F-18 FDG PET Images of the Cervix at Various Time Points after the Loop Electrosurgical Excision Procedure

Shin Young Jeong · Jung-Joon Min

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Abstract F-18 FDG PET is useful for monitoring residual or recurrent tumors after surgical resection. We describe five F-18 FDG PET images of three patients who had cervical carcinoma and then underwent a loop electrosurgical excision procedure (LEEP). Two of the images were taken within 15 days and three at least 2 months after LEEP. The earlier F-18 FDG PET images revealed linear hypermetabolic lesions in the cervix that were produced by inflammation. This was confirmed by pathological analysis. The later F-18 FDG PET images did not reveal any remarkable hypermetabolism in the cervix without any treatment. These observations suggest that, to determine the response to LEEP therapy, F-18 FDG PET should not be performed within 15 days of the procedure.

Keywords Loop electrosurgical excision procedure · Cervical carcinoma · F-18 FDG PET

Introduction

The loop electrosurgical excision procedure (LEEP) is one of the methods used to treat cervical intraepithelial

neoplasia [1]. Although recurrence rates after LEEP are low (10–15%) and progression to invasion is rare (less than 2% in most series), lifelong surveillance of these patients must be maintained [1]. HPV typing, cervical cytology, colposcopy, and endocervical curettage have been used to check for local recurrence after LEEP. Pelvic CT scans and MR imaging have also been used to identify metastasis in regional lymph nodes or distant metastases [2]. At present, F-18 FDG PET of cervical cancer patients is increasingly being used to assess cervical cancer patients. Several investigators have shown that it is useful for the initial staging of cervical cancer patients [3–6]. Several reports have also revealed that the maximum levels of FDG uptake reflect tumor aggressiveness and are negatively associated with survival [3, 7–9]. In addition, some reports have shown that F-18 FDG PET is useful for the post-treatment evaluation of patients with cervical cancer [3, 10–12]. However, the typical features of F-18 FDG PET images of the cervix after surgical procedures such as LEEP and the time when these images should be taken have not yet been reported. We report here the typical features of F-18 FDG PET images of patients with cervical cancer that were taken either shortly after (10–15 days) or later (2–12 months) after LEEP.

S. Y. Jeong
Department of Nuclear Medicine,
Kyungpook National University Medical School,
Daegu, Republic of Korea

J.-J. Min
Department of Nuclear Medicine,
Chonnam National University Medical School,
Gwangju, Republic of Korea

J.-J. Min (✉)
Department of Nuclear Medicine,
Chonnam National University, Hwasun Hospital,
160 Ilsim-ri,
Hwasun, Jeonnam 519-809, Republic of Korea
e-mail: jjmin@jnu.ac.kr

Case Reports

Case 1

A 28-year-old female underwent gynecological evaluation due to abdominal distension. Severe dysplasia was found in the uterine cervix. For diagnosis, conization was performed. Microinvasive squamous carcinoma (T1a1) of the cervix was diagnosed. Since the patient was young and wanted to have children later, LEEP was performed to treat the cervical cancer. Fifteen days later, F-18 FDG PET scan

was performed to assess the presence of residual cervical cancer and metastasis. The scan revealed a linearly shaped hypermetabolic lesion along the posterior cervical wall (Fig. 1a, b). HPV typing, cervical cytology, colposcopy, and endocervical curettage were also performed to determine if residual cervical cancer was present. None detected residual cancer, but the cervical cytology revealed there were reactive cellular changes in the cervix that were associated with inflammation. Therefore, the hypermetabolic activity in the cervix revealed by the F-18 FDG PET scan was considered to be inflammation-associated false positive uptake. When another F-18 FDG PET scan was performed at 2 months after LEEP, abnormal F-18 FDG uptake that was suggestive of malignancy in the cervix was not observed (Fig. 1c, d). HPV typing, cervical cytology, colposcopy, and endocervical curettage performed 2 months

after LEEP also did not show any evidence of recurrence or residual malignancy.

Case 2

A 52-year-old female underwent cervical cytology during her annual cancer screening and a carcinoma in situ was found in the uterine cervix. A colposcopically directed punch biopsy was performed. The final diagnosis was carcinoma in situ of the cervix. LEEP was performed to treat the cervical cancer. A F-18 FDG PET scan was performed 10 days later to determine whether residual cervical cancer and metastasis were present. The scan revealed linearly shaped hypermetabolic uptake along the posterior cervical wall (Fig. 2a, b). HPV typing, cervical cytology, colposcopy, and endocervical curettage were also

Fig. 1 Sagittal (a) and coronal (b) F-18 FDG PET and PET/CT fusion images taken 15 days after LEEP showed a linearly shaped hypermetabolic lesion (arrow) on the posterior wall of the cervix

(mSUV 4.3). Although further treatment was not instituted, these hypermetabolic lesions were not detected on the sagittal (c) and coronal (d) images taken 2 months after LEEP

performed, but only reactive cellular changes in the cervix that were associated with inflammation were detected. Since the patient was very afraid of recurrence, a total hysterectomy was performed 1 month after LEEP. Pathological evaluation of the cervix and uterus showed inflammatory cell infiltration that was suggestive of cervicitis; residual malignant cells were not detected (Fig. 2c).

Case 3

A 34-year-old female underwent a gynecological evaluation due to vaginal bleeding. A colposcopically

directed punch biopsy was performed. The final diagnosis was carcinoma in situ of the cervix. LEEP was performed to treat the cervical cancer, and an F-18 FDG PET was performed 72 days later to determine whether there was residual cervical cancer. The scan did not detect any abnormal F-18 FDG uptake by the whole body, including the cervix (Fig. 3a, b). HPV typing, cervical cytology, colposcopy, and endocervical curettage also did not detect any evidence of malignancy. One year later, a second F-18 FDG PET was performed. Abnormal F-18-FDG uptake that was suggestive of malignancy in the cervix was not detected (Fig. 3c, d).

Fig. 2 Sagittal (a) and coronal (b) F-18 FDG PET and PET/CT fusion images taken 10 days after LEEP showed a linearly shaped hypermetabolic lesion (arrow) on the posterior wall of the cervix (mSUV 5.4). However, photomicrographs of the hematoxylin and

eosin-stained uterus and cervix removed by hysterectomy 1 month after LEEP (c and d) revealed only the presence of neutrophils infiltrating below the stratified squamous epithelium

Fig. 3 Sagittal (a) and coronal (b) F-18 FDG PET and PET/CT fusion taken 72 days after LEEP did not reveal remarkable FDG uptake in the cervix. Sagittal (c) and coronal (d) F-18 FDG PET and PET/CT fusion images taken 1 year after LEEP also showed no remarkable FDG uptake in the cervix

Discussion

F-18 FDG PET, which can measure the metabolic changes associated with tumors, has been used to assess the response of tumors to treatment. However, while F-18 FDG PET is increasingly being used to predict the therapeutic response, the optimum interval between completion of therapy and scanning remains unclear. This is an important issue because post-treatment F-18 FDG PET scanning can be complicated by several factors, particularly acute therapy-induced inflammatory changes in both the tumor and surrounding tissue. A recent study suggested that post-treatment F-18 FDG PET studies should be performed 2 weeks after the end of a particular chemotherapy and at least 6–8 weeks after radiation therapy [13]. However, when F-18 FDG PET scans should be performed after surgical procedures has not yet been addressed.

In two of our cases, F-18 FDG PET was performed 10 and 15 days after LEEP, respectively. In both cases, linearly shaped hypermetabolic lesions were detected in the coronal and sagittal images of the cervix. In both cases, this hypermetabolic uptake was found by cytology and surgical pathology to be due to reactive inflammatory changes associated with LEEP. The maximum standard uptake values (mSUV) of these hypermetabolic lesions were 4.3 and 5.4 g/mL. Thus, if a linearly shaped hypermetabolic lesion on the posterior wall of the cervix is found within 15 days after LEEP, it may be due to surgery-induced inflammatory changes that mimic the hypermetabolic uptake of residual or recurrent tumors. In contrast, when F-18 FDG PET studies were performed 2 months after

LEEP in one of our cases and 72 days and 1 year after LEEP in another case, none detected remarkable hypermetabolic lesions in the cervix. This suggests that by 2 months after LEEP, the inflammatory changes due to the surgical procedure have settled down and no longer result in remarkable F-18 FDG uptake. Thus, F-18 FDG PET is useful for assessing residual tumor or recurrence but should be performed at least 2 months after LEEP.

In conclusion, acute inflammation after LEEP appeared in F-18 FDG PET images as a linearly shaped hypermetabolic lesion. Thus, hypermetabolism of the cervix detected by F-18 FDG PET within 15 days after LEEP should be interpreted with caution. This in turn suggests that F-18 FDG PET should not be performed to determine the response to LEEP within 15 days after the procedure. However, given the small sample size of the current study, additional studies are needed to confirm these observations.

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