Increased ^{18}F-FDG Uptake in Degenerative Disease of the Spine: Characterization with ^{18}F-FDG PET/CT

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We determined the prevalence of abnormal spinal ^{18}F-FDG uptake and assessed the relationship between the severity of findings on ^{18}F-FDG PET and the severity of degenerative spinal disease (DSD) on CT. **Methods:** PET/CT scans of 150 patients >18 y old, referred for whole-body ^{18}F-FDG PET/CT for evaluation of known or suspected malignancy from June to July 2002, were analyzed retrospectively for the presence of increased ^{18}F-FDG uptake in the spine and for anatomic correlates. Initially, PET images were examined and foci of ^{18}F-FDG uptake in the spine were graded on a 0–4 scale based on intensity of ^{18}F-FDG uptake (0 = definitely normal, 1 = probably normal, 2 = equivocal, 3 = probably abnormal, 4 = definitely abnormal). From PET alone, an impression as to whether lesions were most likely metastases or degenerative, as well the level of the spine involved, was also recorded. CT images of all 150 patients were reviewed independently by a musculoskeletal radiologist, who was unaware of patient identification, history, and findings of other imaging modalities, with the location recorded and severity graded on a 4-point-scale (0 = normal, 1 = mild, 2 = moderate, 3 = severe for both degenerative disk and facet disease). The relationship between PET and CT findings was then determined. **Results:** Of the 150 patients, 63 (42.0%) had no abnormal findings in the spine on PET (grade 0), 27 (18.0%) had grade 1, 25 (16.7%) had grade 2, 17 (11.3%) had grade 3, and 16 patients (10.7%) had grade 4 ^{18}F-FDG uptake for DSD. Two additional patients had apparent spinal metastases with no degenerative changes. Five patients had metastases and DSD (included above). Of the patients who had abnormal spinal findings graded as probable or definite for DSD on CT (grades 3–4), 11 had abnormal findings in the cervical spine, 16 in the thoracic spine, and 23 patients in the lumbosacral spine. Seven patients (4.7%) had PET findings suggestive of spinal metastases. For patients with a maximum regional DSD score of 3, the mean ^{18}F-FDG uptake for that spinal level was 1.4 ± 1.5, whereas for patients with a maximum regional DSD score of 0, the mean PET grade was significantly lower at 0.4 ± 0.9 ($P = 0.0001$). **Conclusion:** Incidental findings on PET suggestive of DSD are common (22% of patients), most common in the lumbosacral spine, and can be recognized on CT. The severity of PET findings correlates with the severity of degenerative disk and facet disease as graded by CT, likely due to the fact that the inflammatory process that accompanies DSD is evident on PET. Increased ^{18}F-FDG uptake in DSD should not be confused with metastatic disease.

Key Words: ^{18}F-FDG; PET; PET/CT; CT; degenerative spinal disease

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Dedicated PET/CT, the combination of dedicated PET and CT, is a powerful tool that provides both metabolic and anatomic information (*1*). CT enhances PET by enabling more accurate localization and characterization of PET findings, shortens scanning time, and provides improved diagnostic accuracy and certainty in common conditions such as lung and colon cancer (*1,2*). The spine is a common site of skeletal metastases in cancer patients. However, degenerative spinal changes also are very common in that same patient population and must not be confused with malignancy. ^{18}F-FDG PET helps us to differentiate benign from malignant lesions in the spine. PET with ^{18}F-FDG has been reported to have fewer false-positive studies in the spine than bone scans with ^{99m}Tc-diphosphonates (*3*). Because degenerative changes and spinal metastases are typically located at different sites and have different morphologies, they can be well recognized by the CT portion of ^{18}F-FDG PET/CT. This can also explain the better specificity of ^{18}F-FDG PET/CT compared with ^{18}F-FDG PET alone in the detection of spinal metastases (*4*).

^{18}F-FDG PET has additional uses in the evaluation of spinal disease. Stumpe et al. found ^{18}F-FDG PET to be useful for the differentiation of degenerative from infectious endplate abnormalities in the lumbar spine detected on MRI (*5*). ^{18}F-FDG PET was also useful in diagnosing infection (*6–8*). Although ^{18}F-FDG PET was found to correlate with MR and clinical findings in quantifying inflammatory activity in the wrist (*9*), this relationship has not been explored in the spine.

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The objective of this study was to use the strengths of ^{18}F-FDG PET and CT to systematically determine the prevalence of abnormal focal ^{18}F-FDG PET findings in the spine and determine if any were caused by degenerative spinal disease (DSD) as well as to assess the correlation between the severity of findings on ^{18}F-FDG PET with CT. Our expectation was that at least some foci of ^{18}F-FDG avidity in the spine were attributed to DSD and that these could be clearly identified with ^{18}F-FDG PET/CT.

MATERIALS AND METHODS

All 150 consecutive patients >18 y old who were referred for whole-body ^{18}F-FDG PET/CT for evaluation of known or suspected nonbrain malignancy from June to July 2002 (69 males, 81 females; age, 19–88 y; mean age, 60.4 ± 14.5 y) were reviewed retrospectively for the presence of increased ^{18}F-FDG uptake in the spine and independently for the presence or severity of degenerative disease of the spine. This was a retrospective blinded review and thus ruled as an exempt study by the institutional review board with regard to written informed consent. All ^{18}F-FDG PET/CT scans were performed with the Discovery LS PET/CT scanner (GE Healthcare). Patients fasted for at least 4 h before ^{18}F-FDG injection. Blood glucose levels were checked before ^{18}F-FDG injection and the patient received 8.14 MBq/kg (0.22 mCi/kg) ^{18}F-FDG intravenously. The patients received READI-CAT barium sulfate oral contrast (E-Z-EM Canada Inc.) for non–head and neck cancer imaging. For patients weighing >68 kg, 2 bottles were administered before ^{18}F-FDG injection and 1 bottle was administered 30 min after ^{18}F-FDG injection. For patients weighing ≤68 kg, 1.5 bottle were administered before ^{18}F-FDG injection and 1/2 bottle was administered 30 min after ^{18}F-FDG injection. A tracer uptake phase of approximately 60 min was allowed, during which the patients sat in a quiet room without talking. The patients were instructed to breathe normally during CT and ^{18}F-FDG PET acquisition. No intravenous contrast material was administered in these patients.

CT Scanning

CT was performed before ^{18}F-FDG PET emission acquisition. Patients were normally positioned with their arms up. Images were acquired with the patients positioned the same as for the emission scan by adjusting the table in linear increments. The CT portion of the Discovery LS scanner consists of a multidetector helical CT scanner (LightSpeed Plus; GE Healthcare). The imaging parameters used for a typical 6-bed–position PET/CT acquisition were 140 kVp, 80 mA, 0.8 s per CT rotation, a pitch of 6, a table speed of 22.5 mm/s, a 31.9-s acquisition time. The milliamperes were adjusted upward in larger patients on the basis of body weight. CT data were resized from a 512 × 512 matrix to a 128 × 128 matrix and were smoothed to match the ^{18}F-FDG PET data to allow for fusion of the CT and ^{18}F-FDG PET images. A CT transmission map was used for attenuation correction; 512 × 512 CT images were also available digitally for interpretation.

PET Scanning

^{18}F-FDG PET emission data were acquired for 5–7 bed positions, generally from the base of the skull to the level of the midthighs. Emission data were obtained for 5 min for each bed position in the 2-dimensional mode. Each bed position had 35 scanning planes with a 14.6-cm longitudinal field of view and a 1-plane overlap between scanning bed positions. CT data were used for generation of the transmission map. ^{18}F-FDG PET images were reconstructed to a 128 × 128 matrix using CT data for attenuation correction with the ordered-subsets expectation maximization algorithm (2 iterations, 28 subsets) and an 8-mm gaussian filter. Both CT attenuation-corrected images and nonattenuation-corrected images were reviewed.

Image Analysis

^{18}F-FDG PET and CT studies were reviewed and interpreted retrospectively and independently by a nuclear medicine physician and a musculoskeletal radiologist, respectively, who were unaware of patient identification, history and findings of other imaging modalities. The studies had previously been interpreted clinically, but the clinical reports were not used for this study. All ^{18}F-FDG PET and CT images were reviewed on an interactive computer display using commercial fusion software (eNTEGRA; GE Healthcare). ^{18}F-FDG PET and CT studies were reviewed in a random order, followed by ^{18}F-FDG PET/CT studies in a separate reading session, also in a randomized order, without access to the previous ^{18}F-FDG PET reading.

^{18}F-FDG PET images of all 150 patients were reviewed and analyzed retrospectively by a board-certified nuclear medicine physician with 2.5 y experience in PET. Initially, ^{18}F-FDG PET images were examined without CT, and foci of ^{18}F-FDG uptake in the spine were identified and scored on a 0–4 scale based on the intensity of tracer uptake relative to surrounding background tissues about that region of the spine as follows: 0 = definitely normal (uptake less than or equivalent to background), 1 = probably normal (mild ^{18}F-FDG accumulation near background level), 2 = equivocal (focal uptake equivocally greater than background), 3 = probably abnormal (focal uptake probably greater than background), 4 = definitely abnormal (focal uptake clearly greater than background). From ^{18}F-FDG PET alone, an impression as to whether lesions were most likely metastases or degenerative was also recorded with lesions obviously in the vertebral body viewed as most consistent with metastases. These scores were recorded for regions of the spine, so that a maximum score was recorded for each area of the spine (cervical, thoracic, and lumbosacral spine). Thus, 3 scores were recorded per patient. In the patients with metastases, the scan at the tumor site was not included in the analysis.

CT images of all patients were reviewed for DSD by an experienced musculoskeletal radiologist and graded using established criteria (*10–13*). Diagnostic grading for degenerative disk disease on CT was graded as follows: 0 = normal, 1 = mild (no disk narrowing, osteophytes < 2 mm, no significant canal narrowing), 2 = moderate (visible disk narrowing, osteophytes > 2 mm, canal stenosis central or lateral 150–250 mm^2), 3 = severe (complete loss of disk height, osteophytes > 2 mm, canal stenosis 100–250 mm^2 or touching cord). Diagnostic grading for degenerative facet disease was graded as follows: 0 = normal, 1 = mild (sclerosis, no hypertrophy), 2 = moderate (hypertrophy, no narrowing of neural foramina), 3 = severe (neural foramina narrowing). The location and type (disk or facet) of the degenerative changes were recorded by precise vertebral number and region, as for ^{18}F-FDG PET. Other CT findings such as metastases were also recorded. Metastases were lytic, blastic, or mixed in character, as assessed on standard CT bone windows. For metastases, a binary "yes" or "no" scale was applied based on typical radiographic criteria. A sclerotic lesion with morphologic characteristics not typical of bony island (sclerotic focus with thorny

TABLE 1
Distribution of Degenerative PET Grades in Various Spinal Levels

Spinal level	Number of patients (%)				
	PET grade 0	PET grade 1	PET grade 2	PET grade 3	PET grade 4
Cervical	122/150 (81.3)	9/150 (6.0)	8/150 (5.3)	4/150 (2.7)	7/150 (4.7)
Thoracic	101/150 (67.3)	17/150 (11.3)	16/150 (10.7)	13/150 (8.7)	3/150 (2.0)
Lumbosacral	87/150 (58.0)	21/150 (14.0)	19/150 (12.7)	13/150 (8.7)	10/150 (6.7)

borders) was classified as suspicious for metastatic disease. A lytic or mixed lytic lesion with an ill-defined or permeative appearance not typical of endplate changes associated with degenerative disk disease was also classified as suspicious for metastatic disease. Finally, spondylolysis was also recorded on a binary "yes" or "no" scale based on the presence or absence of pars defects.

Region-by-Region Analysis

The grades of the ^{18}F-FDG PET findings in the spine were compared directly with the CT grading, region by region and for the entire spine. The spine for this purpose was divided into sections: cervical, thoracic, and lumbosacral spine.

Statistical Assessment

Descriptive statistics regarding the CT and PET findings were generated. Grading of ^{18}F-FDG PET and CT were compared directly for each region using the Mann–Whitney test. $P < 0.05$ was considered statistically significant. Correlation coefficients were also determined between the qualitative ^{18}F-FDG PET readings and the qualitative CT readings. Because the CT and PET grades used are categoric, Spearman correlation was calculated. As many of the foci of degenerative disease were small, including in the facet joints, standardized-uptake-value (SUV) determinations were not done because of the difficulties associated with partial-volume corrections for small and irregularly shaped structures.

RESULTS

Of the 150 patients studied, 63 patients (42.0%) had no abnormal findings in the spine on ^{18}F-FDG PET (grade 0). Twenty-seven patients (18.0%) had minimal PET findings in the spine, graded as probably normal (grade 1). Twenty-five patients (16.7%) had equivocal PET findings (grade 2). Seventeen patients (11.3%) had abnormal PET findings, graded as probably abnormal (grade 3), and 16 patients (10.7%) had PET findings graded as definitely abnormal for DSD (grade 4). Two patients had metastases only on ^{18}F-FDG PET, whereas 5 patients had metastases and DSD (included above).

Of the 150 patients, a total of 450 regions could be assessed by PET (3 spinal levels for each patient). These findings are summarized in Table 1. Of the 33 patients who had abnormal spinal findings graded as probable or definite for DSD (grades 3 and 4), 11 patients had abnormal findings in the cervical spine, 16 patients had abnormal findings in the thoracic spine, and 23 patients had abnormal findings in the lumbosacral spine.

Of the 150 patients, a total of 900 regions could be assessed by CT (3 spinal levels, as well as disk vs. facet joint for each level). In 2 patients (1.3%) the maximum CT grade of abnormality in any spinal level was 0, in 26 patients (17.3%) the maximum CT grade was 1, in 71 patients (47.3%) the maximum CT grade was 2, and in 51 patients (34.0%) the maximum CT grade was 3.

Of the 450 spinal levels considered (3 for each of the 150 patients), in 104 spinal levels (23.1%), the maximum CT grade seen (facet and disk spaces combined) was 0. In 110 spinal levels (24.4%), the maximum CT grade seen was 1. In 173 spinal levels (38.4%), the maximum CT grade seen was 2. In 63 spinal levels (14.0%), the maximum CT grade seen was 3.

The distribution of the CT grades in the disk and facet joints in the cervical, thoracic, and lumbosacral spine for all patients combined is shown in Tables 2 and 3. In our patient population, degenerative changes seen on CT (CT grades 1, 2, and 3) were most common in the lumbosacral spine. It was not uncommon for more than one area of the spine to be involved with degenerative changes.

There is a great deal of variability in terms of the intensity of ^{18}F-FDG uptake versus the severity of degenerative disease. Some patients with severe degenerative changes in disks or vertebrae have low ^{18}F-FDG uptake, whereas others with severe degenerative disease have much higher ^{18}F-FDG uptake. Although there is overlap and variability, it is clear that for both degenerative disk disease and degenerative facet disease, ^{18}F-FDG uptake is

TABLE 2
Distribution of Degenerative CT Grades in Various Spinal Levels

Spinal level	Number of patients (%)			
	CT grade 0	CT grade 1	CT grade 2	CT grade 3
Cervical	52/150 (34.7)	18/150 (12)	50/150 (33.3)	30/150 (20.0)
Thoracic	46/150 (30.7)	49/150 (32.7)	51/150 (34.0)	4/150 (2.7)
Lumbosacral	6/150 (4.0)	43/150 (28.7)	72/150 (48.0)	29/150 (19.3)

TABLE 3
Distribution of Degenerative CT Grades in Various Spinal Levels: Disk vs. Facet Joint

	Cervical spine		Thoracic spine		Lumbosacral spine	
CT grade	Disk	Facet	Disk	Facet	Disk	Facet
0	84	68	55	121	36	23
1	23	13	44	17	63	41
2	38	40	49	9	44	64
3	5	29	2	3	7	22

significantly higher in patients with severe degenerative disease than in those with no obvious degenerative disease on CT. For severe degenerative disk disease, there is greater ^{18}F-FDG uptake than in normal disks ($P = 0.039$). For severe facet joint disease, there is greater ^{18}F-FDG uptake than in normal facets ($P < 0.0001$). For both types of DSD (disk and facet) combined, the difference between ^{18}F-FDG uptake values was substantial, with greater ^{18}F-FDG uptake in severe degenerative regions than in normal regions ($P = 0.0001$) (Table 4, 5, and 6). Of note is the larger difference between ^{18}F-FDG uptake in regions with CT grade 0 versus CT grade 3 degenerative facet disease than between CT grade 0 versus CT grade 3 degenerative disk disease.

The correlation between the maximum CT grade (disk and facet joints combined) and the PET grade for the corresponding spinal level was analyzed. In general, the correlation was positive but weak. The correlation coefficient was 0.0878 ($P = 0.2855$) in the cervical spine, 0.2318 ($P = 0.0043$) in the thoracic spine, 0.3567 ($P < 0.0001$) in the lumbosacral spine, and 0.2266 for all spinal levels combined ($P < 0.0001$). The mean PET grade ± SD for spinal levels with a CT grade of 0 was 0.38 ± 0.87. The mean PET grade ± SD for spinal levels with a CT grade of 1 was 0.49 ± 0.97. The mean PET grade ± SD for spinal levels with a CT grade of 2 was 0.71 ± 1.16. The mean PET grade ± SD for spinal levels with a CT grade of 3 was 1.38 ± 1.55. These findings are shown in Table 6. The correlation between disk grade on CT and PET grade in corresponding spinal levels was positive and significant but weak (correlation coefficient $r = 0.1466$; $P = 0.0018$). The correlation between facet joint grade on CT and PET grade in corresponding spinal levels was significant and positive but also weak (correlation coefficient $r = 0.1561$; $P = 0.0009$).

TABLE 4
Comparison of CT Grading of Degenerative Disk Disease and PET Grading (per Spinal Level)

Disk disease grade per CT	Mean PET grade ± SD	Mann–Whitney test
0	0.49 ± 1.00 ($n = 175$)	
3	1.79 ± 1.63 ($n = 14$)	$P = 0.0039$

TABLE 5
Comparison of CT Grading of Degenerative Facet Joint Disease and PET Grading (per Spinal Level)

Facet joint disease grade per CT	Mean PET grade ± SD	Mann–Whitney test
0	0.19 ± 0.47 ($n = 182$)	
3	1.33 ± 1.57 ($n = 54$)	$P < 0.0001$

Illustrative figures demonstrate the findings described earlier. In Figure 1, ^{18}F-FDG PET/CT images show increased ^{18}F-FDG uptake in the region of the facet joint, corresponding to degenerative facet disease seen on CT. In Figure 2, ^{18}F-FDG PET/CT images show abnormal ^{18}F-FDG uptake in the region of degenerative disk and degenerative facet disease seen on CT. In contrast, in Figure 3, only minimal or no ^{18}F-FDG uptake is seen in spite of severe degenerative changes evident on CT.

Seven of the 150 patients (4.7%) had PET findings highly suggestive of spinal metastases on the basis of location and intensity; of these 7 patients, 3 patients had apparent sacral metastases, 2 patients had lumbar metastasis, 1 patient had thoracic metastasis, and 1 patient had thoracic, lumbar, and sacral metastases.

DISCUSSION

^{18}F-FDG PET is generally a very sensitive and specific method for detecting systemic metastases of a wide variety of cancers. In some studies, ^{18}F-FDG PET has been shown to be more specific than ^{99m}Tc-diphosphonate bone scans, as ^{18}F-FDG PET images show fewer foci of degenerative changes (*14*). However, some forms of degenerative and inflammatory changes do show abnormal ^{18}F-FDG uptake (*15*). The accumulation of ^{18}F-FDG in foci of inflammation is well known and has been proven useful for infection detection, among other applications (*15–23*). ^{18}F-FDG uptake is also clearly increased in various inflammatory joint diseases (*9,24*), including rheumatoid arthritis (*25–27*). ^{18}F-FDG PET also has showen promising results in the evaluation of the metabolic activity of synovitis and monitoring

TABLE 6
Comparison of CT Grading of Degenerative Facet Joint and Disk Disease Combined and PET Grading (per Spinal Level)

Maximal combined facet and disk joint disease grade per CT	Mean PET grade ± SD	Mann–Whitney test
0	0.38 ± 0.87 ($n = 104$)	
1	0.49 ± 0.97 ($n = 110$)	CT grade 1 vs. 0: $P = 0.3914$
2	0.71 ± 1.16 ($n = 173$)	CT grade 2 vs. 0: $P = 0.0333$
3	1.38 ± 1.55 ($n = 63$)	CT grade 3 vs. 0: $P = 0.0001$

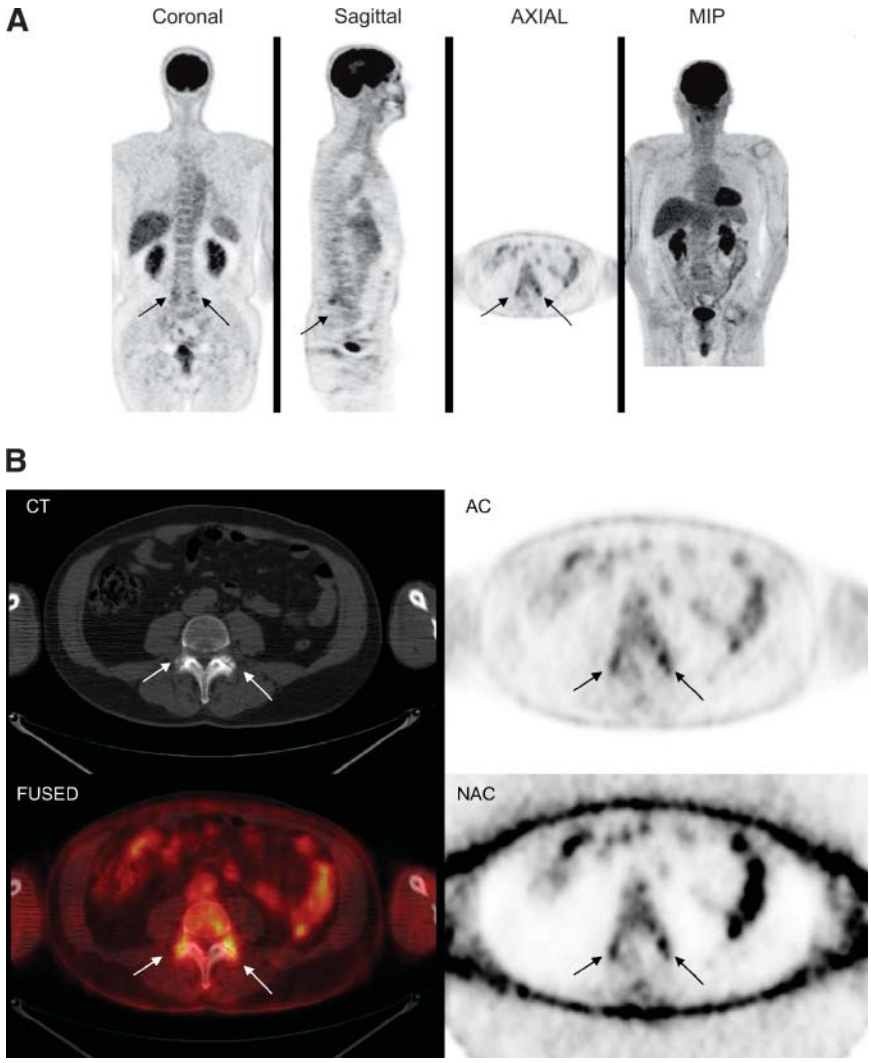

FIGURE 1. ^{18}F-FDG PET/CT images of lumbosacral spine show increased ^{18}F-FDG uptake in region of facet joint, corresponding to abnormal findings on CT (arrows). (A) Coronal, sagittal, axial, and maximum-intensity-projection (MIP) PET images. (B) CT, attenuation-corrected, fused, and nonattenuation-corrected PET images. AC = attenuation-corrected PET image; FUSED = fused CT and PET images; NAC = nonattenuation-corrected PET image.

rheumatoid arthritis. The SUV appeared to correlate with power Doppler signal and clinical parameters (*25*).

DSD is very common in the age group of patients who undergo ^{18}F-FDG PET scans for cancer and our initial clinical experience using ^{18}F-FDG PET/CT has shown foci of ^{18}F-FDG uptake in the spine that appeared to clearly localize to radiographic findings of degenerative disease in the spine. To date, very little has been published with regard to the characteristics of spinal ^{18}F-FDG uptake in DSD evident on CT. The purpose of our study was to systematically determine whether our initial clinical impression that some foci of DSD were ^{18}F-FDG avid was substantiated in our patient population. Additionally, this study aimed to assess the relationship between the severity of findings on ^{18}F-FDG PET and CT in DSD. For this purpose, ^{18}F-FDG PET/CT scans of 150 patients referred for whole-body ^{18}F-FDG PET/CT for evaluation of known or suspected malignancy were reviewed and analyzed retrospectively for the presence of increased ^{18}F-FDG uptake in the spine and for the anatomic correlates of the ^{18}F-FDG uptake. Of the 150 patients studied, only 63 patients (42.0%) had no abnormal findings in the spine on ^{18}F-FDG PET (grade 0), whereas 87 patients (58.0%) were found to have abnormal spinal ^{18}F-FDG uptake of various degrees. Of the 33 patients who had abnormal spinal findings graded as probable or definite for DSD (grades 3 and 4), 11 patients had abnormal findings in the cervical spine, 16 patients had abnormal findings in the thoracic spine, and 23 patients had abnormal findings in the lumbosacral spine. Only 7 patients (4.7%) had ^{18}F-FDG PET/CT findings highly suggestive of spinal metastases. On the basis of these findings, it appears that abnormal spinal findings of varying severities are very common on ^{18}F-FDG PET and are commonly of benign etiologies, located most frequently in the lumbosacral spine.

In the second part of the study, CT images of all patients were reviewed blindly by a musculoskeletal radiologist and graded on a 4-point-scale (from 0 = normal to 3 = severe, for both degenerative disk and facet disease). ^{18}F-FDG PET grading was significantly higher in those patients with severe versus normal CT grading of degenerative disk disease or facet disease. There was significantly more intense

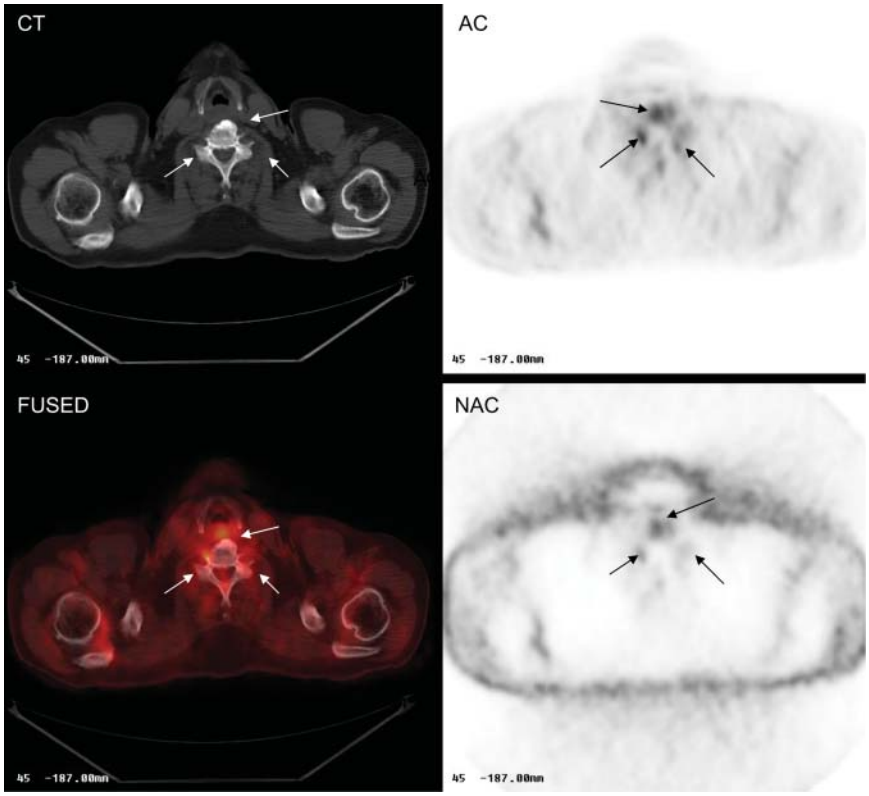

FIGURE 2. ^{18}F-FDG PET/CT images of cervical spine show abnormal ^{18}F-FDG uptake in region of disk and facet joint disease seen on CT (arrows). AC = attenuation-corrected PET image; FUSED = fused CT and PET images; NAC = nonattenuation-corrected PET image.

^{18}F-FDG uptake, on average, in patients with severe degenerative changes in comparison with those with minimal or no degenerative changes on CT. This relationship may be explained by the inflammatory process that accompanies some phases of DSD, seen on ^{18}F-FDG PET.

Though statistically significant, the relationship we have established between severity of CT findings and severity of ^{18}F-FDG uptake in the spine is weak. The substantial variability in ^{18}F-FDG intensity scores in patients with severe arthritic changes is likely reflective of varying degrees of severity of active inflammation in the imaged degenerative areas. Although ^{18}F-FDG uptake relates to the metabolic activity at one point in time, CT shows the end result of an ongoing process that evolves over many years. In patients who have severe findings on CT and only minimal or no ^{18}F-FDG uptake, it is possible that the inflammatory process that caused the severe findings on CT had subsided with time. On the other hand, in patients who have intense ^{18}F-FDG uptake in the setting of only minimal findings on CT, the opposite may be true. Therefore, as rheumatoid arthritis that waxes and wanes but with time results in anatomic malformations, the process of degenerative

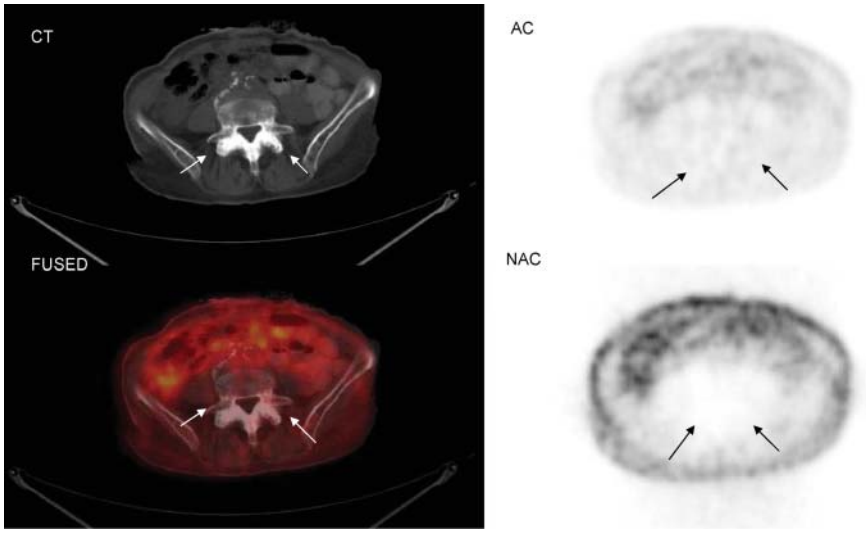

FIGURE 3. ^{18}F-FDG PET/CT images of the lumbosacral spine show no abnormal ^{18}F-FDG uptake in region of facet joint disease seen on CT (arrows). AC = attenuation-corrected PET image; FUSED = fused CT and PET images; NAC = nonattenuation-corrected PET image.

disease in the disk and facet joints should be viewed as a continuous process during which there is a variable degree of inflammation evident on ^{18}F-FDG PET, which over the years results in the abnormalities seen on anatomic imaging.

Several limitations exist in our study. We have no biopsy proof of inflammation in regions of suspected inflammatory changes. Other causes of increased glucose use, such as proliferative processes, may be contributory as well. Additionally, the CT images reviewed were of lower *z*-axis resolution and lower diagnostic quality in comparison with thin-slice diagnostic bone CT. Furthermore, MRI is superior to CT in being able to detect bone marrow edema seen with inflammatory changes and was not evaluated in this study. Our study could also be strengthened by longer-term follow-up to determine the stability and significance of these findings. We did not calculate SUVs as the lesions varied substantially in size and shape; thus, it is not clear what would represent the proper partial-volume correction.

Our study clearly demonstrates that foci of ^{18}F-FDG uptake can occur in foci of DSD evident on CT in the absence of obvious systemic metastases. The ^{18}F-FDG uptake in such spinal foci, while variable, can be intense and is likely related to the severity of the degenerative process. Such foci of increased ^{18}F-FDG uptake should not be confused with active skeletal metastases.

CONCLUSION

Incidental findings on ^{18}F-FDG PET of increased tracer accumulation associated with DSD are common in the population of patients referred for clinical ^{18}F-FDG PET. In this study, 22% of the patients referred for whole-body ^{18}F-FDG PET/CT had findings on ^{18}F-FDG PET most likely to be caused by inflammatory DSD, most commonly in the lumbosacral spine. ^{18}F-FDG PET grading of DSD was related to the CT grading for DSD. The findings of moderate-to-intense ^{18}F-FDG uptake in foci of degenerative changes in the spine should not be confused with metastatic tumor and can clearly be recognized from the CT portion of PET/CT.

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