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Exploring the short-term prognosis and predictive factors of mechanically ventilated patients

[1]Ali Raza, [2]Ali Mohib, [3]Kashif Lodhi, [4]Hammad Ali, [5]Dr. Abaid ur Rehman, [6]Umar Ali

[1]PIMS
[2]PIMS
[3]Department of Agricultural, Food and Environmental Sciences. Università Politécnica delle Marche Via Brecce Bianche 10, 60131 Ancona (AN) Italy
[4]PIMS
[5]Associate Professor Anesthesia, Rashid Latif Medical College/ Hameed Latif hospital Lahore
[6]PIMS

Abstract:
Objective: Finding out the incidence of short-term mortality among patients undergoing mechanical ventilation at Mayo Hospital in Lahore, Pakistan, is the goal of this descriptive cross-sectional research.
Methods: From September 2021 to September 2022, this research was collaboratively carried out by the gynecology & obstetrics, surgery, and anesthesiology departments at Mayo Hospital.
This research comprised a total of 112 individuals who were given mechanical ventilation. Gender, age, condition at admission, ventilation duration, justification for ventilation, results, and complications were recorded for the patients. Data analysis was performed using SPSS 29.
Results: 54 patients (48.21%) were successfully weaned off, whereas 58 (51.78%) patients passed away. In the first group of patients who died, sepsis (27.5%), coagulopathy (29.3%), VAP/ventilator-associated pneumonia (32.7%), and multi-organ failure (37.9%) were the main causes of death. However, among the survivors, 3 (5.55%) suffered pneumothoraxes, 5 (9.25%) experienced VAP, and 3 (5.55%) experienced a fever with no apparent cause.
Conclusions: In contrast to affluent nations, the short-term death rate of patients receiving mechanical breathing in an intensive care unit (ICU) in Lahore, Pakistan, is much higher.
Keywords: intensive care unit, mechanical ventilation, respiratory distress

Introduction:

The demands of the patients are altering as a result of the vagaries in illness patterns and therapies. In order to manage acute illnesses and control the cyclical nature of chronic diseases, a wise and quick ventilation strategy is crucial [1]. The most often used short-term life support method in the world, mechanical ventilation is used every day for a broad range of reasons, from routine surgical operations to severe organ failure. Since its creation in the biblical age, it has experienced a great amount of evolution. Mechanical ventilators have gone through four generations in use, and smart ventilators are shortly to follow.
These "smart" ventilators are anticipated to, among other things, carry closed-loop control over the majority of ventilatory support functions, electronically connect with other bedside equipment, efficiently ventilate all patients in all situations, and more [2]. Ongoing research is largely responsible for this actual and anticipated growth. In fact, several randomized studies have improved mechanical breathing techniques globally. Mechanical ventilation is connected with known difficulties and potentially fatal

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consequences due to the seriousness and complicated nature of the clinical circumstances of the patients who need it. As a result, anything less than multimodality therapy and preventative efforts will result in subpar results. Unexpectedly, extended ventilation in a critical care situation is a finite resource and can only sustain one organ, the lung, and cannot support any other disease processes. In addition to extensive nursing care, effective mechanical ventilation necessitates a fundamental knowledge of the physiology of breathing and ventilator mechanics. Teamwork, understanding of care objectives, and treatments based on best practices, patient requirements, and therapeutic response are necessary for these critically ill patients who are receiving mechanical ventilation. In order to properly care for patients on ventilators, nurses must be educated, skilled, and confident. Mechanical ventilation has become a widespread kind of therapy.

Figure 1: Mechanical Ventilation

There is less information available than in wealthy nations like the United States on the effectiveness of ventilatory assistance in third-world nations like Pakistan. Little information on Pakistan has been acquired through studies conducted at prestigious hospitals in the biggest cities in the nation [3,4]. Despite their historical and economic contributions to the nation, satellite towns have not been the subject of any research. Finding the short-term mortality rate of patients receiving mechanical ventilation at Mayo Hospital, Lahore, is the goal of this study.

Methods:

This descriptive research looked backward at the medical files of individuals who had mechanical ventilation at Mayo Hospital. During the designated trial period, which ran from September 2021 to September 2022, 156 patients had mechanical breathing. Only 116 patients' medical data, however, were retrievable since the remainder were unavailable. This research included all patients who had been put on mechanical ventilation, regardless of age or length of ventilation. Age, gender, the condition present at admission, the length of ventilation, the reason for ventilation, the results, and complications were the factors observed. Expired, weaned off, and certified brain dead were the three sets of outcomes since the primary objective of this research is mortality. The latter two were combined into one group to estimate mortality. Using SPSS 29, the data were examined. The data were compiled using descriptive statistics. Results and consequences were determined using percentages and frequencies. Age-related numerical data were converted to mean and standard deviation.

Results:

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Four individuals were removed from the study owing to uncertain outcomes after being discharged or sent to higher centers while using portable ventilators out of a total of 116 patients who were included in the evaluation. A total of 112 people were included in the computations, and 59 (52.7%) of them were female and 53 (47.3%) males. With the youngest patient being 4 months old and the oldest patient being 85 years old, the mean age was 38.6 19.37 years. The average length of time the patients were kept on ventilator support was 3.52 days. The smallest time a patient was ventilated mechanically was 30 minutes, while the longest time was 51 days. Acute COPD exacerbations, heart failure, apnea/impending respiratory arrest, and acute hypoxemic respiratory failure accounted for 80.3% of patients who were put on a mechanical ventilator. Most of the surgical instances (19.6%) were those after surgical intervention, either because the patient was prophylactically put on a ventilator or because they had a difficult time recovering from anesthesia. (Table-1). Out of the 112 patients, 50 (44.64%) passed away while receiving mechanical ventilation, and 8 (7.14%) had their ventilators turned off due to being deemed brain dead. The resultant percentage was 51.78%, which represents the short-term death rate. 54 patients (48.11%) were successfully weaned off ventilation (Figure 2). Five patients (9.25%) who were successfully weaned off the ventilator had ventilator-associated pneumonia (VAP), three (5.55%) experienced pneumothorax, and three additional patients (5.55%) acquired a fever with no apparent cause (Table 2).

In the group of patients who passed away, sepsis (27.5%), coagulopathy (29.3%), VAP/ventilator-associated pneumonia (32.7%), and multi-organ failure (37.9%) were the main causes of death. Pneumothorax (12.06%) and cardiac problems (12.06%) were also reported (Table 3).

Table 1: Causes and Effects of Mechanical Ventilation

Indications		**n**	**%**
Medical Causes	No definite indication	4	3.57
	Seizures and status epilepticus	5	4.46
	Respiratory edema	8	7.14
	Muscular dystrophy	1	0.89
	Hypotension	7	6.25
	Cardiac arrest	1	12.5
	Pulmonary failure due to acute hypoxia	9	8.03
	Acutely detrimental asthma	7	6.25
	COPD acute exacerbation	21	18.7
	Impending respiratory arrest and apnea	14	12.5
Surgical Causes	Flail chest	1	0.89
	Traumatic brain damage	4	3.57
	Inadequate healing after surgery	2	1.7
	Postoperative prevention	15	13.3

Table 2: List of the issues related to the survivor group

Complications	**Fever with an unclear cause**	**Pneumothorax**	**Inhalator-related pneumonia**
n	3	3	5

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%	5.55	5.55	9.25

Table 3: Complications that led to mortality in the group of expired patients

Complications	**n**	%
Underlying illness	6	10.3
Cardiovascular issues	7	12.06
Coagulopathy	17	29.3
Septicemia/sepsis	16	27.5
Multiple organ failure	22	37.9
Pneumothorax	7	12.06
Inhalator-related pneumonia	19	32.7

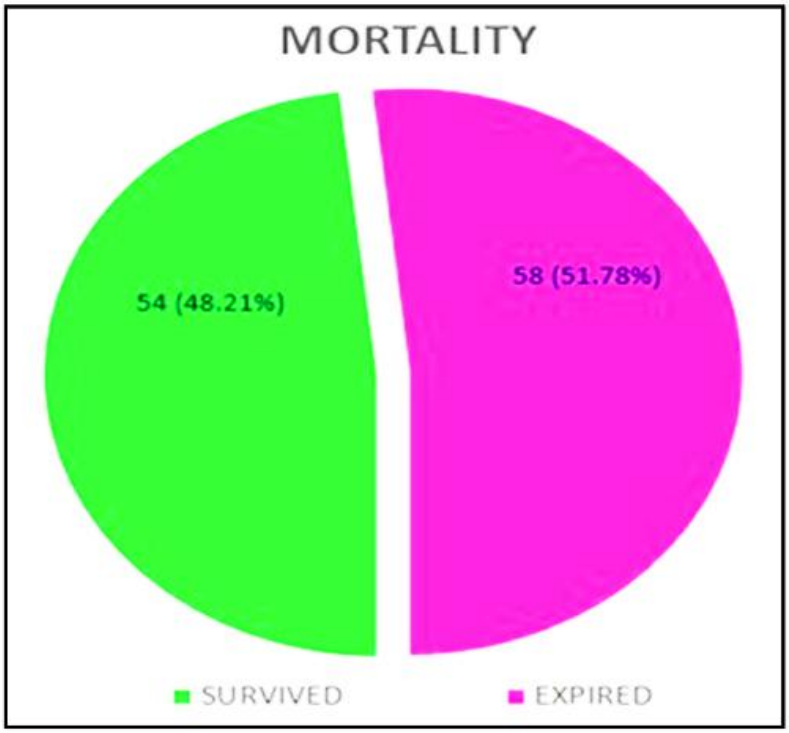

Figure 2: Results of mechanical ventilation in the short term

Discussions:

Mechanical ventilation may indeed save your life. It is given to individuals who are at an elevated risk of pulmonary or cardiovascular compromise, which contributes to its association with significant consequences. The direct mechanical consequences of the intrathoracic pressures produced by the ventilator, alveolar and chronic inflammation, or brain activation may all be contributing factors to these issues [5]. The hypothesized cross-talk between the kidneys and the lung as well as between the brain and the lung is also impacted by mechanical breathing [6,7]. The possibility to avoid or reduce many of

the issues exists. According to this research, 51.78% of patients receiving mechanical ventilation died within the first 30 days. This research compared the results of mechanical ventilation across ICUs in developed and developing nations, with one of its goals being to compare the results between an ICU in Lahore in the poor world and those in wealthy nations. According to research, with a general increase in the care of these critically sick patients, the crude death rate for patients on mechanical ventilation was 31% in 1998 and further decreased to 28% in 2010. The development of several integrated treatment techniques for precipitating circumstances, such as sepsis guidelines linked to ventilator administration, involving sedation and integrating intensive care to avoid nosocomial infections, may have had a role in these results [8,9,10,11] However, a few related research found similar conclusions despite the paucity of data from the underdeveloped world. For patients using mechanical ventilation, the research found that the short-term death rate was 71.5% [12]. In a similar vein, local Pakistani research that looked at ventilator results revealed a death rate of 48% [13]. In another research, the results of patients in the coronary care unit receiving ventilator assistance were recorded, and the death rate was determined to be 70%. This high incidence was mainly caused by the fact that these patients who needed intubation and ventilation in a coronary care context had underlying left ventricular dysfunction, and in almost two-thirds of them, the ejection fraction was 40% or even lower, making it much more challenging for them to wean and extubate [14]. The fact that our center's short-term death rate was 1.85 times makes it clear to us that more has to be done in the poor globe. To rule out the causes of the difference, action is required. The results of mechanical ventilation might vary depending on several variables. The patient's underlying diagnosis and physiological condition at the start of mechanical breathing are among them, and they are a consistent influence in the study. Accelerated physiology and acute health assessment (APACHE) II and SOFA, a clinical grading system, have both been shown to predict the effectiveness of ventilators. pCO2 levels and blood indicators like CRP are further mortality predictors. Unfortunately, this retrospective analysis left little possibility for these factors to be evaluated for this location as well since there was a paucity of collected data. It is a crucial choice that might affect the result to decide when to wean a patient off the ventilator. Diaphragmatic excursion, as opposed to the more conventional volume-based weaning parameters, was shown to be a more accurate modality in predicting weaning failure or success in a previous study [15].

Additionally, iatrogenic problems are linked to mechanical ventilation. Acute lung damage, barotrauma, ventilator-associated pneumonia (VAP), and intubation-associated trauma are a few of them. The ventilator-associated pneumonia is among them, and it is the most prevalent in patients who are mechanically ventilated and the second most frequent nosocomial infection in the intensive care unit (ICU) [16,17]. Due to the destruction of their first-line defenses brought on by endotracheal intubation, these individuals are more likely to have VAP [18]. The likelihood of VAP occurring is greatest during the first few days of hospitalization, according to a few studies, and it is predicted to affect 9–27% of all mechanically ventilated patients. VAP is linked to increased mortality, morbidity, and cost burden [19,20]. As opposed to this, other sources in Pakistan reported, respectively, 33.5% and 28.6% VAP mortality in two distinct tertiary care facilities [21,22]. According to studies, depending on the length and severity of acute respiratory distress syndrome (ARDS), as well as the kind of ventilator being used for treatment, patients receiving mechanical ventilation have an estimated chance of developing barotrauma of 4%–15%, and the incidence of pneumothorax ranges from 14%–87%. Barotrauma is more likely to occur in those with ARDS, whereas asthma and Chronic Obstructive Pulmonary Disease (COPD) patients are thought to have an intermediate risk [23]. Ten (8.92%) pneumothorax instances occurred throughout our research. On the results of mechanical ventilation as a whole, there is not much information. As a result, the

significance of this research as a representative of data from a developing nation like Pakistan is established. In terms of their understanding of prognoses, the data is equally important for doctors. In addition, the research put out the theories that patient presentation delays, a lack of funding, a woefully underfunded healthcare system, and budgetary restraints were to blame for the worse results. The health care system has to be evaluated urgently for ventilator care-related flaws. The fact that established ICUs in the developed world have superior equipment, trained personnel, and a respiratory therapist for mechanical ventilation is one of the main causes of the disparity in fatality rates between the data provided by these studies and Western statistics. Most of these are absent from ICUs in Pakistan. The delayed manifestation of multi-organ dysfunction syndrome may also contribute to the greater fatality rate. By holding monthly training for all medical staff working in the ICU, results may be improved. All medical professionals, including nurses, must receive training in the fundamental principles and practical applications of ventilator management. The choices made by critical care professionals about mechanical ventilation and associated therapies, such as the dose of sedation, may have more significant and lasting residual effects than previously thought. Physical therapy should be provided around the clock to achieve better results and shorten the duration of ventilatory support as well as possible mortality rates in these critically ill patients who are on mechanical ventilation. Early mobilization should be implemented for these patients within 72 hours of the support's initiation. There is now a better knowledge of the physiology of mechanical breathing thanks to decades of study, development, and clinical observation. When the goal of mechanical ventilation shifted from stabilizing blood gas levels to minimizing ventilator-induced lung damage while maintaining acceptable gas exchange, the fundamental tenet of mechanical ventilation was altered. This research did not reveal the long-term results of patients who had received mechanical breathing since it was retrospective in nature and solely examined patients' prior medical information. As of right now, we are unaware of the existential or functional state of our research participants. This research, however, might provide a model for further prospective studies that do keep tabs on patients for a few months or years following discharge.

Conclusions:

Patients who underwent mechanical breathing in an ICU in Lahore, Pakistan, had a short-term death rate that was much greater than that of wealthy nations. To exclude the precise reason for this discrepancy, additional study, especially prospective trials, is required.

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