Editorial

Editorial on the integrated multidisciplinary algorithm for the management of spinal metastases

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The spine is a common site for cancer metastasis making it up to 60% of all metastases (1). Due to the complex anatomy of the spine which comprise of mechanical (bone and joints) and neurological (spinal cord and cauda equina) structures, the treatment modalities of spinal metastases (SM) can be more complicated than other osseous metastatic diseases. Conventional management of spinal metastases include external-beam radiotherapy (ERBT), surgical *en-bloc* tumor resection or both. However, the latter is associated with significant risk and morbidity (2,3) and since patients with metastases are living longer, other managements for palliation and quality of life maintenance are sought after. Recently, alternative ameliorative options such as spine stereotactic radiosurgery (SRS) and spine stereotactic body radiotherapy (SRBT) are becoming more common (4-6).

In addition to therapeutic options, frameworks for decision making in regard to SM management such as the NOMS (neurological, oncological, mechanical and systemic) and the LMNOP (location, mechanical instability, neurology, oncology and patient's factors) frameworks (7,8) were developed. However, the Spine Oncology Consortium (SOC) postulates the above frameworks being not all-encompassing, hence has proposed two multidisciplinary algorithms to manage SM (9).

Assessment algorithm

An initial assessment algorithm used to assess patients with SM based on the performance status and systemic burden of the disease; how the disease is controlled systemically; the options for systemic treatment; and treatment recommendations was formulated. Benefits of any proposed treatments should be weighed against the associated adverse effects. The overall performance status of a patient with SM is assessed based on the Eastern Cooperative Oncology Group or the Karnofsky performance status (KPS) (9,10). Depending on the KPS, different treatment approaches follow. For patients with better overall performance (KPS >40 and >2 months of life expectancy), the systemic burden of disease and how well it is controlled should be considered. Systemic treatment options can then be cogitated. Based on the outcomes, the multidisciplinary team can decide between considering ERBT or best supportive care; or using the mechanical, neurological, oncological, preferred treatment (MNOP) algorithm proposed by the SOC (9). As different cancers have different characteristics, systemic therapies might have a better outcome than localized treatments or vice versa (9).

Algorithm for management of spinal metastases

In order to evaluate the disease (SM) itself, the proposed MNOP algorithm can aid in determining a preferred treatment option. Firstly, the mechanical stability should be assessed. As instability often leads to pain, reduction in functionality and may result in neurological symptoms, spinal stability should be the first thing to consider. A widely adopted system, the Spine Instability Neoplastic Score (SINS), is recommended by the SOC to aid in determining the stability of the spine (9,11,12). Even though the SINS provides an easy-to-use scoring system with three outcomes (stable, potentially unstable, unstable), clinical judgement is crucial as well (9,12). This is followed by a detailed evaluation of the patient's neurological risk which include current and potential neurological functions/outcomes. This can be assessed both clinically as well as utilizing imaging for direct visualization of cord compression. A potential helpful grading system, the epidural spinal cord compression scale is a common tool adapted by spinal oncologists (9,13). In terms of oncology, histology plays a major role in determining treatment. The SOC has broken this down into three categories: radiosensitivity, radioresponsiveness, and vascularity. Radiosensitivity is the likelihood of durable local control from ERBT. Radioresponsiveness on the other hand is how rapid the tumor size decreases with treatment. Vascularity however relates directly to surgical management (e.g., preoperative tumor embolization) (9). These parameters will eventually lead to a recommended treatment option.

Recommended treatment regimens

The SOC has classified treatment options for SM into three categories: radiotherapy, surgery and neurointerventional procedures. These options can be used either in conjunction with one-another or utilized alone.

The fundamental treatment for SM is radiotherapy with the intention of pain control and preventing/improve neurological menace. ERBT, SRS and SRBT are among the options for delivering radiotherapy. ERBT can be delivered in different dosage and fractions, however, a single-fraction option is reported with a higher chance of retreatment compared to a multifraction option although equivalent efficacy has been reported for both regimens (9,14,15). Nevertheless, tumor radiosensitivity, histology and dose are crucial factors when ERBT is considered. Spine SRS and SBRT are more localized options of radiotherapy delivery, sparing adjacent tissues (16). However, spine SRS are considered complicated due to the need of pretreatment imaging, specialized immobilization, computer-based planning and precise image guidance for accurate delivery (9). Variability in target delineation remains a concern for this method (17). Hence, both oncologist and surgeons should work together in reducing the delineation (9). Given the fact, the presence of intramedullary or significant epidural involvement may be controversial for SRBT (9).

The purposes of surgical intervention are as follow: direct decompression of the neural structures, instrumentation of the spine to provide stability, local removal of tumor, or as a neoadjuvant therapy prior to radiotherapy. Preceding surgery, the spinal mechanical stability, neurological status, patient's preferences and adjuvant procedures should be taken into account. Since SM is commonly non-local, surgery itself is not used for cure but to improve the delivery of postsurgical radiotherapy (9). When spinal SRS became more available and multidisciplinary care has become the standard of care, en-bloc resections for SM has become less favored (3,9,18). When stabilization is utilized, the surgery should be planned as to fit the overall treatment. External bracing or minimally invasive procedures are useful in terms of allowing early or efficient delivery of radiotherapy. Separation surgery is another technique that involves decompression of the thecal sac to provide a safe distance between the cord/cauda equina and the tumor for spine SRS or SRBT (7,9,19-21). The idea is to provide a 360° decompression which can be achieved by different approaches depending on surgeon's preferences. However, this may result in spinal instability hence an additional stabilization construct may be required subject to the decompression (9).

Advancement in neurointerventional procedures has improved the care for SM. Among them include image-guided biopsies, spinal myelography, device or cement augmentation, local ablative techniques and tumor embolization (9). Early acquiring of the tumor histology is crucial to assist in management. Depending on the location, different imaging modalities are used for image-guided biopsies. CT myelograms are useful in terms of assessing epidural disease, spine SRS or SRBT planning and when MRI is contraindicated (9). In terms of pain management, apart from stabilization, the exothermic reaction during cement augmentation can damage the tumor and pain receptors thus reducing pain (22). However, cement augmentation alone without radiotherapy is not an option for SM management (9). Local ablation is another helpful procedure to assist in pain control. Additionally, local ablative techniques are also used as salvage procedures when re-radiation is thought to be fruitless although occasionally they can be used as primary treatments (9,23). In order to reduce intra-operative blood loss and symptomatic pain relief, preoperative intra-arterial embolization may also be potentially useful especially for hypervascular tumors (24).

Lastly, symptomatic management or rehabilitation management for SM can improve the patient's quality of life. Non-surgical interventions such as bracing and muscular strengthening can be helpful for those who cannot undergo surgery. Analgesia should be prescribed according to the ladder approach (9). Adjuvants such as steroids, drugs for neuropathic pain and bisphosphonates can be added if required (9,25). For patients with bladder or bowel issues; or sensory or motor deficits, rehabilitation and physical medicine should be referred (9). Nonetheless, a multidisciplinary care will provide a better regimen for SM patients.

Editorial comments

Although the algorithm uses a 2-month period as a cut-off for determining interventional options, the decision to proceed with surgical intervention using 2 months as a cut-off time-point should be questioned given concerns with significant cost associated with surgical management and quality of life issues related to recovery after major surgery. The authors believe that a 6-month cut-off given the cost and quality of life would be a more reasonable figure. The one exception would be vertebroplasty where the cost profile is relatively minimal and recovery is quick compared to other surgical interventions; however for separation surgery and reconstruction surgery, a 6-month cut-off should be considered.

We agree that tumor histology is an important aspect for the management of SM. The treatment will largely depend on the primary pathologies for SM. One such therapy that is worthwhile mentioned is heavy particle therapy such as proton beam therapy. Although not yet widely available, the role of proton beam therapy should be considered due to its promising outcomes (26,27). In terms of surgical instrumentation, radiolucent devices should be further developed to facilitate accuracy of radiotherapy delivery. The current metal implants will still result in flaring and distortion in CTs and MRIs thus affecting the accuracy of stereotactic delivery of radiotherapies. Hence, advancement in radiolucent implants could largely benefit patients with SM.

Since the review provided by the SOC are based largely on retrospective studies and expert opinions, future multi-center high-level prospective trials and studies should be carried out to improve the current available evidence in SM management. Nevertheless, this editorial is a brief summary of the review provided by the SOC. For a detailed description, please refer to the original article (9).

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