ORIGINAL ARTICLE

Dialysis for End Stage Renal Disease: A Descriptive Study in Penang Hospital

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Summary

This research was carried out to study the characteristics of ESRD patients and the resources consumed with dialysis treatment as well as to assess the clinical outcomes of ESRD treatment in Penang Hospital. A total of 117 ESRD patients were studied over 30 months. 56.4% of the patients were male and the median age was 40. Diabetic nephropathy was the commonest cause of ESRD (29.9%). Hypertension was the predominant comorbidity (60.6%). A larger proportion started treatment with Continuous Ambulatory Peritoneal Dialysis (59.0%). At the end of the study period, 49.6% of the patients continued their treatment in the same modality and 27.4% died. Average Dialysis Adequacy (Kt/V) achieved was satisfactory, 2.29 in CAPD and 1.50 in Haemodialysis.

Key Words: End stage renal disease, Hemodialysis, Continuous ambulatory peritoneal dialysis, Penang Hospital, Resources consumed.

Introduction

The incidence and prevalence of patients in need of maintenance dialysis therapy is increasing throughout the world[1,2,3]. United States Renal Data System (USRDS) reported that the point prevalence of End Stage Renal Disease (ESRD) rose from 156,461 at the end of 1989 to 340,261 at the end of 1999 and the annual incidence rose from 44,569 in 1989 to 88,091 a decade later[4]. The same problem of ESRD is seen in Malaysia. At the end of the year 2001 there were 8633 patients on renal replacement therapy, 7330 of whom were on dialysis and 1303 with a functioning renal transplant. The acceptance rate increased by 45 pmp between 1994 and 2001[5], (Fig. 1).

Most patients with ESRD have complications such as hypertension, and cardiovascular disease. Cardiovascular disease is the major cause of death in ESRD patients. Diabetes is the commonest cause of ESRD and diabetic patients continue to have less survival time and medical rehabilitation compared to non-diabetics.

The removal of waste products from the body in ESRD is achieved only with Renal Replacement Therapy (RRT) i.e. either dialysis or renal transplantation. The choice between dialysis and transplantation for patients depends on many factors such as the clinical condition of the patient, the availability of a donor for transplant, and other resources needed for each choice[3]. Dialysis comprises two modalities: hemodialysis (HD) or peritoneal dialysis (PD). HD removes waste products through an artificial semipermeable membrane (dialyzer)[8]. HD may be done in-center (IHD), at home (HHD) or at the office (OHD). PD removes toxins from the circulating blood in the capillaries that supply the semipermeable membrane (peritoneum), and requires a catheter (Tenckhoff Catheter) inserted into the

This article was accepted: 16 February 2005

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peritoneal cavity. PD can be Continuous Ambulatory Peritoneal Dialysis (CAPD), Cyclic Continuous (CCPD), or Intermittent Peritoneal Dialysis (IPD).

HD in recent decades has shown great improvement in outcomes through advances in procedures and technique. Despite this, patients still experience clinical problems on dialysis (such as hypotension, cramps, hypoxia, bleeding, hemolysis and access problems), which sometimes lead to cessation of hemodialysis. Patients with insurmountable problems can be transferred to another RRT modality. In terms of PD, peritonitis is the most serious and frequent complication such that a patient may need to switch to HD if unresolved. With consideration of all of the above, dialysis treatment requires considerable resources (people, time, facilities, equipment, and money) that are scarce. This survey aims to study ESRD patient characteristics and determine the resources consumed in each dialysis modality, patients' demographic and clinical data, and evaluate the treatment resources and clinical outcomes.

Materials and Methods

Study design and sampling
This was a descriptive study. Data were collected by retrospective and prospective methods. This study was carried out at the nephrology unit (HD and CAPD units), Penang hospital over a period of 30 months (1st Jan. 2000- 30th June 2002), and a follow-up of 12 months. All patients registered in each treatment modality through the period assigned were included in the study including patients who were already in the programme on 1st January 2000. Exclusion criteria were used to determine the characteristics of eligible patients, instruments and consumables for the modalities. The exclusion criteria were:

- Patients registered in either dialysis unit but did not complete one year in the same modality.
- Surgical procedures for dialysis access either vascular or peritoneal.
- The period between dialysis access construction/insertion and starting of dialysis modality through the mentioned access.

Data collection
Forms were drawn up to gather the patients' demographic data such as age, sex, race, working status and monthly income together with the patients' clinical data. Drugs used through the first year period that the study dealt with, dialysis materials used, laboratory tests and diagnostic investigations done to each patient were also gathered in the data collection form. Clinical outcomes were expressed as outcome status after the period studied (death, transferred to other modality, transplanted and lost to follow up), achievement of dialysis adequacy (Kt/V), number and days of hospitalizations.

Data analysis
Descriptive analysis was performed using SPSS™ (Statistical Package for Social Science) software version 11. Student t-test was used for detection of differences in continuous variable between the two groups (HD, CAPD). Chi-square test was used to test for differences for discrete variables. All tests were done using a *priori* level of significance 0.05.

Results

Demographic
Over the 30 months period studied, there were 117 ESRD patients accepted for dialysis in HD (35 patients) and CAPD (82 patients) units. The ethnic distribution was similar between Malay (47%) and Chinese (48.7%) races with 4.3% Indian. The sex distribution was 56.4% male. Average mean age was 38.72±21.03 years with a median of 40. Forty-two (53.9%) patients were in the 40-64 age range. 50.4%of the patients were unable to work part or full time. The government supported 95 patients financially (81.2%) and partially subsidized (14 patients). Twenty-two patients had a monthly income of Malaysian Ringgit (RM) 500-900 and the other 22 patients had an income of ≥RM2000.

Figure 2 shows the causes of ESRD. Diabetic nephropathy was the cause in 35 (29.9%) of the patients followed by glomerulonephritis in 23 patients (19.7%). Comorbidity is represented in Figure 3. Seventy-one patients (60.7%) had hypertension and 24 patients (20.51%) were without comorbidity. A larger proportion of the ESRD patients started treatment with CAPD (n= 69; 59.0%) and there were 7 patients (6.0%) who returned to dialysis after failed renal transplant.

Patients treated with hemodialysis were older (mean age of 42.37 years) than those treated with CAPD (mean age of 37.10 years) and were more likely to be working (60.0%) ($P<0.001$). They differed from CAPD patients in being mostly Chinese (57.1%) (Table I). At the end of the period, 49.6% of the patients continued their treatment in the same modality, 18.8% were transferred to the other modality, 0.9% were

transplanted, 3.4% were transferred to other centers and 27.4% of the patients died.

Outcomes

Only 82 out of 117 patients completed 12 months follow up and were included in the resource utilization and outcome assessment. Table II represents average laboratory tests and diagnostic investigations done through a one year follow up. Table III shows the list of drugs used for the treatment co-morbidities and complications.

There was significant difference between the two groups in terms of average systolic BP but no significant difference in diastolic blood pressure (Table IV). Concerning the fractional urea clearance Kt/V, HD and CAPD patients achieved 1.51±0.63 and 2.29±0.52, respectively. There were 151 CAPD patient admissions of which 46 were for CAPD training, while hospitalization days were 18.77±18.02 in CAPD patients and 5.38±6.16 in HD patients. 84.4% of the deaths were among CAPD patients.

Table I: Demographic data of all registered ESRD patients and patients on CAPD and HD January 2000-June2002

Demographic Variable	All Patients n=117	CAPD n=82	HD n=35
Mean age, years	38.72±21.03	37.10±22.67	42.37±16.41
Paediatrics (<19)	31 (26.5%)	28 (34.1%)	3 (8.6%)
Young (19-39)	25 (21.4%)	14 (17.1%)	11 (31.4%)
Middle (40-64)	42 (35.9%)	24 (29.3%)	18 (51.4%)
Old (≥65)	16 (13.7%)	13 (15.9%)	3 (8.6%)
Gender			
Male	66 (56.4%)	44 (53.7%)	22 (62.9%)
Female	51 (43.6%)	38 (46.3%)	13 (37.1%)
Race			
Malay	55 (47.0%)	42 (51.2%)	13 (37.1%)
Chinese	57 (48.7%)	37 (45.1%)	20 (57.1%)
Indian	5 (4.3%)	3 (3.7%)	2 (5.7%)
Working*			
Yes	52 (44.5%)	31 (37.8%)	21 (60.0%)
No	59 (50.4%)	46 (56.1%)	13 (37.1%)
Payment Fund*			
Government funded	95 (81.2%)	82 (100%)	13 (37.1%)
Partially subsidized by the government	14 (12.0%)	0	14 (12.0%)
Monthly Income (RM)*			
<500	13 (11.1%)	4 (4.9%)	9 (25.7%)
500-999	22 (18.8%)	15 (18.3%)	7 (20.0%)
1000-1499	17 (14.5%)	13 (15.9%)	4 (11.4%)
1500-1999	12 (10.3%)	11 (13.4%)	1 (2.9%)
≥2000	22 (18.8%)	21 (25.6%)	1 (2.9%)

*Total percent ≠100% because of the missing data

Table II: Laboratory, diagnostic investigation and physician review data of all eligible patients on CAPD and HD (January 2000-June 2002)

Demographic Variable	All Patients (n=82)	CAPD (n=55)	HD (n=27)
Average laboratory test (Total done)			
Haemoglobin	6.9 (563)	6.9 (380)	6.8 (183)
Creatinine	6.3 (519)	7.0 (387)	4.9 (132)
Albumin	6.6 (540)	7.1 (388)	5.6 (152)
Calcium	6.5 (533)	6.8 (375)	5.9 (158)
Average diagnostic investigation (Total done)			
X-Rays	0.8 (65)	0.3 (18)	1.7 (47)
Renal Biopsy	0.01 (1)	0.02 (1)	-
Ultrasound	0.1 (11)	0.1 (5)	0.2 (6)
Echocardiography	0.1 (6)	0.1 (4)	0.1 (2)
Electrocardiography	0.2 (20)	0.1 (6)	0.5 (14)
Endoscopy	0.2 (17)	0.2 (9)	0.3 (8)
Physician's review	6.6 (538)	6.6 (365)	6.7 (182)

Table III: Drugs used for patients on CAPD and HD registered January 2000- June 2002

Drugs	CAPD patients (n=55)	HD patients (n= 27)
Antihypertensive Agents		
Frusemide 40mg	30	8
Metoprolol 100mg	28	14
Nifedipine 10mg	23	11
Nifedipine 20mg	19	9
Captopril 25mg	14	5
Prazosin 1mg	14	5
Atenolol 100mg	12	1
Slow K 600mg	43	0
Antibiotics		
Cloxacillin 500mg	23	2
Cloxacillin 250mg Inj.	18	0
Ceftazidime 250mg	16	1
Vancomycin 1g	11	1
Ciprofloxacin 500mg	7	1
Others		
Cal-Carbonate 500mg	49	27
Erythropoietin 2000IU	25	19
Calcitriol 0.25mcg	23	17
Insulin Monotard (unit)	8	3
Insulin Actrapid (unit)	9	3
Prednisolone 5mg	6	1

Table IV: Dialysis Treatment Outcomes

Outcome Variable	CAPD (n=55) mean±SD (min.-max.)	HD (n=27) mean±SD (min.-max.)	p
Average Systolic BP	134.41±22.21 (86-186)	151.23±15.08 (127-188)	0.000
Average Diastolic BP	82.93±12.37 (50.0-111.0)	85.91±9.51 (66.7-106.7)	NS
Number of Hospitalization	2.823±1.79 (1.00-8.00)	1.33±0.50 (1.00-2.00)	NS
Hospitalization days for CAPD training	11.89±6.18 (2.00-30.00)	-	
Hospitalization days for other causes	18.77±18.02 (1.00-67.00)	5.38±6.16 (1.00-16.00)	0.000
Hospitalization Cause	N=151	N=11	
Dialysis access related infection	63 (41.72%)	1 (9.09%)	
Other infections	5 (3.31)	2 (18.18%)	
CAPD training	46 (30.46%)	-	
Surgical intervention	6 (3.97%)	3 (27.27%)	
Fluid overload	16 (10.60%)	-	
Others	15 (9.93%)	5 (45.45%)	
Average Kt/V	2.29±0.52 (1.05-3.49)	1.50±0.36 (0.93-2.38)	
Average number of Kt/V trials	1.33±0.48 (0.0-2.0)	2.38±0.92 (0.0-4.0)	0.000
Deaths	27	5	

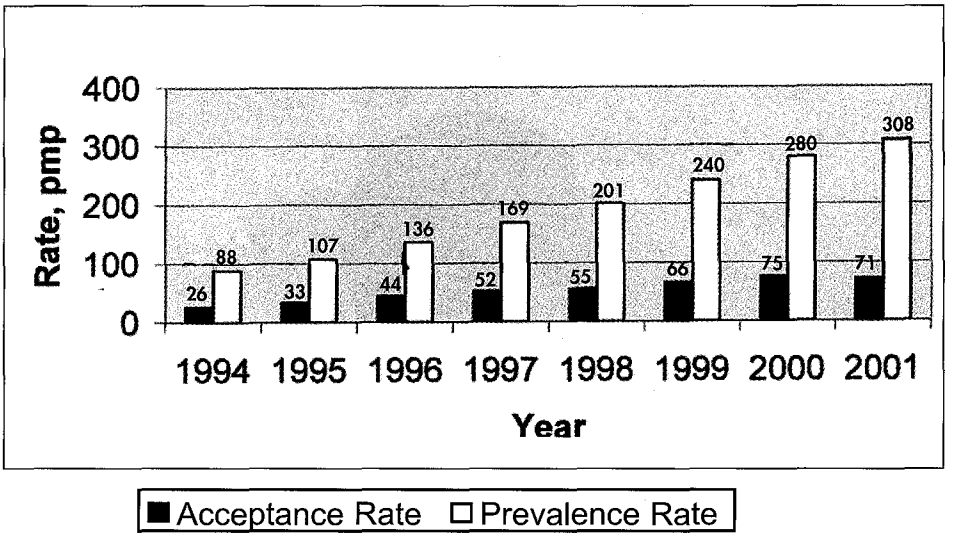

Fig. 1: Dialysis rate, pmp in the Malaysia ESRD Population
Source: Adopted from ninth report of the Malaysian dialysis and transplantation registry 2001
Pmp = per million population

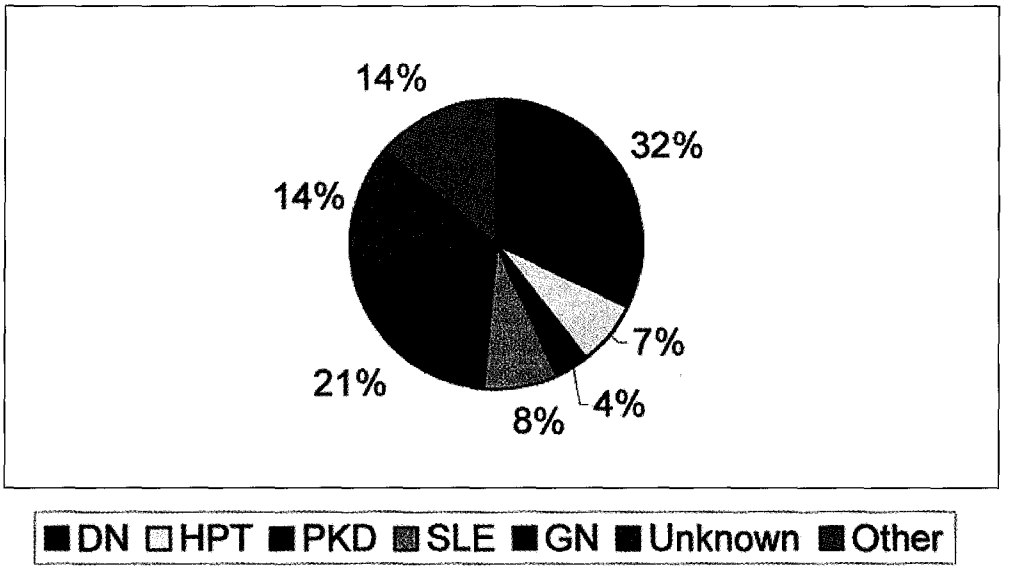

Fig. 2: Cause of ESRD among all patients
DN=Diabetic nephropathy, HPT=Hypertension, PKD=Polycystic kidney disease, SLE=Systemic lupus erythromatosus, GN=Glomerulonephritis

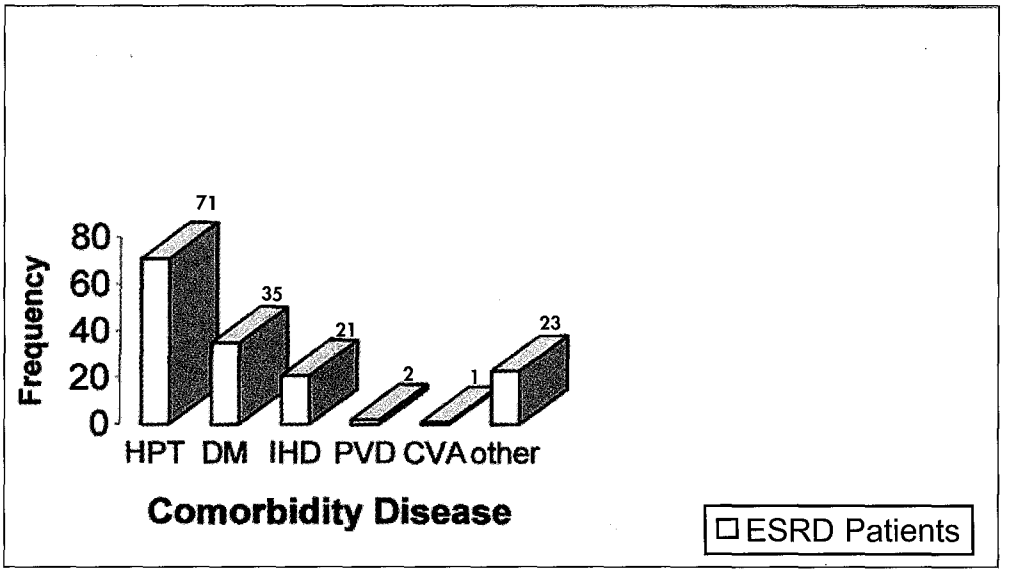

Fig. 3: Comorbidity in ESRD patients
DM=Diabetic Mellitus, HPT=Hypertension, IHD=Ischemic heart disease, PVD=Peripheral vascular disease, CVA=Cerebrovascular accident

Discussion

According to the Malaysian national renal registry (NRR) report of 2001, there were 22 HD centers in Penang state with a capacity of 920 pmp. On 31 December, 2001 3% of all Malaysian patients with ESRD had chronic hemodialysis in Penang hospital, while 12% of all Malaysian patients had CAPD in Penang hospital.

Many of the ESRD patients were in the range of 40-64 years old, consistent with NRR data. The male breadwinner was the predominant gender as in Ile France [9]. This has an impact on the economic and social life style of the family. There were more Chinese patients on dialysis but this can be due to the fact that the predominant race in the state is Chinese. Many patients were not able to work, and were financed by the government. In terms of clinical aspects they mostly started their treatment with CAPD modality, as there are more new dialysis slots in CAPD than in HD. In contrast to Kuwait where tubulointerstitial disease is the major cause of ESRD [10], diabetic nephropathy is the main cause of ESRD in Malaysia as in Japan [11] and USA [12,17]. Hypertension is the predominant comorbidity.

HD patients were predominantly male, Chinese, able to work part time or full time and are partially subsidized by the government and with monthly income of RM500-1499. In contrast, more CAPD patients are Malay, unable to work part time or full time and were fully financed by the government but were predominantly male as in HD. Baseline laboratory tests were performed in both modalities at the same frequency. In terms of diagnostic investigations, X-rays were more frequently done in HD patients than in CAPD patients.

Although many studies found ACE inhibitors to decrease the morbidity and mortality rates among HD patients [13,14,15], Metoprolol was the most common antihypertensive agent prescribed in both modalities. Mortality appears to be high among CAPD patients possibly because more patients (often with diabetic nephropathy and heart disease) are accepted into CAPD. This study showed that hypertension as comorbid condition accounted for as much as 84% and 72% for CAPD and HD patients, respectively. Fifty-five percent of CAPD patients had diabetes compared to only 23% of HD patients. It was also found that ischeamic heart disease (IHD) was more prevalent in CAPD (41%) patients than HD (9%) patients. Patients with three comorbidities were more likely to be on CAPD. In a prevalence study among U.S. dialysis patients, treatment assignment to PD patients was associated with a 19% higher in all-cause mortality rate than HD patients [14].

According to the Malaysian RRT practice guidelines 1999, adequate dialysis is defined as the amount of dialysis yielding satisfactory clinical results and the recommended target Kt/V for CAPD and HD respectively were ≥ 2.0 and ≥1.2 [16]. Achievement of these targets in this study was satisfactory in HD as well as in CAPD patients.

Our study has several limitations. Due to its retrospective method, some data were not available particularly for patients transferred out to other centers. Data were only available for resources utilized within the hospital regardless of what may have been consumed in other health care centers. However, this will not significantly change the final results.

There are special concerns that need to be considered in future studies:

- Quality of life outcome of ESRD patients on dialysis treatment.
- The duration of predialysis care, and its consequences on the long-term survival and quality of life of ESRD patients.
- Resources utilized for dialysis access and its complication.

In conclusion, the study found that ESRD patients in Penang Hospital are more likely to start dialysis via CAPD than HD. The study also showed CAPD patients have a higher mortality and are less likely to be working compared to HD patients although the dialysis dose administered achieved the recommended target.

Acknowledgements

We thank all of our colleagues for their support, Elfatih I. for his generous assistance, the nursing staff of the dialysis units, especially Tuan Hj Harith and Staff Nurse Lim for their collaboration, and Cik Wan Rohayu for her assistance.

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