18f fluorothymidine positron emission tomography

The PET tracer fluorothymidine FLT is an analog to the nucleoside thymidine and was developed as a PET agent to assess cellular proliferation by tracking the thymidine salvage pathway [1)].

Fluorothymidine F-18 (FLT) is a tumor-specific PET tracer and radiopharmaceutical. It is a version of alovudine in which the fluorine atom has been isotopically labeled as fluorine-18. FLT is suitable for monitoring how tumors respond to cytostatic therapy. FLT accumulates in proliferating cells where it indicates the activity of the enzyme thymidine kinase. Cell division can be characterized by the activity of that enzyme. FLT is phosphorylated as though it were thymidine, and is subsequently incorporated into DNA. Thymidine is essential for DNA replication. Considering that FLT lacks a 3′-hydroxy group, transcription of DNA is impeded following incorporating of FLT. FLT indicates changes in tumor cell proliferation by tracking the restoration of nucleosides from degenerated DNA.

Neurofibromatosis type 2 (NF2) related vestibular schwannomas (VS) demonstrated uptake of both FLT and FDG, which is significantly increased in rapidly growing tumors. A short static FDG PET scan with standard clinical resolution and reconstruction can provide relevant information on tumor growth to aid clinical decision making [2)].

In a study of the University Medical Centre Groningen, The Netherlands baseline fluorothymidine (FLT) uptake appears to be predictive of overall survival. Furthermore, changes in SUVmax over time showed a tendency to be associated with improved survival. However, further studies are necessary to investigate the ability of FLT PET imaging to discriminate between true progression and pseudoprogression in patients with glioblastoma [3)].

Samples of 26 tumors were analyzed (mean age=51.6; range=26-72 years; 16 males, 10 females). All examinations were performed using a PET/CT scanner equipped with lutetium oxyorthosilicate (LSO) detectors. All data were acquired with a delay of 15 min, following intravenous application of 18F-FLT (dosed 2 MBq/kg of body weight). The PET/CT contained CT after intravenous application of iodinated contrast agent and high-resolution brain PET acquired during 15 min in one position. PET/CT was performed before confirmation of the histological diagnosis and the level of 18F-FLT accumulation was compared to the grading of the tumor evaluated using immunohistochemistry staining of Ki-67. Samples were obtained by stereotactic biopsy (5×) or surgical resection (21×). RESULTS: Five tumors of grade IV, 7 tumors of grade III and 14 tumors of grade II were found. Pre-bioptical discrimination between high-grade and low-grade tumors reached accuracy 92.3% (24/26), sensitivity 92.3% (12/13) and specificity 92.9 (13/14). The mean maximum standardized uptake value (SUVmax) in high-grade tumors was 2.23, significantly different from low-grade tumors (mean SUVmax 0.61, T=7.803, p<0.0001). CONCLUSION: 18F-FLT-PET/CT enables to estimate the proliferation activity of glioma before biopsy [4)].

1)
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emission tomography. Nat Med. 1998; 4(11):1334-1336.

2)

Anton-Rodriguez JM, Lewis D, Djoukhadar I, Russell D, Julyan P, Coope D, King AT, Lloyd SKL, Evans DG, Jackson A, Matthews JC. [18F]fluorothymidine and [18F]fluorodeoxyglucose PET Imaging Demonstrates Uptake and Differentiates Growth in Neurofibromatosis 2 Related Vestibular Schwannoma. Otol Neurotol. 2019 Apr 19. doi: 10.1097/MAO.0000000000002272. [Epub ahead of print] PubMed PMID: 31033921.

3)

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4)

Ferdová E, Ferda J, Baxa J, Tupý R, Mraček J, Topolčan O, Hes O. Assessment of grading in newly-diagnosed glioma using 18F-fluorothymidine PET/CT. Anticancer Res. 2015 Feb;35(2):955-9. PubMed PMID: 25667480.