Original Research Article

An Analytical Cross-Sectional Study on the Impact of Clinical Profile on the Outcome of Patients on Mechanical Ventilation at a Tertiary Care Centre

P. Maneesha[1], K. Sri Prabhatha[2], B. Neeharika[3*]

[1]Assistant Professor, Department of Respiratory Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari, Andhra Pradesh, India
[2]Assistant Professor, Department of Respiratory Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari, Andhra Pradesh, India
[3]Associate Professor, Department of Respiratory Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari, Andhra Pradesh, India

Received: 29-11-2021 / Revised: 17-12-2021 / Accepted: 30-12-2021

Abstract

Introduction: Mechanical ventilation (MV) is an invasive life supporting device to mimic the respiratory physiological function at the time of impending respiratory failure. There is dramatic improvement in the survival of critically ill patients, but also associated with complications affecting the overall outcome. A part from the severity of underlying disease, MV and care related parameters also influence the outcome. **Aim:** To determine the outcome of mechanically ventilated patients in an ICU depending on their clinical profile**. Materials and Method**: Retrospective cross sectional study for duration of 6 months. **Inclusion criteria**: Patients >18years of age, male and female patients, All patients requiring MV support for >12hours, Patients with failing respiratory drive or who failed O2 therapy and NIV are eligible for the study. **Exclusion criteria:** Patients <18years of age, Patients who died within12 hours of intubation, Patients who were extubated <12 hours of intubation, Pregnant and lactating women, patients with Incomplete data**. Conclusion**: Increased mortality observed in patients with sepsis and more number of ventilator days and increased length of hospital stay.

Keywords: Mechanical Ventilation, ICU, Outcome

Introduction

Mechanical ventilation (MV) is an invasive life supporting device to mimic the respiratory physiological function at the time of impending respiratory failure[1]. With the advancement in the ICU care facilities, there is a dramatic increase in the survival of critically ill patients, but also associated with complications which affects the overall outcome. ICU is one of the places where patients are admitted with complexity of the disease and are vulnerable to experience adverse outcomes due to multiple interventions [1]. Complications during MV involving lungs and other organs play a significant role in increasing the morbidity and mortality of the patient. There are not many studies looking at unselected broad patient spectrum and much concentration is given to specific disease and patient groups [2]. A part from the severity of the underlying disease, MV and care related parameters also influence the outcome of patient.

The spectrum of patients admitted to ICU with the health care resources and practices in developing countries is different from developed countries [2]. Hence it is essential to get information on the outcome of patient on MV in a resource limited settings. This study also helps to know the mortality rate in ICU and also reveal areas of improvement in our patient care delivery.

Aim and Objective

To determine the outcome of mechanically ventilated patients in an ICU depending on their clinical profile, length of stay and complications.

*Correspondence
Dr. B. Neeharika
Associate Professor, Department of Respiratory Medicine, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari, Andhra Pradesh, India.
E-mail: asramlibrary@gmail.com

Materials and Method

Retrospective cross sectional study for duration of 6 months. A thorough data analysis of all the included patients will be done.

Inclusion criteria

Patients >18years of age, male and female patients.
All patients requiring MV support for >12hours.
Patients with failing respiratory drive or who failed O2 therapy and NIV are eligible for the study.

Exclusion criteria

Patients <18years of age,
Patients who died within 12 hours of intubation,
Patients who were extubated <12 hours after intubation,
Pregnant and lactating women
Patients with Incomplete data

Methodology

During the study period total 125 patients were admitted to ICU for mechanical ventilation. Out of which 99 patients met the inclusion criteria. All the patient's data was analyzed for indication of admission and ventilation, symptomatology, Arterial Blood Gas (ABG), microbiological cultures, duration on IMV, length of hospital stay and they were related to the outcome of the patient. Outcome is measured as extubated and survived or dead.

Results

Socio-Demographic characteristics of ventilated patients

The present study was carried out at a rural based tertiary care

hospital over a period of April 2021 to October 2021. A total of 99 patients required ventilator support for more than 12 hours. Out of 99 patients, 37 were female and 62 patients were male with 61 to 70 years as predominant age distribution.

Indication for admission

The indications for IMV were identified as pneumonia in 25 (25.3%) patients, 15 (15.2%) neurological diseases, 10 (10.1%) non-pulmonary sepsis, 15 (15.2%) acute on chronic respiratory failure (COPD / Asthma), 10 (10.1%) cardiogenic/ hypovolemic shock, 11 (11.1%) cardiogenic pulmonary edema, 3 (3.0%) aspiration and 10 (10.1%) others cases.

Co morbidities

The co morbidities observed were, 69 (69.7%) patients had HTN, 63 (63.6%) T2DM, 10 (10.1%) with hypothyroidism, 25 (25.3%) had CKD (chronic kidney disease), 5 (5.1%) CLD (chronic liver disease), 52 (52.5%) with respiratory co morbid conditions, 49 (49.5%) cardiac co morbid conditions, 10 (10.1%) CNS co morbid conditions, 5 (5.1%) had malignant conditions, 8 (8.1%) were chronic alcoholic, 38 (38.4%) smokers / tobacco chewer and 7 (7.1%) had other co morbid conditions. Majority of patients (66.7%) had three to four co morbid conditions together.

Microbiological profile

Bacterial growths were positive in 25 blood cultures and 42 tracheal aspirates. Among them VAP was diagnosed in 10 and 22 cases respectively. Hence, growths from tracheal aspirates were more significantly associated with development of VAP.

Of 67 culture isolates, Gram negative organisms were predominantly isolated and K.pneumoniae was in majority (34) of cases. P.aeruginosa (15), S.pneumoniae (9), Staphylococcus aureus (4), Enterococcus spp (3), E.coli (2) of cases. The organisms grown were similar in both early and late VAP in our study which was similar to the study by Ravi k et al [3].

Complications

The complications developed out of 99 patient were, 27 (27.3%) developed ARDS, 32 (32.3%) ventilator associated pneumonia (VAP), 50 (50.5%) sepsis, 30 (30.3%) developed shock, 33 (33.3%) acute renal failure (ARF), 5 (5.1%) multiorgan dysfunction (MODS), 20 (20.2%) UTI and 14 (14.1%) developed gastrointestinal (GI) bleeding.

Length of stay

In our study, mean duration on ventilator days was 9.64 days with SD of 5.95. The range of on ventilator days was 2days to 27 days (Table 1). Mean duration of hospital stay (days) was 20.38 days with SD of 10.07. The range of hospital stay was 3 days to 60 days (Table 2).

Table 1: Distribution of on ventilator days in patients

ON VENTILATOR DAYS	Frequency	%
<=7 days	44	44.4%
8 - 14 days	37	37.4%
15 - 30 days	18	18.2%
Total	99	100%
Mean ± SD	9.64 ± 5.95	
Min - Max	2 - 27 days	

Table 2: Distribution of hospital stay (days) in patients

DURATION OF HOSPITAL STAY (DAYS)	Frequency	%
<=7 days	8	8.1%
8 - 14 days	27	27.3%
15 - 21 days	22	22.2%
22 - 30 days	29	29.3%
>30 days	13	13.1%
Total	99	100%
Mean ± SD	20.38 ± 10.07	
Min - Max	3 - 60	

Outcome

It was observed that 45 (45.5%) patients survived after invasive ventilatory support for more than 12 hours and 54 (54.5%) patients died (Table 3). The mean age of survived patients was 59.64 years with SD of 11 and mean age of dead patients was 68.28 years with SD of 11.35 years. Maximum mortality was 90.9% in 81 to 90 years age group. This result was found statistically significant ($p<0.05$).

Table 3: Comparison of mean age with mortality

Outcome	N	Mean ± SD	P Value
Survived	45	59.64 ± 11.00	<0.001
Dead	54	68.28 ± 11.35	

Factors associated with outcome

In our study 54 (54.5%) died out of which 21 (38.9%) were females and 33 (61.1%) were males. Comparison of mortality among male (53.2%) and female (56.8%) study group with p 0.672 did not show much difference. This result was found statistically non-significant (p>0.05).

Out of 99 patients, 54 (100%) died which included 12 (22.2%) pneumonia cases, 9 (16.7%) neurological cases, 7 (13.0%) non pulmonary sepsis, 8 (14.8%) acute on chronic respiratory failure cases, 5 (9.3%) cardiogenic / hypovolemic shock cases, 5 (9.3%) cardiogenic pulmonary edema cases, 2 (3.7%) aspiration cases and 6 (11.1%) other cases. Comparison of mortality among different diagnosis groups showed that patients with non pulmonary sepsis had higher mortality (70.0%) (Table 4). This result was found statistically non-significant (p>0.05).

Table 4: Comparison of mortality among diagnosis on admission

Diagnosis on Admission	Total	Survived		Dead		P value
		Frequency	%	Frequency	%	
Pneumonia	25	13	52.0%	12	48.0%	0.950
Neurological	15	6	40.0%	9	60.0%	
Non -Pulmonary sepsis	10	3	30.0%	7	70.0%	
Acute on chronic respiratory failure	15	7	46.7%	8	53.3%	
Cardiogenic / Hypovolemic shock	11	6	54.5%	5	45.5%	
Cardiogenic pulmonary edema	10	5	50.0%	5	50.0%	
Aspiration syndromes	3	1	33.3%	2	66.7%	
Others	10	4	40.0%	6	60.0%	
Total	99	45	45.5%	54	54.5%	

Out of 99 patients, 69 had HTN with 53.6% (n=37) mortality, 63 had T2DM with 52.4% (n=33) mortality, 10 had hypothyroidism with 60% (n=6) mortality, 25 had CKD with 48.0% (n=12) mortality, 5 had CLD with 100% (n=5) mortality, 52 had respiratory co morbid conditions with 55.8% (n=29) mortality, 49 had cardiac co morbid conditions with 61.2% (n=30) mortality, 10 had CNS co morbid conditions with 80% (n=8) mortality, 5 had malignant conditions with 100% (n=5) mortality, 8 were alcoholic with mortality 62.5% (n=5) mortality, 38 were smoker / tobacco chewer with 65.8% (n=25) mortality and 7 had other co morbid conditions with 42.9% (n=3) mortality. From this result chronic liver disease (CLD), malignant conditions were found statistically significant (p<0.05) and other co morbid conditions were found statistically non-significant (p>0.05).

Patients had more than one co morbid conditions together and comparison between cluster of co morbid conditions and mortality showed that increase in number of co morbidities associated with high mortality. This result was found statistically significant (p<0.05).

45 of 99 patients survived with median 6.5 days (IQR = 4.0-9.25) and 54 died with median 11.5 days (IQR = 6.0-16.0) (table 19). Maximum mortality 100% was found in patients with more than 15 days of duration on ventilator stay. This result was found statistically significant (p<0.05).

Out of 99 patients, 45 survived with median duration of hospital of 19 days and IQR of 11.50-26.50 and 54 died with median duration of hospital of 20 days and IQR of 11.75-30 (table 19). Maximum mortality 92.3% was found in patients with more than 30 days duration of hospital stay. This result was found statistically significant (p<0.05).

It was noted that, 27 had ARDS with 92.6% (n=25) mortality, 32 had ventilator associated pneumonia (VAP) with 53.15% (n=17) with mortality, 50 had sepsis with 66.0% (n=33) mortality, 30 had shock with 73.3% (n=22) mortality, 33 had ARF with 63.6% (n=21) mortality, 5 had MODS with 100% (n=5) mortality, 20 had UTI with 40.0% (n=8) mortality, 14 had UGI bleeding with 71.4% (n=10) mortality. From this result ARDS, sepsis, shock and MODS were found statistically significant (p<0.05) and other complications were found statistically non-significant (p>0.05).

Discussion

The use of MV in patients admitted to ICU has been increasing. It is essential to know the characteristics and factors affecting the outcome of ventilated patients and identify the causes for poor outcome. How the age, diagnosis, duration of MV and length of hospital stay would influence the outcome of the patient. This study assessed the characteristics and outcome of MV adult patients admitted to ICU at a tertiary care centre of rural setup.

In this study the mean age was 64.35±11.23 years and 62.6% of them were males.

It was observed that pneumonia (25.3%), neurological (15.2%), non pulmonary sepsis (15.2%) were predisposing to more than 50% of total causes. This finding differs from some rural studies where most of the admissions in rural India were due to poisoning and envenomation [4, 5].

Age and co morbidities are independent factors associated with hospital mortality. The finding in our study correlates with studies in which increasing age is independently associated with mortality [6, 7]. Gender was not independently associated with mortality in our study. Co morbidities like HTN, diabetes, CKD, CAD were found to have significant association with mortality. These finding were in line with other publications.

Having large number of cases of sepsis mortality, attention should be given on prevention of nosocomial infections. Sepsis assessment with specific scoring system should be implemented. Early blood and endotracheal secretions culture, rationale use of antimicrobials should be done. Suitable interventions like dialysis, invasive ventilation should be made early when indicated to reduce to delay in the treatment which results in poor outcome of the patient.

The duration of MV has been reported to be directly associated with the incidence of VAP. Fagon et al. estimated an increased risk of 1% per day of mechanical ventilation [8]. Rajan N et al. in their study found that the incidence of VAP increased in patients who were on MV for >15 days[9]. In our study patients who had been on MV for >10 days were more likely to develop VAP compared to those with MV for <10 days which is correlating with the study conducted by Umara et al [10].

The overall mortality rate as an outcome in patients requiring MV was high (54.5%). This rate is similar to the studies from low resource settings in rural areas [11, 12] that had documented mortality rates of

more than 70%. This is in contrast to global trends, where mortality of MV patients had improved >60% over last decade, due to advances in medical and access to medical aids. These observations suggest that MV in low resource settings need extensive appraisal [13].

Poor outcome in our study could be explained by various patient and health care related factors. Patient factors like chronic medical conditions, risk factors, advanced age at presentation, patient being referred in advanced stage of disease may influence the outcome. Health care factors include lack of resources and delay in pre hospital care would result in poor outcome.

The causes for need of MV should be justified in patients with chronic health conditions and advanced age which has association with poor outcome. The most important and easy way to improve outcomes in open ICU is effective communication[14]. Recognizing critical illness and treating needs specialist intensive care clinicians. Nurse to patient ratio also may have influence on efficient patient care[15].

Limitations

The findings in the study are subjected to some limitations. As the natures of the study was retrospective conducted at single centre, no direct intervention or observation of the patient was done. Limited number of patients and also the study focused on factors influencing outcome of the patient and not on post ICU discharge. Despite the limitations, this study also has strengths, as it could assess the characteristics that influence the outcome at our centre and measures to improve ICU patient care.

Conclusion

The mortality rate of MV patients in the selected hospital was substantially high. Patients with diagnosis of Sepsis have higher mortality rate. More number of co morbidities, more ventilator days and increased length of hospital stay were found to have independent association with mortality in this study. The high mortality rate in patients requiring ventilator support from low- resource setting is suggesting the need for extensive improvement in ICU protocols. Reasons leading to worse outcome can be hypothesized due to delayed presentation of patient to the hospital, lack of resources, elderly age presentation and end referral centre in our area. The information on patient characteristics and outcome would help to improve health care services and reduce the mortality in IMV patients in rural settings.

Abbreviations

ICU- Intensive care unit, MV- Mechanical Ventilation, MODS- Multiple organ dysfunction, VAP- Ventilator associated pneumonia, ARDS- Acute respiratory distress syndrome, NIV- Non invasive ventilation, IMV- Invasive mechanical ventilation, COPD- chronic obstructive pulmonary disease, HTN- hypertension, T2DM- Type 2 Diabetes mellitus, CKD- chronic kidney disease, CLD- chronic liver disease, UTI- urinary tract infection.

References

1. Clinical profile and outcome of ventilated children in a pediatric intensive care unit (PICU): A study in Dhaka shishu (children) hospital, Dhaka, Bangladesh Shafiul Hoque et al., SAS Med. 2020;6(12):242-246 .
2. A retrospective study on clinical profile and outcome of respiratory cause of ventilation in children with age group between 1 month to 5 years in pediatric intensive care unit of a tertiary centre hospital. J pediatr crit care. 2017;4(2):28-30
3. Ravi et al. Bacteriological profile and outcome of VAP. Asian journal of Medical Sciences, 2017;8(5):12.
4. Karthikeyan B, Kadhiravan T, Deepanjali S, Swaminathan RP. Case mix, care processes and outcome in medical-III patients receiving mechanical ventilation in a low- resource setting from south India: a prospective clinical case series. PLoS One. 2015;10(8):1-16.
5. Esteban A, Anzueto A, Frutos F, Alia I, Brochard L et al. Characteristics and outcome in adult patients receiving mechanical ventilation: a 28 day international study. JAMA. 2002;287:345-55.
6. Luhr OW, Antonsen K, Karlson M, the ARF study Group, et al. Incidence and mortality after acute respiratory failue and acute respiratory distress syndrome in Sweden, Denmark, Iceland. Am J respire Crit Care Med. 1999; 159:1849-61.
7. Behrendt CE. Acute respiratory failure in the United states. Chest. 2000;118:1100-5.
8. Fagon JY, Chastre J, Domart Y, Trouillet JL, Pierre J, Darne C et al. Nosocomial pneumonia in patients receiving continuous mechanical ventilation: prospective analysis of 52 episodes with use of a protected specimen brush ans quantitative culture techniques. American review of respiratory Diseases. 1989;139(4):877-884.
9. Rajan N, Chaudhary U, Chaudhry D, Ranjan KP. Ventilator- Associated pneumonia in a tertiary care intensive care unit: Analysis of incidence, risk factors and mortality. Indian J Crit Care Med. 2014;18(4):200-04.
10. Umara et al. Microbiological profile and clinical outcome of ventilator- associated pneumonia patients in an intensive care init at a teritiary care Institute of North India. International journal of research and review, 2020,7(12).
11. Rajapakse VP, Wijeswkera S. Outcome of mechanical ventilation in Sri Lanka. Ann R coll Surg Engl. 1989;71:344-6.
12. Sundarasanam TD, Jeyaseelan L, Thomas K, John G. Predictors of mortality in mechanically ventilated patients. Postgrad Med J. 2005;81:780-3.
13. Esteban A, Feutos- Vivar F, Muriel A, Ferguson ND et al. Evolution of mortality over time in patients receiving mechanical ventilation. Am J Respir Crit Care Med. 2013;188:220-30.
14. Pronovost PJ, Angus DC, Dorman T, Robinson KA, Dremsizov TT, Young TL. Physician staff patterns and clinical outcomes in critically ill patients: a systematic review. JAMA. 2002;288:2151-52.
15. Needleman J, Buerhaus P, Pankratz VS, Leibson CL, Stevens SR, Harris M. Nurse staffing and inpatient hospital mortality. N Engl J med. 2011;364(11):1037-45.

Conflict of Interest: Nil Source of support: Nil