American Journal of Gastroenterology and Hepatology

ISSN 2692-7942

Research Article

Diagnostic Correlation of PET-CT in Incidental Colorectal Lesions with Colonoscopy for the Detection of Advanced Colon Adenomas

Silvia Karina Astudillo Gómez[1], Mauro Eduardo Ramírez Solís[1], Angelica Ixtaccihuatl Hernández Guerrero[1] and Aguilar-Soto Mercedes[2]*

[1]*Instituto Nacional de Cancerología, Gastrointestinal Endoscopy Service, Mexico*

[2]*Instituto Mexicano del Seguro Social, PMCODS UNAM, Mexico*

Abstract

Positron emission tomography allows detection of benign and malignant conditions that require further investigation with other diagnostic modalities such as colonoscopy in case the metabolic activity is in the colon or rectum.

Objective: To correlate the incidental up take of 18-FDG in the colon by PET-CT with the lesions detected by colonoscopy and their histopathological outcome.

Materials and methods: Retrospective study, colonoscopy reports performed from January 2016 to February 2021, whose indication was the approach of incidental 18-FDG uptake in colon and rectum by PET-CT, were reviewed. We sought to correlate these findings with the endoscopic and histological report. Cases of inflammatory bowel disease, history of colorectal cancer and poor bowel preparation were excluded.

Results: Forty-one patients were included, 36.7% were men and 60.3% were women. Sixty-three lesions were recorded on colonoscopies, 19 corresponded to advanced adenomas, and predominantly Paris 0-Is and located in the ascending colon, with a mean size of 12 mm. No correlation was observed between the presence of advanced adenoma, size (r=-0.71, p<0.0001) and SUVmax (r=-0.068, p=0.5947). A SUVmax cutoff point of 16.2 presented a sensitivity and specificity of 80% and 81.3% respectively for advanced adenomas and for cancer a SUVmax of 12.59, showed a sensitivity of 100% and specificity of 72.4%.

Conclusion: Premalignant and malignant lesions will show a higher SUVmax than other lesions, therapeutic intervention should be anticipated during colonoscopy if an elevated SUVmax is recorded.

Keywords: SUVmax; Advanced colon adenoma; Incidental finding; PET-CT; Colonoscopy

Abbreviations

PET-CT: Positron Emission Tomography and Computed Tomography; 18-FDG: 18F-fluorodeoxyglucose; SUVmax: Standarized Uptake Value; CA: Colon Adenoma; LST-G: Lateral Spreading Tumor-Granular Type

Introduction

The International Agency for Research on Cancer of the World Health Organization (WHO) reported 1,931,590 new cases of colorectal cancer and 935,173 deaths worldwide in 2020. In Mexico there were 195,499 new cases and 90,222 deaths, placing it in third place in frequency [1]. According to the National Institute of Public Health, the incidence of colorectal cancer has increased [2]. In developed countries, a reduction in mortality of around 50% has been observed due to the introduction of better screening, treatment and surveillance techniques [3].

Positron Emission Tomography (PET-CT) is a highly effective tool in the staging of neoplasms, the evaluation of residual or recurrent disease and in the detection of synchronous or metachronous tumors. F18-Fluorodeoxyglucose (FDG) is the radiotracer of choice for imaging since being glucose analog it is avidly taken up by cells through glucose transporter proteins located in the cell membrane, mainly GLUT1. These transporters are over expressed by tumor cells. Other factors that condition an increased FDG uptake in neoplastic cells are the high vascularity of the tissue, the high rate of cell mitosis and the presence of circulating inflammatory cells [4]. However, this metabolic pattern is not specific to neoplasms; it is associated with cell multiplication and therefore may be present in benign conditions such as inflammation or it may be a physiological response [5].

Multiple patterns of uptake have been described: focal, multifocal, segmental and diffuse, the focal pattern being the most associated with clinically significant lesions. The segmental pattern may represent inflammation, especially if accompanied by thickening of the colonic wall. The diffuse pattern has been related to situations that can increase intraluminal FDG uptake such as episodes of diarrhea, constipation or other external factors, for example the use of drugs such as metformin. The degree of metabolic activity can be measured

Citation: Gómez SKA, Solís MER, Guerrero AIH, Mercedes A-S. Diagnostic Correlation of PET-CT in Incidental Colorectal Lesions with Colonoscopy for the Detection of Advanced Colon Adenomas. Am J Gastroenterol Hepatol. 2022;3(1):1013.

Publisher Name: Medtext Publications LLC

Manuscript compiled: Jan 11th, 2022

***Corresponding author:** Silvia Karina Astudillo Gómez, Instituto Nacional de Cancerología, Gastrointestinal Endoscopy Service, Calle San Juan de Dios number 460, int: 201, Villa Lazaro Cardenas neighborhood, Tlalpan, Mexico City, 14370, Mexico, Tel: +52-3313140910; E-mail: karinastudillo@hotmail.com

semi quantitatively by the standardized maximum uptake value or SUVmax. The prevalence of focal uptake in the colon ranges from 0.6% to 3.7% [6].

In 2001 Yasuda et al. [7], described for the first time the ability of PET-CT to record the metabolic activity of adenomas in the colon and its relationship with size, location and histology. Subsequent studies have included SUVmax as a quantitative indicator of uptake, without managing to standardize a cut-off point for high-risk lesions such as advanced adenomas. The study by Luboldt et al. [8], showed that SUVmax increases with the degree of malignancy of the lesion considering a SUVmax=9.7 ± 6.9 for low grade dysplasia, a SUVmax=11.6 ± 4.4 for high grade dysplasia and a SUV max=12.9 ± 6.8 for cancer. The most recent study that included a larger number of patients with incidental colorectal lesions found risk of malignancy in 12% and premalignant lesions (adenomas) in 72% of cases of lesions with higher uptake, making evaluation with colonoscopy a priority [9].

Primary objective

To identify the correlation between incidental findings in the colon by PET-CT expressed in SUVmax and the type of uptake pattern with the lesions detected by colonoscopy and their histopathological outcome.

Materials and Methods

Observational, retrospective, cross-sectional study was carried out in a tertiary care center; colonoscopy reports performed from January 2016 to February 2021 whose indication was to address significant metabolic activity detected incidentally in colon and rectum by PET-CT were reviewed.

Subsequently, the histopathological report was collected in the case of having obtained biopsies of the lesion, in order to correlate the findings. The records of patients with a history of colorectal cancer, inflammatory bowel disease or poor bowel preparation (Boston≤6 points) were not included, as well as those in which no biopsy had been taken.

Incidental uptake was defined as focal or segmental accumulation of 18F-FDG in patients studied for non-colon-related pathology. The intensity of uptake was measured semi quantitatively with SUVmax. Suspicious colonoscopy was considered as that which presented a lesion in the topography previously described by PET-CT. If more than one polyp was identified in the same colon segment, only the one with the most advanced endoscopic appearance was included in the sensitivity and specificity analysis, due to the recording of a single SUVmax value in the Nuclear Medicine report.

Inclusion criteria

Patients undergoing PET-CT in whom 18F-FDG hyper uptake was recorded in the colon and subsequently underwent colonoscopy and biopsy.

Exclusion criteria

- Patients with a history of colorectal cancer.
- Patients with inflammatory bowel disease.
- Colonoscopy with suboptimal bowel preparation (Boston≤6 points).
- Patients with no endoscopic, PET-CT or histopathological report.

Statistical analysis

Descriptive measures were used initially expressing data as means with standard deviation in case of parametric distribution variables, medians with interquartile range (P25-P75) in case of nonparametric distribution variables, and frequency with proportions in case of dichotomous qualitative variables. The variables were compared for patients with advanced adenomas found in the biopsy versus those with other lesions. Chi-square tests were performed for categorical variables, Student's t test for numerical variables with parametric distribution, and Mann Whitney U test for those with nonparametric distribution.

The correlation between the presence of advanced adenomas and PET uptake was assessed by Pearson correlation. Logistic regressions were performed to calculate the OR of presenting advanced adenomas according to the maximum SUV, initially unadjusted and subsequently adjusted for age and sex.

Sensitivity, specificity and likelihood ratio were calculated for the variables with diagnostic capacity, as well as the negative predictive value and the area under the curve to identify the best cut-off points for SUV and the size of the lesions identified by colonoscopy using biopsy as the gold standard. All statistical tests were 2-tailed considering a p value <0.05 as significant. Analyses were performed with SAS on Demand for Academics (SAS Institute, Cary, NC).

Results

Data were collected from 41 patients, with a median age of 64.4 years (62-71). The 36.7% were men and 60.3% were women. The main indications for PET-CT were staging and surveillance of the pathologies shown in Table 1. Most of the previously known malignancies were hematologic diseases and breast cancer (Figure 1).

A total of 63 lesions were recorded in the colonoscopies. The general characteristics of the lesions, compared by the presence or not of advanced adenoma are summarized in Table 2. A significant difference was observed between men and women for the frequency of advanced adenoma, as 16 women presented it as opposed to only 3 men (p=0.011).

Forty-one polyps were identified, 19 met the definition of advanced adenomas (size≥10 mm, villous component or high-grade dysplasia), and predominantly Paris 0-Is and located in the ascending colon, with an average size of 12 mm (Table 2). Polyps that did not meet histological characteristics of advanced adenomas (villous component or high-grade dysplasia) were reported as hyperplastic

Table 1: Primary disease.

Neoplasia	Number	Percentage
Hematologic	20	31.8
Breast	17	26.9
Lung	4	6.3
Melanoma	4	6.3
Cervix	2	3.2
Hepatocellular	2	3.2
Prostate	4	6.3
Gastroesophageal junction	2	3.2
Endometrium	1	1.6
Esophagus	1	1.6
Ovarian	2	3.2
Pancreas	1	1.6
AIDS	1	1.6
Other	2	3.2

AIDS: Acquired Immunodeficiency Syndrome

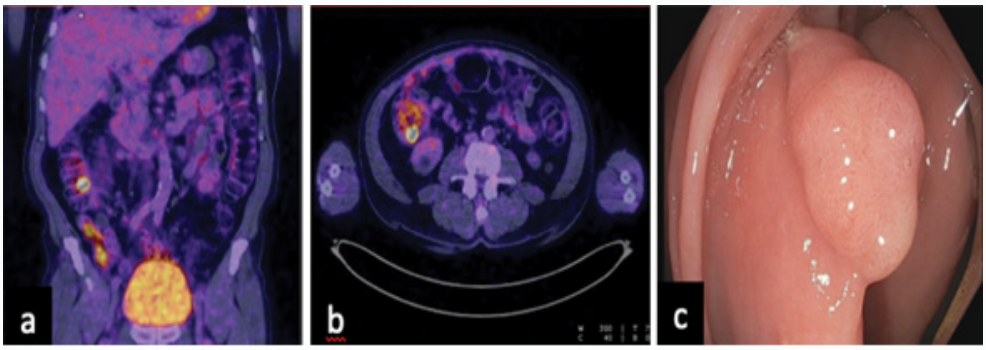

Figure 1: PET-CT performed in a 67-year-old patient because of melanoma. Incidental FDG uptake was recorded in the ascending colon (SUVmax 26.5). a, b) Intraluminal nodular image showing focal increase of metabolism; c) Sessile polyp in ascending colon of 15 mm, corresponding to the PET-CT finding.

polyps 12, tubular adenomas 25 and lesions with adenocarcinoma histology 5, with SUVmax of 7.36, 14.33 and 26.14 respectively (Figure 2).

A difference was observed between suspicious colonoscopy for advanced adenomas, as 100% of these were considered suspicious in the endoscopic study (p=0.0038). No difference was observed according to polyp location, maximum SUV at colonoscopy or Paris classification.

Regarding Pearson correlations, a significant negative correlation was observed between the presence of advanced adenomas and polyp size (r=-0.71, p<0.0001). No correlation was observed between the presence of advanced adenoma and the maximum SUV of the lesion (r=-0.068, p=0.5947) (Figure 3).

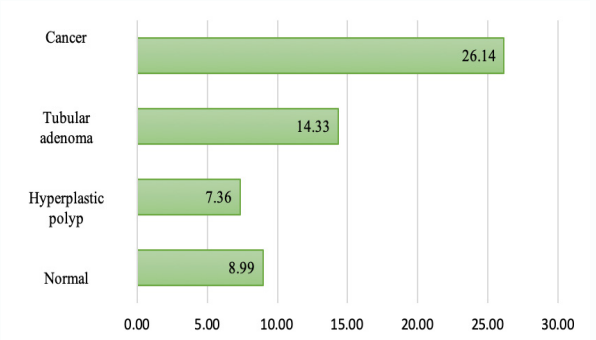

Figure 2: SUVmax according to histology of the lesions detected by colonoscopy.

In the evaluation of sensitivity and specificity for different SUVmax cut-off points for the different types of lesions, it was observed that a SUVmax of 16.2 (p=0.018) has a sensitivity of 80% and a specificity of 81.3% for high-grade dysplasia, while for cancer a SUVmax of 12.59 had a sensitivity of 100% and a specificity of 72.4% (p=0.003) (Table 3).

Increased SUVmax was found to confer an OR of 2.89 (1.09-7.49) which was significant and an OR of 2.98 with 95% CI of 1.06-8.33 for the age- and sex-adjusted model.

Discussion

PET-CT is not a first-line diagnostic modality in the initial evaluation of colorectal cancer or premalignant lesions of the colon. International guidelines recommend colonoscopy as the first option or, in its absence, computed axial tomography and magnetic resonance imaging in symptomatic or high-risk patients. PET-CT is considered a second line study [10]. There are indications for its use such as the evaluation of operable metastases, the identification of disease in another location that could condition surgical resection and in case of contraindication to the use of contrast medium [11].

Since routine PET-CT studies include the recording of metabolic activity from the base of the skull to the proximal third of the lower extremities, the detection of significant uptake at different levels, mainly the colon, is frequent. The positive predictive value of PET-

Table 2: Comparison between the characteristics of patients with advanced adenoma versus those without advanced adenoma.

		No adenoma (n=44)		Advanced adenoma (n=19)		p
Sex	Female	22	-50	16	-80	0.011
	Male	22	-50	3	-20	
Age, mean (SD)		63.1	-14.2	67.4	-14.7	0.28
PET-CT with focal uptake		29	-65.9	11	-57.9	0.59
SUVmax, mean (SD)		8.42	(5.97-15.9)	8.2	(6.3-18.4)	0.29
PET-CT to colonoscopy, days (SD)		34.1	-25	23.7	-18.6	0.11
Solid tumor		13	-56.5	16	-88.9	
Paris Classification	0-Is	17	-77.2	15	-78.9	0.93
	0-Ip	1	-4.6	2	-10.5	
	IIa	4	-18.2	0	0	
	0-Isp	0	0	1	-5.3	
	LST-G‡	0	0	1	-5.3	
Size† , mm mean (SD)		3	(2-5)	12	(10-20)	
Location	Right	7	-35	10	(52-6)	0.65
	Transverse	5	-25	0	0	
	Left	8	-40	9	-47.4	
Positive colonoscopy		28	-63.6	19	-100	0.0038

*Data presented as n (%) unless otherwise specified.

† Size reported by histology.

‡ LST-G: Lateral spreading tumor-granular type.

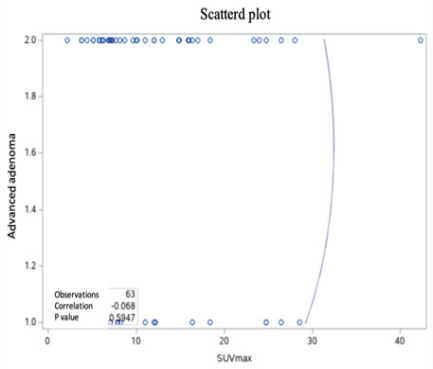

Figure 3: Pearson's correlation for advanced adenoma and SUVmax.

CT in the detection of premalignant lesions was described by Treglia et al. [12]. They observed a direct relationship between size and the adenoma detection capability of this tool, 90% for adenomas≥13 mm and 0% if≤9 mm, with a sensitivity of 0%, 5% and 69% for lesions of 1 mm to 5 mm, 6 mm to 10 mm and >10 mm respectively [12].

The results of our study suggest that an increased SUVmax is associated with an increased risk of presenting advanced adenomas, even after adjusting for age and sex (OR 2.98, 95% CI 1.06-8.33). It was also observed that a cutoff value of SUVmax≥12.59 is highly sensitive and specific for the detection of cancer and high-grade dysplasia. The above coincides with an analysis performed by Van Hoeij, who proposed a cutoff point of SUVmax≥11.4 for premalignant and malignant lesions; however, this value does not have the capacity to differentiate benign lesions from non-advanced adenomas, so perhaps the cutoff of 12.59 selected in our study is more optimal [13].

Importantly, a statistically significant difference was observed in the presence of suspicious lesions on colonoscopy in patients with advanced adenomas versus those with other types of lesions (p=0.0038), which underscores the importance of colonoscopy as a follow-up study in patients with suspicious lesions on PET-CT.

In Mexico the use of PET-CT is limited due to the high cost of this resource and the scarce number of available equipment. No studies have been published in our country evaluating the relevance of incidental findings in the colon using this imaging modality. The weaknesses of this study are the small sample number, its retrospective nature and the lack of long-term surveillance in those patients with colorectal hypermetabolism but without visible lesions at colonoscopy.

In cases in which the characteristics of the metabolic activity recorded by PET-CT (type of pattern, SUVmax and location) do not point to a high-risk lesion, the patient should be individualized according to his risk factors such as age, familial history, history of abdominopelvic radiotherapy and clinical manifestations to determine the time of his endoscopic evaluation.

So far, other modalities for the evaluation of these incidental findings have not been evaluated, such as non-invasive methods; Fecal Immunochemical Test (FIT), Fecal Occult Blood in Feces (gFOBT) and DNA blood test, which could be less expensive alternatives and with zero risk of complications. The Endoscopist should know the uptake pattern, SUVmax and the location of metabolic activity detected in the colon prior to colonoscopy, as well as anticipate the possibility of performing a therapeutic intervention such as polypectomy or mucosal resection in case of elevated SUVmax in the colon and rectum.

References

1. The Global Cancer Observatory. Globocan 2020. México: Int Agency Res Cancer; 2020. p. 29-30.
2. Gobierno De Mexico. Instituto Nacional de Cancerología (INCan), Instituto Nacional de Salud Pública (INSP). Mexico: Cancer de Colon y Recto; 2015. p. 800.
3. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. CA Cancer J Clin. 2018;68(1):7-30.
4. Bomanji JB, Costa DC, Ell PJ. Clinical role of positron emission tomography in oncology. 2001;2(3):157-64.
5. Liu Y, Ghesani NV, Zuckier LS. Physiology and Pathophysiology of Incidental Findings Detected on FDG-PET Scintigraphy. Semin Nucl Med. 2010;40(4):294-315.
6. Lin M, Koo JH, Abi-Hanna D. Management of Patients Following Detection of Unsuspected Colon Lesions by PET Imaging. Clin Gastroenterol Hepatol. 2011;9(12):1025-32.
7. Yasuda S, Fujii H, Nakahara T, Nishiumi N, Takahashi W, Ide M, et al. 18F-FDG PET detection of colonic adenomas. J Nucl Med. 2001;42(7):989-92.
8. Luboldt W, Volker T, Wiedemann B, Zöphel K, Wehrmann U, Koch A, et al. Detection of relevant colonic neoplasms with PET/CT: Promising accuracy with minimal CT dose and a standardised PET cut-off. Eur Radiol. 2010;20(9):2274-85.
9. Kousgaard SJ, Gade M, Petersen LJ, Thorlacius-Ussing O. Incidental detection of colorectal lesions on 18F-FDG-PET/CT is associated with high proportion of malignancy: A study in 549 patients. Endosc Int Open. 2020;8(12):E1725-31.
10. Schmoll HJ, Van cutsem E, Stein A, Valentini V, Glimelius B, Haustermans K, et al. Esmo consensus guidelines for management of patients with colon and rectal cancer. A personalized approach to clinical decision making. Ann Oncol. 2012;23(10):2479-516.
11. Benson AB, Venook AP, Al-Hawary MM, Cederquist L, Chen YJ, Ciombor KK, et al. NCCN Guidelines Insights: Colon Cancer, Version 2.2018. J Natl Compr Canc Netw. 2018;16(4):359-69.
12. Treglia G, Calcagni ML, Rufini V, Leccisotti L, Meduri GM, Spitilli MG, et al. Clinical significance of incidental focal colorectal 18F-fluorodeoxyglucose uptake: Our experience and a review of the literature. Color Dis. 2012;14(2):174-80.
13. van Hoeij FB, Keijsers RGM, Loffeld BCAJ, Dun G, Stadhouders PHGM, Weusten BLAM. Incidental colonic focal FDG uptake on PET/CT: can the maximum standardized uptake value (SUVmax) guide us in the timing of colonoscopy? Eur J Nucl Med Mol Imaging. 2015;42(1):66-71.

Table 3: Sensitivity and specificity for different cut-off points of the maximum SUV for each type of lesion.

	SUVmax cut-off point	Sensitivity (%, IC 95%)	Specificity (%, IC 95%)	Positive predictive value	Likelihood ratio	AUC	p
Advanced adenoma	7.8	50 (26.7.- 73.23)	47.73 (32.73- 63.12)	70	0.96	0.58 (0.43-0.73)	0.313
High grade dysplasia	16.2	80 (29.88. - 98.95)	81.3 (68.19-89.71)	97.92	4.22	0.821 (0.67-0.97)	0.018
Cancer	12.59	100 (81.5 - 100)	72.4 (1.1 - 28.0)	100	3.63	0.9 (0.79-0.99)	0.003