

Evaluation of the Efficacy of 68Ga-DOTATATE PET/CT in Insulinoma Patients

Barış Sariaçalı¹, Gülhan Duman², Zekiye Hasbek³

^{1,2} Division of Endocrinology and Metabolism, Department of Internal Medicine, Sivas Cumhuriyet University Faculty of Medicine., Sivas, Turkey

³ Department of Nuclear Medicine, Sivas Cumhuriyet University Faculty of Medicine, 58140 Sivas, Turkey

ORCID; 0000-0001-5133-1318, 0000-0002-4057-5701, 0000-0002-8119-3363

Abstract: Investigation of the success of diagnostic interventions used in insulinoma patients in detecting insulinoma lesions. Five patients who were operated on with the diagnosis of insulinoma and whose pathology results were compatible with insulinoma were included in the study. We documented the results of endoscopic ultrasonography, CT, MRI, 68Ga-DOTATATE positron emission tomography (PET) used for diagnosis in patients and compared the success rates of these tests in diagnosing insulinoma. MRI and CT detected the pancreatic lesion in two of our five patients and gave a positive result. Endoscopic ultrasonography gave positive results in three of our patients. 68Ga-DOTATATE PET/CT 5 detected the lesion in all of our patients and gave a positive result. We would like to point out that the sensitivity of 68Ga-DOTATATE PET/CT is high in diagnosing insulinoma, a neuroendocrine tumor.

INTRODUCTION

Insulinoma is the most common pancreatic neuroendocrine tumor. The annual incidence is 1-3 cases per million¹. Over 90% of insulinoma cases are benign. Patients have hypoglycemia. The blood glucose level is found below 50 mg/dl. In addition to autonomic symptoms such as palpitations, irritability, and hunger, neuroglycopenic symptoms such as speech disorder, visual impairment, confusion, and coma may also be present when blood glucose level falls below 50 mg/dl^{2,3}. Low blood glucose, symptoms of hypoglycemia, and improvement of symptoms when glucose is given are known as the Whipple triad⁴. Diagnosis is made by high plasma insulin, proinsulin, and c-peptide values when the blood glucose level is 50 mg/dl and below during the prolonged fasting test. About 10% of insulinomas are associated with familial syndromes, most commonly with multiple endocrine neoplasia type 1 (MEN 1)⁵. 90% of insulinoma cases are smaller than 2 cm in size¹. The fact that insulinomas are smaller than 2 cm in most cases makes it difficult to diagnose with non-invasive imaging methods such as computed tomography (CT), magnetic resonance imaging (MRI), abdominal ultrasonography⁶. Invasive diagnostic methods used in the diagnosis of insulinoma are endoscopic ultrasonography (EUS)^{7,8}, intra-arterial calcium stimulation test with hepatic venous sampling⁹, intraoperative manual palpation, and intraoperative ultrasonography^{10,11}. Subtotal pancreatic resection is not recommended in cases where insulinoma cannot be localized by diagnostic methods¹². The use of 68Gallium (Ga)-DOTA peptides in detecting insulinomas has been reported in previous studies. 68Ga-DOTATATE positron emission tomography (PET) is an effective diagnostic method to diagnose insulinomas^{13,14}. This study aimed to present the efficacy of 68Ga-DOTATATE positron emission tomography (PET) in diagnosing insulinoma in our five insulinoma cases by comparing it with other diagnostic methods.

MATERIAL and METHODS

We evaluated the patients who were operated on with the diagnosis of insulinoma at Sivas Cumhuriyet University. We identified five patients whose pathology results were compatible with insulinoma. We confirmed the laboratory findings and pathological diagnoses of these five patients diagnosed between January 2018 and April 2021. In the laboratory evaluation, we documented the insulin, glucose, and C-peptide values at the time of hypoglycemia. We documented the results of endoscopic ultrasonography, CT, MRI, 68Ga-DOTATATE positron emission tomography (PET) used for diagnosis in patients and compared the success rates of these tests in diagnosing insulinoma.

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Corresponding Author:
Barış Sariaçalı
E-mail: drbbbarissariakali@gmail.com
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RESULTS

Of our five insulinoma patients, three were female, and 2 were male. MRI and CT detected the pancreatic lesion in two of our five patients and gave a positive result. Endoscopic ultrasonography gave positive results in three of our patients. 68Ga-DOTATATE PET detected the lesion in all 5 of our patients and gave a positive result. The age and gender of the patients, the imaging methods used, glucose, insulin, and c-peptide values during the prolonged fasting test are presented in Table 1. Figures 1-5 show 68Ga-DOTATATE PET/CT images of insulinoma patients.

DISCUSSION

Insulinomas are rare neuroendocrine tumors that can lead to death if left untreated. The treatment of this neuroendocrine tumor is the surgical removal of the lesion. Diagnosis is difficult in insulinomas because the tumor size is less than 2 cm in most cases and can be located anywhere in the pancreas gland¹⁵. In addition to non-invasive imaging methods such as CT, MR, 18F-L-dihydroxyphenylalanine PET, invasive methods such as endoscopic ultrasonography, intra-arterial calcium stimulation test with hepatic venous sampling, intraoperative manual palpation, and intraoperative ultrasonography can be used in the diagnosis of insulinoma⁶⁻¹¹. In addition, an intra-arterial calcium stimulation test with hepatic venous sampling is a laborious procedure that cannot be applied in all centers.

68Ga-DOTATATE binds to somatostatin receptor 2, which is frequently expressed in neuroendocrine tumors. It has been reported that somatostatin receptor 2 is highly present in most cases in insulinomas¹⁶. It has been reported that 68Ga-DOTATATE PET/CT

can detect insulinoma lesions up to 6 mm in size¹⁴. Nockel P. et al., in a retrospective study involving 31 series of insulinoma cases, applied 68Ga-DOTATATE PET/CT to 10 patients with insulinoma and had positive results in 9 patients. Prasad V. et al. applied 68Ga-DOTATATE PET/CT to 6 patients and visualized insulinoma in 5 patients¹⁸. Tuzcu et al., in their retrospective study, found positive results with 68Ga-DOTATATE PET/CT in all three insulinoma patients¹⁹. In a published study on neuroendocrine tumors, the sensitivity of 68Ga-DOTATATE PET/CT in gastroenteropancreatic neuroendocrine tumors was reported to be 82-100%²⁰.

Our study detected the lesion in all five patients in whom we applied a non-invasive examination, 68Ga-DOTATATE PET/CT, and found the sensitivity to be 100%. 68Ga-DOTATATE PET/CT detected insulinoma masses detected and undetected in CT, MRI, and endoscopic USG. In our study, we used CT, MRI, EUS, and 68Ga-DOTATATE PET/CT to locate the lesion in all of our five insulinoma cases, allowing us to compare the effectiveness of these imaging modalities. CT, MRI showed positive results in two patients and EUS in three patients, showing the location of the mass. These results show the power of 68Ga-DOTATATE PET/CT in diagnosing insulinoma and being a non-invasive test is one of the advantages of ease of application.

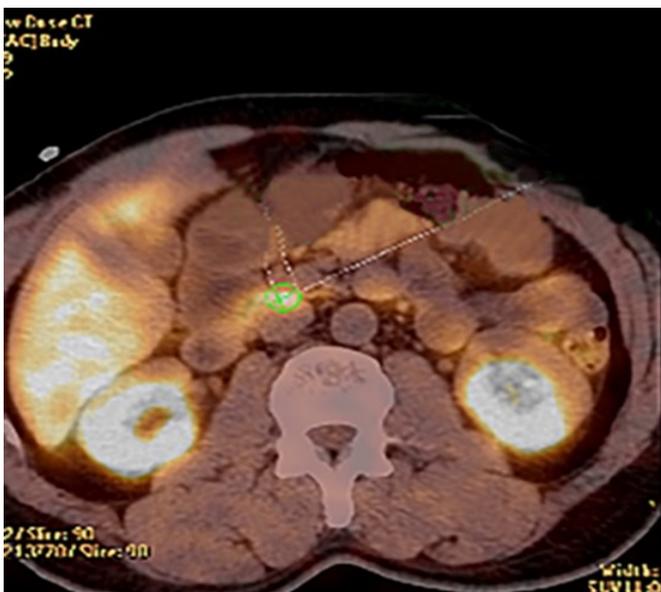
Conclusion

It showed the insulinoma lesion in all of our five patients, which clearly shows us that 68Ga-DOTATATE PET/CT has a high sensitivity in diagnosing insulinoma. In conclusion, we would like to state that the sensitivity of 68Ga-DOTATATE PET/CT is high in diagnosing insulinoma, a neuroendocrine tumor.

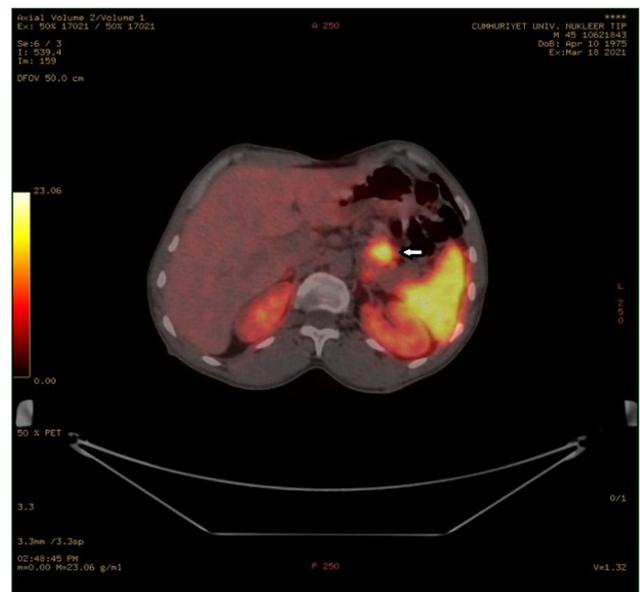
Table 1. The age and gender of the patients, the imaging methods used, glucose, insulin, and c-peptide values during the prolonged fasting test.

	CT	MRI	EUS	DOTA	Insulin	C-peptide	Glucose	Tumor Size
62 years old M	Negative	Negative	Positive	Positive	12	2.3	44	13.8 mm
46 years old M	Negative	Negative	Negative	Positive	4.1	2.43	22	26 mm
45 years old W	Negative	Negative	Negative	Positive	26	3.79	26	16 mm
40 years old W	Positive	Positive	Positive	Positive	14	2.49	28	13.4 mm
26 years old W	Negative	Negative	Positive	Positive	4.85	1.31	37	21 mm

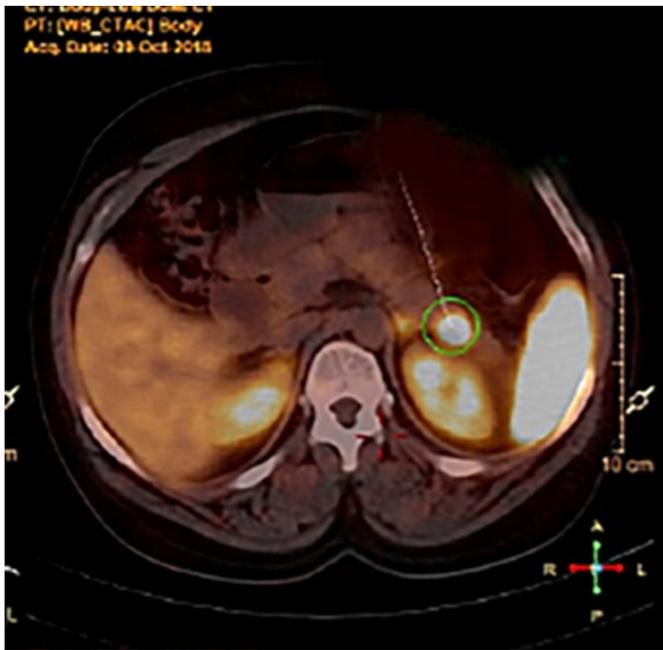
M : man, W: woman, CT : computed tomography, MRI: magnetic resonance imaging, EUS :endoscopic ultrasonography, DOTA : 68Ga-DOTATATE PET/CT,



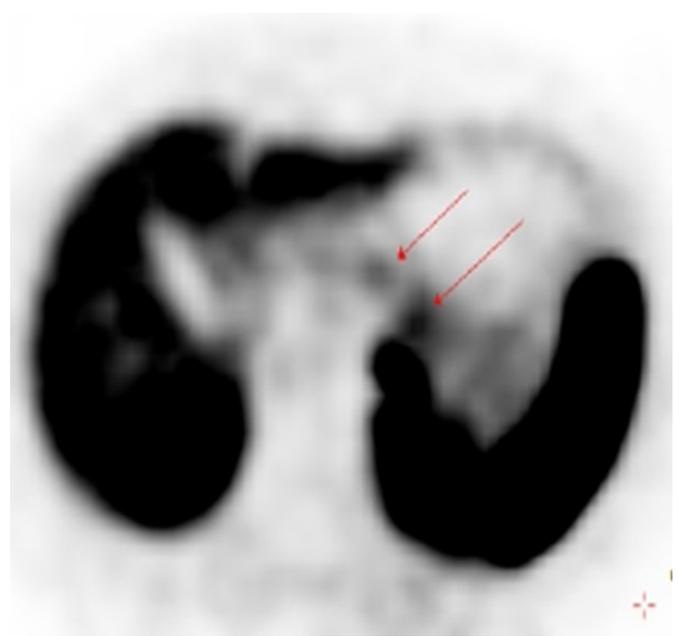
Figures 1. Male/62 years



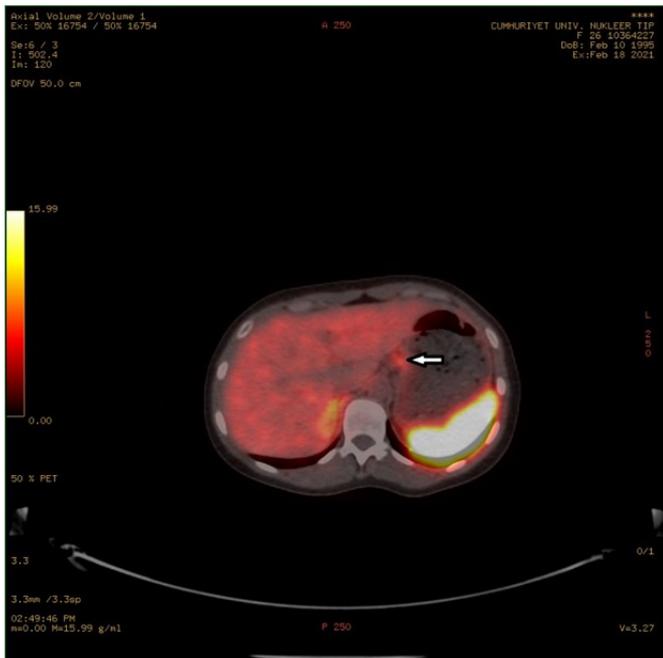
Figures 2. Male/46 years



Figures 3. Female/45 years



Figures 4. Female/40 years



Figures 5. Female/26 years

Conflict of interest

The authors declare that there are no conflict of interests.

Financial disclosure

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