PERITONEAL RESIDUAL VOLUME IN PATIENTS TREATED WITH PERITONEAL DIALYSIS

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Introduction

- **Peritoneal residual volume (PRV) is the volume of dialysis solution that remains in the peritoneal cavity after the complete drainage.**
- PRV affects the concentration of fresh drained-in dialysis solution
- **PRV is used in diagnosis of drainage or ultrafiltration failure** (catheter function problems, adhesions, malposition of the catheter), incomplete drainage of peritoneal fluid
- High PRV is one of the causes of inadequate fluid removal in PD patients.
- **Wide inter-individual variation in PRV is a common clinical observation**
- In an animal experiment, high PRV decreased ultrafiltration through decreasing dialysate osmolality and increasing intraperitoneal hydrostatic pressure.
- The high PRV decreased the solute diffusion gradient and decreased peritoneal small solute clearances, particularly sodium. **Therefore, a high PRV may compromise the efficiency of dialysis**
- It was proposed that the drainage time in PD should be minimized to increase the contact between dialysate and the peritoneum (effective dialysis time), which may increase the efficiency of peritoneal dialysis.
- Shortening the drainage time in general increases the PRV. **This is the rationale for tidal peritoneal dialysis (TPD)**
  However, it was described that **TPD resulted in lower solute clearances** than the conventional automated peritoneal dialysis.

Methods

Peritoneal residual volume was counted in 54 stable PD patients (women 17/men 37), using the formula
$RV = Vin * CD_2 / (CD_1 - CD_2)$

- Where : Vin = fill-in volume, CD_1= creatinine concentration in dialysate right after the fill-in and CD_2 = creatinine concentration in dialysate at the end of previous peritoneal dialysis exchange).

We also evaluated:

- modified PET with 3,86% glucose concentration
- ultrafiltration test
- Adequacy of PD - KT/V, weekly creatinine clearance
- Phosphate removing
- Protein catabolic rate (PCR)
- Intraperitoneal pressure (IPP)

The statistical analysis was performed using:

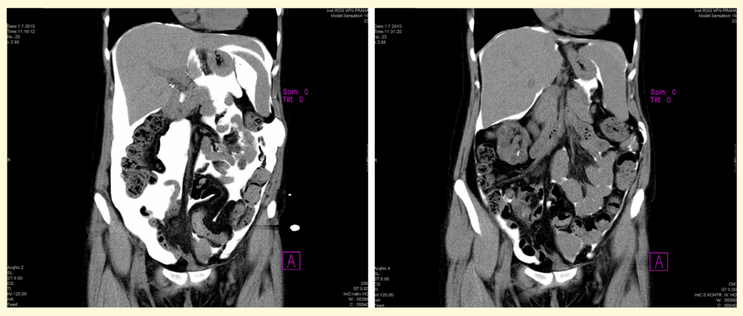
- Pearson correlation coefficient, Student´s t-test

Objectives

The aim of this single centre, cross sectional study in 54 PD patients was to evaluate :

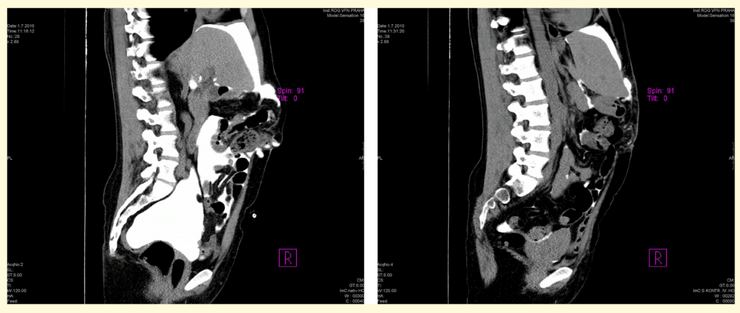
- Is PRV related to Body surface area or Body mass index?
- Does PRV affect ultrafiltration ?
- Does PRV influence the intraperitoneal pressure?
- Does PRV affect transport characteristics of peritoneum ?

CT peritoneography before and after the drainage of dialysate



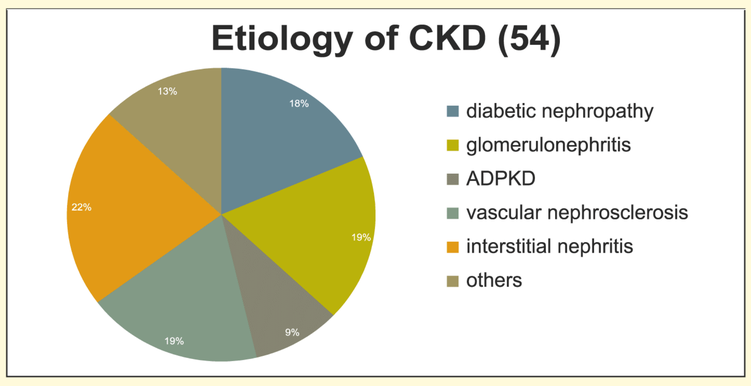
In a patient in the supine position, the PRV remains in the pelvic cavity and paracolic gutter; in a sitting patient, most of the PRV remains in the pelvic cavity.

Peritoneal residual volume (PRV). CT peritoneography before and after the drainage of dialysate



Study group

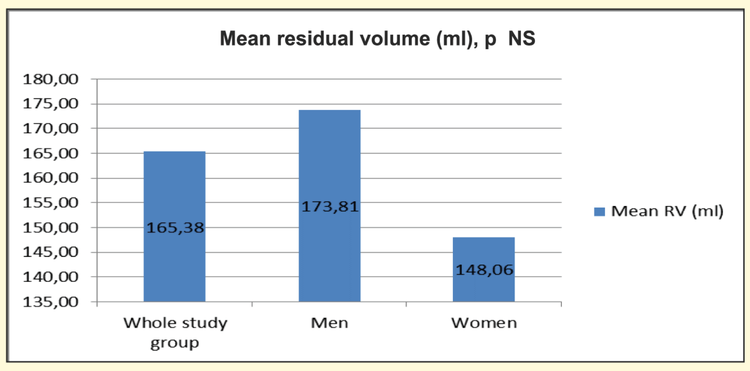
	Study group (54)	Men (37)	Women (17)	P
Age (years)	54,2 ±14,2	52,7± 14,02	51,6 ±13,9	NS
Duration of PD (months)	17,7±12,8	17 ± 9,6	19,7 ±18,88	NS
Weight (kg)	72,8±13,2	81,9 ±12,7	68,1 ±88	0,001
Height (cm)	174,2 ± 8,2	178,4± 4,8	165,5 ± 2,6	0,001
Automated PD %	28%	29%	29%	

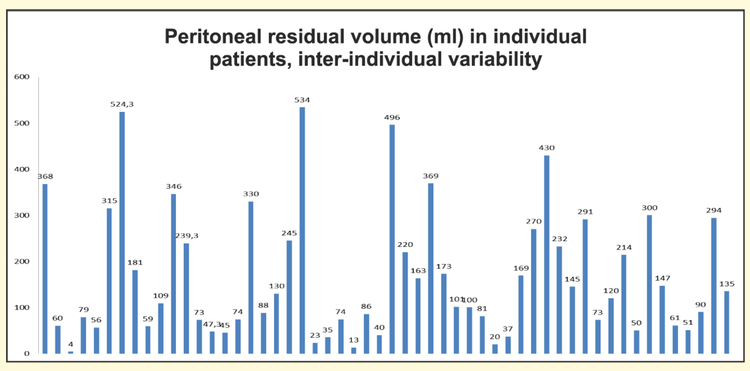


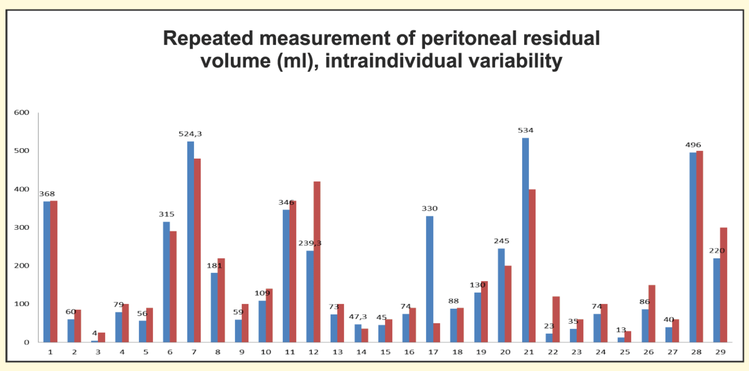
Results

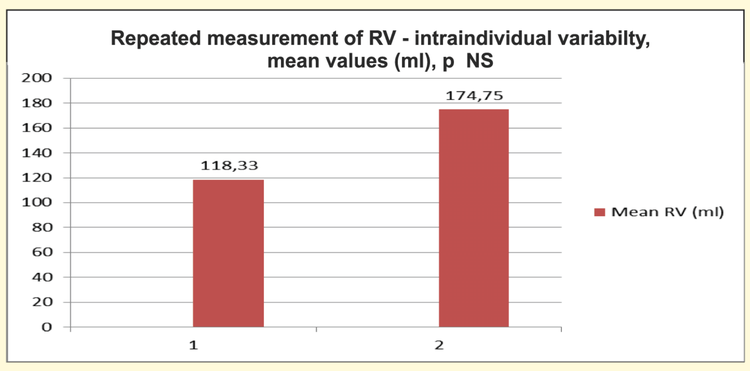
	Study group (54)	Men (37)	Women (17)	P
D/P creatinine	0,76 ± 0,1	0,79 ± 0,1	0,69 ± 0,1	0,05
$D/D_{0\ glucose}$	0,26 ± 0,07	0,25 ± 0,06	0,29 ± 0,06	0,05
KT/V	2,37 ± 0,6	2,23 ± 0,5	2,76 ± 0,7	0,05
Weekly creatinine clearance (litres)	94,2 ± 38,6	96,1 ± 39,1	88,9 ± 34	NS
Protein catabolic rate (g/kg/day)	0,84 ± 0,27	0,82 ± 0,24	0,93 ± 0,4	NS
Removal of phosphorus (mg/day)	614,8 ± 211,8	637 ± 208,3	506 ± 156	NS

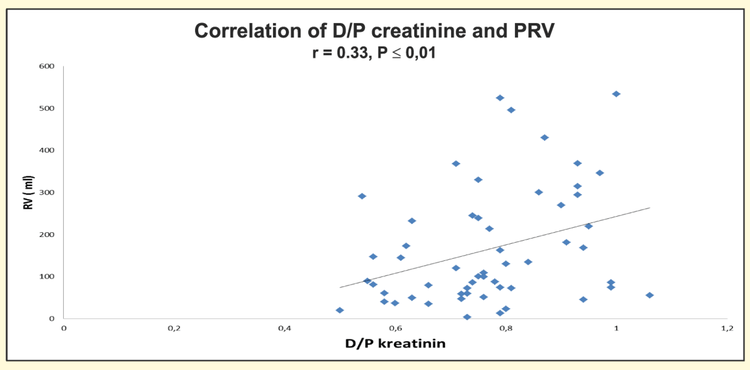
	PRV < 100 ml (27)	PRV>100 ml (27)	P
D/P creatinine	0,72 ± 0,13	0,79 ± 0,1	0,05
D/P phosphorus	0,59 ± 0,1	0,67 ± 0,16	0,03
KT/V	2,21±0,5	2,52 ± 0,6	0,07
Weekly creatinine clearance (litres)	87,5 ± 36,1	100,5 ± 37	NS
IPP mm H20	11,4 ± 2,7	9,44 ± 3,3	0,03
Phosphorus removal by dialysis (mg/day)	405 ± 150	288,5 ± 115	0,01

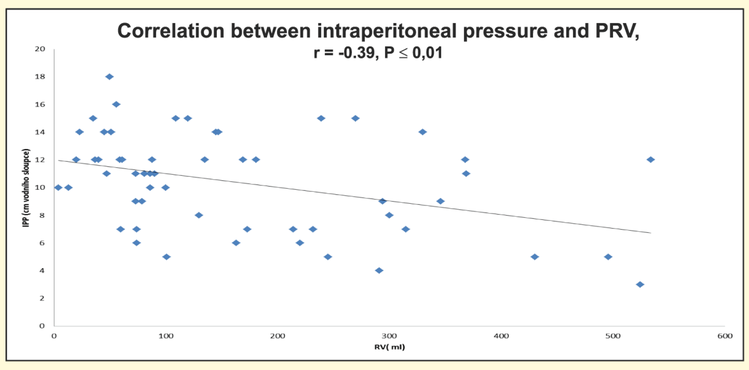












- Mean RV was 165.4 ±136 (median 109) mL, in men 173.81± 136 and in women 148.06 ± 88.0, there was wide inter-individual variability of RV
- In 29 patients the RV was measured repeatedly but the intra-individual variability was non-significant
- No significant correlation was detected between RV and BSA, BMI, gender or ultrafiltration
- In contrast, during the PET we detected a significant positive correlation between dialysate/plasma (D/P) creatinine and RV ($r = 0.33$, $P \leq 0.01$) and between D/P phosphorus and RV ($r = 0.39$, $P \leq 0.01$)
- We found a significant negative correlation between the intraperitoneal pressure and RV ($r = -0.39$, $P \leq 0.01$).
- In the group of patients with low RV (< 100 ml) we noted significantly higher removal of phosphorus by dialysis

Conclusions

- **The amount of peritoneal residual volume varies significantly between individual patients, but intraindividual variability is insignificant.**
- **Higher peritoneal dialysis volume may affect peritoneal equilibration test results, it may overestimate D/P for creatinine and D/P for phosphorus.**
- **Higher peritoneal dialysis volume may decrease efficiency of dialysis.**

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Peritoneal dialysis II
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