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PATH-01. ACCURATE AND RAPID PEDIATRIC BRAIN TUMOR CLASSIFICATION (PBT) BY METHYLATION PROFILING USING NOVEL NATIVE REAL TIME OXFORD NANOPORE TECHNOLOGY SEQUENCING TECHNOLOGY
Gaila Feinberg1, Assaf Grunwald2, Nurit Gal Mark1,2, Lena Shinderman Maman1, Keren Shihur3, Michal Hameiri-Grossman4, Helen Toledano1,2, Orly Michaeli1, Suzanna Fichman6, Shai Izraeli1,2, Yehudit Birger1,2; 1Hemat-Oncology Laboratory, Schneider Children’s Medical Center of Israel, Petach Tikva, Israel, 2Department of Physical Chemistry, School of Chemistry, Tel Aviv University, Tel-Aviv, Israel, Israel, 3Felsenstein Medical Research Center, Tel Aviv University, Israel, Petach Tikva, Israel, Israel, 4Hemat-Oncology Laborat, Petach Tikva, Israel, Israel, 5Department of Human Molecular Genetics and Biochemistry, Faculty of Medicine, Tel Aviv University, Tel-Aviv, Israel, 6Department of Pathology, Beilinson Hospital Institute of Pathology, Petach Tikva, Israel, Petach Tikva, Israel, Israel, 7Felsenstein Medical Research Center, Tel Aviv University, Petach Tikva, Israel, Israel

BACKGROUND: Pediatric brain tumors (PBTs) pose a significant challenge being the leading cause of cancer related mortality in children. The existing classification process is time-consuming and fails to capture the heterogeneity of PBTs. Urgent advancements in diagnostic and therapeutic approaches are needed. The WHO classification 5th edition for CNS tumors introduced DNA methylation analysis into the diagnostic process, especially for difficult-to-diagnose cases. However, the currently available DNA methylation array-based methods are laborious, costly, & require large amounts of DNA. Nanopore methylation analysis is rapid, accurate, and inexpensive & requires minimal tissue. We applied this technology on 24 PBT samples that were classified into ten molecular subgroups.

RESULTS: Our results were compatible with those obtained through Heidelberg methylation analysis, standard histopathological examination, and molecular tests and were in concordance with the final neuropathological diagnosis. Moreover, for five prospective cases, that would have challenged standard methods, Nanopore yielded same-day results, guiding additional tests and providing a significant diagnostic advantage. In one case, a 2.2-year-old male, with a large left parieto-temporal tumor and a suprasellar lesion initially treated elsewhere with upfront chemotherapy without biopsy, developed clinical deterioration. We resected the temporal lesion and frozen tissue diagnosis suggested low-grade glioma. However, same day Nanopore sequencing analysis indicated a high score for ‘Meningioma’. Final pathology examination 10 days later confirmed “Atypical meningioma, WHO grade 2” – an extremely rare diagnosis in this age group. Visual deterioration prompted immediate resection of the second lesion before final pathological confirmation. Thus, early Nanopore classification played a vital role in diagnosis and management. CONCLUSIONS: Our preliminary results underscore the potential of Nanopore potential for accurate and rapid PBT classification from small brain biopsies, with DNA input as low as 100 nanograms. This cutting-edge technology promises to substantially reduce time to diagnosis, shaping future neurosurgical strategies for individualized PBT patient management.