Relationship between Fasting Blood Glucose Level and 18F-FDG PET/CT Biodistribution Quality in Patients with Cancer: How Much Should We Concern?

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Objective: *This study was performed to evaluate the relationship between the fasting blood glucose (FBG) level and 18F-FDG biodistribution quality in patients with cancer for suitable patient preparation in our institute. We also investigated the relationship between the FBG level and the standardized uptake value (SUV) of the liver and bilateral gluteal muscles.*
Material and Method: *This retrospective case-control study involved 69 patients who underwent 18F-FDG PET/computed tomography from November 2006 to February 2011. The biodistribution quality of 18F-FDG PET images was visually defined using a 5-point scoring system. Twenty-three patients with an altered biodistribution (score of 3-4) and 46 controls with an adequate biodistribution (score of 0-2) were matched for sex, age (±5 years), and lean body mass (±5 kg) (case:control = 1:2). The relationship between the FBG level and 18F-FDG biodistribution quality, the SUV of the liver and bilateral gluteal muscles, the SUV ratio of these regions and tumor positivity rate were analyzed.*
Results: *Among 69 patients (51 male, 18 female) with an FBG level of 64 to 155 mg/dL (mean, 94.67±17.78 mg/dL), there was no significant difference in the FBG level between those with an adequate versus altered biodistribution (mean, 96.00 ±16.76 and 95.65±14.75 mg/dL, respectively; p = 0.74). The biodistribution quality of 18F-FDG was not significantly correlated with the serum glucose level using cut-off levels of 120, 130, and 150 mg/dL (p = 1.00, 1.00, and 0.55, respectively). There was no significant correlation between the FBG level and SUV of the liver or bilateral gluteal muscles. No significant correlation between the tumor positivity rate and any blood sugar cut-off level (p = 0.100-1.000), or biodistribution quality (p = 0.205) was found.*
Conclusion: *18F-FDG PET can be performed when the FBG level is ≤155 mg/dL without a significantly altered biodistribution. Moreover, no significant correlation between the tumor detection rate and either FBG level or biodistribution quality was observed.*

Keywords: *18F-FDG, PET/CT, blood glucose level, hyperglycemia, biodistribution quality*

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Acute hyperglycemia is an important factor associated with both decreased 18F-fluorodeoxy glucose (18F-FDG) uptake by malignant tumor cells and enhanced uptake by muscle tissue. Although some authors have suggested controlling the serum glucose level to minimize competition of tumoral 18F-FDG uptake by these tissues[1-7], the effect of hyperglycemia on 18F-FDG positron emission tomography (PET) and the optimum blood glucose level remain controversial[8-10].

According to our facility's protocol for 18F-FDG PET/computed tomography (CT) oncologic imaging, we always postpone the PET/CT scan if the patient's fasting blood glucose (FBG) level is >200 mg/dL as suggested by the guidelines of the Society of Nuclear Medicine (SNM)[11] and European Association of Nuclear Medicine (EANM)[12] to avoid altered biodistribution on PET images, which may cause misinterpretation (i.e., false-negative diagnosis of malignant lesions). Some studies have also reported

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images with altered biodistribution in patients with an FBG level of >150 mg/dL[13,14], and careful interpretation in this setting should also be considered. However, practice guidelines for patients with an FBG level of 150 to 200 mg/dL are unclear. Several societies have proposed different guidelines on suitable FBG levels for performing 18F-FDG PET ranging from 120 to ≤200 mg/dL[11,12,15,16]. These guidelines are based on data from Western countries, where patient characteristics may differ from those of Asian populations. Furthermore, previous studies did not control for other confounding factors affecting the biodistribution quality, such as body size or insulin use. Moreover, results from previous studies regarding the effect of hyperglycemia on 18F-FDG PET are inconsistent[1-10].

In this study, we evaluated the correlation between the FBG level and 18F-FDG biodistribution quality, SUV of the liver and bilateral gluteal muscles, and SUV liver-to-muscle ratio. We also assessed the effect of the FBG level and biodistribution quality on the accuracy of 18F-FDG PET. The results from this study will be considered for suitable patient preparation in our institute.

Material and Method

This was a retrospective case-control study. Patients with cancer who underwent 18F-FDG PET/CT from November 2006 to February 2011 at Siriraj Hospital were eligible for inclusion. The exclusion criteria were a diagnosis of cancer that was not pathologically confirmed, lack of following preparation instructions before performing the scan, the presence of 18F-FDG–avid lesions in the liver and gluteus, absence of FBG data, 18F-FDG activity outside the range of 0.14 to 0.20 mCi/kg, postinjection uptake time beyond 60±10 min, a study acquisition protocol that did not follow our institute's imaging protocol, and age of <18 years. The maximum intensity projection PET images of 359 eligible patients were retrospectively reviewed by two experienced nuclear medicine physicians who were blinded to the clinical information and serum glucose levels. The images were scored from 0 to 4 points in terms of their biodistribution quality according to a previous study by Roy et al[17]: 0 = normal biodistribution, 1 = mild muscular uptake, 2 = muscular uptake involving more than one muscle group, 3 = diffuse muscular uptake of moderate intensity, and 4 = diffuse, intense muscular uptake. The images were then categorized into case and control groups; those showing adequate biodistribution (score of 0-2) were assigned to the control group, and those showing an altered biodistribution (score of 3-4) were assigned to the case group (Fig. 1). The sample size was calculated using the prevalence of patients with an altered biodistribution (score of 3-4 and interval decreased FBS level post insulin administration of 7.6 ±1.8 mmol/L or 136.8±32.4 mg/dL) and adequate biodistribution (score of 0-2 and interval decreased FBS level post insulin administration of 5.3±2.6 mmol/L or 95.4±46.8 mg/dL) from the same study[17] using a p value of 0.05 and power of 80%. Thus, the calculated sample size for the case group was 22, and we established a case:control ratio of 1:2. Therefore, the required total sample size of this study was 66 patients. After identifying patients with an altered biodistribution (case group), we enrolled consecutive patients with adequate biodistribution (control group) and matched them to the case group in terms of sex, age (±5 years), and lean body mass (±5 kg) until the calculated sample size was reached.

All patients ingested a low-carbohydrate diet for 24 hours and fasted for at least 6 hours prior to the examination as recommended by SNM and EANM guidelines[11,12]. The fingerstick FBG level was tested using glucose meter (Stat Strip®, Nova Biomedical, Waltham, USA) just before 18F-FDG administration. 18F-FDG equivalent to an activity level of 0.14 to 0.2 mCi/kg body weight was intravenously injected. The patients stayed in the uptake room for about 60 min after injection, and PET/CT images were then obtained using a Discovery STE PET/CT scanner (GE Healthcare, Milwaukee, WI, USA). All images passed the standard quality control. Low-dose CT with or without contrast medium administration was performed from the skull base/vertex to the mid-thigh/toe. Three-dimensional PET images of the same region were then acquired for 3 min per bed position during normal breathing. The PET data were reconstructed using a 128×128 matrix size, ordered-subset expectation maximization algorithm (2 iterations, 20 subsets) with a 4.29-mm full-width-at-half-maximum Gaussian filter, and CT attenuation correction.

Visual analysis of the maximum intensity projection PET image using an AW workstation (GE Healthcare) and scoring were performed, and consensus was reached in every case by two nuclear medicine physicians. One experienced technician then performed quantitative analysis by placing the volume of interest (VOI) on the axial views in the same position three times. The SUV of the right liver lobe was measured using three 42.16-cm3 circular VOIs, and

the SUV of the bilateral gluteal muscles was measured using three 11.03-cm3 circular VOIs (Fig. 2). The average SUV from these three VOIs of each organ were used for statistical analysis. When a primary or metastatic tumor was identified, the tumor SUV was also recorded.

Statistical analysis

All data were analyzed using the statistical software package PASW Statistics for Windows, Version 18.0 (SPSS Inc., Chicago, IL, USA). The average FBG level and SUV between the case and control groups were compared using an unpaired Student's t-test. A receiver operating characteristic (ROC) curve was also generated to evaluate the correlation between the FBG level and biodistribution quality. Correlations between different FBG cut-offs and biodistribution quality and also tumor positivity rate were assessed using a chi-squared test or Fisher's exact test. Correlations between the biodistribution quality and SUV were evaluated using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

Results

Of 359 patients who met the study criteria, 30 patients' PET images showed an altered biodistribution (score of 3, n = 30; score of 4, n = 0). Seven of these patients were excluded from the study because they were aged <18 years (n = 3; FBG level of 80, 84, and 87 mg/dL, respectively), they had no match in the control group because of extremely old age (n = 2; FBG level of 78 and 85 mg/dL, respectively), they had a very low body mass (n = 1; FBG level of 97 mg/dL), or their uptake time was longer than 60±10 min (n = 1; FBG level of 110 mg/dL). Thus, 23 patients with an altered biodistribution were assigned to the case group. Of the remaining 336 patients with an adequate biodistribution, 46 patients matched with the case group for sex, age (±5 years), and lean body mass (±5 kg) and were randomly selected for inclusion in the control group (case:control = 1:2).

The patients' ages ranged from 24 to 79 years, and their lean body mass ranged from 33.33 to 62.91 kg. Because sex, age, and lean body mass matching were prespecified, similar baseline characteristics were observed between the patients in the case and control groups; i.e., the sex ratio, mean age, mean lean body mass, and history of diabetes (Table 1). The most common primary cancer in this study was colorectal cancer, followed by lung cancer, lymphoma, nasopharyngeal, esophageal, and other cancers. There was no significant difference in cancer types between the case and control groups ($p = 0.269$), as shown in Table 2.

Relationship between biodistribution quality and serum glucose level

There was no significant difference in the glucose level between the case and control groups ($p = 0.74$) (Table 3). There was also no significant correlation between the biodistribution quality and FBG level using either a 120, 130, or 150 mg/dL cut-off level ($p = 1.00$, 1.00, and 0.55, respectively) (Table 4) However, the statistical significance analysis may be limited due to small sample size, especially in high FBG subgroups. The correlations between the FBG level and SUV of the liver and gluteus muscles and the liver-to-gluteus SUV ratio were also not statistically significant, as shown in Fig. 3.

Correlation between biodistribution score and SUV

The correlation between the biodistribution score and SUV of the right liver lobe and bilateral gluteus areas, including their ratio, was analyzed using Pearson's correlation coefficient. We found a strong correlation between the biodistribution score and all SUVs of the gluteus muscles and liver-to-muscle SUV ratio. Therefore, simple visual assessment using the biodistribution score can be used to evaluate muscular uptake and determine the biodistribution quality of 18F-FDG images. However, no statistically significant correlation between the biodistribution score and SUV of the liver was detected (Table 5). Similar results were obtained when the SUV was corrected for either body weight or lean body mass.

Correlation between biodistribution quality of 18F-FDG images and other factors

Other possible factors that may affect the biodistribution quality, such as the activity of injected 18F-FDG and uptake time, were also evaluated. We found no significant difference in these factors between the case and control groups. The mean activity of 18F-FDG in the case and control groups was 12.63± 1.65 mCi (range, 8.37-15.47 mCi) and 12.27±2.17 mCi (range, 7.49-16.40 mCi), respectively ($p = 0.49$). The average postinjection uptake time in the case and control groups was 58±0.03 and 60±0.1 min, respectively ($p = 0.50$).

Correlation between biodistribution quality of 18F-FDG images and diagnostic accuracy

Fifty-two of 69 patients (75.4%) showed an average of 2 positive lesions on 18F-FDG images with a mean maximum SUV (SUVmax) of 13.16 (standard deviation [SD], 11.87). In the altered biodistribution group, the mean SUVmax was 15.98 (SD, 14.50), which was not significantly different from that in the adequate biodistribution group (SUVmax, 9.27; SD, 5.29; $p = 0.122$). There was no significant correlation between the positivity rate and cancer type ($p = 0.429$) or FBG level using a cut-off of either 100 mg/dL ($p = 0.409$), 120 mg/mL ($p = 0.622$), 130 mg/dL ($p = 0.100$), or 150 mg/dL ($p = 1.000$). The positivity rate in patients with an altered biodistribution is surprisingly higher (13/23, 56.5%) but not significantly different from that of patients with an adequate biodistribution (18/46, 39.1%) ($p = 0.205$). All of these positive FDG PET/CT lesions were histopathologically confirmed to be malignant (23/52, 44.2%) or progressive lesions based on clinical and/or radiological follow-up (29/52, 55.8%). During a minimum 18-month follow-up after the PET/CT study, there was no evidence of tumor recurrence or progression in the remaining 17 patients with negative 18F-FDG PET/CT results; true negative results were thus assumed.

Discussion

Competitive uptake of FDG versus blood glucose by tumor cells via the glucose transporter together with hyperinsulinemia stimulated by a high plasma glucose level may enhance FDG uptake in muscle cells and decrease 18F-FDG uptake by tumor cells. This may result in a poor tumor-to-background ratio and lower both the interpretation confidence and tumor detection rate[1-7,18-20]. However, the correlation between hyperglycemia and biodistribution quality as well as diagnostic accuracy of PET studies remains inconclusive.

When the FBG level did not exceed 155 mg/dL in the present study, there was no significant effect on the biodistribution quality of 18F-FDG using both qualitative and quantitative evaluation. This result is similar to that in a recent study by Belohlavec and Jaruskova[8]. In their study, no significant difference was found in the muscle-to-liver ratio, muscle SUV, or frequency of positive PET findings among patients with an FBG level of ≤4.7, 5.6 to 7.0, and >11 mmol/L. However, patients with hyperglycemia showed a 10% higher liver SUV than the other subgroups.

The SNM guidelines for PET/CT[11] recommended postponing the 18F-FDG PET scan if the blood glucose level is >150 to 200 mg/dL, while the EANM guidelines listed a variety of suitable FBG cut-off levels. The 2003 EANM guidelines recommended that a suitable FBG level should be <130 mg/dL and that the study should be postponed when the patient's FBG level exceeds 200 mg/dL[12]. The revised 2009 EANM guidelines[15] recommended a lower suitable FBG cut-off level of <120 mg/dL and postponement of the PET study if the patient's FBG was higher than this level. However, this strict cut-off might not be practical for routine service. Because of the recent evidence that fasting hyperglycemia does not hamper the clinical value of FDG PET[8,9], the latest EANM guidelines in 2015 suggest two suitable fasting plasma glucose cut-off levels: <11 mmol/L (about 200 mg/dL) for clinical studies and 7.0 to 8.3 mmol/L (126–150 mg/dL) for research studies[16].

In this study, we also evaluated the relationship between the biodistribution quality and different FBG cut-off levels as previously recommended by the SNM and EANM guidelines. We found no significant correlation between any of the suggested FBG levels and the biodistribution quality using a cut-off level of either 120, 130, or 150 mg/dL. A previous study by Roy et al[17] mentioned that a high FBG level could result in decreased accumulation of 18F-FDG in the liver and the muscles. Another study by Büsing et al[10] reported that changes in the blood glucose and insulin levels affect the FDG biodistribution in muscle tissue, although tumor uptake was not significantly impaired. However, these findings might influence tumor detection; another study found that hyperglycemia resulted in an 11% false-negative rate of cancer detection[19]. We found no statistically significant correlation between the FBG level and either the SUV of the liver or gluteus muscles or the liver-to-muscle SUV ratio. The mean FBG level of patients in some previous studies was higher than that in our study, and enhanced FDG uptake by muscle might be due to the effect of insulin administration[10,20-22]. One of these studies found that the ratio of FDG uptake contrast between the tumor and muscle tissues was lower during hyperinsulinemic clamping, resulting in a change in the imaging contrast. This was explained by the fact that insulin increases intracellular glucose uptake through activation of the glucose transporter and enzymes involved in glycolysis, which affects the muscle tissue more than the tumor and is consistent with different insulin sensitivities between muscle and

Table 1. Characteristics of patients in altered and adequate biodistribution groups

	Altered biodistribution (case group) n = 23	Adequate biodistribution (control group) n = 46
Sex Male	17 (73.9)	34 (73.9)
Female	6 (26.1)	12 (26.1)
Age (years)	53±12.3	54±12.2
Lean body mass (kg)	48.41±7.20	48.27±6.50
Body weight (kg)	60.60±10.38	61.17±9.36
Body surface area (m2)	1.67±0.16	1.67±0.15
Body mass index (kg/m2)	21.77±3.66	22.59±3.17
FBG (mg/dL)	95.65±14.75	96.00±16.76
18F-FDG (mCi)	12.63±1.65	12.27±2.17
Postinjection uptake time (min)	58±0.03	60±0.10
History of diabetes	10 (43.5)	19 (41.3)

Data are presented as n (%) or mean±standard deviation.
FBG, fasting blood glucose; 18F-FDG, 18F-fluorodeoxyglucose

Table 2. Primary cancer types in all patients and in each group with respect to biodistribution quality

Cancer type	Altered biodistribution (n = 23)	Adequate biodistribution (n = 46)	Total patients (n = 69)
Colorectal cancer	4 (17.4)	14 (30.4)	18 (29.0)
Lung cancer	6 (26.1)	12 (26.1)	18 (25.0)
Lymphoma	6 (26.1)	4 (8.7)	10 (17.0)
Nasopharyngeal cancer	1 (4.3)	4 (8.7)	5 (6.0)
Esophageal cancer	2 (8.7)	1 (2.2)	3 (4.0)
Others*	4 (17.4)	11 (23.9)	15 (19.0)

Data are presented as n (%)
*Adrenal, bladder, cervical, endometrial, gastric, laryngeal, liver, melanoma, renal, thyroid, and trophoblastic cancers

Table 3. Correlation between fasting blood glucose level and biodistribution quality

Biodistribution quality	Patients (n)	Fasting blood glucose level (mg/dL)	*p*-value
Altered	23	95.65±14.75 (78-140)	0.74
Adequate	46	96.00±16.76 (64-155)	

Data are presented as mean±standard deviation (range)

Table 4. Correlation between biodistribution quality and fasting blood glucose using different cut-off levels

Fasting blood glucose (mg/dL)	Altered biodistribution (n = 23)	Adequate biodistribution (n = 46)	*p*-value*
<120	22 (95.7)	43 (93.5)	1.00
≥120	1 (4.3)	3 (6.5)	
<130	22 (95.7)	44 (95.7)	1.00
≥130	1 (4.3)	2 (4.3)	
<150	23 (100.0)	44 (95.7)	0.55
≥150	0 (0.0)	2 (4.3)	

Data are presented as n (%)
*Fisher's exact test

Table 5. Correlation between biodistribution score and liver SUV, bilateral gluteal SUV, and liver-to-gluteus SUV ratio

Site		SUV	Pearson correlation	*p*-value
Liver	$SUVmax_{LBM}$	2.49±0.37	0.05	0.67
	$SUVmean^{LBM}$	1.86±0.31	0.07	0.56
	$SUVmax_{BW}$	3.13±0.57	-0.03	0.83
	$SUVmean_{BW}$	2.32±0.40	0.04	0.78
Gluteal muscles	$SUVmax_{LBM}$	0.74±0.13	0.42	0.00
	$SUVmean_{LBM}$	0.83±2.55	0.44	0.00
	$SUVmax_{BW}$	0.92±0.19	0.33	0.005
	$SUVmean_{BW}$	0.99±2.91	0.35	0.003
SUV ratio (SUVliver: SUVgluteus)				
	$SUVmax_{LBM}$	3.41±0.54	-0.43	0.00
	$SUVmean_{LBM}$	3.53±0.69	-0.37	0.002
	$SUVmax_{BW}$	3.53±1.15	-0.40	0.001
	$SUVmean_{BW}$	3.59±0.74	-0.31	0.009

SUV is given as mean±standard deviation
SUV, standardized uptake value; SUVmaxLBM, maximum SUV corrected by lean body mass; SUV maxBW, mean SUV corrected by body weight; SUVmeanLBM, mean SUV corrected by lean body mass; SUVmeanBW, mean SUV corrected by body weight

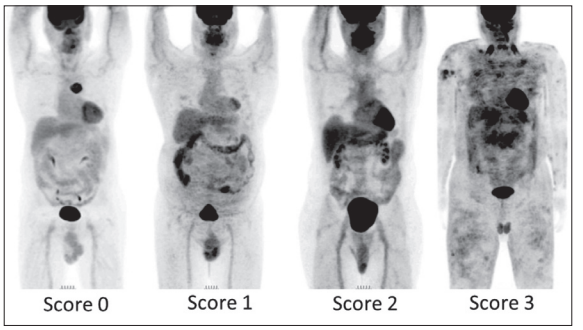

Fig. 1 Maximum intensity projection images of 18F-FDG PET/CT show the adequate biodistribution group (score of 0-2) and the altered biodistribution group (score of 3). No images had a score of 4 because none of our patients showed intense muscular uptake.

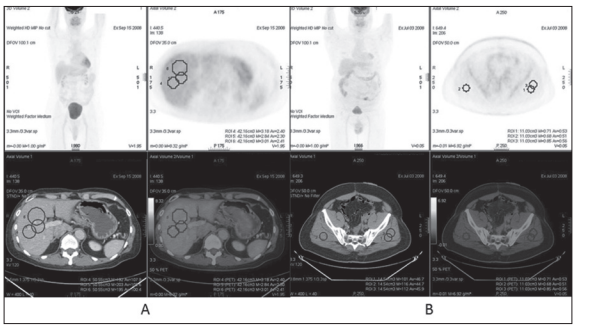

Fig. 2 Quantitative assessment using the average of three SUVmax and SUVmean values from three circular 42.16-cm3 VOIs centered on the middle region of a transverse slice of the right liver lobe (A) and the average of three SUVmax and SUVmean values from three circular 11.03-cm3 VOIs on the bilateral gluteal muscles (B).

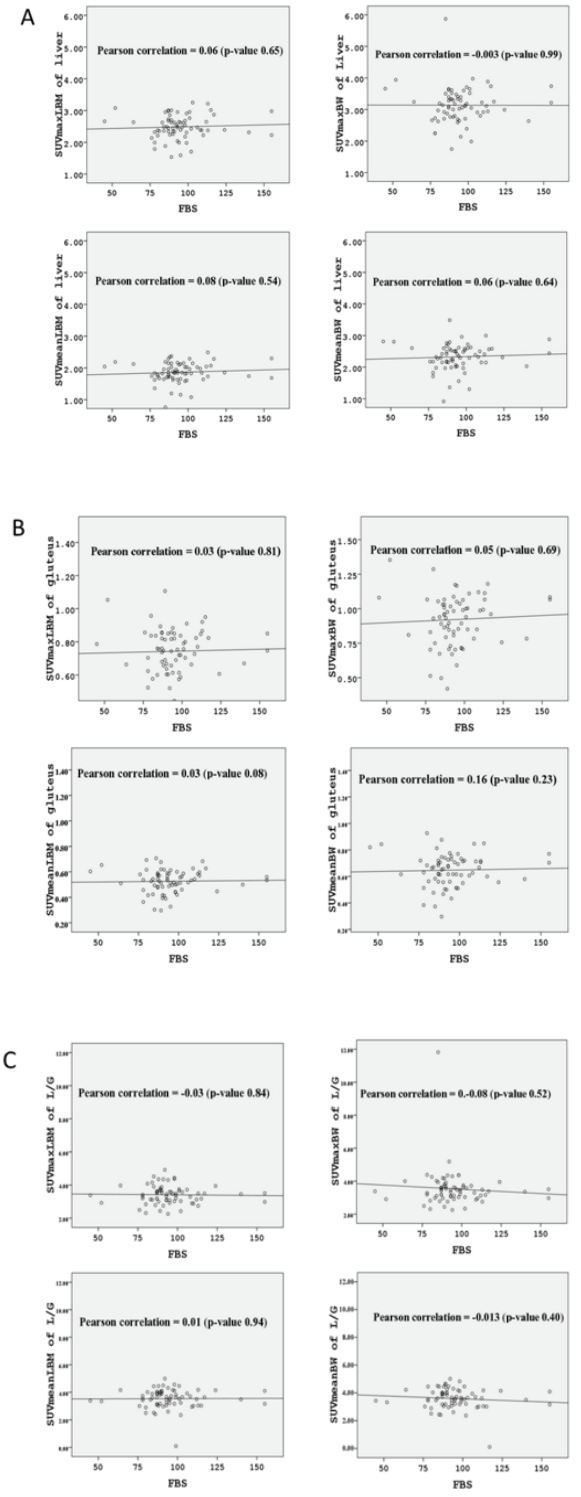

Fig. 3 Relationship between FBG level and liver SUV (A), gluteal muscle SUV (B), and liver-to-gluteus SUV ratio (C).

tumor tissues[21]. This negative effect of insulin on the biodistribution quality may be avoidable by delayed injection of FDG after insulin administration[6,22]. Furthermore, other confounding factors that might affect the biodistribution quality could contribute to these different results, such as the larger body size of Western than Asian patients. One study found that obesity (body mass index of >25 kg/m2) decreased the FDG uptake in several healthy organs by up to 30%, but did not significantly influence tumoral uptake[10]. In the present study, factors including the activity of administered FDG, uptake time, PET/CT equipment, and imaging technique were controlled by our institute's protocol, and all of these factors as well as the patients' body size were similar in both groups. Therefore, we assume a minimal confounding effect of these factors.

There was a strong correlation between the biodistribution score and SUV in muscles as well as between the biodistribution score and liver-to-muscle SUV ratio. These findings indicate that simple visual assessment using the biodistribution score can be applied in routine practice instead of the more complicated quantitative assessment to evaluate the biodistribution quality. Similar results were reported in a previous study by Zasadny and Wahl[23].

Nonetheless, this study had some limitations. First, this was a retrospective study; therefore, uncontrolled factors such as paravenous leakage and different imaging acquisition techniques might have affected the results. Although we instructed all patients to rest during the postinjection uptake period, the preinjection level of muscular activity could not be controlled. Second, because our facility's protocol suggested rescheduling the scan when the patient's FBG level was >200 mg/dL, none of the patients in our study had an FBG level of >200 mg/dL. The maximum FBG level in our study was 155 mg/dL; only 6.5% and 4.3% of patients had an FBG level of >120 and >150 mg/dL, respectively. This also might have affected the statistical analysis. Third, although our study showed no significant difference in either the positive tumor detection rate or the SUV between the adequate and altered biodistribution groups or among the different FBG cut-off levels, there were still 17 patients who underwent PET/CT scans for surveillance or detection of tumor recurrence and showed negative results. Thus, their tumor uptake could not be assessed. None of these 17 patients showed tumor recurrence during the 18-month follow-up period, and we

therefore assume that there were no false-negative PET/CT results. These findings are similar to those in a recent report by Webb et al[24], although we did not find a significant effect of the FBG level on liver uptake, as shown in their study.

Conclusion

There was no significant correlation between the FBG level and biodistribution quality or the SUV of the liver and gluteus muscles when the FBG level did not exceed 155 mg/dL. Moreover, there was no significant correlation between the tumor detection rate and either the FBG level or biodistribution quality. However, the clinical impact of fasting hyperglycemia higher than this level on both the biodistribution quality and tumor detection may requires further consideration.

What is already known on this topic?

Acute hyperglycemia is an important factor associated with both decreased 18F-FDG uptake by malignant tumor cells and enhanced uptake by muscle tissue. However, the effect of hyperglycemia on 18F-FDG PET and the optimum blood glucose level remain controversial. Several societies have proposed different guidelines on suitable FBG levels for performing 18F-FDG PET based on data from Western countries, where patient characteristics may differ from those of Asian populations. Furthermore, previous studies did not control for other confounding factors affecting the biodistribution quality, such as body size or insulin use.

What this study adds?

Since there was no significant negative effect of FBG level on biodistribution quality, the SUV of the liver and gluteus muscles and tumor detection rate, patients whose FBG level do not exceed 155 mg/dL can be appropriately performed 18F-FDG PET. This practical issue is helpful for nuclear medicine clinicians, radiologists, and oncologists in preventing unnecessary postponing of F-18 FDG study in moderate hyperglycemic patients, to reduce delayed patient management and cost of unused radiotracer.

Disclosure statement

The authors have nothing to disclose.

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Potential conflicts of interest

None.

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ความสัมพันธ์ของระดับน้ำตาลในเลือดต่อคุณภาพการกระจายของสารเภสัชรังสี 18F-FDG ในร่างกายจากการตรวจสอบเพทซีทีสแกนในผู้ป่วยมะเร็ง: เราควรกังวลเพียงใด?

ธัญญลักษณ์ เธียรธัญญกิจ, นันทพร วงศ์สุรวัฒน์, ชมพูนุช หาญนันทวิวัฒน์, อัครินทร์ นิมมานนิตย์

วัตถุประสงค์: *เพื่อศึกษาความสัมพันธ์ของระดับน้ำตาลในเลือดต่อคุณภาพการกระจายตัวของ 18F-FDG จากการตรวจเพทซีทีสแกน ของผู้ป่วยมะเร็งเพื่อนำผลการศึกษามาพัฒนาแนวทางในการเตรียมผู้ป่วยก่อนตรวจ และศึกษาความสัมพันธ์ของระดับน้ำตาลในเลือดต่อค่า standardized uptake value (SUV) บริเวณตับและกล้ามเนื้อ Gluteus*

วัสดุและวิธีการ: *ทำการศึกษาย้อนหลังแบบ Case-control ในผู้ป่วยมะเร็งจำนวน 69 คนที่มารับการตรวจเพทสแกนด้วย 18F-FDGตั้งแต่เดือนพฤศจิกายน พ.ศ. 2549 ถึงเดือนกุมภาพันธ์ พ.ศ.2554 โดยให้คะแนนคุณภาพการกระจายตัวของ 18F-FDG เป็น 5 ระดับจากการประเมินด้วยตา มีผู้ป่วย 23 รายอยู่ในกลุ่มที่มีคุณภาพการกระจายตัวของสารเภสัชรังสีที่ไม่ดี (คะแนน 3-4) และสุ่มผู้ป่วยกลุ่มควบคุมจำนวน 46 รายที่มีคุณภาพการกระจายตัวของสารเภสัชรังสีที่ดี (คะแนน 0-2) จับคู่โดยอาศัยเพศ, อายุ (±5 ปี) และ lean body mass (±5 กิโลกรัม) (อัตราส่วนกลุ่มศึกษาและกลุ่มควบคุมเท่ากับ 1 ต่อ 2) นำมาศึกษาความสัมพันธ์ผลของระดับน้ำตาลต่อคุณภาพการกระจายตัวของสารเภสัชรังสี, ค่า SUV บริเวณตับและกล้ามเนื้อ Gluteus, สัดส่วนของค่า SUV ในบริเวณดังกล่าวรวมถึงอัตราการตรวจพบรอยโรคมะเร็งจากภาพการตรวจ*

ผลการศึกษา: *จากผู้ป่วย 69 ราย (ชาย 51 ราย หญิง 18 ราย) ที่มีค่าระดับน้ำตาล 64 ถึง 155 มก./ดล. (ค่าเฉลี่ย 94.67±17.78 มก./ดล.) ไม่พบความแตกต่างอย่างมีนัยสำคัญของค่าเฉลี่ยระดับน้ำตาลระหว่างกลุ่มที่มีคุณภาพการกระจายตัวของ 18F-FDG ที่ดีและกลุ่มที่คุณภาพการกระจายตัว ไม่ดี (เฉลี่ย 96.00±16.76 มก./ดล.และ 95.65±14.75 มก./ดล. ตามลำดับ; p-value = 0.74) และไม่พบความสัมพันธ์ระหว่างคุณภาพการกระจายตัวของ 18F-FDG กับระดับน้ำตาลในเลือดไม่ว่าจะใช้ค่า cut-off เท่ากับ 120, 130 และ 150 มก./ดล. (p-value เท่ากับ 1.00, 1.00 และ 0.55 ตามลำดับ) ไม่พบความสัมพันธ์ของระดับน้ำตาลต่อค่า SUV บริเวณตับและกล้ามเนื้อ Gluteus รวมทั้งไม่พบว่าอัตราการตรวจพบรอยโรคมะเร็งมีความสัมพันธ์อย่างมีนัยสำคัญกับค่า cut-off ของระดับน้ำตาล (p = 0.100-1.000) หรือคุณภาพการกระจายตัวของ 18F-FDG (p = 0.205)*

สรุป: *การตรวจ 18F-FDG เพทสแกนสามารถทำได้เมื่อผู้ป่วยมีระดับน้ำตาลไม่เกิน 155 มก./ดล. โดยไม่ส่งผลต่อคุณภาพการกระจายตัวของ 18F-FDG ในร่างกายอย่างมีนัยสำคัญ นอกจากนี้ยังไม่พบความสัมพันธ์ระหว่างอัตราการตรวจพบรอยโรคมะเร็งกับระดับน้ำตาลหรือแม้แต่คุณภาพการกระจายตัวของ 18F-FDG*