Revision of the Katagiri Tumor Histology Grouping for Patients with Metastatic Bone Disease: A Retrospective Study of 495 Patients

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INTRODUCTION: As diagnostic tools and oncologic treatment for cancer advance, the prevalence of metastatic bone disease (MBD) is increasing. Accurate short-term and long-term survival prediction is vital for end-of-life treatment decisions. The Katagiri tumor histology grouping is a commonly used tool to assess the impact of the primary tumor on survival and is based on several laboratory tumor markers, general demographics, and primary tumor histology. This method on tumor grouping has been repeatedly validated and has been widely used in several survival prediction studies involving patients with MBD. However, the tumor histology grouping has not been updated since 2014. As treatment regimens for oncology patients continue to evolve, this tumor histology grouping requires temporal reassessment. Our study aimed to revise this grouping and validate it on our institutional dataset.

METHODS:

All patients who presented at our institution between 2016 and 2021 for surgical treatment of a metastatic bone lesion of the extremities with a minimal follow up of 2-years were included. Patients who received revision surgery or patients who received surgery for a primary bone tumor were excluded. The primary tumor histology of all patients was manually collected from the electronic medical records. The primary outcome was survival post-diagnosis, which was defined as the time from diagnosis until death or date of last follow up. Using Cox proportional hazard regression, three groups (slow, moderate, and rapid growth) were defined by setting thresholds at the 33rd and 66th percentile of the calculated coefficients.

RESULTS:

A total of 495 patients were included in the final analysis. The most common tumors were lung, breast, and renal cell carcinoma. Compared to the Katagiri tumor grouping, patients with NSCLC treated with targeted therapy, renal cell carcinoma, hepatocellular carcinoma, head and neck cancer, and melanoma showed improved survival, while patients with gynecological cancer showed decreased survival in this study. Applying the revised tumor grouping on a logistic regression model resulted in more accurate prediction in terms of discriminative ability. For 90-day survival, the AUC increased from 0.76 (95%CI 0.72-0.80) to 0.78 (95%CI 0.75-0.83) and for 1-year mortality from 0.74 (95%CI 0.70-0.78) to 0.79 (95%CI 0.76-0.83) (Figure 2).

DISCUSSION AND CONCLUSION: In this study, we successfully evaluated the impact of primary tumor on survival after diagnosis with MBD and proposed a revised Katagiri primary tumor histology grouping. Implementing this tumor grouping when developing prediction models may aid in more accurate survival predictions of patients with metastatic bone disease of the extremities who receive surgical treatment.

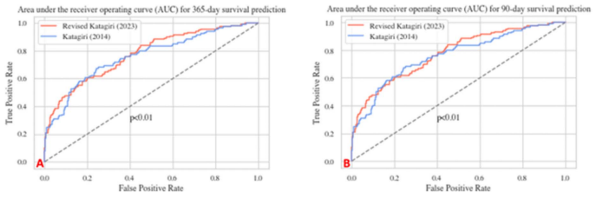

Figure 2. Area under the receiver operating curves (AUC) showing increased discriminative performance using the revised tumor grouping for 365-day (A) and 90-day mortality (B). The AUC is a performance metric used in machine learning to measure the ability of a model to distinguish (discriminate) between two different outcomes (in this case survival or death at both timepoints). The performance metric ranges from 0.5 (no better than a coin toss) to 1.0 (perfect discrimination).

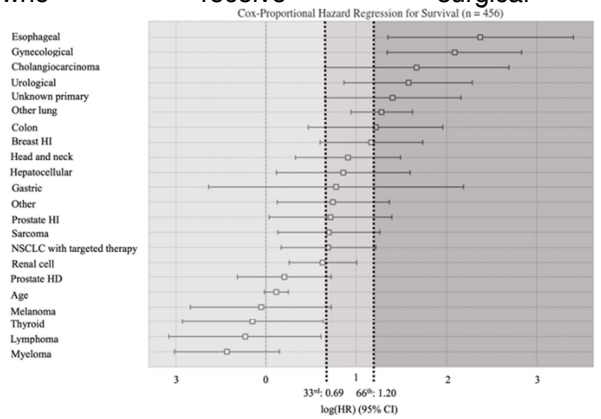

Figure 1. Cox proportional hazard regression showing the impact of each primary tumor on survival. The primary tumors were divided in three groups (slow growth, moderate growth, and rapid growth) based on the B-coefficient of the regression results. HI = Hormone independent; HD = Hormone dependent; NSCLC = non-small cell lung cancer.