*Original Article*

# The Fast Peritoneal Equilibration Test First and Second Hour Results

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## Abstract

**Introduction.** The Peritoneal Equilibration Test (PET) is employed to assess peritoneal membrane transport function. The purpose of the test is to determine the optimal peritoneal dialysis regimen. The performance of the test, which is conducted over 4 hours, is time consuming both for the nurses and the patient. There have been studies to validate an approved short version of the original PET protocol, and all have yielded different results. We evaluated the concordance between the 1-hour, 2-hour and 4-hour (classical) test results of the fast PET.
**Methods.** The study included 32 patients (20 males and 12 females). The patients underwent the 4-hour fast PET test, and the dialysate-to-plasma ratio of creatinine concentration (D/Pcrea) was determined. The standard deviation was added to or subtracted from the mean D/Pcrea ratios at hours 1, 2, and 4 to determine transport groups.
**Results.** The mean age of the patients was 51.4±16.7 years. Mean D/Pcrea ratios at hours 1, 2, and 4 were 0.41±0.07, 0.54±0.10, and 0.69±0.12, respectively. There was a strong correlation between the 4-hour D/Pcrea ratio and 1-hour (r=0.756, p<0.001) and 2-hour (r=0.867, p<0.001) D/Pcrea ratios. Seventeen patients (53%) were in the same transport group at hours 1, 2, and 4. Eighteen patients (56%) at 1 hour and 24 patients (75%) at 2 hours fell into the same transport group at 4 hours. The patients that fell into different transport groups at different time points showed a shift to a lower or higher transport group.
**Conclusions.** Two-hour fast PET gives promising results for clinical assessment purposes.

**Key words:** dialysate/plasma creatinine ratio, fast peritoneal equilibration test, peritoneal dialysis, peritoneal transport groups

## Introduction

The peritoneal equilibration test is performed to determine peritoneal membrane transport functions in patients on peritoneal dialysis. The test was performed for the first time by Twardowski, *et al*. The aim of the test is to determine the most appropriate peritoneal dialysis regimen [1]. Standard PET is performed using 2.5% glucose peritoneal dialysis solution for a dwell time of 4 hours, and transport ratio of glucose in the dialysate, and transport ratio of creatinine in the blood is calculated. According to the dialysate-to-plasma creatinine ratio and end dialysate-to-initial dialysate ratio of glucose, the patients are divided into four categories of peritoneal permeability as high, high-average, low-average, and low [1,2]. Repeat testing is recommended after an episode of peritonitis, change in the treatment regimen, or in the presence of suspicion for insufficient dialysis, and at least once a year [2,3].
After the introduction of standard PET protocol, fast PET, short PET and modified PET protocols (using 3.5% glucose) have been described for the assessment of PET, and insufficiency of UF [3-6]. Standard PET is the most widely used testing method, and none of the other testing methods has been found superior to the other [2].It is very important that each patient should be followed on the same testing method in the future. Standard PET requires 4 hours to be performed, and it is a time consuming procedure necessitating nursing support and multiple sampling from the dialysate. This consumes nursing time for the patients and brings about loss in the work force. The fast PET requires the analysis of dialysate and plasma samples only at 4 hours [4]. The fast PET protocol therefore becomes less laborious (less work force), requires less sampling and nursing time, and limited use of medical processes without changing the total procedure time.

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There have been studies to validate the approved short version of the original PET protocol, and all have yielded different results. In the present study, the aim was to evaluate the concordance between the 1-hour, 2-hour, and 4-hour test results of the fast PET.

## Material and methods

The study was conducted in 32 patients (20 males and 12 females) on peritoneal dialysis who were followed-up in the Peritoneal Dialysis Unit of Adnan Menderes University Faculty of Medicine and who remained stable for the last two months. The patients who sustained an episode of peritonitis within the last 3 months were excluded from the study. The patients were informed of the procedure, and their consent was obtained.

### Fast PET Protocol

All patients underwent 4-hour fast PET protocol using 2.27% glucose-containing peritoneal dialysis solution. The fluid remaining in the peritoneal cavity after night-time peritoneal dwell for 8 hours was drained off in the Peritoneal Dialysis Unit. Later, 2 liters of 2.27% glucose dialysis solution was administered into the peritoneal cavity within 10 minutes. Ten ml of dialysate and simultaneous blood samples were obtained at hours 1, 2, and 4 for the analysis of urea, creatinine, and glucose. Dialysate/Plasma creatinine ratios (D/Pcrea) were calculated at hours 1, 2, and 4. Standard deviation (SD) was added to or subtracted from mean D/Pcrea ratios at hours 1, 2, and 4 to determine transport groups. The patients with a D/Pcrea ratio +1 SD higher than the mean value were considered high; patients with a ratio between +1 SD and mean value were considered high-average; patients with a ratio between mean value and -1 SD were considered low-average; and patients with a ratio -1 SD lower than the mean value were considered low-permeable (Table 1).

**Table 1.** Patients peritoneal transport groups according to 1. 2. vs 4. hour D/P creatinine ratio

| Transport groups | 1. hour D/Pcrea | 2. hour D/Pcrea | 4. hour D/Pcrea |
|---|---|---|---|
| Low | <0.34 | <0.44 | <0.56 |
| Low-average | 0.34-0.41 | 0.44-0.54 | 0.56-0.69 |
| High-average | 0.42-0.49 | 0.55-0.65 | 0.70-0.82 |
| High | >0.49 | >0.65 | >0.82 |

### Statistical analyses

Statistical analyses were performed using the Statistical Package for Social Sciences for Windows, version 17 [SPSS Inc; Chicago, IL, USA].
The Kolmogorov-Smirnov test was used to evaluate if quantitative data had normal distribution. Descriptive statistics included number (n, %) and mean ± standard deviation. Pearson's correlation coefficient was used to evaluate the correlation between the parameters. P values <0.05 were considered significant.

## Results

The mean age of the patients was 51.4±16.7 years. The mean duration of peritoneal dialysis was 42.8 months. The most common cause of end-stage renal failure was hypertension (34.4%). The clinical and demographic features of the patients are presented in Table 2.
According to the fast PET results, 4 patients were in the high permeability category, 13 patients were in the high-average permeability category, 11 patients were in the low-average permeability category, and 4 patients were in the low permeability category. The mean D/Pcrea ratios at 1, 2, and 4 hours were 0.41±0.07, 0.54±0.10, and 0.69±0.12, respectively.
There was a strong correlation between 4-hour D/Pcrea ratio and 1-hour (r=0.756, p<0.001) and 2-hour (r=0.867, p<0.001) D/Pcrea ratios (Figure 1). Seventeen patients (53%) remained in the same transport group at hours 1, 2, and 4. Eighteen patients (56%) at 1-hour and 24 patients (75%) at 2-hours fell into the same transport group at 4-hours. The patients that fell into different permeability categories at different time points showed a shift to a lower or higher permeability category (Figure 2). Of the patients that fell into different permeability categories, 6 were male and 2 were female according to the 2-hour test results.

**Table 2.** Clinical and demographic features of patients

| Parameters | Female | Male | Total |
|---|---|---|---|
| Patient number (n, %) | 12(%37.5) | 20(%62.5) | 32(%100) |
| Age (year) | 50.9±22.0 | 51.7±13.2 | 51.4±16.7 |
| *ESRD etiology* | | | |
| Hypertension | 6(%18.8) | 5(%15.6) | 11(%34.4) |
| Diabetes Mellitus | 1(%3.1) | 6(%18.8) | 7(%21.9) |
| Glomerulonephritis | 2(%6.3) | 2(%6.3) | 4(%12.5) |
| Unknown etiology | 1(%3.1) | 4(%12.5) | 5(%15.6) |
| Post-renal | 2(% 6.2) | 3(%9.3) | 5(%15,5) |
| Total | 12(%37.5) | 20(%62.5) | 32(%100) |
| BMI (kg/m$^2$) | 29.6±7.4 | 25.6±3.9 | 27.1±5.7 |
| UF amount (ml) | 159.6±202 | 261.8±229 | 223.5±221 |
| Kt/V (week) | 11.5±12.4 | 9.1±10.6 | 10.0±11.2 |
| Peritoneal duration (month) | 44.6±37.7 | 41.7±38.9 | 42.8±37.9 |
| *Treatment regimen (n, %)* | | | |
| APD | 8 (%25) | 15 (%46.8) | 23 (%72) |
| CAPD | 4 (%12.5) | 5 (%15.6) | 9 (%28) |

Abbreviations; ESRD; end-stage renal disease, BMI; body mass index, UF; ultrafiltration, APD; automated peritoneal dialysis, CAPD; continuous ambulatory peritoneal dialysis
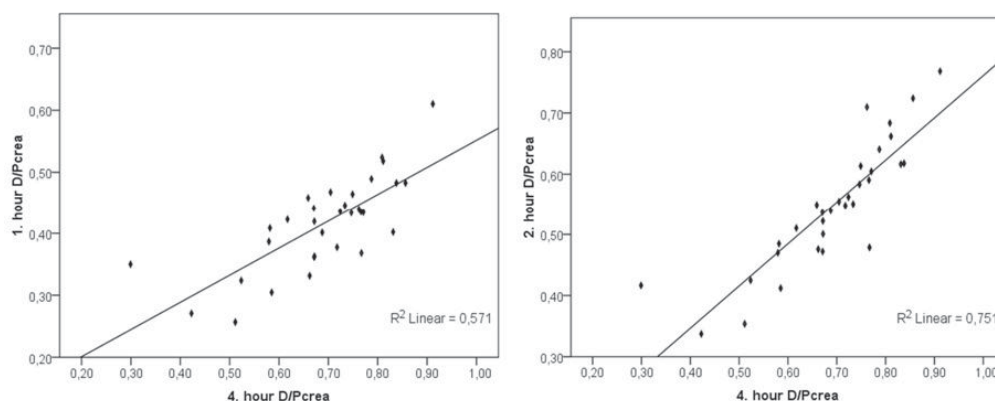
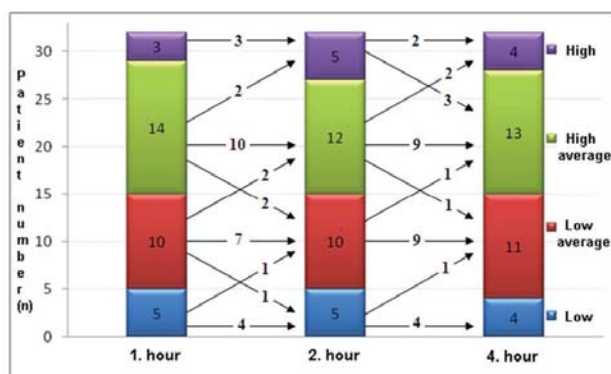**Fig. 1.** Correlation between 1. hour, 2. hours and 4. hours D/P creatinine ratio results



**Fig. 2.** Patients transport group distribution according to 1. hour, 2. hours and 4. hours D/P creatinine ratio

## Discussion

Peritoneal dialysis is one of the renal replacement therapy options in patients with end-stage renal disease. Peritoneal dialysis is a safe and effective treatment modality even in elderly and patients transferred from transplantation or hemodialysis [7,8]. The fast PET was described in 1990 in order to decrease work load and to offer a more practical and easy-to-perform testing method and the test was later validated to assess peritoneal membrane functions [4]. One study comparing standard and fast PET reported a 94% similarity between the results of the two testing procedures, and they suggested that fast PET provided fast, practical, and ready assessment of the peritoneal permeability [9]. The studies comparing the results of the standard and the fast PET have reported a concordance rate of 80 to 100% between dwell times of 2 hours and 4 hours. In conclusion, dwell time of 2 hours provides reliable results and time-saving procedure for the health care personnel and it could be used for the clinical assessment of the patients [5,10-12]. In contrast, a study in children found no correlation between 2-hour and 4-hour dwell times and the authors reported that short testing procedure would not be reliable in pediatric population for the assessment of peritoneal membrane functions [13].

There is no study in the literature that validated the 2-hour fast PET protocol. In this study, we attempted to reduce the dwell time for the fast PET, which is routine ly used at our Clinic. The fast PET is a simple and useful testing method and reducing the dwell time to 2 hours would be time-saving both for the patient and the operating nurses. In the present study, 2-hour test results showed 75% concordance with the fast PET. The patients that had a change in the permeability category showed a shift to a lower and higher permeability category. The current results are similar with the 2-hour results of the standard PET protocol.

## Conclusions

In conclusion, in transport groups determined according to D/Pcrea ratio, 56% of the patients at 1 hour and 75% of the patients at 2 hours fell into the same transport group at 4 hours. Two-hour fast PET gives promising results that have to be confirmed in the future in studies comprising a larger number of patients. Two-hour fast PET offers a simple and practical testing method, and it seems applicable to avoid loss of time.

*Conflict of interest statement.* None declared.

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