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Use of Oxiris Filter in Continuous Renal Replacement Therapy for Postoperative Septic Shock with Multiorgan Failure: A Case Report

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Abstract: ***Postoperative intra-abdominal sepsis with septic shock and multiorgan failure remains a major challenge in intensive care. Adsorptive continuous renal replacement therapy (CRRT) membranes, such as Oxiris, have been proposed as adjunctive therapy in septic shock. We report a case of a 28-year-old patient who developed severe intra-abdominal sepsis one week after hemicolectomy with colostomy for ileus. Computed tomography (CT) revealed the abdominal wall and intra-abdominal collections near the colostomy. A second operation with colostomy relocation and drainage of retroperitoneal and intra-abdominal abscesses was performed. Intra- and postoperatively, the patient deteriorated into septic shock, acute respiratory distress syndrome (ARDS), thrombocytopenia, and anuric acute kidney injury (AKI). Blood cultures grew Klebsiella pneumoniae and broad-spectrum antibiotics were administered (piperacillin–tazobactam, tigecycline, metronidazole). In the intensive care unit, the patient required mechanical ventilation with PEEP 12 cmH_2O, norepinephrine, and CRRT. The ICU team initiated CRRT with an Oxiris filter in a heparin-free circuit at an effluent dose of 22 ml/kg/h. Within 24 hours, urine output increased to >2 ml/kg/h. Inflammatory markers, including procalcitonin (initially 98 ng/mL), decreased within 48 hours, and vasopressor requirements declined. CRRT was continued for 72 hours. Renal function normalized by postoperative day 4 and the patient was extubated on day 5. This case illustrates the potential benefit of Oxiris-based CRRT as part of a multimodal strategy in postoperative septic shock with multiorgan failure.***

Keywords: septic shock; ARDS; acute kidney injury; continuous renal replacement therapy; Oxiris filter; postoperative sepsis; Klebsiella pneumoniae; intra-abdominal abscess.

1. Introduction

Septic shock and acute respiratory distress syndrome (ARDS) are major causes of morbidity and mortality among critically ill surgical patients, particularly when associated with postoperative intra-abdominal sepsis. The frequent coexistence of acute kidney injury (AKI) further worsens prognosis and often necessitates renal replacement therapy. Continuous renal replacement therapy (CRRT) is widely used in hemodynamically unstable septic patients, primarily for fluid and solute control.

Adsorptive membranes such as Oxiris (Baxter) have been introduced with the aim of removing not only uremic toxins but also endotoxins and inflammatory mediators. Evidence for their clinical benefit is still limited, but they are increasingly used as adjunctive therapy in selected patients with severe septic shock and multiorgan failure.

We describe a case of severe postoperative intra-abdominal sepsis with Klebsiella pneumoniae bacteremia, septic shock, ARDS, thrombocytopenia, and anuric AKI in a young adult, successfully managed with early surgical source control, broad-spectrum antibiotics, organ support, and CRRT using an Oxiris filter.

This case underscores the potential utility of Oxiris CRRT in managing complex septic cases where standard supportive measures alone may be insufficient. It contributes to the limited clinical literature evaluating advanced adsorptive membranes in real-world postoperative scenarios.

2. Case Presentation

A 28-year-old patient underwent hemicolectomy with creation of a colostomy for mechanical ileus. The immediate postoperative course was initially stable. Approximately one week after surgery, the patient developed abdominal pain, fever, and clinical signs of sepsis.

Imaging Findings

A CT scan of the thorax and abdomen was performed with 2.5 mm slices, without intravenous contrast.

Thoracic CT showed a thyroid gland with normal aspect; patent trachea and main bronchi; mediastinum in the midline without pathological lymphadenopathy; a heart of normal size without pericardial effusion; and pleuro-parenchymal adhesions more pronounced in both lower lobes. Costophrenic sinuses were free.

Abdominal CT demonstrated a liver of normal dimensions and homogeneous structure without focal lesions, with non-dilated intra- and extrahepatic bile ducts. The gallbladder had thin walls and contained dense material in the lumen. The pancreas was normal in size and homogeneous, with a normal Wirsung duct. The spleen and adrenal glands were of normal appearance. Both kidneys had normal dimensions and

parenchymal structure, without calculi or pelvicalyceal dilatation. The urinary bladder had regular contours.

A left-sided colostomy was visible in the abdominal wall. Inferior to the colostomy, an abdominal wall fluid collection measuring 54 × 44 mm with air bubbles inside was identified. A second collection measuring 70 × 65 mm was seen in the right lateral abdominal canal. There was free fluid between bowel loops associated with mesenteric fat stranding, but no bowel distension and no hydro-aeric levels. Two abdominal wall drains were in place. No aggressive bone lesions were observed. These findings indicated postoperative fluid accumulations and intra-abdominal infection.

Second Operation and Early ICU Course

Given the imaging findings and ongoing sepsis, the patient underwent urgent reoperation. The procedure included:

- Relocation of the colostomy
- Drainage of a retroperitoneal abscess near the third portion of the duodenum (D3)
- Evacuation/debridement of an intra-abdominal abscess
- Placement of four abdominal drains

During the second surgery and in the immediate postoperative period, the patient developed profound hemodynamic instability, characterized by hypotension refractory to fluids and the need for vasopressors, together with worsening oxygenation. The patient was transferred to the intensive care unit (ICU) intubated and mechanically ventilated, fulfilling criteria for septic shock and ARDS. Ventilatory management included invasive mechanical ventilation with a positive end-expiratory pressure (PEEP) of 12 cmH_2O.

Simultaneously, the patient became anuric during surgery and remained anuric postoperatively, indicating severe AKI. Laboratory tests revealed thrombocytopenia. Initial procalcitonin level was markedly elevated at 98 ng/mL, consistent with severe systemic inflammation and bacterial sepsis.

Microbiology and Antimicrobial Therapy

Blood cultures (hemocultures) were positive for *Klebsiella pneumoniae*. Given the intra-abdominal infection and isolation of Gram-negative bacteria in the bloodstream, broad-spectrum antimicrobial therapy was administered with:

- Piperacillin–tazobactam (Tazocin)
- Tigecycline (Tygacil)
- Metronidazole (Flagyl)

Therapy was adjusted to the culture result and surgical findings.

CRRT with Oxiris Filter

Because of persistent septic shock, anuric AKI, and risk of fluid overload, CRRT was initiated early in the ICU course. Venovenous CRRT was performed using an Oxiris filter. The circuit was managed heparin-free, due to thrombocytopenia and recent major abdominal surgery, to minimize bleeding risk. The prescribed effluent dose was 22 ml/kg/h. Platelet transfusions were administered during CRRT to manage thrombocytopenia.

Clinical Evolution

Within 24 hours of starting CRRT with the Oxiris filter, urine output increased to >2 ml/kg/h, indicating early recovery of renal function. Over the following 48 hours, inflammatory markers, including procalcitonin, showed a clear downward trend. Norepinephrine requirements progressively decreased, reflecting improved hemodynamic stability.

CRRT was continued for a total duration of 72 hours. By postoperative day 4, renal function had normalized, allowing discontinuation of kidney replacement therapy. Respiratory status gradually improved, and the patient was successfully extubated on day 5. The subsequent ICU and ward course was uneventful, with continued clinical stabilization and no recurrence of severe sepsis.

3. Discussion

This case illustrates severe postoperative intra-abdominal sepsis in a young adult following hemicolectomy with colostomy for ileus, complicated by *Klebsiella pneumoniae* bacteremia, septic shock, ARDS, thrombocytopenia, and anuric AKI.

From an intensive care perspective, several key aspects are important:

Source control.

Adequate and timely surgical source control was fundamental. The presence of multiple collections-abdominal wall, right lateral canal, and retroperitoneal near D3—required reoperation with colostomy relocation, drainage of abscesses, and placement of four drains. Without definitive source control, organ support alone would likely have been insufficient.

Severity of multiorgan failure.

The patient developed circulatory failure (vasopressor-dependent septic shock), respiratory failure (ARDS requiring high PEEP ventilation), renal failure (anuric AKI), and hematologic involvement (thrombocytopenia). Gram-negative sepsis due to *Klebsiella pneumoniae* is frequently associated with a high endotoxin load and severe systemic inflammation, consistent with the very high initial procalcitonin level.

Indication and modality of CRRT

Given anuric AKI and hemodynamic instability, CRRT was clearly indicated. It allowed careful fluid management, acid–base and electrolyte control, and maintenance of hemodynamic stability. The use of an Oxiris filter added a potential immunomodulatory component, via adsorption of endotoxins and cytokines, in addition to convective–diffusive clearance.

Temporal association with clinical improvement

The initiation of Oxiris-based CRRT coincided with several favorable changes: rapid increase in urine output within 24 hours, reduction of inflammatory markers within 48 hours, and progressive decrease in norepinephrine requirements. While causality cannot be proven from a single case, this pattern is compatible with reports suggesting that adsorptive CRRT membranes may contribute to hemodynamic

improvement and attenuation of the inflammatory response in septic shock. At the same time, these effects must be interpreted in the context of concurrent interventions—adequate source control, antibiotics, and optimized supportive care.

Anticoagulation strategy

CRRT was performed without heparin due to thrombocytopenia and recent major abdominal surgery. Although systemic anticoagulation was withheld, treatment was successfully maintained for 72 hours with careful circuit management. Platelet transfusions were used to correct thrombocytopenia and support hemostasis. This illustrates that heparin-free CRRT is feasible in selected high-risk postoperative patients.

The favorable outcome in this case- full renal recovery by day 4 and extubation by day 5- highlights the potential of integrated, aggressive management in young patients with severe postoperative septic shock and multiorgan failure. However, robust evidence from randomized controlled trials is still needed to clearly define which patients may benefit most from Oxiris-based or other adsorptive CRRT strategies.

4. Conclusion

A 28-year-old postoperative patient with *Klebsiella pneumoniae* intra-abdominal sepsis developed septic shock, ARDS, thrombocytopenia, and anuric AKI after hemicolectomy and reoperation for intra-abdominal and retroperitoneal abscesses. Management in the ICU included prompt surgical source control, broad-spectrum antibiotic therapy, vasopressor and ventilatory support, and early initiation of CRRT using an Oxiris filter in a heparin-free circuit.

The clinical course was characterized by rapid improvement in urine output, reduction in inflammatory markers and vasopressor needs, normalization of renal function by day 4, and successful extubation on day 5. Although high-quality evidence is still lacking, this case supports the potential role of Oxiris-based CRRT as part of an integrated therapeutic strategy in severe postoperative septic shock with multiorgan failure. While encouraging, this case alone cannot establish efficacy; further studies are essential to validate these observations in broader clinical settings

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