

Adjunctive Use of CytoSorb Hemoadsorption with Sustained Low-Efficiency Dialysis (SLED) in Septic and Cardiogenic Shock with Multi-Organ Failure: A Case Report

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ABSTRACT

Background The combination of septic shock and cardiogenic shock (CS) causes extremely high mortality associated with systemic inflammation, as well as progressive multi-organ failure (MOF). Adjunct therapies for refractory shock, such as hemadsorption with CytoSorb are noninvasive extracorporeal blood purification procedures that are being developed; these are mostly investigated in combination with Continuous Renal Replacement Therapy (CRRT) or ECMO. We report on the case of a CytoSorb/BMT impregnated SLED treatment in low-income resources area.

Case A 35-year-old Bangladeshi male was admitted with complaints of sudden onset sharp chest pain, shortness of breath and diarrhea which rapidly developed into Anterior septal ST-Elevation Myocardial Infarction (STEMI) complicated by severe Cardiogenic Shock, Acute Kidney Injury (AKI), and refractory Sepsis (high procalcitonin and CRP). He was intubated, needed high dose vasopressors (inotropic x 2) and a TMP for brady-arrhythmia. Because of sustained hemodynamic instability and AKI, SLED was initiated.

Intervention and Results Given refractory, severe shock and systemic inflammation, CytoSorb hemadsorption was incorporated as an adjunct to the SLED circuit. After 3 days of concomitant CytoSorb and SLED therapy, the patient had an impressive clinical stabilization with decreased need for vasopressors, elimination of lactate and improvement in laboratory values. The patient was treated until recovered from MOF, weaned off mechanical ventilation and renal replacement therapy and discharged after 32 days with stable hemodynamics.

Conclusion In cases of combined septic and cardiogenic shock and MOF, particularly for patients with limited access to CRRT, the adjunct application of CytoSorb in combination with SLED is technically feasible and an effective therapeutic option. This is a unique combination in the context of multi-organ extraction for cardiac disease.

KEYWORDS: Cardiogenic Shock; Septic Shock, Multi-organ Failures; CytoSorb Application; Hemoadsorption and Sustained Low Efficiency Dialysis (SLED).

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INTRODUCTION

Cardiogenic shock is one of the most serious complications of acute myocardial infarction. When it is further confounded by overwhelming systemic infection (sepsis) and acute kidney injury, the resultant multi-organ failure multiplies mortality rates to very high levels. The underlying process is a self-sustained cycle of myocardial depression causing hypoperfusion, and the systemic inflammatory response of sepsis triggering an overwhelming release in cytokines, vasoplegia and endothelial injury which itself worsens the heart injury and renal function.^[1-2]

Extracorporeal blood purification therapies such as CytoSorb hemadsorption are intended to attenuate this inflammatory cascade by eliminating excessive pro- and anti-inflammatory mediators (cytokines) from the circulation.^[3] Although evidence for CytoSorb in refractory septic shock accumulates, indicating a potential association with enhanced survival in targeted groups and decreased vasopressor dependency^[4-5] its utilization, moreover in cardiogenic shock and sepsis combined as well as with concomitant (SLED), is rarely reported.^[6]

SLED is a hemodynamically stable alternative to conventional hemodialysis and may be a reasonable option in resource-limited settings where CRRT machines might not be easily accessible.^[7-8] This case emphasizes the challenge in managing a young

patient with Anterior-septal STEMI, severe CS, AKI and sepsis and reports how to manage this complex patient including the innovative use of CytoSorb as an adjunctive therapy integrated into SLED circuit proving it to be technically feasible and potentially advantageous line of treatment. Considering these challenging, high-mortality patients is especially important in resource-poor settings like the Indian subcontinent, where the burden of cardiogenic shock and multi-organ failure remains unacceptably high. ^[9-10]

CASE PRESENTATION

A 35-year-old Bangladeshi man, known case of hypercholesterolemia and fatty liver visited the Emergency Department due to burning central chest pain radiating along both arms associated with shortness of breath for one day; preceded by abdominal pain & loose stool for two days. He had no history of smoking, diabetes or hypertension. He presented in profound hemodynamic collapse: Blood Pressure (BP) was a critical 60/50 mmHg, heart rate of 128 beats p/min, and oxygen saturations (SpO₂) of 88% on room air. The baseline 12-lead ECG demonstrated anterior-septal STEMI. Bedside Echo demonstrated severely reduced LVEF, which was consistent with ALVF and CS. He also appears to have had VT (AKI D with blockade led to successful reversion) but required a TPM for subsequent Bradycardia/arrhythmia on admission.

Laboratory investigations confirmed MOF:

- Cardiac Injury: Elevated troponin levels.
- AKI (Acute Kidney Injury): Serum creatinine went up sharply to 6.5 mg/dL and Urea to 126 mg/dL.
- Sepsis / Inflammation: Procalcitonin was markedly elevated, and he had an elevated CRP of 45.68 mg/L and a high white blood cell count. Acute pancreatitis was also observed (Amylase 505 U/L, Lipase 409 U/L) and there was severe derangement of liver enzymes (SGPT 3312 U/L).

The patient was intubated for respiratory failure and received dual inotropic support to maintain mean arterial pressure (Dopamine with another vasopressor/inotrope).

MANAGEMENT AND ADJUNCTIVE THERAPY

Despite maximal conventional therapy, including intubation, broad-spectrum antibiotics (Piperacillin-Tazobactam), and cardiac stabilization (TPM, Amiodarone), the patient remained in refractory septic and cardiogenic shock with persistent AKI. On Day 4, Sustained Low-Efficiency Dialysis (SLED) was initiated for fluid and uremic control, chosen over conventional hemodialysis due to his hemodynamic instability, a common choice in similar regional settings. ^[7] Recognizing the overwhelming systemic inflammation contributing to his vasoplegia and MOF, the decision was made to introduce CytoSorb hemoadsorption adjunctively.

The CytoSorb 300 mL device was seamlessly integrated into the SLED circuit. The patient underwent two separate CytoSorb treatments within the first 48 hours, concurrent with SLED sessions.

RESPONSE AND OUTCOME

Following the initiation of the combined CytoSorb/SLED therapy, the patient showed a clear, positive clinical trajectory:

- Hemodynamic improvement: The patient's requirement for vasopressor support (dopamine/inotropes) trended down, allowing for subsequent weaning. This aligns with findings from other studies linking CytoSorb use to reduced vasopressor need. ^[4-5]
- Inflammatory markers: Procalcitonin and CRP levels showed a declining trend.
- Organ function: Renal function stabilized, allowing for the duration of SLED sessions to be extended.

The patient's condition steadily improved over the next few weeks. He was successfully weaned off mechanical ventilation, discontinued renal replacement therapy, and transferred from the General ICU (GICU) to the High Dependency Unit (HDU). After 32 days of hospitalization, the patient was discharged with stable hemodynamics, recovered renal function, and appropriate follow-up plans.

DISCUSSION

This case demonstrates the effective treatment of a challenging and high mortality clinical spectrum of septic plus cardiogenic shock and MOF in the young to middle-aged adult. ^[10-11] The early and vigorous multidisciplinary management, especially extracorporeal blood purification, was crucial.

Uniqueness of CytoSorb + SLED: Few reports on use of CytoSorb in septic shock, mostly as an adjunct with CRRT or ECMO. ^[3, 12] This report is novel for demonstrating successful and practical use of CytoSorb coupled with SLED. SLED is a relatively inexpensive and hemodynamically stable alternative in comparison to CRRT, thereby rendering the CytoSorb + SLED combination to be considered as a practical adjuvant therapy (especially in resource-constrained settings such as Bangladesh) where the facility for CRRT may not exist. ^[7, 9] This approach has been explored in other critical care scenarios in the subcontinent, such as dengue shock. ^[6]

Our patient responded quickly to shock reversal with decrease vasopressor requirement and of systemic inflammatory markers, indicating that haemoabsorption therapy was able to downregulate the cytokine storm, one of the key features in septic-cardiogenic shock's pathophysiology. ^[1, 13] Vasoplegia with high-dose catecholamine requirement is not uncommon during sepsis, even in the absence of acute myocardial infarction; in our case STEMI and AOSD were complicated by sepsis and CytoSorb

could have contributed to stabilize this circulatory failure by blocking vasoplegia due to excessive release of cytokines. This is a case report to contribute the limited literature on CytoSorb application in primary cardiac failure patients.^[14] Such sophisticated extra-corporeal therapies are increasingly being talked about in the Indian subcontinent to better treat critically ill patients.^[15-16]

CONCLUSION

This case illustrates the feasibility and potential efficacy in adjunctively deploying CytoSorb hemoadsorption integrated with Sustained Low-Efficiency Dialysis (SLED) as a therapeutic strategy for patients presenting with refractory septic and cardiogenic shock with multi-organ failure. This empirical strategy might represent an interesting clinical approach for cytokine control in centers without CRRT. Worth notes, CytoSorb + SLED has been shown to reduce mortality among similar patients in other angles. Larger-scale controlled studies are needed to validate the effects and clinical implications of CytoSorb + SLED on mortality for this population.

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