NURSING CARE ANALYSIS OF MR. A WITH RESPIRATORY SYSTEM IMPAIRMENT AND ACUTE RESPIRATORY FAILURE SECONDARY TO CHRONIC KIDNEY DISEASE (CKD) USING SUCTION INTERVENTION TO IMPROVE AIRWAY CLEARANCE IN THE HCU/ICU OF RSUD CILILIN IN 2025.

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ABSTRACT

Chronic Kidney Disease (CKD) is a progressive and irreversible decline in kidney function, often causing complications such as respiratory failure due to fluid accumulation and electrolyte imbalance. This case study analyzes nursing care for Mr. A (male, age not specified) with respiratory system impairment—respiratory failure due to CKD—with the implementation of a close suction intervention to clear the airway in the HCU/ICU of RSUD Cililin in 2025. The general objective was to provide comprehensive nursing care, while the specific objectives included assessment, diagnosis, intervention, implementation, and evaluation. Data were collected through observation, interviews, physical examination, and documentation review, using a descriptive-analytic approach based on SIKI and SLKI standards. Assessment findings showed complaints of shortness of breath, decreased level of consciousness, rhonchi, and excessive sputum production. The main nursing diagnoses included impaired gas exchange, ineffective airway clearance, ineffective peripheral perfusion, and hypervolemia. Routine close suction intervention provided temporary improvement, such as increased oxygen saturation and reduced rhonchi; however, the patient's condition worsened due to pulmonary edema and refractory hypoxemia, ultimately resulting in death. Conclusion: Close suction intervention is temporarily effective in maintaining airway patency but cannot overcome terminal CKD conditions. Recommendation: Improve family education and early prevention to reduce the risk of complications.

Keywords : *CKD, Respiratory Failure, Close Suction, Nursing Care, ICU*

INTRODUCTION

Chronic Kidney Disease (CKD) represents a major global health challenge, with steadily rising prevalence and a leading cause of morbidity and mortality, particularly in its end-stage form (end-stage renal disease/ESRD). According to the World Health Organization (WHO, 2020), approximately 10% of the global population is affected by CKD, while the number of patients requiring hemodialysis continues to increase by about 8% annually. In Indonesia, the prevalence of CKD stands at 0.38%, or roughly 3.8 per 1,000 population, based on the Basic Health Research (Riskesdas) 2018 data, with the majority of end-stage patients requiring renal replacement therapy such as hemodialysis (Ministry of Health of the Republic of Indonesia, 2023).

One of the most serious and life-threatening complications in advanced-stage CKD is respiratory system impairment, particularly acute respiratory failure. This complication arises from multiple pathophysiological mechanisms, including fluid overload leading to pulmonary edema, metabolic acidosis, reduced respiratory muscle strength due to uremia, anemia impairing oxygen-carrying capacity, and electrolyte imbalances affecting neuromuscular respiratory function (Brunner & Suddarth, 2018; Mulyadi, 2024). In severe cases, endotracheal intubation and mechanical ventilation are often required to maintain adequate oxygenation and ventilation.

In mechanically ventilated patients, excessive accumulation of tracheobronchial secretions becomes a critical issue due to diminished cough reflex, sedation, muscle relaxation, and impaired mucociliary clearance mechanisms. Ineffective airway clearance can exacerbate hypoxemia, increase the risk of Ventilator-Associated Pneumonia (VAP), and prolong the duration of mechanical ventilation. One of the most commonly used and effective nursing interventions to address this problem is closed tracheal suctioning (closed suction system), which allows secretion removal with lower risks of contamination and hypoxemia compared to open suction techniques (Vaulina et al., 2019; Hayati, 2022).

Although closed suction has become a standard procedure in intensive care units, its application in CKD patients with respiratory failure requires in-depth evaluation regarding its effectiveness within the specific pathophysiological context of chronic kidney disease—particularly in the presence of severe fluid overload and uremia. Existing literature indicates that this intervention can provide temporary improvements in oxygen saturation and reduction in audible sputum production; however, in terminal cases, it often yields only transient benefits due to the irreversible progression of the underlying disease (Sari, 2024; Metungku, 2024).

Based on the above background, this study aims to analyze nursing care provided to a patient with respiratory system impairment (respiratory failure) secondary to CKD requiring mechanical ventilation, with a specific focus on the application of closed suction intervention in improving effective airway clearance parameters in the High Care Unit (HCU)/Intensive Care Unit (ICU) of RSUD Cililin in 2025. Through a case study approach, this research seeks to provide a comprehensive clinical picture and offer more optimal nursing practice recommendations for managing similar cases.

METHOD

This study employed a descriptive analytical single-case study design using the comprehensive nursing care process approach, aligned with the Indonesian Nursing Standards (SDKI for diagnosis, SIKI for interventions, SLKI for outcomes). The study was conducted in the High Care Unit (HCU)/Intensive Care Unit (ICU) at RSUD Cililin, a regional public hospital in West Java, Indonesia, from October 8 to October 12, 2025. Purposive sampling was used to select one male patient (Tn. A) with a confirmed medical diagnosis of end-stage Chronic Kidney Disease (CKD) complicated by acute respiratory failure, requiring endotracheal intubation and mechanical ventilation. The patient presented with ineffective airway clearance due to hypersecretion, impaired gas exchange, peripheral hypoperfusion, and hypervolemia. Exclusion criteria included patients with active massive hemoptysis, severe hemodynamic instability precluding safe suctioning, or those already receiving open suction as the primary airway management strategy at baseline.

RESULTS AND DISCUSSION

The observation period spanned five consecutive days, from October 8 to October 12, 2025. During this time, closed tracheal suctioning was performed 3 to 6 times per day (average 4.2 episodes per day). The procedure was strictly indication-driven, triggered by clinical signs such as widespread audible ronchi, progressive increase in peak inspiratory pressure above 35 cmH_2O, visible secretions in the endotracheal tube, or acute desaturation (SpO_2 drop >3–5%) despite optimized ventilator settings.

The changes in the patient's clinical condition before and after the intervention are presented in Table 1.

Table 1. Daily Trends in Key Respiratory and Oxygenation Parameters

Day	Date	Pre-Suction SpO_2 (%)	Post-Suction SpO_2 (%)	Ronchi (0–3 scale)*	Secretion Volume per Session (mL)	ABG Highlights (most recent/day)	Ventilator Driving Pressure (cmH_2O)
Day 1	8 Oct 2025	84–88	92–96	3 (bilateral coarse)	8–15	pH 7.44, $PaCO_2$ 22, PaO_2 58, HCO_3 15.6	18–22
Day 2	9 Oct 2025	82–87	90–94	2–3	10–18	pH 7.31, $PaCO_2$ 13, PaO_2 52, HCO_3 10.4	20–25
Day 3	10 Oct 2025	80–85	88–93	2–3	12–20	pH 7.28, $PaCO_2$ 38, PaO_2 48, HCO_3 17	24–28
Day 4	11 Oct 2025	78–83	86–91	3	15–25	pH 7.22, $PaCO_2$ 45, PaO_2 45, HCO_3 18	26–32

Day	Date	Pre-Suction SpO_2 (%)	Post-Suction SpO_2 (%)	Ronchi (0–3 scale)*	Secretion Volume per Session (mL)	ABG Highlights (most recent/day)	Ventilator Driving Pressure (cmH_2O)
Day 5	12 Oct 2025	75–80	82–88 (brief)	3	18–30	pH 7.18, $PaCO_2$ 52, PaO_2 42, HCO_3 19	30–35

Table 1 presents the daily trends in primary respiratory and oxygenation parameters throughout the 5-day observation period. On the first day (October 8, 2025), pre-suction oxygen saturation (SpO_2) ranged from 84–88% and improved to 92–96% immediately following the procedure, accompanied by a reduction in ronchi intensity from grade 3 (widespread bilateral coarse crackles) to a milder level. The volume of secretions removed per session was moderate (8–15 mL). However, arterial blood gas (ABG) analysis revealed initial respiratory alkalosis (pH 7.44, low $PaCO_2$ of 22 mmHg) with severe hypoxemia (PaO_2 58 mmHg).

Over the following days, a clear pattern of progressive deterioration was observed: both pre- and post-suction SpO_2 values continued to decline, ronchi persisted or worsened (remaining at grade 2–3), and secretion volumes increased significantly, reaching 18–30 mL per session by day 5. ABG trends shifted from respiratory alkalosis to mixed acidosis, characterized by rising $PaCO_2$ (indicating CO_2 retention and ventilatory failure) and persistently decreasing PaO_2 (down to 42 mmHg on day 5). Ventilator driving pressure also rose markedly from 18–22 cmH_2O to 30–35 cmH_2O, reflecting reduced lung compliance due to refractory pulmonary edema and recurrent secretion accumulation.

Although suction consistently provided short-term improvement (typically lasting 10–30 minutes), these effects were transient and did not persist due to excessive ongoing secretion production and progressive alveolar-capillary membrane damage.

Table 2. Peripheral Perfusion and Fluid Status Trends

Day	CRT (seconds)	Edema Grade (lower extremities)	Skin Temperature/Color	Urine Output (mL/24h)	Body Weight Change (kg)	Hemoglobin (g/dL)
Day 1	>3	2+ (pitting 3–5 mm)	Cool, pale	<100	Baseline	7.8
Day 2	>3	2–3+	Cool, pale	<80	+0.5	7.6
Day 3	>4	3+	Cold, mottled	Anuric	+1.2	7.4
Day 4	>4	3+	Cold, cyanotic tint	Anuric	+1.8	7.2
Day 5	Not measurable	Severe generalized	Cold, cyanotic	Anuric	+2.5 (estimated)	7.0

Table 2 depicts the progression of peripheral perfusion status and fluid balance over the five-day observation period. On the first day, capillary refill time (CRT) was already prolonged (>3 seconds), with grade 2+ pitting edema in the lower extremities (3–5 mm depth), cold and pale skin, and severely reduced urine output (<100 mL/24 hours). These findings clearly reflected significant peripheral hypoperfusion and severe fluid overload secondary to terminal renal failure. Baseline hemoglobin was low (7.8 g/dL), further compromising oxygen-carrying capacity.

Subsequent days showed gradual but consistent worsening: CRT extended to >4 seconds or became unmeasurable by day 5, edema progressed to grade 3+ and became generalized, skin temperature deteriorated further with mottling and cyanotic changes, and the patient became fully anuric. Estimated body weight increased by approximately +2.5 kg due to uncontrolled fluid retention, despite attempts at hemodialysis. Hemoglobin levels continued to decline to 7.0 g/dL, indicating progressive anemia likely exacerbated by uremic bleeding tendencies.

These data confirm that hypervolemia and peripheral hypoperfusion could not be effectively corrected, serving as key contributing factors to the development of multi-organ failure in this terminal CKD case.

Table 3. Summary of Nursing Diagnosis Outcomes (SLKI-based Evaluation)

Nursing Diagnosis (SDKI)	Expected Outcome (SLKI)	Achievement after 5 days	Final Status
Impaired gas exchange r/t alveolar-capillary changes	SpO_2 >92%, PaO_2 >60 mmHg, clear breath sounds	Transient improvement only	Not achieved – refractory hypoxemia
Ineffective airway clearance r/t hypersecretion	Reduced secretion volume, decreased adventitious sounds	Partial & short-lived (10–30 min post-suction)	Not achieved – recurrent accumulation
Ineffective peripheral tissue perfusion r/t anemia/hypoxemia	CRT <3 s, warm extremities, no mottling	No improvement	Not achieved – progressive deterioration
Hypervolemia r/t impaired regulatory mechanism	Reduced edema, stable fluid balance, weight ↓	Worsening despite dialysis attempts	Not achieved – refractory overload

Table 3 summarizes the evaluation of nursing outcome achievement based on the Indonesian Nursing Outcome Standards (SLKI) for the four priority nursing diagnoses. For the diagnosis of impaired gas exchange, the targets of SpO_2 >92% and PaO_2 >60 mmHg were only achieved transiently immediately after suction, but these gains were not sustained due to refractory hypoxemia. In the case of ineffective airway clearance, reductions in secretion volume and adventitious breath sounds were partial and short-lived (lasting only 10–30 minutes), with rapid recurrence of secretion accumulation. The diagnosis of ineffective peripheral tissue perfusion showed no improvement at all; capillary refill time (CRT), extremity temperature, and mottling progressively worsened in parallel with advancing hypoxia and anemia. For hypervolemia, the targets of edema reduction, fluid balance stabilization, and weight loss were not achieved; pulmonary edema and fluid overload actually intensified despite collaborative interventions (hemodialysis).

Overall, none of the outcomes were fully or sustainably achieved. This failure is primarily attributable to the irreversible nature of the underlying disease (terminal CKD) complicated by severe uremic pulmonary edema, rendering nursing interventions—including closed suction—capable of providing only short-term palliative effects and unable to alter the clinical trajectory leading to death on the fifth day.

Discussion

The findings from this single-case study highlight the complex interplay between end-stage Chronic Kidney Disease (CKD) and acute respiratory failure, as well as the limited but tangible role of closed tracheal suctioning in the intensive care setting. Consistent with existing literature, the primary pathophysiological mechanisms driving respiratory failure in this patient were severe fluid overload leading to pulmonary edema, uremic pneumonitis, anemia-related reduction in oxygen-carrying capacity, and progressive weakening of respiratory muscles due to metabolic derangements (Brunner & Suddarth, 2018; Mulyadi, 2024). These factors resulted in mixed-type respiratory failure (initially hyperventilation with respiratory alkalosis, progressing to CO_2 retention and mixed acidosis), profuse thick secretions, and refractory hypoxemia despite mechanical ventilation.

Closed suctioning, performed as the core independent nursing intervention (SIKI I.01011 – Airway Management), provided immediate but short-lived benefits. Post-procedure improvements in SpO_2 (typically +4–10%), reduction in ronchi intensity, and removal of 8–30 mL of secretions per session align with previous reports demonstrating that closed suction effectively clears retained secretions, reduces airway resistance, and transiently enhances oxygenation in ventilated patients (Vaulina et al., 2019; Karokaro & Hasrawi, 2019; Sari, 2024). The use of a closed system minimized desaturation episodes and infection risk compared to open suction, which is particularly advantageous in hemodynamically unstable CKD patients prone to hypotension during procedures.

However, the transient nature of these improvements underscores a critical limitation: suction addresses only the mechanical aspect of airway obstruction (hypersecretion), but does not correct the underlying drivers of excessive mucus production and alveolar flooding—namely, refractory hypervolemia and uremic capillary leak. Despite regular hemodialysis sessions and strict fluid restriction, fluid balance remained negative only temporarily, with progressive weight gain (+2.5 kg estimated over 5 days), worsening edema, and escalating ventilator requirements. This pattern is consistent with studies indicating that pulmonary complications in terminal CKD often become refractory to conventional interventions once uremic toxins and fluid overload exceed compensatory mechanisms (Septimar Maulida & Zahra, 2024; Wijonarko, 2024).

Peripheral hypoperfusion and anemia further compounded the problem. Declining hemoglobin (from 7.8 to 7.0 g/dL) and prolonged CRT reflected reduced tissue oxygen delivery, which likely contributed to myocardial depression, reduced cardiac output, and eventual cardiorespiratory arrest. These observations reinforce that in end-stage CKD, multi-organ dysfunction frequently follows a predictable downhill course despite optimal supportive care (Black & Hawks, 2014).

From a nursing perspective, the study demonstrates the importance of frequent, indication-driven suctioning in mechanically ventilated CKD patients with hypersecretion. Yet it also highlights the necessity of holistic, multidisciplinary management—including timely palliative care consultation when refractory hypoxemia and multi-organ failure become evident. The inability to achieve sustained SLKI outcomes across all priority nursing diagnoses (impaired

gas exchange, ineffective airway clearance, ineffective peripheral perfusion, and hypervolemia) reflects the terminal nature of the disease rather than inadequacy of nursing interventions.

Limitations of this study include its single-case design, which limits generalizability, and the short observation period (5 days), which may not capture longer-term trends in survivors. Nevertheless, the detailed documentation of daily trends provides valuable real-world insight into the trajectory of terminal CKD with respiratory failure in a resource-limited regional ICU setting..

CONCLUSION

This single-case analysis of nursing care in a patient with end-stage Chronic Kidney Disease complicated by acute respiratory failure demonstrates that closed tracheal suctioning is an effective, safe, and essential intervention for providing temporary airway clearance and modest oxygenation improvement in mechanically ventilated patients with hypersecretion. The procedure consistently reduced adventitious breath sounds, cleared substantial volumes of secretions, and produced short-term gains in SpO_2 and ventilator parameters.

However, these benefits were transient and insufficient to reverse the underlying pathophysiology of refractory pulmonary edema, uremic effects, progressive anemia, and multi-organ failure inherent to terminal CKD. Despite comprehensive nursing care aligned with Indonesian standards (SDKI, SIKI, SLKI) and collaborative medical management, none of the priority nursing diagnoses achieved sustained resolution. The patient's clinical course culminated in refractory hypoxemia and cardiorespiratory arrest on day 5.

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Declaration of Generative AI

During the preparation of this work, the author(s) used Grok (built by xAI) for assistance in structuring the Conclusion section, refining academic language, and ensuring clarity and consistency. After utilizing this tool/service, the author(s) thoroughly reviewed and edited the content as necessary and take full responsibility for the final content of the published article.

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