TOPIC: PERITONEAL DIALYSIS

DIABETIC PERITONEAL DIALYSIS PATIENTS HAVE INCREASED EXTRACELLULAR WATER TO TOTAL BODY WATER AND ARTERIAL PULSE PRESSURE COMPARED TO NON-DIABETIC PATIENTS

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INTRODUCTION

More than 300,000 patients with chronic kidney disease are now treated by peritoneal dialysis worldwide. However the average duration of treatment with peritoneal dialysis remains much less than that for haemodialysis, with peritonitis [1] and ultrafiltration failure being the commonest causes of technique failure for patients established on peritoneal dialysis [2]. A recent study from North American reported that almost 30% of patients initiating peritoneal dialysis changed modality to haemodialysis within the first 90 days [3]

Diabetic patients have been reported to be at greater risk of modality transfer to haemodialysis [4]. As such we wished to review whether there were differences in peritoneal membrane function and volume assessments in diabetic patients attending for their first assessment of peritoneal membrane function compared to non-diabetic patients.

METHODOLOGY

- We reviewed the results of consecutive adult patients attending for their first assessment of peritoneal membrane function between 6 and 10 weeks after completing peritoneal dialysis training.
- Peritoneal membrane function was determined using a standard four hour dwell with a 22.7 g/L dextrose exchange.
- Peritoneal dialysis adequacy with 24 hour effluent peritoneal dialysate samples and urine collections were analyzed to determine both peritoneal clearances and residual renal function.
- Multi-frequency bioelectrical impedance assessments (MFBIA) were carried out after completing peritoneal membrane testing.
- Relative extracellular water (ECW) over hydration was calculated according to the European Society for Parenteral and Enteral Nutrition (ESPEN) guidelines [5].
- Serum biochemistry samples were analyzed using a standard multi-channel biochemical analyzer.
- Patient related data was obtained from hospital computerized records.
- Statistical analysis was done using SPSS 21.

RESULTS

- The results of peritoneal membrane testing in 386 adult patients, 230 males (59.6%), 152 diabetic (39.4%), mean age 57.3 ±16.9 years, median timing of PET 8 weeks (6-10) was reviewed.
- 78 (20.2%) patients were treated by continuous ambulatory peritoneal dialysis (CAPD), 87 (22.5%) by automated peritoneal dialysis cycler (APD) with no day time exchange, and 221 (57.3%) by APD with a day time exchange .
- Diabetic patients were older, and there were more from the ethnic minorities (X2=15.1p=0.005)
- Although body weight was similar, diabetic subjects had greater body mass index (BMI).
- Mean arterial blood pressure was similar between diabetics and non-diabetics, but diabetic patients were prescribed more anti-hypertensive medications (X2=16.8, p=0.005), and had a higher pulse pressure .
- C reactive protein concentrations were higher in the diabetics and serum albumin lower.
- As expected, male patients had greater weight with greater muscle mass and less body fat.
- There were no differences in residual renal clearances or peritoneal, or total clearance.
- Female diabetic patients were faster transporters than non-diabetics, but transporter status was similar between male diabetics and non-diabetics.
- Diabetic patients had greater body fat and increased ECW/TBW and excess ECW .

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variable	Non-Diabetics	Diabetics	p-value
Age	53.9±17.8	62.6±13.8	<0.01
Body mass index (kg/m^2)	26.1±4.9	27.5±5.3	<0.05
Pulse pressure (mmHg)	54.3±17.3	66.9±10.8	<0.001
Serum albumin (g/l)	37.8±4.9	35.2±4.7	<0.05
c-reactive protein (mg/l)	3.0(1.0-8.0)	5.0 (2.0-11.0)	<0.05
Glycated Hgb (IFCC mmol/mol)	34.4 (30.9-36.6)	53.0 (40.5-65)	<0.001

Table 1: Significant demographic/biochemical differences between Diabetics and non-diabetics

variable	β	StE	Stβ	T	95% CL	P-value
Pulse Pressure	0.004	0.001	0.24	4.3	0.002 to 0.006	<0.001
Log NTproBNP	-0.116	0.032	-0.24	-3.6	-0.18 to -0.05	<0.001
Log creatinine	-0.347	0.11	-0.18	-3.2	-0.56 to -0.13	0.002
ECW/ TBW	4.23	1.68	0.19	2.5	0.93 to 7.53	0.012
Serum albumin	-0.01	0.005	-0.14	-2.2	-0.19 to -0.001	0.033

Table 3: Step backward multivariable analysis using International Federation Clinical Chemists (IFCC) measurement of glycated haemoglobin (IFCC) which was log transformed

variable	female		P-value	male		P-value
	Non-diabetics	diabetics		Non-diabetics	diabetics	
Age (years)	49.8±16.1	61.1±14.7	<0.01	56.8±18.5	63.6±13.2	<0.01
%body fat	34.5 (24.6-42.4)	37.5 (31.5-44.8)	<0.05	26.1(23.3-28.7)	30.9 (23.8-36.7)	<0.05
ECW/ TBW	39.1±1.1	40.4±1.2	<0.05	39.3±1.6	40.4±1.1	<0.05
PET(D_4/S_{CR})	0.67±0.14	0.75±0.16	<0.01	0.74±0.12	0.75±0.12	NS
NT-ProBNP	231 (74-509)	240 (100-705)	NS	188(55-657)	373 (170-1207)	<0.05

Table 2:Body composition determined by bioimpedance and peritoneal membrane function (PET) for diabetic and non-diabetic patients.

DISCUSSION

- On comparism, we found that diabetic patients had evidence of ECW excess compared to non-diabetics, and a greater ratio of ECW to TBW.
- It has been proposed that diabetic patients may have greater thirst due to hyperglycaemia, and so drink more [6], and also had a lower urine volume [7].
- On the other hand an increased ECW/TBW ratio could be due to a loss of cell mass, and the diabetic patients were older with a higher CRP and greater co-morbidity, and so at greater risk of muscle loss [8,9] .
- Although systolic blood pressure, and mean arterial blood pressure were similar between diabetic and non-diabetic patients, our diabetic subjects were prescribed more anti-hypertensive agents and we did note that diabetic patients had increased arterial pulse pressure, suggesting stiffening of major arteries.
- Diabetic patients are recognised to be at risk of arterial calcification, and more recently sodium deposition in the vasculature [10].
- The higher arterial pulse pressure would be in keeping with greater vascular stiffness, possibly secondary to sodium retention

CONCLUSION

Our data suggests that greater care should be taken when initiating peritoneal dialysis in diabetic patients, designing peritoneal dialysis prescriptions to increase sodium removal and reduce ECW excess, and improving overall glycaemic control.

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