E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/16.02.396

Research Article

OBSERVATIONAL STUDY OF CONTINUOUS RENAL REPLACEMENT THERAPY USING OXIRIS FILTER AND SUSTAINED LOW EFFICIENCY DIALYSIS IN PATIENTS WITH SEPTIC ACUTE KIDNEY INJURY

Lingaraju K S[1], Pavan Kumar D S [2]*, Rashmi G K [3]

[1]Assistant Professor, Department of General Medicine, Subbaiah Institute of Medical Sciences, Holehonnur road, Purle, Shivamogga.
[2*]Assistant Professor, Dept of General Medicine, Subbaiah Institute of Medical Sciences, Holehonnur road, purle, Shivamogga.
[3]Assistant Professor, Department of Microbiology, Subbaiah Institute of Medical Sciences, Holehonnur road, purle, Shivamogga.
*Corresponding author: Dr.Pavan Kumar D S, Assistant Professor, Department of General Medicine, Subbaiah Institute of Medical Sciences, Holehonnur road, Purle, Shivamogga, India.
ds.pavan134@gmail.com
Received date: 15-08-2026, Date of acceptance: 24-08-2026,
Date of Publication: 25-08-2026

Abstract

Background: Sepsis-associated acute kidney injury (AKI) is a severe complication of critical illness and frequently requires renal replacement therapy (RRT). Sustained low-efficiency dialysis (SLED) and continuous renal replacement therapy (CRRT) using the oXiris adsorptive hemofilter are established treatment options, although direct prospective comparisons remain limited.

Methods: This prospective observational study was conducted in a tertiary care intensive care unit between March 2020 and March 2021. Sixty adults with septic shock-associated AKI requiring RRT were included, with 30 patients treated using SLED and 30 using oXiris-based CRRT. Demographic characteristics, comorbidities, Sequential Organ Failure Assessment and Acute Physiology and Chronic Health Evaluation II scores, vasopressor and ventilatory requirements, biochemical parameters, microbiological findings, ICU outcomes, renal recovery, and resource utilisation were assessed.

Results: Baseline demographic characteristics were comparable between groups. Patients selected for CRRT had greater illness severity, including lower mean arterial pressure, higher SOFA scores, greater vasopressor requirements, and more frequent invasive mechanical ventilation. ICU mortality was higher in the CRRT group than in the SLED group (83.3% vs. 50.0%), whereas renal recovery at discharge was more frequent in the SLED group (40.0% vs. 10.0%). SLED was also associated with earlier hemodynamic stabilisation, greater improvement in bicarbonate and lactate levels, shorter ICU stay, and shorter RRT duration.

Conclusion: Patients receiving SLED had more favourable unadjusted clinical outcomes than those receiving oXiris-based CRRT. These findings should be

interpreted cautiously because substantial baseline severity differences and confounding by indication prevent attribution of outcomes solely to the RRT modality.

Keywords: Sepsis-associated acute kidney injury; Septic shock; Continuous renal replacement therapy; oXirishemofilter; Sustained low-efficiency dialysis

INTRODUCTION

Sepsis is a major cause of critical illness, multiorgan dysfunction and mortality, and acute kidney injury (AKI) is one of the most serious complications of sepsis [1]. Sepsis-associated AKI is often associated with other organ support needs, such as hemodynamic instability, metabolic abnormalities, longer intensive care unit (ICU) stay and higher organ support requirements [1]. If septic shock is complicated by severe AKI, renal replacement therapy (RRT) might be used for acidosis, electrolyte abnormalities, fluid overload, and uremic complications [2]. In hemodynamically unstable patients, continuous renal replacement therapy (CRRT) is usually chosen as it allows for slow removal of fluid and solute [2].

Adsorptive hemofilters have been developed to extend the conventional renal supportive role of CRRT to the ability to remove circulating endotoxins and inflammatory mediators [3]. The oXirishemofilter is a modified AN69 membrane that combines diffusive and convective clearance capabilities and has cytokine and endotoxin adsorption properties [3]. In a systematic review and meta-analysis, it was suggested that the use of oXiris-based CRRT might lead to better hemodynamic parameters and short-term survival in sepsis, but the evidence was predominantly of an observational and heterogeneous nature [3].

Based on comparative observational evidence, the use of oXiris-based CRRT may be associated with alterations in vasopressor needs, inflammatory markers, renal function and short-term outcomes in specific sepsis patients [5]. Its ability to give renal support together with endotoxin and cytokines adsorption is supported with narrative evidence [6]. In clinical reports, the feasibility of using oXiris in the treatment of critically ill patients with sepsis, acute kidney injury (AKI) and acute respiratory distress syndrome (ARDS) has been shown [7]. There has been improvement in selected hemodynamic and biochemical parameters in severe septic shock, as seen in a single-centre experience, but mortality is still high, in this case [8].

Baseline illness severity, hemodynamic instability, and multiorgan dysfunction seem to be significant factors affecting outcomes in patients who receive oXiris-based CRRT [9]. Experience in a resource-limited ICU showed the feasibility of oXirishemoadsorption in sepsis-associated AKI, and that retrospective comparison is limited [10]. Several studies have compared the inflammatory and physiological reactions of hemopurification filters, but did not demonstrate superiority for renal recovery or mortality [11]. Selective use of oXiris is recommended in sepsis and hyperinflammatory conditions, considering the time of use, clinical phenotype, and the integration with standard treatment, according to expert consensus [12].

However, CRRT poses both pharmacological and operational problems, such as changes in the clearance of antimicrobials and the necessity of personalised doses during continuous venovenous hemodiafiltration [13]. In

addition to the practical benefits of a traditional hemodialysis system, SLED provides an alternative extended RRT approach in which the fluid and solute removal rates are slower [14]. There is available evidence demonstrating SLED's ability to correct acid-base, electrolyte and volume abnormalities with acceptable hemodynamic tolerance in the critically ill patient [14]. In long-term studies, severity of the disease and the outcome of the time spent in the intensive care unit (ICU) are found to affect survival and the need for dialysis or renal recovery following CRRT [15]. Multicenter data suggest that oXiris is often employed in patients who suffer from severe shock and have multiple organ-support needs, which means that there is significant confounding by indication in non-randomised comparisons [16]. Randomised crossover evidence has shown that oXiris can have a beneficial effect on reducing circulating levels of endotoxin and cytokines, but the mere removal of biomarkers does not demonstrate a survival benefit [17].

Comparisons of oXiris-based CRRT and SLED are still restricted and limited, especially when applied to adults with septic AKI in resource-limited environments [4,14]. Previous studies have been primarily retrospective or single-centre, have varied protocols, and have included patients with significant differences in baseline disease severity [1,8]. These restrictions limit the ability to determine the impact of RRT modality from the severity of shock, the use of vasopressors, mechanical ventilation, and multiorgan dysfunction [9,15,16]. However, there is limited evidence for mortality in the ICU, renal recovery, hemodynamic response in the early stages of hospitalisation, length of RRT, length of stay in the ICU and the use of resources [4,14-16]. Therefore, this study aimed to compare these outcomes in patients treated with oXiris-based CRRT with the outcomes of patients treated with SLED, taking into account the baseline severity of the patients and the treatment-selection bias [4].

OBJECTIVES OF THE STUDY

The study aims to compare ICU mortality and renal recovery at hospital discharge between patients with sepsis-associated acute kidney injury treated with oXiris-based CRRT and those receiving SLED. It also evaluates differences in early clinical response, ICU length of stay, treatment cost, and renal recovery at one and three months after discharge.

MATERIALS AND METHODS

This prospective observational study was conducted in the intensive care unit of a tertiary care hospital. Clinical outcomes were compared between patients with septic shock-associated acute kidney injury treated with CRRT using the oXiris hemofilter and those treated with sustained low-efficiency dialysis.

Study Setting and Duration

The study was conducted at Apollo Hospitals, Bannerghatta Road, Bengaluru, India, between March 2020 and March 2021.

Study Population

Adult patients admitted to the intensive care unit with septic shock-associated acute kidney injury requiring renal replacement therapy were considered eligible. The treating physician selected the renal replacement modality according to the patient's clinical condition, hemodynamic status, and treatment requirements. Patients received either CRRT using the oXiris hemofilter or SLED.

Eligibility Criteria

Patients were included if they were older than 18 years, had septic shock-associated acute kidney injury, had a cardiovascular component score of 2 or more on the Sequential Organ Failure Assessment scale, required renal replacement therapy (RRT) using either oXiris-based CRRT or SLED, and had provided written informed consent either themselves or through a legally authorised representative.

Patients who met any of the following exclusion criteria were excluded: chronic kidney disease requiring renal replacement therapy, renal replacement therapy in the preceding 30 days, pregnancy, immunosuppressive therapy or systemic cortisone therapy in the past 30 days, or malignancy diagnosis in the past 30 days before the start of the clinical study, or organ transplantation, or involvement in another clinical investigation in the previous 30 days.

Renal Replacement Therapy Protocol

CRRT was completed by continuous venovenous hemodiafiltration via the Prismaflex system and the oXiris hemofilter. A blood flow of 100-150 mL/ min was maintained with an intended effluent dose of 20-35 mL/kg/ hr. Regional citrate or unfractionated heparin was used for anticoagulation. Those who were actively bleeding or had a high risk for bleeding were treated without anticoagulation.

The patient was dialysed in the SLED group using the Fresenius 5008S hemodialysis machine and FX5 dialyser at low efficiency. The flow rate of blood was kept at 100-150 mL per min, and the flow rate of dialysate was fixed at 200-300 mL per min. The treatment time was 6-8 hours per session. Unfractionated heparin was the anticoagulant used, and saline flushes were administered to patients who were at a higher risk of bleeding.

Clinical and Laboratory Assessment

Baseline assessment consisted of age, sex, comorbidities, source of infection and severity of illness. The severity of the disease was measured by the Sequential Organ Failure Assessment and Acute Physiology and Chronic Health Evaluation II scores. Hemodynamic parameters, vasopressor use and need for ventilatory support were documented at admission and within the first 72 hours after renal replacement therapy (RRT) was begun.

Laboratory parameters comprised complete blood count, renal function tests, urinary electrolytes, arterial blood gas analysis, serum bicarbonate, serum lactate and procalcitonin levels. These parameters were evaluated at baseline and 72 hours. Blood and urine cultures were obtained as needed.

Outcomes and Follow-up

The main endpoints were mortality in the intensive care unit and renal recovery at hospital discharge. Secondary outcomes assessed were early hemodynamic and biochemical response, requirement of vasopressors, changes in Sequential Organ Failure Assessment scores, length of time receiving renal replacement therapy, length of intensive care unit (ICU) stay, treatment cost, and mechanical ventilation.

Post-hospitalisation assessment took place at 1 and 3 months after hospital discharge for patients who were able to survive. The outcomes measured included renal recovery, dialysis dependency, hospital re-admission, and death.

Ethical Considerations

The study was approved by the Institutional Review Board of Apollo

Hospitals and was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants or their legally authorised representatives before enrolment.

"Statistical Analysis"

IBM SPSS Statistics for Windows, version 17.0, was used for statistical analysis. Data of continuous variables were expressed as mean ± standard deviation or as median and range as appropriate. Categorical data were reported as frequencies and percentages. Independent-samples t-test and paired-samples t-test were used for continuous variables in between-groups and within-groups comparisons, respectively. The chi-square test was used for comparing categorical variables. P-values < 0.05 were taken as statistically significant (two-sided).

RESULTS

Study Population and Baseline Characteristics

There were 60 patients with sepsis-associated acute kidney injury (AKI) included, with 30 receiving SLED and 30 receiving CRRT with the oXiris hemofilter. The groups did not significantly differ in age or sex distribution, nor in previously identified comorbidities. The CRRT group had a higher rate of diabetes mellitus, although this was not statistically significant. There was also no difference in the rates of hypertension, ischemic heart disease, chronic liver disease or chronic obstructive pulmonary disease between the groups (Table 1).

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population

Characteristic	Category	SLED (n = 30)	CRRT (n = 30)	p-value
Age, years	Mean ± SD	61.0 ± 10.5	63.1 ± 11.6	0.40
Sex, n (%)	Female	11 (36.7)	8 (26.7)	0.40
	Male	19 (63.3)	22 (73.3)	
Diabetes mellitus, n (%)	Present	16 (53.3)	22 (73.3)	0.10
	Absent	14 (46.7)	8 (26.7)	
Hypertension, n (%)	Present	15 (50.0)	15 (50.0)	1.00
	Absent	15 (50.0)	15 (50.0)	
Ischemic heart disease, n (%)	Present	14 (46.7)	17 (56.7)	0.40
	Absent	16 (53.3)	13 (43.3)	
Chronic liver disease, n (%)	Present	10 (33.3)	7 (23.3)	0.10
	Absent	20 (66.7)	23 (76.7)	

Chronic obstructive pulmonary disease, n (%)	Present	5 (16.7)	6 (20.0)	0.10
	Absent	25 (83.3)	24 (80.0)	

CRRT: continuous renal replacement therapy; SD: standard deviation; SLED: sustained low-efficiency dialysis."

Illness Severity and Hemodynamic Status at Admission

Patients receiving CRRT had greater hemodynamic instability at admission. Mean arterial pressure was significantly lower in the CRRT group than in the SLED group (74.3 ± 11.9 versus 86.3 ± 9.6 mmHg; p<0.001). The requirement for three or more vasopressors was also substantially higher in the CRRT group (80.0% versus 20.0%; p<0.001).

Acute Physiology and Chronic Health Evaluation II scores were similar between the groups. The mean day 1 Sequential Organ Failure Assessment score was higher in the CRRT group, indicating greater baseline organ dysfunction (11.0 ± 2.6 versus 10.0 ± 1.7; p=0.001) (Table 2).

Table 2. Illness Severity and Hemodynamic Status at Admission

Parameter	SLED (n = 30)	CRRT (n = 30)	p-value
Mean arterial pressure, mmHg, mean ± SD	86.3 ± 9.6	74.3 ± 11.9	<0.001
APACHE II score, mean ± SD	23.5 ± 2.7	23.7 ± 4.0	0.80
SOFA score on day 1, mean ± SD	10.0 ± 1.7	11.0 ± 2.6	0.001
Requirement for ≥3 vasopressors at admission, n (%)	6 (20.0)	24 (80.0)	<0.001

APACHE II: Acute Physiology and Chronic Health Evaluation II; CRRT: continuous renal replacement therapy; SD: standard deviation; SLED: sustained low-efficiency dialysis; SOFA: Sequential Organ Failure Assessment."

Figure 1 shows the lower mean arterial pressure and higher day 1 SOFA score in the CRRT group. APACHE II scores were comparable between the groups.

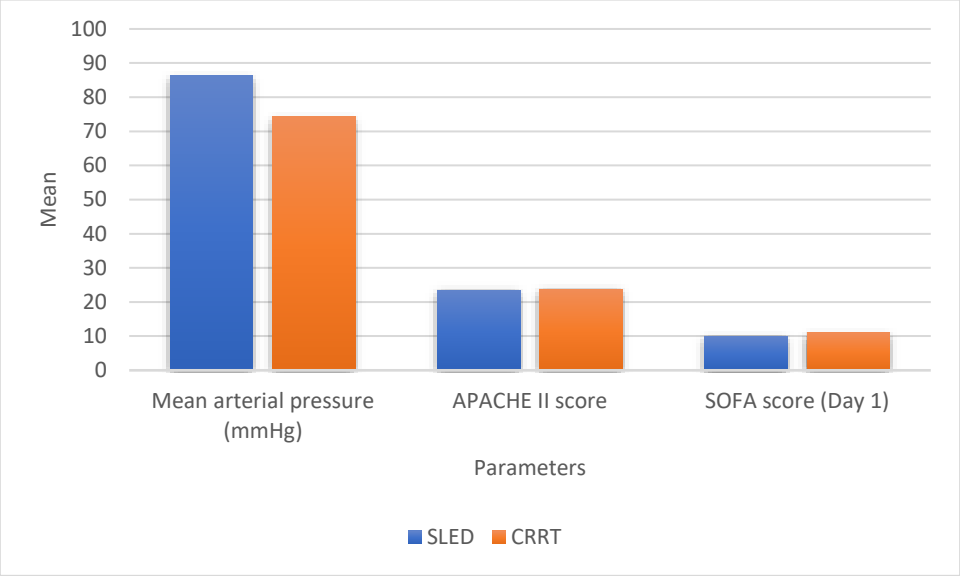

Figure 1. Comparison of hemodynamic and illness-severity parameters at intensive care unit admission

Clinical Course during the First 72 Hours

At 72 hours, the proportion of evaluable patients who were free from vasopressor support was higher in the SLED group than in the CRRT group (48.0% versus 22.2%; p=0.004). The mean day 3 SOFA score was also significantly lower among patients receiving SLED (6.1 ± 3.5 versus 11.2 ± 3.1; p<0.001).

Invasive mechanical ventilation at admission was required in 63.3% of patients in the SLED group and 90.0% in the CRRT group (p=0.02). These findings were consistent with the greater baseline respiratory and hemodynamic support requirements in patients selected for CRRT (Table 3).

Table 3. Clinical Course during the First 72 Hours

Parameter	SLED	CRRT	p-value
Vasopressor-free at 72 hours, n (%)	12 (48.0)	4 (22.2)	0.004
SOFA score on day 3, mean ± SD	6.1 ± 3.5	11.2 ± 3.1	<0.001
Invasive mechanical ventilation at admission, n (%)	19 (63.3)	27 (90.0)	0.02

"CRRT: continuous renal replacement therapy; SD: standard deviation; SLED: sustained low-efficiency dialysis; SOFA: Sequential Organ Failure Assessment."

Biochemical Response

Both groups had marked metabolic abnormalities at baseline. Mean serum bicarbonate was lower in the CRRT group, although the between-group difference was at the threshold of statistical significance (12.4 ± 3.2 versus 14.3 ± 4.2 mEq/L; p=0.05). At 72 hours, bicarbonate was significantly higher in the SLED group (20.3 ± 4.2 versus 13.8 ± 7.8 mEq/L; p<0.001).

Baseline serum lactate was significantly higher in the CRRT group (7.6 ± 3.7 versus 5.1 ± 3.1 mmol/L; p=0.006). Lactate concentrations declined in both groups but remained higher in the CRRT group at 72 hours (3.8 ± 3.3 versus 2.0 ± 1.5 mmol/L; p=0.03).

Procalcitonin concentrations also decreased from baseline to 72 hours in both groups. At 72 hours, the mean procalcitonin concentration was 24.1 ± 13.8 ng/mL in the SLED group and 19.4 ± 7.7 ng/mL in the CRRT group (Table 4).

Table 4. Biochemical Parameters at Baseline and 72 Hours

Parameter	Time point	SLED	CRRT	p-value
Bicarbonate, mEq/L, mean ± SD	Baseline	14.3 ± 4.2	12.4 ± 3.2	0.05
	72 hours	20.3 ± 4.2	13.8 ± 7.8	<0.001
Lactate, mmol/L, mean ± SD	Baseline	5.1 ± 3.1	7.6 ± 3.7	0.006
	72 hours	2.0 ± 1.5	3.8 ± 3.3	0.03
Procalcitonin, ng/mL, mean ± SD	Baseline	35.9 ± 26.5	38.5 ± 20.0	0.03
	72 hours	24.1 ± 13.8	19.4 ± 7.7	0.01

"CRRT: continuous renal replacement therapy; SD: standard deviation; SLED: sustained low-efficiency dialysis."

Figure 2 demonstrates an increase in serum bicarbonate and reductions in lactate and procalcitonin concentrations during the first 72 hours in both treatment groups.

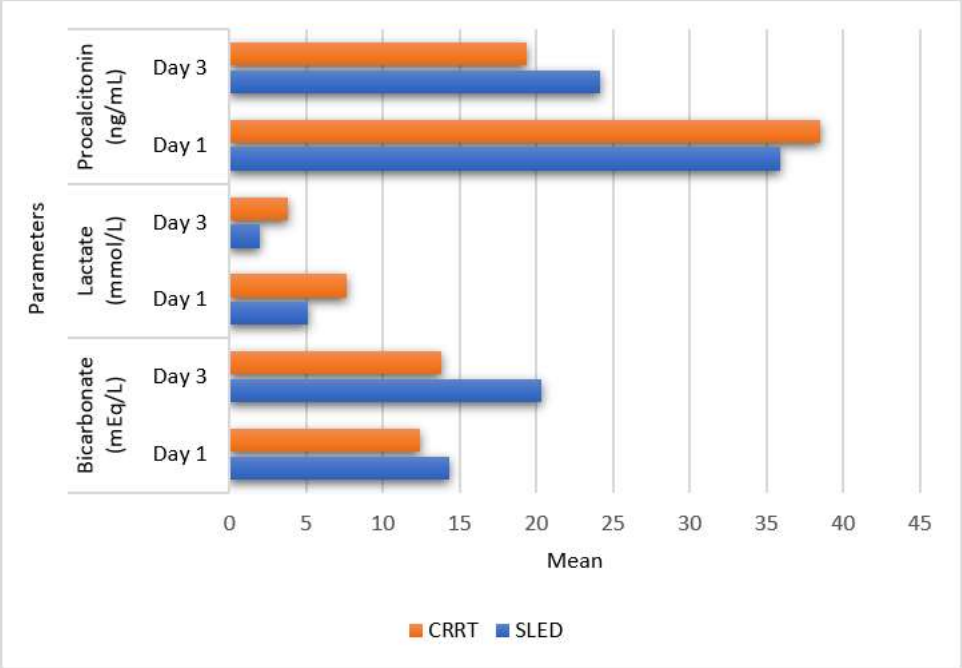

Figure 2. Changes in biochemical parameters over 72 hours

Intensive Care Unit Outcomes and Resource Utilisation

ICU mortality was significantly higher in the CRRT group than in the SLED group (83.3% versus 50.0%; p=0.006). Renal recovery at hospital discharge occurred in 40.0% of patients receiving SLED and 10.0% of those receiving CRRT (p=0.006).

The mean ICU length of stay was longer in the CRRT group than in the SLED group (23.6 ± 8.3 versus 4.9 ± 5.5 days; p<0.001). The mean duration of RRT was also greater among patients receiving CRRT (69.1 ± 30.1 versus 20.8 ± 6.9 hours; p<0.001) (Table 5).

Table 5. Major Clinical Outcomes and Resource Utilisation

Outcome	SLED (n = 30)	CRRT (n = 30)	p-value
ICU mortality, n (%)	15 (50.0)	25 (83.3)	0.006
Renal recovery at hospital discharge, n (%)	12 (40.0)	3 (10.0)	0.006
ICU length of stay, days, mean ± SD	4.9 ± 5.5	23.6 ± 8.3	<0.001
Duration of RRT, hours, mean ± SD	20.8 ± 6.9	69.1 ± 30.1	<0.001

CRRT: continuous renal replacement therapy; ICU: intensive care unit; RRT: renal replacement therapy; SD: standard deviation; SLED: sustained low-efficiency dialysis.

Microbiological Profile

Gram-negative bacilli were the predominant organisms in both groups, accounting for 70.0% of the microbiological profile in the SLED group and 90.0% in the CRRT group. Gram-positive cocci accounted for 20.0% and 6.7% of cases, respectively. *Candida* species, tuberculosis, and culture-negative infection each accounted for approximately 3% of cases in the SLED group. Tuberculosis accounted for 3.3% of cases in the CRRT group. As shown in Figure 3, gram-negative bacilli were the predominant organisms in both treatment groups.

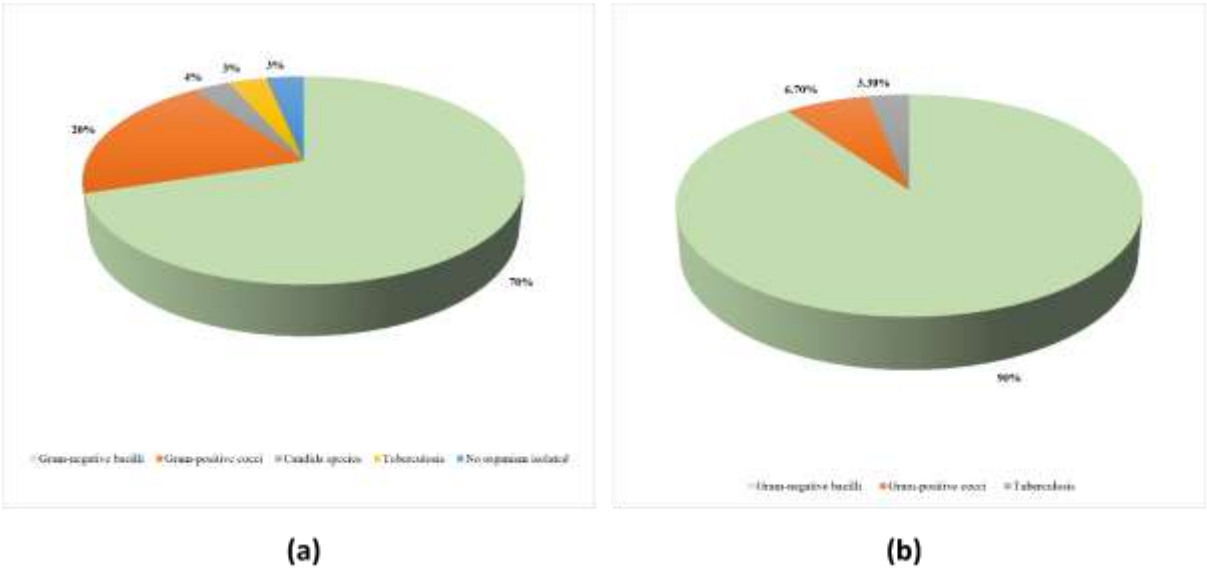

Figure 3. Microbiological profile of the study groups: (a) SLED and (b) CRRT

Source of Infection

Community-acquired pneumonia was the most frequently recorded source of infection, occurring in 26.7% of patients receiving SLED and 40.0% of those receiving CRRT. Urinary tract infection was identified in 20.0% and 16.7% of patients, respectively. Spontaneous bacterial peritonitis occurred in 10.0% of each group.

Other sources included ventilator-associated pneumonia, lower-limb cellulitis, perianal abscess, abdominal sepsis or intestinal obstruction, and disseminated tuberculosis (Table 6).

Table 6. Sources of Infection in the Study Population

Source of infection	SLED (n = 30), n (%)	CRRT (n = 30), n (%)
Community-acquired pneumonia	8 (26.7)	12 (40.0)
Ventilator-associated pneumonia	2 (6.7)	2 (6.7)
Urinary tract infection	6 (20.0)	5 (16.7)
Spontaneous bacterial peritonitis	3 (10.0)	3 (10.0)

Lower-limb cellulitis	4 (13.3)	1 (3.3)
Perianal abscess	2 (6.7)	1 (3.3)
Abdominal sepsis or intestinal obstruction	1 (3.3)	2 (6.7)
Disseminated tuberculosis	1 (3.3)	0 (0.0)

"CRRT: continuous renal replacement therapy; SLED: sustained low-efficiency dialysis."

DISCUSSION

This is a prospective, observational study comparing oXiris-based CRRT to SLED in patients with sepsis-associated acute kidney injury. Patients on CRRT showed a higher mortality in the intensive care unit, lower renal recovery at discharge, longer duration of RRT and longer ICU stay. These non-adjusted differences should be interpreted with caution, as the CRRT group had lower mean arterial pressure, higher Sequential Organ Failure Assessment scores, more vasopressor use and higher rates of invasive mechanical ventilation at baseline. Long-term outcome of critically ill patients on CRRT also shows that the probability of survival, dialytic or renal recovery is highly dependent on the severity of the illness and the subsequent clinical course [15].

There is a significant indication of confounding between groups in the baseline data. As a routine practice, the use of oXiris-based CRRT is typically reserved for patients with significant inflammation, severe organ dysfunction and profound shock. In the real world, patients treated with oXiris often had a complex clinical picture and were on dialysis with more intensive renal replacement modalities, making comparisons with these patients difficult [16]. The increased mortality seen in the CRRT group, therefore, should not be viewed as a sign of more negative results resulting from the use of CRRT or the oXiris membrane.

There is a biological basis for oXiris, which is clinically relevant. Randomised crossover evidence indicated that membrane can lower concentrations of circulating endotoxin and inflammatory cytokines in septic shock patients [17]. Clinical reports have also demonstrated the use of CRRT in multimodal treatment for septic shock with acute kidney injury, respiratory failure and severe metabolic disturbances [18]. In other hyperinflammatory critical illnesses, pilot data indicate that adsorptive hemofiltration may lower levels of selected inflammatory mediators, but not necessarily improve biochemical outcomes, which are not related to survival or renal recovery [19].

In the current study, bicarbonate and lactate showed more significant improvement in the SLED group, while procalcitonin decreased in both groups. These results may be because patients with less severe presentation had quicker shock resolution, not due to any intrinsic benefit of SLED. During oXiris-based CRRT, Theisen et al. were able to report good elimination of endotoxins, inflammatory mediators, and uremic toxins, but mortality was high in the advanced septic shock patients [20]. Zhai et al. also reported that the inflammatory and clinical parameters improved following the treatment with

oXiris, but without a clear survival benefit [21]. These results confirm the view that extracorporeal mediator removal should be used alongside source control and antimicrobial therapy and hemodynamic stabilisation and not as an alternative.

Additionally, registry data suggest that patients who receive CRRT may also be more severely ill and die more often than those treated with intermittent or hybrid treatments [22]. This complexity has also been further emphasised by randomised and controlled studies on improved adsorption methods. ENDOX trial reported biochemical improvements with improved adsorption hemofiltration without showing consistent reduction in mortality with refractory septic shock with the use of extracorporeal blood purification alone, implying that advanced multiorgan failure will not be reversed with extracorporeal blood purification alone [23]. Hemoadsorption research in the neonatal and paediatric population further suggests that it is technically feasible, but cannot be directly extrapolated to adult septic acute kidney injury due to the differences in age, physiology and indications for treatment.

Improved adsorption techniques have been shown to have measurable biological effects in the ENDoX randomised trial, but with no clear mortality benefits in severe refractory septic shock [25]. Based on the present findings, it is possible to select the modality in an individual patient, depending on the hemodynamic situation, organ dysfunction, therapeutic objectives, availability of resources, and institutional skills. SLED may be a viable choice for specific patients with moderate hemodynamic instability, while oXiris-based CRRT is viable if continuous support and better adsorption are clinically indicated.

Limitations and Future Directions

This study has a few limitations. Design was one centre, non-randomised, which results in ‘selection bias' and restricted external validity. The limited number of patients decreases the power of the analysis and makes it impossible to conduct reliable subgroup analyses. Baseline illness severity for patients receiving oXiris-based CRRT was significantly higher with parameters such as lower mean arterial pressure, higher Sequential Organ Failure Assessment scores, more vasopressor use and more mechanical ventilation. Due to a lack of multivariable adjustment, it is unclear if treatment modality or confounding by indication is responsible for the observed differences in outcome. No measurements of endotoxin and cytokines were made directly, and long-term renal outcomes were under characterised.

Adequately powered multicenter randomised trials or prospectively matched cohorts with standardised treatment protocols and defined endpoints would be desirable for future studies. Examples of key endpoints should be mortality, dialysis independence, long-term kidney function, adverse events and quality of life. Patient selection based on a biomarker may be useful in optimising patients who may benefit from adsorptive membranes. The economic analysis should include equipment, personnel, supplies, treatment time and hospitalisation expenses. Systematic evaluation of treatment timing, duration of filtration, anticoagulation regimen and modality selection, depending on the severity, is also required across various health care settings.

CONCLUSION

This prospective observational study compared patients who received oXiris-based CRRT with patients who received sustained low-efficiency dialysis (SLED). Patients in the CRRT group did not show renal recovery at discharge, had greater mortality rates in the ICU, longer duration of SLED, and longer duration of renal replacement therapy, while patients receiving SLED showed earlier hemodynamic stabilisation, a greater improvement in metabolic parameters, and higher dialysis independence at the time of discharge. The results should be interpreted with caution since patients included in CRRT had a much higher baseline illness severity, with lower mean arterial pressure, higher Sequential Organ Failure Assessment scores, higher vasopressor requirements and more frequent invasive mechanical ventilation. The differences in outcome observed, therefore, are unlikely to be solely due to the renal replacement used and are more likely to be seen as a confounding by indication. SLED is a potential strategy which seems to be a viable and resource-saving approach for some patients with relative hemodynamic stability, especially in resource-limited areas. The present findings do not support the view that oXiris-based CRRT is associated with survival benefits in patients who need to be continuously supported during severe septic shock, but this does not exclude its clinical relevance in such patients. Treatment goals, organ dysfunction, hemodynamic condition, and resources should all be considered when deciding on renal replacement therapy. Further, multicenter and larger randomised or severity-adjusted studies are needed to establish comparative effectiveness and to identify which patients would do best to benefit from adsorptive CRRT.

REFERENCES

1. Guan M, Wang H, Tang X, et al. Continuous renal replacement therapy with adsorbing filter oXiris in acute kidney injury with septic shock: a retrospective observational study. *Front Med (Lausanne).* 2022;9:789623. 10.3389/fmed. 2022.789623
2. Zheng F, Wang YL, Zhou WY, et al. Continuous renal replacement therapy with adsorbing filter oXiris in the treatment of sepsis-associated acute kidney injury: a single-centre retrospective observational study. *BMC Nephrol.* 2024;25(1):456. 10.1186/s12882-024-03897-0
3. Wang G, He Y, Guo Q, et al. Continuous renal replacement therapy with the adsorptive oXiris filter may be associated with lower 28-day mortality in sepsis: a systematic review and meta-analysis. *Crit Care.* 2023;27(1):275. 10.1186/s13054-023-04555-x
4. Lingaraju KS, Aleya A, Anandkumar DG, Vellakampadi D, Gokulnath G. WCN25-1093: Observational study of continuous renal replacement therapy using oXiris filter and sustained low-efficiency dialysis in patients with septic acute kidney injury. *Kidney Int Rep.* 2025;10(2 suppl):S382-S384. 10.1016/j.ekir.2024.11.706
5. Rahimi P, Tontu F, Khoundabi B, et al. Does oXiris matter? A comparative outcome study in continuous renal replacement therapy-treated septic intensive care unit patients. *Blood Purif.* Published online November 17, 2025:79-90. 10.1159/000549550
6. Li Y, Sun P, Chang K, et al. Effect of continuous renal replacement therapy with the oXirishemofilter on critically ill patients: a narrative review. *J Clin Med.* 2022;11(22):6719. 10.3390/jcm11226719

7. Sobh O, Soueidan H, Alatifi A, Yassin MT, Elmaghrabi MM, Sobh O. Effect of continuous renal replacement therapy using oXirishemofilter in a critically ill patient with sepsis and acute respiratory distress syndrome. *Cureus.* 2025;17(10):e93732. 10.7759/cureus.93732
8. Mielnicki W, Dyla A, Zając M, Rokicka-Demitraszek N, Smereka J. Does continuous renal replacement therapy with oXiris in septic shock have any positive impact? Single-centre experience with oXiris therapy in septic shock patients. *J Clin Med.* 2024;13(24):7527. 10.3390/jcm13247527
9. Jiang X, Zhang L, You J, et al. The use of oXirishemofilter in the initial continuous renal replacement therapy among patients with septic shock: a propensity score-matched analysis. *J Crit Care.* 2026;95:155666. 10.1016/j.jcrc.2026.155666
10. Ballesteros D, Mantilla Villarreal AC, Narváez Martínez SC, Saravia I, Martínez S. Use of oXirishemoadsorption in sepsis and acute kidney injury: a retrospective cohort study in a resource-limited Colombian ICU. *Front Nephrol.* 2025;5:1628181. 10.3389/fneph.2025.1628181
11. Zhou Y, Liu MJ, Lin X, Jiang JH, Zhuo HC. Comparative efficacy of two hemopurification filters for treating intra-abdominal sepsis: a retrospective study. *Chin J Traumatol.* Published online April 25, 2025. 10.1016/j.cjtee.2024.12.003
12. Zhang L, Srisawat N, Lee CC, et al. Extracorporeal blood purification with the oXiris filter for patients with sepsis and hyperinflammatory conditions: the Asia-Pacific oXiris Expert Meeting 2024 consensus statements. *Blood Purif.* 2025;54(11):621-638. 10.1159/000548214
13. Vega Harwood AW, Fernández MM, EzquerGarin C, et al. Antimicrobial dosing during continuous venovenoushemodiafiltration in septic shock patients: a prospective, multicenter study protocol. *Antibiotics (Basel).* 2025;14(4):420. 10.3390/antibiotics14040420
14. Hellman T, Uusalo P, Järvisalo MJ. Renal replacement techniques in septic shock. *Int J Mol Sci.* 2021;22(19):10238. 10.3390/ijms221910238
15. Valdenebro M, Portoles J, Serrano Salazar ML, et al. Transitions and long-term clinical outcomes in patients admitted to intensive care units receiving continuous renal replacement therapy. *J Clin Med.* 2024;13(17):5085. 10.3390/jcm13175085
16. Villa G, Fioccola A, Cecchi M, et al. Use of oXiris membrane in real-world clinical practice in critical care patients: a multicenter observational study. *J AnesthAnalgCrit Care.* Published online December 15, 2025. 10.1186/s44158-025-00305-3
17. Broman ME, Hansson F, Vincent JL, Bodelsson M. Endotoxin and cytokine-reducing properties of the oXiris membrane in patients with septic shock: a randomised crossover double-blind study. *PLoS One.* 2019;14(8):e0220444. 10.1371/journal.pone.0220444
18. Putra PI, Pradian E. Septic shock management using continuous renal replacement therapy in a postpartum patient with diabetic ketoacidosis, acute kidney injury, and ventilator-associated pneumonia. *J Soc Med.* 2025;4(11):350-357. 10.71197/jsocmed.v4i11.248
19. Villa G, Romagnoli S, De Rosa S, et al. Blood purification therapy with a hemodiafilter featuring enhanced adsorptive properties for cytokine removal in patients presenting with COVID-19: a

pilot study. *Crit Care.* 2020;24(1):605. 10.1186/s13054-020-03322-6

20. Theisen BE, Lichtenstern C, Nusshag C, et al. Simultaneous removal of endotoxins, inflammatory mediators, and uremic toxins in ICU patients with septic shock: a retrospective cohort study. *Sci Rep.* 2024;14(1):19645. 10.1038/s41598-024-70522-3
21. Zhai Y, Pan J, Zhang C. The application value of oXiris-endotoxin adsorption in sepsis. *Am J Transl Res.* 2021;13(4):3839-3844.
22. González-Fernández M, Quílez-Trasobares N, Barea-Mendoza JA, et al. Evaluation of the DIALYREG registry for the assessment of continuous renal replacement techniques in critically ill patients. *Sci Rep.* 2023;13(1):6479. 10.1038/s41598-023-32795-y
23. Nunes RS, Iazzetta KD, Lins PR, et al. Combined extracorporeal carbon dioxide removal with renal replacement therapy and blood purification in a severe inhalation injury patient: case report. *J Burn Care Res.* 2025;46(6):1464-1470. 10.1093/jbcr/iraf128
24. Piñeres-Olave BE, Herrera-Vargas JS, Tibaduiza D, et al. Hemoadsorption in critically ill neonatal and pediatric patients: a retrospective cohort study from a Latin American tertiary center. *Front Med (Lausanne).* 2025;12:1650118. 10.3389/fmed.2025.1650118
25. Wendel-Garcia PD, Eberle B, Kleinert EM, et al. Effects of enhanced adsorption haemofiltration versus haemoadsorption in severe, refractory septic shock with high levels of endotoxemia: the ENDoXbicentric, randomized, controlled trial. *Ann Intensive Care.* 2023;13(1):127. 10.1186/s13613-023-01224-8