

https://dspace.org/

Assessment of peritoneal dialysis adequacy among continuous ambulatory peritoneal dialysis (CAPD) ppatients in Johannesburg Hospital

Abdu, Aliyu

2010-09-29
http://hdl.handle.net/10539/8811

Downloaded from a DSpace repository. https://dspace.org/

ASSESSMENT OF PERITONEAL DIALYSIS ADEQUACY AMONG CONTINUOUS AMBULATORY PERITONEAL DIALYSIS (CAPD) PATIENTS IN JOHANNESBURG HOSPITAL

Dr Aliyu Abdu

A Dissertation Submitted to the Faculty of Health Sciences, University of Witwatersrand, Johannesburg in Fulfillment of the Requirements for the Award of the Degree of Master of Science in Medicine

Johannesburg 2009

Declaration

I, Dr Aliyu Abdu declare that this research is my own work. It is being submitted for the degree of Master of Science in the University of Witwatersrand Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Date 22nd March 2010 Signature 

Dedication

To all the CAPD patients and the PD Support Group in Johannesburg Hospital.

Publications and Presentations arising from this dissertation

1. Abdu A, Naidoo S, Malgas S, Naicker TJ, Mweemba A, Fabian J, Paget G and Naicker S. Assessment of Peritoneal Membrane Transport Characteristics of CAPD Patients at Johannesburg Hospital. Oral Presentation at the African Association of Nephrology meeting at Abuja, February 2009.
2. Abdu A, Ladiera NP, Naidoo S, Malgas S, Naicker TJ, Naicker S. Assessment of Nutritional status of CAPD patients at Johannesburg Hospital. Oral Presentation at the African Association of Nephrology meeting at Abuja, February 2009.
3. Abdu A, Naidoo S, Malgas S, Ladeira NP, Naicker J, Mweeba A, Fabian J, Paget G and Naicker S. Membrane Characteristics, Small Solute Clearance and Nutritional Status of Indigenous African CAPD Patients. Poster Presentation at the World Congress of Nephrology. Milan, May 2009.
4. Abdu A, Naidoo S, Malgas S, Ladeira NP, Naicker J, Mweeba A, Fabian J, Paget G and Naicker S. Membrane Characteristics, Small Solute Clearance and Nutritional Status of Indigenous African CAPD Patients. Poster Presentation at the World Congress of Nephrology Satellite Meeting on Chronic Kidney Disease in Disadvantaged Populations. Milan, May 2009.

Abstract

Introduction: Measurement of small solute clearance is the objective means of quantifying dose of peritoneal dialysis (PD) and various organisations have issued guidelines on target values. Assessment of PD adequacy involves other factors such as blood pressure control, anaemia management, mineral metabolism, nutritional status and ultrafiltration. Membrane transport characteristic is important for PD prescription on an individual patient basis and is related to patient outcome. In this study the adequacy of PD, using small solute clearance measurement as well as other factors, and membrane characteristics have been assessed and classification of patients using our own reference values is reported for the first time. Nutritional status has been studied and the use of simple tools such as the subjective global assessment has been validated for use in our patients.

Materials and Methods: A cross sectional study involving 80 adult continuous ambulatory peritoneal dialysis (CAPD) patients. Peritoneal equilibration test (PET) was performed to assess the membrane characteristics; 24 hour dialysate fluid and urine samples were collected and used for the measurement of solute clearance, while nutritional status was assessed using the subjective global assessment (SGA) instrument, anthropometric measurements and serum albumin estimation.

Results: The mean age was 38 ± 12.43 years, 42.3% were females and 86% were blacks. Mean duration on CAPD was 19.8 ± 20.67 months. The mean of 4 hour D/P creatinine was 0.74 ± 0.13 and based on this, 18% were high transporters, 33.8% high average, 36.9% low average and 12% low transporters. Mean kt/v urea was 1.72± 0.32, and the recommended level of 1.7 was achieved by 62.8% of the patients. Mean haemoglobin was 10.99 ± 2.14 g/dl and the recommended target value of 11-12g/dl was reached by 55.8% of the patients. The mean BMI

was 24.76 ± 3.50, mean Mid Upper Arm Circumference (MUAC) was 28.53±3.89 cm and mean serum albumin was 37.10 ± 7.6 g/l. Based on SGA scores, 42% of our patients were well nourished, 50% moderately undernourished while 8% were severely malnourished. We noted significant correlations between SGA score and BMI and MUAC while there was none with serum albumin level. The mean serum calcium and phosphate levels were within normal though the mean PTH level was higher.

Conclusion: The D/P creatinine at 4 hours was higher than those reported in the literature, though the distribution of the transport types was similar. The recommended targets of kt/v and haemoglobin were achieved by the majority of our patients. Mineral metabolism parameters were within normal range. Malnutrition is common and SGA is a reliable method for nutritional assessment in our patients.

Acknowledgement

I thank God almighty for his numerous privileges to me, and making it possible for me to do this work.

My sincere gratitude goes to my supervisors Professor Saraladevi Naicker and Dr Sagren Naidoo for their guidance and supervision through the performance and writing of this work.

I wish to also thank the International Society for Peritoneal Dialysis (ISPD) for the scholarship offered to me under the fellowship programme of the association, after Professor Naicker had graciously accepted me as a fellow in the Division of Nephrology of the University of Witwatersrand. She proved to be a wonderful mentor who has moulded my career in the field of Nephrology.

I thank my collaborators Dr J Naicker and all the registrars in the Chemical Pathology Department, Sister Shirin Malgas and all the nurses in the PD unit of Johannesburg Hospital, Prof P Manga and Dr Nathan Ruhumaya of the Cardiology Division, as well as Nicole Ladiera of the Dietetics Department of the Johannesburg hospital.

I wish to thank all the consultants in the Division of Nephrology of the University of Witwatersrand: Drs Graham Paget, S Wadee, J Fabian and S Naidoo for the professional guidance I received from them during my training. In the same vein I thank Prof Meyers. Similarly, I wish to thank Drs G. Saleshando, A. Mweemba, G. Kalunga, A. Odonmeta and all the Nephrology fellows and the support staff of the Division of Nephrology.

I also thank Dr M.L Umar of the Department of Community Medicine Aminu Kano Teaching Hospital for his assistance in the statistical analysis of this work.

My wife Hafsat and our son Abdullahi have been a great source of inspiration and I thank them particularly for their patience, understanding and all the support they rendered to me. I am also grateful to my brothers and sisters for their support and prayers.

Table of Contents

	Page
Declaration	ii
Dedication	iii
Publications and presentations	iv
Abstract	v
Acknowledgements	vii
Table of Contents	viii
List of Figures	xii
List of Tables	xiii
Abbreviations	xiv
1.0 INTRODUCTION	1
1.**1 Peritoneal dialysis as a form of renal replacement therapy**	3
1.1.1 History and evolution peritoneal dialysis	3
1.1.2 Physiology of peritoneal dialysis	4
1.1.3 Peritoneal dialysis solutions	8
1.1.3.1 Composition of peritoneal dialysis solution	8
1.1.3.2 Dextrose based peritoneal dialysis solution	10
1.1.3.3 Amino acid based peritoneal dialysis solution	11
1.1.3.4. Icodextrin based peritoneal dialysis solution	12
1.1.3.5 The newer generation peritoneal dialysis solutions	12
1.1.4. Schedules of peritoneal dialysis	13
1.1.5 Advantages of peritoneal dialysis	15

1.1.6 Drawbacks of peritoneal dialysis 17

1.2 **Assessment peritoneal membrane characteristics** 18

1.2.1. Peritoneal Equilibration Test 19

1.3. **Assessment of peritoneal dialysis adequacy** **29**

1.3.1. Urea kinetic model in the assessment of peritoneal dialysis adequacy 21

1.3.2. Creatinine clearance in the assessment of peritoneal dialysis adequacy 23

1.3.3 Solute clearance and patient outcomes in CAPD 24

1.3.4 Solute Clearance Targets 25

1.3.5 Creatinine Clearance or kt/v 26

1.4 **Assessment of Nutritional Status in Peritoneal Dialysis Patients** **27**

1.4.1 Dietary Assessment 28

1.4.2 Anthropometry 29

1.4.3 Biochemical Assays 29

1.4.4 Protein Equivalent of Total Nitrogen Appearance 31

1.4.5 Subjective Global Assessment 31

1.5 Echocardiography assessment in PD patients 32

1.6 Hypothesis 33

1.7 Aims and Objectives 33

2.0 MATERIALS AND METHODS **34**

2.1 Study population 34

2.1.2 Inclusion criteria 34

2.1.3 Exclusion Criteria 34

2.2 **Methods** **35**

2.2.1 Solute clearance measurement 35

2.2.2 Peritoneal Equilibration Test 36

2.2.3 Measurement of Dialysate and Serum Creatinine 37

2.2.4 Measurement of Dialysate Glucose 38

2.2.5 Correction factor for glucose interference with creatinine in the dialysate 38

2.2.6 Other Biochemistry Tests 38

2.2.6.1 Serum albumin 38

2.2.6.2 Serum cholesterol 39

2.2.6.3 Serum calcium 40

2.2.6.4 Serum phosphate 40

2.2.6.5 Serum Intact Parathyroid Hormone 40

2.2.7 Nutritional Parameters 41

2.2.7.1. Anthropometric Parameters 41

2.2.7.1.1 Weight and Height 41

2.2.7.1.2 Mid Upper Arm Circumference 41

2.2.7.1.3 Triceps Skin Fold Thickness 42

2.2.7.1.4 Arm Muscle Area 42

2.2.7.2 Dietary Recall 42

2.2.7.3 Subjective Global Assessment 43

2.2.8 Echocardiography in the assessment of cardiac structure and function 44

2.3 **Statistical Analysis** **45**

3.0 RESULTS **47**

3.1 Demographic Data 47

3.2 Solute Clearance Results 49

3.3 Echocardiograhic Assessment Results 52

3.4 Peritoneal Equilibration Test Results 55

3.5 Biochemistry Results 59

3.6 Nutritional Status Assessment Results 60

3.6.1 Anthropometric Parameters 60

3.6.2 Dietary Recall 61

3.6.3 Subjective Global Assessment 61

4.0 DISCUSSION 63

4.1 Demographic data 63

4.2 Solute Clearance Results 64

4.3 Peritoneal Equilibration Test Results 66

4.4 Aetiology of End Stage Renal Disease 63

4.5 Haemoglobin Level 69

4.6 Biochemistry Results 70

4.7 Nutritional Status 71

4.7.1 Biochemical Methods for Nutritional Assessment 71

4.7.2 Dietary Recall 71

4.7.3 Anthropometric Parameters 72

4.7.4 Subjective Global Assessment 72

4.8 Echocardiographic features 73

4.9 Study limitations 75

5.0 CONCLUSIONS AND RECOMMENDATIONS 76

5.1 Conclusions 76

5.2 Recommendations for Clinical Practice 77

5.3 Recommendations for Research 77

References 78

Appendix1 Subjective Global instrument 92

Appendix2 Ethics Clearance Certificate 93

List of figures

Figure	page
1.1 Histological picture of normal peritoneum	4
1.2. Peritoneal dialysis schedules	15
3.1 Causes of end stage renal disease in the study population	49
4. D/P creatinine result showing different transport groups	56

List of Tables

Table	**page**
1.1 Composition of Standard Glucose Based PD Solutions	11
3.1. Distribution of the different age groups and gender of the study patients	47
3.2 Solute Clearance Parameters	50
3.3 Linear regression analysis for weekly kt/v and other parameters	51
3.4 Analysis of variance results between the different groups based on the weekly kt/v	52
3.5 Echocardiography Parameters	53
3.6 Linear Regression Analysis of Weekly kt/v, LV Systolic and Diastolic Function	54
3.7 D/P Creatinine Results	55
3.8. Proposed Reference Range for Classification of Patients	56
3.9. D/P creatinine results in various populations	57
3.10. Comparison of the means of D/P creatinine in different populations	57
3.11. Linear regression analysis for D/P Creatinine at 4 Hours and other Parameters	58
3.12. D/D0 Glucose Results in the Study Population	58
3.13. Student t- test result comparing the D/D0 glucose result with other populations	58
3.14. D/P Urea Results	59
3.15. Biochemistry Results	59
3.16. Anthropometric Parameters	61
18. Correlation between weekly kt/v and nutritional status parameters	62

Abbreviations

AGEs	Advanced Glycation End Products
AMVL	The anterior mitral valve leaflet
ANOVA	Analysis of Variance
APEX	Accelerated Peritoneal Examination
AQP	Aquaporins
BMI	Body Mass Index
BSA	Body Surface Area
BP	Blood Pressure
CA125	Cancer Antigen 125
Ca	Calcium
CAPD	Continuous Ambulatory Peritoneal Dialysis
CCPD	Continuous Cycler-Assisted Peritoneal Dialysis
Cl	Chloride
CrCl	Creatinine Clearance
CV	Cardiovascular
DATT	Dialysis Adequacy and Transport Test
D/D0	Ratio of dialysate glucose concentration at specified time to the initial level in the dialysate solution
D/P	The ratio of solute concentration in the dialysate and plasma
ESRD	End Stage Renal Disease
G6PDH	Glucose-6-phosphate-dehydrogenase
GDP	Glucose Degradation Product

HBV	High Biological Value
HCT	Haematocrit
ISPD	International Society for Peritoneal
$IVST_d$	Interventricular Wall Thickness During Diastole
k	Solute Clearance
LBM	Lean Body Mass
LV	Left Ventricle
LVEDD	Left ventricular internal dimension measurements in end-diastole
LVESD	Left ventricular internal dimension measurements end-systole
MC	Mesothelial Cells
Mg	Magnesium
MRC	Medical Research Council
MTAC	Mass Transfer Area Coefficient
MUAC	Mid Upper Arm Circumference
MW	Molecular Weight
Na	Sodium
NHLS	National Health Service Laboratories
NIPD	Nocturnal Intermittent Peritoneal Dialysis
NKF	National Kidney Foundation
nPNA	Normalized Protein Nitrogen Appearance
PD	Peritoneal Dialysis
PDC	Peritoneal Dialysis Capacity
PEM	Protein-Energy Malnutrition

PET	Peritoneal Equilibration Test
PTH	Parathyroid Hormone
PWT_d	Posterior Wall Thickness During Diastole
RRT	Renal Replacement Therapy
RSA	Republic of South Africa
SGA	Subjective Global Assessment
SPA	Standard Peritoneal Permeability Analysis
t	Treatment Time
TSF	Triceps Skin Fold Thickness
UF	Ultrafiltration
UKM	Urea Kinetic Modeling
v	Distribution Volume Dialysis