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FDG PET/CT Findings in GYN Cancer Patients and Clinical Impact on Patient's Management

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Abstract

Background: Imaging modalities including computed tomography (CT) scan, magnetic resonance imaging (MRI) and positron emission tomography (PET) are important diagnostic tools in gynecological malignancies. Clinicians usually underestimate PET scan in diagnostic approaches for gynecology cancer patients. In this study, PET scan results are compared with MRI and CT scan for restaging of gynecological malignancies to evaluate possible changes in treatment strategy. Materials and methods: In this cross-sectional study, 365 cases referred to a training hospital in Tehran-Iran between 2014 and 2017 for restaging of gynecological cancers including ovarian, cervical and uterine cancers were enrolled. The results of PET scan were compared with MRI and CT scan for added value of PET scan over CT scan or MRI to demonstrate evidence of under or over diagnosed new, residual or recurrent disease. Results: The CT scan and MRI results demonstrated positive findings in 45.5% and were unremarkable in 9.6% of patients. Applicability of PET scan for increasing the diagnostic accuracy for detection of peritoneal seeding (P=0.0001), lung metastasis (P=0.001), abdominal metastasis (P=0.0001), abdominal lymphadenopathy (P=0.0001), mediastinal/hilar lymphadenopathy (P=0.005), and local recurrence (P=0.028) were significant. For ovarian, cervical, endocervical and uterine cancers; there was diagnostic usefulness of 93.5%, 89.8%, 85.2%, and 82.2%, respectively. Conclusion: According to our study PET scan is an adjunctive diagnostic tool, helpful for restaging of gynecological malignancies more specifically in cases with peritoneal seeding, lung and abdominal metastases, mediastinal/hilar and abdominal lymphadenopathies and local recurrence. The applicability of PET scan is higher in ovarian and cervical malignancies.

Keywords: PET Scan, Gynecological Cancers, Imaging Modalities, Treatment Strategy, Metastases.

Introduction

Gynecological cancers affecting different part of female reproductive system are among common cancers in female subjects, worldwide. Imaging modalities are important part of diagnostic approaches including Positron emission tomography (PET) and computerized tomography (CT) (Matthews et al., 2011; Maisey, 2004). Hence combination of metabolic data obtained from PET with anatomical data by CT would develop a more complete clinical pattern and would help more definite localization of the tumor detected in either PET or CT scan (Matthews et al., 2011; Maisey, 2004; Hany et al., 2002). Three-dimensional imaging with PET scan would develop valuable data about biological activity of tumors (Burger et al., 2002; Meyer and Wahl, 2009; Sachelarie et al., 2005). FDG-PET has better role in distinction between benign and malignant lesions and may be used from Skull-base to mid-thigh; but CT with contrast may only be used in a smaller regions of the body at once (von Schulthess et al., 2006). Combined use of FDG-PET and CT scan would develop valuable data in different tumors including lung, colorectal, head and neck, and lymphatic cancers (Meyer and Wahl, 2009).

Among gynecological cancers, the ovarian malignancies have high mortality rate (Lurie et al., 2007; Morris et al., 2008). This multi-factorial malignancy is the sixth most common cancer among females worldwide and in the ninth order in Iran (Siegel R, Naishadham D, Jemal, 2012; Siegel et al., 2011; Myers et al., 2007; Kjaerbye-Thygesen et al., 2005; Wisner et al., 2015). Cervical cancer is the second most common gynecological cancer and sixth fatal cancer worldwide with mortality in half of affected cases (Bergmark et al., 2002; Ercoli et al., 2009; Hoai and Victoria, 2001). Curability with surgical, chemotherapy, and radiotherapy approaches and presence of screening methods has led to more clinical focus on cervical cancer (Hoai and Victoria, 2001; Devita, 2005; Pierluigi et al., 2002; Green et al., 2001).

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In all these cancers, staging would be beneficial to select best therapeutic approaches. Staging would determine the local or remote extension of the tumor. PET/CT imaging is faster and more definite for staging in comparison with other imaging modalities such as CT scan or MRI. In this study the results of PET scan are compared with MRI and CT scan findings in restaging of cases with gynecological cancers to evaluate possible change in their treatment strategy.

Materials and Methods

The gynecological cancers are typically characterized by increased glucose metabolism and therefore present with increased FDG uptake, where as benign tumors are usually negative on PET but common pitfalls include normal ovaries, normal endometrium, bowel loops bladder diverticula and pelvic kidney.

In this cross-sectional diagnostic study, 365 consecutive cases referred to a training hospital in Tehran-Iran since 2014 to 2017 for restaging gynecological cancers including ovarian, cervical and uterine cancers. Inclusion criteria were the age older than 18 years, known or newly proven cases of gynecological malignancy, raising tumor markers such as CA-125, and availability of CT/MRI and PET scan results. The exclusion criteria were pregnancy/breastfeeding, losing follow-up, simultaneous dual cancers, undetermined or equivocal PET results and unavailability of MRI/CT scan results.

Totally 57 cases were excluded due to at least one exclusion criteria including 28 cases with ovarian, 12 cases with cervical, 10 cases with uterine and 7 cases with endometrial cancers.

As shown in Figure-1 there were 49, 54, 56, and 217 cases with cervical, endocervical, uterine, and ovarian cancers, respectively .This figure also shows the percentage of cases based on their referral reason and cancer type.

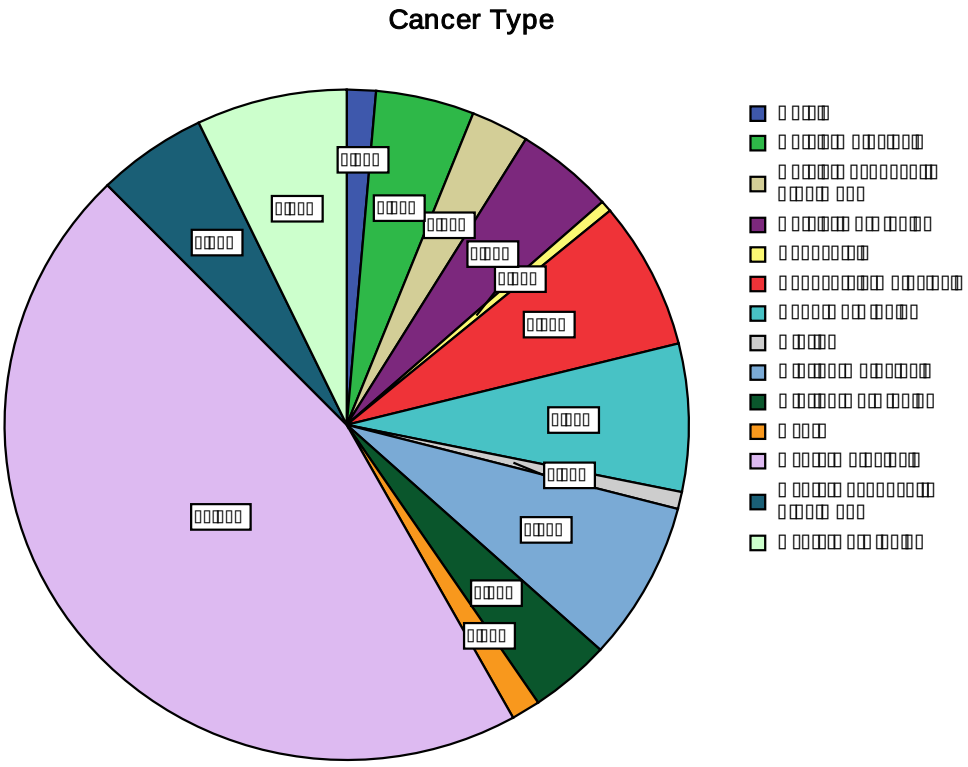

Fig. 1: Cancer type demography and reason for referral

The pathological and imaging modality results for the patients were extracted from existing medical records. All CT and MRI results had been reported by two expert radiologists and the PET results had been reported by two expert nuclear medicine specialists. There has been close collaboration between the diagnosticians. The results of PET scan were compared with MRI and CT scan in search for added

value of PET scan over CT scan or MRI to demonstrate evidence of under or over diagnosed new, residual or recurrent disease. The study was approved by the institutional review board (IRB).

Data analysis was performed by SPSS version 18.0. There were only categorical data, reported as frequency and percent for each variable. We used Chi-Square test and the P values less than 0.05 was considered statistically significant.

Results

As shown in Figure-2 In PET scan the peritoneal seeding, local invasion, bone metastasis, lung metastasis, abdominal metastasis, abdominal lymphadenopathy, mediastinal/hilar lymphadenopathy, neck lymphadenopathy, and local recurrence were seen in 37%, 45%, 4.9%, 14.8%, 14.2%, 45.8%, 7.1%, 0.5%, and 20%, respectively. Overall the CT scan and MRI result demonstrated positive findings in 45.5% and were unremarkable in 9.6% of patients.

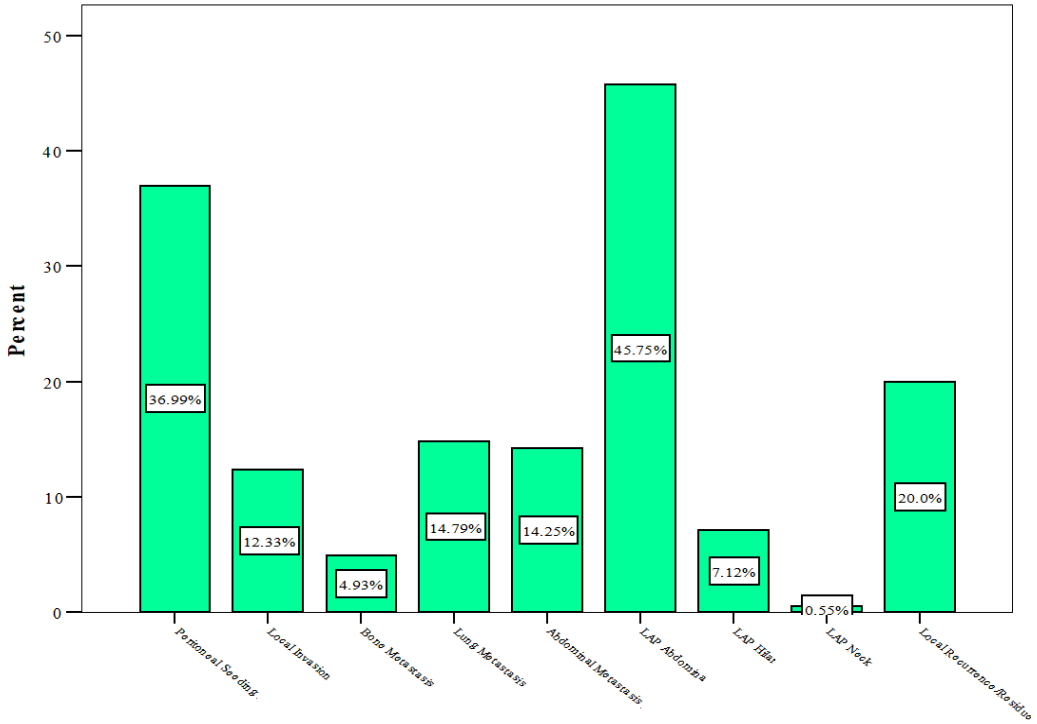

Fig. 2: percentage of PET scan findings in all Gynecologies malignancies.

figure 3 shows the percentage of PET scan finding in patients with positive and negative imaging (CT scan and MRI) findings . According to this figure also those with positive imaging findings had peritoneal seeding, local invasion, bone metastasis, lung metastasis, abdominal metastasis, abdominal lymphadenopathy, hilar lymphadenopathy, neck lymphadenopathy, and local recurrence in 18.6%, 11.5%, 7.1%, 21.2%, 21.2%, 59%, 10.9%, 0.6%, and 24.4%, respectively.

Applicability of PET scan (Figure 3) for increasing the diagnostic accuracy for detection of peritoneal seeding, local invasion, bone metastasis, lung metastasis, abdominal metastasis, abdominal lymphadenopathy, hilar lymphadenopathy, neck lymphadenopathy, and local recurrence was 55.1%, 12.8%, 3.2%, 8.6%, 8%, 34.2%, 3.2%, 0.5%, and 15%, respectively.

In comparison between PET with MRI and CT SCAN this study shows the significance OF PET for peritoneal seeding (P=0.0001), lung metastasis (P=0.001), abdominal metastasis (P=0.0001), abdominal lymphadenopathy (P=0.0001), hilar lymphadenopathy (P=0.005), and local recurrence (P=0.028)

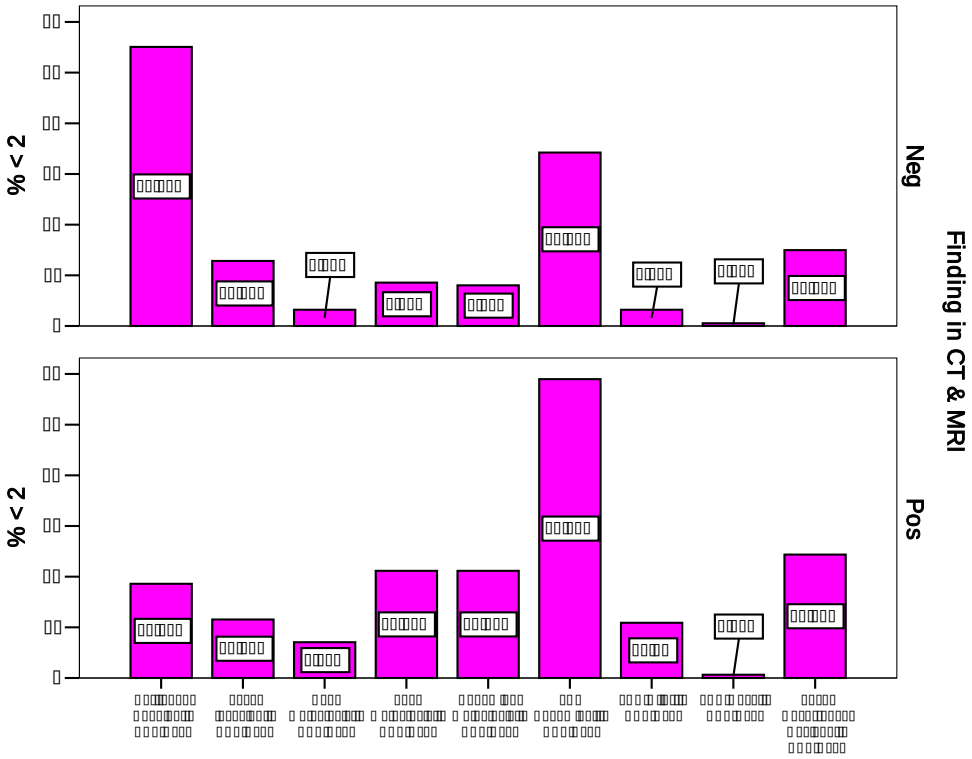

Fig. 3: Applicability of PET scan for diagnosis in comparison to CT Scan and MRI

Presence of unremarkable lesions in PET and imaging was related to location of tumors (P=0.046) and as shown in Figure-4 the unremarkable status was more common in endocervical lesions with 19.2% rate. In ovary, cervix, endocervix, and uterine there was diagnostic usefulness of 93.5%, 89.8%, 85.2%, and 82.2%, respectively. Some figures in patients are shown in Figures 4, 5, and 6 that all were proven by biopsy sampling.

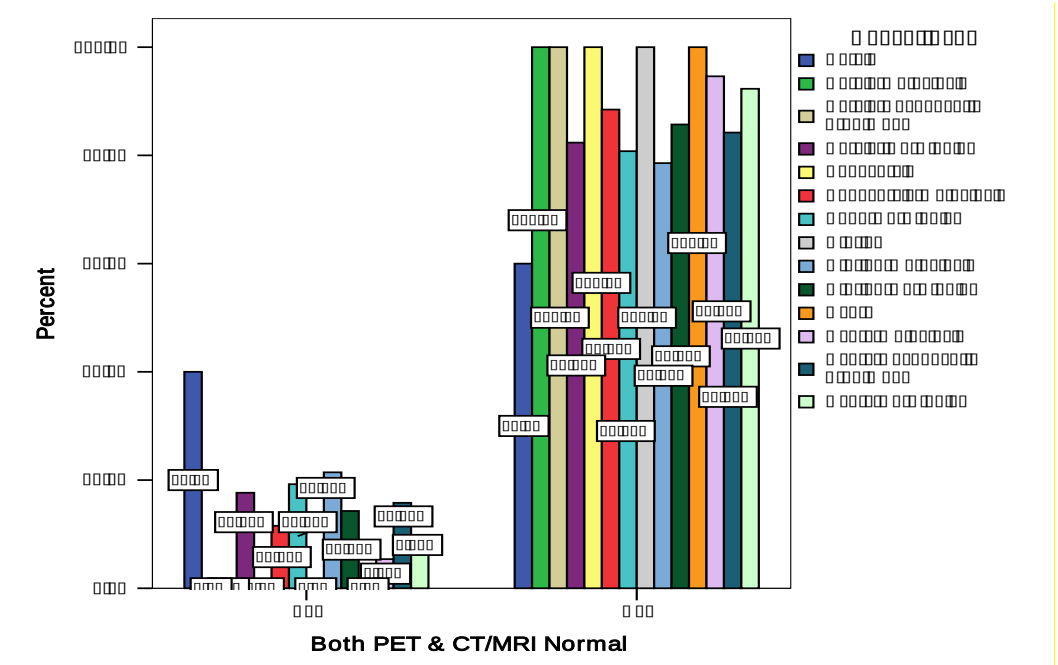

Fig. 4: Comparison of PET and imaging results based on cancer type and reason for referral

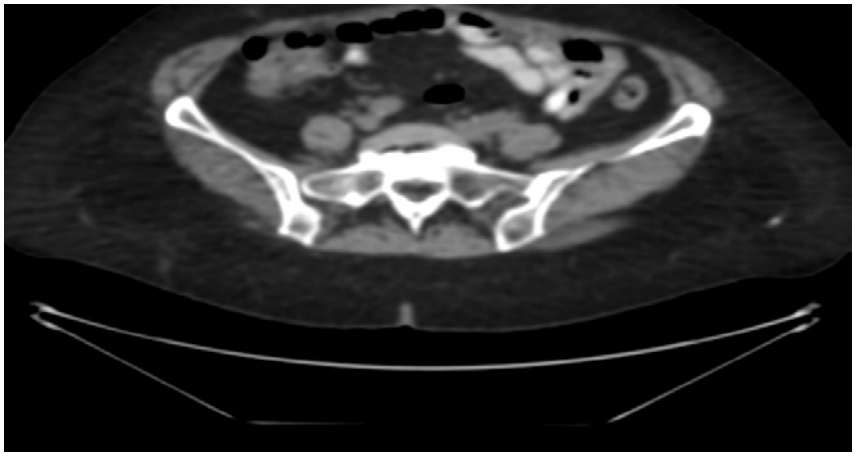

Fig. 5: Fifty-year-old woman with small peritoneal seeding in pelvis and abdominal wall without positive findings in CT scan

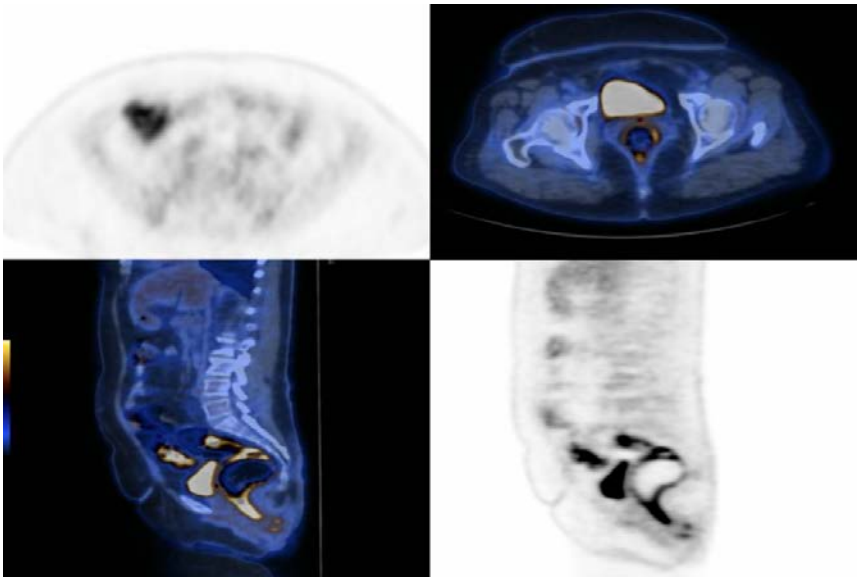

Fig. 6: Sixty-five-year-old woman with endometrial cancer with positive PET results due to absorption of rectal wall air and with normal CT scan

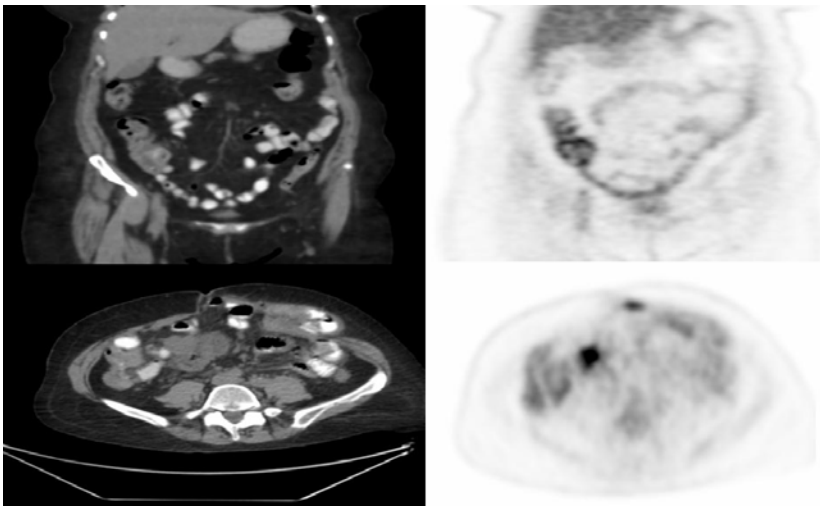

Fig. 7: Sixty-four-year-old woman with endometrial cancer with and cecal extension and positive PET results and normal CT scan

Discussion

Use of FDG PET is useful method for malignancy staging in various cancers. Combined use of PET with CT or MRI tests would develop better results. In this study this matter was assessed for gynecological cancers and it was found that hilar lymphadenopathy and peritoneal seeding were most common findings in PET scan. Also in nearly ten percent of cases both PET scan and MRI/CT assessments had unremarkable findings. Applicability of PET scan for increasing the diagnostic accuracy for detection of peritoneal seeding and abdominal lymphadenopathy was 55 and 34 percent, respectively.

Dragosavac et al (2013) in Brazil found that 42 out of 45 cases with ovarian cancers had positive findings in PET scan/CT showing the applicability rate of nearly 90 percent . They reported significant association for local recurrence in congruence with our study. The liver, spleen, pleura, lung, and bone were most common site of metastasis. In our study the bone and lung were most common sites for metastasis. The authors reported the PET/CT as a useful method to determine the extension of ovarian cancer. It was also approved in our study and ovarian cancer had highest applicability rate. Hetta et al (2017) from Egypt assessed 44 patients with ovarian cancer and demonstrated an applicability rate of 91 percent for PET/CT that is approximately similar to the found rate for ovarian cancer in our study.

Yildirim et al (2008) assessed 16 cases with cervical cancer and found that PET/CT method had applicability rate of 75 percent. But the rate in our study was upper with 93.5% rate. The study by Robertson et al (2016) revealed that among 83 cases with vulvovaginal cancer, the PET/CT used to diagnosis in 51 percent of cases.

Iyer and colleagues (2007) reported that combined use of PET and CT would result in higher detection rate as well as our study. Spick et al (2016) reported that MRI and CT would have similar applicability in detection of gynecological cancers and each one may be used. Hence in our study both methods were utilized in combination with PET. Prabhakar and colleagues (2015) reported that simultaneous use of PET and CT scans would develop more applicable results as seen in our study.

According to our study PET scan is an adjunctive diagnostic method helpful for restaging of gynecological malignancies more specifically in cases with peritoneal seeding, lung and abdominal metastasis, hilar and abdominal lymphadenopathy, and local recurrence. PET scan findings can help the clinicians for better restaging of gynecological cancer by revealing unrecognized entities in MRI and CT scan. The applicability of PET scan was higher in cases with ovary and cervix malignancies. However further studies with larger sample size are required to attain more definite results.

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