*Molecular Oncologic Imaging 2024;4(2):10-16* **ISSN: 2791-965X**

# Vulva Lesions as Characterized by F-18 Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography

Zehra Pınar Koç[1] Pınar Pelin Özcan[2] Tolgay Tuyan İlhan[3] Şevki Göksun Gökulu[4] Yasemin Yuyucu Karabulut[5]

**Corresponding Author*
*[1,2]Mersin University, Faculty of Medicine, Department of Nuclear Medicine, Mersin, Turkey*
*[3,4]Mersin University, Faculty of Medicine, Department of Gynecologic Oncology, Mersin, Turkey*
*[5]Mersin University, Faculty of Medicine, Department of Pathology, Mersin, Turkey*

**Abstract**

**Aim**: Vulva malignancy (primary or metastatic lesions) has significant FDG accumulation according to previous literature. The aim of this study is to analyze the metabolic imaging characteristics of apparently malignant vulva lesions determined by Fluorine-18 Fluorodeoxyglucose Positron Emission Tomography/Computed tomography (F-18 FDG PET-CT).

**Materials and Methods**: 27 female patients (mean: 56 years) with suspicious vulva lesions were retrospectively analyzed. The F-18 FDG PET- CT characteristics of the lesions, the first diagnosis of the patients and other metastatic sites were recorded and compared with pathology and or follow up and pelvic examination results.

**Results:** The SUVmax levels of the truly positive results (primary vulva lesions (n=4), metastatic lesions (n=5), local invasion (n=2), sarcoma (n=2), lymphoma (n=1)) were 19,35 and false positive results was 14,48. The accuracy of the F-18 FDG PET-CT in the estimation of the vulva lesions was 48%.

**Conclusion:** There are several false positive causes in the diagnosis of vulva lesions on F-18 FDG PET-CT and this issue should be considered but pelvic examination is necessary in case of increased metabolic activity in a vulva lesion.

***Keywords*****:** *vulva, malignancy, positron emission tomography, fluorodeoxyglucose.*

## Introduction

Although Fluorine-18 Fluorodeoxyglucose Positron Emission Tomography/Computed tomography (F-18 FDG PET-CT) is the method of choice in most of the oncological tumors the possible contribution of this modality in gynecological tumors is limited due to the several false positive causes. These reasons are related to the metabolic activity of the gynecological organs during menstrual phases. As well as frequent findings including follicule cysts and myoma of uteri which also accumulate FDG. The role of F-18 FDG PET-CT in vulva carcinoma

**Address for Correspondence:** Zehra Pınar Koç, Mersin University Training and Research Hospital, Clinic of Nuclear Medicine, Mersin, Turkey
**Phone:** + 90-324-2410000/22524 **E-mail:** zehrapinarkoc@gmail.com **ORCID ID:** https://orcid.org/0000-0002-3274-5790 **Received: 15.08.2024 Accepted: 04.09.2024 Published: 06.09.2024**

which is a rare malignant tumor (the rarest of the gynecological tumors) has been evaluated in limited number of case series have shown advantages in staging and prognostification [1, 2]. There are conflicting results about the advantage of F-18 FDG PET-CT compared to the morphological imaging modalities CT/MR (3). Additionally, there are several case reports about the unexpected findings lesions tumors of the vulva as shown by F-18 FDG PET-CT [4-7]. However, there are no previous series about the incidental vulva lesions in the literature. The aim of this study is to analyze the incidental vulva lesions as well as vulva carcinoma lesions with their metabolism and spreading characteristics.

**Materials and Methods:**

The F-18 FDG PET- CT characteristics of the lesions, the first diagnosis of the patients and other metastatic sites of the 27 female patients (mean: 56 years old) with suspicious vulva lesions were retrospectively analyzed. The imaging results were recorded and compared with pathology and/or follow up and pelvic examination results.

The informed consent of the patients was obtained before the imaging examination. The study was approved by local Ethics Committee.

The imaging was performed by intravenous administration of approximately 10 mCi (370 MBq) of 18-Fluorine Fluorodeoxyglucose after fasting for at least 4 hours in craniocaudal direction by PET-CT scanner (Siemens MCT 20) with low dose CT scan for attenuation correction.

The quantitative variables including the size and maximum standardized uptake value (SUVmax) from the most active part of the main lesions were compared by Student's T test. $P>0.05$ considered significant.

**Results**

The patients' first diagnoses were necessarily malignant (breast (n=5), other gynecologic tumors (n=6), lymphoma (n=5), vulva (n=4), colon (n=2), primary unknown (n=2), multiple myeloma, Ewing's sarcoma, pancreas. Among these patients 24 had additional metastatic site (lymph nodes, lung, liver, mesenteric and bone lesions).

The mean size of the vulva lesion in largest dimension was 15.5 mm and the mean SUVmax of these lesions was 16.5 (Figure 1).

Two patients died in the follow up period. The pathologic findings of the vulva lesions were obtained from 23 patients which were inflammatory or infectious lesions in 9 and malignant in 14 and pelvic exams were normal in others (Table 1).

In a patient (with number 1 in table 1) in this series another mediastinal lymph node pathology also revealed anthracosis which is a granulomatous disease with significant FDG uptake.

There were four patients with suspicious findings and diagnosis of Llymphoma was achieved in one patient (Figure 1). Ewing sarcoma was determined by pathology results in another patient with vulva lesion who recured in the follow up (Fig 1c).

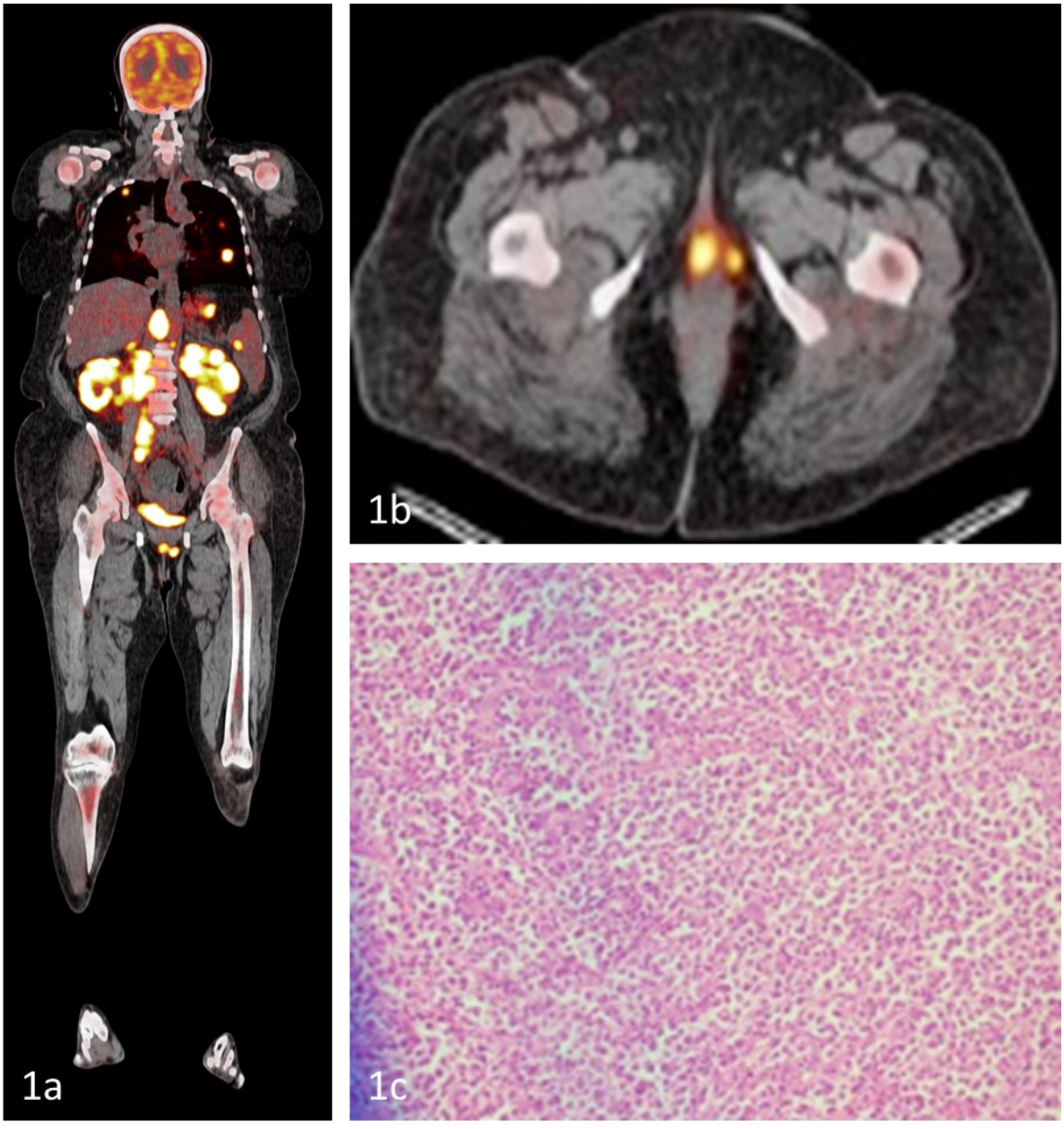


**Figure 1**: Whole body horizontal PET and CT fused image (Figure 1a) and transaxial plane image of vulva (Figure 1b).

**Table 1. The size and SUVmax levels of vulva lesions and pathology results**

| Patient No | Size (mm) | SUVmax | Pathology |
|---|---|---|---|
| 1 | 27 | 29 | Inflammation |
| 2 | 30 | 6,5 | Metastasis of breast carcinoma |
| 3 | 10 | 13 | High grade serous carcinoma |
| 4 | 10 | 8 | Inflammation |
| 5 | 20 | 20 | Cutenous involvement of pancreatic malignancy |
| 6 | 10 | 7,9 | Lentiginous melanocyte hyperplasia |
| 7 | 24 | 18 | Squamous cell carcinoma of vulva |
| 8 | 10 | 10 | Inflammation |
| 9 | 10 | 8,7 | Vulvitis |
| 10 | 30 | 49 | Invasion of bladder carcinoma |
| 11 | 10 | 10 | Intramuscular metastasis of endometrium carcinoma |
| 12 | 10 | 11 | Cutenous involvement of breast malignancy |
| 13 | 10 | 14 | Endometrial polip |
| 14 | 10 | 10 | Infection of the skin |
| 15 | 25 | 62 | Leiomysarcoma |
| 16 | 10 | 16 | Pseuriasis |
| 17 | 16 | 4,6 | Ewing’s sarcoma |
| 18 | 10 | 6 | Invasion of rektum adenocarcinoma |
| 19 | 17 | 10 | Inflammation |
| 20 | 10 | 17 | Inflammation |
| 21 | 24 | 22 | B cell Lymphoma |
| 22 | 20 | 13 | Squamous cell carcinoma of vulva |

| | | | |
|---|---|---|---|
| 23 | 15 | 23,8 | Squamous cell carcinoma of vulva |

**Discussion**

This retrospective research summarizes the possible causes of the suspicious lesions of the vulva as well as several primary lesions. The results of this study indicated sparce correlation of the pathology results and the metabolic uptake. Since metabolism of a lesion is not only a consequence of malignancy there are several cases with significantly higher SUVmax levels and inflammatory finding in pathology results. These false positive reasons must be considered in interpretation of the F-18 FDG PET-CT.

There are several malignancy types including the tumors of the skin as well as Lymphoma, Sarcoma and metastatic involvement of other tumors. There are limited number of the case reports with Lymphoma involvement of the vulva presented with F-18 FDG PET/CT in the literature [5-8]. Metastasis of breast carcinoma has been presented as a rare interesting finding in a case report [7] and we also determined in this case series in a patient. Clitoral invasion-metastasis is another rare presentation of gynecological tumors was also reported in the literature with F-18 FDG PET-CT images [9].

Vulva carcinoma usually spreads to inguinal lymph nodes but metastatic involvement of pelvic lymph nodes upstages the patient to metastatic disease. The discrimination of the pelvic lymph node involvement is important at staging. In a study evaluating the survival outcome of the patients with pelvic nodal involvement pointed out the high specificity of F-18 FDG PET/CT in detection [10]. Another research group documented infectious lesions might have high quantitative metrics in F-18 FDG PET-CT as we observed in this group as well [11]. In another series with recurrent tumors F-18 FDG PET-CT showed high diagnostic sensitivity and specificity for pathologically proven recurrency [2]. In a study F-18 FDG PET-CT performed sensitivity of 80%, specificity of 90%, PPV of 86% and NPV of 86% in lymph nodes staging [12]. Previous literature also pointed out the change in the prognostic impression in more than half of the patients [13]. A series comparing HIV positive and negative cases showed no significant difference between MTV and TLG values [14]. However nearly half of the patients upstaged to metastatic disease in that series (48%) [14]. Interestingly, in previous series significant proportion of the patients' managements changed due to the F-18 FDG PET-CT results [15] Additionally, in a series with radiomics results there were significant correlations between some radiomics derived variables and PFS and OS [16]. The impact of F-18 FDG PET-CT in change in patients' management has also been documented to be %61.5 in a recent study including SCC and non-SCC cases [17].

**Conclusion**

F-18 FDG PET-CT determined lesion with significant FDG uptake also could be false positive results but significant proportion determine second malignancy and warrant significant consideration. Although limited number of primary lesions existed in this series these lesions uptake was not different from benign lesions included.

**Peer-review:** Externally peer-reviewed.

**Authorship Contributions**

**Concept:** Z.P.K., P.P.O., T.T.I., S.G.G., Y.Y.K., **Design:** Z.P.K., P.P.O., T.T.I., S.G.G., Y.Y.K., **Supervision:** Z.P.K., P.P.O., T.T.I., S.G.G., Y.Y.K., **Data Collection and/or Processing:** Z.P.K., **Analysis and/or Interpretation:** Z.P.K., **Literature Review:**. Z.P.K., **Writer:** Z.P.K.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study has received no financial support.

**References**

1. Brar, H., May, T., Tau, N., Langer, D., MacCrostie, P., Han, K., & Metser, U. (2017). Detection of extra-regional tumour recurrence with 18F-FDG-PET/CT in patients with recurrent gynaecological malignancies being considered for radical salvage surgery. Clinical radiology, 72(4), 302–306. https://doi.org/10.1016/j.crad.2016.12.009
2. Rao, Y. J., Hassanzadeh, C., Chundury, A., Hui, C., Siegel, B. A., Dehdashti, F., DeWees, T., Mullen, D., Powell, M. A., Mutch, D. G., Schwarz, J. K., & Grigsby, P. W. (2017). Association of post-treatment positron emission tomography with locoregional control and survival after radiation therapy for squamous cell carcinoma of the vulva. Radiotherapy and oncology : journal of the European Society for Therapeutic Radiology and Oncology, 122(3), 445–451. https://doi.org/10.1016/j.radonc.2016.12.019
3. Lin, G., Chen, C. Y., Liu, F. Y., Yang, L. Y., Huang, H. J., Huang, Y. T., Jung, S. M., Chou, H. H., Lai, C. H., & Ng, K. K. (2015). Computed tomography, magnetic resonance imaging and FDG positron emission tomography in the management of vulvar malignancies. European radiology, 25(5), 1267–1278. https://doi.org/10.1007/s00330-014-3530-1
4. Shen, G., Wang, R., Pan, L., & Kuang, A. (2021). Malignant Extrarenal Rhabdoid Tumor of the Vagina on FDG PET/CT. Clinical nuclear medicine, 46(12), 1020–1021. https://doi.org/10.1097/RLU.0000000000003751
5. Beyhan, E., Ergül, N., Bektaş, S., Erol, Ö., & Çermik, T. F. (2021). Solitary Vulvar Involvement of Ovarian Non-Hodgkin Lymphoma Mimicking Bartholin's Abscess on 18F-FDG PET/CT. Clinical nuclear medicine, 46(3), 255–257. https://doi.org/10.1097/RLU.0000000000003494
6. Guglielmo, P., Paderno, M., Elisei, F., Guerra, L., Landoni, C., Buda, A., & Crivellaro, C. (2019). 18F-FDG PET/CT in a Case of Metastatic Breast Cancer to the Vulva. Clinical nuclear medicine, 44(7), 572–573. https://doi.org/10.1097/RLU.0000000000002583
7. Gandhi, A. K., Roy, S., Mridha, A. R., & Sharma, D. N. (2015). Vulvar metastasis from carcinoma breast unveiling distant metastasis: Exploring an unusual metastatic pattern. Journal of the Egyptian National Cancer Institute, 27(4), 243–246. https://doi.org/10.1016/j.jnci.2015.05.005
8. Treglia, G., Paone, G., Perriard, U., Ceriani, L., & Giovanella, L. (2014). An unusual case of diffuse large B-cell lymphoma involving the vulva evaluated by 18F-FDG PET/CT. Clinical nuclear medicine, 39(10), e439–e441. https://doi.org/10.1097/RLU.0000000000000258
9. Lu, Y. Y., Lu, C. H., & Wang, H. Y. (2017). Clitoral Metastasis From Advanced Cervical Carcinoma on 18F-FDG-PET/CT. Clinical nuclear medicine, 42(1), 54–55. https://doi.org/10.1097/RLU.0000000000001410
10. Thaker, N. G., Klopp, A. H., Jhingran, A., Frumovitz, M., Iyer, R. B., & Eifel, P. J. (2015). Survival outcomes for patients with stage IVB vulvar cancer with grossly positive pelvic lymph nodes: time to reconsider the FIGO staging system?. Gynecologic oncology, 136(2), 269–273. https://doi.org/10.1016/j.ygyno.2014.12.013
11. Burger, I. A., Vargas, H. A., Donati, O. F., Andikyan, V., Sala, E., Gonen, M., Goldman, D. A., Chi, D. S., Schöder, H., & Hricak, H. (2013). The value of 18F-FDG PET/CT in recurrent gynecologic malignancies prior to pelvic exenteration. Gynecologic oncology, 129(3), 586–592. https://doi.org/10.1016/j.ygyno.2013.01.017
12. Cohn, D. E., Dehdashti, F., Gibb, R. K., Mutch, D. G., Rader, J. S., Siegel, B. A., & Herzog, T. J. (2002). Prospective evaluation of positron emission tomography for the detection of groin node metastases from vulvar cancer. Gynecologic oncology, 85(1), 179–184. https://doi.org/10.1006/gyno.2002.6605
13. Robertson, N. L., Hricak, H., Sonoda, Y., Sosa, R. E., Benz, M., Lyons, G., Abu-Rustum, N. R., Sala, E., & Vargas, H. A. (2016). The impact of FDG-PET/CT in the management of patients with vulvar and vaginal cancer. Gynecologic oncology, 140(3), 420–424. https://doi.org/10.1016/j.ygyno.2016.01.011

14. Mokoala, K. M. G., Lawal, I. O., Lengana, T., Popoola, G. O., Boshomane, T. M. G., Mokgoro, N. P., Vorster, M., & Sathekge, M. M. (2020). 18F-FDG PET/CT imaging of vulva cancer recurrence: A comparison of PET-derived metabolic parameters between women with and without HIV infection. 18F-FDG PET/CT-Bildgebung von Vulvakarzinom-Rezidiven: Ein Vergleich der PET-Stoffwechselparameter bei Frauen mit und ohne HIV-Infektion. Nuklearmedizin. Nuclear medicine, 59(6), 419–427. https://doi.org/10.1055/a-1221-7810
15. Boellaard, R., Delgado-Bolton, R., Oyen, W. J., Giammarile, F., Tatsch, K., Eschner, W., Verzijlbergen, F. J., Barrington, S. F., Pike, L. C., Weber, W. A., Stroobants, S., Delbeke, D., Donohoe, K. J., Holbrook, S., Graham, M. M., Testanera, G., Hoekstra, O. S., Zijlstra, J., Visser, E., Hoekstra, C. J., … European Association of Nuclear Medicine (EANM) (2015). FDG PET/CT: EANM procedure guidelines for tumour imaging: version 2.0. European journal of nuclear medicine and molecular imaging, 42(2), 328–354. https://doi.org/10.1007/s00259-014-2961-x
16. Collarino, A., Garganese, G., Fragomeni, S. M., Pereira Arias-Bouda, L. M., Ieria, F. P., Boellaard, R., Rufini, V., de Geus-Oei, L. F., Scambia, G., Valdés Olmos, R. A., Giordano, A., Grootjans, W., & van Velden, F. H. P. (2018). Radiomics in vulvar cancer: first clinical experience using 18F-FDG PET/CT images. Journal of nuclear medicine : official publication, Society of Nuclear Medicine, 60(2), 199–206. Advance online publication. https://doi.org/10.2967/jnumed.118.215889
17. Peiró, V., Chiva, L., González, A., Bratos, R., Alonso, S., Márquez, R., Carballo, N., & Alonso-Farto, J. C. (2014). Utilidad de la PET/TC en el manejo del cáncer de vulva [Utility of the PET/CT in vulvar cancer management]. Revista espanola de medicina nuclear e imagen molecular, 33(2), 87–92. https://doi.org/10.1016/j.remn.2013.07.009

© Author(s) 2022. This work is distributed under https://creativecommons.org/licenses/by-sa/4.0/