A Novel System for the Surgical Staging of Primary High-Grade Osteosarcoma margins of excision: The Birmingham Classification

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Introduction: Chemotherapy response and surgical margins have been shown to increase the risk of local recurrence in osteosarcoma patients. However existing surgical staging systems fail to reflect response to chemotherapy or define an appropriate safe metric distance from the tumour that will allow a complete excision and closely predict the chance of disease recurrence. We proposed to review a group of patients with primary high grade osteosarcoma treated with neoadjuvant chemotherapy and surgical resection and analyzed margins and chemotherapy response in terms of local recurrence.

Materials & Methods: A retrospective study was performed. All primary high-grade conventional osteosarcoma treated between 1997 and 2012, with pre-operative chemotherapy followed by surgery and under the age 50 years old were included in the study. Univariate and multivariate analyses were undertaken to identify statistically significant predictors of local recurrence (LR). The Birmingham Classification was devised on the basis of two stems: the response to chemotherapy (good response = ≥ 90% necrosis; poor response = <90% necrosis) and margins (< 2 mm or ≥ 2mm).

Results: A total of 389 participants matched the inclusion criteria. The five-year survival was 66.5% (95% CI 61.3-71.2%) and 47 patients developed local recurrence (12%). Multivariate analysis showed that intralesional margins and a poor response to neo-adjuvant chemotherapy were significant risk factors for LR. The best predictor of LR however was a combination of margins <2mm and response to chemotherapy. Two-stage Cox regression, ROC analysis, and higher Harrell's C statistic demonstrate that the Birmingham Classification was superior to the MSTS criteria as well as tumour free margins for predicting LR.

Conclusion: A combination of the recording of surgical margins in millimetres and the response to neo-adjuvant chemotherapy should be the standard practice in oncology centres treating patients with osteosarcomas and can more accurately predict the risk of local recurrence than the current MSTS system. A multi-centre collaboration study initiated by the ISOLS is recommended to test the validity of the proposed classification and allow more effective communication of margin status for research.

Keywords : Osteosarcoma, margins, classification

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