



Serratia liquefaciens Sepsis in a Patient with ARDS, Cardiac Dysfunction and Complex Multimorbidity: A Case Report

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ABSTRACT

Background:

Serratia liquefaciens is an uncommon pathogen associated with opportunistic infections and increasing antimicrobial resistance. Patients with respiratory failure, cardiac comorbidities, and metabolic disorders are at heightened risk of severe outcomes. Management is complicated by resistance patterns and the need for coordinated critical care.

Case Presentation:

A 78-year-old male with a history of pulmonary tuberculosis, ARDS, type 2 diabetes with hypoglycemia, recurrent SVT, anemia, and acute limb ischemia presented with severe pneumonia and respiratory failure. Blood cultures identified carbapenem-resistant *Serratia liquefaciens*. He received tailored antibiotic therapy, ventilatory support, and cardiovascular management. Clinical

improvement was achieved with multidisciplinary intensive care.

Discussion:

This case underscores the difficulty in managing carbapenem-resistant *Serratia liquefaciens* sepsis in patients with complex multimorbidity. The interplay between chronic lung injury, cardiac dysfunction, and resistant infection necessitates precise antimicrobial stewardship and integrated organ support. The role of anesthesiology in hemodynamic and respiratory management was pivotal. Limited literature documents such carbapenem-resistant *Serratia* infections, highlighting the need for awareness and comprehensive care strategies.

Conclusion:

Serratia liquefaciens sepsis in patients with ARDS, cardiac dysfunction, and multimorbidity demands swift diagnosis, personalized antimicrobial treatment, and coordinated multidisciplinary care. This report adds valuable insight into challenges and management of carbapenem-resistant *Serratia* infections in critical care settings.

Keywords:

Sepsis, *Serratia liquefaciens*, Antimicrobial Resistance, Acute Respiratory Distress Syndrome (ARDS), Multidisciplinary Critical Care

INTRODUCTION

Sepsis is a life-threatening systemic inflammatory response caused by infection and remains a leading cause of mortality and morbidity worldwide, particularly in critically ill patients with multiple comorbidities.^[1] The pathophysiology of sepsis involves an overwhelming immune response leading to multi-organ dysfunction, including acute respiratory distress syndrome (ARDS) and cardiogenic shock, which significantly worsen the prognosis.^[2]

Serratia liquefaciens, a member of the Enterobacteriaceae family, is a rare but increasingly recognized opportunistic pathogen responsible for severe infections such as sepsis, especially in immunocompromised and elderly patients.^[3] Despite its clinical significance, cases involving *Serratia liquefaciens* remain underreported, leading to challenges in early diagnosis and optimal management strategies.

This case report highlights the complexity of managing sepsis caused by *Serratia liquefaciens* in a 78-year-old patient complicated by ARDS, congestive heart failure (CHF), and cardiogenic shock. The interactions between septic-induced cardiac dysfunction and respiratory failure illustrate critical considerations for anesthesiologists and intensivists. Early identification and a multidisciplinary treatment approach are paramount for improving patient outcomes in such complex clinical scenarios.

CASE REPORT

Demographic Data and Patient History

Patient Name: Mr. J Age: 78 years Body Weight: 37 kg Past Medical History: Pulmonary tuberculosis with treatment completed twice (last treatment 2 years ago), hypertension under routine control, history of supra-ventricular tachycardia (SVT) and right bundle branch block (RBBB) seen on ECG. Status Post-ICU: Patient currently under critical care management following ICU admission.

Chief Complaints and Physical Examination

Presentation: Dyspnea persisting for 3 days, chest pain originating from the epigastric region radiating to the right arm, worsening since morning, accompanied by cold sweats. Denied fever, cough, or runny nose. Vital Signs on Admission:

Blood Pressure: 70/43 mmHg

Pulse Rate: 105 bpm

Temperature: 36.5°C

Respiratory Rate: 42 breaths/min

Oxygen Saturation (SpO₂): 57% (severe hypoxia)

General Condition: Patient demonstrated bilateral pulmonary ronchi and bilateral lower limb edema; extremities initially warm but later became cold post-intubation.

Supporting Examinations

Diagnoses: Acute Respiratory Distress Syndrome (ARDS), Congestive Heart Failure (CHF), Sepsis Shock with differential diagnosis of cardiogenic shock. Electrocardiogram (ECG): Supraventricular tachycardia (SVT), Right Bundle Branch Block (RBBB). Laboratory Findings: Hypokalemia, reactive hyperglycemia. Microbiology: Blood culture positive for *Serratia liquefaciens*.

Laboratory Findings Summary

Glucose: 317 mg/dL (high)

Hemoglobin: 10.0 g/dL (low)

Leukocytes: $18.7 \times 10^3/\mu\text{L}$ (high, leukocytosis)

Erythrocytes: $3.62 \times 10^6/\mu\text{L}$ (low)

Hematocrit: 31% (low)

Platelets: $360 \times 10^3/\mu\text{L}$ (normal)

Electrolytes:

Sodium: 132 mmol/L (low)

Potassium: 2.6 mmol/L (very low)

Chloride: 96 mmol/L (low)

Arterial Blood Gas (ABG):

pH: 7.399 (normal)

pCO₂: 31.6 mmHg (low)

pO₂: 61 mmHg (low, hypoxemia)

HCO₃: 19.7 mmol/L (low)

Base Excess: -3.7 (low)

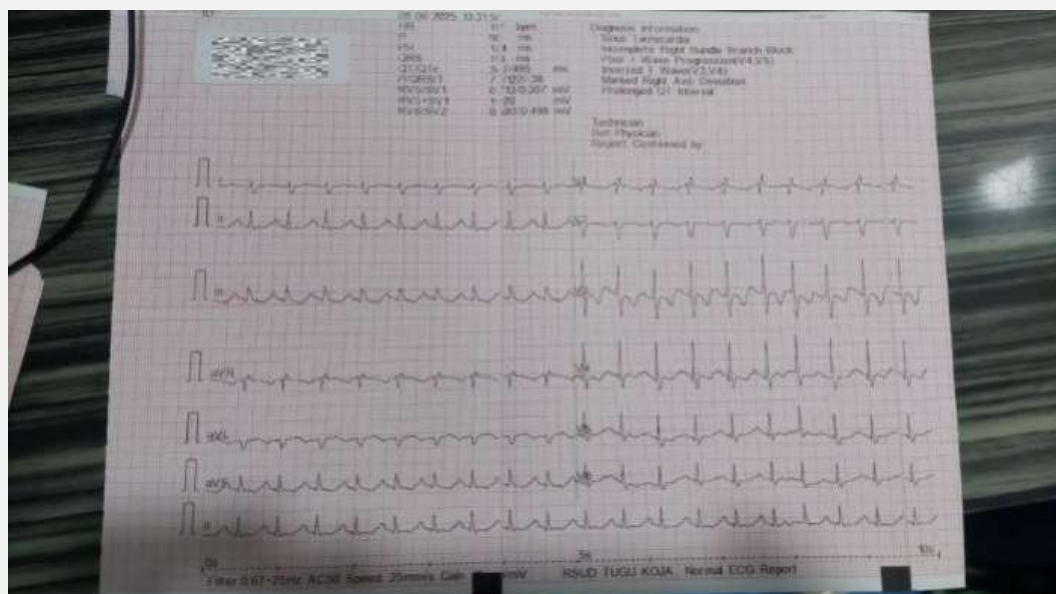
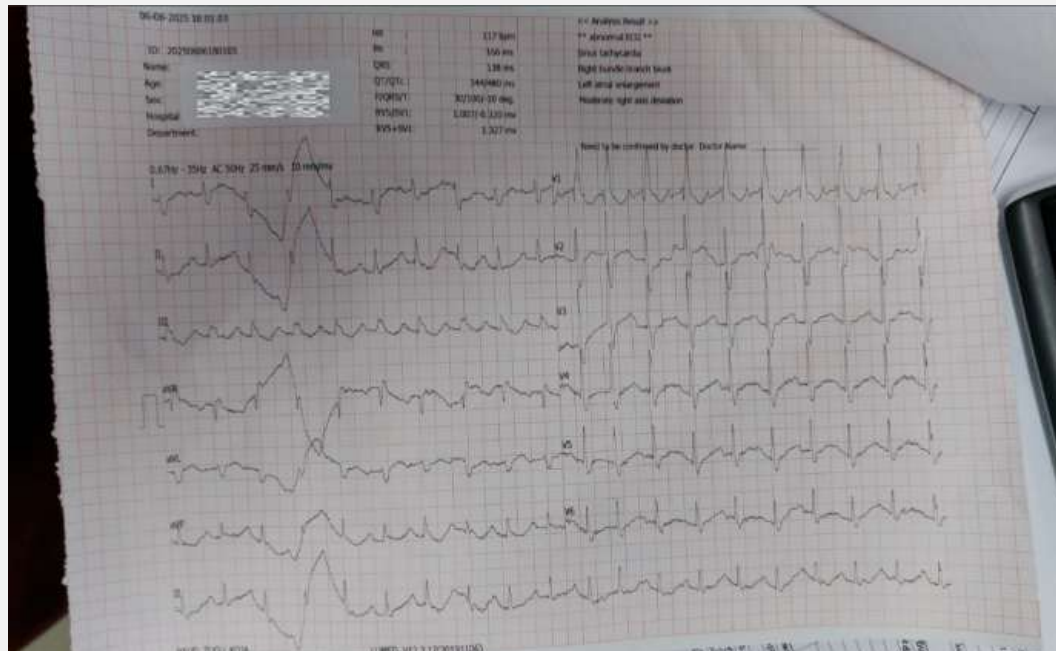
O2 Sat: 91% (low)

Pemeriksaan	Hasil	Satuan	Nilai Rujukan	Flag
Glukosa Sewaktu				
Glukosa Sewaktu	317 ^H	mg/dL	Neonatus = 1 hari : 40 - 60 mg/dL 1-28 hari : 50 - 80 mg/dL >28 hari - 18 tahun : 60 - 100 mg/dL >18 tahun : 60-140 mg/dL	H
SGOT				
SGOT (AST)	14	U/L	5 - 34	N
SGPT				
SGPT (ALT)	5	U/L	< 56	N
Kreatinin				
Kreatinin	0.72	mg/dL	0.67 - 1.17	N
Ureum				
Ureum	16	mg/dL	0 - 50	N
Darah Lengkap (Darah Rutin+Hitung Jenis+E+NER+LED)				
Hemoglobin	10.0 ^L	g/dL	13.0 - 17.0	L
Leukosit	18.7 ^H	10 ^{^3} /μL	4.0 - 10.0	H
Eritrosit	3.62 ^L	10 ^{^6} /μL	4.50 - 5.50	L
Hematokrit	31 ^L	%	40 - 50	L
Trombosit	360	10 ^{^3} /μL	150 - 410	N
Basofil	0.4	%	0 - 2	N
Eosinofil	0.7 ^L	%	1 - 6	L
Neutrofil	59.0	%	40 - 80	N
Limfosit	33.3	%	20 - 40	N
Monosit	6.6	%	2 - 10	N
Netrofil Limfosit Ratio	1.77			
MCV	85	fL	83 - 101	N

MCH	28	pg	27 - 32	N
MCHC	33	%	32 - 34	N
Elektrolit (Na, K, Cl)				
Natrium	132 ^L	mmol/L	135 - 145	L
Kalium	2.6 ^{LL}	mmol/L	3.5 - 5.3	LL
Klorida (Cl)	96 ^L	mmol/L	98 - 107	L
Analisa Gas Darah				
pH	7.399		7.350 - 7.450	N
p CO2	31.6 ^L	mm Hg	35.0 - 45.0	L
p O2	61 ^L	mm Hg	75 - 100	L
HCO3	19.7 ^L	mmol/L	21.0 - 25.0	L
Total CO2	20.7 ^L	mmol/L	21.0 - 27.0	L
Base Excess	-3.7 ^L	mmol/L	- 2.5 - + 2.5	L
O2 Saturasi	91.0 ^L	%	95.0 - 98.0	L

Electrocardiogram (ECG) Highlights

Heart rate: 117 bpm (tachycardia), Sinus tachycardia, Right bundle branch block, Left atrial enlargement, Moderate right axis deviation



Heart rate (HR): 117 bpm, sinus tachycardia. Presence of Complete Right Bundle Branch Block (RBBB). Poor R wave progression in leads V4 and V5. Inverted T waves in leads V3 and V4. Marked right axis deviation. Prolonged QT interval.



The EKG wave pattern shown on the monitor in the image reflects an extremely rapid heart rhythm of about 200 bpm, which appears as a series of very closely spaced, regular, narrow complexes without distinct P waves visible. This pattern is consistent with supraventricular tachycardia (SVT), which is a fast heart rhythm originating above the ventricles.

Blood pressure (BP) is elevated with a systolic of 169 mmHg and diastolic of 84 mmHg, which suggests hypertension. Oxygen saturation (SpO2) is low at 79%, indicating significant hypoxemia (low blood oxygen level). Body temperature is 36.6°C, which is within normal range.

Chest X-Ray Observations

Infiltrates and opacifications in lung fields consistent with possible pneumonia or ARDS. Signs of cardiomegaly or congestive heart failure may be seen. Post-intubation lung condition visible on subsequent X-ray.



Microbiology and Antibiotic Susceptibility

Organism: *Serratia liquefaciens*

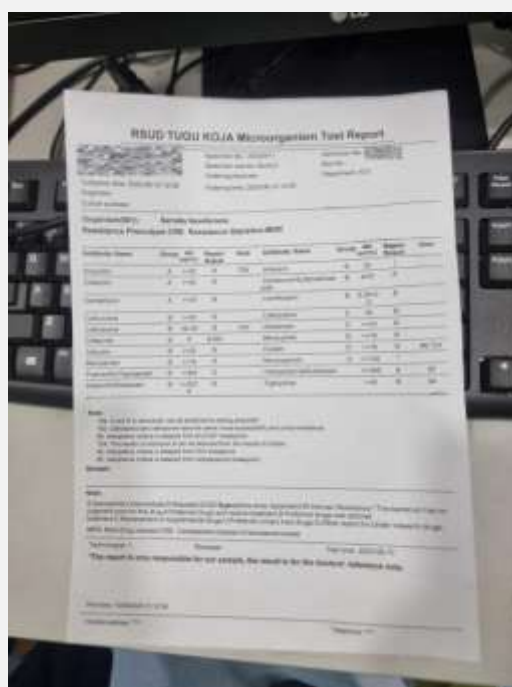
Resistance Phenotype: CRE (Carbapenem-resistant Enterobacteriaceae)

Resistance Pattern: MDR (Multi-Drug Resistant)

Cetak

Hasil Lab diambil dari LIS

Pemeriksaan	Hasil	Satuan	Nilai Rujukan	Metode
Kultur + Res. Sputum				
Spesimen	: Sputum			
Hasil	Pewarnaan Gram: Batang Gram Negatif—Isolate 1: <i>Serratia liquefaciens</i> —Susceptibility Terlampir			
Colistin				



This susceptibility profile shows the *Serratia liquefaciens* isolate is resistant to many antibiotics including carbapenems (meropenem), cephalosporins, aminoglycosides (gentamycin), and colistin, with susceptibility retained only to some agents like Piperacillin/Tazobactam, Levofloxacin, and Cefoperazone/Sulbactam.

Therapy and Medical Devices

Medical Devices Installed:

Medical Device	Description	Duration of Use
Mechanical Ventilator	Respiratory support (ventilation)	From ICU admission, duration as needed
Endotracheal Tube (ETT)	Artificial airway for ventilation	Inserted Day 1, replaced Day 6
IV Catheters (multiple lines)	Venous access for fluids and drugs	Inserted early, multiple changes over days
Nasogastric Tube (NGT)	Gastric decompression and feeding	Inserted Day 2, replaced with silicone NGT later
Foley Catheter	Urinary catheterization	Used during ICU stay
Arterial Line	Invasive blood pressure monitoring	Used during ICU stay
Central Venous Catheter (CVC)	Central venous access for medication and monitoring	Used throughout ICU stay

Therapeutic Regimen:

Medication/Therapy	Indication/Role	Duration of Use / Notes
IV Fluid (NaCl 0.9% + KCl)	Fluid and electrolyte balance	From Day 1, volume and frequency adjusted daily
Norepinephrine (NE)	Vasopressor support (hemodynamic support)	Day 1, stopped early
Midazolam (MiloZ)	Sedation	Continuous, dose adjusted (e.g., 3-5 mg/hour)

Medication/Therapy	Indication/Role	Duration of Use / Notes
Novorapid (Insulin)	Blood glucose control	Continuous IV infusion (0.5 unit/hr), stopped on Day 4
Fentanyl	Analgesia and sedation	Started Day 1, doses varied, continued through Day 10
Oral N-acetylcysteine (NAC)	Mucolytic agent	Started Day 1, continued
Meropenem	Broad-spectrum antibiotic (sepsis)	Day 1 to Day 5 (stopped later)
Methylprednisolone (MP)	Anti-inflammatory corticosteroid	Started Day 1, tapered and stopped by Day 5
Paracetamol	Analgesic and antipyretic	As needed, continued throughout
Omeprazole	Gastroprotection	Daily throughout ICU stay
Ventolin (Salbutamol) & Fluticasone	Bronchodilator and inhaled corticosteroid	Started Day 1 or Day 4, continued
Rifampicin	Anti-tuberculosis therapy	Started Day 3
Isoniazid	Anti-tuberculosis therapy	Started Day 3
Ethambutol	Anti-tuberculosis therapy	Started Day 3
Pyrazinamide	Anti-tuberculosis therapy	Started Day 5
Curcuma (Turmeric Extract)	Complementary anti-inflammatory	Started Day 4, continued

Medication/Therapy	Indication/Role	Duration of Use / Notes
Bisoprolol	Beta-blocker for cardiac rate control	Started Day 4, dose varied
Candesartan	Angiotensin receptor blocker (cardioprotective)	Started Day 6
Amiodarone	Antiarrhythmic for supraventricular tachycardia	Day 4 onwards with bolus doses
Cefoperazone	Antibiotic	Started Day 6 onward
Levofloxacin	Antibiotic	Started Day 5 onward
Dexamethasone	Corticosteroid	Tapered from Day 5
Heparin	Anticoagulant	Started Day 4
Aminophylline (Aminopilin)	Bronchodilator (xanthine derivative)	Started Day 5, dose adjusted
Furosemide	Diuretic	Started Day 6
Tranexamic Acid (Asam tranexamat)	Antifibrinolytic	Short-term use (2 days)
Vitamin K	Coagulation support	Short-term (2 days)
Calcium Gluconate (ca gluconas)	Electrolyte supplement	Added around Day 9
Nutrition (Blender + Pulmosol)	Enteral nutrition support	From Day 1 to Day 10+

Clinical Course and Outcome

The patient was admitted to the Intensive Care Unit (ICU) and received intensive monitoring and treatment for 14 days. During this period, the clinical condition of the patient was closely managed with supportive care and antimicrobial therapy targeting the *Serratia liquefaciens* sepsis and complications including acute respiratory distress syndrome (ARDS) and congestive heart failure.

After stabilization, the patient was transferred from the ICU to a general ward for continued care.

This outcome highlights the severity and high mortality risk associated with sepsis caused by *Serratia liquefaciens*, especially in elderly patients with multiple comorbidities such as ARDS and heart failure.

In-depth Analysis of Pharmacological Therapy from Day 1 to Day 14

Days 1-3: Intensive Initial Phase

During the initial phase of treatment (Day 1 to Day 3), intensive therapy was promptly initiated to address severe sepsis with a high risk of infection caused by multi-drug resistant (MDR) and carbapenem-resistant Enterobacteriaceae (CRE). Meropenem, a broad-spectrum carbapenem antibiotic, was administered empirically to ensure effective coverage against the suspected pathogens before culture results became available. The decision for Meropenem use was driven by the need for an aggressive and early intervention, considering the patient's initially unstable hemodynamic condition.

To support mechanical ventilation, the patient received Midazolam for sedation and Fentanyl for analgesia, effectively reducing discomfort and facilitating tolerance to the ventilator. Concurrently, Norepinephrine was administered as a vasopressor to stabilize blood pressure during septic shock but was discontinued once circulatory stability was achieved.

To attenuate the systemic inflammatory response and potential cytokine storm, Methylprednisolone was introduced. Additional supportive care measures included careful fluid management, glycemic control via insulin administration, gastric protection with Omeprazole, and correction of electrolyte imbalances.

Clinical progress during this period was marked by significant improvement: the initially unstable hemodynamic status stabilized after antibiotic and vasopressor therapy; sedation and analgesia allowed the patient to better tolerate mechanical ventilation; systemic inflammation markers began to decrease, indicating effective infection control. Overall, infection markers trended downward, confirming the efficacy of the broad-spectrum antibiotic regimen started early in the course.

Days 4–7: Adjustment and Refinement Phase

During the mid-phase of treatment (Days 4 to 7), therapeutic adjustments were made based on microbiological findings and ongoing clinical progress. Blood cultures revealed *Serratia liquefaciens*, a pathogen known for intrinsic antibiotic resistance and exhibiting potential multidrug-resistant (MDR) phenotypes. Sensitivity testing showed resistance to several antibiotics, including carbapenems in some isolates, indicating a carbapenem-resistant Enterobacteriaceae (CRE) phenotype.

In response, the initial broad-spectrum carbapenem therapy with Meropenem was critically reassessed. To maintain effective antimicrobial coverage while reducing selection pressure for resistance, therapy was adjusted with the introduction of Cefoperazone Sulbactam, a beta-lactam/beta-lactamase inhibitor combination active against resistant *Serratia* strains. Additionally, Levofloxacin was added aiming for synergistic antimicrobial effects and to cover quinolone-sensitive subpopulations. This strategy reflected a deliberate effort to de-escalate from carbapenems while preserving antimicrobial efficacy.

Concurrently, anti-tuberculosis drugs (Rifampicin, Isoniazid, and Ethambutol) were initiated in line with clinical suspicion or confirmation of pulmonary tuberculosis, complementing infection management. For cardiac arrhythmia management, Amiodarone was introduced successfully to control supraventricular tachycardia (SVT).

Supportive respiratory therapy included continuation of Midazolam sedation with dose adjustments suited to clinical status, as well as administration of bronchodilators (Ventolin, Aminophylline) and inhaled corticosteroids (Fluticasone) to improve airway function.

Clinical progress was notable during this phase: cardiovascular and respiratory parameters improved, allowing reduced ventilatory support and more stable organ function. SVT episodes were effectively controlled using Amiodarone and beta-blockers such as Bisoprolol. Respiratory function steadily improved under bronchodilator and inhaled steroid therapy. The anti-tuberculosis regimen aligned well with the underlying infectious etiology and was tolerated appropriately. These ongoing therapy refinements correlated strongly with the patient's clinical stabilization and incremental recovery.

Days 8–10: Stabilization and Supportive Care Phase

During Days 8 to 10 of the patient's ICU stay, the therapeutic approach focused on stabilization, antimicrobial stewardship, and supportive care to optimize recovery.

Antibiotic Regimen: The continuation of Cefoperazone Sulbactam and Levofloxacin was maintained, guided by culture and susceptibility results confirming their effectiveness against the *Serratia liquefaciens* strain. The initially broad-spectrum carbapenem Meropenem was tapered and ultimately discontinued in cases where microbiological data confirmed carbapenem-resistant Enterobacteriaceae (CRE) phenotype or lack of ongoing clinical benefit. This step reflected sound antimicrobial stewardship aimed at minimizing further resistance development by de-escalating from last-resort carbapenems to narrower-spectrum agents without compromising therapeutic efficacy.

Anti-Tuberculosis Regimen: The anti-TB therapy was intensified by the addition of Pyrazinamide to the initial regimen of Rifampicin, Isoniazid, and Ethambutol. This comprehensive TB treatment was aligned with confirmed or strongly suspected pulmonary tuberculosis, addressing a critical component of the patient's infectious condition.

Corticosteroid Therapy: Systemic corticosteroid dosing was gradually tapered during this period to balance the need for ongoing inflammation control while minimizing potential side effects related to prolonged steroid use. This careful modulation aimed to sustain immune response without impairing recovery.

Nutrition and Metabolic Control: Enteral nutrition was actively maintained to support metabolic demands and immune competence, while strict glycemic control was adhered to as elevated glucose levels could impair infection control and wound healing.

This phase highlights the clinical progression from aggressive broad-spectrum initial therapy towards targeted, evidence-based antimicrobial management, combined with supportive measures for organ recuperation and infection control. The stepwise de-escalation of antibiotics based on culture results demonstrates excellent stewardship principles, which are essential to avoid antimicrobial resistance propagation while ensuring adequate patient coverage.

Days 11–14: Recovery and Weaning Phase

During Days 11 to 14 of the patient's ICU course, clinical management focused on recovery consolidation, careful weaning of supportive measures, and minimizing therapeutic burden.

Antibiotic Therapy

Antibiotics were either discontinued or adjusted in strict alignment with clinical improvement and microbiological stability confirmed via repeat cultures. This step was essential to reduce unnecessary antibiotic exposure, thereby minimizing the risk of secondary antimicrobial resistance development and adverse drug effects.

Sedation and Respiratory Weaning

The sedative agent Midazolam was gradually tapered to promote improved consciousness and enable safe ventilator weaning. This measured reduction in sedation supported neurological recovery and facilitated liberation from mechanical ventilation.

Fluid Management

The introduction of Furosemide, a diuretic, addressed fluid overload, which contributed to optimizing respiratory mechanics and facilitating breathing efforts. Proper fluid balance was critical to improving lung function and overall recovery.

Thrombosis Prophylaxis and Supportive Care

Anticoagulation therapy was continued to prevent ICU-related venous thromboembolism, a common and serious complication in critically ill patients. Additionally, supportive supplements such as Vitamin K and calcium were provided to meet metabolic demands and aid recovery.

Overall Clinical Progress: Marked improvements were observed in the patient's ventilatory independence, hemodynamic stability, organ function tests, and mental status. These gains reflected the successful progression out of the critical illness phase toward rehabilitation.

This final phase of therapy underscores a strategic shift from intensive intervention to recovery optimization, focused on minimizing medication side effects, preventing complications, and promoting physiological restoration.

DISCUSSION

This case report describes a rare but critical presentation of *Serratia liquefaciens* sepsis in an elderly patient with severe septic shock complicated by ARDS, multidrug-resistant (MDR) *Serratia liquefaciens* bloodstream infection, and significant comorbidities including prior pulmonary tuberculosis and cardiac conduction abnormalities. The therapeutic strategy employed demonstrates adherence to evolving critical care best practices emphasizing early appropriate antimicrobial therapy, dynamic microbiological reassessment, and integrated supportive care.

Phased Pharmacologic and Clinical Management

Initial empiric therapy with meropenem targeted likely MDR Gram-negative pathogens consistent with international sepsis guidelines advocating rapid administration of broad-spectrum antibiotics to reduce mortality.^[4] The transition to targeted antibiotic regimens based on repeated blood culture sensitivity highlights key principles of antimicrobial stewardship, optimizing efficacy while reducing selective pressure driving resistance.^{[5][6]} The therapy titration from intensive early coverage to gradual de-escalation aligns with evidence supporting dynamic antibiotic strategies tailored to clinical and microbiological evolution.^[7]

Supportive interventions were pivotal in managing ARDS and multi-organ dysfunction. Mechanical ventilation settings were carefully adjusted to minimize

ventilator-induced lung injury.^[8] The sedation using Midazolam was judiciously titrated, balancing the need for patient comfort and ventilator synchrony with the imperative to reduce sedation for weaning readiness.^[9] Fluid balance optimization using diuretics was initiated to mitigate pulmonary edema and improve respiratory mechanics, a critical consideration in ARDS management.^[8] Anticoagulant therapy underscores prevention of thrombotic complications frequent in ICU patients, especially those immobilized and with inflammatory sepsis.^[10]

Uniqueness of the Case and Clinical Correlations

The identification of *Serratia liquefaciens* as the causative MDR pathogen is noteworthy. While *Serratia marcescens* has classically been recognized in nosocomial infections, *S. liquefaciens* is less commonly reported yet exhibits similar resistance patterns mediated by beta-lactamases and efflux mechanisms^{[11][12]}. The carbapenem resistance noted poses significant treatment challenges given few reliable antimicrobial options, making early detection and tailored therapy essential to improve outcomes.^[13]

Literature on *Serratia liquefaciens* infections remains limited; however, reports of carbapenem-resistant strains causing severe systemic infections are increasing worldwide.^[14] This case contributes valuable clinical insight into the presentation, laboratory findings, and management dilemmas posed by MDR *Serratia* species. It also highlights the critical need for rapid microbiological diagnosis and susceptibility testing to guide appropriate antimicrobial therapy, prevent further resistance development, and improve clinical outcomes.

Patient-specific factors contributed considerably to the clinical complexity. Pre-existing pulmonary sequelae from tuberculosis likely compromised baseline respiratory reserve, thus exacerbating the severity of ARDS. The concomitant cardiac conduction abnormalities (RBBB, supraventricular tachycardia) complicated hemodynamic management and sedation strategies, demanding nuanced balance to avoid exacerbation of arrhythmias while maintaining organ perfusion and oxygen delivery. These comorbidities demonstrate how multimorbidity necessitates individualized treatment plans considering overlapping pathophysiologies.^[15]

Multidisciplinary Management and the Role of Anesthesia

The management complexity required coordinated multidisciplinary collaboration among infectious disease specialists, pulmonologists, cardiologists, intensivists, and anesthesiologists. Anesthesia played a vital role beyond procedural sedation: meticulous adjustment of sedative dosing optimized ventilator synchrony and consciousness level to support respiratory weaning while preventing cardiac complications. Furthermore, hemodynamic support through vasopressors involved anesthetic expertise in titration and monitoring, ensuring adequate tissue perfusion.^[9]

Continuous interdisciplinary reassessment enabled responsiveness to changing clinical status—the hallmark of modern ICU care. Such collaboration also facilitated integration of adjunct supportive treatments including electrolyte management, thrombosis prophylaxis, and metabolic supplementation, which collectively promoted organ recovery and minimized secondary complications.^[16]

Comparison with Relevant Literature

The rising incidence of carbapenem-resistant Enterobacteriaceae presents a pressing global challenge, associated with elevated mortality and healthcare burden.^[7] *Serratia* species' role in ICU-acquired infections, while less prominent than *Klebsiella* or *E. coli*, is increasingly recognized, particularly in immunocompromised or elderly hosts.^[12] Mechanistic studies reveal beta-lactamase production and efflux pump activity as primary resistance mechanisms, complicating therapeutic choices. This case corroborates these findings and highlights the critical necessity of routine susceptibility testing.^[11]

Complications including septic shock, ARDS, cardiac arrhythmias, electrolyte imbalances, prolonged mechanical ventilation, and sedation-associated risks align with common ICU challenges described in literature.^{[10][17]} Notably, extended sedation raises concerns for ICU-acquired weakness and delirium, underscoring the importance of early mobilization and delirium prevention protocols to improve long-term outcomes.^[17]

CONCLUSION

This case highlights the complexity and critical importance of a tailored, multidisciplinary approach in managing severe septic shock complicated by

multidrug-resistant *Serratia liquefaciens* bloodstream infection, ARDS, and multiple comorbidities in an elderly patient. The phased pharmacologic strategy, starting with broad-spectrum empirical antibiotics followed by de-escalation guided by microbiological data, proved essential in controlling the MDR pathogen while mitigating antibiotic resistance risks. Supportive critical care measures including lung-protective ventilation, fluid balance management, sedation control, and thromboprophylaxis collectively contributed to gradual stabilization and recovery.

The clinical uniqueness of this case lies in the rare isolation of *Serratia liquefaciens* as a carbapenem-resistant pathogen causing bloodstream infection, a scenario that underscores the growing global challenge of antimicrobial resistance in ICU settings. This pathogen's resistant mechanisms necessitated vigilant microbiological monitoring and individualized antibiotic stewardship.

Moreover, the interplay of pre-existing conditions such as prior pulmonary tuberculosis and cardiac conduction abnormalities complicated the clinical course, emphasizing the need for personalized management that integrates infectious disease control with cardiopulmonary support. The involvement of anesthesia specialists was pivotal, not only for sedation and ventilatory management, but also for nuanced hemodynamic optimization amid multifactorial organ dysfunction. To prevent similar events in the future, hospital infection control strategies must be strengthened. Measures that can be implemented include: (a) strict application of intravascular catheter care bundles to minimize catheter-related bloodstream infections (CRBSI); (b) standardized protocols for the insertion, replacement, and maintenance of endotracheal tubes (ETT) and nasogastric tubes (NGT) using aseptic techniques; (c) regular monitoring of the quality and sterility of intravenous fluids, injectable medications, and enteral nutrition; (d) antibiotic audits and implementation of an antimicrobial stewardship program to prevent excessive or inappropriate carbapenem use; and (e) reinforcement of ICU microbiological surveillance for early detection of potential outbreaks. Consistent implementation of these strategies, even in resource-limited secondary care hospitals, may substantially reduce the risk of nosocomial infections caused by *Serratia liquefaciens* and other multidrug-resistant organisms.

Overall, this case underscores the imperative of dynamic multidisciplinary collaboration, incorporating evolving clinical data and microbiological findings to refine therapy and support recovery. It also reinforces the critical global imperative to strengthen antimicrobial stewardship programs to address resistant infections that increasingly challenge conventional therapies. Future cases with similar complexity may benefit from early detection, rapid susceptibility testing, and flexible care plans that adapt to changing pathogen profiles and patient needs.

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