REVIEW

Recent Trends in the Management of Spinal Metastasis: A Narrative Review of the Literature

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Abstract

Background data: Approximately 60% of osseous metastases are in the spine, and 10% of patients with spinal metastases are expected to develop spinal cord compression. In our opinion, there is a need for a recent review of the management of spinal metastases and the role of oncological spine surgeons due to recent advances in the diagnosis and management of spinal metastases.

Purpose: This study aims to review the available data about the current concepts regarding decision making and treatment options for spinal metastasis.

Study design: A narrative literature review was performed.

Patients and methods: The authors reviewed the English literature published over the past two decades for recent and relevant data about decision making and treatment options in cases of spinal metastases. A PubMed search was conducted, and the most relevant articles according to the study aim and spine surgeon’s practice were extracted.

Results: The classification-based approaches described by Tokuhashi and colleagues and Tomita and colleagues are well-established methods to estimate life expectancy in patients with spinal metastasis; however, they do not consider newer radiotherapy technologies and chemotherapies to treat these metastases. Recent advances in molecular genetics might explain why survival might be different in patients having the same tumor histopathology and metastases. Survival is related to genes in tumors, and this is proven for melanoma, breast cancer, and non-small-cell lung cancer. Neurologic, oncologic, mechanical, and systemic framework was recently developed and provided a comprehensive assessment of metastatic spinal tumors, including four pillars: neurologic, oncologic, mechanical, and systemic assessment. In this framework, the role of oncological spine surgeons is limited to separation surgery or restoring spinal stability, whereas the rest of the management depends mainly on radiotherapy. Targeted therapeutics are recent drugs that have the potential to improve markedly the outcomes in cases of spinal metastases. Several targeted therapies have been approved for metastatic renal cell carcinoma.

Conclusion: Prognosis in cases of spinal metastases seems to be more influenced by genetic subtyping. The role of spinal oncological surgery is fading away. Surgery is limited to separation surgery and surgeries for restoration of spinal stability. The future of spinal metastases management lies in the recent advances in techniques of radiotherapy and targeted therapeutics (2021ESJ254).

Keywords: Genetic phenotyping, Radiotherapy, Separation surgery, Stereotactic radiosurgery, Targeted therapeutics

Introduction

Spinal metastasis is known to occur in 30–50% of patients with cancer [1]. Pain is the most common symptom; however, 10% of cancer patients present with a neural deficit in the form of sensory or motor deficit, bowel and bladder incontinence, and gait disturbances caused by spinal instability or due to direct cord compression [2]. These patients
are considered incurable [3,4]; thus, treatment is aimed primarily at palliation rather than cure [5].

In our opinion, there is a need for a recent review of the management of spinal metastases and the role of oncological spine surgeons for several reasons. First, patients with the metastatic spinal disease are now expected to live longer owing to early diagnosis of primary tumors with better imaging technologies, like MR, fluorodeoxyglucose-positron emission tomography, better treatment with advanced systemic therapies like biologics, advances in radiation therapy, and better surgical techniques [6]. Second, improvements in radiotherapy techniques, like stereotactic body radiosurgery (SSRS), enable accurate delivery of highly concentrated radiation to the metastatic area, thus making the term ‘radioresistant tumors’ obsolete [6,7]. Third, minimally invasive spine surgery (MIS) techniques are introduced in managing spinal metastases [8]. Moreover, the guidelines and strategies dictating the management of patients with spinal metastases have been rendered less valid as they do not take into consideration newer radiotherapy technologies and chemotherapy regimens to treat these metastases [9–13].

This review article aims to provide an overview of recent treatment protocols and the changing role of a spine oncology surgeon in the management of these conditions.

Decision-making systems

Decision making in cases of spinal metastases should be a multidisciplinary approach that needs cooperation between radiotherapy physicians, spinal oncology surgeons, medical oncologists, interventional radiologists, and pain management specialists to improve their health-related quality of life (HRQOL).

Although broad guidelines for managing patients with spinal metastasis have been developed, they are not universally accepted.

Tokuhashi score and Tomita surgical strategy

The classification-based approaches described by Tomita et al. [13] (Table 1) and Tokuhashi et al. [12] (Table 2) are well-established methods to estimate life expectancy in patients with spinal metastasis; however, they fail to address important aspects of patient care like a response to previous therapy and do not take into consideration newer radiotherapy technologies and chemotherapies to treat these metastases as well. Published research works using these two protocols for decision making in patients with spinal metastases are contradictory, with a very wide range of specificity, sensitivity, and accuracy [1,10,14,15].

As an example of decision making using Tomita’s ‘Surgical Strategy of Spinal Metastases,’ a case of a 57-year-old male presented in 2008 with severe low back pain of 2 months and agonizing right sciatica of 1 month. On examination, neurological examination was challenging to perform because of severe pain; however, the sciatic nerve stretch test was positive at 30°. MRI demonstrated mass along the right side of the L5 vertebral body (Fig. 1A–C). Computed tomography (CT) (Fig. 1D) showed bone destruction of the pedicle of L5 pedicle. Abdominal ultrasonography reported a mass measured 3 × 4 cm in the right liver lobe. Tc bone scan and chest CT did not demonstrate any other extraspinal metastases. Ultrasound-guided biopsy from the liver mass proved the diagnosis of hepatocellular carcinoma. Using the ‘Surgical Strategy of Spinal Metastases,’ the patient's total score was 5. He was a candidate for posterior decompression and stabilization, which was subsequently used to treat metastases (Fig. 1E). The patient had immediate postoperative improvement in pain and received postoperative conventional radiotherapy. The patient enjoyed pain-free survival for 9 months until his death.

Primary tumor-based decision

Another school of thought regarding decision making in patients with spinal metastases considers primary tumor as the single most important factor. Hence, several research works have tried to establish a clear policy for treating spinal metastases originating from thyroid, renal, and breast cancers. The senior author in the current manuscript coauthored four publications trying to establish a treatment policy for spinal metastases from thyroid cancer [9–11,16]. This work was the base upon which further trials were undertaken to develop an algorithm to be used in managing spinal metastases from thyroid and renal cancer [17].

Neurologic, oncologic, mechanical, and systemic framework [18]

Neurologic, oncologic, mechanical, and systemic framework was developed to overcome the shortcomings of the Tokuhashi score and Tomita Surgical Strategy of Spinal Metastases. It provides a comprehensive assessment of metastatic spinal tumors. It has four pillars: neurologic, oncologic, mechanical, and systemic assessment (Fig. 2). The neurological examination assesses myelopathy—radiculopathy-induced symptoms and assesses radiologically Epidural Spinal Cord Compression (ESCC) using the ESCC scale 7 (Fig. 3). The
oncological assessment evaluates the predicted local tumor control from radiation, chemotherapy, or surgical intervention. The mechanical assessment evaluated spinal instability, which may arise secondary to tumor spread and its sequelae using the Spinal Instability Neoplastic Score (SINS) [20] (Table 3). It also serves as an independent indication for procedure-based interventions. Systemic assessment evaluates the various patient comorbidities and predicts the ability of a patient to tolerate the procedure, the risk-to-benefit ratio of treatment, and expected survival. From this current framework, it is evident that most of the cases are to be managed by radiotherapy, either the conventional external beam radiotherapy (CEBRT) or the SSRS. Surgery is indicated to restore the stability of an unstable spine or to do decompression/separation surgery, preparing for postoperative radiotherapy.

**Molecular genetic-based decision**

Recent advances in molecular genetics might explain why survival might be different in patients

Table 1. Tomita surgical strategy of spinal metastases [13].

<table>
<thead>
<tr>
<th>Prognostic factors</th>
<th>Treatment Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary tumor</td>
<td>Wide or Marginal excision</td>
</tr>
<tr>
<td>Visceral mets.**</td>
<td>Middle-term local control</td>
</tr>
<tr>
<td>Bone mets.**</td>
<td>Short-term palliation</td>
</tr>
<tr>
<td>Slow growth</td>
<td>Terminal care</td>
</tr>
<tr>
<td>Moderate growth</td>
<td>Supportive care</td>
</tr>
<tr>
<td>Rapid growth</td>
<td></td>
</tr>
</tbody>
</table>

* No visceral mets. = 0 point. ** Bone mets. including spinal mets.

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Table 2. Revised Tokuhashi score [12].

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Prognostic factors</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>General condition (KPS)</td>
<td>Poor (KPS 10–40%)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Moderate (KPS 50–70%)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Good (KPS 80–100%)</td>
<td>2</td>
</tr>
<tr>
<td>Number of extraspinal bone metastatic foci</td>
<td>&gt;3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1–3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Number of metastases in a vertebral body</td>
<td>&gt;3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1–3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Metastasis to major organ</td>
<td>Resectable</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Unresectable</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No metastasis</td>
<td>2</td>
</tr>
<tr>
<td>Primary site of cancer</td>
<td>Lung, osteosarcoma, stomach, bladder, esophagus, pancreas</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Liver, gallbladder, unidentified</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Kidney, uterus</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Rectum</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Thyroid, prostate, breast, carcinoid</td>
<td>4</td>
</tr>
<tr>
<td>Spinal cord palsy</td>
<td>Complete (Frankel A, B)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Incomplete (Frankel C, D)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>None (Frankel E)</td>
<td>2</td>
</tr>
<tr>
<td>Total points</td>
<td>Mean survival</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0–8</td>
<td>&lt;6 months</td>
</tr>
<tr>
<td></td>
<td>9–11</td>
<td>&gt;6 months</td>
</tr>
<tr>
<td></td>
<td>12–15</td>
<td>&gt;12 months</td>
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</tbody>
</table>
having the same tumor histopathology and metastases. Survival seems to be related to genes in tumors. This is proven for melanoma, breast cancer, and non-small-cell lung cancer. If a melanoma metastasis has a BRAF mutation in the genetic phenotype of the primary tumor, survival is influenced by the response to immunotherapy rather than by the number of spinal and visceral metastases at presentation. The same is applied for epidermal growth factor receptor status in non-small-cell lung carcinoma and estrogen, progesterone, or HER2 receptor status in breast carcinoma. Thus, it is clear that future decision making regarding spinal metastases must take into consideration the genetic subtype of the primary tumor \[21\].

**Treatment options**

Various treatment options for patients with spinal metastasis include the following: (a) medical management, (b) radiation therapy, (c) surgery, and (d) hybrid therapy.

**Medical management**

**Pain management**

Symptomatic management of pain is essential as almost 90% of patients with metastatic disease suffer from chronic debilitating pain \[15\]. This pain is attributed to weakened bone leading to pathological fractures and spinal instability. Pain may be radicular

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**Fig. 1.** (A) MRI coronal STIR view of lumbosacral spine shows soft tissue mass at the right side of L5. (B) MRI sagittal STIR view showing the metastases at L5. (C) MRI axial cut T2-weighted image at L5 showing the large soft tissue mass occupying the right side of L5 body and right pedicle with epidural and extraspinal extension. (D) Preoperative CT at L5 level showing bone destruction at the body and right pedicle of L5. (E) Post-operative plain radiographs after posterior decompression and stabilization. CT, computed tomography.

**Fig. 2.** NOMS framework: low-grade ESCC is defined as grade 0 or 1 on the Spine Oncology Study Group scoring system. High-grade ESCC is defined as grade 2 or 3 on the ESCC scale. Stabilization options include percutaneous cement augmentation, percutaneous pedicle screw instrumentation, and open instrumentation. For patients with significant systemic comorbidities that affect the ability to tolerate open surgery, stabilization may be limited to cement augmentation and/or percutaneous screw augmentation \[18\]. CEBRT, conventional external beam radiation; ESCC, Epidural Spinal Cord Compression; NOMS, neurologic, oncologic, mechanical, and systemic; SSRS, spine stereotactic radiosurgery.
due to nerve root involvement or myelopathic features due to cord compression. This pain is managed by utilizing the pain ladder, starting with NSAIDs and paracetamol for mild pain, opioids like tramadol for moderate pain, and oxycodone and morphine for severe pain. Neuropathic pain is managed using tricyclic antidepressants, pregabalin, and gabapentin [22].

Targeted therapeutics

The development of biologics and molecular markers can enhance and augment the tumor responses to chemotherapy and result in a paradigm shift in treatment. It has been noted that some patients with lung adenocarcinoma have activated endothelial growth factor receptor (EGFR) mutations. The presence of an EGFR mutation has been shown to be a predictor of treatment efficacy in non-small-cell lung cancer. Several studies have focused on developing EGFR inhibitors (i.e., erlotinib and gefitinib). The use of these tyrosine kinase inhibitors has improved median overall survival in non-small-cell lung cancer up to 24–36 months [23].

In cases of breast cancer bone metastases, the identification of molecular therapeutic targets has the potential to markedly improve the outcomes in these patients. The most notable molecular markers that have yielded new therapies in treating breast cancer are the estrogen receptor (ER) and HER2. In patients with tumors positive for ER, the use of tamoxifen, an ER antagonist, has led to markedly improved survival [23].

Several targeted therapies have been approved for metastatic renal cell carcinoma (RCC). These agents include cytokines (interleukin-2), multitargeted RTK inhibitors (TKI, i.e., sunitinib, pazopanib, axitinib, and sorafenib, among others), mTOR inhibitor (temsirolimus), and VEGF monoclonal antibody (bevacizumab) in combination with interferon-alpha. Ptashnikov et al. [24] retrospectively reviewed 100 patients of RCC with spinal metastases. Metastasectomy was performed in 39 cases, and 61 patients underwent decompression procedures with stabilization. Only 26 patients had adjuvant-targeted therapy (seven with metastasectomy and 19 with palliative decompression). Their results showed a statistically significant better overall survival in patients who received targeted therapy.

Radiation therapy

Radiotherapy has long been the treatment modality of choice for metastatic spinal tumors. It involves delivering a dose of radiation to a precisely defined area, which leads to tumor necrosis and tumor shrinkage, thus allowing effective local tumor

![Image](image-url)
control. This shrinkage also helps with spinal decompression and pain relief within 24 h of therapy [25]. Radiation therapy is usually administered in two forms: CEBRT and SSRS.

Conventional external beam radiation

CEBRT has been the mainstay of spinal metastasis management. It delivers multiple small additive doses of radiation (usually 30 Gy in 10 fractions) to a wide field. Owing to the wide field surrounding normal soft tissues, the spinal cord is exposed to large doses of radiation. Depending on the response to therapy, tumors are classified as radiosensitive or radioresistant. CEBRT-amenable radiosensitive metastatic pathologies include hematological malignancies, small-cell cancer, germ cell tumors, and breast and prostate carcinomas. Radioresistant tumors include solid tumors like tumors of kidney, thyroid, hepatocellular, and colorectal origins [26]. Mizumoto et al. [27] have reported 2-year local control rates of 86, 69, and 30% for breast, lung, and gastrointestinal tumors, respectively, when treated with CEBRT.

Spine stereotactic radiosurgery

SSRS has become the modality of choice in recent years for achieving local control in cases of spinal metastasis without significant cord compression [6,14]. This has been made possible by advances in image guidance systems, which allows for high biological equivalent hypofractionated dose to be delivered with submillimeter accuracy to a contoured target volume with improved collateral tissue sparing. SSRS can also be given as palliation therapy, retreatment therapy, or both following failed CEBRT [28].

Tumors confined to bone (stage 0) and tumors with minor epidural extension without abutment or compression of the spinal cord (stages Ia and Ib), that is, low-grade ESCC, have the requisite separation from the spinal cord to be safely treated with SSRS. By contrast, tumors displacing or compressing the spinal cord (stages II and III, respectively) are classified as high-grade ESCC and require resection of the epidural component to separate the tumor from the spinal cord before SSRS (separation surgery).

SSRS has multiple advantages over conventional radiation therapy. SSRS allows the use of higher biologically equivalent radiation doses (>10 Gy per fraction), which damages tumor cell DNA leading to tumor necrosis. It also causes additional damage to the tumor vascular supply leading to hypoperfusion of the tumor [29]. This allows successful application of SSRS in traditionally radioresistant tumors like RCC [30] and sarcoma [31].

Another advantage of SSRS is that it is delivered in one to three fractions compared to 10 with 20 fractions of CEBRT, thus leading to better patient compliance. Additionally, it can be used as definitive therapy in patients with spinal metastasis without ESCC, thus replacing en bloc resection for solitary metastasis used earlier [32]. Although revolutionary, SSRS is associated with its own set of complications, primarily being dose-dependent toxicity. Patients undergoing SSRS have an increased incidence of vertebral compression fractures; however, this is usually associated with high-dose therapy [33].

Another dose-dependent complication is of the spinal cord in the form of radiation-induced myelopathy in ESCC management and epidural disease progression [31]. Thus, a balance needs to be achieved, which allows successful patient management: on the one hand, it prevents low/suboptimal dose-related treatment failure, whereas on the other hand it prevents high-dose-dependent toxicities. We consider that radiosensitive tumors with high-grade ESCC are better managed with surgical decompression [31].

Intraoperative radiation therapy

The use of SSRS has led to the paradigm shift in treating patients with spinal metastasis; however, it has less role in patients with circumferential tumors around the dura and those with a previous history of radiation therapy because of the increased complication of spinal cord toxicity. This has led to the use of intraoperative radiation therapy, which allows the delivery of a single dose of therapeutic radiation to the dural margin using a short-ranged source. This allows delivery of a high dose of 25 Gy fraction to the dura while sparing the spinal cord [34].

Surgical intervention

The surgical approach is dependent on the level of lesions, the extent of bone involvement, and surgeon preference. Traditional surgical interventions include posterior decompression, stabilization, and debunking surgery (piecemeal excision or even en-bloc spondylectomy) [9–11,13,35]. However, surgical interventions are associated with varying degrees of complications and associated surgical morbidities. These ranged from 21 to 26% and correlated with the extent of surgical procedure and use of preoperative radiation therapy [36].

With radiosensitive metastasis being managed by CEBRT and radioresistant metastasis being managed with SSRS, the need for cytoreductive surgery has
declined. Indications for surgery currently might include evidence of neurological function deterioration especially if caused by compression by a bone fragment, spinal instability (assessed using SINS) causing pain and neurological deficit or tumor progression despite RT, neurological deficit persisting after RT, unproven cancer histology, significant metastatic spinal cord compression (using ESCC scale), and a life expectancy of at least 3 months. Surgery allows immediate decompression of the neural elements while providing spinal stabilization and histological diagnosis [37].

Spine Oncology Study Group defined spinal instability as a ‘loss of spinal integrity as a result of a neoplastic process that is associated with movement-related pain, symptomatic or progressive deformity, and/or neural compromise under physiological loads’ [20].

SINS (Table 3) is currently the most accepted method for evaluating mechanical instability in spinal tumors. High SINS (13–18) reliably predict the need for surgical stabilization, whereas low SINS (0–6) are considered stable, and the intermediate SINS (7–12) tumors need further refinement, but essentially the need for treatment is based on the discretion and experience of the spine surgeon [19].

MISS. For the surgical procedures to be of actual benefit, the associated surgical morbidity should be minimal, thus allowing for early recovery and improved HRQOL. This has led to the adoption of MISS principles in the treatment of spinal metastasis. MISS allows early postsurgical irradiation, with some patients being treated within 3 days of surgery using the stereotactic technique [38]. Thus, MISS provides significant benefits compared with traditional surgery, where an already terminal patient has to wait for a prolonged period to allow for adequate wound healing before starting radiation therapy. Recent study comparing open surgery with MISS for treatment of symptomatic vertebral metastasis has also concluded that MISS has shorter operative times, shorter recovery times, better pain improvement, and comparable neurological function while having lower complication rates [39].

**Combined surgery and radiotherapy**

Combined surgery and radiation therapy has become the standard of care in patients with good performance status, oligometastatic disease, and vertebral metastases causing instability or ESCC with neurological deficits. A combined surgery and radiation therapy offers a significant advantage: the radiation therapy provides local tumor control, whereas the surgery helps with neural decompression and spinal stabilization. In a randomized controlled study of surgical decompression with conventional radiotherapy (30 Gy in 10 fractions) compared with radiotherapy alone for metastatic ESCC secondary to solid malignancies, Patchell et al. [40] demonstrated the superiority of a combined surgical and radiotherapeutic approach for the maintenance and recovery of ambulation, duration of ambulation, functional ability, maintenance of continence, and survival [40]. Recent multicenter prospective studies have also shown a significant improvement in HRQOL of patients undergoing a combination of surgery and radiotherapy.

Consensus guidelines for the use of postoperative SRSS based on an international survey have concluded that postoperative SRSS may be indicated for (a) radioresistant primary histology, (b) disease that is confined to one to two vertebral levels, and (c) prior overlapping or adjacent conventional RT.

Moreover, the consensus opinion was that postoperative SSR5 is contraindicated in cases of residual postoperative severe spinal cord compression (Bilsky grade 3) and complete spinal cord injury (ASIA grade A) and when more than three contiguous vertebral levels are involved. For treatment planning, the preoperative MRI and postoperative T1-weighted MRI (with and without gadolinium) should be co-registered and delineation of the cord should be performed using co-registered T1-weighted and/or T2-weighted MRI or a CT myelogram in cases of significant hardware artifact [41].

A meta-analysis by Klimo and Schmidt [42] reported that surgery should be the primary treatment in patients with spinal epidural disease, with radiotherapy used as an adjunct.

Multiple studies have reported that postoperative adjuvant SRSS following separation surgery is safe and effective in achieving local tumor control [42,43]. However, complications include hardware failure, seen in ~2.8% of the cases [44].

**Study limitations**

This review is not a systematic review. We intentionally neglected to discuss classifications of spinal tumors as they were previously discussed in several research works. Moreover, the effect of these classifications in decision making is fading. For sure, many suggested scores and algorithms cannot be included in the current review, so we reported the most frequently used. We did not discuss en bloc excision of spinal metastases as it was previously discussed and, again, its indications are currently very limited.
Recommendation

Several unresolved topics related to managing spinal metastases are still waiting for prospective, well-designed studies. It seems that well-planned studies should be directed toward studying the survival of patients having spinal metastases from every genetic subtype of various tumors separately. Although it seems difficult and needs multicenter collaboration, such studies will give clues to a lot of questions related to the expected survival of the patients and consequently facilitate decision making. Furthermore, the inclusion of targeted therapeutics in the algorithm for treating spinal metastases needs well-planned studies to detect the best line of treatment for every patient.

Conclusion

Prognosis in cases of spinal metastases seems to be more influenced by genetic subtyping. The role of spinal oncological surgery is fading away, and surgery is limited to separation surgery and surgeries to restore spinal stability. The future of spinal metastases management lies in the recent advances in radiotherapy techniques and targeted therapeutics.

Conflict of interest

There are no conflicts of interest.

Abbreviation list

- MRI: Magnetic resonance imaging
- FDG-PET: Fluorodeoxyglucose-positron emission tomography
- SSSR: Stereotactic body radiosurgery
- MIS: Minimally invasive spine surgery
- HRQOL: Health-related quality of life
- ESSE: Epidural Spinal Cord Compression
- SINS: Spinal Instability Neoplastic Score
- CEBRT: Conventional external mean radiotherapy
- NSAIDs: Nonsteroidal anti-inflammatory drugs
- NSCLC: Non-small-cell lung cancer
- HR: Estrogen receptor
- RCC: Renal cell carcinoma
- SOSG: Spine Oncology Study Group

References


الملخص العربي

الاتجاهات الحديثة في إدارة ورم ثانوي خبيث في العمود الفقري مراجعة سرد للأدبيات

البيانات الخلفية

العمود الفقري هو الموقع الأكثر شيوعاً للثانويات السرطانية وحوالي 60% من الثانويات العضلية تكون في العمود الفقري ومن المتوقع أن يrencني 10% من مرضى الثانويات السرطانية للعلاج من حدوث ضغط على النخاع الشوكي. في رأينا، هناك حاجة لمراجعة حديثة لعلاج الثانويات السرطانية الفقريه ودور جراحة العمود الفقري بسبب النظائر الحديثة في مجالات تشخيص وعلاج تلك الحالات.

الغرض

суارة البيانات المتوفرة حول الطرق الحديثة في علاج الثانويات الفقريه الخبيثه

تصميم الدراسة

مراجعة الأدب السردي

ผลกระทบ النمو الأفلاح المتنوعة خلال العقد الماضي لمصلحة المرضى الذين يعانون من ورم ثانوي خبيث في العمود الفقري، ولكنها لا تأخذ في الاعتبار أحدث تقنيات العلاج الإشعاعي والعلاج الكيميائي لعلاج هذه الثانويات. قد تشير التقارير الحديثة في علم الوراثة الجزيئية ب описание اختلاف النبات والوراثة الجزيئية في عم الوراثة الجزيئية بخصوص هذا المجال. بتنش وتطور النبات الوراثة في النباتات النباتية بالفقرات. يحتوي هذا التقديم على 4 أعمدة من NOSM ووراثة النبات الوراثة في النباتات النباتية بالفقرات. يحتوي هذا التقديم على 4 أعمدة من NOSM ووراثة النبات الوراثة في النباتات النباتية بالفقرات.

نتيجة

رعي نموذج لوحظ في حالات الثانويات الفقريه بالفقرات وقد تم اجراء عدد من العلاجات المستجابة لسرطان الكلى

الخلاصة

بدأت هذه النماذج لوحظ في حالات الثانويات الفقريه بالفقرات بالكبد الفقري، وقد أجراه إجراء العالمي لوراثة الوراثة في النباتات الفقريه بالفقرات، بفضل هذه النماذج. النماذج المستجابة في علاج الثانويات الفقريه بالفقرات هو القيام بعلاج الإشعاعي والعلاجات الكيميائية المستجابة.