Characteristics, Complications and Outcome of Patients Treated with Automated Peritoneal Dialysis at the Peritoneal Dialysis Unit, University Hospital of the West Indies

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ABSTRACT

Objective: *To characterize and evaluate complications and outcomes of the patients treated with automated peritoneal dialysis (PD) at the University Hospital of the West Indies (UHWI), Jamaica.*

Method: *Retrospective data were collected from peritoneal dialysis patients' case files retrieved from the medical records department of UHWI. Demographic data (age, gender, address, marital status), year of dialysis commencement, cause of end stage renal disease (ESRD), haemoglobin, serum electrolytes, serology, blood pressure readings, medications used, blood transfusion and erythropoietin use were collated. Complications such as infections (pneumonia, catheter-related infections), cardiac related disorders (congestive cardiac failure, acute coronary syndrome, pericarditis/pericardial effusion), cerebrovascular diseases, renal osteodystrophy, complications of the procedure and of end stage renal disease (ESRD), outcome and cause of death were retrieved from patients' case files for analysis.*

Results: *There were 202 patients receiving peritoneal dialysis between September, 1999 and December, 2008. Data on 190 were analysed. The case files of 12 patients were not included because of incomplete data. The ages of the studied PD patients ranged between 33 and 65 years.*

The mean haemoglobin was 7.4 g/dL, serum calcium of 2.1 mmol/L, serum phosphate of 1.9 mmol/L and calcium/phosphate product of 4.1mmol^2/L^2. The serum albumin was 32 g/L and serum total cholesterol/HDL ratio of 5.3. Most patients were from Kingston and St Andrew (56.8%), St Catherine (18.9%) and Clarendon (7.4%). Hypertension (27.9%), chronic glomerulonephritis (17.9%) and diabetes mellitus (17.4%) were the commonest causes of ESRD. There were 70.5% unmarried persons and 81.6% of patients were unemployed. HIV, Hepatitis B and Hepatitis C seropositivity were discovered in 4.1%, 1.1 and 0.5% of patients respectively. Only 20% of the patients used erythropoietin and of this 92% used it less than 50% of the prescribed frequency.

Infections (43.2%) such as pneumonia, peritonitis, catheter tunnel infection, exit site infection and cardiac related complications (37.4%) such as congestive cardiac failure, acute coronary syndrome, pericarditis/pericardial effusion were the most frequently encountered complications. Forty-one per cent of patients were transferred to haemodialysis mainly on account of inadequate dialysis clearance. Sepsis (42%) such as pneumonia, urinary tract infection, peritonitis and cardiac related causes (31%) such as congestive cardiac failure and acute coronary syndrome were the two major causes of death. Of those who died of sepsis, 45.2% had pneumonia. Only 9.5% (4/42) of patients had confirmed peritonitis during their illness.

Conclusion: *Infection and cardiovascular disease were common complications observed in this study. Therefore intensive management of risk factors (hypertension, diabetes and dyslipidaemia) and prompt recognition of infection is hereby recommended. Early recognition and appropriate management of sepsis in peritoneal dialysis patients should be initially based on standard protocol. The use of erythropoietin in peritoneal dialysis patients will enhance better management of anaemia and improve quality of life.*

Keywords: Complications, outcome, peritoneal dialysis

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Características, Complicaciones y Resultados Clínicos de los Pacientes Tratados con Diálisis Peritoneal Automatizada en la Unidad de Diálisis Peritoneal del Hospital Universitario de West Indies

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RESUMEN

Objetivo: *Caracterizar y evaluar las complicaciones y resultados clínicos de los pacientes tratados con diálisis peritoneal automatizada (DP) en el Hospital Universitario de West Indies (HUWI), Jamaica.*

Método: *Los datos retrospectivos fueron recopilados de pacientes de diálisis peritoneal tomados del departamento de historias clínicas del HUWI. Se recopilaron datos demográficos (edad, género, dirección, estado civil), año de comienzo de la diálisis, causa de la enfermedad renal en fase terminal (ERFT), hemoglobina, electrólitos del suero, serología, lecturas de la presión arterial, medicamentos usados, transfusión de sangre y uso de la eritropoyetina. Asimismo, a partir de las historias de casos de pacientes, se recogió para su análisis, información sobre complicaciones tales como infecciones (neumonía, infecciones por catéter), trastornos cardíacos (insuficiencia cardíaca congestiva, síndrome coronario agudo, pericarditis/derrame pericárdico), enfermedades cerebrovasculares, osteodistrofia renal, complicaciones de procedimiento y enfermedad renal en fase terminal (ERFT), así como resultado clínico y causa de muerte.*

Resultados: *Entre septiembre de 1999 y diciembre de 2008, un total de 202 pacientes se encontraban recibiendo diálisis peritoneal. Los datos de 190 pacientes fueron analizados. Las historias clínicas de 12 casos, no fueron incluidas debido a que los datos estaban incompletos. Las edades de los pacientes de DP estudiados tenían edades entre 33 y 65 años.*

La hemoglobina media fue 7.4 g/dL, el calcio sérico 2.1 mmol/L, el fosfato sérico 1.9 mmol/L y el producto calcio/fosfato 4.1mmol²/L². La albúmina sérica fue 32g/L y la proporción colesterol total sérico/HDL fue 5.3. La mayoría de los pacientes eran de Kingston y Saint Andrew (56.8%), Saint Catherine (18.9%) y Clarendon (7.4%). La hipertensión (27.9%), la glomerulonefritis crónica (17.9%) y la diabetes mellitus (17.4%) fueron las causas más comunes de ERFT. Había un 70.5% de personas solteras y un 81.6% de pacientes eran desempleados. Se descubrió seropositividad para el VIH, la hepatitis B y la hepatitis C en 4.1%, 1.1% y 0.5% de los pacientes respectivamente. Sólo el 20% de los pacientes usaban eritropoyetina y de estos 92% lo usaban menos del 50% de la frecuencia prescrita. Las infecciones (43.2%) como la neumonía, la peritonitis, la infección del túnel del catéter, la infección del sitio de salida y las complicaciones cardíacas relacionadas (37.4%) tales como la insuficiencia cardíaca congestiva, el síndrome coronario agudo, y la pericarditis/derrame pericárdico, fueron las complicaciones encontradas con más frecuencia. Cuarenta y uno por ciento de los pacientes fueron transferidos a hemodiálisis debido principalmente a depuración inadecuada de la diálisis. Sepsis (42%) como la neumonía, la infección de las vías urinarias, peritonitis y causas cardíacas relacionadas (31%) tales como la insuficiencia cardíaca congestiva y el síndrome coronario agudo, fueron las dos causas principales de muerte. De los fallecidos por sepsis, 45.2% tenían neumonía. Sólo 9.5% (4/42) de los pacientes había confirmado peritonitis durante su enfermedad.

Conclusión: *La infección y la enfermedad cardiovascular constituyeron complicaciones comunes observadas en este estudio. Por lo tanto, se recomienda aquí el tratamiento intensivo de los factores de riesgo (hipertensión, diabetes y dislipidemia) y el pronto reconocimiento de la infección. La detección precoz y el tratamiento adecuado de la sepsis en los pacientes de diálisis peritoneal, deben basarse inicialmente en el protocolo estándar. El uso de la eritropoyetina en los pacientes de diálisis peritoneal proporcionará un mejor tratamiento de la anemia y conducirá a mejorar la calidad de vida.*

Palabras claves: complicaciones, resultado, diálisis peritoneal

INTRODUCTION

Peritoneal dialysis (PD) first became a practical and widespread modality of renal replacement therapy in the 1980s. Renal replacement therapy (RRT) in the Caribbean mainly comes in the form of haemodialysis and to a less extent, transplantation (1). There are no data available from the Caribbean evaluating patients on PD. Peritoneal dialysis is one of the available renal replacement therapy for patients with end stage renal disease (ESRD). It involves the transport of solutes and water across a "membrane" that separates two fluid containing compartments. Blood in the peritoneal capillaries in renal failure contains excess of urea, creatinine and potassium *etc* on one side and the dialysis solution in the peritoneal cavity, which typically contains sodium, chlorine and lactate rendered hyperosmolar by inclusion of glucose is on the other side. The peritoneal membrane acts as the dialyzer.

Knowledge of the transport properties of the peritoneal membrane is important to guide therapy, evaluate changes in the peritoneal membrane over time and also prognosticate. Peritoneal equlibration test is used to characterize the peritoneal membrane function and to select the most appropriate technique for the patient. This will ultimately guide clinical decision and prescription management.

Chronic long-term PD is associated with progressive loss of ultrafiltration capacity and integrity of the peritoneal membrane. In PD therapy, the quality of life for patients with ESRD is improved with preservation and prolongation of residual renal function which is associated with improved survival. Despite this, technique failure rate and complication remain high. Factors contributing to this include peritonitis, catheter-related difficulties, viability of the peritoneal membrane and various psychosocial problems.

This study was designed with the objective to characterize and evaluate complications and outcome in patients treated with automated peritoneal dialysis at the University Hospital of the West Indies, (UHWI) Peritoneal Dialysis Unit (PDU) between September 1999 and December 2008.

SUBJECTS AND METHODS

A retrospective review of all data collected from peritoneal dialysis case files of patients dialyzed at the Peritoneal Dialysis Unit (UHWI) was performed. The study period was between September 1999 and December 2008. Patient's case files were all retrieved from the medical records department, UHWI.

Parameters recorded for study included demographic data (age, gender, address, marital status), year of dialysis commencement, cause of ESRD, haemoglobin, serum urea , serum creatinine , serum calcium, serum phosphate, HIV and hepatitis serology. Blood pressure readings, number and types of daily medications used, blood transfusion, erythropoietin use, complications, outcome and cause of death were also collected.

Data analysis was performed using the statistical package for Social Sciences (SPSS version 16.0) software. Graphs were generated using SPSS software and Microsoft Excel.

RESULTS

A total of 202 patients received peritoneal dialysis at UHWI between September 1999 and December 2008. Of these, 190 (94.1%) had adequate records available for review.

Most patients were from Kingston (56.8%). St Catherine and Clarendon accounted for 18.9% and 7.4% respectively (Fig 1). The unmarried accounted for 70.5% of patients while 81.6% of all patients were unemployed. There was no data available for those who were in common-law union. The average age was 49 ± 16.2 with a range of 33 to 65 years. Females accounted for 54.27 % of patients and 45.8% were males (Table 1).

The major causes of ESRD found in this population were hypertension, diabetes mellitus and chronic glomerulonephritis (Fig. 2). Sickle cell disease and persistent posterior urethral valves were also found as significant causes of ESRD. HIV, Hepatitis B and Hepatitis C viral seropositivities were documented in 4.1%, 1.1% and 0.5% of studied patients respectively (Table 1). The mean haemoglobin was 7.4 g/dl, serum calcium of 2.2 mmol/L, serum phosphate of

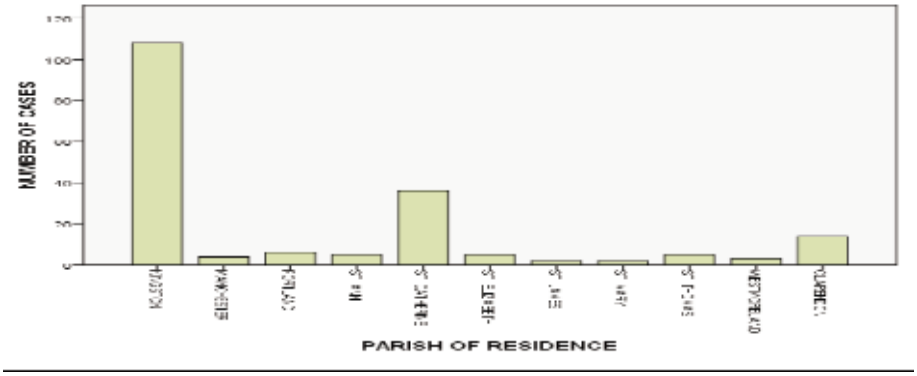

Fig. 1: Patients geographic location.

Table 1: Different variables and the frequencies

VARIABLES	OUTCOME	FREQUENCY	PERCENTAGE
Gender	Male	87	45.8
	Female	103	54.2
Marital status	Married	55	29
	Single	135	71
Occupation	Employed	35	18.4
	Unemployed	155	81.6
Pre-dialysis Blood pressure	Controlled	91	47.9
	Uncontrolled	99	52.1
Post-dialysis Blood pressure	Controlled	131	69.3
	Uncontrolled	58	30.7
HIV serology	Negative	186	97.9
	Positive	4	2.1
Hepatitis B surface antigen	Negative	18.8	98.9
	Positive	2.0	1.1
Hepatitis C virus	Negative	18.9	19.9
	Positive	1.0	0.5
Erythropoietin use	No	150	79.4
	Yes	39	20.6
Frequency of Erythropoietin use	> 75%	1	2.5
	> 50%	6	15.4
	> 25%	12	30.8
	< 25%	20	51.3
Blood transfusion	No	78	41.1
	Yes	112	58.9
Complications	No	39	20.5
	Yes	161	79.5

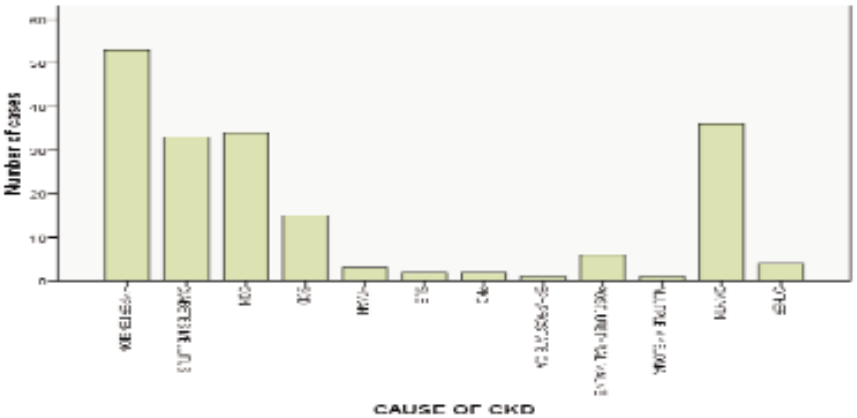

Fig. 2: Causes of end-stage renal disease.

1.94 mmol/L, calcium phosphate product of 4.1, albumin of 32 g/L and serum total cholesterol/HDL ratio of 5.3 (Table 2).

Of all the studied patients, 41% of patients were transferred to haemodialysis mainly on account of inadequate dialysis clearance. Infections (43.2%) such as pneumonia, peritonitis, tunnel infection, exit site infection and cardiac related complications (37.4%) such as congestive cardiac failure, acute coronary syndrome, pericarditis/pericardial effusion were the most frequently encountered complications. Causes of death were most commonly attributed to sepsis,

Table 2: Common variables and their mean value

Variable	Mean Serum Value	Standard Deviation
Haemoglobin	7.363	1.539
Calcium	2.127	0.325
Phosphorus	1.937	0.622
Ca/P product	4.12	1.679
Albumin	32.26	5.80
LDL	2.79	1.46
HDL	0.99	0.35
Total cholesterol	4.92	1.73
Total cholesterol/HDL ratio	5.39	2.54

42% (due to pneumonia, urinary tract infection, peritonitis, exit site infection) and cardiac disorders (31%) such as congestive cardiac failure and acute coronary syndrome (Fig. 3). Of those who died due to sepsis (Fig. 4), 45.2% were due to pneumonia. Only four (9.5%) patients had peritonitis confirmed during their terminal illness. However, death could not be ascribed to peritonitis in these four patients.

Only 20% of the patients used erythropoietin and of this, 92% use it < 50% of the prescribed frequency (Fig. 5).

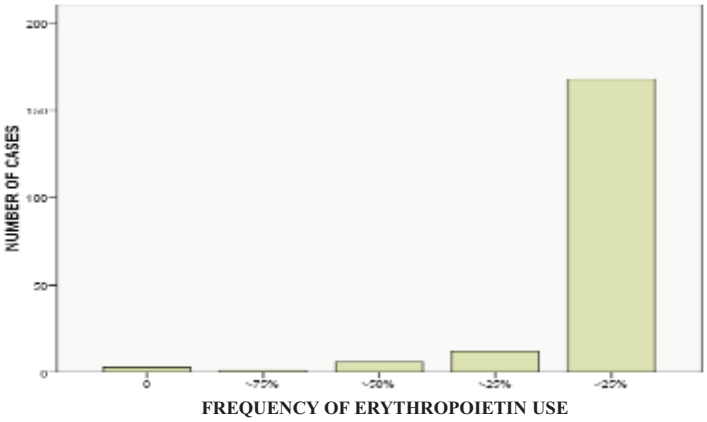

Fig. 5: Erythropoietin usage.

Pill burden in this study showed that the majority of patients were taking between five to ten pills per day, with some taking up to 16 pills for the day (Fig. 6).

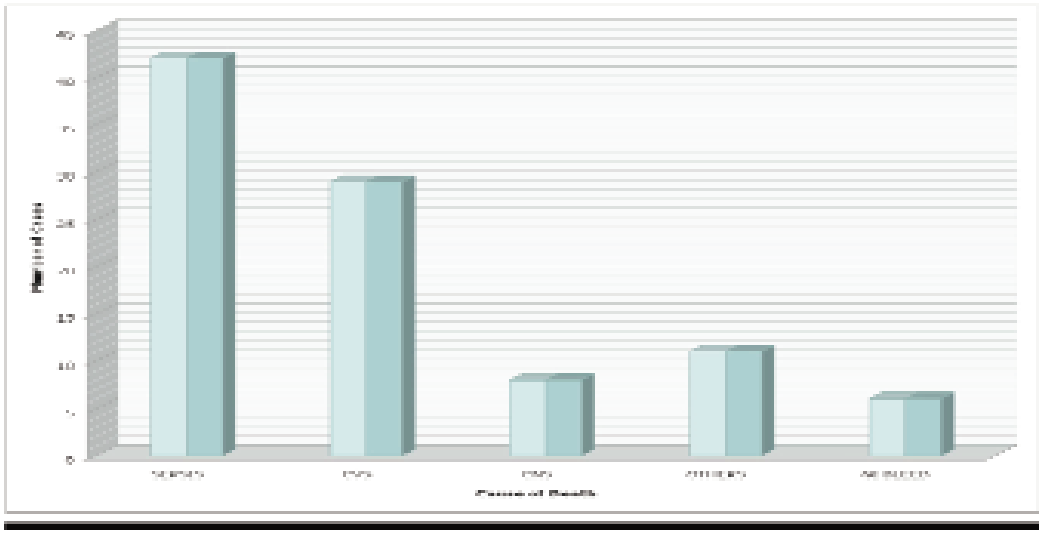

Fig. 3: Reported causes of death

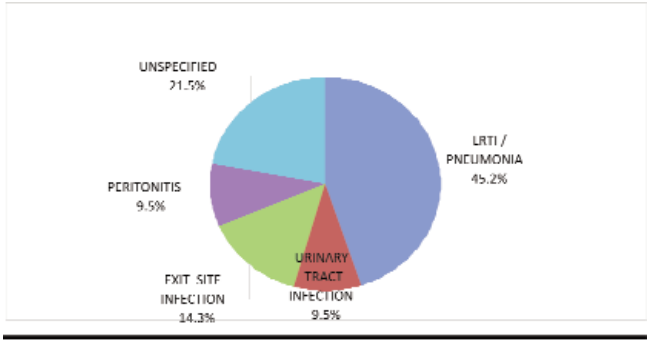

Fig. 4: Causes of sepsis

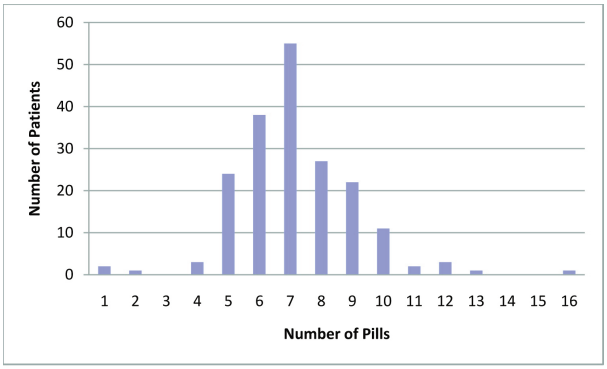

Fig. 6: Graph of number of patients and the average number of pills taken daily.

DISCUSSION

Peritoneal Dialysis is an effective means of renal replacement therapy (9) for patients with ESRD. Peritoneal dialysis is one of the effective means of renal replacement therapy and can be home-based or centre-based but this study was based at an in-hospital centre. The long term use of intermittent peritoneal dialysis in ESRD was well documented as far back as 1968 and peritoneal dialysis was popularized in 1976 by Popovich and co-worker and it has been shown to offer better quality of life with better mortality profile (10, 11).

There are different types of peritoneal dialysis, such as continuous ambulatory peritoneal dialysis (CAPD), continuous cyclic peritoneal dialysis (CCPD) and intermittent peritoneal dialysis (IPD). Cycler assisted IPD is the form offered at the PDU (UHWI) where the study was conducted. Despite advancements, peritoneal dialysis is plagued by different types of complications as revealed by this study.

The average age of 49 (range of 33 to 65) years from this study is similar to many other reviewed studies (8, 12) and is also similar to the age seen in patients on haemodialysis (1). The geographic location of the patients on PD reflects a higher proportion in the Kingston as well St Catherine environs and this could simply be due to location bias as the PDU is located in this area.

The causes of ESRD were no different from other studies as hypertension, diabetes mellitus and chronic glomerulonephritis were the leading causes (1, 3, 8, 12). Persistent posterior urethral valves are found to be quite a significant cause of ESRD compared to the causes found in patients on chronic haemodialysis (1). Perhaps this reflects the fact that PD is a better choice in paediatric and adolescent population combined with the fact that patients with persistent posterior urethral valves will present earlier in life with CKD. However, when compared to data on HD, the mean age was similar. Therefore, the reason for this is still unclear. Sickle cell disease was also seen in a significant proportion of these cases and this will have implications especially on the mean haemoglobin concentration seen in the studies. A sub-analysis of the mean haemoglobin among the different cause of ESRD would reflect this and possibly shed some light on the observed trend.

Anaemia is a common complication of ESRD (1, 6, 7, 8). The mean haemoglobin from this study was 7.4 g/dL, significantly lower than the kidney disease outcomes quality initiative (K/DOQI) guideline target haemoglobin values of 11 to 12 g/dL. This K/DOQI target is supported by other studies (13, 14). However, this can be attributed to the general low usage of erythropoietin as demonstrated in this study. Only 20% of the studied population used erythropoietin and of this, 92% used it less than 50% of the prescribed frequency. Patients had to purchase erythropoietin out of their own resources. A significant majority of the patients rely on packed red cell transfusion to maintain their haemoglobin as well as to relieve symptoms of anaemia. However, with the free availability of erythropoietin to patients with CKD and ESRD at government hospitals in Jamaica over the last year, there should be an improvement in the mean haemoglobin in ESRD. The repeated use of blood transfusion also has implications (matching, selection and graft survival) for patients being considered for renal transplantation. Other causes of anaemia in CKD includes poor dietary intake of iron and the presence of high levels of circulating inflammatory cytokines promoting destruction of immature erythroblast and hepatic release of hepcidin (a peptide hormone) reducing iron absorption from the gut.

Cardiovascular disease is the leading cause of mortality in patients with ESRD and CVD mortality is significantly more in patients treated by RRT than the age-matched general population (K/DOQI). The United States Renal Data System (USRDS) annual data (abstracted from prevalent patients in the years 1998–2000) shows that 75.47 (42.2%) of the 178.92 deaths per 1000 patient years at risk have cardiovascular causes. Of these deaths, 36.51 (46%) were recorded as cardiac arrest. Cardiac-related causes accounted for 37.4% of mortality in the present study. The cause is multifactorial as the ESRD patient is in a pro-inflammatory state with multiple risk factors for CVD including diabetes mellitus, hypertension and uncontrolled dyslipidaemia. There is new evidence (15, 16) which suggests that the constant high load of glucose in PD patients may predispose to impaired glucose tolerance, diabetes mellitus and even metabolic syndrome.

Sepsis (43.2%) has been demonstrated in this study as the commonest cause of death. Although further breakdown showed that pneumonia (45.2%) accounted for the majority while peritonitis was seen in 9.5%. A known risk factor for mortality and peritonitis is the presence of diabetes and over 36% of the patients in this study had diabetes (Fig. 2). Prompt recognition of sepsis in peritoneal dialysis patients is highly recommended to reduce this preventable cause of mortality. Also, the use of vaccination as primary prevention in this population which is also likely to have congestive cardiac failure is recommended.

It is worthwhile to note that only 9.5% of peritonitis documented in the case files was confirmed. Also it would have been useful to know how many peritonitis episodes were there per patient.

Congestive cardiac failure and coronary event (confirmed) accounted for approximately 30% of all complications. It therefore is not surprising that they also accounted for the higher mortality seen in the study.

Identification and risk stratification should be encouraged in the patients both on PD as well as HD, and should be extended to other stages of CKD. Management of blood pressure and lipid according to international guidelines should be followed.

The PD first concept as practised in Hong Kong should be examined in this region. In Hong Kong, CAPD is presented as first line dialysis modality unless medical contraindication dictates otherwise. The hospital authority in Hong

Kong reimburses only patients for PD. Peritoneal dialysis offers significant advantage of better residual renal function (RRF) when compared with haemodialysis. High RRF translate to less mortality in dialysis patients. Peritoneal dialysis has been documented in various studies to be a cheaper modality of renal replacement therapy when compared with haemodialysis. In fact, the Asian Round Table on dialysis economics has agreed to look into ways to increase the utilization of PD in order to improve the clinical and financial management of patients with ESRD.

CONCLUSION

Peritoneal dialysis for patients with ESRD offers many advantages, including better quality of life, preservation of residual renal function, and patients and care-giver flexibility and satisfaction. Therefore, careful attention should be paid to patient selection, timing and dose of PD, patients' and family quality of life, maintenance of adequate volume status, maintaining serum biochemical parameters at recommended values, control of calcium-phosphate product and long term viability of therapy. All RRT centres should include both PD and HD in their programmes and provide ESRD patients with unbiased information, thus allowing them to freely choose between the two RRT modalities. It is recommended that more peritoneal dialysis centres be set up, both home and centre-based, as first line modality of renal replacement therapy.

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