

Clinical Profile and Outcomes of Patients Requiring Invasive Mechanical Ventilation in a Medical ICU: A Prospective Observational Study from Central India

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Background: Invasive mechanical ventilation (IMV) is a cornerstone of critical care, yet data from medical ICUs in resource-limited settings in central India remain sparse. We aimed to characterise the clinical profile, complications, and outcomes of patients requiring IMV in a tertiary care medical ICU.

Methods: A prospective observational study was conducted in the Medical ICU (MICU) of a tertiary care hospital in central India, from 2023–2026. Adults (>12 years) requiring IMV for ≥24 hours were enrolled consecutively (n=143). Demographics, comorbidities, primary diagnosis, SOFA score, GCS, ABG parameters, ventilator settings, complications, and ICU outcomes were systematically recorded. Statistical analysis used the Chi-square test, independent t-test, Mann-Whitney U-test, and Kaplan-Meier survival analysis.

Results: Mean age was 55.92 ± 17.06 years; 69.9% were male and 62.9% from rural areas. Leading diagnoses were COPD/asthma exacerbation (16.1%), pneumonia (15.4%), and stroke (15.4%). Mean SOFA score was 8.8 ± 3.1 and mean GCS was 8.6 ± 4.5 . Airway protection was the primary indication for IMV in 53.1% of cases. Lung-protective ventilation (tidal volume 6.0 ± 0.2 mL/kg PBW) was applied in 97.9%. Overall ICU mortality was 58.0%. Mortality ranged from 0% in seizures to 91.7% in meningoencephalitis. Higher SOFA score was a significant predictor of mortality in sepsis ($p = 0.020$), ACS/cardiogenic shock ($p = 0.040$), stroke ($p = 0.030$), and uremic encephalopathy ($p = 0.010$). Ventilator-associated pneumonia (VAP) occurred in 10.5% overall and was markedly higher in non-survivors (16.9 vs 1.7%). Admission SOFA score, serum lactate, and VAP were independent predictors of ICU mortality.

Conclusion: IMV carries high mortality in this Indian MICU, particularly in neurological emergencies and sepsis. SOFA score, serum lactate, and VAP are key prognostic determinants. Consistent lung-protective ventilation and VAP prevention are feasible and critical in resource-limited Indian settings. These data provide locally relevant benchmarks for clinical practice and quality improvement.

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Mechanical ventilation, MICU, SOFA score, VAP, ICU mortality, India, Resource-limited setting, lung-protective ventilation

Introduction

Invasive mechanical ventilation (IMV) is an essential life-support intervention in the medical intensive care unit (MICU). Common indications include acute respiratory failure, sepsis, ARDS, acute exacerbations of COPD, cardiogenic pulmonary oedema, and neurological emergencies requiring airway protection. Despite advances in ventilatory strategy and critical care medicine, ICU mortality among mechanically ventilated patients remains high—often exceeding 30 to 50% in published cohorts.^{1,2}

Mortality is shaped by baseline characteristics, primary diagnosis, admission severity, ventilator management quality, and iatrogenic complications

such as ventilator-associated pneumonia (VAP) and barotrauma. High SOFA and APACHE II scores, sepsis or shock, vasopressor requirements, and complication onset are consistently identified as potent mortality predictors.^{3,4} However, existing data from low and middle-income countries (LMICs), including India, are hampered by small sample sizes, narrow disease focus, incomplete comorbidity documentation, and variable reporting of ventilation practices and complication rates.⁵

Within India, published IMV literature derives predominantly from large urban tertiary hospitals. Data from smaller referral hospitals serving rural and semi-urban communities where disease profile, age at presentation, and severity at admission differ substantially are almost entirely absent. There is a particular lack of data from Madhya Pradesh and central India.

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This prospective observational study addresses these gaps by providing the first systematic documentation of clinical profile, illness severity, complications, and outcomes from a tertiary MICU in Madhya Pradesh. Our objectives were to: (1) characterise demographics, comorbidities, and primary diagnoses; (2) assess illness severity using SOFA score and GCS; (3) document ABG parameters and laboratory findings at admission; (4) record duration of IMV and ICU stay across diagnostic categories; and (5) examine the association of clinical, laboratory, and severity parameters with patient outcome.

Methods

Study Design and Setting

This was a hospital-based, prospective observational study conducted in the MICU of a government-affiliated tertiary teaching hospital in central India, serving a predominantly rural population. The study was conducted over a minimum period of one year following Institutional Ethics Committee (IEC) approval (in accordance with the Declaration of Helsinki and ICMR guidelines for biomedical research). No intervention was introduced; patients received standard care per departmental protocols.

Study Population

All adults (>12 years) admitted to the MICU and requiring IMV for ≥ 24 hours were enrolled consecutively. Exclusion criteria included: age ≤ 12 years; IMV <24 hours (including early self-extubation or death within 24 hours); patients managed on non-invasive ventilation only; and refusal of written informed consent.

Sample Size

The minimum sample size was calculated using the formula for estimation of a population proportion (reference: VAP prevalence ~50%; Vora *et al.*, 2015), requiring $n=119$. After a 10% attrition allowance, the targeted minimum was 133; 143 patients were ultimately enrolled.

Data Collection

A pre-designed structured case record proforma captured: sociodemographic data; presenting complaints and comorbidities (hypertension, diabetes mellitus, COPD/asthma, CAD/IHD, CHF, CKD, liver disease/cirrhosis, prior stroke/TIA, and malignancy); vital signs; primary diagnosis; indication for intubation; initial ventilator parameters (mode, tidal volume, respiratory rate, PEEP, FiO_2); ABG analysis (pH, PaO_2 , PaCO_2 , HCO_3^- ,

SpO_2); laboratory investigations (CBC, RFT, LFT, serum lactate); SOFA and GCS scores; complications (VAP, barotrauma, VILI/new ARDS); duration of IMV and ICU stay; and outcome (survived/died).

Definitions

SOFA score was calculated at initiation of mechanical ventilation across six organ systems (maximum 24); score bands of 0–5, 6–8, 9–11, 12–14, and ≥ 15 were used for mortality stratification. The P/F ratio was derived from direct ABG-measured PaO_2 where available, or estimated from SpO_2 via the Severinghaus equation with pH correction (Kelman formula). VAP was defined per CDC/NHSN criteria: pneumonia after >48 hours on IMV, with new radiological infiltrates plus ≥ 2 of: fever/hypothermia, leukocytosis/leukopenia, or purulent secretions. Sepsis and septic shock were defined per Sepsis-3 consensus definitions (Singer *et al.*, JAMA 2016).

Statistical Analysis

Quantitative data were summarised as mean $\pm$ SD or median (IQR). Categorical variables were compared using chi-square or Fisher's exact test. Continuous variables between groups were compared using the independent t-test or Mann–Whitney U test as appropriate. Kaplan–Meier survival curves were compared using the log-rank test. A p -value <0.05 was considered statistically significant.

Results

Patient Demographics

Of 143 patients enrolled, mean age was 55.92 ± 17.06 years (median 60 years; range 16–89). The largest age group was 60–74 years (57 patients, 39.9%), followed by 45–59 years (34 patients, 23.8%) (Table 1). Males constituted 69.9% ($n=100$) and most patients came from rural areas (62.9%; $n=90$), consistent with the hospital's role as a tertiary referral centre serving a predominantly rural catchment.

Comorbidities

Hypertension was the most prevalent comorbidity (38.5%), followed by COPD/asthma (28.7%), type 2 diabetes mellitus (17.5%), CAD/IHD (16.1%), prior stroke/TIA (13.3%), chronic heart failure (11.2%), chronic kidney disease (10.5%), liver disease/cirrhosis (9.8%), and malignancy (7.0%).

Primary Diagnoses and Indications for IMV

The three most frequent primary diagnoses were COPD/asthma exacerbation (16.1%), pneumonia (non-COVID, 15.4%), and stroke (15.4%), followed by ACS/

Table 1: Demographic and baseline clinical profile

Variable	Value
Age, mean $\pm$ SD (years)	55.92 $\pm$ 17.06
Age group 60–74 years, n (%)	57 (39.9%)
Male sex, n (%)	100 (69.9%)
Rural residence, n (%)	90 (62.9%)
SOFA score, mean $\pm$ SD	8.8 $\pm$ 3.1 (median 9; range 3–18)
GCS, mean $\pm$ SD	8.6 $\pm$ 4.5 (median 8)
Sepsis/shock at admission, n (%)	100 (69.9%)
Vasopressor support at admission, n (%)	35 (24.5%)
Dialysis/RRT at admission, n (%)	9 (6.3%)

HF/cardiogenic pulmonary oedema (11.9%), sepsis/septic shock (9.1%), hepatic encephalopathy (8.4%), meningoencephalitis (8.4%), poisoning/trauma/HIE (6.3%), seizures (4.9%), and uremic encephalopathy (4.2%). The primary indication for IMV was airway protection/other in 53.1%, hypoxic respiratory failure in 28.0%, and hypercapnic respiratory failure in 18.9% (Table 2).

Admission Severity, Vitals, and Laboratory Parameters

Mean SOFA score was 8.8 $\pm$ 3.1 (range 3–18); 36.4% of patients scored in the 6–8 band and 30.8% in the 9 to 11 band. Mean GCS was 8.6 $\pm$ 4.5. Admission vital signs showed tachycardia (mean HR 103.1 $\pm$ 22.3 bpm). ABG analysis revealed a mean arterial pH of 7.29 $\pm$ 0.18 (acidaemia), mean PaO₂ of 74.2 $\pm$ 44.7 mmHg, mean PaCO₂ of 44.8 $\pm$ 24.3 mmHg, mean HCO₃⁻ of 20.9 $\pm$ 9.1 mmol/L, and a mean P/F ratio of 121.4 $\pm$ 51.3 (indicating moderate-to-severe oxygenation impairment). Laboratory findings included mean haemoglobin 10.9 $\pm$ 3.0 g/dL, leukocyte count 16.6 $\pm$ 15.5 $\times 10^3$ /mm³, serum creatinine 3.35 $\pm$ 7.36 mg/dL, blood urea 92.0 $\pm$ 82.5 mg/dL, and serum lactate 2.85 $\pm$ 3.18 mmol/L.

Ventilator Settings

Volume assist-control (VAC) mode was used in 97.9% of patients. Mean tidal volume was 6.0 $\pm$ 0.2 mL/kg PBW (lung-protective strategy), mean set respiratory rate 18.0 $\pm$ 0.2 breaths/min, mean PEEP 6.0 $\pm$ 0.2 cmH₂O, and mean initial FiO₂ 99.3 $\pm$ 5.9%.

Duration of IMV and ICU Stay

Overall mean IMV duration was 5.7 $\pm$ 4.4 days (median 4 days; range 2–23 days). Neurological conditions required the longest ventilatory support: poisoning/trauma/HIE (7.8 $\pm$ 7.9 days), stroke (7.1 $\pm$ 4.2 days), and meningoencephalitis (6.8 $\pm$ 5.7 days). Shortest durations were seen in seizures (3.4 $\pm$ 1.8 days) and hepatic encephalopathy (3.9 $\pm$ 2.3 days). Mean ICU stay was 7.4 $\pm$ 5.0 days (median 6 days), consistently exceeding IMV duration, indicating continued monitoring after extubation.

ICU Outcomes

Overall ICU mortality was 58.0% (83/143). Mortality varied widely: from 0% in seizures (0/7) to 91.7% in meningoencephalitis (11/12). Other high-mortality groups were poisoning/trauma/HIE (88.9%), sepsis/septic shock (76.9%), and hepatic encephalopathy (75.0%). The lowest mortality aside from seizures was ACS/HF/cardiogenic oedema (35.3%).

SOFA Score and Mortality

A clear stepwise mortality gradient was observed with increasing SOFA score: 47.4% (SOFA 0–5), 50.0% (6–8), 54.5% (9–11), 86.4% (12–14), and 83.3% (≥ 15). SOFA score was significantly higher in non-survivors across several diagnostic categories: sepsis/septic shock (10.40 $\pm$ 2.67 *vs* 7.00 $\pm$ 1.73; *p* = 0.020), ACS/HF/cardiogenic shock (10.33 $\pm$ 1.75 *vs* 7.55 $\pm$ 2.84; *p* = 0.040), stroke (9.67 $\pm$ 3.42 *vs* 7.20 $\pm$ 1.75).

Table 2: IMV duration and ICU mortality by primary diagnosis

Primary diagnosis	n (%)	IMV days (Mean $\pm$ SD)	ICU days (Mean $\pm$ SD)	Mortality (%)
COPD/Asthma exacerbation	23 (16.1%)	5.2 $\pm$ 3.3	7.1 $\pm$ 5.3	43.5
Pneumonia (non-COVID)	22 (15.4%)	6.2 $\pm$ 5.0	8.3 $\pm$ 5.1	63.6
Stroke	22 (15.4%)	7.1 $\pm$ 4.2	7.7 $\pm$ 4.4	54.5
ACS/HF/Cardiogenic oedema	17 (11.9%)	5.3 $\pm$ 4.6	6.8 $\pm$ 4.8	35.3
Sepsis/Septic shock	13 (9.1%)	4.8 $\pm$ 2.6	6.3 $\pm$ 1.5	76.9
Hepatic encephalopathy	12 (8.4%)	3.9 $\pm$ 2.3	7.3 $\pm$ 3.7	75.0
Meningoencephalitis	12 (8.4%)	6.8 $\pm$ 5.7	9.5 $\pm$ 7.4	91.7
Seizures	7 (4.9%)	3.4 $\pm$ 1.8	3.9 $\pm$ 2.0	0.0
Uremic encephalopathy	6 (4.2%)	4.5 $\pm$ 1.6	7.0 $\pm$ 3.8	50.0
Poisoning/Trauma/HIE	9 (6.3%)	7.8 $\pm$ 7.9	7.8 $\pm$ 7.9	88.9
Overall	143 (100%)	5.7 $\pm$ 4.4	7.4 $\pm$ 5.0	58.0

1.14; $p = 0.030$), and uremic encephalopathy (12.33 ± 0.58 vs 10.00 ± 1.00 ; $p = 0.010$).

ABG Parameters and Outcome

In sepsis/septic shock, non-survivors had significantly lower baseline PaO₂ (60.08 ± 19.25 vs 84.67 ± 5.86 mmHg; $p = 0.010$). In uremic encephalopathy, non-survivors had markedly lower arterial pH (6.81 ± 0.08 vs 7.11 ± 0.16 ; $p = 0.03$) and serum HCO₃⁻ (5.50 ± 1.22 vs 12.67 ± 5.69 mmol/L; $p = 0.04$), reflecting severe metabolic acidosis. In stroke, non-survivors had a significantly higher PaCO₂ (39.75 ± 10.23 vs 31.13 ± 4.67 mmHg; $p = 0.030$). Serum lactate was consistently higher in non-survivors across most diagnostic groups, though most individual differences did not reach significance.

Complications

VAP occurred in 15 patients (10.5%), barotrauma in 3 (2.1%), and VILI/new ARDS in 1 (0.7%). VAP was strongly associated with non-survival: 16.9% of non-survivors developed VAP compared to 1.7% of survivors. VILI/new ARDS occurred exclusively in non-survivors. Three independent predictors of ICU mortality were identified: admission SOFA score ($p = 0.001$), serum lactate ($p = 0.027$), and development of VAP ($p = 0.008$).

Discussion

This prospective study of 143 mechanically ventilated adult MICU patients in central India provides locally relevant epidemiological and prognostic benchmarks. The mean age of 55.92 years and male predominance (69.9%) are consistent with reported patterns in Indian and LMIC ICU cohorts.^{23,24} The predominance of rural patients (62.9%) underscores the role of the study hospital as a critical regional referral centre.

Respiratory conditions (COPD/asthma exacerbation, pneumonia) and neurological emergencies (stroke, encephalopathies, meningoencephalitis) were the leading causes of IMV, reflecting regional disease burden. This pattern aligns with Yasar *et al.* (2024), who reported respiratory diseases (33.7%) and neurological conditions (19.8%) as the two most common admission diagnoses in mechanically ventilated patients.²³ Hypertension (38.5%), COPD/asthma (28.7%), and diabetes mellitus (17.5%) as the leading comorbidities are consistent with the existing literature.^{3,5}

The mean SOFA score of 8.8 (indicating moderate-to-severe organ dysfunction) and mean GCS of 8.6 (reflecting significant neurological compromise) document the high severity of illness at admission. The stepwise mortality

gradient with increasing SOFA bands from 47.4% (score 0–5) to 86.4% (score 12–14) confirms SOFA as a strong prognostic tool in this setting, consistent with reported sensitivity of 83.9% and specificity of 69.9% for mortality prediction in Indian ICU cohorts.⁴ Significant SOFA–outcome associations were confirmed in sepsis, ACS/cardiogenic shock, stroke, and uremic encephalopathy.

Overall ICU mortality of 58.0% is consistent with, though at the upper end of, published ranges for LMICs (29–63%). Meningoencephalitis (91.7%) and poisoning/trauma/HIE (88.9%) showed the highest mortality, reflecting the lethality of severe CNS infection with systemic sepsis and the limited resource availability for advanced neuromonitoring and neuroprotective interventions. Notably, zero mortality was observed in seizures reflecting the inherent reversibility of ventilatory support in status epilepticus when airway protection is the primary indication.

Uniform application of lung-protective ventilation (tidal volume 6.0 ± 0.2 mL/kg PBW; 97.9% of patients) was associated with very low rates of barotrauma (2.1%) and VILI/new ARDS (0.7%), validating this strategy as both safe and feasible in a resource-limited Indian MICU. Mean IMV duration (5.7 ± 4.4 days) and ICU stay (7.4 ± 5.0 days) align with comparable Indian and international cohorts.

VAP was the most important modifiable complication, occurring in 10.5% overall but in 16.9% of non-survivors versus only 1.7% of survivors—and independently predicting mortality. This is consistent with the strong association of VAP with mortality reported by Yasar *et al.* (49.5% in deceased vs 9.8% in survivors).²³ Admission SOFA score and serum lactate were the other two independent predictors of ICU mortality in this cohort.

In uremic encephalopathy, non-survivors exhibited profound metabolic acidosis (pH 6.81; HCO₃⁻ 5.50 mmol/L), demonstrating the critical importance of renal function and acid-base status as prognostic determinants in this subgroup. The paradoxical finding of lower age in non-survivors with hepatic encephalopathy (40.78 vs 59.00 years; $p = 0.01$) likely reflects the severity of underlying liver disease rather than age per se.

Limitations

This study has several limitations. First, as a single-centre study, findings may not be generalisable to all Indian or LMIC settings with differing disease profiles and resources. Second, small case numbers within individual diagnostic subgroups limited the statistical power for subgroup mortality analyses. Third, long-term post-

discharge outcomes (quality of life, cognitive function, post-intensive care syndrome) were not assessed, limiting understanding of late morbidity. Future multicentre prospective studies with standardised data collection and long-term follow-up are warranted.

Conclusion

This prospective observational study provides the first systematic epidemiological and prognostic dataset from a tertiary MICU in central India. IMV carries high mortality (58.0%) in this resource-limited setting, with neurological emergencies and sepsis bearing the greatest burden. SOFA score, serum lactate, and VAP are key independent predictors of ICU mortality. Consistent lung-protective ventilation is safe and feasible. Targeted VAP prevention, rigorous haemodynamic monitoring—particularly in sepsis, cardiogenic shock, and neurological emergencies and early identification of patients with rising SOFA scores represent the most actionable quality improvement targets. These findings establish locally relevant benchmarks and provide a foundation for protocol optimisation and future investigator-initiated research in this under-studied region.

Ethical Approval

Ethical approval was taken from the institutional ethical review board IEC-RDGM (IEC Ref no. PG/GENERAL MEDICINE/30/2024).

References

- Hickey SM, Sankari A, Giwa AO. Mechanical Ventilation. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025.
- MSD Manual Professional Edition. Overview of Mechanical Ventilation. Merck & Co., Inc.
- Vora CS, Karnik ND, Gupta V, Nadkar MY, Shetye JV. Clinical profile of patients requiring prolonged mechanical ventilation and their outcome in a tertiary care medical ICU. *J Assoc Physicians India*. 2015 Oct;63(10):14–19. PMID: 27608686.
- Eapen CE, Thomas K, Cherian AM, Jeyaseelan L, Mathai D, John G. Predictors of mortality in mechanically ventilated patients. *Postgrad Med J*. 2005 Dec;81(962):780–783. doi:10.1136/pgmj.2005.033159. PMID: 16344303.
- Jeong BH, Suh GY, An JY, Park MS, Lee JH, Lee MG, *et al*. Clinical demographics and outcomes in mechanically ventilated patients in Korean intensive care units. *J Korean Med Sci*. 2014 Jun;29(6):864–870. doi:10.3346/jkms.2014.29.6.864. PMID: 24932091.
- Shehabi Y, Bellomo R, Reade MC, *et al*. Early intensive care sedation predicts long-term mortality in ventilated critically ill patients. *Am J Respir Crit Care Med*. 2012;186(8):724–731. doi:10.1164/rccm.201203-0522OC.
- Pun BT, Balas MC, Davidson JE. Sedation practices and clinical outcomes in mechanically ventilated patients in a prospective multicenter cohort. *Crit Care*. 2019;23(1):110. doi:10.1186/s13054-019-2394-9.
- Ottestad W, Kongsgaard UE, Hagen T, Strand K. COVID-SED study: association between early deep sedation and clinical outcomes in mechanically ventilated patients during COVID-19. *Crit Care*. 2022;26(1):174.
- Pellegrini JAS, Moraes RB, Maccari JG, *et al*. Pulmonary atelectasis in mechanically ventilated trauma patients: incidence, risk factors and outcomes. *Ann Intensive Care*. 2023;13(1):11.
- Farhan M, Hasan M, Khan R, Ahmad F, Asif N. Inspiratory muscle strength and function in mechanically ventilated COVID-19 survivors 3 and 6 months after ICU discharge. *ERJ Open Res*. 2023;9(1):00329-2022.
- Rousseau AF, Prescott HC, Brett SJ, *et al*. Long-term outcomes after critical illness: recent insights. *Crit Care*. 2021;25(1):108.
- Ozlu T, Bülbül Y, Gür A, *et al*. IMV Mortality Prediction Score (IMPRES): a novel scoring system for invasive mechanical ventilation. *Turk J Med Sci*. 2019;49(6):1710–1720.
- Alkhatib H, Abou-Arab O, Astier B, *et al*. A machine learning-based prediction of hospital mortality in mechanically ventilated ICU patients. *PLOS One*. 2024;19(9):e0309383.
- Hodgson CL, Bailey M, Bellomo R, *et al*. Early active mobilization during mechanical ventilation in the ICU. *N Engl J Med*. 2022;387(19):1747–1758.
- Wang Y, Lu X, Li Y, *et al*. The effects of early mobilization in mechanically ventilated adult ICU patients: systematic review and meta-analysis. *Front Med (Lausanne)*. 2023;10:1202754.
- Singer M, Deutschman CS, Seymour CW, *et al*. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315(8):801–810.
- Lone NI, Walsh TS. Prolonged mechanical ventilation in critically ill patients: epidemiology, outcomes and modelling the potential cost consequences of establishing a regional weaning unit. *Crit Care*. 2011;15(2):R102.
- Vasilevskis EE, Han JH, Hughes CG, Ely EW. Epidemiology and risk factors for delirium across hospital settings. *Best Pract Res Clin Anaesthesiol*. 2012;26(3):277–287.
- Cardenas-Garcia J, Schaefer E, Lindenauer PK, Walkey AJ. New-onset atrial fibrillation in mechanically ventilated patients: epidemiology and association with patient outcomes. *Crit Care Med*. 2018;46(4):e305–e311.
- Rello J, Kalwaje Eshwara V, Lagunes L, *et al*. A global priority list of the TOP TEN resistant Microorganisms (TOTEM) study at intensive care. *Eur J Clin Microbiol Infect Dis*. 2019;38(2):319–323.
- Moromizato T, Liangos O, Averbuch T, *et al*. Association between sepsis and new-onset atrial fibrillation during hospitalization. *Chest*. 2015;147(4):1022–1028.
- Shehabi Y, Chan L, Kadiman S, *et al*. Sedation depth and long-term mortality in mechanically ventilated critically ill adults: a prospective longitudinal multicentre cohort study. *Intensive Care Med*. 2013;39(5):910–918.
- Yasar E, Inci K, Aygencel G, Turkoglu M. Characteristics and Outcomes of Critically Ill Medical Patients with Invasive Mechanical Ventilation: A Retrospective Cohort Study. *J Crit Intensive Care*. 2024;15(3):102–109.
- Tadesse EE, Tilahun AD, Yesuf NN, Nimani TD, Mekuria TA. Mortality and its associated factors among mechanically ventilated adult patients in the ICUs of referral hospitals in Northwest Amhara, Ethiopia, 2023. *Front Med*. 2024;11:1345468.
- Ismaeil T, Almutairi J, Alshaikh R, *et al*. Survival of mechanically ventilated patients admitted to intensive care units: Results

- from a tertiary care center between 2016–2018. *Saudi Med J*. 2019;40(8):781–788.
26. Shafi MJ, Nasrin S, Iqbal MJ. Characteristics and clinical outcomes of patients on mechanical ventilation in the coronary care unit of a tertiary care hospital in Bangladesh. *Bangladesh Heart Journal*. 2023;38(1):23.
27. Tsegay K, Teklu T, Debebe F, Beza L. Outcomes of patients on mechanical ventilation among adult intensive care units of Tikur Anbesa Specialized Hospital, Addis Ababa, Ethiopia. *Research Square*. 2023. doi:10.21203/rs.3.rs-3368699/v1.