

## EVALUATION OF RADIOSENSITIVITY BY POSITRON EMISSION TOMOGRAPHY WITH 18-FLUORO-2-DEOXY-D-GLUCOSE IN PATIENTS AFFECTED BY UTERINE NEOPLASMS

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The aim of this study was to evaluate predictivity of tumor response by Positron Emission Tomography imaging (PET) with 18-fluoro-2-D-deoxyglucose (FDG) in patients affected by uterine neoplasms and treated with radiotherapy.

From march 1996 to January 1997 we enrolled 14 consecutive patients, median age 53 years (range 32-74), Performance status 1 or 2, affected by histologically proven uterine neoplasms. PET imaging was performed using a whole body PET-camera (Siemens EXACT 47 scanner). All patients were submitted to PET with FDG (370 MBq i. v., pelvic and whole body images) before radiotherapy. Fluorine - 18 was produced by protonic bombardment with scanditronix MC17 cyclotron via  $^{18}\text{O}(p,n)^{18}\text{F}$  nuclear reaction. FDG synthesis was developed using Anatech RB 86 robotic system.

Pelvic uptake was recorded in 11 patients. No evidence of uptake was detected in three patients. Six out of eleven patients showed extraabdominal positivity, confirmed by CT scan. One patient with two different tumors (history of breast carcinoma) at PET-FDG presented a relapse to the chest wall without pelvic or abdominal uptake.

These preliminary findings suggest that PET-FDG may be a useful imaging tool for patients staging.

### Introduction

Fluoro-deoxyglucose is a metabolic marker, which follows the same route into cells as that of glucose. It can be radiolabelled with 18-Fluorine and 18-Fluoro-deoxyglucose (FDG) is suitable for imaging with positron emission tomography (PET). In vivo imaging of human tumors with PET-FDG is a clinical extension of classical studies on carbohydrate metabolism. Rapidly proliferating cells, such as tumor cells, accumulate FDG more avidly than normal cells. It has been demonstrated that a high rate of anaerobic glycolysis is one of the most conspicuous characteristics of the cancer cell phenotype.

PET imaging with FDG show a high sensitivity in the detection of both primary tumors and lymph node metastases. In gliomas, soft tissue sarcomas and non-

Hodgkin lymphomas FDG uptake has been associated with a high-grade tumor.

Uterine neoplasms are a clinically heterogeneous entity that show a large variability in response to treatment. The standard primary therapy consists of surgery and/or radiotherapy.

The aim of this study was to evaluate the tumor response predictivity of PET-imaging with FDG in patients affected by uterine neoplasms submitted to radiotherapy.

### Materials and Methods

Between March 1996 and January 1997, 14 patients affected by newly diagnosed uterine carcinoma underwent an FDG-PET study before radiotherapy. Non-diabetic patients with a median age of 53 years (range 32-74), a

WHO performance status 1-2 and a histologically verified uterine carcinoma were eligible.

Patients characteristics before FDG-PET imaging were described in Tab. 1.

PET imaging was performed using a whole body PET-camera (Siemens EXACT 47 scanner) with patients in fasting conditions for at least 4 hours. All patients were submitted to PET with FDG (370 MBq i. v., pelvic and whole body images). Fluorine - 18 was produced by a protonic bombardment with scanditronix MC17 cyclotron via  $^{18}\text{O}(p,n)^{18}\text{F}$  nuclear reaction. FDG synthesis was developed using Anatech RB 86 robotic system.

Routine blood chemistry and abdominal CT scan or MRI was obtained in each case. All patients were submitted to curative radiotherapy.

Radiotherapy was performed with a 6-23 MV photons beam linear accelerator (Siemens-MEVATRON). Treatment was planned with a 4-fields box-technique. Pelvic lymph nodes received 45 Gy in 5 weeks. A boost of dose, up to 60 Gy, in 1.3 weeks, was given to the GTV (according ICRU 50). The dose fraction was 1.8 Gy.

After radiotherapy patients were followed up every 4 months; median follow-up time was 20 months (range: 18-26 mo).

Survival curves were calculated from the PET study, generally performed 2 weeks before radiotherapy.

#### PATIENTS CHARACTERISTICS

Stage	Pts N.
IIB	5
III	6
IV	3
<b>Histology</b>	
Squamous	10
Adenoca	3
Others	1
<b>Sites</b>	
Cervix	6
Bottle shaped	2
Body	6

TAB.1

#### Results

Pelvic uptake was recorded in 11 patients, six patients with cervical involvement and five with carcinoma of the uterine body. No evidence of uptake was detected in three patients (two patients affected by cervical bottle shaped carcinoma and one with adenocarcinoma of the uterine body).

In six patients out of eleven FDG-PET imaging showed extra-abdominal sites of disease without evidence of disease at CT scan. One patient with two different tumors (history of breast carcinoma) at PET-FDG presented a relapse to the chest wall without pelvic or abdominal FDG uptake.

Seven (64%) out of eleven patients with FDG-PET uptake obtained local control of disease after radiotherapy and in this group the median disease-free-survival was 12 months, and the estimated median survival was 18 months.

In one of three patients (33%) with non FDG uptake at PET imaging, local control was achieved.

#### Conclusion

FDG-PET is useful for evaluation of malignancy diffusion of uterine carcinoma. Patients presenting with different sites of disease have poor survival and should be considered for intensive treatment protocols including chemotherapy for systemic control of disease.

These preliminary findings suggest that whole body FDG-PET imaging confirms to be effective in detecting and following the systemic progression of recurrent uterine carcinoma. Through the use of PET we have been able to identify recurrent disease before it becomes clinically apparent by other standard modalities.

Even if this study has enrolled a restrict number of patients, it appears clear that PET is very helpful in determining radiosensitivity of the uterine neoplasms, so that the PET results could help define a tailored radiotherapy treatment in every patient (dose fraction, total dose, number of fraction a day, etc) in order to improve therapeutic results.

#### References

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