Spinal metastases treatment

- Predicting the risk of lymph node metastasis in colon cancer: development and validation of an online dynamic nomogram based on multiple preoperative data
- Phase 2 Trial of Stereotactic Body Radiation Therapy with Dose Escalation Using Simultaneous Integrated Boost for Spinal Metastases
- Clinical Characteristics, Histopathological Profile, and Postoperative Outcomes of Tumoral Radiculomedullary Compressions
- Institutional disparities in the treatment of bone metastases by orthopaedic surgeons at training facilities designated by the Japanese orthopaedic association-A nationwide survey
- Exceptional Response to Rechallenge Peptide Receptor Radionuclide Therapy in Metastatic Carotid Body Tumor
- Napsin A as a key prognostic biomarker in spinal metastases of lung cancer: implications for survival and neurological function
- Single-fraction versus multifraction stereotactic radiosurgery for spinal metastases: systematic review and meta-analysis
- Transpedicular approach for circumferential decompression and separation surgery as a safe and effective way to maximize surgical treatment for spinal metastases: a multicentric study

The approach to the treatment of spinal metastases is interdisciplinary, often involving various combinations of chemotherapy, radiation, stereotactic radiosurgery, and surgery.

Since the 2005 publication of the study by Patchell et al., [1] surgery has become part of the treatment paradigm for patients with metastatic epidural cord compression in concert with radiation therapy. With radiation therapy in mind, efforts have been made to cause only minimal injury to the adjacent tissue and to prevent destabilization of the spine column that would affect quality of life for these patients.

Balloon kyphoplasty has been shown to be effective in providing rapid pain relief and enhancing health-related quality of life in patients with metastatic spinal tumors.

Intraoperative blood loss remains a major cause of perioperative morbidity for patients with hypervascular spinal metastasis undergoing surgery. Pre-operative embolization is used to reduce intraoperative blood loss and operative time. This is commonly performed under general anesthesia via a trans-arterial approach, which carries a risk of spinal stroke.

Patients with spinal metastases present a unique challenge given these patients' frequent poor nutritional status at the time of surgery, the delivery of early post-operative chemotherapy or radiation, and placement of large amounts of hardware and avascular bone graft into a wound bed that is atrophic, previously operated or irradiated. As a result, wound morbidity has traditionally been high in this cohort of patients.

The treatment of spinal metastases is multidisciplinary and usually involves a team of medical oncologists, radiologists, radiotherapists, and spinal surgeons [2].

Life expectancy is one of the factors considered when deciding whether surgery is warranted.

To be a surgical candidate, a patient should have a life expectancy of at least 3 months. Estimation of survival by experienced specialists has proven to be unreliable.

Scoring systems help the physician to best define the objective of treatment by evaluating the life expectancy.

A reliable and simple model with which to predict the survival of a patient with spinal epidural metastasis is presented by Bartels et al. Without the need for extensive investigations, survival can be predicted and only 5 easily obtainable parameters are required [3].

Untreated, it can cause pain, instability and neurologic deficit, which can severely alter the patient's ability and quality of life.

Therapeutic intervention can alleviate pain, preserve or improve neurologic function, achieve mechanical stability, optimize local tumor control, and improve quality of life.

Treatment options available for metastatic spine tumors include radiation therapy (RT), surgery, and chemotherapy.

Often, they are immune-compromised and have nutritional deficiencies, and, most importantly, the surgical interventions that can be offered necessarily must include consideration of their prognosis, physical independence and tumor pathology [4] [5].

Surgery

see Spinal metastases surgery.

Indications for decompression surgery

Unknown primary

Spinal instability

Deficit

Radioresistant tumor

Recurrence after maximal XRT

Rapid neurological deterioration.

The aim of a surgical treatment is the reduction of pain and the maintenance of neurological function as well as spine stability. The indication for surgery should be determined individually in an interdisciplinary consultation.

Decompression surgery followed by adjuvant radiotherapy is an effective therapy for preservation or recovery of neurological function and achieving durable local disease control.

In 2005, a Landmark study showed that direct decompressive surgery, followed by postoperative external beam radiotherapy (EBRT) is superior to EBRT alone in patients with metastatic epidural

spinal cord compression (MESCC). Patients undergoing both surgery and EBRT had similar median survival but experienced longer ambulation than with EBRT alone. Additional studies have shown improvements in quality-of-life, higher cost-effectiveness, improved pain control, and higher functional status with surgery plus EBRT. Improved neurological outcome also improved the patients' ability to undergo postoperative adjuvant therapy.

Even patients over 65 or patients with aggressive primary tumors and additional metastases have benefited from surgical intervention, living longer than expected with preservation of ambulation and sphincter control until death or shortly before. Preserving ambulation is critical. With current surgical devices and techniques, patients with MESCC who present with a single area of cord compression, back pain, neurological deficit, or progressive deformity, may benefit from surgery prior to adjuvant radiation-based treatment or chemotherapy [6].

Spinal laser interstitial thermotherapy

see Spinal laser interstitial thermotherapy

Radiotherapy

Spinal Metastases Radiotherapy.

Spinal intraarterial chemotherapy

Patsalides et al describe their initial experience with a novel therapeutic approach that consists of intraarterial (IA) infusion of chemotherapy to treat progressive spinal metastatic disease.

The main inclusion criterion was the presence of progressive, metastatic epidural disease to the spine causing spinal canal compromise in patients who were not candidates for the standard treatments of radiation therapy and/or surgery.

All tumor histological types were eligible for this trial. Using the transfemoral arterial approach and standard neurointerventional techniques, all patients were treated with IA infusion of `melphalan in the arteries supplying the epidural tumor. The protocol allowed for up to 3 procedures repeated at 3- to 6-week intervals. Outcome measures included physiological measures:

1) periprocedural complications according to the National Cancer Institute's Common Terminology Criteria for Adverse Events; and 2) MRI to assess for tumor response. RESULTS Nine patients with progressive spinal metastatic disease and cord compression were enrolled in a Phase I clinical trial of selective IA chemotherapy. All patients had metastatic disease from solid organs and were not candidates for further radiation therapy or surgery. A total of 19 spinal intraarterial chemotherapy (SIAC) procedures were performed, and the follow-up period ranged from 1 to 7 months (median 3 months). There was 1 serious adverse event (febrile neutropenia). Local tumor control was seen in 8 of 9 patients, whereas tumor progression at the treated level was seen in 1 patient. CONCLUSIONS These preliminary results support the hypothesis that SIAC is feasible and safe [7].

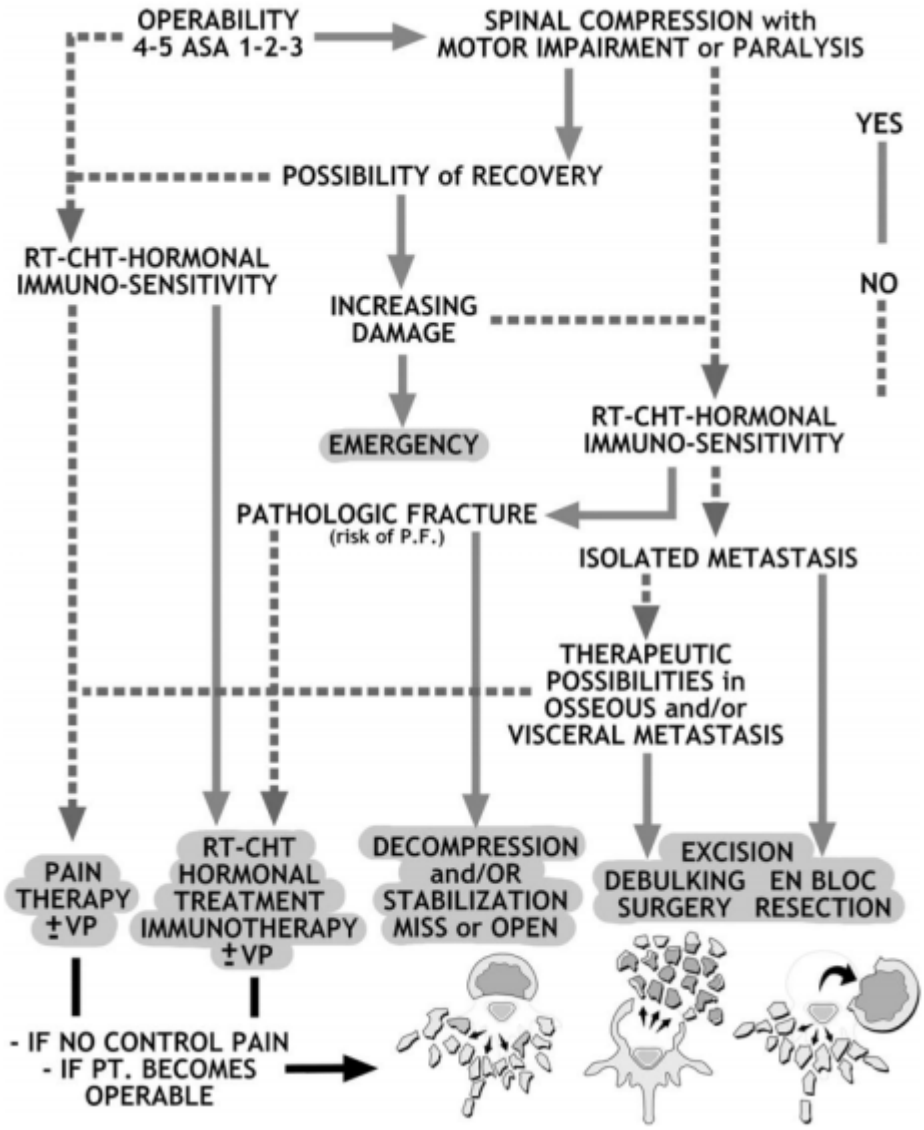
Systematic reviews

A literature search of the PubMed database was performed for spinal oncology outcome studies published in the English language between 2006 and 2016. Data concerning study characteristics, patient demographics, tumor origin and spinal location, treatment paradigm, and median survival were collected. The search retrieved 220 articles, 24 of which were eligible to be included. There were overall 3457 patients. Nine studies of 1723 patients discussed parameters affecting median survival time with comparison of different primary cancers. All studies found that primary cancer significantly predicted survival. Median survival time was highest for primary breast and renal cancers and lowest for prostate and lung cancers, respectively. Multiple spinal metastases, a cervical location of metastasis, and pathologic fracture each had no significant influence on survival. Survival in metastatic spinal tumors is largely driven by primary tumor type, and this should influence palliative management decisions. Surgery has been shown to greatly increase quality of life in patients who can tolerate the procedure, even in those previously treated with radiotherapy. Surgery for SpM can be used as first-line therapy for preservation of function and symptom relief. Future studies of management of SpM are warranted and primary tumor diagnosis should be studied to determine contribution to survival [8)].

Case reports

Lim et al. propose an alternative technique for embolization of hypervascular metastases using the Onyx embolic agent via a percutaneous direct intra-tumoural injection under local anesthesia and sedation to reduce embolization risks and procedure time, as well as operative blood loss and operative time. A 74-year-old man presented with thoracic myelopathy with back and radicular pain on background of metastatic renal cell carcinoma. Magnetic resonance imaging (MRI) revealed a 3cm mass centered on the right lamina of T10 with extension into the spinal canal. The patient underwent a percutaneous imaging-guided direct intra-tumoural contrast parenchymogram, and Onyx embolization via a single needle. Initial needle placement and tumour assessment was completed in 30min; embolization time was 15min. Complete devascularization was achieved with no complications. Surgical resection was performed with lower than expected operative blood loss (150ml) and operative time (90min). His pre-operative symptoms improved, and he was discharged home the following day. At 6-month follow-up there was no recurrence of his symptoms. Further evaluation of direct percutaneous intra-tumoural Onyx embolization for hypervascular spinal tumours is warranted [9)].

Algorithm



ChatGPT

The integration of artificial intelligence (AI), particularly large language models (LLMs) like ChatGPT-4, is transforming healthcare. ChatGPT's potential to assist in decision-making for complex cases, such as spinal metastases treatment, is promising but widely untested. Especially in cancer patients who develop spinal metastases, precise and personalized treatment is essential. A study examines ChatGPT-4's performance in treatment planning for spinal metastasis cases compared to experienced spine surgeons.

Five spine metastasis cases were randomly selected from recent literature. Consequently, five spine surgeons and ChatGPT-4 were tasked with providing treatment recommendations for each case in a standardized manner. Responses were analyzed for frequency distribution, agreement, and subjective rater opinions. ChatGPT's treatment recommendations aligned with the majority of human raters in 73% of treatment choices, with moderate to substantial agreement on systemic therapy, pain management, and supportive care. However, ChatGPT's recommendations tended towards generalized statements, with raters noting its generalized answers. Agreement among raters improved in sensitivity analyses excluding ChatGPT, particularly for controversial areas like surgical intervention and palliative care. ChatGPT shows potential in aligning with experienced surgeons on certain treatment aspects of spinal metastasis. However, its generalized approach highlights

limitations, suggesting that training with specific clinical guidelines could potentially enhance its utility in complex case management. Further studies are necessary to refine AI applications in personalized healthcare decision-making [10)]

1)
Patchell RA, Tibbs PA, Regine WF, Payne R, Saris S, Kryscio RJ, et al.: Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: a randomised trial. Lancet 366:643–648, 2005
2)
Kim CH, Chung CK, Sohn S, Lee S, Park SB. Less invasive palliative surgery for spinal metastases. J Surg Oncol. 2013 Dec;108(7):499-503. doi: 10.1002/jso.23418. Epub 2013 Aug 27. PubMed PMID: 23982866.
3)
Bartels RH, Feuth T, van der Maazen R, Verbeek AL, Kappelle AC, André Grotenhuis J, Leer JW. Development of a model with which to predict the life expectancy of patients with spinal epidural metastasis. Cancer. 2007 Nov 1;110(9):2042-9. PubMed PMID: 17853394.
4)
Patchell RA, Tibbs PA, Regine WF, Payne R, Saris S, Kryscio RJ, et al. Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: A randomised trial. Lancet. 2005;366:643–8.
5)
Xu R, Garces-Ambrossi GL, McGirt MJ, Witham TF, Wolinsky JP, Bydon A, et al. Thoracic vertebrectomy and spinal reconstruction via anterior, posterior, or combined approaches: Clinical outcomes in 91 consecutive patients with metastatic spinal tumors. J Neurosurg Spine. 2009;11:272–84.
6)
Itshayek E. [Paradigm shift in the management of metastatic epidural spinal cord compression: the importance of preserving ambulation]. Harefuah. 2013 Dec;152(12):718-9, 752. Hebrew. PubMed PMID: 24482995.
7)
Patsalides A, Yamada Y, Bilsky M, Lis E, Laufer I, Gobin YP. Spinal intraarterial chemotherapy: interim results of a Phase I clinical trial. J Neurosurg Spine. 2015 Oct 23:1-6. [Epub ahead of print] PubMed PMID: 26496162.
8)
Yao A, Sarkiss CA, Ladner TR, Jenkins AL 3rd. Contemporary spinal oncology treatment paradigms and outcomes for metastatic tumors to the spine: A systematic review of breast, prostate, renal, and lung metastases. J Clin Neurosci. 2017 Jul;41:11-23. doi: 10.1016/j.jocn.2017.04.004. Epub 2017 Apr 24. Review. PubMed PMID: 28462790.
9)
Lim KZ, Goldschlager T, Chandra RV. Pre-operative embolization of hypervascular spinal metastasis using percutaneous direct intra-tumoural injection with Onyx under local anesthesia. J Clin Neurosci. 2017 Aug 1. pii: S0967-5868(17)30089-9. doi: 10.1016/j.jocn.2017.07.003. [Epub ahead of print] PubMed PMID: 28778801.
10)
Heisinger S, Salzmann SN, Senker W, Aspalter S, Oberndorfer J, Matzner MP, Stienen MN, Motov S, Huber D, Grohs JG. ChatGPT's Performance in Spinal Metastasis Cases-Can We Discuss Our Complex Cases with ChatGPT? J Clin Med. 2024 Dec 23;13(24):7864. doi: 10.3390/jcm13247864. PMID: 39768787; PMCID: PMC11727723.