The value of FDG-PET/CT for the diagnosis of Rheumatoid arthritis on patients with malignancies

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Aims and objectives

The usefulness of positron emission tomography (PET) using fluorine-18-labeled fluorodeoxyglucose (FDG) (FDG-PET) has been well established for various types of cancer. It has been also reported that FDG-PET could detect the active lesions of rheumatoid arthritis (RA). [1-4]

Because of the known association of RA and malignancy [5-7], a significant proportion of patients on PET for cancers should be occupied by those with RA. Thus, FDG accumulations in the RA lesions could be detected in these cases.

For these patients, however, diagnosis of RA might have been made before PET scans. If so, FDG uptakes in the synovial inflammations might be obscured by anti-RA drug administrations. [4, 8, 9]

In addition, pathognomonic toe or digital arthritis could not be evaluated in some cases of the routine PET studies because the scans might not cover lower extremities or arms in upward positions.

In this study, we retrospectively analyzed the feasibility of oncologic PET for the diagnosis of RA in the clinical setting and the relationship between PET findings and patients’ clinical situations.

Methods and materials

There were sixty four consecutive adult patients with RA who received routine FDG-PET/CT scans for evaluation of malignant tumors between June 2010 and August 2013 in our hospital. Excluding four patients whose RA diagnoses were overturned after PET, we finally selected 60 patients (27 male, 33 female; from 56 to 82 years old, mean: 70 years old).

Medical records about RA were, if possible, investigated in terms of the past histories, disease status or administered drugs in order to examine the correlations between PET findings of RA and these items.

FDG-PET/CT

Patients fasted for at least 4 hour before FDG administration, and 185 MBq of FDG was intravenously administered to each patient. Images were acquired 1 hour after FDG administration. PET/CT scans were performed from skull to thigh with a 3 minute emission scan/bed and CT attenuation correction.
Image analysis

Not only PET images but also CT images were retrospectively interpreted by at least two board-certified nuclear medicine physicians. Uptakes in the large joints were recognized as positive if they were equivocal to or exceeded those in the livers.

To avoid interpreting non-RA lesions such as senile degenerative changes as RA, we used the following diagnostic criteria [10, 11]: 1) bilateral or symmetrical FDG accumulations in the multiple large joints consistent with RA, or 2) abnormalities of atlanto-axial joints including FDG accumulations on PET or subluxations and erosions on CT for attenuation correction.

We did not evaluate extra-articular uptakes in the reactive lymphnode swellings or pulmonary ground glass opacities due to RA associated lung diseases, because they could also be found in cases with non-RA diseases such as lymphoma or drug induced pneumonitis.

Statistical assessment

The correlations between PET-CT findings and clinical features were assessed using nonparametric tests of chi-square tests. A p-value below 0.05 was considered statistically significant.

Results

Patients

Excluding 9 patients without detailed records, all had histories of drug therapy for RA or were receiving anti RA drugs. Durations of RA ranged from 30 years to less than one year (mean: 11 years). As a result of analysis of clinical informations, the disease status of RA was evaluated as stable in 27 patients, highly active or worsening in 16 patients, and unclear in 17 patients.

Cancers for which PET scans were requested were malignant lymphomas (n=20), lung cancers (n=17), colon cancers (n=5), cancers of unknown primary (n=4), esophageal cancers (n=2), gastric cancers (n=2), pancreas cancers (n=2), and so on.

PET/CT results

The prevalence of patients with positive joint findings was 55% (33/60). Increased uptakes were found in 9 cervical spines, 3 hip joints, 11 elbows, 19 shoulders, and 17
wrist. In 37 cases, FDG avid cancers were found, which could easily be distinguished from RA arthritis.

In 5 cases (8%) PET showed typical RA findings of symmetrical arthritis in the joints (Fig.1). Abnormalities in atlanto-axial joints were found in 13 cases (22%) including 10 of uptake increases on PET (Fig.2) and 6 of structural changes on CT (Fig.3). (3 patients had both PET and CT findings.) Taken together, the overall sensitivity of PET-CT was 25% (15 patients).

Statistical analysis

Longer durations of RA were significantly associated with the atlanto-axial joint abnormalities on CT (p<0.05). No significant correlations were shown between FDG uptakes suggesting RA and clinical disease activities, durations, or underlying malignancies.

Images for this section:
Fig. 1: Typical FDG-PET findings of RA in a 74-year-old female on a scan requested for the evaluation of lymphoma. A. Maximum Intensity Projection (MIP) of PET. B.-G. Axial PET-CT fusion images. Symmetrical FDG uptakes in the large joints including shoulder, wrist, hip, and knee joints (C,D,E,G) should be due to active RA lesions. The clinical disease activity was, however, evaluated as stable. FDG-avid lymphnode swellings in the neck, axilla (B), pelvic and inguinal regions (F,D) were interpreted as lymphoma, but it was difficult to rule out the possibility of reactive lymphnode changes especially in the inguinal regions. Thus, nodal uptakes were not evaluated in this study.

Fig. 2: An abnormal uptake in the atlanto-axial joint in a 56-year-old male. A. In the MIP image, apparently no definite signs of RA could be found (As previously explained, uptakes in the bilateral axillary lymphnodes were not evaluated in this study.), but there was a faint abnormal uptake in the cervical spine (black arrow), which could be clearly observed in the axial or sagittal scan of PET (E,B). In the PET-CT fusion image, the uptake was definitely located in the atlanto-axial joint (D), and no significant structural changes could be found in the CT for attenuation correction (C). He did not complain of any symptom related to this uptake.
**Fig. 3:** Subluxation of the atlanto-axial joint on CT without an FDG abnormal uptake in a 58-year-old female. In this scan with FDG avid lymphoma, there were no abnormal accumulations suggesting RA on the MIP (A) or axial PET images (C), but a vertical invagination and erosion of the odontoid process could be found on CT (B) or, of course, PET-CT fusion images (D). The lack of uptakes on the joint might represent the inactivity of the arthritis. E. Cervical X-ray for the same patient (as a reference). The RA duration was 27 years at the scan.
Conclusion

Although study limitations should be noted including the heterogeneity of RA disease status, the low number of patients, or the lack of a gold standard for the final diagnosis, the diagnostic value of FDG-PET for RA may be limited in the usual oncologic examination.

Personal information

References
