Feasibility of brain tumor surgery guided by high resolution intraoperative positron emission tomography imaging

A. Krivoshapkin\textsuperscript{1,2,4}  D. Beylin\textsuperscript{3}  A. Gaytan\textsuperscript{1}  
G. Sergeev\textsuperscript{1}  E. Puzakin\textsuperscript{1}  O. Abdullaev\textsuperscript{1,2}

\textsuperscript{1}European Medical Center, Moscow, 
\textsuperscript{2}Novosibirsk State Medical University, Novosibirsk, Russia 
\textsuperscript{3}Brain Biosciences, Inc., Rockville, Maryland, USA 
\textsuperscript{4}Meshalkin National Medical Research Center, Novosibirsk, Russia
Disclosure

Herewith we confirm that we do not have any relevant financial relationships with commercial interests.

We have no actual or potential conflict of interest in relation to this presentation.
It has been recently demonstrated that volume of tumor remnant detected by post surgery PET had impact on life expectancy in the patients with malignant gliomas

Our institution implemented a program for intraoperative brain PET
Two patients with malignant gliomas underwent 5-ALA guided surgery and intraoperative $^{18}$F-FDOPA PET, whereas for the third one $^{18}$F-FDG was used.

Conventional PET machine was exploited at operations.

Extent of tumor resection was evaluated on early postoperative enhanced MRI scans using automated volumetric analysis.
New generation of portable, dedicated brain PET device was also tested for pre-operative imaging

2 mm spatial resolution, 22 cm aperture

Scans lasting 10 minutes were performed at 5-15 minutes after $^{18}$F-FDOPA injection in 4 malignant glioma patients

Additionally, in 8 patients, a 10 minute scan performed at 100-110 minutes after tracer injection.

Images had been reconstructed with 1.2x1.2x1.2mm$^3$ voxel and overall image quality was evaluated.
Case 1

Female, 54 y.o.
Left temporal lobe GBM (WHO Grade 4, NOS)
Surgery for newly diagnosed GBM in May 2018 followed by adjuvant treatment (Stupp protocol)
19.04.2019 surgery for recurrent tumor + balloon electronic brachytherapy
09.18.2019 a new lesion in the left frontal lobe

CE MRI and $^{18}$F-FDG PET CT before surgery
$^{18}$F-FDG PET CT intraoperative imaging
CE MRI within 24 hrs after surgery
Case 2

Male 54 y.o.
Left temporal lobe GBM (WHO Grade 4, IDH-, MGMT -)

No residual tumor on postop CE MRI

CE MRI

MRI Perfusion

18F- FDOPA PET at Surgery

Before Surgery

New soft «Neurosegment»
Automated volumetric MRI analysis-World Neurosurgery
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Results

In all patients 5-ALA surgery provided gross total tumor removal and intraoperative PET confirmed complete tumor resection at surgery.

The average duration for PET procedures was 73 minutes.

PET images acquired with a portable scanner were compared with conventional PET images and demonstrated excellent images quality.
Conclusion

PET is a feasible and promising technology in the navigation guided brain surgery for monitoring the extent of tumor removal.

Intraoperative imaging using conventional PET scanners is time-consuming procedure due to the need to transport the patient to PET scanner and back to operating room.

Portable PET scanner will allow for fast and accurate diagnostics in the intraoperative environment.