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A STUDY OF SPECTRUM OF PERITONEAL EQUILIBRATION TEST IN CAPD PATIENTS IN NEPHROLOGY UNIT OF MLB MEDICAL COLLEGE ,JHANSI AND ITS CLINICAL IMPORTANCE

Medicine

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ABSTRACT

Introduction: The peritoneal equilibration test (PET) is a test used for assessment of peritoneal membrane transport function in patients on peritoneal dialysis. Peritoneal membrane function in patients on peritoneal dialysis is influenced dialysis prescription, clinical outcome and may be changed with time on treatment. **Materials &Methods:**This was a cross-sectional study of peritoneal Equilibration Test in CAPD patients over a period of 1.5 years .The peritoneal Equilibration Test was performed and the biochemical markers of CKD-MBD namely, calcium, phosphorus, intact parathyroid hormone(iPTH), and VitaminD3 were measured in CKD patients attended in Nephrology unit of MLB Medical College, Jhansi , UP. **Results:** A total of 30 chronic kidney disease patients on CAPD were studied. All patients in the stage V of CKD (100 %) . Maximum no. of cases were males i.e. 22(73.33%). The male : female ratio was 2.75:1. Majority of the cases (50%) were in the age group of 41-50 years, followed by 51-60 years of age (16.67%), followed by age group of 31-40 years and >60 years of age (each contributing 13.33%). Only 2 cases (6.66%) were in the age group of 21-30 years. Diabetes was the major risk factor (40%) in our study followed by hypertension (33.33%) followed by obstructive uropathy (10%) followed by, chronic NSAID abuse (6.67%) and APKD 3.33%. Most of the cases (26/30) were having below normal level of Hb (<11 g/dL) and only 4 cases were having Hb within normal range. The frequency of various MBD abnormalities was hypocalcemia (90%), followed by hyperphosphatemia (76.67%) , secondary hyperparathyroidism(70%) and vitamin D deficiency (16.67%). Mean serum calcium level was 7.483±0.960 and mean serum phosphate levels was 6.04±1.536 ,The mean vitamin D level was 17.199±7.553 and mean iPTH level was 409.78±234.8. In our study , 4 hour PET is showing that maximum Patients (60%) patients have low average transport type, followed by high average type (20%), high transport type(13.33%) and low (slow) transport type(6.67%) peritoneal membrane. **Conclusion:** Peritoneal transport type classification was recognized not only as aid for prescription, but also as a prognostic index.

KEYWORDS

Chronic Kidney Disease, Continuous Ambulatory Peritoneal Dialysis , Peritoneal Equilibration Test , Mineral Bone Disorder

INTRODUCTION:

The peritoneal equilibration test (PET) is an assessment of peritoneal membrane transport function in patients on peritoneal dialysis.Peritoneal Equilibration Test was developed by Dr Twardowski who defines peritoneal membrane's clearance and ultrafiltration rates by measuring dialysate to plasma (D/P) ratio of creatinine and Dt/D0 glucose. It allowed assessment a number of aspects of membrane function including solute transport rates, ultrafiltration capacity, effective re-absorption, transcellular water transport, and permeability to macromolecules .Patients are classified on the basis of their D/P ratio for creatinine at 4 hours in to four groups - high, high average, low average, and low transport . Peritoneal membrane function in patients on peritoneal dialysis influenced dialysis prescription, clinical outcome and may be changed with time on treatment. The aims of testing peritoneal membrane function are: to optimize a treatment prescription with regard to the removal of kidney failure related toxin's of different sizes and fluid volume regulation; and to see how peritoneal membrane function changes over time. The peritoneal membrane characteristics, specifically the transport rate of toxic solutes and ultra-filtration capacity, are fundamental to PD prescription, and will guide prescription. Based on these differences, a therapy can be tailored to the specific needs of the patient in terms of the ideal duration of different dwells, the number of dwells, and the type of dialysis solution used. An inappropriate prescription can lead to substantial underachievement in terms of the removal of toxic waste products and ultra-filtration, or unnecessary exposure to the high glucose content of dialysis solutions (i.e. heavy bags).

MATERIALAND METHODS:

This was a cross-sectional study conducted in M.L.B Medical College, Jhansi (U.P.). The study included CAPD patients attended in the Nephrology unit of MLB Medical College, Jhansi during the period March 2019 to October 2020. 30 patients were selected for the study and patients with Acute renal failure cases, patients having adhesions due to previous abdominopelvic surgery, Morbid obese & severely malnourished patients were excluded from study.

The standardized 4 hour PET , measures dialysate creatinine and glucose levels at 0 hour, 2 hours and 4 hours of dwell, and serum levels of creatinine and glucose at 2 hours of dwell & the Dt/D0 glucose and the D/P ratios for creatinine .

• Dialysis regimen based on PET-

Transport Type	D/P creatinine	Solute clearance	Ultrafiltration	Preferred Regimen
High (fast)	0.82-1.03	Excellent	Poor	shorter dwell, APD regimens (eg. NIPD, CCPD,PD plus)
High average	0.65-0.81	Adequate	Adequate	Any regimen
Low average	0.50-0.64	Adequate/ inadequate	Good	Standard dose CAPD
Low (slow)	0.34-0.49	Inadequate	Excellent	High dose, longer dwell CAPD (or hemodialysis)

RESULTS

The study was carried out to find out the spectrum of Peritoneal equilibration test in CAPD patients in Nephrology Unit of MLB Medical College, Jhansi and its clinical importance over a period of March 2019 to October 2020 including 30 patients.

In the study all patients were in the stage V of CKD (Figure -1).

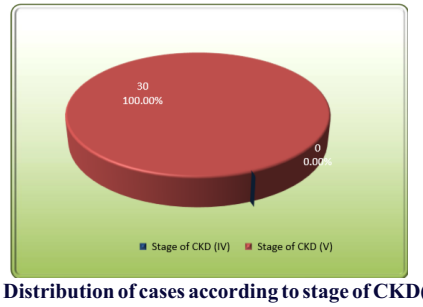

Figure 1 : Distribution of cases according to stage of CKD(n=30) Maximum no. of cases were males 22(73.33%) while only 8 cases (26.67%) were females.

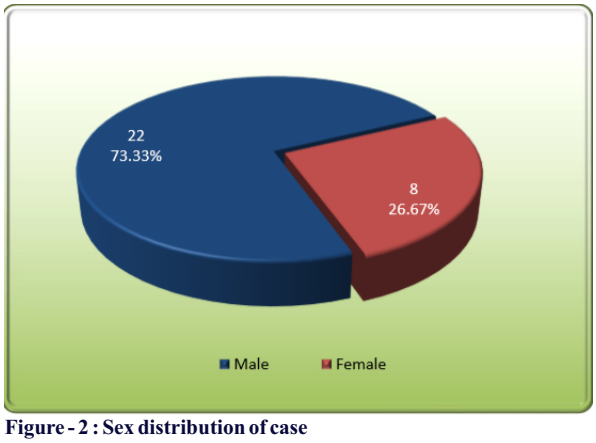

Figure - 2 : Sex distribution of case

Most of the cases (50%) were in the age group of 41-50 years, followed by 51-60 years of age (16.67%), followed by age group of 31-40 years and >60 years of age (each contributing 13.33%). Only 2 cases (6.66%) were in the age group of 21-30 years.

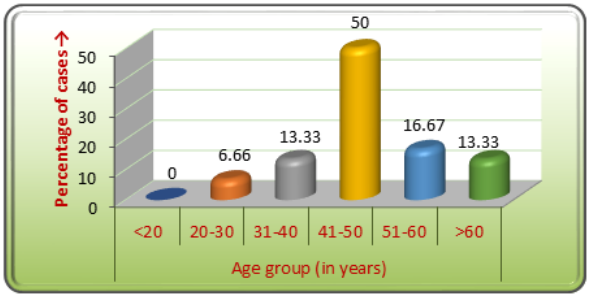

Figure 3 -Age distribution of cases

In our study , diabetes was the major risk factor (40.%) followed by hypertension (33.33%). Very few cases were from obstructive uropathy(10%),chronic NSAID abuse (6.67%) and APKD 3.33%.

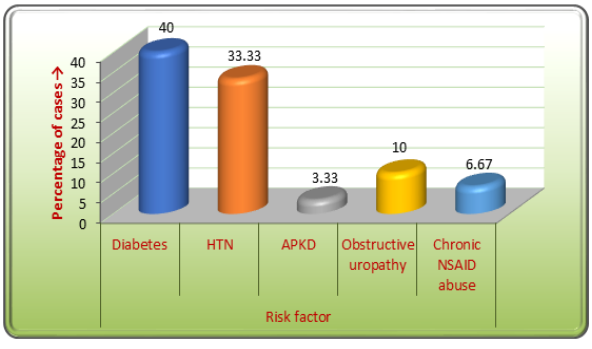

Figure 4-Distribution of cases according to risk factors

Table 1– Distribution of cases on the basis of CKD-MBD markers.

Parameters		No. of cases	Percentage%
S . Calcium	<8.5	27	90
	8.5-10.5	3	10
	>10.5	0	0
S. Phosphorus	<2.5	0	0
	2.5-4.5	7	23.33
	>4.5	23	76.67
iPTH	<150	4	13.33
	150-300	5	16.67
	> 300	21	70.0
Vit D3	<10(deficiency)	5	16.67
	10-30 (insufficiency)	23	76.67
	>30	2	6.66

In our study , most common CKD-MBD was hypocalcemia (90%) followed by hyperphosphatemia (76.67%), secondary hyperparathyroidism(70%) and vitamin D deficiency (16.67%).

Table 2- Mean MBD markers values in study patients.

Parameter	Mean±SD
Sr. Ca^{+2}	7.483±0.960
Sr $PO4^{2-}$	6.04±1.536
Vit D	17.199±7.553
iPTH	409.78±234.8

The mean serum calcium levels in our cases were 7.483±0.960 and mean serum phosphate levels was 6.04±1.536. The mean vitamin D level was 17.199±7.553 and mean iPTH level was 409.78±234.8.

Table 3–Distribution of cases according to their hemoglobin level

Hb (mg/dl)	No. of cases	Percentage %
<7	0	0
7-11	26	86.67
11-12(recommended)	4	13.33
>12	0	0
Total	30	100
Mean ±SD	8.803±1.40	

Above table shows that most of the cases (26/30) were having below normal level of Hb (<11 g/dL) and only 4 cases were within normal range of Hb level.

Table 4– Distribution of cases on the basis of result of peritoneal equilibration test.

D/P ratio	No. of cases	Percentage%
0.82-1.03 (High)	4	13.33
0.65-0.81 (High Average)	6	20
0.50-0.65 (Low Average)	18	60
0.34-0.49 (Low)	2	6.67
Total	30	100

4 hr D/P creatinine (PET)

In our study majority of cases i.e. 18(60%) were low average transporters, followed by 6(20%) cases were high average transporters, and 4 cases (13.33%) were high transporters (13.33%). Only 2 cases belonged to low transporter group.

DISCUSSIONS:

In our study, 30 CAPD patients were studied. All of the patients were in the stage V of CKD (100 %) . Maximum no. of cases were males i.e. 22(73.33%). The male : female ratio was 2.75:1. Majority of the cases (50%) were in the age group of 41-50 years, followed by 51-60 years of age (16.67%), followed by age group of 31-40 years and >60 years of age (each contributing 13.33%). Only 2 cases (6.66%) were in the age group of 21-30 years. Diabetes was the major risk factor (40%) in our study followed by hypertension (33.33%) followed by obstructive uropathy (10%) followed by, chronic NSAID abuse (6.67%) and APKD 3.33%. Most of the cases (26/30) were having below normal level of Hb (<11 g/dL) and only 4 cases were having Hb within normal range. The frequency of various BMD abnormalities was hypocalcemia (90%), followed by hyperphosphatemia (76.67%) , secondary hyperparathyroidism(70%) and vitamin D deficiency (16.67%). Mean serum calcium level was 7.483±0.960 and mean serum phosphate levels was 6.04±1.536 . The mean vitamin D level was 17.199±7.553 and mean iPTH level was 409.78±234.8.

In our study , 4 hour PET is showing that maximum Patients (60%) patients have low average transport type, followed by high average type (20%), high transport type(13.33%) and low (slow) transport type(6.67%) peritoneal membrane. High transport implies a structural or functional alteration of the peritoneum which may be due to a larger effective peritoneal surface or due to higher intrinsic membrane permeability (for the rapid equilibration of small solutes including creatinine and urea). Due to rapid absorption of glucose from the dialysate, high transporters are prone to loose the osmotic gradient which is required for sustained ultrafiltration. High transporters have poor ultrafiltration capacity and greater systemic exposure to glucose. High transporters may be predisposed to malnutrition from increased amino acid losses in the dialysate, and decreased fluid removal due to poor ultrafiltration. High transporters tend to have problems achieving ultrafiltration goals but are efficient with clearance and these patients do best on regimens that involve frequent short duration dwells (APD) and should be put preferably on APD regimens eg. NIPD, CCPD etc. In our study 18 (60%) patients have low average transport type membrane . These patients have good ultrafiltration but may or may

not achieve adequate solute clearance. These patients should be put on standard dose of CAPD regimen preferably. In our study 6 (20%) patients have high average transport type . These patients achieve adequate solute clearance and ultrafiltration goals and these patients can be put on any dialysis regimen. In our study 2 (6.67%) patients have low (slow) transport type peritoneal membrane. Slow transporters may be inadequately dialyzed due to diminished solute removal. Low transporters tend to achieve ultrafiltration goals but have difficulty with clearance targets and these patients should be put on longer dwell CAPD or hemodialysis regimen preferably.

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LIMITATIONS:

It has been seen that in a significant proportion of individuals the efficiency of peritoneal membrane transport changes over time with exposure to PD solutions. But in our study, the time interval between initiation of CAPD to the PET was not uniform . Sample size was small due to limited number of CKD patients undergoing CAPD. To validate the results a large multi-centric study involving large number of patients will be required.

CONCLUSION:

The PET is an easy, inexpensive, reliable test to assess peritoneal transport type and it also provided information about peritoneal clearance of solutes and ultrafiltration. The proper classification of patient peritoneal transport type is an important issue in the practice of peritoneal dialysis. Peritoneal transport type classification was recognized not only as aid for prescription, but also as a prognostic index. The patients classified as high transporters have more co-morbid diseases, lower D4/D0 glucose, lower drained volume and a higher mortality risk than patients classified in other transport categories.

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