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A novel approach to predicting survival in patients with symptomatic spinal bone metastases.

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Background-Extent and type of treatment for symptomatic spinal bone metastases (SBM) should primarily depend on symptoms and secondarily on expected survival time. Predictive models have been developed but their use entails a risk of over- or undertreatment.
Study objective was to develop a new approach to predict survival in patients with symptomatic SBM.

Methods-All patients who were treated for symptomatic SBM between 2001 and 2010 were included in this single center retrospective study (n=1043). Treatment consisted of radiotherapy and/or surgery. Medical records were reviewed for gender (male n=542, female n=501), age (mean 64.8±12.5 years), type of primary cancer, performance status, presence of visceral, brain and bone metastases, number and location of spinal metastases and neurologic functioning. Primary cancers were classified according to Tomita in three categories: slow, medium and fast growing. Performance status was assessed with the Karnofsky performance score (KPS) and neurologic functioning was graded with the Frankel scale. The most prevalent primary tumors were those of breast (n=299), lung (n=250), prostate (n=215) and kidney (n=60). Survival time was calculated as the difference between start of treatment for SBM and date of death. Analysis was performed using the Kaplan-Meier method, univariate log-rank tests and Cox-regression models.

Results-Median follow up duration was 6.6 years and six patients were lost to follow-up. After stratification for primary tumor category, univariate log-rank tests showed an effect of KPS on survival in all three categories ($p<0.001$). Presence of visceral ($p<0.001$) and brain metastases ($p=0.009$) was shown to influence survival only in the slow growth category. Based on these results a flowchart was created, dividing the population in eight groups (figure 1). These groups were matched according to survival, resulting in four categories. Median survival in category A was 31.2 months, followed by 15.4 months for B, 4.8 months for C and 1.6 months for category D (figure 2). Corresponding Hazard ratios were 1.7 (95%CI 1.4-2.2, $p<0.001$) for B, 4.3 (95%CI 3.4-5.5, $p<0.001$) for C and 9.1 (95%CI 7.1-11.7, $p<0.001$) for D.

Conclusion-Assessing patients according to the presented model results in four categories with significantly different survival times. Extent of treatment can be adjusted accordingly.

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