

Physiological F-18 FDG Uptake in Normal Pituitary Gland on Digital PET Scanner

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Introduction

Most PET/CT scanners around the world are analog (cPET) scanners. Pituitary gland (PG) is usually non visualised on these systems due to small volume and partial volume effect.^{1,2,3} Incidental PG uptake is very rare on cPET, thus any uptake warrants further evaluation.^{4,5,6}

Recently developed digital PET (dPET) scanners have given new dimensions to PET/CT scans. Due to solid state detectors, there is increased system sensitivity (approximately 70%), higher spatial resolution (3.7 mm) and higher image contrast.^{7,8,9}

Increased SUV signal recovery on dPET makes normal PG appear abnormal/ hot looking, which may lead to unnecessary further imaging and clinical dilemmas.¹⁰

There is only one study published and only one conference abstract in literature comparing PG uptake in dPET vs cPET.^{10,11}

Adequate knowledge of pituitary uptake on dPET will lead to correct interpretation of results and reduce additional imaging, saving radiation exposure, cost and time for healthcare system.

Objectives

To assess the frequency of high ¹⁸F-FDG uptake of normal pituitary gland on digital PET scanner and To evaluate the degree of physiological uptake and approximate SUV values of normal pituitary gland.

Methods and Materials

Retrospective, observational, cross-sectional study at SQCCRC. Muscat after Ethical approval 88 ¹⁸ F-FDG PET scans on digital PET scanner with normal PG on MRI brain and 20 controls with ¹⁸ F - FDG PET scan done on analog scanner were included.

All scans were acquired with similar and standard protocol with TOF + PSF reconstruction. (FDG dose: 2-3MBq/kg for dPET, 3.7- 5.2 MBq/kg for cPET)

Visually any focal uptake in PG was considered as positive and absence of uptake as negative.

Using a 3-point color bar in the Philips PACS system, the uptake in pituitary was graded as mild, moderate or severe. (Figure 1)

Qualitative assessment was made by measuring SUVmax and SUVmean for pituitary gland, background in the skull region and mediastinal blood pool.

The mean and standard deviation of SUV max and mean were recorded and ratio of pituitary uptake with background were calculated.

For statistical analysis Non parametric (Mann-Whitney U test) was applied to compare between digital and analog PET.

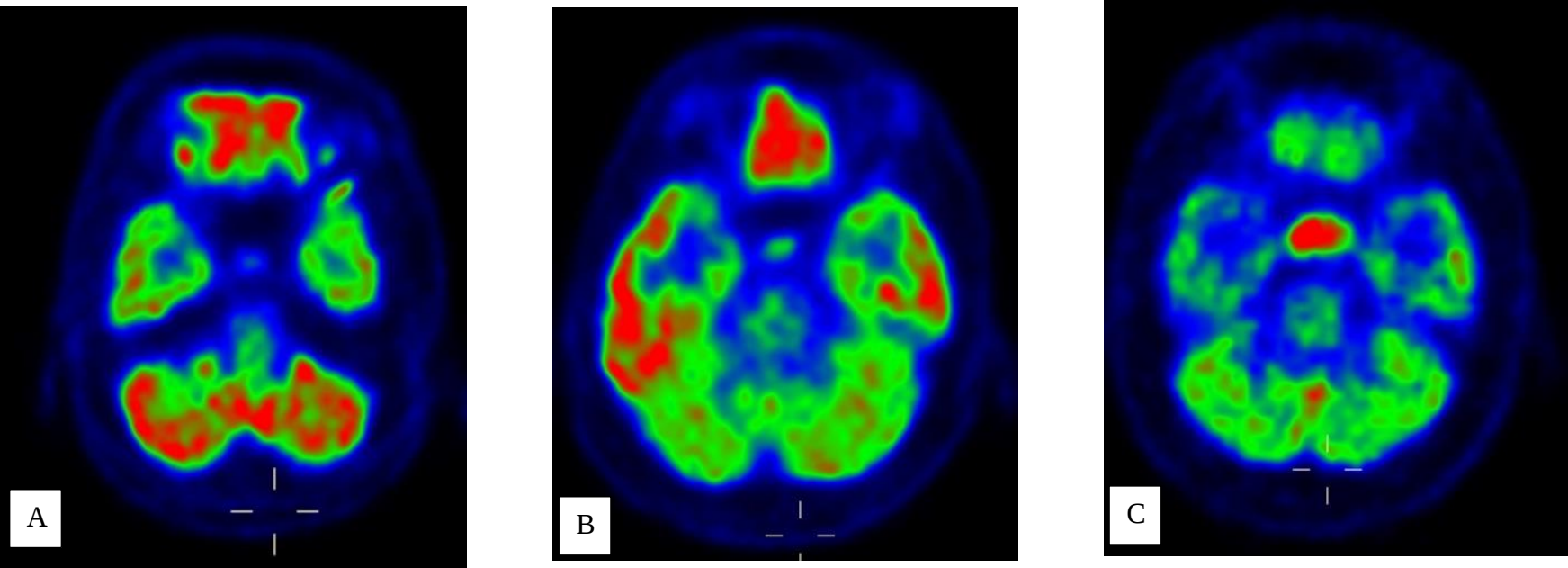


Figure 1. Grades of pituitary uptake A) Mild B) Moderate C) Severe

Conclusion

Pituitary gland uptake of ¹⁸F-FDG is commonly seen on dPET. Mild to moderate grade of uptake could be physiological with no requirement for further evaluation. These should be reported with caution. A severe grade of ¹⁸F-FDG uptake in PG should be evaluated further with an MRI brain and biochemical evaluation to exclude pituitary pathology.

Limitation: Single centre study. SUV values are based on protocol followed at our institute. It may vary in different institutions depending on reconstruction parameters and other factors.

Results

In study population of 88 patients, mean age was 54.4 years, 25 males/ 63 females, while in controls mean age was 58.1 years with 5 men and 15 women.

Among 88 patients PG uptake was seen in 43 (48.8%). In 43 patients, 31 (72%) showed mild uptake, 11 (26%) moderate and 1 (2%) showed moderate to severe uptake. None of them showed severe uptake. In the control group, 3 (15%) showed mild uptake with no moderate or severe uptake.(Table 1). The mean of SUV max in patients on dPET with focal increased pituitary gland uptake is 4.63±1.11 as compared to mean of SUV max 2.67±0.57 (p<0.001) in patients with no pituitary gland uptake.

Patients imaged with dPET presented with higher pituitary SUV max and SUV mean compared to patients imaged with cPET (3.63±1.31 vs. 2.63±0.51, p=0.0011; and 2.47±0.85vs 1.99±0.46, p=0.012 respectively (Table 2). The pituitary /background (SUV max) is higher in dPET 3.68±1.57 compared to cPET 2.85±0.74 (p=0.030), while there was no difference for pituitary/background (SUV mean) 3.91±1.56 vs 3.27±0.97 (p=0.098). (Table 2).

The pituitary/ mediastinal (SUV max and SUVmean) was not significant with P> 0.05. The Box plot of pituitary uptake, SUV ratios (SUVR) and background and mediastinal activity on conventional PET (cPET) and digital PET (dPET) is described in Figure 2.

Table 1. Visual analysis of pituitary uptake on dPET and cPET

Visual Analysis	Mean ±SD	
	Control (N=20)	Subjects (N=88)
Pituitary Uptake		
Yes	3 (15%)	43 (49%)
No	17 (85%)	45(51%)
Grade of Uptake		
No Uptake	17	45
Mild	3 (100)	31 (72%)
Moderate	0	11(26%)
Moderate to Severe	0	1(2%)

Table 2. Quantitative analysis of pituitary uptake in dPET and cPET.

Quantitative Parameter	Mean SUV±SD		P value
	Control (N=20)	Digital PET (N=88)	
Pituitary (SUVmax)	2.63±0.51	3.63±1.31	0.001
Pituitary (SUVmean)	1.99±0.46	2.47±0.85	0.012
Background (SUVmax)	0.955±0.19	1.07±0.34	0.116
Background (SUVmean)	0.63±0.13	0.67±0.20	0.376
Mediastinal (SUVmax)	2.32±0.51	2.65±0.56	0.021
Mediastinal (SUVmean)	1.78±0.38	1.95±0.42	0.114
Target to background ratio			
Pituitary /background (SUV max)	2.85±0.74	3.68±1.57	0.030
Pituitary /background (SUVmean)	3.27±0.97	3.91±1.56	0.098

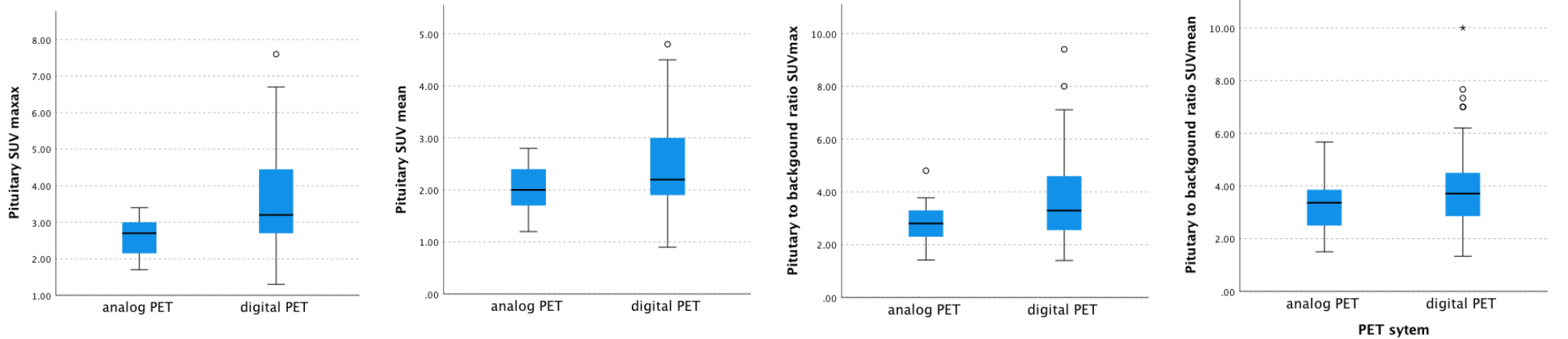


Figure 2. Figure 2.Box plot of pituitary uptake and SUV ratios (SUVR) on conventional PET (cPET) and digital PET (dPET)

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