Clinical value of $^{18}$F-FDG PET/CT fusion imaging in hepatocellular carcinoma after transarterial chemoembolization with lipiodol

Poster No.: C-2262  
Congress: ECR 2013  
Type: Scientific Exhibit  
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Keywords: Interventional vascular, Liver, Nuclear medicine, Catheter arteriography, PET-CT, Chemoembolisation, Neoplasia  
DOI: 10.1594/ecr2013/C-2262

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Purpose

1) Transarterial chemoembolization (TACE) has been the mainstay of treatment for unresectable hepatocellular carcinoma. It has proved effective in achieving some local tumor control, improving the quality of life through symptomatic control as well as survival time. However, the tumor recurrence rate after TACE is high, with reported 6- and 12-mo recurrence rates of 22.3% and 78%, respectively (3).

2) It is important to accurately evaluate tumor viability after TACE. The degree of lipiodol deposition in the lesions is closely related to its efficacy. Multiphasic computed tomography (CT) is the generally accepted imaging tool used for the detection of recurrent tumors following TACE; however, the retained hyperattenuating lipiodol material makes it difficult to detect contrast enhancement within a viable tumor (4).

3) The $^{18}$F-fluoro-2-deoxy-D-glucose positron-emission-tomography ($^{18}$F-FDG PET) is a functional imaging tool. It is effective for diagnosis, monitoring therapy and detection of recurrent tumours of various cancers. Furthermore, it is not influenced by tumor morphology or lipiodol deposition. The purpose of this study was to investigate the value of $^{18}$F-FDG PET/CT in Hepatocellular Carcinoma after Transcatheter Arterial Chemoembolization with Lipiodol.

Methods and Materials

Patients

Fifteen patients with HCC (12 male and 3 female, age range from 41 to 72 years, median age 51 years) who underwent $^{18}$F-FDG PET/CT fusion imaging after TACE were included. The diagnosis of HCC was based on the diagnostic criteria for HCC used by the European Association for the Study of the Liver (6). All patients underwent at least one TACE procedure before $^{18}$F-FDG PET/CT fusion imaging. The $^{18}$F-FDG PET scans were performed within three months after TACE.

$^{18}$F-FDG PET/CT scans

All patients fasted for 4~6 h before PET/CT scan. The imaging agent 18F-FDG with radiochemical purity above 95% was produced by using circular accelerator and
synthesized automatically by automated synthesis modules. Serum glucose levels were monitored immediately before the injection of the \(^{18}\)F-FDG, blood glucose was <7 mmol/L in all cases. In the PET/CT system, CT acquisition was performed on spiral dual-slice CT with a slice thickness of 4 mm. Image was acquired using a matrix of 512 X 512 pixels. After CT acquisition, the table was moved toward the field of view of PET, and PET acquisition of the same axial range was started with the patient in the same position on the table. 2D PET acquisition was done for 2 to 3 minutes per bed position. PET data were acquired using matrix of 128 X 128 pixels with a slice thickness of 1.5 mm. CT-based attenuation correction of the emission images was used. PET images were reconstructed by iterative method ordered subset expectation maximization (2 iterations and 8 subsets). After completion of PET acquisition, the reconstructed attenuation-corrected PET images, CT images, and fused images of matching pairs of PET and CT images were available for review in axial, coronal, and sagittal planes, as well as in maximum intensity projections, 2-dimensional cine mode.

**Imaging review**

All \(^{18}\)F-FDG PET scans were visually assessed by 2 experienced nuclear medicine physicians unaware of the the clinical information. The region of tumor with no \(^{18}\)F-FDG uptake or if \(^{18}\)F-FDG uptake was lower than that in the surrounding normal liver was defined as tumor necrosis. If \(^{18}\)F-FDG uptake in tumor was greater than that in the surrounding normal liver in the PET images of three consecutive levels, it was defined as tumor survival.

The relationship between the area of tumor necrosis or survival and lipiodol dense distribution was observed by the PET/CT fusion imaging.

The findings of imaging were compared with next digital substract angiography and clinical follow up.

**Results**

The regions of absent \(^{18}\)F-FDG uptakes could be found in all 15 patients after TACE. Eleven cases showed increased \(^{18}\)F-FDG uptake around or inside the regions of absent \(^{18}\)F-FDG uptake in the shape of annular or crescent. PET/CT fusion imaging showed that \(^{18}\)F-FDG uptakes could be found in regions with good lipiodol distribution(Fig.1-Fig3), the
other 4 patients had no increased $^{18}$F-FDG uptakes in tumor, only intrahepatic radioactive defect area was found.

Digital substract angiography and clinical follow up showed that residual viable tumor could be found in liver of all 15 patients after TACE. The sensitivity of $^{18}$ F- FDG PET/CT fusion imaging was 73.3%, and the specificity was 100%.

Images for this section:
Fig. 1: Multiphasic CT (A) shows complete lipiodol dense distribution in the right lobe of the liver.

Fig. 2: 18F-FDG PET images (B) shows increased activity in the right lobe of the liver.
**Fig. 3**: 18F-FDG PET/CT fusion images (C) show increased activity in the marginal portion of the tumor.
Conclusion

$^{18}$F - FDG PET / CT imaging is not good enough to monitor response of hepatocellular carcinoma after TACE.

There were no correlation between increased $^{18}$F - FDG up takes and lipiodol dense distribution.

References


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