THE SINGAPORE RENAL REGISTRY: AN OVERVIEW

K T Woo

ABSTRACT

The Singapore Renal Registry (SRR) is created to collect and analyse information on incidence, prevalence, morbidity and mortality of End Stage Renal Disease (ESRD) in Singapore. Its objectives include the implementation of a consolidated renal disease data system, report on incidence and trends over time of renal disease, analyse aggregate data on effect of various modalities of therapy, identify problems and opportunities for special studies and research.

The framework of the Registry encompasses the following areas: incidence, demographics and causes of ESRD, utilization of treatment modalities, institutions providing treatment, morbidity and survival rates of various treatment modalities, the paediatric sector, the private sector, international comparisons and research areas.

This overview will present whatever existing data and renal statistics that are currently available on a regional or national basis. The collection of nationwide statistics will provide a database to formulate national averages of individual renal statistics. Statistics can also be collected to provide valuable data for planning and projection for future needs.

Keywords: *end stage renal disease, modalities of treatment, morbidity, survival*

SINGAPORE MED J 1993; Vol 34: 157-163

The Singapore Renal Registry (SRR) is created to collect and analyse information on incidence, prevalence, morbidity and mortality of End Stage Renal Disease (ESRD) in Singapore. It is jointly sponsored by the Ministry of Health (MoH) and the National Kidney Foundation (NKF). The Executive Committee consists of nephrologists from the Government, University, NKF and the Private Sector. It had an incubation period of about two years and has been operative since 20 February 1993.

Its objectives are four-fold:

1. Design and implement a consolidated renal disease data system that will provide the biostatistical, data management and analytical expertise necessary to characterise the total renal patient population and describe the distribution of patients by sociodemographic variables across treatment modalities.
2. Report on the incidence, prevalence and mortality rates and trends over time of renal disease by primary diagnosis, treatment modality and other sociodemographic variables.
3. Develop and analyse aggregate data on the effect of various modalities of treatment by disease and patient group categories. These data and analyses will examine the prevention and progression of renal disease with special emphasis on morbidity, mortality and quality of life criteria.
4. Identify problems and opportunities for more focussed special studies of renal research issues.

At the present time we do not have any national statistics on kidney diseases and kidney failure. As the number of patients with ESRD increases year by year, it becomes more important to have data dealing with the various aspects of renal disease and to maintain this data in one central place in Singapore. Such an attempt to gather data at a national level will be time consuming and the cooperation of various nephrologists from the many dialysis centres and hospitals will be crucial to the success of the registry. There is also the neccssity for a constant source of funding. In most developed countries there are existing national or regional renal registries where data on renal failure are stored and analysed. Such registries are invaluable for validating incidences, causes and trends of renal diseases.

This overview will outline the various aspects of renal statistics the Registry will initially cover as well as some of the future areas which we may like to eventually focus upon. Wherever appropriate I shall utilise whatever existing data that are currently available in Singapore to illustrate the need to have a National Registry. A framework of the Registry would encompass the following areas:

I. Incidence and demographics of ESRD
II. Causes of ESRD
III. Methods of Treatment and Utilization of Treatment Modalities
IV. Institutions providing ESRD Treatment
V. Morbidity and Survival Rates of Treatment Modalities
   1. Haemodialysis
   2. Continuous Ambulatory Peritoneal dialysis (CAPD/CCPD)
   3. Renal Transplantation
VI. Hospitalisation
VII. Paediatric ESRD
VIII. The Private Sector
IX. International Comparisons
X. Research Areas
XI. The Database

I. Incidence

The incidence of ESRD in Singapore is 96 per million population. With a population of 2.7 million, every year about 260 new cases of ESRD are diagnosed. This is the same as for Western countries, 90 per million population a year.

II. Causes of ESRD

In Singapore, the cause of ESRD are as shown in Table I. In the past glomerulonephritis used to be the leading cause of ESRD. But presently, if one were to consider Glomerulonephritis as a heterogenous group of mixed nephritides, then Diabetic Nephropathy, as a single homogenous disease entity would now be the leading cause of ESRD. In a country like the United States, Hypertensive Nephrosclerosis is the second commonest cause of ESRD after Diabetes Mellitus, whereas in our population, hypertension appears to be under-represented[1]. This is because we are more specific in our diagnosis as we perform many more biopsies

Singapore Renal Registry
c/o Department of Renal Medicine
Singapore General Hospital
Outram Road
Singapore 0316

K T Woo, MBBS, M Med, FRACP
Chairman

Correspondence to: Assoc Prof K T Woo

compared to the United States. Many of their so-called Hypertensive Nephrosclerosis are diagnosed in patients who have not had kidney biopsies and in our context, these patients if biopsied would be classified under Glomerulonephritis. Some of these patients would also fall into the group that we classify as Unknown. It is, however, true that in the United States there is a high preponderance of young hypertensive blacks who develop ESRD with hypertension as the obvious etiology. But be it as it may, in our context, the majority of such patients would be investigated in Singapore and diagnosed as having secondary hypertension or renal hypertension, secondary to either an underlying glomerulonephritis or chronic pyelonephritis and in those where the cause is not readily discernible we would classify them as "Unknown", hence our large number (25%) of Unknown. This was also the findings of a survey conducted by Dr Shanta Emmanuel, Assistant Director of Medical Services, Research and Evaluation Department, Ministry of Health[2].

Table I - Causes of ESRD in Singapore

Chronic Glomerulonephritis	30%
Diabetes Mellitus	25%
Chronic Pyelonephritis	10%
Kidney Stones	4%
Polycystic Kidneys	2%
Others (SLE, Henoch Schonlein, Malignant Hypertension	4%
Causes Unknown	25%
TOTAL	100%

III. Method of Treatment of ESRD and Utilization of Treatment Modalities

1. Haemodialysis

The first haemodialysis service was started in 1968 at the Singapore General Hospital. Since then, throughout the country, there are now 17 haemodialysis centres with 223 stations with a capacity to dialyse 1,043 patients.

2. CAPD/CCPD

CAPD was started in 1980 and CCPD in 1990. There are now about 270 patients on CAPD and another 35 patients on CCPD at the Singapore General Hospital (SGH) and the National University Hospital (NUH).

3. Renal Transplantation

The first cadaver transplant was performed at the SGH in 1970 and the first living related donor (LRD) transplant in 1976. Presently, 308 cadaveric transplants, 224 LRD transplants and 5 living unrelated (spouse to spouse) transplants have been performed.

IV. Institutions providing ESRD Therapy; Facilities and Service Trends

In Singapore, ESRD therapy is provided by the SGH, NUH and the various hospitals in the Private Sector.

1. Haemodialysis Centres

The first haemodialysis centre was established in 1968 at the SGH. This centre was followed by two satellite dialysis centres at Alexandra Hospital in 1975 and at Tan Tock Seng Hospital in 1983. These are state supported haemodialysis centres where fees for dialysis are heavily subsidised. Fully-assisted dialysis is provided at the Dialysis Centre at SGH while the satellite centres provide only self dependency dialysis where the patients are dialysed with the help of their spouses or other family members. In these self help centres, one nursing officer can supervise the dialysis of 20 patients. The cost of staff salary is therefore much reduced. The standard dialysis is 4 hours, thrice a week. In 1981, with the opening of the new SGH, a new dialysis centre was set up in SGH. This remains today as the main dialysis centre and copes with patients requiring temporary dialysis, training of patients for the satellite centres and dialysis of those patients with problems from the various NKF centres as well as the private centres. Here too, patients requiring transplant workup and those who require temporary dialysis for CAPD related peritonitis are dialysed. In addition, the Centre also trains patients for the Home Haemodialysis Programme which was established in 1970. Presently this programme supports about 35 patients.

Today there are 17 haemodialysis centres established throughout the Republic. Table II shows the various centres with their number of stations and the patients currently dialysed. All these centres offer both acetate and bicarbonate dialysis. In addition some centres offer heparin free dialysis, rapid high efficiency dialysis and hemodiafiltration. These newer techniques on improved methods of haemodialysis have resulted in shortening the hours of dialysis from 4-5 to 3 hours. All patients admitted to the chronic haemodialysis programme are vaccinated against hepatitis B. Anemia still remains a problem and it would appear that 2 out of 5 patients on haemodialysis would benefit from human recombinant erythropoeitin injections to maintain Hb about 10 gm/dl. The incidence of hypertension exceeds 30% and this reflects patient non-compliance with salt and water restriction. In some patients this problem is solved by using newer membranes with larger sieving coefficients and surface area to draw more fluid from these patients.

Table II - Growth of Haemodialysis Facilities in Singapore

Year	No. of Singapore Centre	No. of Dialysis Stations	Capacity for Treatment (Patients)	No. of patients on Dialysis
1968	1	8	32	32
1975	2	19	76	76
1981	2	21	84	84
1983	3	41	164	164
1987	8	101	491	402
1988	11	129	514	434
1989	13	166	643	536
1990	13	169	740	608
1991	14	171	857	746
1992	17	223	1043	839
2010	----	----	----	1600 (Expected)

Seventeen years ago there was a shift from providing high cost centre dialysis where the patient is fully assisted during dialysis with a nurse patient ratio of 1:3 to self dependency dialysis where one nurse can look after 10 patients because the patient has been trained to dialyse himself or herself with the help of the spouse or other family member. There is obvious cost savings with the self dependency dialysis programme. However, all cost control policy must have moral justification that commands political consensus. Economics alone should not provide such justification. Hence, the trend now is to shift from self dependency dialysis to assisted dialysis, so that the helper, a working spouse or housewife does not need to be tied down three times a week at the dialysis centre to help the patient. His job will be more secure and for the housewife and mother, she can spend more time with the children at home.

Table II shows the growth of Haemodialysis Facilities in Singapore. Table III lists the Haemodialysis Centres in Singapore.

Table III - Haemodialysis Centres In Singapore (1992)

	Facility	No. of Stations	Capacity	No. of Patients
	GRAND TOTAL	223	1043	839
Govt & Restructured Hospitals				
1981	Singapore General Hospital (Old SGH, 1968)	20	80	65
1975	Alexandra Hospital	11	44	42
1983	Tan Tock Seng Hospital	20	80	63
1987	National University Hospital	13	72	72
	Sub-Total	64	276	242
National Kidney Foundation				
1987	SIA - NKF	15	84	77
1989	Singapore Pools - NKF	15	84	72
1989	National Panasonic - NKF	15	84	74
1990	SAF - NKF	14	78	67
1992	Singapore Buddhist Welfare - NKF	15	84	58
1992	NTUC - INCOME - NKF	16	84	56
	Sub-Total	90	498	404
Private Centres				
1987	Renal Care - Mt Elizabeth Hospital	13	52	34
1987	S & J Dialysis Centre	14	84	28
1987	Renal Care - Katong	8	35	18
1988	Grace Polyclinic (Medical & Dialysis Centre)	10	20	28
1989	Renal Care - Jurong	6	30	25
1989	Renal & Dialysis Centre	12	24	29
1990	Youngberg Hospital	6	24	22
	Sub-Total	69	269	184

2. CAPD/CCPD

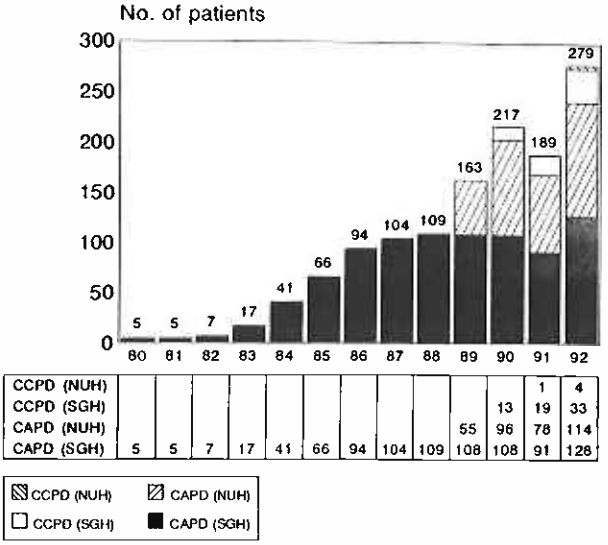
CAPD was introduced in Singapore in 1980 when 5 patients started the CAPD programme at SGH. Today there are about 270 patients on CAPD in SGH and NUH. Another 35 patients are on CCPD at SGH. These are the only two centres providing chronic peritoneal dialysis as a means of ESRD therapy. The NUH also runs a Paediatric CAPD Unit.

In April 1987, a CAPD Unit was formally established in SGH to provide an integrated approach to patient training, management and education. The state supported haemodialysis programme allowed only the entry of patients with primary renal disease up to the age of 50 years. CAPD provided a less expensive and equally viable alternative to patients and the programme allowed the entry of patients with diabetes mellitus and systemic lupus erythematosus as well as those patients with primary renal disease who are over the age of 50 years who were precluded from the haemodialysis programme. Private haemodialysis may cost the patient anything from $1,500 to $2,500 a month. CAPD cost only $860 a month. There is no government subsidy for the CAPD programme. If a patient has Medishield, he can claim $600 a month up to a maximum of $70,000 a lifetime. In other words, if the patient has Medishield, he only requires another $260 to keep himself alive.

Fig 1 shows the growth of the CAPD and the CCPD programme in Singapore.

Continuous Cycling Peritoneal Dialysis (CCPD) is a newer method of chronic peritoneal dialysis which requires an automated peritoneal dialysis cycler. The exchanges are done at night by the machine while the patient sleeps. This allows the patient to be free during the day, unlike CAPD where exchanges are done in the daytime. It has less incidence of peritonitis and exit site infection.

Fig 1 - Growth Of Continuous Ambulatory Peritoneal Dialysis Population In Singapore



changes are done in the daytime. It has less incidence of peritonitis and exit site infection.

Other newer techniques which have been introduced over the past few years include the "0" Disconnect Set, the 2.5 litre dialysate and the low calcium dialysate.

3. Renal Transplantation

Cadaveric renal transplantation is presently performed in SGH and NUH. In addition, these two hospitals and Mount Elizabeth Hospital also perform living related donor (LRD) kidney transplant.

The first cadaveric renal transplant was performed in SGH in 1970 and the first LRD transplant in 1976. We have seen more than two decades of renal transplantation in Singapore. Since 1985, Cyclosporine A was introduced, initially as part of a dual therapy with prednisolone and over the past 7 years as part of a triple therapy which includes prednisolone and low dose azathioprine (50 mg/day). Fig 2 and 3 show the growth of the renal transplantation programme in Singapore.

The present focus for transplantation in Singapore is on increasing the availability of donor kidneys through continuing public education. Since there are now more kidneys available for transplant, patients with diabetes mellitus and SLE

Fig 2 - Cadaveric Transplantation In Singapore

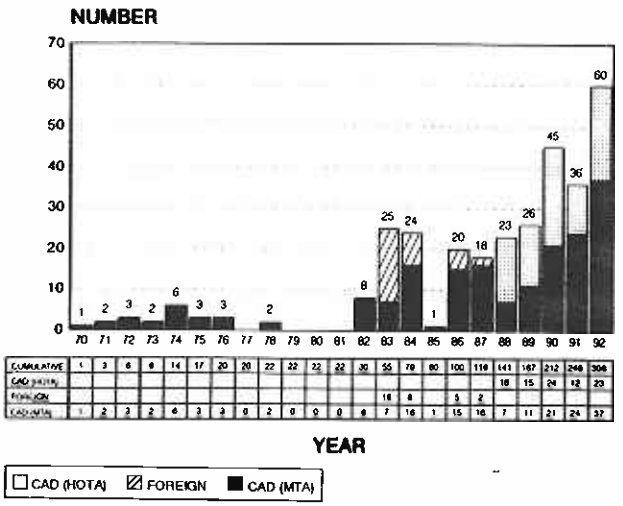
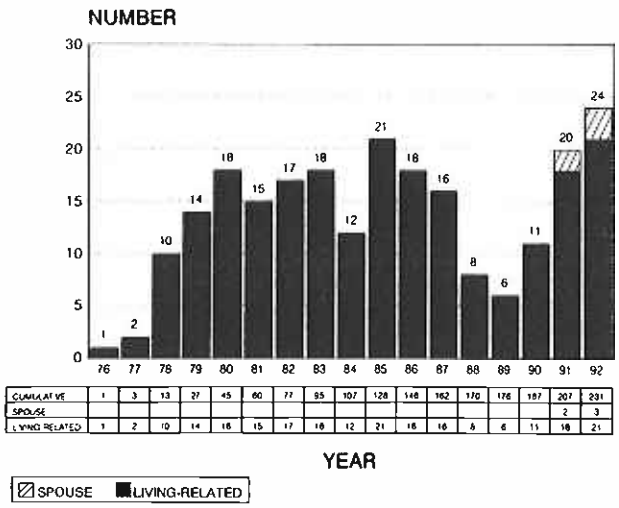


Fig 3 - Living-Related Transplantation In Singapore



are being considered for cadaveric transplantation. Until now, only living related donor transplants are available to patients with diabetes mellitus and SLE.

V. Morbidity and Survival Rates of Treatment Modalities

1. Haemodialysis

Table IV compares the complications of 2 groups of patients starting chronic haemodialysis between 1972-78 and 1980-86.

The various complications of dialysis have been reduced significantly. This is based on data dating back to 1976. If we were to survey our centres today I am sure the incidence of all these complications will be even lower with immunization against HBsAg, the use of 1, 25 di(OH) cholecalciferol Vit D3 and the advent of Human recombinant RNA Erythropoictin[3].

Ten years ago, the commonest cause of death was Dialysis Dementia due to aluminium present in the tap water used for mixing with the dialysate (Table V). Today, with the introduction of water treatment using reverse osmosis and deionisers, this is now a disease of the past. Cardiac deaths now rank first place among the causes of death and this is consistent with the trends in most other centres overseas.

2. CAPD/CCPD

Table VI shows the Peritonitis rates, Technique survival and Patient survival rates. The peritonitis rate of CAPD has improved dramatically with new techniques like the UV Exchange Device (UVXD) and the "O" Disconnect Set. All the above rates are comparable to those of many overseas centres[4].

3. Renal Transplantation

Table VII shows the number of kidney transplants performed in Singapore. The three centres performing kidney transplants are the SGH, the NUH and the Mount Elizabeth Hospital which performs only living related transplants (in parenthesis in Table). Sources of overseas donors were USA, Canada and Europe.

Table IV - Comparing the complications of 2 groups of patients starting chronic haemodialysis between 1972-78 and 1980-86.

Complication	1972-78 (n=30)	1980-86 (n=119)	p value
Anaemia of < 7 gm	37%	20%	p<0.01
Hypertension	77%	41%	p<0.005
Hepatitis	63%	28%	p<0.001
HBsAg	13%	9%	NS
Radiological bone disease	80%	50%	p<0.01

Table V - Causes of death in haemodialysis patients

Causes of Death	1968-80 (n=59)	1981-89 (n=57)
Dialysis Dementia	44%	5%
Cardiovascular	22%	37%
Gastrointestinal Haemorrhage	8%	2%
Sepsis	7%	10%
Poor Compliance	7%	23%**
Others	6%	6%
Unknown	6%	13%
Total	100%	100%
5 year survival	48%	81%*

* p<0.001, ** p<0.01

Table VI - Peritonitis rates, Technique survival and Patient survival rates.

(i) Peritonitis Rates:

1983: 1 in 13.2 patient months
1990: 1 in 20.1 patient months
Admission of CAPD patients:
1 in 13.8 patient months
(50% CAPD related)

(ii) Technique Survival

	1983-86 (n=153)	1987-90 (n=153)	p value
1st year	80%	85%	NS
2nd year	67%	82%	p<0.05
3rd year	52%	72%	p<0.01

(iii) Patient Survival
1980-90 (n=317) 1st year - 94%
5th year - 76%

Table VII - Number of Kidney Tranplants Performed In Singapore 1970 - 1992

YEAR	LIVE DONOR	CADAVERIC LOCAL DONOR	CADAVERIC OVERSEAS DONOR	TOTAL CADAVERIC	TOTAL
1970	-	1	-	1	1
1971	-	2	-	2	2
1972	-	3	-	3	3
1973	-	2	-	2	2
1974	-	6	-	6	6
1975	-	3	-	3	3
1976	1	3	-	3	4
1977	2	-	-	-	2
1978	10	2	-	2	12
1979	14	-	-	-	14
1980	18	-	-	-	18
1981	15	-	-	-	15
1982	17	8	-	8	25
1983	18	7	18	25	43
1984	12	16	8	24	36
1985	21(6)	1	-	1	22(6)
1986	18(4)	15	5	20	38(4)
1987	16(3)	16	2	18	34(3)
1988	8(4)	23	-	23	31(4)
1989	6(4)	26	-	26	32(4)
1990	11(4)	45	-	45	56(4)
1991	20(5)	36	-	36	56(5)
1992	22(1)	58	-	58	80(1)
TOTAL	229(31)	273	33	308	535(31)

Prior to the introduction of the Human Organ Transplant Act (HOTA) in 1987, the average number of cadaveric transplants performed was only 5 a year under the Medical Therapy, Research and Education Act (MTA). With the introduction of HOTA, not only has the number of transplants performed increased, but even those under MTA have also increased significantly. The cause for this changing trend we believe is the result of "education" with the increasing public awareness for the need of donor organs[5]. Table VIII shows the number of kidneys obtained under HOTA and MTA since 1988.

Table VIII - Increase in the number of Cadaveric Transplants with the Introduction of the Human Organ Transplant Act (HOTA)

YEAR	HOTA*	MTA**	TOTAL	Living Related Donor Tx
1988	16	7	23	8
1989	15	11	26	6
1990	24	21	45	11
1991	12	24	36	20
1992	23	37	60	22
TOTAL	90	100	190	67

* Human Organ Transplant Act
** Medical Therapy, Research & Education Act
Prior to 1988, only an average of 5 cadaveric transplants obtained under the Medical Therapy Act.

Table IX compares the complications in 2 groups of patients; the earlier azathioprine based regimen using a combination of azathioprine and prednisolone and the later cyclosporine A (CyA) based regimen, either in combination with prednisolone alone or with prednisolone and a small dose of azathioprine (50mg) as a triple therapy regimen. Among the various complications, only septicemia and avascular necrosis of bones showed a significantly decreased incidence. There are less patients with diabetes mellitus but this difference was not significant[5].

4. Overseas Kidney Transplantation in India and China

With the availability of living unrelated donor (LUD) transplant in India and overseas cadaveric transplant in China (from executed convicts), since 1986, many Singaporeans have obtained transplants overseas.

In India, conditions for surgery are often far from ideal; infections and rejection rates are high and many patients have lost their lives overseas. To start with, some patients are elderly (>60 years old) and have cardiac or other multisystem disease, eg diabetes mellitus with various complications and would not have been considered for a kidney transplant at home. Some of those who managed to get the transplant returned home with rejection or infections like malaria, tuberculosis and what is most feared, HIV (AIDS) infection. Transplant surgery requires blood and in India, blood is often "donated" or "sold" by drug addicts who may themselves be HIV carriers. The blood products used for the transplant operation are not screened for HIV. Already 4 of our patients who had LUD transplant from India have been infected with HIV[5].

Table IX - Complications of Renal Transplantation (1970-91)

	Without Cyclosporine A (prednisolone/Azathioprine) (n=199)	On Cyclosporine A (n=150)	
Septicemia	35	3	p<0.001
Avascular Necrosis	38	3	p<0.001
Diabetes Mellitus	19	7	NS
Cataract	8	8	NS
Malignancy	5	1	NS
Liver disease	28	12	NS

NS: Not Significant

Apart from India, patients are also going to China for overseas cadaveric transplants. The donors are executed convicts. In Singapore, we also obtain kidneys from prisoners who are condemned to death. This is under the Medical Therapy Act, with the prisoner's consent. In China, a convict's consent is not sought. The body belongs to the State after execution. Facilities are far from ideal in China. Infection and rejection rates are high. A good number of our patients who went for transplants in China have not returned. Some years ago, there was widespread publicity about poor and inadequate facilities in China resulting in deaths of many patients. As a result the number of patients going overseas to China have dropped. Table X shows the Overseas Transplants in India and China compared with the number of living related donor transplant in Singapore.

Table X - Overseas Kidney Transplant Compared To Living Related Transplants

	SINGAPORE GENERAL HOSPITAL			Living Related
Year	China	India	Total	Transplants
1986	1	1	2	18
1987	17	6	23	16
1988	10	32	42	8
1989	3	29	32	6
1990	2	46	48	11
1991	4	10	14	20
1992	2	8	10	22
Total	39	132	170	101

OTHER CENTRE: (1986-1992) CHINA TX 19, INDIA TX 22, TOTAL = 41

The combined effects of the India and China overseas transplants have affected our living related transplant programme as our patients would rather buy kidneys from overseas donors than get their family members to donate their kidneys for LRD transplantation. Instead of the yearly average of 16 per year during the past four years we only had 8, 6 and 11 up to 1990. In 1991 and 1992 we had some publicity campaigns to discourage patients from going overseas and warned them about the dangers of AIDS. This has resulted in a significant decrease in the number of India transplants and the number of local LRD transplants have also increased.

Table XI shows the Renal Transplant Survival Rates in Singapore. With the use of cyclosporine A our graft survival rates have improved dramatically. These results are comparable with many major overseas centres[5].

VI. Hospitalisation

Hospitalisation measures several aspects of ESRD therapy. In some instances the initial hospital stay is part of the therapy, eg admission for vascular access, placement of Tenckhoff catheter and the transplant operation. In other instances, hospitalisation could be related to the modality of therapy, like admission for episodes of peritonitis in a patient on CAPD, vascular access problems in a patient on haemodialysis and acute rejection in a transplant patient. Hospitalisation could also relate to

Table XI - Renal Transplant Survival Rates In Singapore

I - Living Related : 1976 - 1991

	Without Cyclosporin A (n = 121) (prednisolone / azathioprine)		On Cyclosporin A (n = 341)	
Year	Graft Survival	Patient Survival	Graft Survival	Patient Survival
1	82%	90%	97%	97%
5	79%	82%	94%	97%
10	73%	77%	-	-

II - Cadaveric : 1970 - 1991

	Without Cyclosporin A (n = 76)		On Cyclosporin A (n = 116)	
Year	Graft Survival	Patient Survival	Graft Survival	Patient Survival
1	60%	70%	86%	95%
2	43%	62%	77%	95%
10	34%	46%	-	-

the severity of illness of the patient and the presence of co-morbid conditions.

The hospitalisation trend for a particular modality of therapy is also relevant. In the old days, patients had insertion of chronic AV Shunts in the leg and had to stay in hospital for about 10 to 14 days for the wound to heal before they could go home. Up till 1987, CAPD patients had to stay in hospital for two weeks training to learn how to do CAPD themselves. Nowadays this training is done on an out-patient basis. Similarly, treatment of peritonitis which used to be in-patient based is now done on an out-patient basis.

Hospitalisation therefore can be used as a measure of the quality of health and life on a particular modality. Do transplant patients have lower hospitalisation rates than CAPD patients? It would be useful to capture results for hospitalisation by age, sex, race, treatment modality, disease group (glomerulonephritis, diabetes mellitus, SLE), etc. We may find that patients with diabetes mellitus and SLE have higher hospitalisation rates compared to other disease group. Or a particular ethnic group on CAPD may have a higher hospitalisation rate for CAPD.

VII. Paediatric ESRD

The causes of ESRD in children are very different from adults. In adults, diabetes mellitus is a leading cause while in children, the main causes are glomerulonephritis and congenital diseases. The age of the patient will influence the primary choice of treatment modality. Transplant is usually the primary choice of treatment modality, followed by CAPD in the younger patient and haemodialysis in the older paediatric patient. In general, living related donor transplantation occurs more frequently compared to cadaveric transplants in children; whereas in adults the reverse is often true.

VIII. The Private Sector

The various centres and hospitals in the Private Sector play a very important role in providing ESRD therapy in the Republic. Though patients who are able to afford can have home dialysis in the privacy of their own homes at their own time under a Home Haemodialysis Programme established at SGH in 1970 where they are trained for two months and then sent home to dialyse themselves at home, many others who can afford would rather pay for the services provided by Private Dialysis Centres. They find it more convenient to check in twice or thrice a week at a private centre where everything is done for them.

IX. International Comparisons

The availability of national statistics will enable comparisons to be made with countries like the United States, Europe, Australia and other countries in Asia to provide ourselves with an international perspective on the incidence and demographics of ESRD, causes of ESRD, choice of modalities of treatment as well as morbidity and survival rates. In the West, the incidence of ESRD is 90 per million population. Diabetes mellitus is the leading cause of ESRD which is similar to what we have. The incidence of ESRD is highest in the USA. This is related to the high incidence of ESRD among the US black population and to the relatively greater acceptance of older patients for haemodialysis in USA. Haemodialysis is the commonest modality of therapy in Singapore as in most countries; but in Hong Kong, CAPD is the leading modality. Clearly, there would be difference in choices among the various treatment modalities and this could be explained by specific policies in the country as well as the prevailing cultural practice and beliefs. This point is well illustrated in the reversal of trend in the renal transplantation programme in Singapore. As in most Asian countries, our cadaveric transplant rate was very low prior to the introduction of HOTA due to traditional beliefs and superstition. But HOTA has now resulted in a dramatic increase in the number of cadaveric renal transplants done in Singapore.

X. Research Focus

The collection of nation-wide statistics will provide us with a database to work out the national averages of various renal statistics. Contributing centres will also be able to gauge their performance against the national average. Availability of national statistics on ESRD will enable planning and projection of our future needs; to identify useful trends and help in decision making, as well as to be forewarned and take measures to avoid unfavourable trends. Statistics can also be collected to provide valuable feedback for education and other monitoring purposes.

There are certain areas where it is necessary to have specific data collection and analyses to enable us to conduct in-depth research in areas like Glomerulonephritis, Diabetes Mellitus and Hypertension. It is proposed therefore to form 3 sub-registries for specific data collection and analyses.

1. Glomerulonephritis Registry

To maintain records of all renal biopsies. Here the records are analysed to study various types of Glomerulonephritis in relation to demographics, natural history, outcome and modification by therapy where available. It is also important to define a subgroup which progresses to ESRD.

2. Diabetic Nephropathy Registry

To document demographics, natural history, clinical indicators and predictors of ESRD, outcome and modification by therapy.

3. Hypertension Registry

To document demographics, specific diagnoses, define subgroup progressing to ESRD, identify factors contributing to progression and modification by therapy.

XI. The Database

There should be adequate and proper documentation and maintenance of the database and the methodologies used in reporting. Data quality issues and changes in database will have to be defined. Data would be reviewed and updated at six monthly

intervals and as when necessary. Each year new data will be added and errors corrected and methodologies refined.

REFERENCES

1. Woo KT. Renal replacement therapy in Singapore. In: Tanaka H, ed. Dialysis Therapy in the 1990s. Contributions to Nephrology. Basel, Karger, 1990;82:6-14.
2. Emmanuel S. A Study of End Stage Renal Failure in Singapore. Ministry of Health, Singapore, 1986.
3. Choong HL, Pwee HS, Woo KT, Lim CH. Maintenance Haemodialysis in Singapore. Singapore Med J 1991;32:133-8.
4. Lee GSL, Woo KT. Infection in Continuous Ambulatory Peritoneal Dialysis (CAPD): Aetiology, Complications and Risk Factors. Ann Acad Med Singapore, 1992;21:354-60.
5. Vathsala A, Woo KT, Lim CH. Two decades of renal transplantation in Singapore. Clinical Nephrol (In press).
6. Woo KT. Social and Cultural Aspects of Organ Donation in Asia. Ann Acad Med Singapore 1992;21:421-7