Prognosis of Skeletal Metastases: A Case Report

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ABSTRACT

Skeletal metastasis is a relatively common feature in patients with cancer, and there are multiple treatment modalities, which include radiotherapy, surgery, and palliative care with the goal of increasing the patient’s quality of life. In order to appropriately guide treatment, the clinician must be able to accurately assess the patient’s prognosis. Today, there are numerous prognostic scoring systems used to assess a patient’s life expectancy with skeletal metastases. This case report examines one patient’s account and discusses recent literature to compare the scoring systems that are commonly used to determine prognosis. A 55-year-old woman presented to the emergency department complaining of progressive right hip pain, which was due to a pathologic fracture of the right femoral neck secondary to skeletal metastases from an unknown primary carcinoma. Upon further investigation, imaging revealed osteolytic lesions in her spine, pelvis, and both femurs, while biopsy of a femoral bone lesion found a metastatic carcinoma of unknown origin. After determining a prognosis, the patient received simple palliative surgeries to decrease pain and increase mobility.

It is important to be aware of the multiple scoring systems used in estimating prognosis in a patient with skeletal metastases. Accurately predicting life expectancy in this population will lead to the most appropriate treatment plan. The new Katigiri scoring system is the preferred as it has been shown to be highly accurate as well as user-friendly.

CASE PRESENTATION

A 55-year-old woman without a significant past medical history presented to the emergency department with progressive right lower extremity pain located primarily in her right thigh, hip, and foot. She reported the pain began 7 months prior when she began having trouble ambulating without limping. While initially the pain was not significant enough for her to seek help, the pain became intolerable over the last several days, prompting her to seek care. An X-ray of her pelvis was performed and revealed a pathologic, non-displaced fracture of the right femoral neck, along with several other lytic lesions in the neck and intertrochanteric regions of the right femur. Lytic lesions were observed in the mid-shaft and subtrochanteric region of the left femur with thinning of the cortices. These radiograph results prompted a computed tomography (CT) scan with contrast of her...
pelvis, abdomen, and thorax, as well as a CT scan without contrast of both lower extremities. This exposed similar lesions found diffusely throughout her body, including the thoracic and lumbar spine, the right seventh rib, the pelvis, and both femurs. The CT series also demonstrated a spiculated 1.5 cm soft tissue mass in the lateral left breast, a 2 cm pathologic lymph node in the left axillary region and countless, bilateral metastatic nodules in the lungs. The patient reported that the mass in her breast had been present for over a year, was non-tender, and was not growing at a noticeable rate; her last mammogram was over ten years ago. Core biopsy of the breast mass revealed fibroadipose tissue with foci of atypical lobular hyperplasia, which suggested the breast mass was not the origin of the metastases. She then underwent right hip hemiarthroplasty for her pathologic hip fracture. During this initial surgery, a bone biopsy was taken from an osteolytic lesion and was determined to be metastatic carcinoma of unknown origin. Subsequently, in a second surgery, a cephalomedullary nail was placed in the left femur to prevent a pathologic fracture of the left femoral neck.

After the pair of surgeries, the patient was able to control the pain in her legs with hydrocodone/acetaminophen tablets, and was able to ambulate with a walker within 48 hours. Four days after the second surgery, she was discharged from the hospital and was scheduled to follow up with internal medicine, orthopaedics, and oncology. She did not want to start chemotherapy at the time of discharge, but was willing to consider radiotherapy for palliative care. She was able to return home under the care of family and friends. She has since recovered enough to restart work.

While the patient’s complicated situation makes determining her outcome with a prognostic scoring system difficult, the recent literature supports the most accurate determination would be made with the scoring system developed by Katigiri et al.\(^1\) With a rapidly growing primary tumor of unknown origin, nodular visceral metastases (lung), abnormal lab data (elevated C-reactive protein), a performance status of 4 according to the Eastern Cooperative Oncology Group (ECOG), and multiple skeletal metastases, her score is a 7 using the 2014 Katigiri system, which places her in the high-risk group. As the survival rate at 6 months in this group is only 27\(^1\), invasive surgery is generally withheld, and radiotherapy is considered the appropriate treatment. However, this patient opted to receive palliative repair of pathologic fractures in the extremities to relieve pain and increase mobility.

**DISCUSSION**

Skeletal metastasis, especially involving the spine, is quite prevalent in cancer patients.\(^2\) Some of the more common tumors that spread to bones include breast, kidney, lungs, and prostate.\(^3\) Approximately one-third of breast cancer and up to 60% of advanced lung cancer will metastasize to bones.\(^4\) Other than the type of primary cancer, other risk factors for skeletal metastasis include advanced stage and grade of the primary cancer, as well as evidence of metastases to other organs.\(^5\) A wide array of compounding factors, such as pathologic fractures or spinal cord compression, may be considered in the course of treatment of these patients.\(^6\) Radiotherapy is the primary means of treatment; however, surgery is often needed to stabilize fractures, fix deformities, and relieve pain and other symptoms.\(^7\) Furthermore, certain primary tumors have unique chemotherapy treatment strategies that are known to be successful.\(^8\) Based on the life expectancy of the patient and their unique complications, a
treatment strategy must be tailored to relieve suffering and maintain functionality. A patient with a short life expectancy may be managed conservatively with only a short course of radiotherapy as the morbidity and risk of surgery likely outweighs the benefit of the procedure. On the other hand, a patient with a relatively long life expectancy could be offered a long course of radiotherapy as well as surgery to resect skeletal lesions.

Today there are more than seven different prognostic scoring systems used in determining the life expectancy of a patient with skeletal metastases. These include systems put forth by Bauer (original and modified), Katigiri, Sioutos, Tokuhashi (original and revised), Tomita, and van der Linden. These scores utilize different sets of prognostic factors (Table 1), and they assign these factors different values depending on what each study finds significant. In addition, the types of populations examined in each study are not homogenous as some studies focus on surgical patients while others focus on non-surgical patients. This confusion can potentially lead to the same patient receiving different life expectancy prognoses that involve vastly different therapeutic courses. This article will discuss multiple studies pertaining to prognostic scoring systems for skeletal metastases and discuss the implications for patient care.

Leithner et al. evaluated seven scoring systems to determine which one predicted survival the most accurately. The study followed 69 subjects with spinal metastases who received surgery and prospectively calculated their scores preoperatively using the Bauer (original and modified), Sioutos, and Tokuhashi systems, as well as retrospectively using the revised Tokuhashi, Tomita, and van der Linden systems. Eight parameters were assessed for each participant, including the location of the spinal lesion, amount of spinal metastases, primary tumor type, visceral metastases, number of extraspinal bone metastases, severity of spinal cord palsy, and the Karnofsky Performance Score (KPS). The only statistically significant factors found by Leithner et al. were the type of primary tumor and the presence, or absence, of visceral metastases. The authors then compared each patient’s predicted score to their actual survival

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<th>Primary Tumor Origin</th>
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<th>Extraspinal Bone Mets</th>
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Orig=original; Rev=revised; Mets=metastases; ECOG PS=Eastern Cooperative Oncology Group Performance Status; KPS=Karnofsky Performance Scale.
time to evaluate which scoring system was the most accurate. The original and modified Bauer scores had the strongest correlation with actual survival time, and the authors believe the modified Bauer score should be used clinically due to its simpler format.

Leithner et al.\(^\text{15}\) were the first to compare more than two prognostic scoring systems at once. Simultaneously comparing seven systems is a key strength of this study. The authors also took into account patients with surgically treated multiple myeloma (MM), a key fact as the prognosis for MM is similar to metastatic bone lesions and can also be treated surgically. Disadvantages to this study that should be considered include that the authors only analyzed patients who had surgery. The exclusion of patients who did not receive surgery is important, as a system is needed that can efficiently determine prognosis for any patient with skeletal metastasis regardless of treatment options. Another major limitation of this study is the small sample size of 69 patients; however, a majority of previous similar studies had comparable sample sizes. Finally, while the authors mentioned that some patients received chemotherapy and others received radiotherapy, they did not analyze these variables in their study. This topic should be revisited to see if any of these factors play a role in changing the prognosis.

Padalkar and Tow\(^\text{17}\) looked retrospectively at 102 patients who required surgery for spinal metastases to assess variables that could predict postoperative life expectancy. This study also compared the revised Tokuhashi to the Tomita scoring systems, which are two commonly used systems in spinal metastases. Significant factors for the revised Tokuhashi system included the general condition score (KPS), extent of visceral metastases, and number of extraspinal skeletal metastases. The type of primary tumor was not found to be significant in the revised Tokuhashi system. The Tomita score was shown to be significant for grade of malignancy, presence of visceral metastases, and presence of bone metastases. Both of the systems examined correlated with survival after surgery. More than 50% of patients with a revised Tokuhashi score of 7 or more and a Tomita score of 6 or less survived 6 months postoperatively.\(^\text{17}\) The authors recommend using the Tomita score when considering surgery as it is simpler and has a higher correlation with survival than the revised Tokuhashi score according to their findings. They also recommend that patients should have an estimated survival of at least 3-6 months in order to proceed with surgery.\(^\text{17}\)

The strengths of Padalkar and Tow’s study\(^\text{17}\) include their ability to show correlation of survival with both systems analyzed, as well as their confirmation that the Tokuhashi and Tomita systems are both reliable and accurate. One may reason that focusing on fewer variables allowed them to acquire more significant results. Limitations of their study include a lack of power, which could be a reason the revised Tokuhashi score did not find the type of primary tumor to be significant.\(^\text{17}\) This is meaningful because in many studies the primary tumor type is found to be of critical importance. Additionally, they also only focused on surgically treated patients, which does not represent an accurate population.

Katigiri et al.\(^\text{1}\) designed a study to update the previous Katigiri scoring system\(^\text{6}\) from 2005 for patients with skeletal metastases by introducing laboratory data as a new variable, while also reconsidering the importance of the primary tumor as a prognostic variable. They prospectively analyzed 808 patients (779 followed up) with skeletal metastases that had received some form of treatment such as surgery (7%), nonsurgical therapy (93%), or simply palliative care (8% of nonsurgical population).\(^\text{1}\)

Employing multivariate analysis, the authors
found that the primary tumor group (rapid, moderate, and slow growing), the presence of visceral or cerebral metastases, performance status, prior chemotherapy, abnormal laboratory data including increased C-reactive protein (CRP) or lactate dehydrogenase (LDH), and multiple skeletal metastases were discovered to be significant prognostic factors. The authors compared the old Katigiri system with this new system and the results suggest that the new system did a significantly better job at placing patients in the proper risk group.

This newly introduced system by Katigiri has several advantages over similar systems. First, other prominent systems (Bauer, Tomita, and Tokuhashi) evaluated mainly surgically treated patients, when in reality most patients with skeletal metastases receive only nonsurgical therapy. Second, it takes into account more prognostic variables that were found to be significant, such as primary tumor group and abnormal laboratory values. Finally, this study is able to break down primary cancer categories into more detail than other studies because of the amount of participants. A noteworthy limitation of this study is the fact that only 7% of the patients underwent surgery. However, this surgical population is a similar sample size in regards to other studies that focus exclusively on surgical patients. Another limitation is that some of the cancer types are not well represented, such as cervical cancer, which included only 9 patients.

Tomita et al. and Bauer et al. focused on surgical patients exclusively, while van der Linden et al. excluded all surgical patients. Katigiri et al. used a very large sample population in comparison to other studies and considered all patients with skeletal metastases regardless of treatment, which allows the physician to proceed confidently with determination of a prognosis regardless of surgical treatment.

Using one system for every patient is not the only issue of concern to clinicians. As suggested by Leithner et al., several systems, such as the modified Bauer, are popular because they are simple and user-friendly. While it is important to have a user-friendly system, it is also necessary to use sufficient variables to distinguish unique cases. If the system is too simple it may neglect significant factors that could change the prognosis. This is another example of where Katigiri et al. outperforms the other systems. This system is user-friendly for clinicians, and it considers significant variables not factored into other systems, such as previous chemotherapy and abnormal laboratory data.

When caring for a patient who has been diagnosed with skeletal metastases, it is valuable to have a dependable prognosis. However, treatment should always be tailored to the patient depending on the involved circumstances; a prognostic scoring system is not the definitive determinant of therapy. Clinical judgment should always be applied to ensure the best quality of care.

**LEARNING POINTS**

- It is important to be aware of the multiple scoring systems used in estimating a survival prognosis in a patient with skeletal
metastases.

• Accurately predicting life expectancy in this population will help identify the most appropriate treatment plan.

• The new Katagiri scoring system is a reliable choice to determine a patient’s prognosis.

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REFERENCES


