Neuroblastoma: New combination method reliably detects hidden tumor cells

(Vienna, 04.09.2025) – **Hidden tumor cells in the bone marrow are one of the greatest challenges in treating neuroblastoma, one of the most common childhood cancers. St. Anna Children's Cancer Research Institute and international partner centers have achieved decisive progress in a new study: by combining three modern analysis methods, previously hard-to-detect tumor cells can now be identified more reliably.**

Neuroblastoma is the most common solid tumor outside the brain in children. The prognosis is particularly critical in high-risk patients: at the time of diagnosis, more than 90% of these children already have tumor cells in their bone marrow. This is especially problematic because relapses mostly arise from these cells, which usually remain undetected despite regular monitoring. Conventional methods miss around 60% of cases with minimal residual disease – a risk that might now be significantly reduced through new diagnostics.

Three methods, one goal: detecting tumor cells early

Sabine Taschner-Mandl, head of the Tumor Biology research group at St. Anna Children's Cancer Research Institute (St. Anna CCRI), together with Labdia, and an international research team at the Princess Máxima Center (Netherlands), analyzed 509 bone marrow samples from 108 high-risk neuroblastoma patients from Austria and the Netherlands. "We used a combination of three different analytical methods. This enabled us to detect significantly more hidden tumor cells compared to conventional methods," explains Taschner-Mandl.

A particularly effective approach proved to be a computer-controlled automated immunofluorescence method combined with molecular analysis using PCR of so-called adrenergic cells, which detects even the smallest amounts of tumor cells in the bone marrow. In addition, the immunofluorescence method provides crucial information about targets for immunotherapies, helping to select patients for anti-GD2 antibody therapy. The combination creates a much more precise picture of the disease and thus offers highly sensitive diagnostics.

Optimized sample collection reduces burden on children

Another important finding concerns the procedure of bone marrow sampling: while at initial diagnosis tumor cells are usually detectable in both sides of the bone marrow, later during therapy and follow-up they often appear only on one side. This means that in the future, single-sided sampling may be sufficient at the time of diagnosis, significantly reducing the burden on young patients. Bilateral sampling would be reserved for follow-up, when only very few tumor cells remain in the bone marrow.

Research with clinical relevance

A central aim of the study was also to test the practical feasibility of this highly sensitive diagnostic approach. With success: the new methods can be combined with conventional examinations, even across national borders. Moreover, very small sample volumes are sufficient to obtain reliable results.

New hope for affected patients

"The new methods will make it possible to detect disease progression and relapses earlier in the future," says Marie Bernkopf, one of the co-authors. This allows physicians to intervene in time and adjust further diagnostics and treatments individually. In addition, changes in tumor cells and potential targets for immunotherapies can be monitored, helping to better understand therapy resistance and possible relapses.

Publication

Gelineau, N.U., Bozsaky, E., van Zogchel, L.M.J. et al. Sensitive detection of minimal residual disease and immunotherapy targets by multi-modal bone marrow analysis in high-risk neuroblastoma – a multi-center study. *J Exp Clin Cancer Res* 44, 224 (2025). https://doi.org/10.1186/s13046-025-03481-w

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St. Anna Children's Cancer Research Institute (CCRI) is an international and interdisciplinary research institution dedicated to developing and improving diagnostic, prognostic, and therapeutic strategies for the treatment of children and adolescents with cancer through innovative research. Taking into account the specific characteristics of childhood tumors, dedicated research groups in tumor genomics and epigenomics, immunology, molecular biology, cell biology, bioinformatics, and clinical research work together to align the latest scientific and experimental findings with the clinical needs of physicians and sustainably improve the well-being of young patients. www.ccri.at www.kinderkrebsforschung.at

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