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DIALYSIS – TRANSPLANTATION

Ethnicity and survival on dialysis in west London

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Background. Indo-Asian and Afro-Caribbean patients have higher rates of renal failure and requirement for renal replacement therapy than the general population in the UK. Despite this, information regarding survival on dialysis is limited.

Methods. The incident hemodialysis population of a large west London renal service was reviewed from 1996 to 2001 ($N = 465$).

Results. The cohort's ethnic background was Indo-Asian (30.8%), Caucasian (49%), Afro-Caribbean (18.3%), and other (1.9%). Indo-Asians and Afro-Caribbeans were younger than Caucasian patients, with a higher rate of diabetes mellitus. Survival on hemodialysis for Indo-Asians was 97.5% and 81.6% at 1 and 3 years, respectively, compared with 92.7% and 75.2% for Caucasians, and 97.5% and 85.3% for Afro-Caribbeans ($P =$ nonsignificant). Dialysis adequacy was observed to be associated with survival. Patients with mean single pool Kt/V of over 1.4 had survival of 90.6% and 74.8% at 2 and 5 years, respectively, compared with 74.0% and 42.9% for those with Kt/V less than 1.4 ($P < 0.001$). There were significantly more patients in the Indo-Asian cohort with a mean Kt/V of 1.4 or over (87.4%) compared with Caucasians (57.6%) and Afro-Caribbeans (52.4%), and the benefit of higher Kt/V was seen in all ethnic groups. In a multivariate analysis of factors including Kt/V over 1.4, age, diabetic status, gender, and ethnicity, Indo-Asian or Afro-Caribbean ethnicity did not confer a survival disadvantage. The strongest predictors of survival were age and dialysis adequacy.

Conclusion. Indo-Asian and Afro-Caribbean hemodialysis patients have survival comparable to Caucasians despite a higher burden of diabetes.

The United Kingdom (UK) has an ethnic minority population of 4.6 million (8% of the total population), half of which originates from the Indian subcontinent [1]. However, almost 8% of all new patients, and 7% of existing patients on renal replacement therapy are Indo-Asian [2], twice the percentage expected based on the proportion of Indo-Asians in the general population. The predisposition of this ethnic group to renal disease has previously been well described [3–5]. As the relatively young Indo-Asian population ages, there will be an increasing burden on renal services in areas with large non-white communities [6, 7]. A similar problem exists in the Afro-Caribbean community, which contributes 8% of existing patients on dialysis [2]. This issue is particularly relevant to London, where 45% of the ethnic minority population resides [1]. Despite the breadth of the problem, data regarding the short- and long-term outcome of ethnic minorities on renal replacement therapy in the UK remain scarce.

Different outcomes for patients who are Indo-Asian, Afro-Caribbean, or from other ethnic minorities can be suspected on the basis of race-specific differences in population demographics, patterns of pathology, perceptions of health and disease, and varying access to services. Data from the United States [8, 9] and Canada [10] have suggested that among dialysis patients, ethnic minorities have superior dialysis outcomes and survival to white Caucasians. The possibility of such differences in the UK dialysis population has not yet been defined.

In the west London districts of Brent and Harrow, Indo-Asians contribute almost 30% of the resident population [1]. St. Mary's Hospital provides a large proportion of the adult renal services to this area. This study reviews the impact of ethnicity within our population over a five-year period.

METHODS

We assessed the incident dialysis population from January 1996 to September 2001. Only patients commencing renal replacement therapy for the first time were included to avoid comparing new patients and those with prior history of treatment for end-stage renal failure. Thus, patients with failed renal transplants, or those who changed from another dialysis modality were excluded. Patients with acute renal failure were not included. We employed a 90-day rule, whereby patients who died or ceased dialysis within 90 days were excluded. This is in keeping with the U.S. Renal Data System (USRDS), which includes patients from 90 days onward [8], and the UK Renal Registry, which reports data for both 0 to 90 days and after 90 days to allow comparisons with other databases, such as USRDS [2]. All patients were followed up

Key words: dialysis adequacy, ethnicity, hemodialysis, Indo-Asian, kidney failure, patient survival.

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Table 1. Patient characteristics

	Indo-Asian $N = 143$	Caucasian $N = 228$	Afro-Caribbean $N = 85$	Other $N = 9$
Age *years* (mean ± SD)	55.6 ± 15	59.6 ± 16	53.0 ± 17	59.0 ± 16
Over 65 years %	29.3	43.8	24.7	44.4
Male %	57.3	65.8	58.8	66.7
Diabetic %	39.9	28.5	34.1	11.1
Months on dialysis (mean ± SD)	28.4 ± 18	27.1 ± 17	29.3 ± 19	30.8 ± 23
Dialysis adequacy				
Kt/V less than 1.2 %	0.7	10.4	9.5	0
Kt/V 1.2–1.4 %	11.9	32.0	38.1	12.5
Kt/V ≥ 1.4 %	87.4	57.6	52.4	87.5
Status at end of follow-up				
On hemodialysis %	77.0	60.5	74.1	33.0
Transplanted %	8.4	13.6	8.2	45.0
Death %	11.9	21.1	17.6	22.0
On peritoneal dialysis %	2.1	0.5	0	0
Transferred %	0.7	4.4	0	0

to December 31, 2001, with mean follow-up time of 35 months (3.2–71.8).

Age, gender, diabetic status, cause of end-stage renal failure, dialysis start date, cause of death, and status at the end of follow-up was recorded for each patient. In keeping with Census 2001 ethnic classification [1], patients were categorized into the following four ethnic groups: Caucasian, Indo-Asian (Indian, Pakistani, and Bangladeshi), Afro-Caribbean (black African, Caribbean), and Other.

Patients with renal impairment are referred by general practitioners and physicians from the community and hospital system, and are closely followed in pre-dialysis clinics. The suitability of patients for dialysis is assessed on an individual basis by a multidisciplinary team, led by the nephrologist. Acceptance for maintenance dialysis in our unit is in accordance with the published recommendations and guidelines of the UK Renal Association [20]. In particular, there is no specific age cut-off for access to dialysis. The majority of patients on renal replacement therapy at St. Mary's Hospital are on hemodialysis due to ready access to hemodialysis facilities both in-center and through several satellite units. Although all patients are offered a choice of dialysis modality, hemodialysis is generally the preferred option, and the number of patients suitable for peritoneal dialysis who choose this option is small.

Hemodialysis was undertaken thrice weekly at St. Mary's Hospital or one of three satellite centers. Until 2000, dialysis adequacy was assessed four times per year using the Sargent and Gotch method [11], and dialysis prescription was adjusted to achieve a single-pool dialysis dose (Kt/V) of 1.2 or more. Thereafter, adequacy was measured monthly using the Daugirdas method [12], and our unit policy was to achieve a Kt/V of 1.4 or greater. For the purpose of analysis, mean Kt/V over the period of observation was determined. Peritoneal dialysis was either continuous ambulatory or automated dialysis, with a target Kt/V of 2.0 or more. Diagnosis of peritonitis was based on dialysate white cell count and culture findings.

Statview for Windows (version 5.0, SAS Institute, Cary, NC, USA) was used for statistical analyses. Groups were compared using *t* test and chi-square analysis. The Kaplan-Meier method with the log rank test was used for survival analysis. Patients were censored at transplantation, transfer to another unit and consequent loss of follow-up, change to peritoneal dialysis, or upon reaching the end of the study period. Multivariate analysis was performed using Cox regression model analysis. A significance level of 5% was used for all analyses.

RESULTS

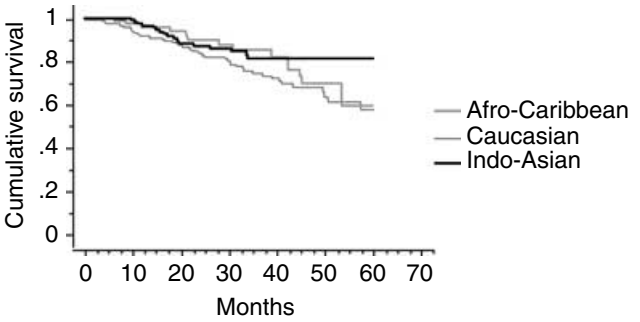
Hemodialysis

Four hundred and seventy-four patients commenced hemodialysis during the study period. Nine patients were excluded because they did not remain on hemodialysis for more than 90 days. Of these, 3 patients died within 90 days, 2 changed to peritoneal dialysis, 3 were transplanted, and 1 transferred from our unit. Details of the final cohort of 465 patients are shown in Table 1. Indo-Asians contributed to 30.8% of the dialysis population. There were only 9 patients of other ethnicity. These have not been analyzed further as a separate group. Caucasian patients were older than either Indo-Asian or Afro-Caribbean patients, and had a higher percentage of patients aged over 65 years ($P < 0.02$), while the non-white groups were similar in age ($P =$ NS). Of 110 patients who were aged over 70 years at commencement of dialysis, 61.8% were Caucasian. The gender distribution was similar between all groups ($P =$ NS), and 32.7% of the entire patient group was diabetic (type I or type II). Indo-Asians had a significantly higher rate of diabetes when compared with Caucasians ($P < 0.03$), but not significantly higher than Afro-Caribbeans. Mean single pool Kt/V of over 1.4 was observed in 66.5% of the cohort. A higher rate of Kt/V of 1.2 to 1.39 and over 1.4 was seen in Indo-Asians when

Table 2. Causes of end-stage renal failure

Cause of ESRF	Indo-Asian %	Caucasian %	Afro-Caribbean %
Diabetic nephropathy	31.5	22.8	30.6
Small smooth kidneys	25.2	11.4	28.2
Glomerulonephritis[a]	12.6	17.1	14.1
Renovascular	7.7	14.9	0.0
Other[b]	6.3	7.5	4.7
Tubulo-interstitial nephritis	4.9	1.8	1.2
Hypertension	4.2	4.8	5.9
Urological[c]	2.1	7.0	10.6
Polycystic Kidneys	2.8	7.0	1.2
N/A[d]	2.8	5.7	3.5

[a]Glomerulonephritis: IgA nephropathy, membranous nephropathy, focal and segmental glomerulosclerosis, lupus nephritis, vasculitis, fibrillary glomerulonephritis, antiglomerular basement membrane disease, and HIV-associated nephropathy.
[b]Other: cortical necrosis, amyloidosis, sickle cell disease, hemolytic uremic syndrome, scleroderma, calcineurin inhibitor toxicity, sarcoidosis, multiorgan failure, reflux nephropathy, analgesic nephropathy.
[c]Urologic: renal cell carcinoma, nephrectomy for any reason, obstructive uropathy, and renal calculi.
[d]N/A, data not available.



	Indo-Asian		Caucasian		Afro-Caribbean	
	%	*N*	%	*N*	%	*N*
1 year	97.5	110	92.7	171	97.5	70
2 year	87.5	74	84.2	114	90.2	41
3 year	81.6	47	75.2	69	85.3	29
5 year	81.6	9	58.1	14	59.6	5

Fig. 1. Cumulative survival on hemodialysis according to ethnic background.

compared with both Caucasians and Afro-Caribbeans ($P < 0.001$). There was no statistical difference in the percentage of patients transplanted from each ethnic group.

Cause of end-stage renal failure

The cause of end-stage renal failure for each ethnic group is shown in Table 2. The incidence of diabetic nephropathy, glomerulonephritis, and hypertensive nephropathy was not significantly different between groups. Indo-Asian patients had a higher rate of tubulointerstitial nephritis ($P < 0.05$). Patients presenting end-stage with small kidneys were more common in the ethnic minority groups compared with Caucasians ($P < 0.001$). Renovascular disease was significantly more common in Caucasians than Indo-Asians ($P < 0.05$) and Afro-Caribbeans ($P < 0.001$). Urologic problems were more common in Afro-Caribbean and Caucasian patients than Indo-Asians ($P < 0.01$).

Patient survival according to ethnicity

Patient survival on hemodialysis was similar between ethnic groups at 1, 2, and 3 years (Fig. 1). At 5 years, patient numbers were small, but again, no significant difference in survival was found. In multivariate analyses including factors such as age, gender, diabetic status, and Kt/V, Indo-Asian ethnicity (vs. non-Asian) conferred a relative risk of death at 3 years of 1.2 ($P = 0.52$, CI 0.65–2.3). Afro-Caribbean ethnicity (vs. non Afro-caribbean) conferred a relative risk of 0.61 ($P = 0.21$, CI 0.29–1.3).

Causes of death

Eighty-two patients died during the period of follow-up. Cardiac or peripheral vascular disease was the leading cause of death on dialysis (Table 3). There was no significant difference in cause of death based on ethnicity, although the rate of death from vascular disease was observed to be lower in Afro-Caribbean patients.

Table 3. Cause of death on hemodialysis according to ethnicity

	All deaths	Indo-Asian		Caucasian		Afro-Caribbean	
	%	*N*	%	*N*	%	*N*	%
Vascular	43	9	52.9	22	46.9	3	18.8
Sepsis	17	3	17.6	6	12.7	5	31.3
Malignancy	11	0	0.0	6	14.9	2	12.5
GI Bleed	5	2	11.8	0	0	1	6.2
Other	2	1	5.9	0	0	1	6.2
Unknown	22	2	11.8	12	25.5	25	25

Dialysis adequacy

Dialysis adequacy was found to be a predictor of patient survival. Patients who achieved the target mean Kt/V of 1.4 or more had significantly better survival than those with Kt/V of below 1.4 (96.4%, 90.6%, 84.0%, and 74.8% vs. 91.3%, 74.0%, 66.9%, and 42.9% at 1, 2, 3, and 5 years, respectively, $P < 0.001$). Thirty-two patients (7.0%) were unable to achieve a consistent Kt/V of over 1.2 due to access difficulties, large body habitus, noncompliance with dialysis hours, and intercurrent illness. A small number of these patients were not aggressively dialyzed on compassionate grounds due to advanced age and comorbidity. To exclude the possibility that this group of patients was mainly responsible for the poorer survival of patients with Kt/V less than 1.39, further analysis was undertaken of 121 patients (33.4%) with Kt/V greater than or equal to 1.2, but below 1.4. Survival remained poorer

in these patients (93.1%, 75.8%, 65.9%, and 42.2% at 1, 2, 3, and 5 years, respectively, $P < 0.001$).

Caucasian patients with Kt/V over 1.4 had superior survival compared to those with Kt/V under 1.4 (82.0% vs. 65.2% at 3 years, $P = 0.004$). Few Indo-Asian patients ($N = 17$) had Kt/V below 1.4, which limited survival analysis. At 2 years, survival of Indo-Asian patients with Kt/V greater than 1.4 was 89.8% compared with 50.0% for those below 1.4. However, in the Afro-Caribbean group the survival difference between patients with higher Kt/V versus lower Kt/V was less pronounced (93.4% vs. 73.7% at 3 years, $P = 0.048$). Analysis of all patients who achieved a Kt/V 1.4 or more revealed survival up to 3 years was similar between ethnic groups and male and female patients.

In a multivariate model including age, gender, ethnicity, and diabetic status, Kt/V over 1.4 was positive predictor of survival, conferring a relative risk of death at 3 years of 0.38 ($P = 0.001$, CI 0.22–0.68).

Diabetic status

Over one third of Indo-Asian and Afro-Caribbean patients were diabetic, and diabetic nephropathy was the most common cause of renal failure in all ethnic groups. At 3 years, there was a trend toward worse survival of Indo-Asian diabetics compared with nondiabetics (68.3% vs. 88.7%, $P = 0.05$). Analysis of the entire cohort, regardless of ethnicity, confirmed a trend toward worse survival in diabetic patients at 3 years, which became statistically significant at 5 years (69.5% vs. 50.5%; $P = 0.02$). However, in multivariate analysis after adjusting for age, gender, dialysis adequacy, and ethnic background, diabetes did not confer a significantly increased risk of death at 3 years (RR 1.3, $P = 0.35$, CI 0.76–2.2).

Age at start of dialysis

Patients commencing dialysis when aged 65 or over had worse 5-year survival than those who started dialysis at a younger age (48.3% vs. 76.6% at 5 years; $P < 0.0001$). This effect of age was not seen when Indo-Asians were analyzed as a separate group (over 65 vs. under 65; 77.6% vs. 83.2%; $P = 0.21$ at 3 years). This is most likely due to small numbers of patients over 65 years of age ($N = 42$) in the Indo-Asian group, reflecting the younger Indo-Asian population in the general community. In multivariate analysis, age over 65 at start of dialysis conferred a 2.0 times higher relative risk of death on hemodialysis ($P = 0.006$, CI 1.2–3.4).

Peritoneal dialysis

From January 1996 until December 2001, 43 patients commenced peritoneal dialysis as their first form of renal replacement therapy. The cohort consisted of 23 Caucasians, 19 Indo-Asians, and 1 Afro-Caribbean patient. There was no difference in mean age, gender distribution, or rate of diabetes between Indo-Asian and non-Asian patients. The main causes of end-stage renal failure were diabetes (18.6%) and glomerulonephritis (14%), although 46.5% of patients presented with small kidneys with no diagnosis evident. There was no difference in cause of renal failure between ethnic groups. The mean (±SD) duration on peritoneal dialysis was 29.7 ± 17.0 months for Indo-Asians and 23.8 ± 17.0 months for non-Asians ($P = 0.26$). At the end of follow-up, 12 patients remained on peritoneal dialysis, 11 were transplanted, and 18 patients changed to hemodialysis. Twenty-three patients experienced at least one episode of peritonitis, with equal rates in each ethnic group. The main reasons for changing to hemodialysis were a single severe episode of peritonitis or recurrent peritonitis ($N = 10$), or ultrafiltration failure ($N = 5$). Two patients died, one due to peritonitis, the other with an out-of-hospital collapse. There was no difference in outcome between ethnic groups, although both deaths on peritoneal dialysis were in Caucasian patients. An overall survival analysis of all patients (peritoneal dialysis and hemodialysis) revealed outcomes similar to those seen in the hemodialysis group alone (data not shown).

DISCUSSION

Indo-Asians in the UK have a 3 to 6 times higher age-adjusted relative risk of end-stage renal failure compared with white Caucasians [3, 5]. A review of the London Thames area population in the early 1990s [4] revealed the relative risk of renal replacement therapy for Asians compared with white patients aged 16 to 54 years was 3.0, and rose with age to 8.0 for those aged over 65 years. A similarly alarming picture is seen nationwide [6]. The death rate from renal disease for Indo-Asians in the general UK population is over 3 times the national rate [7]. Patterns of renal pathology are different in Indo-Asians compared with Caucasians, with higher rates of diabetic nephropathy, interstitial nephritis, and focal segmental glomerulosclerosis [5, 13, 14]. The cause of renal failure is often unknown.

Knowledge of outcomes of renal replacement therapy in ethnic minorities has been very limited. A study of Indo-Asians from Bradford, UK, raised the possibility of worse long-term outcomes after renal transplantation in this group compared with non-Asians, due to a higher rate of death with graft function [15]. Data from our own unit [16] have suggested equivalent graft and patient outcomes in Indo-Asians, at least up to 3 years post-transplant. Information regarding ethnicity and dialysis outcomes has suggested the opposite situation. The United States Renal Data System (USRDS) has reported differences in survival between white and non-white

patients on dialysis, with higher crude mortality rates among white patients [8]. However, the majority of non-white patients in the U.S. are African American or Hispanic. "Asian" Americans are a heterogeneous ethnic group of Oriental and southeast Asians, as well as those from the Indian subcontinent [9], and it is not known if differences exist within these ethnic subgroups. The UK Renal Registry has reported a trend toward superior survival at 1 year in non-white patients in the 2000 incident renal replacement therapy cohort (dialysis and transplantation) [2], but longer-term data and ethnic breakdown are not available. There has been one UK-based study relating to peritoneal dialysis in 70 patients, half of who were Indo-Asian [15]. Survival analysis was limited to the absolute death rate, which, at 2 years, was not different between ethnic groups.

The Toronto Regional Dialysis Registry [10] has, thus far, provided the most detailed analysis of dialysis survival of Indo-Asians in a western country. This study of almost 4000 patients included 322 south Asians of similar ethnic background to Indo-Asians in our study. It reported worse survival and a relative risk of death of 1.36 (CI 1.07–1.73) for Caucasians compared with south Asians. This was despite a higher rate of diabetes in non-whites, and was independent of differences in cardiovascular burden and transplantation. It provides further support for the hypothesis that important race-related differences do exist in dialysis cohorts, and need to be searched for in our local population.

The problem of renal failure also extends to Afro-Caribbean patients. In the UK, this ethnic group has rates of renal disease and dialysis dependency that are similar to that for Indo-Asians, and much higher than the general non-ethnic population [2, 4], but as with Indo-Asians, little is known about dialysis outcome. The largest body of knowledge arises from African American patients, who are reported in the USRDS registry as having better long-term survival rates than white patients [8].

This is the first UK-based study to assess the influence of ethnicity on hemodialysis survival. Our findings reassure us that Indo-Asians and Afro-Caribbeans have excellent medium-term survival, similar to Caucasians. Up to 3 years, all ethnic groups have survival above 75%. Longer follow-up is required before further conclusions can be made about survival beyond this point. Patient survival on hemodialysis in our patient cohort is consistent with survival reported elsewhere for the UK, keeping in mind that our study cohort consisted of a large non-white ethnic group, that patients with prior history of any renal replacement therapy were specifically excluded, and that a 90-day rule was applied. The UK Renal Registry reported 84% 1-year survival for all prevalent patients in England and Wales established on hemodialysis or peritoneal dialysis for more than 90 days [2]. The adjusted survival of incident patients on hemodialysis after 90 days was 80.8% at 1 year. Data regarding ethnicity were available for only 56% of patients in the registry, and therefore, further analysis of survival with ethnic divisions has not been made.

The good survival of Indo-Asian and Afro-Caribbean dialysis patients is surprising given the burden of diabetes mellitus and consequent cardiovascular risk that could be predicted for these groups. UK Indo-Asians aged 30 to 64 years with diabetes are more likely to die a cardiovascular death than non-Asians [18]. Diabetes in UK dialysis patients of all ethnic backgrounds is associated with a higher rate of cardiovascular disease and death, regardless of age [2]. Almost 40% of our Indo-Asian and 34% of our Afro-Caribbean dialysis population had diabetes. Diabetic nephropathy was the cause of renal failure in 31% of patients, which is slightly higher than the previously reported rate of 21% in Asians in England on renal replacement therapy [6]. In our cohort of patients, diabetics had worse survival at 5 years in univariate analysis. This is despite the fact that 74% of the diabetic population were from non-Caucasian backgrounds, and therefore, were younger, and, in the case of Indo-Asians, had better dialysis adequacy. After multivariate analysis including these factors of ethnicity, age, and Kt/V, diabetes did not appear to significantly increase the relative risk of death. However, we did not adjust for cardiovascular comorbidity and the presence of related risk factors such as hypertension, body mass index, smoking, and dyslipidemia, which could vary in each ethnic group. We did note that cardiovascular disease was the most common cause of death on dialysis in both Caucasians and Indo-Asians, a finding consistent with UK data [2].

As expected, age over 65 at the start of dialysis was shown to be a strong negative predictor of survival. This effect was seen predominantly in the Caucasian population, as we found significantly fewer patients aged over 65 in the non-Caucasian groups. Ethnic and migrant communities in the general population tend to be younger than Caucasians [1] and deliver younger patients for renal replacement therapy [10]. The age distribution within ethnic groups in our cohort is consistent with other studies. Pei et al [10] reported mean ages for south Asians (comparable to UK Indo-Asians) and blacks (comparable to UK Afro-Caribbeans) on dialysis of 52.7 and 50.6 years, respectively, which are slightly younger than the mean ages of our patient cohort. As with our study, these ethnic groups on dialysis were found to be significantly younger than Caucasian groups. It is likely that as ethnic populations age in the community, their renal replacement therapy cohorts will also age, and this may have an influence on comorbidity and survival.

Dialysis adequacy was found to be associated with patient mortality. Guidelines for hemodialysis adequacy suggest a minimum target Kt/V of 1.2, preferably prescribing a higher dose to ensure adequacy does not fall

below this minimum [19, 20]. Just over 7% of our patient population had a mean single pool Kt/V below 1.2, and only one of these patients was Indo-Asian. A significantly higher proportion of Indo-Asian patients had mean Kt/V of greater than 1.4 compared with other ethnic groups, perhaps reflecting smaller body size or muscle mass, or lower protein intake. Higher Kt/V and urea reduction ratios have been found elsewhere in Asian Americans (including Indo-Asians, as well as other Asians), independent of differences in body mass [9]. The relationship between dialysis dose and mortality is currently a contentious issue. A positive link between higher dialysis delivery and improved survival was not confirmed by the recent HEMO study [21]. In our patient cohort, Kt/V above 1.4 did appear to be associated with better survival, although causality has not been established. There is some evidence to suggest the relationship between dialysis dose and survival may not be uniform in all ethnic groups. For example, African American patients have better survival than other ethnic groups on dialysis in the United States, despite lower Kt/V and urea reduction ratios [22, 23]. In our study, we found the benefit of a higher Kt/V on survival was less pronounced in the Afro-Caribbean population, although still significant. These differences between ethnic groups warrant further study of parameters that influence adequacy and survival, such as dialysis hours, vascular access function, lean body mass, protein intake, hemoglobin, and serum albumin, which were not included in our study.

CONCLUSION

Using data from a large patient cohort derived from a population with a strong ethnic minority presence, we have shown that Indo-Asian and Afro-Caribbean patients have good survival on hemodialysis, comparable to Caucasians. This is despite a higher prevalence of diabetes, and is due in part to the younger age of ethnic populations. Indo-Asian patients achieve better dialysis adequacy than non-Asians, although the influence of adequacy on survival in different ethnic groups is unclear and merits further investigation.

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