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Comprehensive Management of Septic Shock Secondary to Intra-Abdominal Infection Complicated by Acute Respiratory Distress Syndrome: A Case Report

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ABSTRACT

Introduction: Septic shock is a life-threatening complication frequently encountered after major abdominal surgery and is associated with substantial morbidity and mortality in the intensive care unit (ICU). Intra-abdominal infection following laparotomy is a common precipitating source of sepsis that may rapidly progress to circulatory failure. The development of acute respiratory distress syndrome (ARDS) further exacerbates disease severity and necessitates early recognition and coordinated multidisciplinary management.

Case Description: We report the case of a 65-year-old man who developed septic shock secondary to postoperative peritonitis following a laparotomy. The patient had previously undergone low anterior resection for rectal carcinoma. On intensive care unit (ICU) admission, the patient presented with severe hemodynamic instability requiring aggressive fluid resuscitation, vasopressor support, and invasive mechanical ventilation. On ICU day three, the patient developed ARDS, characterized by persistent fever, marked leukocytosis, worsening hypoxemia, and bilateral pulmonary infiltrates on chest radiography. Management included early goal-directed resuscitation, vasopressor therapy, and empiric broad-spectrum antibiotics (meropenem and levofloxacin). Lung-protective ventilation strategies were implemented in close collaboration with intensivists, surgeons, and anesthesiologists. The patient showed gradual clinical improvement and was successfully extubated on ICU day ten.

Conclusion: This case underscores the critical importance of rapid recognition and meticulous management of septic shock secondary to intra-abdominal infection complicated by ARDS. Optimal outcomes depend on timely resuscitation, appropriate empiric antimicrobial therapy, early identification of ARDS, implementation of lung-protective ventilation, and a coordinated multidisciplinary approach to critical care management.

Keywords

Septic Shock, Intra-Abdominal Infection, Acute Respiratory Distress Syndrome, Intensive Care Unit, Lung-Protective Ventilation, Postoperative Sepsis

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INTRODUCTION

Septic shock is the most severe clinical manifestation of sepsis, characterized by a dysregulated host response to infection, leading to profound circulatory, cellular, and metabolic abnormalities. Clinically, septic shock is defined as persistent hypotension requiring vasopressor therapy to maintain an adequate mean arterial pressure and elevated serum lactate levels despite adequate fluid resuscitation [1]. Septic shock most commonly results from severe Gram-negative or Gram-positive bacterial infections, particularly in postoperative abdominal patients, and carries an extremely high risk of multiorgan dysfunction involving the lungs, kidneys, liver, and

cardiovascular system, with mortality rates remaining unacceptably high despite advances in critical care [2]. In postoperative patients, particularly those undergoing abdominal surgery, intra-abdominal infection should be considered the primary precipitating factor for septic shock development.

Patients with rectal carcinoma frequently undergo complex abdominal procedures, including low anterior resection with primary anastomosis and abdominoperineal excision. These surgical interventions inherently carry a substantial risk of postoperative intra-abdominal complications, such as anastomotic leakage, intra-abdominal abscess formation, and diffuse peritonitis. Multicenter data indicate that approximately 3.7% of patients undergoing rectal cancer surgery develop postoperative abdominopelvic sepsis, with reported mortality rates approaching 5% [3]. Consequently, postoperative intra-abdominal infection should be recognized as a major precipitating factor for septic shock in surgical patients, rendering individuals with rectal carcinoma particularly vulnerable to rapid deterioration from localized infection to systemic sepsis and septic shock. Acute respiratory distress syndrome (ARDS) is a severe and often fatal complication in critically ill patients with sepsis. It is characterized by acute hypoxemic respiratory failure resulting from diffuse inflammatory injury to the alveolar–capillary membrane, independent of cardiogenic edema. The incidence of ARDS among ICU patients is estimated to be approximately 10%, with mortality rates ranging from 35% in mild cases to more than 45% in severe cases. Sepsis remains the leading extrapulmonary cause of ARDS, and ARDS secondary to septic shock is consistently associated with greater disease severity and poorer outcomes [4]. Therefore, the coexistence of septic shock and ARDS constitutes a life-threatening clinical entity requiring immediate recognition, aggressive respiratory support, and meticulous critical care monitoring.

CASE DESCRIPTION

A 65-year-old man was referred from Al Islam Hospital to Dr. Hasan Sadikin General Hospital for the definitive management of rectal carcinoma. He presented with progressive constipation and fresh rectal bleeding for approximately two weeks prior to admission. The bleeding was profuse, bright red, and estimated to be equivalent to one adult diaper per episode. The patient also reported unintentional weight loss over the preceding two months. The stool consistency was described as small, pellet-like. He denied a history of hypertension, diabetes mellitus, tuberculosis, chronic medication use, or family history of malignancy. One month prior to admission, colonoscopy revealed a rectal mass consistent with carcinoma, which was subsequently confirmed by contrast-enhanced abdominal computed tomography (CT). Three days after hospital admission, the patient underwent laparoscopic low anterior resection (LAR). The initial postoperative recovery was unremarkable. On postoperative day three, the patient developed acute abdominal pain, fever, and clinical signs of peritonitis. An emergency exploratory laparotomy was performed. Intraoperative findings included diffuse fecal peritonitis, grade 2–3 interloop bowel adhesions, and a 1-cm perforation at the rectosigmoid anastomosis site.

A peritoneal toilet and Hartmann procedure were performed. During surgery, the patient became hemodynamically unstable and required norepinephrine infusion at 0.2 µg/kg/min. The patient was intubated intraoperatively and subsequently transferred to the ICU for continued mechanical ventilation and hemodynamic support. Upon ICU admission, the patient was mechanically ventilated and sedated with continuous midazolam infusion. He presented with persistent hypotension, tachycardia, elevated serum lactate levels, and reduced urine output, fulfilling the criteria for septic shock secondary to intra-abdominal infection. Hemodynamic support was initiated with norepinephrine at 0.2–0.4 µg/kg/min, with the addition of vasopressin at 0.04 IU/min due to refractory hypotension. Intravenous hydrocortisone at a total dose of 200 mg/day was administered. Empiric broad-spectrum antimicrobial therapy was promptly initiated using meropenem (1 g intravenously every 8 h) combined with levofloxacin (750 mg intravenously daily). Blood and respiratory cultures were obtained before the administration of antibiotics. Close monitoring of hemodynamic parameters, laboratory indices, urine output, and fluid balance was performed throughout the ICU stay. On the third day of ICU treatment, the patient developed worsening hypoxemia accompanied by fever, leukocytosis, and bilateral pulmonary infiltrates on chest radiography. Arterial blood gas analysis

revealed a declining PaO_2/FiO_2 ratio, consistent with the diagnosis of acute respiratory distress syndrome (ARDS) secondary to septic shock. Lung-protective mechanical ventilation was subsequently implemented using low tidal volumes and optimized positive end-expiratory pressure. Serial arterial blood gas measurements demonstrated a gradual improvement in oxygenation and acid–base balance Figure 1.

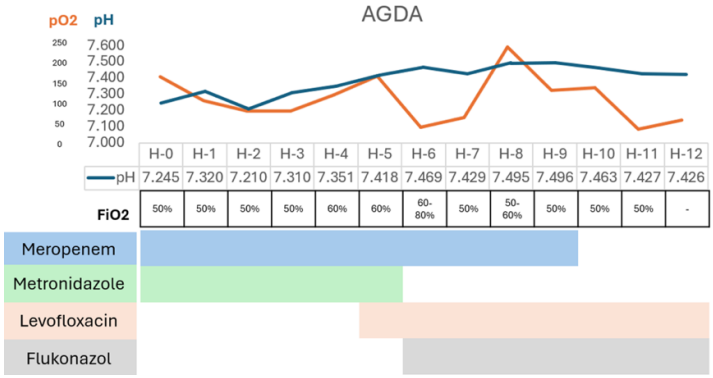

Figure 1. Trends in arterial blood gas parameters (pH and PaO_2) during ICU stay

During the subsequent ICU stay, the patient showed gradual clinical improvement and was successfully extubated. The vasopressor requirements decreased progressively and were eventually discontinued. Blood cultures showed no microbial growth, whereas sputum cultures identified carbapenem-resistant Acinetobacter baumannii (CRAB). Antimicrobial therapy was adjusted according to the clinical response and infectious disease consultation, and antifungal therapy with fluconazole was initiated based on the Candida score. Fluid balance optimization resulted in improved urine output and resolution of lactic acidosis. Sedation was gradually tapered, allowing successful weaning from the ventilator. By ICU day ten, the patient achieved stable hemodynamics without vasopressor support and demonstrated adequate spontaneous respiratory effort, permitting successful extubation. A concise summary of the patient's daily clinical course and major therapeutic interventions during ICU care is presented in Table 1.

Table 1. Summary of Clinical Course and Key Interventions During ICU Stay

ICU Period	Major Clinical Features	Key Interventions
Days 0–2	Septic Shock, Lactic Acidosis	Vasopressors, Fluids, Broad-Spectrum Antibiotics
Days 3–5	ARDS, Hypoxemia	Lung-Protective Ventilation, PEEP Optimization
Days 6–8	Hemodynamic Improvement	Vasopressor Weaning, Antifungal Therapy
Days 9–11	Stable Respiration	Ventilator Weaning
Days 12–13	Clinical Recovery	Extubation, Transfer To Ward

The patient continued to improve clinically following extubation and was transferred to the general ward on ICU day 13 in a stable condition. An overview of the ICU course from the onset of septic shock and ARDS to recovery is shown in Figure 2.

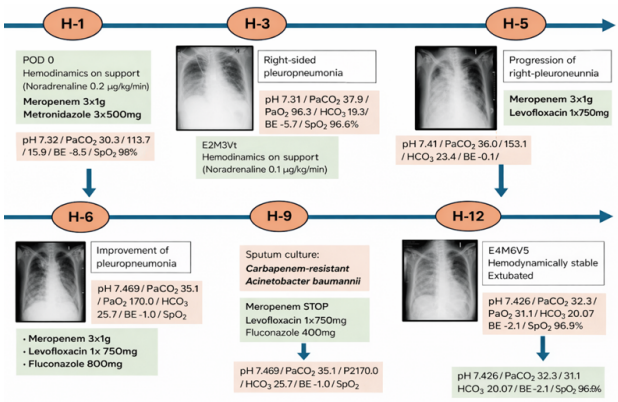

Figure 2. Timeline of ICU course from septic shock and ARDS to recovery

DISCUSSION

Sepsis remains a major cause of morbidity and mortality in critically ill patients, particularly after major abdominal surgery. According to the Sepsis-3 definition, sepsis is characterized by life-threatening organ dysfunction caused by a dysregulated host response to infection, whereas septic shock represents its most severe form, marked by profound circulatory and metabolic abnormalities with a substantially increased risk of death [2]. In the present case, septic shock developed as a consequence of diffuse intra-abdominal infection following anastomotic leakage. The calculated Sequential Organ Failure Assessment (SOFA) score of 9 indicated significant organ dysfunction and a high predicted mortality risk [6-9].

Early and definitive source control is a critical determinant of the outcome of abdominal sepsis. Emergency exploratory laparotomy revealed diffuse fecal peritonitis secondary to anastomotic leakage, and definitive control was achieved through peritoneal toilet and the Hartmann procedure. Delayed source control is consistently associated with refractory shock and increased mortality [10,11]. Despite negative blood cultures, the clinical diagnosis of septic shock was well supported by hemodynamic instability and biochemical evidence of tissue hypoperfusion. Culture-negative sepsis is a recognized phenomenon that occurs in a substantial proportion of cases, particularly when antibiotics are administered before microbiological sampling [8]. Therefore, negative cultures should not delay aggressive management of sepsis when clinical suspicion remains high. During the ICU course, the patient developed acute hypoxemic respiratory failure consistent with ARDS. Sepsis remains the most common extrapulmonary trigger of ARDS [12]. The pathophysiology involves widespread inflammatory injury to the alveolar–capillary membrane, leading to increased vascular permeability, pulmonary edema, and impaired gas exchange. Microbiological analysis identified carbapenem-resistant Acinetobacter baumannii (CRAB), a pathogen frequently associated with hospital-acquired pneumonia and high mortality rates in critically ill patients [13-15]. Although differentiation between colonization and true infection may be challenging, the patient's clinical deterioration and radiographic findings supported a diagnosis of clinically significant lower respiratory tract infection.

Lung-protective mechanical ventilation remains the cornerstone of ARDS management. The use of low tidal volumes, optimized positive end-expiratory pressure (PEEP), and limitation of airway pressures reduces ventilator-induced lung injury and improves survival [8]. In this case, the early implementation of lung-protective ventilation was associated with gradual improvement in oxygenation and successful weaning from mechanical ventilation. This report has inherent limitations as a single-case observation and may not be generalizable to all patients with postoperative septic shock and ARDS. Additionally, microbiological confirmation of bloodstream infection was not obtained, which may limit pathogen-specific interpretation. Nevertheless, the clinical course of this patient provides valuable insights into multidisciplinary management strategies for complex critical illnesses.

CONCLUSION

This case underscores the critical importance of early source control, timely hemodynamic resuscitation, appropriate antimicrobial therapy, and lung-protective ventilation for managing septic shock complicated by ARDS. An integrated, multidisciplinary, and evidence-based strategy is essential for improving survival and clinical outcomes in high-risk postoperative patients.

DECLARATIONS

Ethical Approval: Not required for a single case report, according to institutional policy.

Consent for Publication: Written informed consent was obtained from the patient for publication of this case report and accompanying clinical information.

CONSENT FOR PUBLICATION

The Authors agree to be published in the Journal of Society Medicine.

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COMPETING INTERESTS
The authors declare no conflicts of interest in this case report.

AUTHORS' CONTRIBUTIONS
D.S. was responsible for patient management, data acquisition, and drafting the initial manuscript. N.D.K. contributed to the clinical supervision and critical revision of the manuscript for important intellectual content. Both authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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