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Original Article

재발 난소암의 진단에서의 ^{18}F-fluorodeoxyglucose PET/CT의 유용성: Enhanced CT와 Tumor Marker CA 125와의 비교

가톨릭 대학교 영상의학과학교실
오주현 · 유이령 · 최우희 · 이원형 · 김성훈 · 정수교

Role of ^{18}F-fluorodeoxyglucose PET/CT in Recurrent Ovary Cancer

Joo Hyun O, M.D., Ie Ryung Yoo, M.D., Woo Hee Choi, M.D., Won Hyoung Lee, M.D., Sung Hoon Kim, M.D., PhD. and Soo Kyo Chung, M.D., PhD.
Department of Radiology, The Catholic University of Korea, Seoul, Korea

Purpose: To date, anatomical imaging modalities of the pelvis and tumor markers have been the mainstay of surveillance for recurrent ovary cancer. This study aimed to assess the role of ^{18}F-FDG PET/CT in evaluation of ovary cancer recurrences, especially in comparison with enhanced CT and tumor marker CA 125. **Materials and methods:** 73 patients who had PET/CT scan for restaging of confirmed ovary cancer, and additional imaging with enhanced CT of the pelvis within one month were included. CA 125 level was available in all patients. From the PET/CT images, maximum standard uptake values (SUVmax) of suspected recurrence sites were recorded. Confirmation was available through re-operation or biopsy in 26 cases, and clinical assessment with series of follow-up images in 47. **Results:** PET/CT had 93% sensitivity and 88% specificity for detecting recurrent ovary cancer. Enhanced CT of pelvis had sensitivity and specificity of 83% and 88%, and CA 125 50% and 95%. **Conclusion:** PET/CT has higher sensitivity for detecting recurrent ovary cancer compared to enhanced CT though the differences were not significant. PET/CT has significantly higher sensitivity than CA 125. However, the three tests all agreed in only 43% of the recurrence cases, and recurrence should be suspected when any of the tests, especially PET/CT, show positive findings. (Nucl Med Mol Imaging 2008;42(3):209-217)

Key Words: ^{18}F-FDG, PET/CT, ovary cancer, recurrence

INTRODUCTION

Despite great improvements in therapy of ovarian carcinoma over the past decades, unfortunately ovarian cancer still remains one of the leading causes of death from gynecologic cancers. And recurrence is positive in majority of advanced ovarian cancer patients.[1] Up to 50% of patients who have negative findings on their second look operation develop recurrent tumor.[2] In clinical setting, gynecologists will perform a number of tests in patients who received operation and/or chemotherapy for ovary cancer, scrutinizing for signs of early tumor recurrence. Enhanced CT and MRI of the pelvis is at present the most commonly used modality in patients with suspected recurrent ovarian cancer.[3,4] However, ovarian cancer characteristically sheds from tumor surface and disseminates throughout the intraperitoneum. In imaging studies, small local recurrences and metastases on the visceral surface are difficult to detect along the extensively large surface area of peritoneum, omentum, mesentery, and bowel serosa.[5]

^{18}F-fluorodeoxyglucose (FDG) positron emission tomography (PET) is known to have higher contrast between tumor and background than CT and MRI.[4] In many ovarian cancer cases, PET can detect recurrent foci missed

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• Address for reprints: Ie Ryung Yoo, M.D., Department of Radiology, Kangnam St. Mary's Hospital, 505 Banpo-dong, Seocho-gu, Seoul 137-701, Korea
Tel: 82-2-590-1752, Fax: 82-2-593-2992
E-mail: iryoo@catholic.ac.kr

Table 1. Initial Histologic Types of Ovarian Tumors Included in the Study

Surface epithelial-stromal tumors	61
Serous cystadenocarcinoma	44
Mucinous tumor, malignant	6
Endometrioid tumor, malignant	4
Clear cell tumor, malignant	6
Malignant Brenner tumor	1
Sex cord-stromal tumors	5
Granulosa cell tumors	3
Malignant thecoma	2
Germ cell tumors	4
Immature teratoma	2
Dysgerminoma	1
Yolk sac tumor (endodermal sinus tumor)	1
Malignant neuroectodermal tumor	3

by conventional imaging modalities, and also help the physician distinguish post-operative scars from recurrent lesions.[6] However, PET can give false negative results for lesions less than 1 cm in size, or give false positive results for inflammatory lesions.[4] Previous reports have demonstrated widely varying accuracy of FDG PET, with sensitivity ranging from 45% to 100% and specificity 46% to 100%.[3,7-9]

Enhanced CT of the pelvis is one of the most commonly used diagnostic technique, but has its limitations as well. Small lesions can be missed, and even when a small lesion is detected, the finding may be inconclusive and recurrent tumor cannot be diagnosed with confidence.[3,10]

Serum tumor marker carcinoembryonic antigen (CA) 125 is a high-molecular-mass glycoprotein that contains 24% carbohydrate and is physiologically expressed in fetal coelomic epithelium, by epithelial ovarian tumors, and normal or pathologic tissues of müllerian duct origin.[11] CA 125 is considered to be the most reliable serum marker for follow-up of patients with histologically proven ovarian carcinoma.[12] Many oncologists believe CA 125 level agrees with disease activity and depend on CA 125 level for making therapeutic decisions.[13] Elevated CA 125 level during follow-up is strongly suggestive of recurrent tumor. On the other hand, a negative CA 125 does not exclude recurrent tumor.[14] In addition, past studies have demonstrated that benign pelvic masses can cause CA 125 levels to rise to concentrations greater than 65 U/mL.[15] And even when the CA 125 level is elevated, the numeric value provides no information regarding the site of recurrence.

Standard surveillance guideline in ovarian cancer patients are few in number, with no set consensus on the type of imaging test to perform or timing of the test. The purpose of this study was to find out the role of ^{18}F-FDG PET/CT in evaluation of ovary cancer recurrences, especially in comparison with anatomical imaging modality enhanced CT and tumor marker CA 125.

MATERIALS AND METHODS

Patient population and study design

The population of this retrospective study consisted of 73 female patients (age: 48.0 years, range 8 to 81 years) with proven underlying ovary malignancy who had whole-body PET/CT with ^{18}F-FDG for restaging from November 2003 to March 2006. All patients had operation and then completed initial chemotherapy. Regardless of the type or number of operations and type of chemotherapy regimen and number of chemotherapy cycles, patients who had PET/CT scan for (1) surveillance for recurrence, or (2) further evaluation after results of another imaging study or tumor marker were positive or equivocal were included. The patient's stages were widely spread out: 6 stage Ia patients, 7 stage Ic, 2 stage IIa, 1 IIb, 5 IIc, 1 IIIa, 1 IIIb, 40 IIIc, and 10 stage IV patients. The most common primary cell type of the cases included in the study was surface epithelial-stromal tumors, and germ cell tumors and sex cord-stromal tumors were also included (Table 1). The period from initial diagnosis to PET/CT scan varied greatly with a range from 4 months to 14 years and 6 months. All patients had enhanced CT performed within 4 weeks from the PET/CT scans. Tumor maker CA 125 was tested in all patients. Cases with histologic confirmation or clinical follow-up of 1 year or longer were included.

The ethical committee of our institution does not require patient consent for retrospective review of imaging studies.

Imaging

All patients fasted at least six hours before the PET/CT study. An average amount of 444 MBq was injected intravenously, and scanning began 60 minutes later. None of the patients had blood glucose levels exceeding 130

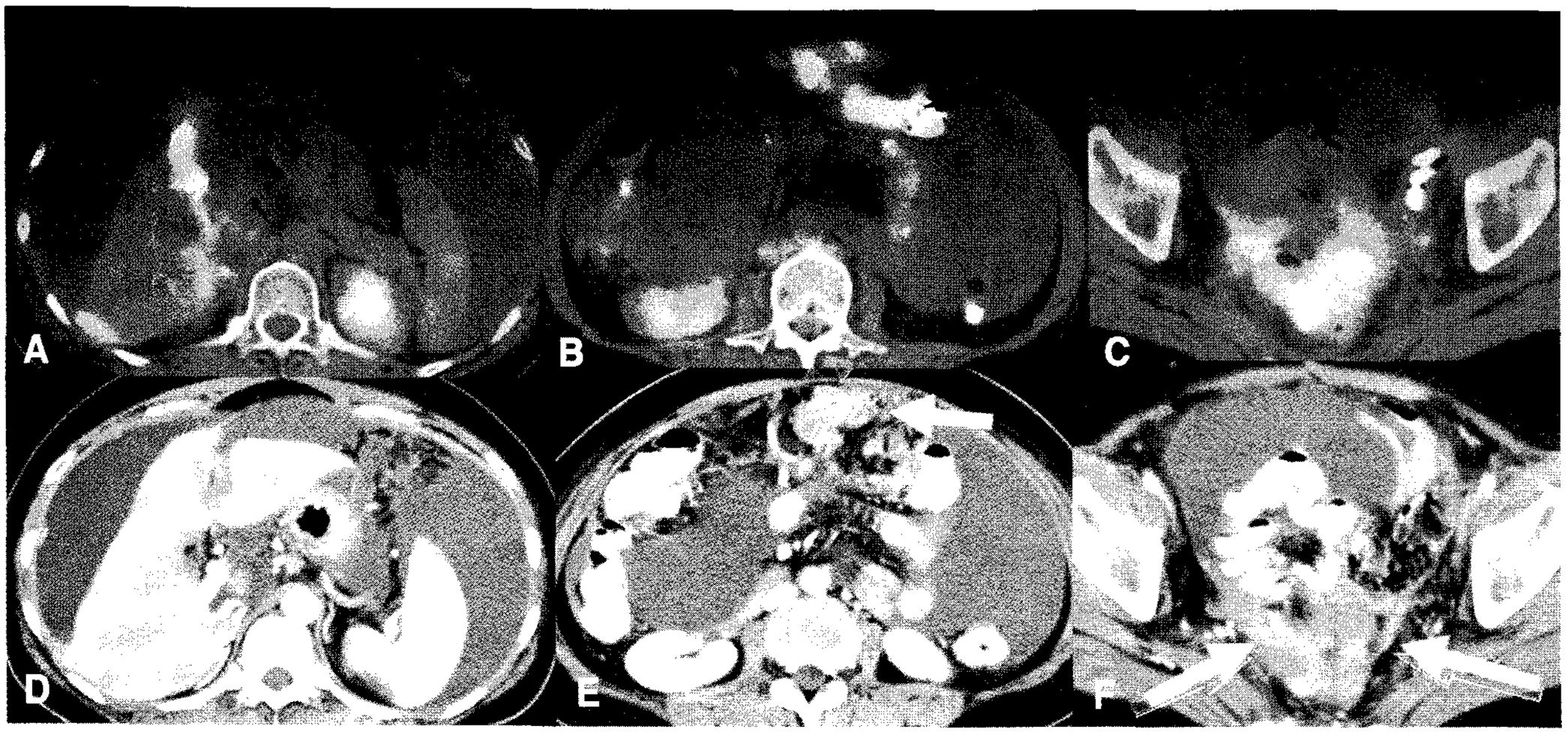

Figure 1. A 53 year old female patient received operation 14 months ago and chemotherapy until 8 months ago for serous cystadenocarcinoma. Fusion images of follow-up PET/CT (A, B, C) show prominent peripheral curvilinear FDG activity along perihepatic area, intense plaque like FDG uptake around the falciform ligament, right paracolic gutter, omentum, mesentery, and pelvic cavity. Enhanced CT (D, E, F) demonstrate findings consistent with carcinomatosis peritonei: massive ascites, irregular shaped soft tissue lesion is seen in greater omentum (arrow), and pelvic cavity lesion encasing sigmoid colon and adjacent small bowel loops (arrows). Tumor marker CA 125 titer was elevated to 1087.60 IU/mL. Ascites fluid cytology was positive for malignant cells and confirmed recurrence.

mg/dL before the injection. No intravenous contrast agent was used. A combined PET/CT in-line system (Biograph LSO; Siemens Medical Solutions, Knoxville, TN) was used to acquire all data. Full-ring PET scanner integrated with a dual-section helical CT scanner (Somatom Emotion; Siemens) acquired the co-registration of PET and CT images in one session. There were six to eight bed positions and the acquisition time was two minutes per bed position. All patients were in supine position with their arms raised. CT scanning began at orbitomeatal line and progressed to the upper thigh (30 mAs; 130 kV; slice thickness 5 mm). PET imaging followed immediately over the same body region from upper thigh and progressed caudally. The CT data were used for attenuation correction, and images were reconstructed using standard ordered subset expectation maximization (OSEM) algorithm. The axial spatial resolution was 6.5 mm at the center of the field of view. When necessary to differentiate bowel activity, two to three beds of delay images were additionally acquired from the abdomen or pelvis.

Interpretation

All PET/CT images were reviewed at a workstation with fusion software (Syngo; Siemens) that provided multiplanar reformatted images and displayed PET images either before or after attenuation correction, CT images, and PET/CT fusion images. Two nuclear medicine physicians reviewed the PET/CT images. Lesions with moderately to markedly greater FDG uptake on visual assessment compared to the background activity were considered positive for recurrent tumor. Lesions with mild but discrete uptake pattern were also considered positive for recurrence. Physiologic uptake areas in the bowel or urinary tract were excluded. The locations of the positive lesions were grouped as follows: (i) local recurrence of the stump, (ii) peritoneal seeding, (iii) lymph node metastasis, or (iv) distant metastasis. Semi-quantitative analysis by measuring the maximum standard uptake value (SUVmax) was also performed. From the CT images, solid mass around the stump, peritoneal implants and ascites, enlarged lymph nodes and distant metastases were noted. CA 125 greater than 35 U/mL was considered abnormal.

The final diagnosis was verified by two methods. First, biopsy or re-operation yielded tissue histology in 26 patients. Second, series of consequent imaging studies were obtained during clinical follow-up period of 1 year or longer.

Table 2. Patient Based Accuracies of PET/CT, enhanced CT of pelvis, and CA 125

	Sensitivity	Specificity	PPV	NPV	Accuracy
PET/CT	93.3%	88.4%	84.9%	95.0%	90.4%
Enhanced CT	83.3%	88.4%	83.3%	88.4%	86.3%
CA 125	50.0%	95.2%	88.2%	72.7%	76.4%

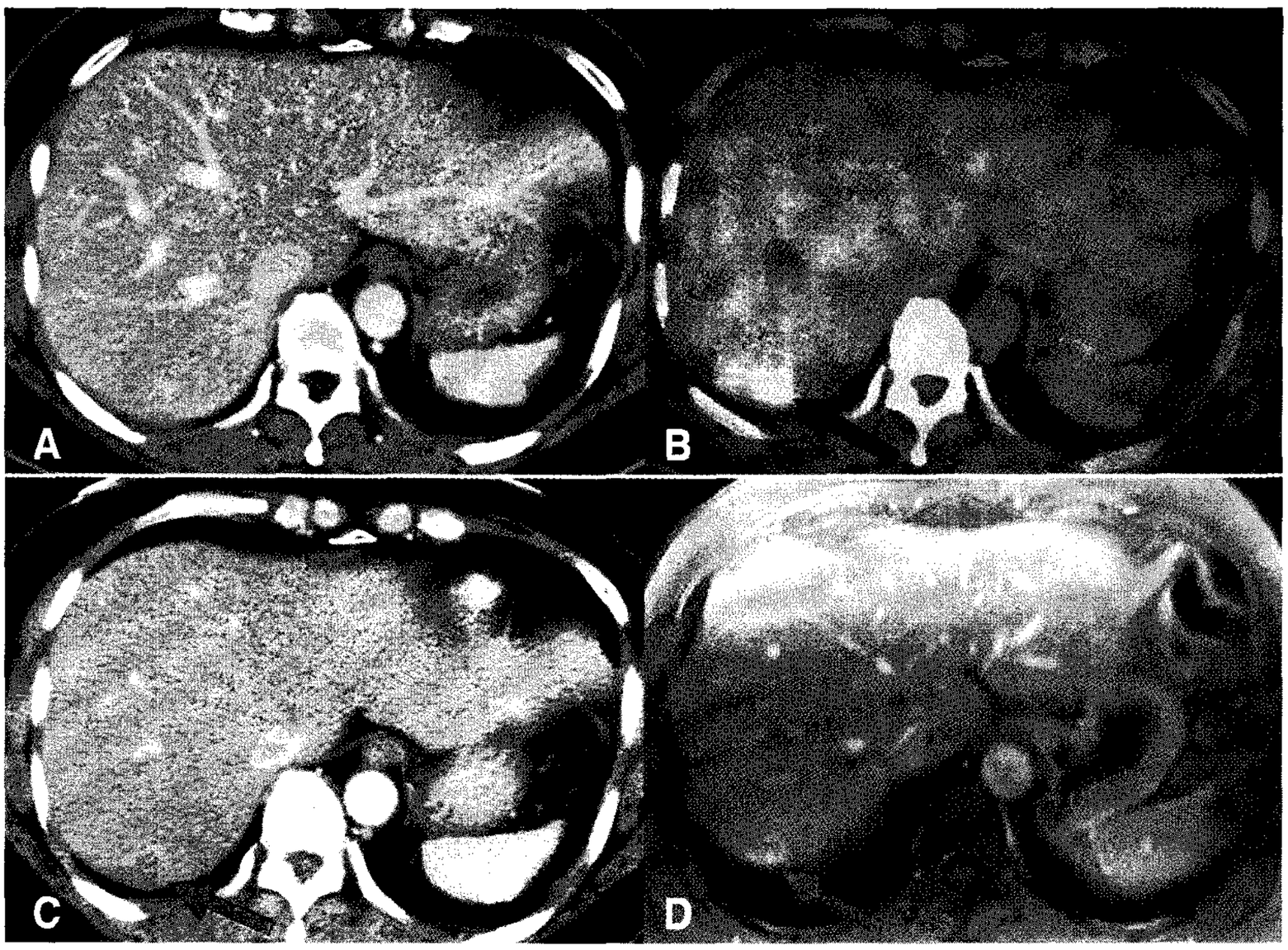

Figure 2. A 52 year old patient received operation and chemotherapy for papillary serous cystadenocarcinoma of the ovaries. Enhanced CT exam done 16 months after the termination of chemotherapy (A) shows no perceptible abnormality, and CA 125 level was normal at 18.13 IU/mL. However, PET/CT exam performed 3 weeks later (B, arrow) demonstrates focal FDG uptake in posterior margin of segment 7 of the liver. On follow-up CT exam done 3 months later (C, arrow), about 2.1 cm sized hypodense nodule is seen in the same area of right hepatic lobe. MRI exam 4 months after the PET/CT (D, arrow) also shows enhancing nodule, and CA 125 was elevated at 90.69 IU/mL.

Statistical analysis

Statistical analysis was carried out using the statistical package for social sciences (SPSS) software (version 13.0). Mann Whitney test was used to compare the differences between the conclusively recurrence free group and ovarian cancer recurrent group. (P value of less than 0.05 was considered significant).

RESULTS

Of the 73 patients included in the study, thirty (41%) of the cases were positive for ovarian cancer recurrence: 23 cases were histologically confirmed as recurrent tumor after surgery, and 7 cases by the results of series of enhanced pelvis CT, MRI, or PET/CT studies. PET/CT, enhanced CT, and CA 125 were all positive in 13 of the 30 recurrence positive cases (43%) (Figure 1), and all were negative in 34 cases out of 43 true negative cases (79%). PET/CT detected local recurrence of the stump in 3 cases (true positive in all 3), peritoneal seeding in 22 cases (true positive in 20), lymph node metastases in 16 cases (true positive in 12), and distant metastases to the lungs in 4 cases (true positive in all 4 cases).

Of the 30 recurrence positive cases, PET/CT correctly identified 28 cases, yielding a sensitivity of 93.3% (Table 2). Of the 43 recurrence free cases, PET/CT findings were negative in 38 cases, giving a specificity of 88.4%. The positive predictive value was 84.9%, negative predictive

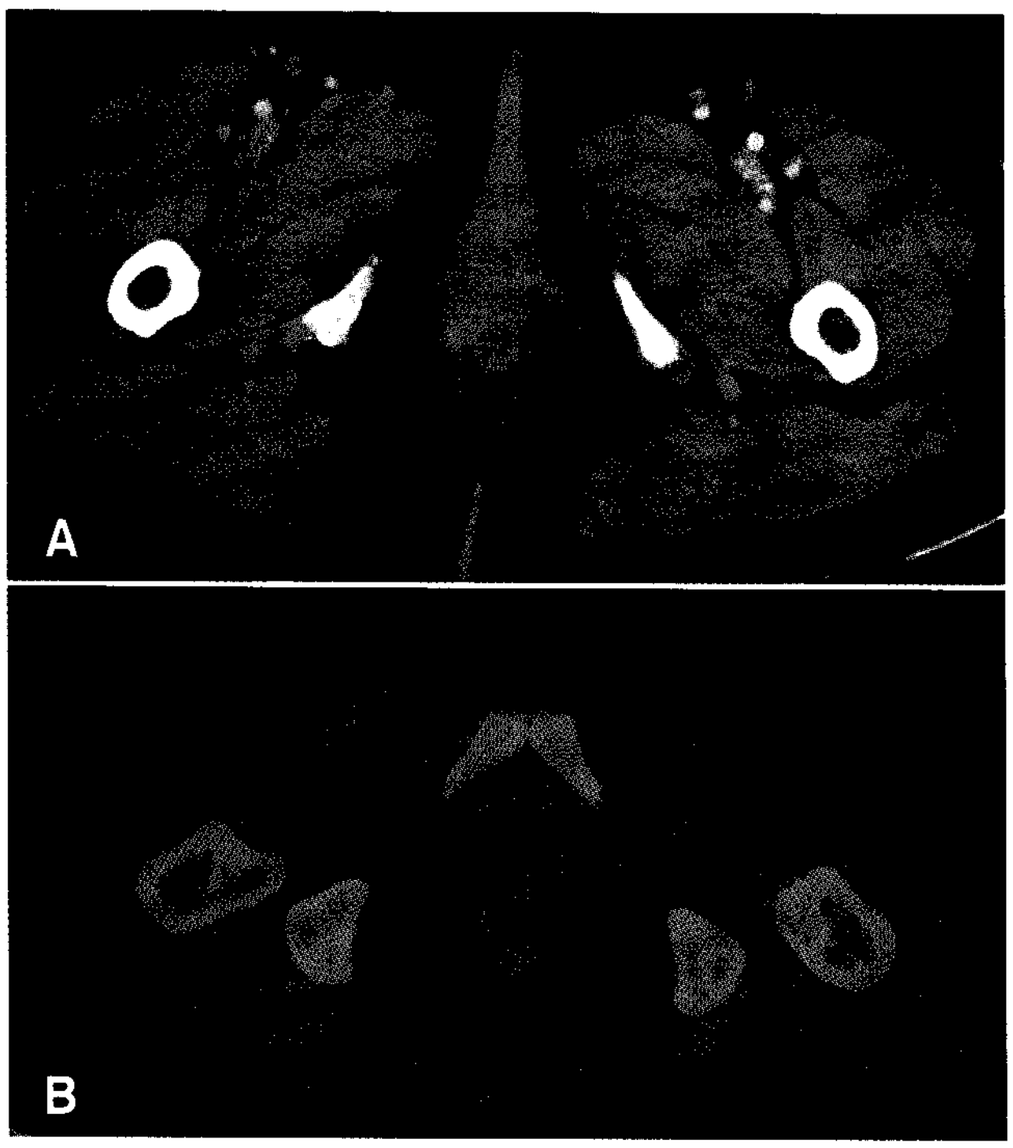

Figure 3. This 56 year old patient received second look operation and chemotherapy for metastatic serous adenocarcinoma. Follow-up CA 125 level was normal 1.83 IU/mL, but enhanced CT image (A, arrow) shows focally enhancing lesion in right perineum, and in the fusion image of PET/CT image (B) focal FDG uptake is also perceptible in the same area (arrow). Biopsy confirmed the lesion to be benign perivascular mononuclear cell infiltration.

value 95.0%, and overall accuracy 90.4%.

Of the total 73 patients, focal FDG abnormality was imperceptible in 22 cases. For the 51 cases with perceptibly increased FDG uptake in the peritoneal cavity, excluding focal physiologic activity, PET/CT images were interpreted as recurrent tumor in 33 cases and PET/CT findings were considered recurrence free in 18 cases. There were 4 false positive and 2 false negative PET /CT cases. Statistically meaningful difference ($p<0.001$) was seen in the mean SUVmax of the FDG-avid benign lesions (PET/CT false positive lesions) (2.6±1.11) and mean SUVmax of the recurrent sites (PET/CT true positive lesions) (4.7±1.97). The false positive cases demonstrated increased FDG uptake in the reactive benign lymph nodes of the iliac chain, inguinal region, and inhomogeneous physiologic activity in periphery of liver. The SUVmax of the false positive cases were 2.1 in the iliac chains, 1.8 in the inguinal regions, and 2.2 in the perihepatic area.

The sensitivity, specificity, and accuracy of enhanced CT were 83.3%, 88.4%, and 86.3%, respectively. CT showed 5 false positive and 5 false negative findings. PET/CT correctly identified recurrence in 4 cases that enhanced CT missed (Figure 2), and CT detected 1 recurrence case that PET/CT missed. PET/CT and CT were all false positive in 1 case.

Tumor marker CA 125 yielded sensitivity of 50.0%, specificity of 95.2%, and overall accuracy of 76.4%. No difference was noted in the mean CA 125 titer of recurrence free group and recurrence positive group (125.8±768 versus 201.2±329.7, p=0.615). There were only 2 false negative PET/CT cases, but 15 false negative CA 125 cases; and 5 false positive PET/CT cases (Figure 3) and 3 false positive CA 125 cases. PET/CT was correct in 13 cases that CA 125 missed (Figure 4), but there was no case where CA 125 was abnormally increased while PET/CT finding was negative. The cell types of the CA 125 false negative cases were various, and included mucinous adenocarcinoma, endodermal sinus tumor, serous papillary adenocarcinoma, endometrial adenocarcinoma, malignant thecoma, clear cell carcinoma, granulosa cell tumor, and neuroendocrine cell carcinoma.

DISCUSSION

Though a leading cause of death among women with gynecological cancer, ideal follow-up method after primary therapy is unclear according to the National Institute of Health Consensus Development Conference Statement.[14] In clinical practice, in addition to complete history, physical, rectovaginal pelvic exam, and tumor marker CA 125 titer, enhanced CT or MRI are used to detect recurrence. Recently, PET/CT scans are performed as follow-up study more frequently and many gynecologic oncologists will order tumor maker titer, enhanced CT, and PET/CT scans together. However, when the various test results show discrepancy, the physician falls into diagnostic dilemma. Some physicians may put greater weight on the results of tumor marker compared to imaging tests when imaging test findings are equivocal. Under such perplexing circumstances, PET/CT images could provide additional information and guide clinical decisions. We wanted to review our institution's cases and find out the accuracy of

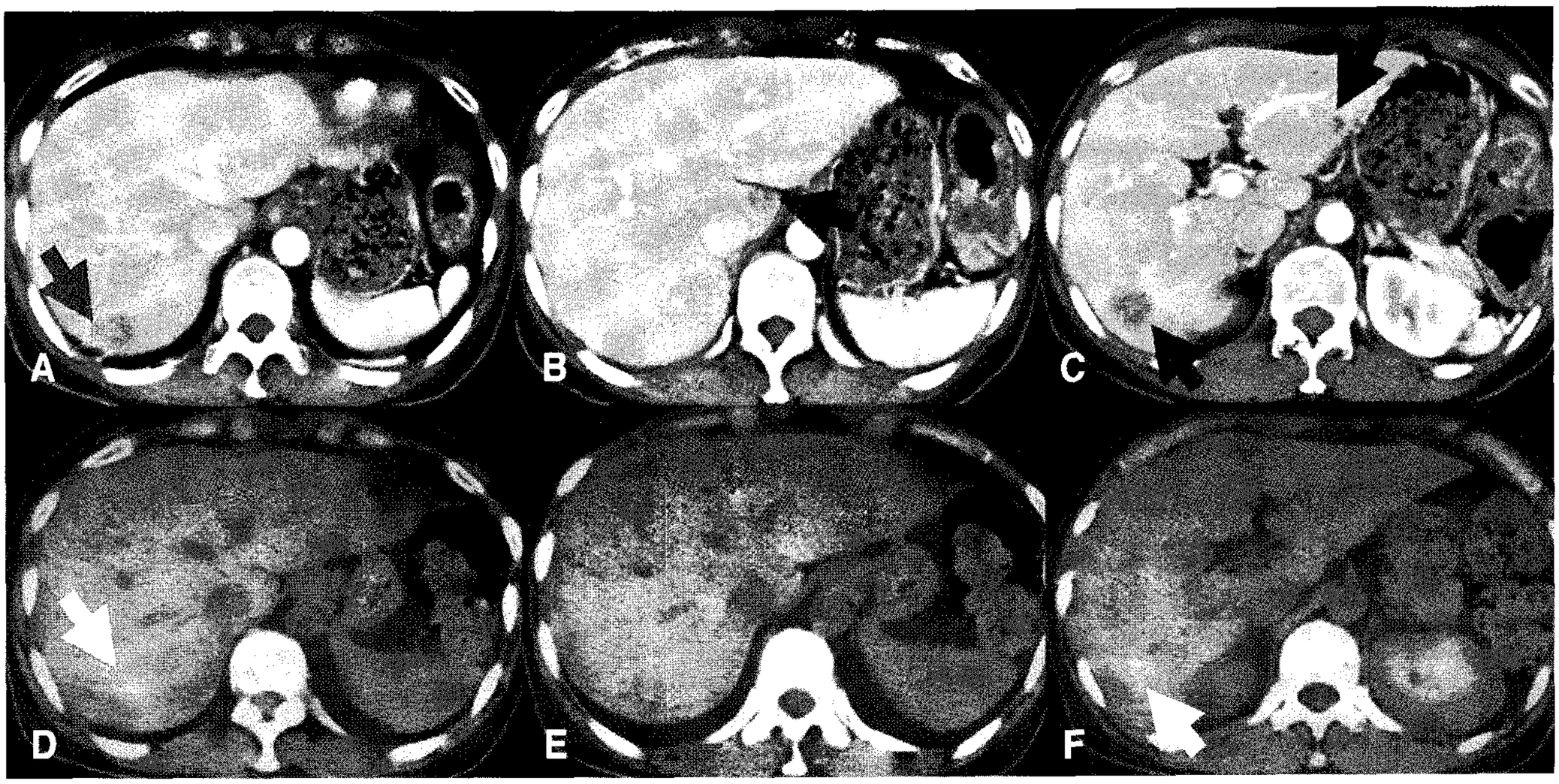

Figure 4. CT images (A, B, C) of this 53 year old patient with adenocarcinoma of ovary who received extensive surgery and chemotherapy until 4 months ago show low density lesions in both hepatic lobes and caudate lobe, suggesting multiple liver metastasis (arrows). PET/CT (D, E, F) demonstrates focal FDG uptake (SUVmax 3.6) in right hepatic lobe (arrows). However, the patient's tumor marker CA 125 titer remained low at 3.71 IU/mL. Re-operation confirmed metastatic endometrioid adenocarcinoma.

PET/CT the functional imaging test especially in comparison with enhanced CT the anatomic imaging modality and tumor maker CA 125 titer, and determine the possible role of PET/CT in management of recurrent ovarian cancer.

^{18}F-FDG PET is a molecular imaging technique that takes advantage of altered glucose uptake and glycolysis of malignant cells. Many tumor cells use glucose as energy source, and have increased expression of glucose transporter and hexokinase activity. Fluorodeoxyglucose (FDG) is a glucose analog, but while phosphorylated glucose is further metabolized, phosphorylated FDG is not quickly metabolized and remain essentially trapped within the cell.[16] ^{18}F-FDG PET is known to have a high contrast between tumor and background, and thus a high diagnostic accuracy. PET can detect tumor sites as well as quantitatively monitor metabolic changes in tumors that are undergoing therapy.[17] However, small tumor size, below the approximate 1 cm spatial resolution of PET can lead to false negative results.[18] Reports have shown very varying results for FDG PET in detecting recurrent ovarian cancer. Cho et al[3] reported low sensitivity of 45% and high specificity of 100%, and Torizuka et al showed low sensitivity of 55%, while Yen et al reported low specificity of 46% for detecting recurrent ovarian cancer.[8,9]. Bristow on the other hand demonstrated moderate sensitivity of 83%, positive predictive value of 94%, and overall accuracy of 82%.[19] The variations in the accuracy of the different reports may be due to a number of elements: presence or absence of co-registered CT images, differences in the size of tumor, tumor staging, or percentage of tumors with low FDG-avidity such as mucinous adenocarcinoma.

In a study comparing FDG PET and other imaging modalities by Kubik-Huch and colleagues, FDG PET had a sensitivity of 100%, specificity of 50%, and accuracy of 90%, while the results for CT were 40%, 50%, and 43%, and for MRI 86%, 100% and 89%, respectively.[7] PET exam was the only technique that correctly identified seeding metastasis of transverse colon in Kubik-Huch's study.[7] A study by Kim et al compared the prognostic values of FDG PET with second-look laparotomy in advanced ovarian carcinoma patients after chemotherapy, and suggested that FDG PET can substitute second-look operation as there was no difference in disease-free and progression-free intervals between the PET group and

laparotomy group.[20] In our study, there was only one recurrence positive case that enhanced pelvis CT detected but PET/CT missed involving seeding metastasis of malignant thecoma in the posterior perihepatic region. The malignant thecoma lesion was less than 1 cm, and the small size may have lead to imperceptible FDG uptake. On the other hand, PET/CT detected recurrence in 4 patients that CT missed: 2 cases where CT reading suggested benign loculated fluid collection in perihepatic and anterior subphrenic spaces, 1 case where metastatic lymphadenopathy of inguinal region was missed, and another case of missed paraaortic lymph node metastases. The loculated fluid collection considered benign on CT images demonstrated focally increased FDG uptake with SUVmax of 2.6 on the PET/CT images. Size is the main criterion in making a decision regarding the malignancy potential of a lymph node in enhanced CT images, and size alone may not provide sufficient information. Our results show relatively high accuracy, possibly due to more precise anatomical localization made possible by the accompanying CT images. Other studies on combined PET/CT generally demonstrate good results. In a prospective study on recurrent ovarian cancer patients by Nanni et al, FDG PET/CT provided sensitivity of 88.2%, specificity 71.4%, and accuracy 85.4%, while Chung et al's study results were higher at 93.3%, 96.9%, and 94.8%, respectively.[21,22] In addition, treatment plan was altered in 24.7% of patients in Chung's study.[22] PET/CT helped to avoid operation by detecting additional disease in unresectable sites in 18% of patients in another study.[23] Sironi et al evaluated the results of FDG PET/CT and histologic findings from second look operation, lesion by lesion and showed relatively lower overall sensitivity, specificity, and accuracy of 78%, 75% and 77% for PET/CT. [24] In our study, 3 cases of reactive lymphadenopathy in iliac chain and inguinal region, and 1 case of inhomogeneous uptake in the liver were misinterpreted as recurrent tumors on PET/CT images. Presence of reactive lymph node hyperplasia is an important cause of false positive PET results. In a study by Roh et al, PET demonstrated low positive predictive value of 56% for paraaortic and pelvic lymph node staging in uterine cervical cancer, and reactive lymphadenopathy was responsible for all of the false-positive lymph nodes.[25] And Chang et al suggest complementing other imaging modalities for diseases located near physiologic uptake site such as liver, kidney, and bladder.[26] FDG uptake in the ureters and bladder can also imitate metastases in PET images.[27] Therefore, when equivocal PET findings are suspected in lymph nodes or near physiologic uptake, correlation should be made with the CT portion of the PET/CT scan, and also with other imaging modalities.

For ovarian cancer, CT is currently recommended as the imaging modality of choice.[28] However, CT is unable to detect small peritoneal and mesenteric implants.[29] Furthermore, detection of peritoneal implants depends on variables such as location, surrounding ascites, and implant size. In a study by De Rosa et al, sensitivity of only 47% and specificity of 87% was reported for CT obtained before second look surgery.[30] MRI is suggested as a valuable clinical tool with 91% sensitivity and 87% specificity.[10] However, the value of MRI has been partially limited due to long acquisition times compared to the CT scans.[17] MRI is performed only in selected cases of ovarian cancer follow-up and not routinely done, so we did not included MRI in our study.

Patients are customarily followed up with serial measurements of serum CA 125 levels, as the value is reported to be a good reflector of response to chemotherapy. However, normal CA 125 level does not exclude the presence of recurrent tumor, and CA 125 has a low negative predictive value of 38%.[31] Higher specificity (95%) and positive predictive value (88%), and relatively low sensitivity (50%) and negative predictive value (73%) of CA 125 were seen in our study. The low sensitivity of CA 125 in this study may be explained by the fact that the CA 125 titer was obtained from a single blood test, instead of a serial study. Age was not incorporated in the interpretation either. In addition, 20% of the women with ovarian cancer are known to never have elevated CA 125.[32] Furthermore, since CA 125 is secreted from surface epithelial cells, the wide variety of primary tumor cell types included in this study may have contributed to lowering the sensitivity. When the PET/CT finding and CA 125 titer result were discordant, PET/CT result was correct in all our cases. Therefore, it would be sensible to perform further tests in patients with elevated CA 125 markers, but

the physician should be cautious before assuming recurrence-free state based on low CA 125 titer alone. Sometimes, the referring physician may doubt the results of PET/CT scan when the tumor marker is stable, patient shows no signs or symptoms of recurrence and enhanced CT findings are negative. However, results of this study suggest that it would be imprudent to put more emphasis on the normal results of tumor marker, patient's good general condition, and normal enhanced CT findings than the positive results of PET/CT scan. Though PET/CT may show false positive findings due to various causes, the physician should always keep in mind that positive PET/CT findings warrant further evaluation even in the setting of normal enhanced CT images and CA 125 titer.

When tumor marker titer and enhanced CT findings are discordant, PET/CT findings were of value in making clinical decisions. In our study, PET/CT correctly identified recurrence in 4 cases that CT did not detect or misinterpreted. PET/CT has the additional advantage of enabling evaluation of distant locations. Our findings suggest that FDG PET/CT has higher accuracy compared to tumor marker CA 125 and enhanced CT. Therefore, we believe PET/CT could be a useful tool to the physician and benefit the patient in follow-up of ovarian cancer.

A limitation of our study is that not all patients in the study population received histologic confirmation, and the conclusions made based on clinical and follow-up images cannot substitute gold standard. Further study with greater number of patients and pathologic correlation is necessary.

CONCLUSION

^{18}F-FDG PET/CT has higher sensitivity and similar specificity compared to enhanced CT though the differences were not statistically meaningful, and significantly higher sensitivity than tumor marker CA 125 in detection of recurrent ovary cancer. PET/CT, enhanced CT, and CA 125 were all positive in only 43% of the recurrence positive cases, so the clinician should have a high degree of suspicion for recurrence when any of the tests, especially PET/CT exam, demonstrate positive findings.

요 약

목적: 현재까지 난소암의 재발을 평가하는데 해부학적 영상 검사와 tumor marker들이 주를 이루고 있다. 저자들은 재발 난소암의 진단에서 CT, 그리고 tumor marker CA 125와 비교하여 ^{18}F-FDG PET/CT의 유용성을 알아보고자 하였다. **대상 및 방법:** 조직학적으로 확진 된 난소암 환자 중 재발 평가를 위하여 PET/CT를 시행하고 한달 이내로 pelvis CT 검사를 시행한 환자 73명을 대상으로 하였다. Tumor marker CA 125은 모두에서 측정하였다. PET/CT 영상에서 의심 되는 부위의 maximum SUV를 기록하였다. 26명은 수술 또는 생검을 통해 확진되었고, 나머지 47명은 임상 소견과 추적 영상 검사를 통하여 진단하였다. **결과:** 난소암의 재발을 진단하는데 PET/CT의 예민도는 93%였고, 특이도는 88%였다. Enhanced CT 의 예민도는 83%, 특이도는 88%였다. Tumor marker CA 125의 예민도와 특이도는 각각 50%와 95%였다. **결론:** 재발 난소암의 진단에서 FDG PET/CT의 예민도가 CT보다 좋았으나 통계학적으로 의미있는 차이는 아니였고, 특이도는 PET/CT 와 CT가 비슷하였다. Tumor marker CA 125보다는 PET/CT의 예민도가 월등히 높았다. 하지만 재발 환자에서 위의 세 검사의 일치도는 43%로 낮은 편으로, 난소암 환자의 경과 관찰 중, 특히 PET/CT 영상에서, 양성 소견이 보이면 재발의 가능성이 높다.

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