ejpmr, 2021,8(5), 405-410

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

ACUTE PERITONEAL DIALYSIS AS A BRIDGE THERAPY IN CRITICALLY ILL PATIENTS OF ACUTE KIDNEY INJURY

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Article Received on 22/02/2021 **Article Revised on 15/03/2021** **Article Accepted on 04/04/2021**

INTRODUCTION

Acute kidney injury (AKI) is a major cause of hospitalization and associated with high mortality. Recent evidences have suggested that outcomes of acute peritoneal dialysis (APD) in patients of AKI admitted to ICU is as good as hemodialysis. The present single centre study was planned to evaluate the effect of Acute PD as a bridge therapy in patients of AKI admitted to intensive care unit (ICU). **Materials and Methods:** This was a single center retrospective observational study done on patients of AKI admitted to GMCH hospitals ICU and nephrology department from January 2013 to December 2020. These patients had received acute peritoneal dialysis as a bridge therapy. **Results:** A total of 118 patients record were included in the present study. Most common cause of AKI was sepsis. Majority of the patients were converted to intermittent HD which comprised of 64 patients (54%), while 30 patients (25%) recovered after APD and 22 patients (18.6%) died due to underlying disease. **Conclusion:** Acute peritoneal dialysis is a good modality of renal replacement therapy in patients of acute kidney injury who all are critically ill and it could be used as a bridge therapy for intermittent haemodialysis in resource poor setting with minimum monitoring and expertise.

KEYWORDS: Acute Kidney Injury, peritoneal dialysis, ICU, hemodialysis.

INTRODUCTION

The incidence of acute kidney injury (AKI) is increasing on a global scale. Out of 13 million global cases of AKI, more than 80% of the cases are reported from low to middle income countries.[1,2] Apart from increased risk of progression to chronic kidney disease (CKD), AKI is associated with augmented morbidity and mortality accounting for more than million deaths annually in developing countries.[1]

Many patients of AKI require dialysis.[3] Particularly, AKI is seen in patients admitted to intensive care unit (ICU) with the diagnosis of multiple organ failure. These patients have been found to have comparatively increased requirement of dialysis. Currently, peritoneal dialysis (PD) and hemodialysis (HD) are two major types of dialysis that are available. Intermittent type of PD was the first type of dialysis which was given to patients of AKI, which was later superseded by continuous PD via the use of cyclers.[4]

Recent evidences have suggested that outcomes of APD in patients of AKI admitted to ICU is as good as HD.[5,6] As per the guidelines for the management of AKI, PD has been recommended as a customary choice for optimal outcomes in these patients.[7] There are many advantages seen with the use of PD over HD in the form of safe, efficacious, simple method of renal replacement therapy, which is able to attenuate the electrolyte, metabolic, acid-base derangements in patients of AKI admitted to ICU.[7,8]

Intensive types of PD like continuous flow, high volume PD have been proven to provide renal replacement therapy comparable to existing extracorporeal methods of blood purification.[9] PD is especially preferred in patients who are hemodynamically unstable and in whom systemic anticoagulation is to be avoided or contraindicated.[10] However, PD is not without limitations usually in the form of requirement of patent peritoneal space, increased chances of peritoneal infections, loss of protiens, etc.[11,12]

Recent International Society of Peritoneal Dialysis (ISPD) 2021 guidelines have recommended that acute PD (APD) should be considered as a therapeutic option in patients of AKI in all settings.[13] Also, recent published evidences has suggested that equivalent

survival rates and shorter period of renal replacement therapy (RRT) can be seen with PD as compared to other extracorporeal modalities of blood purification. These findings have ignited newer attentiveness in the consideration of PD as one of the main therapeutic option for AKI.[14,15,16]

There is still paucity of literature on the use of PD to treat AKI patients, and what exists often does not address fundamental parameters. Hence the present single centre study was planned to evaluate the effect of Acute PD in critically ill patients.

MATERIALS AND METHODS

The present study was a retrospective single centre study conducted at Gauhati Medical College, Guwahati, India. The study was conducted from January 2013 to December 2020 to evaluate the role of Acute PD as a bridge therapy in critically ill patients. In this study 118 patients of AKI admitted to ICU's were included who received acute peritoneal dialysis using rigid PD catheter.[17]

AKI was defined using KDIGO criteria[18] as a rise in serum creatinine of 0.3 mg/dL from baseline within last 48hrs, decrease in urine output to <0.5ml/kg/hr for 6hrs, rise in S. creatinine by 50% in last one week.

Inclusion criteria

Patients >18 years of age of AKI admitted to ICU's were included who received acute peritoneal dialysis.

Exclusion criteria

- Recent abdominal surgery
- Pleuroperitoneal communication
- Diaphragmatic paralysis and severe respiratory failure
- Severe volume overload in a patient not on a ventilator
- Severe gastroesophageal reflux disease
- Low peritoneal clearance
- Peritonitis
- Abdominal wall cellulitis

Indications for RRT were any one or a combination of blood urea ≥150 mg/dL, serum creatinine ≥3 mg/dL , S. Potassium ≥6 mEq/L , metabolic acidosis with arterial pH 7.2 or lower, together with hourly urine output of less than 0.5 mL/kg for more than 12 hours despite correction of volume depletion.

After each session of PD, the patients were reassessed clinically and by biochemical parameters and non-recovering patients or those who improved hemodynamically were shifted to intermittent HD. The demographic, clinical, biochemical and treatment data of the cases were analyzed by standard analytical methods.

Statistical analyses

Demographic and clinical variables were expressed in terms of mean, standard deviation and percentages as a part of descriptive statistics. Paired t-test was used to analyse the effect of PD on various laboratory parameters. $P < 0.05$ was considered statistically significant. All statistics were carried out using SPSS, version 18 (SPSS, Chicago, IL, USA).

RESULTS

A total of 118 patients record were included in the present study. Mean age of population 43.6 ± 17.16 (table 1). Number of male (n=65, 55%) superseded that of females (n=53,45%) (figure 1).

Table 1: Age wise distribution of cases in the present study.

Age (Years)	No. of patients	No. of recovered patients n (%)
18-30	21	8 (38%)
31-40	28	9 (32%)
41-50	32	7 (21.8%)
51-60	22	4 (18%)
>60	15	2 (13.3%)
Total	118	30 (25.4%)

Figure 1: Gender wise distribution of patients of AKI in the present study.

Different causes of AKI in each group are enlisted in (table 2).

Table 2: Causes of AKI in the patients of present study.

Causes of AKI	No of cases
Sepsis	38
Acute gastroenteritis	24
Post Partum AKI	21
Malaria	18
Poisoning	11
Acute pancreatitis	5
Chronic liver disease	3
Leptospirosis	6
Snake bite	7
Cardio-renal Syndrome	3
Total	118

Thereafter patients were categorized based on urine output, oliguric 53.3% (n=63), anuric 28.8% (n=34) and non-oliguric 16% (n=19) (figure 2).

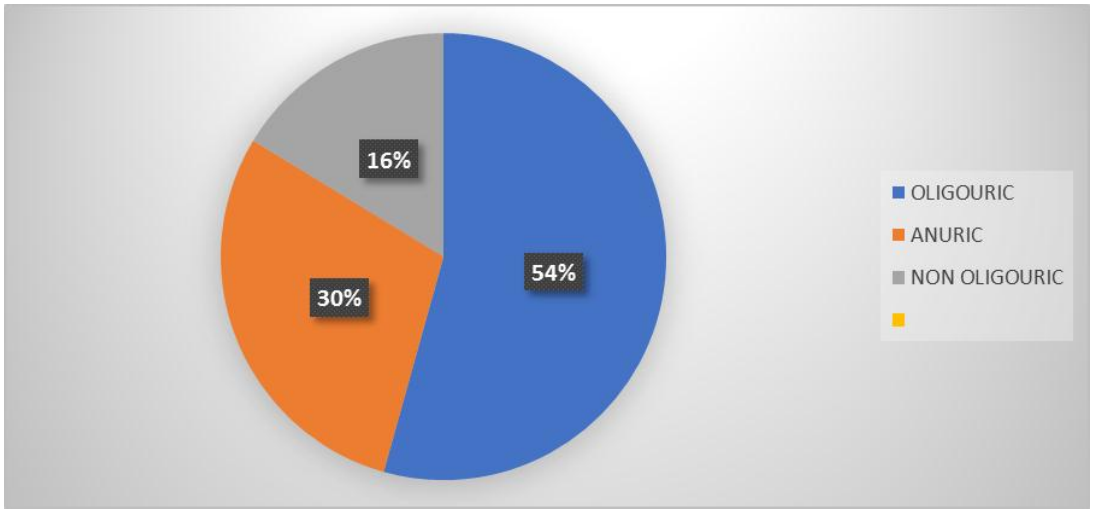

Figure 2: Types of AKI depending on urine output in the patients of present study.

The changes in laboratory parameters at baseline and after APD are are listed in table3.

Table 3: Laboratory parameters at baseline and after acute peritoneal dialysis (APD) in patients of AKI in the present study.

	At initiation of PD	After stopping PD	p-value
Haemoglobin	10.6 ±2.34	10.23±2.12	0.32
Total leukocyte count	12500±4500	10900±3200	0.08
Blood urea	124± 34	76±23	<0.01
Serum Creatinine	5.23±1.34	2.56±1.22	<0.01
S. Potassium	5.8±1.4	4.3±1.1	0.03
S. Calcium	7.8±1.3	8.2±1.1	0.12
S. Phosphorous	5.5±1.6	4.5±1.2	0.04
S. Uric acid	6.21±2.37	5.23±0.9	0.02
pH	7.23±0.15	7.34±0.12	0.01
S. Bicarbonate	16.31±2.25	18±3.23	0.01

Outcomes: Outcomes were measured as number of patients shifted to Intermittent HD, number of patients recovered on Acute PD, and Acute PD stopped due to complication related to Acute PD, death due to underlying disease. Majority of the patients were converted to intermittent HD which comprised of 64 patients (54%), while 30 patients (25%) recovered after APD and 22 patients (18.6%) died due to underlying disease (figure 3).

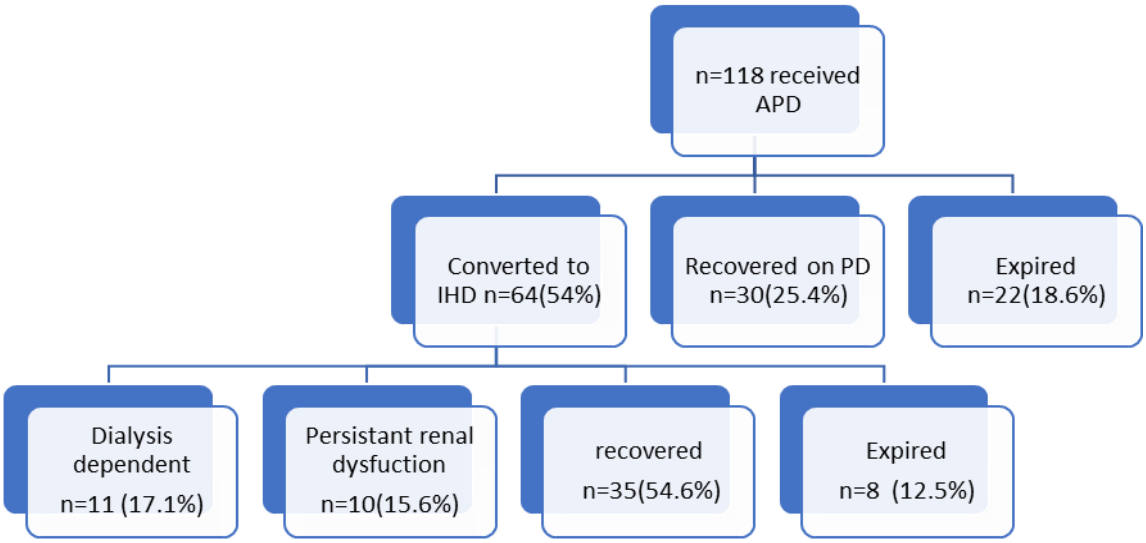

Figure 3: Outcomes of patients of acute kidney injury (AKI) who received acute peritoneal dialysis in the present study.

Most common complication of APD in present study was outflow obstruction (5%), followed by hyperglycemia and acute peritonitis (3% each) [figure 4].

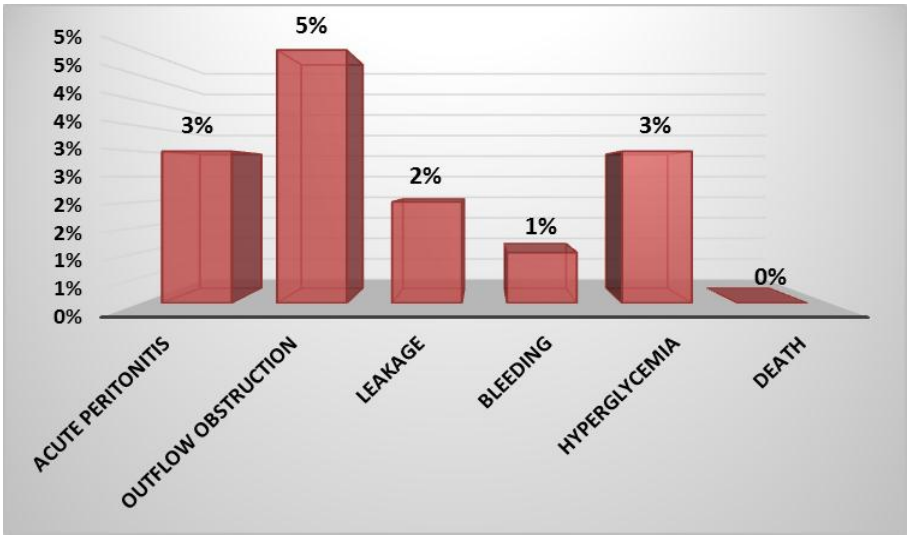

Figure 4: Complications of acute peritoneal dialysis in patients of present study.

DISCUSSION

AKI in India is a major health problem with high mortality and morbidity, because of lack of resources, difficult access to facilities, and cost. Ease of administration of acute PD in resource poor setting, unavailability of purified water treatment and cost and non-requirement of extensive training has made Acute PD is as a treatment of choice for AKI.[13]

There has been scepticism about PD in terms of lack of complete clearances and therefore its comparison with extracorporeal techniques of blood purification was not considered to be practically feasible. Owing to recent evidences generated through meta-analyses, APD has re-ignited interests of clinicians as a potent option of renal replacement therapy, especially in the ongoing COVID 19 pandemic. Also, previous guidelines have recommended APD as appropriate therapeutic option for treatment of AKI (recommendation 1B).[7]

Multiple studies have established superior effect of acute peritoneal dialysis over continuous renal replacement therapy.[15,19, 20] Additionally, acute peritoneal dialysis has been found to more effective in hypercatabolic type of AKI and elderly patients.[21,22]

In our study we have found that out of 118 patients initiated on acute PD, 25.4% (n=30) has recovered and 54.2% (n=64) were shifted onto Intermittent hemodialysis. Among those who were shifted on intermittent hemodialysis 54.6% (n=35) recovered, 15.6% (n=10) had partial recovery and 17.1% (n=11) were dialysis dependent at the time of discharge. The complications due to per se acute PD very few and no death was reported due to procedure itself.

In a randomised clinical study conducted in India effect of two types of PD was analysed prospectively in 87 patients of AKI who were hemodynamically stable. Tidal PD and continuous PD were used in these patients and the results were compared in both the groups. These patients had mild to moderate severity of hyper catabolism and severe hyper catabolic AKI patients were not included in the study. Patients were randomised to receive either of these PD after insertion of peritoneal catheter. If there was no renal improvement, other type of PD was administered to the patient after a gap of over 12 hours. Only those patients were included for analysis who completed a set of dialysis. The findings suggested that bot the types of PD were adequate in terms of maintaining blood urea nitrogen level at 65 mg/dl in patients of AKI who were in mild to moderate hyper catabolic state.[22] These findings were corroborated by other such studies conducted in western countries.[21,23]

In another Indian randomized clinical trial comparative assessment of continuous venovenous hemodiafiltration and peritoneal dialysis on outcomes was done. This clinical trial involved 55 patients of acute kidney injury with multiple organ involvement admitted to intensive care unit and requiring renal replacement therapy. These patients were randomized to receive either continuous venovenous hemodiafiltration or peritoneal dialysis. It was found that clinical outcomes in both the groups were similar in terms of improvement, shift to haemodialysis and deaths. The researchers of this clinical trial concluded that peritoneal dialysis is equally effective as continuous venovenous hemodiafiltration and it can serve as better option in economically constraint geographies, particularly rural areas.[24]

APD has many comparative advantages over continuous renal replacement therapy (RRT) or intermittent PD like paucity of stringent water and electricity requirements, less requirement of expert manpower for handling the instrument, lesser cost, and cardiovascular stability in

hypotensive patients. Due to these factors, APD is majorly used in developing countries where healthcare economy is one of the crucial limiting factor.[24]

Due to these benefits and the simplicity of APD, the Saving Young Lives (SYL) program has dedicated its efforts into developing acute PD programs in developing countries and it has become the effector arm of the ISN's 0- 25 initiative for delivery of dialysis. So far, over 500 patients in SYL centres have been treated with a >60% survival along with recovery of renal function.[25-28]

Finally, the recent Covid-19 pandemic has highlighted the benefits of acute PD in patients who have a hypercoagulable state, especially when extracorporeal therapy options are limited due to demands on machines, supplies and staffing.[29]

The present study is not without limitations. Due to its retrospective study design the chances of bias cannot be ruled out. Similar such studies should be carried out at multiple centres with a larger sample size, so that present study findings can be compared and generalized.

CONCLUSION

Acute peritoneal dialysis is a good modality of renal replacement therapy in patients of acute kidney injury who all are critically ill. And it could be used as a bridge therapy for intermittent haemodialysis in resource poor setting with minimum monitoring and expertise.

Source of Funding: Not applicable.

Conflicts of Interest: None declared by the authors.

Ethics Committee approval: Taken prior to the start of the study.

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