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A STUDY OF CLINICAL PROFILE AND PREDICTORS OF OUTCOME IN PATIENTS REQUIRING MECHANICAL VENTILATION.

General Medicine

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ABSTRACT

Background: Acute respiratory failure (ARF) is a common cause of admission to intensive care unit (ICU) that occurs due to several reasons. Among ICU patients, 40-65% patients need mechanical ventilation during their ICU stay. **Aims and objectives:** To determine the clinical profile and predictors of outcome in cardiac patients with preserved ejection fraction requiring mechanical ventilation in a tertiary medical care unit of central India. **Design-** Observational longitudinal study. **Methods:** This was a longitudinal study conducted in Department of Medicine,Ashram medical college ,Eluru. A total of 100 patients in medical ICU requiring mechanical ventilation were included in the study. Data was entered and analyzed. **Results:** 20.83 patients per 100 patients required mechanical support among those admitted in ICU . Mean age was 46.88 ±19.58 years with male (57%) predominance. Association between patient outcome with sepsis ($p<0.001$), Ventilator associated pneumonia ($p<0.001$), presence of pneumothorax ($p<0.001$), extubatuion trial ($p<0.001$) and presence of comorbidities ($p<0.001$) was found to be statistically significant. **Conclusion:** This study may contribute to better knowledge of risk factors, better ICU environment, proper use of ventilators and the measures to prevent of complications arising during ventilation that can have a bearing on the patient's outcome.

KEYWORDS

INTRODUCTION:

Acute respiratory failure (ARF) is a common cause of admission to intensive care unit (ICU) that occurs due to several reasons, including pulmonary disease, neuromuscular disease, shock and the need for airway protection and respiratory support after major procedure[1]. Mechanical ventilation (MV) is cornerstone for management of acute respiratory failure[1].Patients receiving MV require a complex, well–organized and technologically sophisticated level of care[2,3]. However, despite significant advance in ventilatory support, it remains associated with higher mortality as compared to those who do not require ventilatory support[4].

Knowledge of clinical profile of patients requiring MV, including condition of patients at the start of MV, comorbidities, other factors developing during the course of MV, may help to assist clinician in decision making process and better resources allocation.[5]

According to western literature higher mortality rates are reported in patients who require complicated ventilation[5]. The conditions such as acute respiratory distress syndrome (ARDS), multiple organ dysfunction syndrome (MODS), sepsis, and aspiration pneumonia accounts for higher mortality rates[6].

Very little data has been published from Indian researchers regarding etiology, course, complication and the outcome in mechanically ventilated patients.

Thus, this study aimed to determine the clinical profile and predictors of outcome in patients requiring mechanical ventilation in a tertiary medical care unit of central India.

MATERIALS AND METHODS:

Study design: Observational Longitudinal Study

Study area: Department of Medicine, ASRAM medical college

Study duration: September 2020 to august 2022

Sample population: 100 participants

Methodology: Permission to conduct the study was obtained from the ethical committee of ASRAM Medical College, Eluru, Andhra Pradesh. The study was conducted on patients above 18 years of age in medical ICU requiring medical ventilation at Department of Medicine, ASRAM Medical College, Eluru.

After obtaining informed consent and explaining the purpose of study to the participants, data collection was done and information was recorded on a predesigned, pretested and semi-structured questionnaire.

The questionnaire included information on socio-demographic profile, details of clinical and laboratory investigations. Socio-demographic variables included details on age, gender, contact number, address, etc. Clinical data included the details of the duration of in-hospital stay, duration of medical ICU stay, duration of stay on MV support, clinical diagnosis, complications and treatment, recordings of the sensorium, body temperature, pulse rate, blood pressure, respiratory rate and the ventilator settings.

Laboratory data including complete haemogram, serum biochemistry, blood, urine and endotracheal aspirate culture and sensitivity reports, chest radiograph, 12-lead electrocardiogram (ECG) other special investigations done as per the needs of the individual patient. The outcome was recorded as discharge or death. All the patients were managed as per the treatment protocols of the institute.

The results thus obtained from clinical/laboratory examinations were recorded and analyzed.

Inclusion criteria:

Patients above 18 years of age in medical ICU requiring medical ventilation

Exclusion criteria:

1. Patients below 18 years of age
2. Patient intubated during CPR

Investigation:

- Complete Haemogram
- Serum Biochemistry
- Urine Analysis
- Blood Urine Endotracheal Aspirate Culture & Sensitivity Report
- Chest Radiogram
- 12 lead electrocardiogram

Statistical analysis: Data was entered into MS excel 2007, analysis was done with the help of Epi info Version 7.2.2.2. Frequency and percentages were calculated. Quantitative variables were expressed as the mean and standard deviation. Categorical data was expressed as percentage. Microsoft office was used to prepare the graphs ,wherever

needed Yates correction was also done. P<0.05 was taken as statically significant.

RESULTS:

A total of 480 patients were admitted in ICU .Out of these,100 patients require mechanical ventilation.Thus,20.83patients per 100 patients required mechanical support among those admitted in ICU.

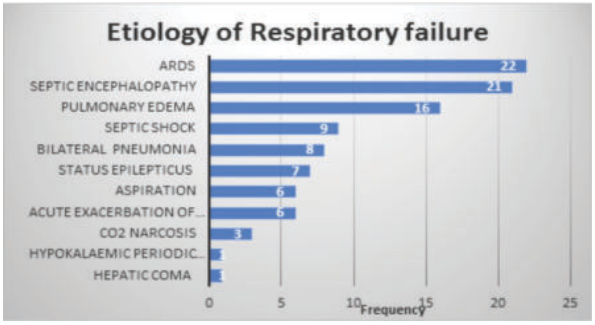

Figure 1: Distribution of study participants on the basis of etiology of respiratory failure

Distribution of study participants on the basis of etiology of respiratory failure have been displayed in figure 1. 22% of participants reported ARDS, followed by septic encephalopathy (21%), pulmonary edema (16%) and septic shock (9%) status epilepticus (7%).

51% of the patients were admitted in ICU for the duration of 3 to 6 days. While 44% of the participants stayed in ICU for 0 to 2 days. Among patients requiring mechanical ventilation, 66% of the patients were successfully discharged while 34% reported mortality. 57% were male while 43% were females. The mean age of study participants was found to be 46.88 ±19.58 years. Around 41% of study participants were in the age group of 41 to 60 years. While only 10% of participants, each, were aged less than 20 years and more than70years. Table 1 displays various parameters with their mean values.

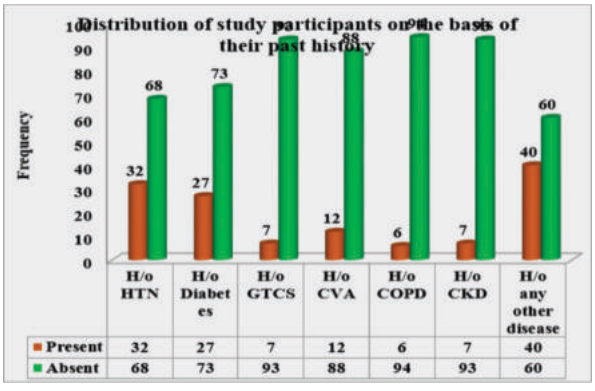

Figure 2: Distribution of study participants on the basis of their past history

Figure 2 shows that, 32% of patients reported presence of hypertension, 27% were diabetic, 7% reported previous history of GTCS and12% patients had previous history of CVA. 6% of them had COPD in the past. Previous history of chronic kidney disease was observed in 7% of patients on mechanical ventilation. It should be noted that in around 40% of patients, previous history of any other disease was observed, which included pulmonary tuberculosis, Coronary artery disease, People living with HIV/ AIDS and double valve replacement.

Table1:Patientcharacteristicsparametersonadmission

Sl. No.	Variables	Minimum	Maximum	Mean	Std. Deviation
1	Age (in years)	18	89	46.88	19.584
2	SpO2 on room air (in %)	56	90	58.25	14.408
3	Haemoglobin (in gm/dl)	5.0	14.2	9.222	1.8571
4	TLC (in cells/dl)	5000	115000	14559.11	14778.757
5	Platelets (in cells/µl)	40000	320000	141779.00	55583.969
6	ESR (in mm/hr)	14	145	44.19	30.319
7	CRP (in mg/l)	9	320	55.58	54.647
8	FBS (in mg/dl)	71	541	137.49	62.375
9	PPBS (in mg/dl)	120	619	218.77	98.203
10	Urea (IN mg/dl)	18	230	82.38	33.665
11	Creatinine (in mg/dl)	.63	9.00	2.5598	1.65885
12	Sr. Bilirubin (in mg/dl)	.30	7.10	1.5461	1.19949
13	SGOT (in u/l)	19	225	62.40	37.534
14	SGPT (in u/l)	10	301	70.44	45.512
15	Sr. Protein (in gm/dl)	5.0	7.0	5.816	.4359
16	S. Albumin (in gm/dl)	2.0	4.0	2.899	.4162
17	Sodium (in mmol/l)	113	145	128.27	6.745
18	Potassium (in mmol/l)	1.60	6.10	3.7289	.92689

Table 2: Distribution of study participants on the basis of their clinical profile

	Sl. No.	Variables	Frequency (n=100)	Percentage (%)
General Examination	1	Abnormal Pulse <60 &/ >100 bpm	64	64.0
	2	SpO2 on room air≤ 60%	65	65.0
	3	SBP<100 &/ >140 (in mmHg)	44	44.0
	4	DBP<60 &/ >100 (in mmHg)	9	9.0
	5	Pallor (Present)	39	39.0
	6	Icterus (Present)	22	22.0
	7	Edema (Present)	37	37.0
Laboratory investigations	1	Hblevels (less than normal range)	98	98.0
	2	TLC levels (abnormal levels)	65	65.0
	3	Platelet levels <1.5 lakhs/ul	66	66.0
	4	ESR levels > 22 mm/hr	74	74.0
	5	CRP levels >10 mg/L	95	95.0
	6	FBS > 126 mg/dl	41	41.0
	7	PPBS > 200 mg/dl	65	65.0
	8	Urea levels > 35 mg/dl	100	100.0
	9	Creatinine levels > 1.3 mg/dl	75	75.0
	10	Bilirubin levels >1.2 mg/dl	51	51.0
	11	SGOT levels > 45 U/L	57	57.0
	12	SGPT levels > 56 U/L	51	51.0
	13	Sr. Protein levels < 6 gm/dl	49	49.0
	14	Sr. Albumin levels < 3 gm/dl	52	52.0
	15	Sodium levels < 135 mmol/l	82	82.0
	16	Potassium levels < 3.5 mmol/l	55	55.0

Distribution of study participants on the basis of their clinical profile has been depicted in table 2. On general examination, it was observed that abnormal pulse was found to be 64% of patients. 65% of patients had SpO2 - 60% and less. 56% of patients reported systolic BP within normal limits and 91% of patients reported diastolic blood pressure within normal limits. Pallor was found in 39% of patients. 22% reported icterus and37% patients had edema. 56% of participants were stuporous at the time of admission followed by 37% drowsy patients.

Only 2 % of participants reported normal Haemoglobin levels. In 65% of patients, TLC levels were >11,000 cells/dl. Around 66% of patients had platelets <1.5 lakhs/ul, 74% patients reported ESR > 22 mm/hr and 95% of patients reported CRP > 10 mg/L. Raised levels of FBS and PPBS were observed in 41% and 65% of the participants respectively. Raised levels of creatinine, Bilirubin, SGOT and SGPT were observed among 75%, 51%, 57% and 51% of patients respectively. Table 2 also shows that, only 51% of patients reported protein levels within normal (6 to 8 gm/dl) limits. 48% of patients reported albumin levels between 3 to 5 gm/dl.Only 18% of study participants had normal (135 to 145 mmol/l) levels of sodium.55%, 31% and 14% of the participants reported potassium levels between <3.5 mmol/l, 3.5 to 5 mmol/l and >5 mmol/l respectively.Bilateral hazy infiltrates were reported among 87% of study participants on Chest X-ray findings.

Table 3: Distribution of study participants on the basis culture sensitivity

Sl. No.	Cultures Sensitivity	Frequency (n=100)	Percentage (%)
A	Blood culture		
1	Sterile	84	84.0
2	Acinetobacter	2	2.0
3	Escherechia Coli	1	1.0
4	MRSA	6	6.0
5	Pneumococcal	3	3.0
6	Pseudomonas	8	8.0
7	Staphylococcus	10	10.0
8	Streptococcal pneumoniae	6	6.0
B	Urine culture		
1	Sterile	79	79.0
2	Candida	9	9.0
3	E. Coli	8	8.0
4	Others	4	4.0
C	ET aspirate culture		
1	Sterile	70	70.0
2	Acinetobacter	2	2.0
3	Enterococcus	3	3.0
4	Haemophilus	2	2.0
5	Klebsiella	4	4.0
6	Pneumococcus	3	3.0
7	Psedomonas	2	2.0
8	Salmonella	4	4.0
9	Staphylococcal	4	4.0
10	Streptococcal	3	3.0
11	Others	3	3.0

Table 3 shows the distribution of study participants on the basis of culture sensitivity from blood, urine and endotracheal aspirate. Majority of the study participants reported sterile aspirates from blood (64%), urine (79%) and ET aspirate (70%). Among complications as per our study, 41% of patients reported sepsis, 19% reported Ventilator associated pneumonia, 8% reported bedsores, 17% reported Pneumothorax.

Table 4: Association between various predictors with patient outcome

Sl. No.	Variable	Outcome (n = 100)			$\chi 2$ (p- value)
		Death (34)	Discharge (66)	Total	
1	Sepsis (Present)	23	19	42	13.910 (<0.001)
2	VAP (Present)	13	6	19	12.385 (<0.001)
3	Pneumothorax (Present)	16	1	17	32.988 (<0.001)
4	Extubation trial	1	47	48	41.903 (<0.001)
5	Age (>50 years)	27	51	78	0.060 (0.807)
6	Comorbidities (Present)	29	12	41	41.782 (<0.001)

Table 4 depicts association between various predictors and Patient Outcome.p<0.001depicts that the association of patient outcome with sepsis is statistically significant. Similarly, significant association was observed between patient outcome with Ventilator associated pneumonia, presence of pneumothorax, extubation trial and presence of comorbidities.

DISCUSSION:

A total of 480 individuals were hospitalized to the medical intensive care unit during the course of our research. 100 of them needed to be ventilated with invasive mechanical ventilation. Ventilatory support was needed in 20.83% of patients admitted in the medical ICU of ASRAM hospital.

In our study, hospital mortality rate of patients who required mechanical ventilation (MV) was 34% while 66% patients were successfully discharged. Factors associated with increased mortality included conditions present before the start of ventilation as well conditions developing during course of MV. The underlying diseases which required initiation of MV were themselves found to be the major attributing factor for mortality in patients on invasive mechanical ventilation.

The underlying diseases, which included ARDS (22%), sepsis (21%), pulmonary edema (11%), septic shock (9%) and bilateral pneumonia (8%) were found to be the main reason for initiation of MV

As per our study, it was observed that maximum (51%) of the patients were admitted in ICU for the duration of 3 to 6 days. While 44% of the participants stayed in ICU for 0 to 2 days.

In present study hospital mortality was 34% and 66% patients were successfully discharged.

In our study at the time of admission, 56 percent of participants were stuporous, followed by 37 percent patients drowsy in our study. Low Glasgow score also linked to higher mortality similar to findings in our study.

Among complications as per our study, 41% of patients reported sepsis, 19% reported Ventilator associated pneumonia, 8% reported bedsores, 17% reported Pneumothorax.

In present study, 13/100 cases complicated with VAP reported as outcome. The association was found to be statistically significant (p<0.001). Similarly, 16% cases complicated with pneumothorax reported death as outcome out of 100 participants. The association between outcome with pneumothorax was found to be statistically significant (p<0.001). Association between Sepsis and Patient Outcome was found to be statistically significant, p<0.001.

In our study, extubation trial was attempted in around 48% of participants. On calculation of association between attempted extubation trial with Patient Outcome, it was found to be highly significant with $p < 0.001$. In our study, insignificant association was observed between age of the patients >50 year with patient outcome as per our study

CONCLUSION:

Patients who require mechanical ventilation are likely to have a more serious disease and therefore have higher death rates as compared to other ICU patients. With the increase in availability of MV facility, the number of ICU provided with the respiratory support is expected to increase day by day.

Therefore, this study on patients with MV,was conducted to understand the factor that can aid in improving the outcome in MV patients.

Outcome of MV patients are multifactorial dependant, these factor may be present before MV initiation as well as develop after onset of MV, some of these factors may include previous history of hypertension (HTN), diabetes mellitus (DM), coronary artery disease (CAD). Sepsis and ventilator-associated pneumonia were found to be strongly associated with poor outcome in our study. Similarly, extubation trials were found to be associated with good outcome in our study.

This study may, thereby, contribute to better knowledge of risk factor that can have a bearing on the patient's outcome. Things like a better ICU environment for dealing with critical patients in the acute stage, regular training for ICU staff on opt use ventilators and the measures to prevent of complications arising during ventilation, may improve the final outcome of patients.

Limitation:

The ICU was at tertiary care hospital that admits patients with more severe illness,so the interpretation of result may not generalize to other ICU patients. Also, this was an observational study with no intervention. A prospective longitudinal investigation may be needed to confirm the relationship between various risk variables.

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