

Study group – CNS Tumors in Children and Adolescents

The study group targets high-risk CNS malignancies in children and adolescents. Advanced AI-guided MR-image analyses and liquid biopsies from CSF have been implemented to refine primary and relapse diagnostics.

Speaker: Professor Dr. Dr. Michael C. Frühwald, Augsburg

Concept & Achievements

Introduction

The SG “CNS Tumors in Children and Adolescents” has successfully implemented a workflow at all 6 Bavarian academic centers, to generate a framework for analyses of liquid biopsies and automated image segmentation.

Progress and Milestones

- **WP01:** Ethics approval specifically for pediatrics; standards for sample logistics, pre-analytics and banking of biomaterials across sites
- **WP02:** Validation of biomarkers for pediatric CNS tumors – *initiated*
- **WP03:** Retrospective classification of CNS tumors using AI-supported imaging

Benefit for Patients

- **Interaction** of all 6 adult and pediatric Bavarian partner sites
- Set-up of **harmonized AI-based imaging** analysis protocols

- Analyses of molecular targets for **personalized therapies** from tumor tissue, CSF and plasma – *in progress*

Clinical/Scientific Achievements/Perspectives (adult and pediatric)

- Discussions of cases in a **virtual (e.g. KIONET-based) tumor board**
- Set-up of **methods platforms** for high-throughput AI-supported analysis of MRIs, tumor tissue, CSF and blood liquid biopsies and radiotherapy plans
- **Scientific advances fueled by a unique environment** within 6 large University sites
 - Participation in innovative **target-driven interventional, investigator initiated clinical trials**
 - Participation in an increasing number of **Pharma-driven trials** attracted by our excellent environment to follow soon

WP02: Liquid biopsies pediatric CNS tumors

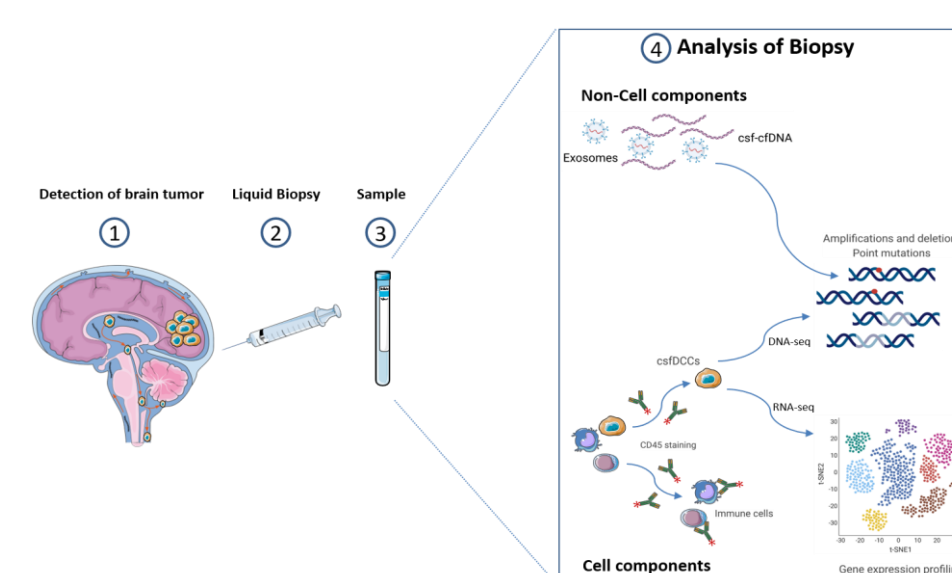


Figure 1: Separation of cellular and non-cellular components of the CSF

Upon CSF puncture, cellular and non-cellular components of the CSF are separated to perform separate molecular workup

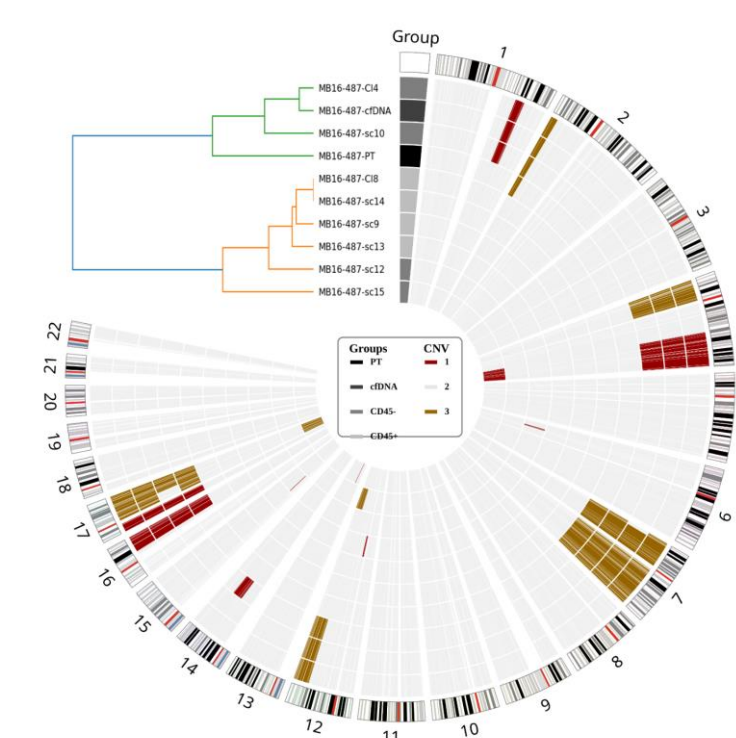


Figure 2: Copy number plot derived from different cell populations of the CSF and cell free DNA

Pilot experiments demonstrate that cell populations isolated from CSF recapitulate the cytogenetic landscape of the primary tumors

WP03: AI-segmentation pediatric CNS tumors

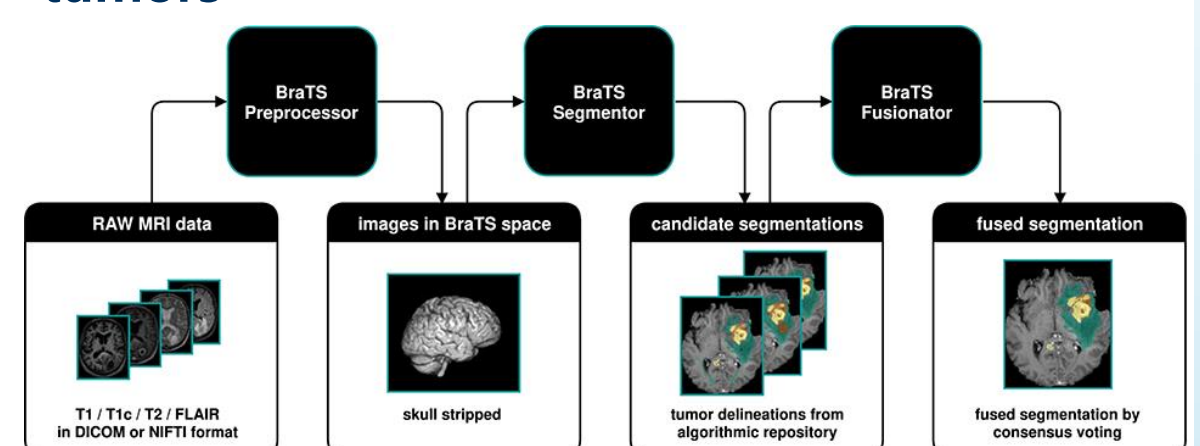


Figure 3: Workflow of image processing for the segmentation of centrally collected imaging data n=60 MRI data sets from UKA, ~140 from UKE and ~300 from LMU/TUM are in the process of analysis

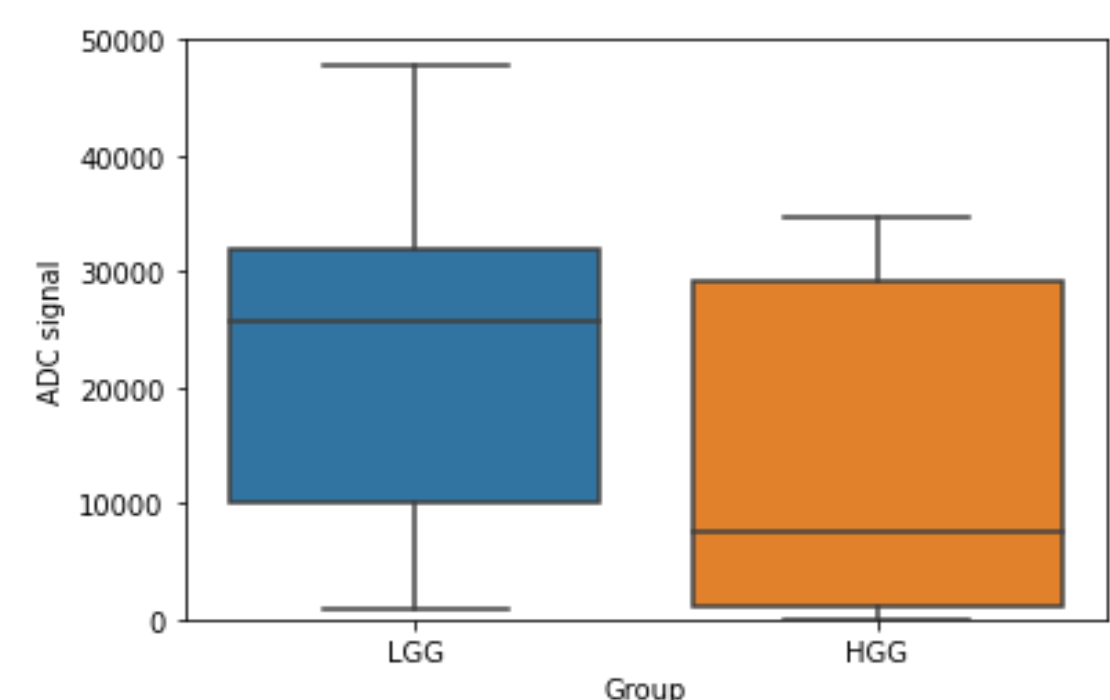


Figure 4: ADC signal of LGG in comparison to HGG

As a proof of principle, we ran the proposed image analysis pipeline (e.g., registration, normalisation, segmentation) on 60 well-annotated cases from UKA and compared the ADC-signals in high-grade and low-grade tumors. As expected, high-grade tumors demonstrate lower ADC signal/higher cellularity, indicating that our pipeline correctly processed these cases

Future Milestones

- Longitudinal and serial analyses of CSF samples at different time points to determine minimal residual disease in pediatric CNS tumors
- Non-interventional trial for adolescents and young adults (AYA 15-39y.) with GB, MB and EP in the first-line situation
- The proposed study (AYA-CNS) will be a collaborative study of the BZKF “SG BT-Adult” and “BT-Pediatric” to fully integrate the methodological and clinical excellence of both groups, and to allow for maximum recruitment. Both study groups have closely cooperated during the first funding period

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