ULTRAFILTRATION IN PERITONEAL DIALYSIS: INFLUENCE OF FACTORS NOT RELATED TO OSMOTIC GRADIENT

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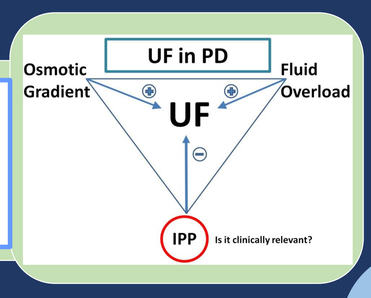
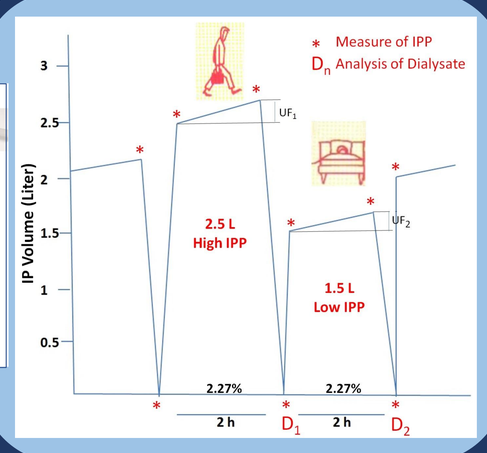
Introduction

In a previous study (Perit Dial Int 2016; 36:555-561) we detected that factors not related to osmotic gradient significantly affect UF in PD. We hypothesized that intraperitoneal pressure (IPP) might be one decreasing UF. Here we evaluate clinical relevance of effect of IPP on UF in PD.



Methods

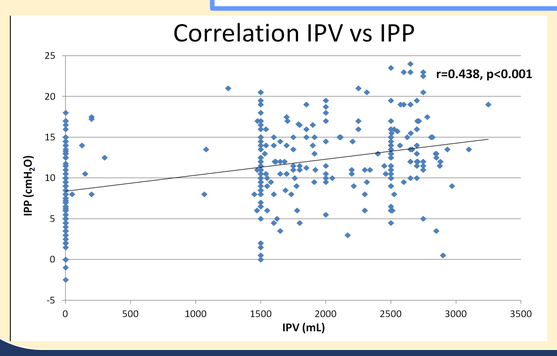
We performed in all our stable PD patients (41 patients, 30m, 37-81y) 2 consecutive **2-h** exchanges with **2.27% glucose**. In the 1st we aimed for high IPP(**2.5L,** upright and active) and in the 2nd for low IPP (**1.5L** at rest). We recorded IPP before and after each infusion or drainage, UF and glucose level of each effluent. We correlated these results with each other and with body size, serum albumin, and transport and UF data from PET 2L 4h 3.86%.

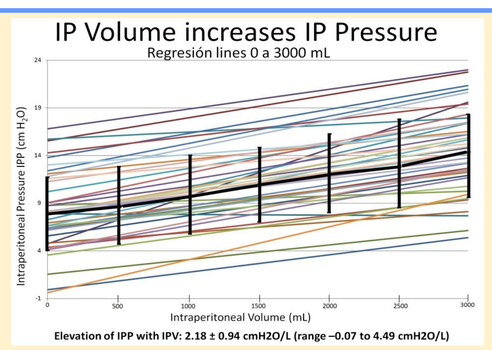


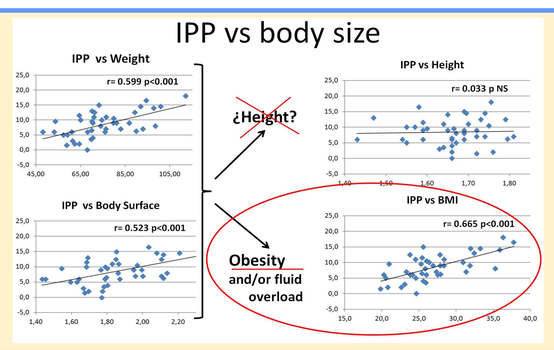
Results

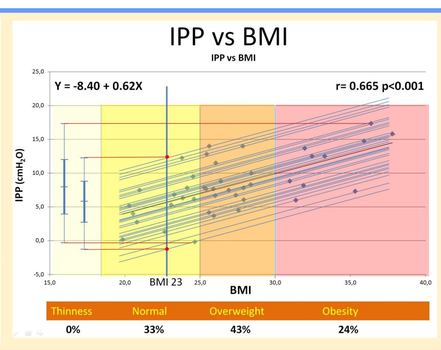
1.- ABOUT INTRAPERITONEAL PRESSURE (IPP)

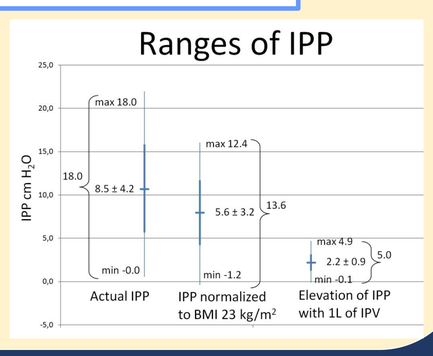
With empty abdomen IPP varied from -0.2 to 17.3 cmH_2O (8.2 ± 4.1), rising with intraperitoneal volume (IPV) 2.2±0.9cmH_2O/L. IPP increased with weight (r=0.58, p<0.001) and body surface area (r=0.50, p<0.001), but not with height, and had a strong correlation with body mass index (BMI) (r=0.65, p<0.0001) main responsible for the broad basal range.











2.- DIFFERENCES BETWEEN 1st AND 2nd EXCHANGE

INFUSION VOLUME (mL)	1st exchange 2.5 L	2nd exchange 1.5 L	p
INTRAPERITONEAL PRESSURE (cmH_2O)	13.6 ± 4.5	11.4 ± 4.0	<0.0001
EFFLUENT GLUCOSE (mg/dL)	1072 ± 191	957 ± 183	<0.001
TOTAL UF (mL)	128 ± 207	195 ± 145	<0.09
%UF (% OF INFUSION VOLUME)	5.1 ± 8.1	13 ± 9.7	<0.0005

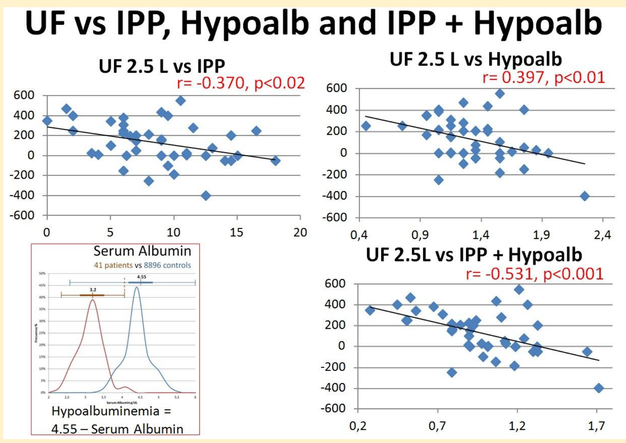
IPP was higher for the 2.5L exchange (13.8±4.4cmH2O) than for the 1.5L exchange (11.2±4.2cmH2O) (p<0.0001). Effluent glucose was higher in the 2.5L exchange (1072±191mg/dL) than in the 1.5L one (957±183mg/dL) p<0.001. Despite the higher volume and osmotic gradient, UF is not higher but actually lower in the 2.5L exchange (128±207mL) than in the 1.5L exchange (195±145mL). This difference is not significant in absolute mL (p=0.09), but it is in percent of infused volume (5±8% vs 13±10%, p<0.005).

3.- UF: INFLUENCE OF FACTORS NOT RELATED TO OSMOTIC GRADIENT

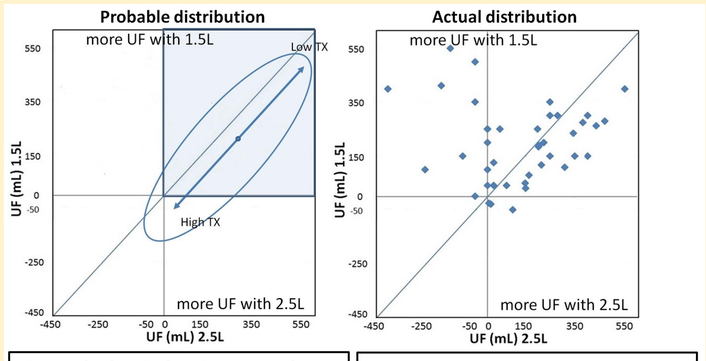
Correlation of <u>UF volume</u> in 1st and 2nd exchanges

	UF 2.5 L	UF 1.5 L	UF1.5 - 2.5 L
WEIGHT	NS	NS	NS
HEIGHT	NS	NS	NS
BODY SURFACE	NS	NS	NS
BMI	NS	NS	NS
EFFLUENT GLUCOSE	NS	NS	NS
INTRAPERITONEAL PRESSURE	p<0.02(r=-0.37)	NS	p<0.01(r=-0.40)
ALBUMIN (Hypoalbuminemia)	p<0.01(r=-0.40)	NS	p<0.01(r=-0.41)
IP PRESSURE + HYPOALB	p<0.001(r=-0.51)	NS	p<0.001(r=0.56)
D/P Creatinina (PET 3.86%)	NS	NS	NS
UF (PET 3.86%)	NS	p<0.05(r=0.36)	NS

Only in the 2.5L exchange UF was negatively correlated with **IPP** (r=-0.30, p<0.01) and with **hypoalbuminemia** (HA) (r=0.41, p< 0.01). The decrease of the UF by increasing the IPV from 1.5 to 2.5L correlated with IPP (r=0.32, p<0.05). Partial correlation analysis revealed that these two factors, IPP and HA, **are independent** and so combining them increases the significance of the correlation with UF (r=0.52, p<0.001).



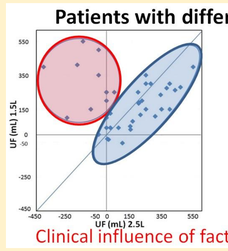
4.-CLINICAL RELEVANCE OF THE EFFECT OF INTRAPERITONEAL PRESSURE AND HYPOALBUMINEMIA ON ULTRAFILTRATION IN PD



Diagonal: Identical UF in 2.5L and 1.5L Low and High TX along the arrow
Shaded area: Positive UF
Inside oval: UF due to osmotic gradient
Out of the oval: UF affected by factors not related to osmotic gradient

Asimetrical distribution: the deviation was exclusively towards higher UF with 1.5L than 2.5L.
There is negative or almost negative UF in many 2.5L, 2.27% exchages.

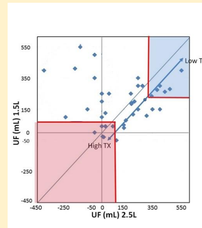
Patients with different (circle) or equal (oval) UF in both exchanges



	>200 mL	<200 mL	p
IPP cmH_2O	11.1 ± 3.7	7.7 ± 4.0	0.019
Alb (g/dL)	3.1 ± 0.4	3.3 ± 0.3	0.048
D/P_{Creat}	0.75 ± 0.05	0.73 ± 0.08	0.487
D/P_{Urea}	0.90 ± 0.03	0.90 ± 0.03	0.874
D/$D0_{Gluc}$	0.27 ± 0.07	0.31 ± 0.09	0.458

Clinical influence of factors not related to osmotic gradient : **10 (24%)** patients

Patients supposed higher or lower transporters

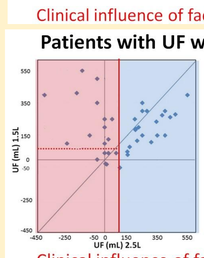


	"HIGHER TX"	"LOWER TX"	p
IPP cmH_2O	10.5 ± 3.5	5.7 ± 3.6	0.041
Alb (g/dL)	3.2 ± 0.2	3.3 ± 0.2	0.293
D/P_{Creat}	0.74 ± 0.10	0.72 ± 0.02	0.612
D/P_{Urea}	0.90 ± 0.03	0.90 ± 0.03	0.874
D/$D0_{Gluc}$	0.27 ± 0.07	0.31 ± 0.09	0.458
UF PET (mL/4h)	508 ± 126	792 ± 173	0.0245

Clinical influence of factors not related to osmotic gradient : **6 (15%)** patients

IPP and hypoalbuminemia significantly affects UF in 40% of patients. In 24% only with IPV of 2.5L and in an additional 15% both with 2.5L and 1.5L. Osmotic gradient and data from PET cannot explain these differences.

Patients with UF with 2.5L 2.27% lower or higher 125 mL (5% infusion)

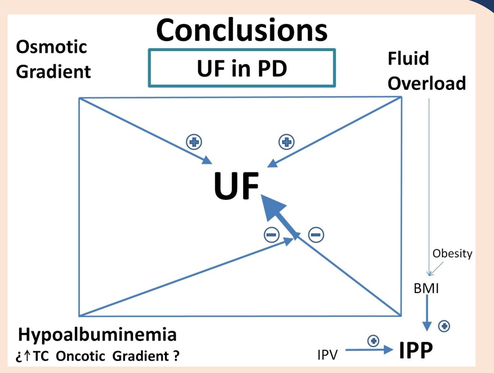


	2.5L Low UF	2.5L High UF	p
IPP cmH_2O	9.8 ± 3.9	7.3 ± 4.2	0.049
Alb (g/dL)	3.1 ± 0.4	3.4 ± 0.3	0.003
D/P_{Creat}	0.75 ± 0.09	0.72 ± 0.05	0.370
D/P_{Urea}	0.90 ± 0.03	0.90 ± 0.03	0.410
D/$D0_{Gluc}$	0.28 ± 0.07	0.29 ± 0.07	0.492

Clinical influence of factors not related to osmotic gradient : **18 (44%)** patients

Conclusions

- Obesity is the main factor that determines a high basal value of IPP.
- IPV increases the IPP in 2.2 cmH_2O per litre, with little interpatient variation.
- Correlated with IPP and HA, UF is lower with IPV 2.5L than 1.5L, in spite the increased volume and osmotic gradient.
- Only when IPP is high, hypoalbuminemia enhances the effect of IPP to reduce net UF.
- Under normal conditions in PD (2h 2.27% glucose), the reduction of UF correlated to factors not related to osmotic gradient (IPP and HA) is clinically significant in as least 15% of patients with 1.5L and up to 40% of patients with 2.5L.
- The lower UF in PET do not correspond with higher D/P but higher IPP in our experiment.
- Measuring IPP in PD is quick and easy, and its effect on UF would justify its monitoring for a better UF valuation.



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