

Abstract number:10844

**Predictive Value of Dynamic Change of Hemoglobin Levels during Therapy on Treatment Outcomes
in Patients with Extremity Osteosarcoma**

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Abstract

Background: Osteosarcoma is a disease with a high heterogeneity. The risk stratification for osteosarcoma patients is uncommon. Hemoglobin (Hb) level has been reported to be a prognostic factor in many malignancies. However, the prognostic value of Hb in osteosarcoma is still unclear.

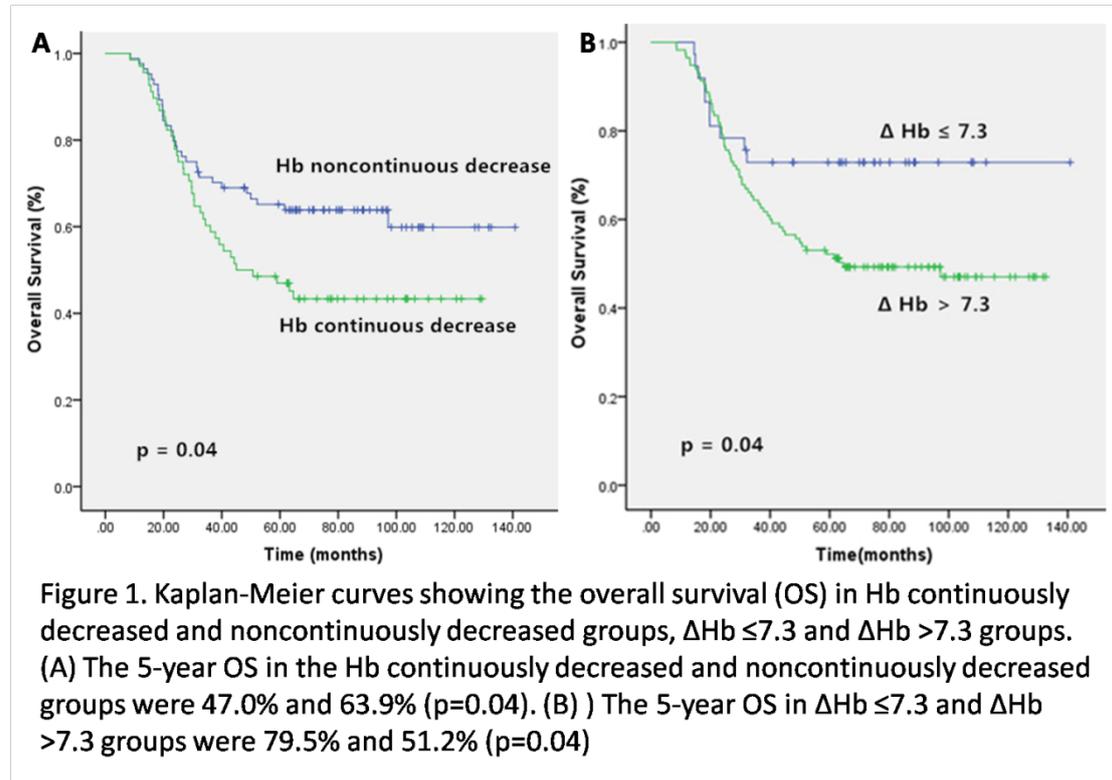
Purpose: To investigate the roles of Hb concentrations and dynamic change during treatment on outcomes of patients with extremity osteosarcoma.

Patients and Methods: A total of 152 patients with extremity osteosarcoma undergoing standard treatment were retrospectively analyzed. Univariate and multivariate analyses including Hb concentrations at the time of pretreatment, neoadjuvant, adjuvant chemotherapy, dynamic Hb changes, difference in Hb decrease (Δ Hb), and patient characteristics were performed to assess the prognostic value on 5-year overall survival (OS) and lung metastasis free survival (LMFS).

Results: The 5-year OS or LMFS were similar between anemia and nonanemia patients at the time of pretreatment, neoadjuvant or adjuvant chemotherapy. Patients with Hb continuous decrease had a poorer 5-year OS than those without Hb continuous decrease (47.0% vs. 63.9%, $p=0.04$, Figure 1A). There was poorer 5-year OS in patients with Δ Hb > 7.3 g/L than those with Δ Hb \leq 7.3 g/L (51.2% vs. 79.5%, $p=0.04$, Figure 1B). However, no significant difference was found for the prognostic value of Hb

continuous decrease for 5-year LMFS. Subgroup analyses revealed that anemia patients at the time of pretreatment, neoadjuvant, or adjuvant chemotherapy with $\Delta \text{Hb} \leq 7.3 \text{ g/L}$ had better survival outcomes than those with $\Delta \text{Hb} > 7.3 \text{ g/L}$ ($p < 0.05$, respectively, Figure 2).

Conclusion: Hb dynamic decrease and $\Delta \text{Hb} > 7.3$ appeared to be poorer prognostic factors for 5-year OS in patients with extremity osteosarcoma. Attempts to correct anemia and the impacts of this condition on outcomes for osteosarcoma patients should be investigated in future trials.



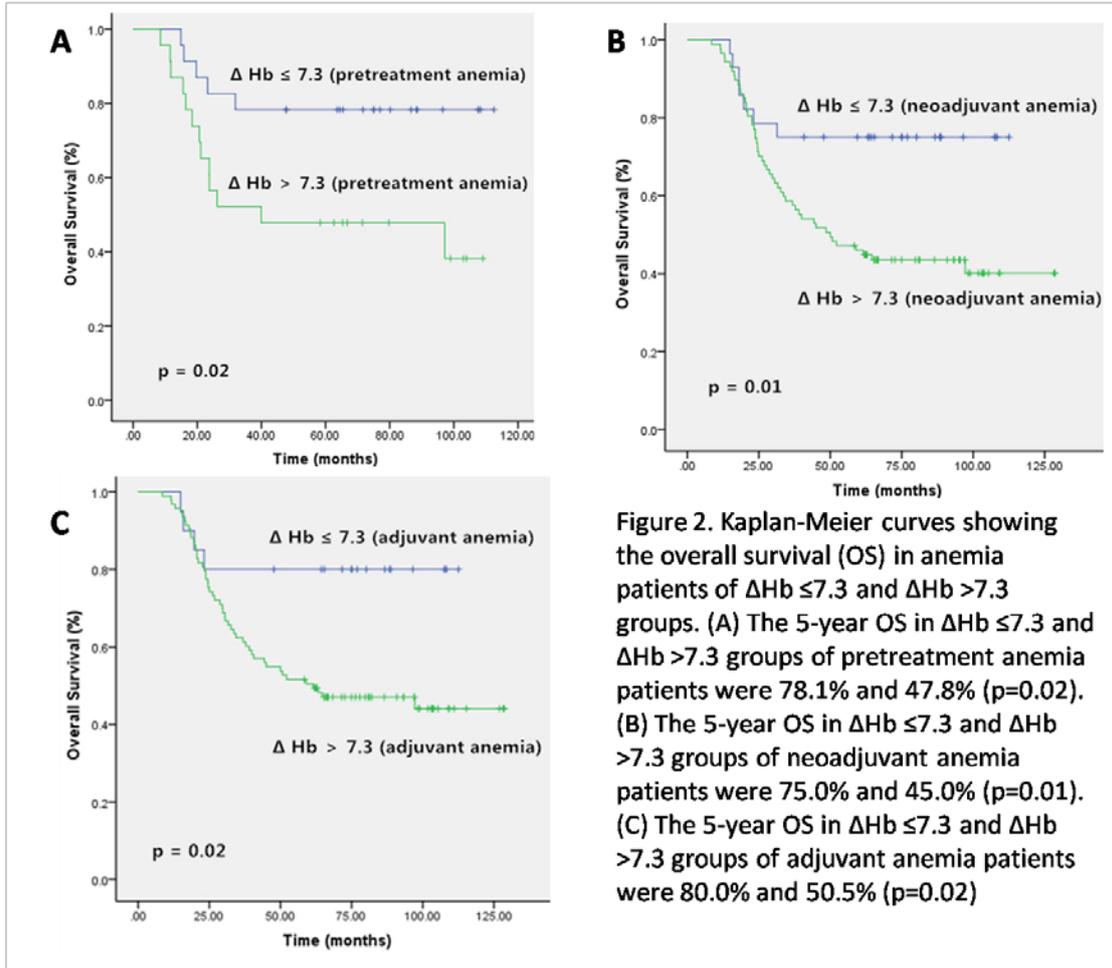


Figure 2. Kaplan-Meier curves showing the overall survival (OS) in anemia patients of $\Delta Hb \leq 7.3$ and $\Delta Hb > 7.3$ groups. (A) The 5-year OS in $\Delta Hb \leq 7.3$ and $\Delta Hb > 7.3$ groups of pretreatment anemia patients were 78.1% and 47.8% ($p=0.02$). (B) The 5-year OS in $\Delta Hb \leq 7.3$ and $\Delta Hb > 7.3$ groups of neoadjuvant anemia patients were 75.0% and 45.0% ($p=0.01$). (C) The 5-year OS in $\Delta Hb \leq 7.3$ and $\Delta Hb > 7.3$ groups of adjuvant anemia patients were 80.0% and 50.5% ($p=0.02$)