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The APACHE 3 Prognostic System Risk Prediction of Hospital Mortality in Critically Ill Hospitalized Adults in Medical Intensive Care Unit on Mechanical Ventilation in Tertiary Care Center

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Abstract

Background: Critically ill patients requiring mechanical ventilation have substantial morbidity and mortality, necessitating reliable tools for severity assessment and outcome prediction. The Acute Physiology and Chronic Health Evaluation III (APACHE III) scoring system incorporates physiological variables, age, and chronic health conditions to estimate hospital mortality. **Materials and Methods:** A prospective observational study was conducted among 120 patients requiring mechanical ventilation in the 10-bedded intensive care unit (ICU) of New Civil Hospital, Surat, from May 2018 to October 2019. Demographic characteristics, indications for ventilation, ventilator-related parameters, comorbidities, clinical findings, and laboratory investigations were recorded. The worst physiological parameters during the first 24 h of ICU admission were used to calculate the APACHE III score. Predicted mortality was calculated using the APACHE III mortality equations and compared with observed hospital mortality. **Results:** The majority of patients were aged 18–30 years (48.3%), and 77% were male. Neurological conditions were the most frequent broad indication for mechanical ventilation (67%), with organophosphorus (OP) poisoning being the most common individual diagnosis (50%). Most patients required ventilation for 1–7 days (60%). Overall, 48 patients (40%) died, whereas the mean predicted mortality was 32% and the mean APACHE III score was 62. Higher APACHE III scores were significantly associated with increased mortality ($\chi^2 = 72.018$, $P < 0.001$). A significant association was also observed between mortality and comorbidities ($P < 0.001$) and PaO_2 levels ($P < 0.001$). Among patients with OP poisoning, APACHE III score was strongly associated with mortality ($\chi^2 = 21.071$, $P < 0.001$). **Conclusion:** APACHE III demonstrated good prognostic utility and effectively stratified mortality risk among mechanically ventilated ICU patients. Higher scores were strongly associated with increased observed mortality, supporting its use for outcome prediction in critically ill patients.

Keywords: Acute physiology and chronic health evaluation III, Intensive care unit, Mechanical ventilation, Mortality prediction, Prognostic scoring

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Introduction

Mechanical ventilation is a fundamental component of modern intensive care and is used to support patients with severe respiratory failure, neurological impairment, and other critical illnesses associated with inadequate spontaneous ventilation or oxygenation. Despite advances in ventilatory techniques and critical care management, mechanically ventilated patients remain at substantial risk of morbidity and mortality. In a large international prospective study of mechanically ventilated adults, Esteban *et al*. reported considerable mortality and demonstrated that outcomes were influenced by the underlying clinical condition, severity of illness, and complications developing during mechanical ventilation.[1] Accurate assessment of disease severity and early estimation of mortality risk are therefore important for clinical decision-making, prognostication, resource allocation, and evaluation of intensive care unit (ICU) outcomes.

The increasing complexity of critically ill patients led to the development of standardized severity-of-illness scoring systems. The acute physiology and chronic health evaluation (APACHE) system was initially developed by Knaus *et al*. in 1981 as a physiologically based method for quantifying the severity of illness among critically ill patients.[2] The system was subsequently modified and expanded to improve its prognostic performance and applicability across different ICU populations. Severity-of-illness scores provide an objective method of comparing patients with differing degrees of physiological derangement and allow observed outcomes to be compared with predicted outcomes.

The APACHE III prognostic system, introduced by Knaus *et al*. in 1991, was developed using prospectively collected data from

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17,440 adult ICU admissions across 40 hospitals.[3] APACHE III incorporates acute physiological abnormalities, age, chronic health conditions, major disease categories, and the location from which the patient was admitted to the ICU. The APACHE III score ranges from 0 to 299, with higher scores indicating greater severity of illness. In addition to the numerical score, APACHE III includes disease-specific predictive equations that estimate an individual patient's probability of hospital mortality. In the original validation study, the 1st-day APACHE III equation demonstrated good discriminatory and predictive performance for hospital mortality.[3]

Subsequent evaluation of APACHE III in independent ICU databases demonstrated its usefulness for estimating hospital mortality and assessing ICU performance.[4] However, the accuracy of any prognostic model may vary according to the characteristics of the study population, case mix, disease spectrum, treatment practices, and severity of illness. Therefore, evaluation of the performance of APACHE III in specific patient populations remains important, particularly among critically ill patients requiring mechanical ventilation.

Mechanical ventilation is frequently required in patients with severe neurological disorders, poisoning, acute respiratory distress syndrome (ARDS), sepsis, and other causes of respiratory failure. Esteban *et al*. reported that factors present at the initiation of mechanical ventilation as well as subsequent complications and management-related factors significantly influence survival.[1] In the Indian setting, organophosphorus (OP) poisoning is an important cause of critical illness and may result in respiratory failure requiring prolonged mechanical ventilation. Studies of patients with OP poisoning have demonstrated substantial morbidity and mortality among those requiring ventilatory support.[5] Clinical severity scores have also been investigated as tools for predicting outcome in OP poisoning, with APACHE-based scores showing potential utility in mortality prediction.[6]

The assessment of mortality risk is particularly relevant in mechanically ventilated patients because these patients often have multiple physiological abnormalities and associated comorbidities. Age, neurological status, oxygenation, cardiovascular instability, renal dysfunction, and chronic health conditions may all influence outcome. APACHE III incorporates many of these variables and therefore provides a comprehensive approach to severity assessment. However, the extent to which APACHE III accurately predicts mortality may differ between general ICU populations and highly selected groups of mechanically ventilated medical patients.

In view of the substantial mortality associated with mechanical ventilation and the need for objective prognostic assessment, the present study was undertaken to evaluate the outcome of mechanically ventilated patients admitted to the ICU of New Civil Hospital, Surat, Gujarat, India, and to assess the utility of the APACHE III score and mortality-prediction equations in predicting hospital mortality. The study further aimed to examine the relationship of APACHE III scores with observed mortality and to assess the influence of age, comorbid conditions, physiological abnormalities, and underlying clinical diagnoses on patient outcomes.

Materials and Methods

A prospective observational study was conducted in the 10-bedded ICU of New Civil Hospital, Surat, Gujarat, India, over a period of 18 months from May 2018 to October 2019 after obtaining ethical approval from the Institutional Ethics Committee. A total of 120 patients requiring mechanical ventilation during their ICU stay were enrolled in the study through random selection. Patients admitted directly to the ICU or transferred to the ICU from other medical wards of New Civil Hospital, Surat, were eligible for inclusion. Patients of either sex aged more than 15 years who required mechanical ventilatory support were included in the study.

Data were collected prospectively using a structured questionnaire designed specifically for the study. Each enrolled patient was systematically evaluated and monitored throughout the ICU stay. Demographic and clinical data, including age, sex, date of ICU admission, date of initiation of mechanical ventilation, and duration of ICU stay, were recorded. The primary indication for mechanical ventilation was documented according to predefined clinical categories. These included acute exacerbation of chronic respiratory failure due to obstructive and/or restrictive pulmonary disease requiring ventilatory support because of infection, bronchospasm, cardiac failure, or other acute precipitating events; poisoning resulting in central nervous system depression and primary ventilatory failure; inflammatory and other diseases of the central nervous system, including tetanus, neurotoxic snake bite, and Guillain–Barré syndrome; and hypoxemic acute respiratory failure, including ARDS.

Ventilator-related parameters were documented for each patient, including the mode of mechanical ventilation and relevant ventilator settings. Tidal volume, mean airway pressure, peak airway pressure, respiratory rate, including both set backup and spontaneous patient respiratory rates, and minute ventilation were recorded. Patients were monitored daily with systematic assessment of vital signs and general and physical examination findings. Central venous pressure and peripheral oxygen saturation were monitored as clinically indicated. Patients were closely observed for complications associated with critical illness and mechanical ventilation, and appropriate preventive and therapeutic measures were instituted whenever required.

Routine and specific laboratory and radiological investigations were performed as part of the clinical evaluation. Routine investigations included hemoglobin concentration, complete blood count, urine routine and microscopic examination, renal function tests, serum electrolytes including sodium, serum calcium and magnesium, liver function tests, portable chest radiography, arterial blood gas analysis, and blood glucose estimation. Specific investigations were undertaken according to the clinical indication and included blood culture, urine culture, tracheal aspirate culture, and serum cholinesterase estimation.

The severity of illness was assessed using the APACHE III scoring system. The APACHE III score was calculated using the worst physiological and laboratory values recorded during the first 24 h following ICU admission, together with the patient's age and relevant chronic health conditions. The acute physiology component included assessment of variables such as heart rate, mean arterial pressure, body temperature, respiratory rate, oxygenation parameters, hematocrit, white blood cell count, serum creatinine, urine output, blood urea nitrogen, serum sodium, serum albumin, serum bilirubin, serum glucose, and acid-base status. Neurological status was assessed using the APACHE III neurological scoring system based on eye opening, verbal response, and motor response. The appropriate oxygenation variable was selected according to the inspired oxygen concentration; arterial oxygen tension (PaO_2) was used when the fraction of inspired oxygen (FiO_2) was below 50%, whereas the alveolar-arterial oxygen gradient ($AaDO_2$) was considered when FiO_2 was 50% or greater. Acute renal failure was identified according to the APACHE III criteria based on serum creatinine and urine output in the absence of chronic dialysis.

The age component of the APACHE III score was assigned according to predefined age categories, whereas the chronic health component incorporated the presence of specified serious comorbid conditions, including acquired immunodeficiency syndrome, hepatic failure, lymphoma, metastatic malignancy, leukemia or multiple myeloma, immunocompromised state, and cirrhosis. The individual APACHE III score was obtained by summing the scores assigned to the acute physiology, age, and chronic health components. The resulting total score was subsequently entered into the APACHE III mortality-prediction equation to obtain the estimated probability of hospital mortality. For patients grouped according to their primary disease or indication for mechanical ventilation, the mean predicted mortality was calculated from the individual predicted mortality estimates within each disease category.

The principal outcome measure was hospital mortality among mechanically ventilated ICU patients. The observed clinical outcome was compared with the mortality predicted by the APACHE III scoring system to assess its utility in mortality prediction. The study also evaluated the relationship between APACHE III scores, underlying comorbid conditions, and clinical outcomes among critically ill patients receiving mechanical ventilation.

Results

A total of 120 patients requiring mechanical ventilation during their ICU stay were evaluated in the present study. Their observations were as follows:

Table 1 presents the association between mortality outcome and selected clinical parameters among mechanically ventilated patients. Age was significantly associated with mortality ($P = 0.002$), with the highest number of deaths observed in the 31–60-year age group. Comorbidities were also showed a significant association with outcome ($P = 0.001$); all patients with heart failure and HIV infection expired, whereas patients without documented comorbidities had comparatively better survival. In contrast, the duration of mechanical ventilation was not significantly associated with mortality ($P = 0.18$). A significant association was observed between PaO_2 concentration and mortality ($P = 0.001$), with mortality being highest among patients with lower PaO_2 levels (44–55 mmHg), whereas higher PaO_2 levels were associated with better survival.

Table 2 summarizes the distribution of indications and ventilator-related parameters among the 120 mechanically ventilated patients. Neurological and primary respiratory indications constituted the major indication for mechanical ventilation (67%), followed by ARDS and leptospirosis (20%). Among individual clinical diagnoses, poisoning was the most common indication (50%), followed by ARDS (11.66%) and leptospirosis (8.33%). Endotracheal intubation was the predominant mode of airway access (61.66%), whereas 34.16% of patients underwent endotracheal intubation followed by tracheostomy. Regarding ventilator modes, intermittent positive-pressure ventilation (IPPV) was most frequently used (93.3%), whereas synchronized intermittent mandatory ventilation (SIMV)/continuous positive airway pressure/bilevel positive airway pressure (BIPAP) modes were used in 6.7% of patients.

Table 3 compares the observed mortality with the mortality predicted by the APACHE III scoring system among the 120 mechanically ventilated patients. The observed mortality was 40% (48/120 patients), whereas the mean predicted number of deaths was 32 patients. The mean APACHE III score was 62, indicating a substantial severity of illness in the study population. Overall, the observed mortality was higher than the mortality predicted by the APACHE III score.

Table 4 demonstrates a highly significant association between APACHE III score and mortality among patients with OP poisoning ($P = 0.0001$). No deaths were observed among patients with APACHE III scores of 0–30, whereas mortality increased markedly with higher scores. Among patients with scores of 61–90, 8 of 14 patients (57.1%) expired, compared with 2 of 36 patients (5.6%) with scores of 31–60. These findings indicate that higher APACHE III scores were strongly associated with increased mortality in OP poisoning patients.

Table 5 demonstrates a highly significant association between APACHE III score and mortality among mechanically ventilated patients ($P = 0.0001$). No deaths occurred among patients with scores of 0–30, whereas mortality progressively increased with higher APACHE III scores. Mortality was particularly high in patients

Table 1: Association of mortality outcome with various clinical parameters

Parameters	*Outcome*		*Total (n=100) (%)*	*P-value*
	Expired (n=48) (%)	*Survived (n=72) (%)*		
Age group				
0–30	14 (11.7)	44 (36.7)	58 (48.3)	0.002
31–60	27 (22.5)	24 (20)	51 (42.5)	
Above 61	7 (5.8)	4 (3.3)	11 (9.2)	
Comorbidity				
Heart failure	18 (15.00)	0 (0.00)	18 (15.00)	0.001
HIV	2 (1.70)	0 (0.00)	2 (1.70)	
None	28 (23.30)	72 (60.00)	100 (83.30)	
Days of ventilator support				
1–7	34 (28.3)	38 (31.7)	72 (60)	0.18
8–14	5 (7.5)	14 (15)	19 (22.5)	
15–21	9 (4.2)	18 (11.7)	27 (15.8)	
>21	0 (0)	2 (1.7)	2 (1.7)	
PO_2 concentration				
44–55	18 (15.0)	6 (5.0)	24 (20.0)	0.001
56–65	24 (20.0)	24 (20.0)	48 (40.0)	
66–90	6 (5.0)	42 (35.0)	48 (40.0)	

Table 2: Distribution of various ventilator parameters

Parameters	*Number of cases (n=120)*	*Percentage*
Indication		
Neurological (Primary respiratory failure, poisoning, GBS, tetanus, and snakebite)	80	67
ARDS, Leptospirosis	24	20
Coma, septicemia, heart failure, pneumonia, DKA, others	16	13
Clinical diagnosis required mechanical ventilation		
Poisoning	60	50
Snake bite	6	5
Tetanus	8	6.66
GBS	6	5
Leptospirosis	10	8.33
ARDS	14	11.66
Septicemia, chronic renal failure, pneumonia, CCF, DKA, others	16	13.33
Mode of airway		
Endotracheal intubation (E.T.)	74	61.66
E.T. followed by tracheostomy	41	34.16
Facial mask	5	4.16
Ventilator mode		
IPPV	112	93.3
SIMV/CPAP, BIPAP	8	6.7

ARDS: Acute respiratory distress syndrome, CCF: Congestive cardiac failure, DKA: Diabetic ketoacidosis, GBS: Guillain–Barré syndrome, IPPV: Intermittent positive pressure ventilation, SIMV: Synchronized intermittent mandatory ventilation, CPAP: Continuous positive airway pressure, BiPAP: Bilevel positive airway pressure

with scores of 91–120, among whom 24 of 26 patients (92.3%) expired, compared with 22 of 34 patients (64.7%) with scores of 61–90. These findings indicate that higher APACHE III scores were strongly associated with increased mortality, supporting its utility as a prognostic indicator in critically ill mechanically ventilated patients.

Table 6 presents the distribution of observed deaths according to APACHE III score categories. No deaths were observed among patients with scores of 0–30. Mortality increased progressively with higher APACHE III scores, with 4 deaths among 42 patients in the 31–60 score group, 20 deaths among 32 patients in the 61–90 group, and 22 deaths among 26 patients with scores of 91–120. Thus, higher APACHE III scores were associated with substantially increased observed mortality, indicating a strong relationship between severity of illness and clinical outcome.

Table 7 compares observed mortality with APACHE III–predicted mortality across different age groups. The observed mortality increased with advancing age, from 27% in patients aged 18–29 years to 100% among those aged ≥75 years. In the 18–29 and 30–44-year age groups, observed mortality was slightly higher than the predicted mortality (27% vs. 24% and 29% vs. 30%, respectively), whereas marked differences were observed in older age groups. Among patients aged 45–59 and 60–74 years, observed mortality was substantially higher than predicted mortality (75% vs. 32% and 87.5% vs. 71%, respectively). In patients aged ≥75 years, observed mortality was 100% compared with a predicted mortality of 62%. Overall, the findings demonstrate an increasing trend in mortality with advancing age, with observed mortality exceeding APACHE III-predicted mortality in most older age groups.

Table 8 presents the distribution of mortality according to patient risk groups based on predicted mortality. Observed mortality increased progressively with increasing risk category. In the 0–30% risk group, 11 of 41 patients (27%) died, compared with a predicted mortality of 16%. In the 31–60% risk group, 23 of 67 patients (34%) died, compared with a predicted mortality of 44%. Among patients in the >61% risk group, 11 of 12 patients (92%) died, compared with a predicted mortality of 83%. Overall, the findings demonstrate a strong positive relationship between increasing predicted-risk category and observed mortality.

Table 3: Observed death rate versus mean predicted death rate

Parameter	*Number*
Observed death	48/120
Percentage	40
Predicted death	32
Mean acute physiology and chronic health evaluation-III score	62

Table 4: Association of mortality outcome with APACHE score in OP poisoning

APACHE score in OP	*Outcome*		*Total (%)*	*P-value*
	Expired (%)	*Survived (%)*		
0–30	0 (0)	10 (16.70)	10 (16.70)	0.0001
31–60	2 (3.30)	34 (56.70)	36 (60)	
61–90	8 (13.30)	6 (10)	14 (23.30)	
Total	10 (16.70)	50 (83.30)	60 (100)	

OP: Organophosphorus

Table 5: Association of mortality outcome with APACHE score

Acute physiology and chronic health evaluation score III	*Outcome*		*Total (%)*	*P-value*
	Expired (%)	*Survived (%)*		
0–30	0 (0.0)	18 (15.0)	18 (15.0)	0.0001
31–60	2 (1.7)	40 (33.3)	42 (35.0)	
61–90	22 (18.3)	12 (10.0)	34 (28.3)	
91–120	24 (20.0)	2 (1.7)	26 (21.7)	
Total	48 (40.0)	72 (60.0)	120 (100.0)	

Table 6: APACHE score and observed deaths

APACHE score	*Number of patients*	*Observed death*
0–30	20	0
31–60	42	4
61–90	32	20
91–120	26	22

APACHE: Acute physiology and chronic health evaluation

Table 7: Age and observed deaths compared with predicted deaths

Age range	*Nos*	*Observed death*	*Percentage*	*Predicted death%*
18–29	41	11	27	24
30–44	59	17	29	30
45–59	08	06	75	32
60–74	08	07	87.5	71
≥75	04	04	100	62

Table 8: Mortality and risk groups

Patient risk group %	*No (n=120)*	*Observed death*		*Predicted death %*
		No.	*Percentage*	
0–30	41	11	27	16
31–60	67	23	34	44
>61	12	11	92	83

Discussion

The present prospective study evaluated the clinical characteristics, ventilator-related parameters, mortality outcomes, and prognostic utility of the APACHE III scoring system among 120 critically ill patients requiring mechanical ventilation. The study population was predominantly young, with 48.3% of patients belonging to the 18–30-year age group and an overall age range of 18–85 years. A marked male predominance was observed, with males comprising 77% of the study population. This demographic pattern may be related to the high proportion of poisoning and neurological conditions encountered in the study setting. In contrast, large international studies of mechanically ventilated patients have reported an older population; Esteban *et al*.[1] reported a mean age of approximately 59 years, reflecting a broader and more heterogeneous ICU population.

Most patients required mechanical ventilation for 1–7 days (60%), with a median duration of 6 days and a maximum duration of 33 days. This was comparable with the findings of Esteban *et al*.,[1] who reported a mean duration of approximately 5.9 days, and with other international data reporting a median duration of approximately 7 days.[7] In the present study, most deaths occurred within the first 7 days of mechanical ventilation. However, the duration of ventilator support was not significantly associated with mortality ($P = 0.18$), suggesting that the outcome was influenced more by the severity and nature of the underlying illness than by the duration of ventilation alone.

Neurological conditions causing primary respiratory failure were the most frequent broad indication for mechanical ventilation (67%). This was largely attributable to OP poisoning and neuromuscular disorders, including Guillain–Barré syndrome, tetanus, and neurotoxic snakebite. Among individual diagnoses, OP poisoning was the most common indication (50%), followed by ARDS (11.66%) and leptospirosis (8.33%). This pattern differs from international studies, where acute respiratory failure has generally been the predominant indication for mechanical ventilation.[10,11] The high frequency of OP poisoning in the present study may reflect the patient profile served by the study institution. OP poisoning remains an important cause of severe acute illness and respiratory failure requiring mechanical ventilation, particularly in developing countries.[5]

Endotracheal intubation was the predominant method of airway access in the present study (61.66%), whereas 34.16% of patients underwent endotracheal intubation followed by tracheostomy. Esteban *et al*.[1] reported endotracheal intubation in approximately 75% of mechanically ventilated patients, while another international study reported endotracheal intubation in 75% and tracheostomy in 24%.[7] Thus, the present findings were broadly comparable. Tracheostomy was generally performed after approximately 7 days of endotracheal intubation in the present study, compared with a median of 11 days reported by Esteban *et al*.[1] IPPV was the predominant ventilator mode (93.3%), whereas only a small proportion received BIPAP or SIMV, reflecting the predominance of conventional invasive ventilation in this population.

A significant association was observed between comorbid conditions and mortality ($\chi^2 = 36$, $P < 0.001$). Patients with underlying conditions, particularly heart failure and HIV infection, had higher mortality than those without documented comorbidities. Chronic disease may reduce physiological reserve and increase susceptibility to complications during critical illness. These findings support the inclusion of chronic health status in APACHE III, which incorporates major comorbid conditions into severity assessment.[8]

Oxygenation status was also significantly associated with mortality. Among patients with PaO_2 levels of 44–55 mmHg, 18 of 24 patients (75%) died, whereas 42 of 48 patients (87.5%) with PaO_2 levels of 66–90 mmHg survived. The association was statistically significant ($\chi^2 = 29.375$, $P < 0.001$), indicating that impaired oxygenation was associated with poorer outcome. This finding highlights the importance of physiological respiratory variables in assessing the severity of critical illness and supports their inclusion in APACHE III.[9]

Overall, 48 of 120 patients died, giving an observed mortality of 40%, whereas the mean predicted mortality was 32%. The difference between observed and predicted mortality was not statistically significant ($Z = 0.69$), suggesting reasonable agreement between the two estimates. The standardized mortality ratio was 1.18, and the mean APACHE III score was 62. The higher mortality observed in the present study compared with larger ICU cohorts may be explained by the inclusion of exclusively mechanically ventilated medical ICU patients with severe physiological derangements and, in several cases, neurological dysfunction and multiorgan involvement.

Zimmerman *et al*.,[4] in a large cohort of 37,668 ICU admissions, reported 4652 observed deaths (12.35%) compared with 4621 predicted deaths (12.27%), with a mean APACHE III score of 45.1. The lower mortality in their study may be explained by the broader and more heterogeneous case mix, which included post-operative and trauma patients, whereas the present study focused exclusively on mechanically ventilated medical ICU patients. The smaller sample size of the present study may also have contributed to greater variability in mortality estimates.

A strong association between APACHE III score and mortality was observed among patients with OP poisoning. Only 2 of 46 patients with scores below 60 died, compared with 8 of 14 patients with scores above 60 ($\chi^2 = 21.071$, $P < 0.001$). Thus, increasing APACHE III scores were associated with substantially higher mortality in OP poisoning. Similar findings have been reported in previous studies demonstrating the usefulness of severity scores for predicting outcomes in OP poisoning.[5,9] These findings suggest that APACHE III may assist in identifying high-risk poisoning patients who require intensive monitoring and aggressive management.

In the overall study population, mortality increased progressively with increasing APACHE III score. No deaths occurred among patients with scores of 0–30, whereas 20 of 32 patients with scores of 61–90 and 22 of 26 patients with scores of 91–120 died. This association was highly significant ($\chi^2 = 72.018$, $P < 0.001$), demonstrating a strong positive relationship between severity score and observed mortality. These findings are consistent with the original APACHE III validation study, which demonstrated increasing mortality with increasing severity scores.[3]

Age was also significantly associated with mortality. Observed mortality increased from approximately 27% in patients aged 18–29 years to 100% among those aged ≥75 years. In younger age groups, observed and predicted mortality were relatively comparable: 27% versus 24% in the 18–29-year group and 29% versus 30% in the 30–44-year group. Zimmerman *et al*.[4] similarly demonstrated reasonable agreement between observed and predicted mortality across age groups. The higher mortality among elderly patients in the present study may reflect reduced physiological reserve and increased susceptibility to organ dysfunction.

Analysis according to APACHE III predicted-risk categories further demonstrated its prognostic value. Observed mortality increased progressively with increasing predicted-risk categories, with substantially higher mortality in the highest-risk group. This positive relationship indicates that APACHE III provided useful risk stratification in the present study and is consistent with observations from large independent ICU databases.[3,4]

The present findings are also consistent with studies evaluating APACHE III among mechanically ventilated patients. An Indian prospective study of 200 patients requiring mechanical ventilation found that APACHE III was useful for predicting mortality and that higher scores were associated with poorer outcomes.[8] This is particularly relevant because the present study was conducted in a medical ICU population in India and similarly demonstrated a strong association between APACHE III score and mortality. The consistency of these findings supports the applicability of APACHE III beyond the original populations in which the score was developed.

Overall, the present study demonstrates that higher APACHE III scores, advanced age, significant comorbidities, and impaired oxygenation were associated with increased mortality among mechanically ventilated ICU patients. The strong association between APACHE III score and observed mortality, together with reasonable agreement between predicted and observed mortality, supports its utility as a prognostic and risk-stratification tool. Its predictive value was particularly evident in OP poisoning. Nevertheless, APACHE III should complement rather than replace clinical judgment, as outcomes are influenced by the underlying disease, comorbidities, treatment response, complications, and ICU practices.

Conclusion

APACHE III scores and mortality-prediction equations demonstrated good prognostic utility, with higher scores being associated with increased observed mortality. The system reasonably predicted overall hospital mortality and provided useful risk stratification among critically ill mechanically ventilated patients. Further improvement in predictive accuracy may be achieved through precise disease classification, improved assessment of neurological abnormalities, and validation using larger contemporary datasets.

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