**Level II Evidence**

**Prospective non randomized in 6 Tertiary Centers**

Surgeons were free to make 3 types of surgery:

- **En Bloc**
- **Debulking**
- **Palliative**

Patients who underwent excision survived significantly longer

However, since this was non random, there was expectedly a strong selection bias

→ patients with a shorter life expectancy would be getting palliative rather than excisional surgery (→ low quality evidence in favor of en bloc excisional)

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Ahmed Ibrahim, M.R.C.S.,¹ Alan Crocker, F.R.C.S.,¹ Pierre Antonietti, M.D.,¹ Stefano Boriani, M.D.,² Cody Rüegger, M.D.,² Alessandro Gasbarrini, M.D.,² Anders Greer, M.D.,² Jürgen Harms, M.D.,² Norio Kawahara, M.D.,³ Christian Mazel, M.D.,³ Robert Melcher, M.D.,³ and Katsumo Tomita, M.D.,³

GSTSG: Global Spine Tumor Study Group
Does spinal surgery improve the quality of life for those with extradural (spinal) osseous metastases? An international multicenter prospective observational study of 223 patients

**Conclusions:**

There is **BENEFIT** from Surgery in Met Spine disease as a way of:

- controlling pain and maintaining mobility
- thus improving quality of remaining life

Document the beneficial role of en bloc or debulking surgery

Palliative may have less benefit

The current treat pattern of RT alone for MT may not be the most efficacious

Patients already given RT may also benefit from surgery without increased complication

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**TABLE 2**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type of Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>En Bloc</td>
</tr>
<tr>
<td>no. of patients (%)</td>
<td>63 (28)</td>
</tr>
<tr>
<td>% wrt pop paty</td>
<td>93</td>
</tr>
<tr>
<td>mean age in yrs</td>
<td>43</td>
</tr>
<tr>
<td>no. of nsa</td>
<td>48</td>
</tr>
<tr>
<td>3 most common tumors</td>
<td>M brst, T li</td>
</tr>
<tr>
<td>Tumor Type 7 (%)</td>
<td>27</td>
</tr>
</tbody>
</table>

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Further Research is required to confirm these results

**GSTSG: Global Spine Tumor Study Group**
GSTSG - Global Spine Tumour Study Group

GSTSG Recommendations - 2010

→ To prospectively collect data to compare outcomes of different surgical techniques
   Difference between TES and debulking?

→ To use a common surgical language

→ To know outcomes of dif treatments

→ To compare surgical series to those of RT

→ To assess Quality of Life (EuroQuol quest)

In order to have better Evidence about treatments

Tokuhashi Score = 10
(life expect ........ 6-12 m)

Tomita Score
Slow growth = 1
Visceral Met treatable = 2
Bone Met Multiple = 4
Total = 7

Multiple Vertebral involvement (7)

Received prior RT
Palliative Surg Dec 2005

Follow up 61 m, still alive
To take home: Summary

- Improved Cancer therapy may result in an increased incidence of MSD
- The choice of most suitable treatment is of crucial importance
- CRT continue to be the 1st choice of treatment
- Although prognosis of MD remains guarded at best, careful surgical management in conjunction with Medical and Radiation Oncologist care has great potential to improve QoL and prolong survival
- Recent studies highlight the benefits of carefully considered Surgical Management

Surgeons must evaluate the survival time, observe the appropriate indications for Surgical treatment and select the most suitable surgical procedure