Table 2: Demographic and clinical characteristics of patients based upon the requirement of second session of PD

Variable	Group 1 (within 1 week)	Group 2 (within 2 weeks)	Group 3 (within 3 weeks)	*P*
Patients	19	45	110	
Age (years)	45.4 (3.2)	46.2 (6.5)	42.2 (8.3)	<0.01
BMI (kg/m^2)	21.2 (2.01)	23.5 (3.1)	23.6 (2.6)	<0.01
Sex				
Male	12	31	73	
Female	7	14	37	
MAP (mm Hg)	115.3 (14.2)	111.7 (13.7)	121.5 (15.1)	<0.01
Primary kidney disease				
Diabetes mellitus	7	15	31	
Nephrolithiasis	4	7	19	
Hypertension	4	8	17	
Chronic glomerulonephritis	3	7	18	
Chronic interstitial nephritis		6	14	
ADPKD	1	2	6	
Others			5	
HB (g/dl)	7.97 (1.03)	7.84 (1.1)	8.4 (0.9)	<0.01
Albumin (g/L)	3.21 (0.35)	3.4 (0.29)	3.6 (0.24)	<0.001
Calcium (mg/dl)	7.11 (0.61)	7.5 (0.48)	7.79 (0.56)	<0.001
Phosphate (mg/dl)	4.77 (1.46)	5.74 (1.57)	5.82 (2.1)	0.09
iPTH (pg/ml)				
Median	196	480	570	
Range	37-1066	267-784	47-920	
Cholesterol (mg/dl)	191.8 (53.6)	194.9 (52.8)	193.7 (52.2)	0.93
TG (mg/dl)	146.9 (100.2)	161.06 (107.9)	165.2 (105.3)	0.78
Creatinine (mg/dl)	8.4 (3.4)	9.1 (3.4)	9.8 (4.5)	0.31
Urea (mg/dl)	121.3 (35.8)	131.8 (38.3)	137.9 (36.9)	0.17
eGFR (ml/min/1.73 m^2)	7.87 (4.1)	9.4 (4.3)	10.2 (3.5)	0.04
Urine output (ml)				
Median	450	650	750	
Range	100-800	200-1000	200-1400	

BMI: Body mass index, eGFR: Estimated glomerular filtration rate, TG: Triglycerides, iPTH: Intact parathyroid hormone, MAP: Mean arterial pressure, ADPKD: Autosomal dominant polycystic kidney disease, PD: Peritoneal dialysis, HB: Hemoglobin

Table 3: Outcomes of the patients at study end

Variable	Overall	Group 1 (*n*=19)	Group 2 (*n*=45)	Group 3 (*n*=110)	*P*
Still on PD	91	5	21	65	0.04
Total sessions of PD	1932	174	469	1289	
Median dialysis free days (range)		11 (5-28)	16 (10-31)	23 (10-41)	
Switched to HD	42	5	16	21	
Reason					
Complications	20	1	4	6	
Persistence of symptoms	18	3	11	13	
Mechanical failure	4	1	1	2	
Death	14	4	2	8	
Transplantation	14	3	4	7	
Lost to follow-up	12	2	2	8	

PD: Peritoneal dialysis, HD: Hemodialysis

switched over to HD [Table 4]. Bowel perforation occurred in 2 patients.

Death-censored technique survival

The overall 1 year death-censored technique survival was 68.4% (91/133). The rates were 50% (5/10), 56.8% (21/37), and 75.6% (65/86) in Group 1, Group 2, and Group 3, respectively. The mean survival time on PD before switching to HD was 9.8 months in group 1 (95% confidence interval [CI]: 8.1–11.4 months), 9.6 months (95% CI 8.6–10.6 months) in Group 2, and 11.1 months (95% CI: 10.7–11.4 months) in Group 3. On Kaplan–Meier analysis, a significant difference

was observed in death-censored technique survival between the three groups (log rank [Mantel-Cox] = 0.05) [Figure 2].

Discussion

The practice of RRT in India is guided mainly by economic considerations. Unlike the developed countries, there is no registry of patients with ESRD in India. Hence, outcomes of these patients are largely unknown. Most of dialysis center are privately managed and are located in large cities. Thus, for a patient requiring dialysis support in a rural area, this requires a lot of investment in terms of time and money. The adherence to the dialysis program is often poor. Rao *et al*. noted that almost 60% of their patients left the RRT program largely due to financial constraints.[4] In their series, only 3.6% of the patients remained on HD after 1 year and 4.5% on CAPD. The mortality in their cohort was 9.5%.[4] This was seconded by Abraham *et al*. who noticed a dropout rate of 51% within 2 years of starting CAPD.[5] Often patients fail to reach the dialysis center at the time of crisis. To bridge some of these gaps and ensure adequate compliance, an alternative, affordable form of RRT is needed. This is where intermittent PD (IPD) as a mode of RRT can be useful. Although IPD is biochemically inferior to HD, the minimal infrastructure and operation cost, need for highly trained staff and sophisticated equipment, makes it an attractive mode of RRT, especially in areas with low-resources.

Table 4: Complications during IPD

Total number of session	*n*=2261 (%)
Pericatheter leak	256 (11.3)
Pain	1431 (63.5)
Bleeding	124 (5.5)
Cessation of PD due to excessive haemorrhage	6
Bowel perforation	2 (0.09)
Peritonitis	49 (2.1)
Mechanical problems	62 (2.7)

IPD: Intermittent peritoneal dialysis

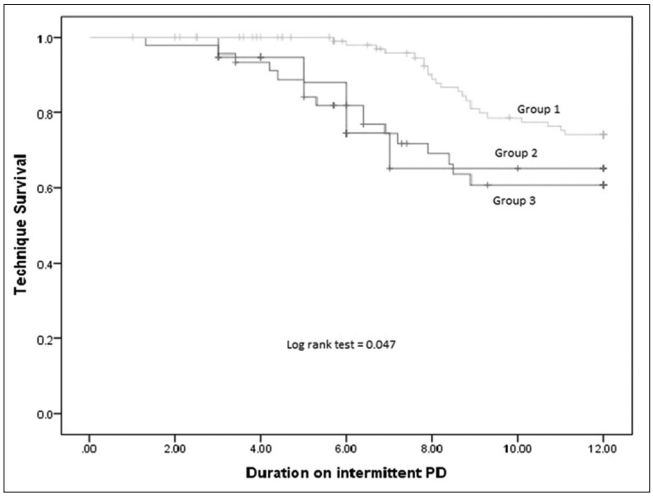

Figure 2: Kaplan–Meier curve showing death-censored technique survival

PD has often been described as "the poor stepchild in therapy for end stage renal disease." Experiment with peritoneal lavage was first reported by Wegner in 1877.[6] However it was in 1923 when Georg Ganter published the first trials of PD for the management of uremia, which prompted researchers around the world to focus on PD as a mode of treating uremia, which until then was a "death sentence" for the patient. In 1946, Frank *et al*. reported the first successful use of "peritoneal irrigation" in the treatment of acute renal failure.[7] Various review during 1950' demonstrated that patients treated with PD showed clinical and biochemical improvement. However, the high incidence of peritoneal infection after repeated puncture PD and other complications associated with it meant that the use of PD was limited to patients who had a reversible cause of their renal failure.[7]

The use of IPD was practiced widely in the 1970's mostly in patients with acute kidney injury; however, its use in ESRD was debatable.[7] The use of repeated puncture IPD has declined in the recent years in favor of intermittent HD and continuous RRT. It lacks the efficiency of HD, the clearance per exchange decreases with shorter dwell, and ultrafiltration rate cannot be controlled as fluid removal is limited and the possibility of PD worsening mechanical ventilation.[8-10]

Since this practice of IPD is often considered "old," studies comparing with other standard forms RRT are lacking. IPD as a form of RRT was studied in the 1960's and 70's.[11-13] In a formal program, 30 nonoliguric patients were offered repeated PD whenever there was biochemical or clinical deterioration. Survival for 4 months was unusual.[12] All these studies are small and for a short duration. In our study, the gap between the first two sessions of PD proved to be a reliable indicator of the further course for the patient on periodic PD. A significant number of patients could be maintained on IPD after 1 year. Those who had an earlier deterioration of their clinical and biochemical status requiring early institution of PD had a lower technique survival. These patients had a lower BMI, albumin level, and HB levels, signifying malnutrition or a persistent inflammatory state. They also had a lower creatinine clearance and a lower urine output. These factors may help to decide the patient profile which can be maintained of repeated puncture PD. Similarly, a longer gap between the first two sessions of PD meant that the patient had a better subsequent course. These patients were maintaining a dialysis-free period of 23 days. Frank peritonitis rate was very low compared to earlier studies. One reason could be the prophylactic use of broad spectrum antibiotics for the session of PD, however, whether this can be considered a significant factor is debatable. No death occurred as a direct consequence of PD. The mortality rate in our study was 8% which is comparable to those seen in other forms of RRT. A mortality rate of 20% within 2 years of initiating HD was reported by Singh and Bhandari.[14]

These data are significant as it provides a cost effective way of managing uremia in patients who cannot be maintained with other conservative measures and is particularly useful for low socioeconomic patients without a potential donor, who otherwise would be destined to die a miserable life. As discussed earlier, this form of PD is provided free of cost to patients in government sector hospital across Rajasthan, thus its utility in this part of the world has a greater significance. Even otherwise, a single session of PD would cost approximately Rs. 2000, and would benefit particularly those patients who require a session every 2 or 3 weeks.

There are certain limitations of this study. First, since, it's a single center study; it cannot be used to represent the overall situation across India or developing world. A multi-center study is required to validate the issue. Secondly, a control group was lacking for comparison with other standard form of therapy such as HD or CAPD. Thirdly, PD adequacy could not be measured due to lack of required data.

Conclusions

Our study showed that it is possible to maintain patients with terminal uremia on repeated puncture PD, without significant complications and provides a safe and cost effective way of palliation in these patients. In spite of limitations, PD can be successfully accomplished in remote areas and in low resource areas.

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Conflicts of interest

There are no conflicts of interest.

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