



# Journal of Medical Sciences

ISSN 1682-4474

**science**  
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*JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued eight times per year on paper and in electronic format.*

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## **Analyzing the Efficacy of Apache III versus Apache II on Duration of Mechanical Ventilation and ICU Stay**

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This study have been designed to compare Apache II and Apache III scores as a predictor factors for mechanical ventilation, mortality rate, duration of mechanical ventilation and ICU stay. This is a prospective study conducted in Alzahra General Hospital, Isfahan-Iran University of medical sciences, from September 2005 to September 2006. All patients with respiratory failure due to COPD, Bronchectasis, Asthma, pulmonary edema and pulmonary emboli admitted to ICU, were evaluated. The Apache II and Apache III scores obtained were calculated at admission. Other variables recorded were clinical outcome (dead/survival), mandatory intubation and mechanical ventilation, duration of mechanical ventilation and ICU stay. Correlation between Apache II and Apache III with duration of mechanical ventilation and ICU stay analyzed by Pearson correlation coefficient and  $p < 0.05$  considered meaningful. One hundred eighty patients were enrolled, that 38 % were women and 62% men. Of the 180 patients 52 (28.9%) died and 128 (71.1%) survived. Correlation between duration of ventilation and Apache II and III were, respectively  $p = 0.09$  and  $p = 0.019$  and correlation between of ICU stay and Apache II and III were  $p = 0.09$  and  $p = 0.019$ . Apache III and Apache II both were used to predict outcome and necessity of intubation and mechanical ventilation but Apache III was more significant predictive factor for ICU stay and duration of mechanical ventilation.

**Key words:** Mechanical ventilation, prognosis, Apache II, Apache III, ICU

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**INTRODUCTION**

Mechanical ventilation is an essential life support mode of treatment given to many patients in Intensive Care Unit (ICU) (Debidas *et al.*, 1997; Eapen *et al.*, 1997). Different scoring systems have been developed to help the physician to determine the severity of medical conditions and prediction of mortality and mobility (Eapen *et al.*, 1997; Listello and Sessler, 1994). Although ICU stay is an important predictive factor and indirectly related to weaning time (Woods *et al.*, 2000; Sudarsanam *et al.*, 2005; Menzies *et al.*, 1989) but duration of mechanical ventilation is not almost always as necessary as the patient's condition (Listello and Sessler, 1994). In other studies the relationship of Apache II Score with ICU stay and duration of mechanical ventilation had been shown (Debidas *et al.*, 1997; Eapen *et al.*, 1997). Because Apache III score is easier to use and it is clinically more practical but still it has not been tried to show that if Apache III is as useful as Apache II (Ludwigs *et al.*, 1991; Jeffrey *et al.*, 1992; Portier *et al.*, 1992; Miller *et al.*, 1992). Therefore, we prospectively compared the two scoring systems to predict duration of mechanical ventilation and ICU stay.

**MATERIALS AND METHODS**

This prospective study which had been conducted in Alzahra General Hospital at Isfahan University of medical sciences from September 2007 to September 2008. All patients with respiratory failure due to COPD, bronchiectasia, asthma, pulmonary edema and pulmonary emboli that needed ICU were evaluated. The patients with age under 18 years, burns, mortality at the first 24 h, pelvic fracture, cardiopulmonary arrest, cardiac disease and postoperative condition, were excluded. Respiratory failure was defined as PaO<sub>2</sub><55 mmHg and PaCO<sub>2</sub>>50 mm Hg. Indications of endotracheal intubation (ET) were respiratory arrest, unconsciousness, increasing PaCO<sub>2</sub> and base acid disorder. The scores obtained in Apache II (Woods *et al.*, 2000) and Apache III (Listello and Sessler, 1994) were calculated at admission. Other variables recorded included clinical outcome (dead/survival), necessity of intubation and mechanical ventilation, duration of mechanical ventilation and ICU stay. Other parameters such as temperature, pulse and respiratory rate, blood pressure, hematocrite, liver and renal function test, serum electrolytes, base acid balance and oxygenation were aggregated during study.

Apache II and Apache III scores based on the need to intubation and mechanical ventilation and mortality rate

were analyzed. Correlation between Apache II and Apache III with duration of mechanical ventilation and ICU stay analyzed by Pearson correlation coefficient and p<0.05 considered meaningful.

**RESULTS**

One hundred eighty patients were enrolled that 38 % were women and 62% were men. Of the 180 patients 52 (28.9%) died and 128 (71.1%) survived. The mean of Apache II was 21.41±2.81 and Apache III was 63.97±11.2. 146 (81.1%) of patients were intubated. Of one hundred eighty patients, 137 (76.11%) of patients needed mechanical ventilation. The mean duration of intubation and mechanical ventilation and ICU stay were subsequently; 19.97±2.31, 11.17±1.19 and 31.62±8.14 days.

The average score of the Apache II and the Apache III based on necessity of intubation and mechanical ventilation and mortality rate are shown in Table 1.

Among 137 patients that needed mechanical ventilation, analysis of correlation was performed between duration of ventilation and Apache II and III (Table 2).

The mean of duration of ICU stay was 31.62 days: (min: 6 max: 122 days) correlation between of ICU stay and two scores of Apache are shown in Table 3 (Woods *et al.*, 2000).

Table 1: The average score of the Apache II and Apache III based on the need to intubation and mechanical ventilation and mortality rate

Variables	Apache II	Apache III
<b>Intubation</b>		
Yes	17.42	67.91
No	11.66	44.4
p-value	<0.01	<0.01
<b>Mechanical ventilation</b>		
Yes	21.77	69.51
No	12.78	43.27
p-value	<0.001	<0.001
<b>Mortality</b>		
Yes	22.96	86.54
No	20.71	54.37
p-value	>0.05	<0.001

Table 2: Correlation between duration of ventilation and Apache II and III score

Duration of ventilation	N	Frequency	Mean Apache II	Mean Apache III
10-1	40	20.29	98.15	57.84
20-11	53	69.38	33.17	64.96
30-21	26	98.18	15.18	73.84
40-31	3	19.20	84.18	75.20
50-41	4	92.20	19.00	79.50
60-51	2	46.10	5.19	80.50
70-61	0	0.00	-	-
80-71	3	19.20	24.00	86.20
90-81	4	92.20	5.29	119.10
100-91	2	46.10	31.00	126.20
<b>Total</b>	<b>137</b>	<b>100.00</b>	<b>77.21</b>	<b>69.51</b>

p = 0.019, p = 0.091

**Table 3: Correlation between of ICU stay and two scores of apache**

ICU stay (day)	N	Frequency	Mean Apache II	Mean Apache III
1-10	18	10.00	16.13	71.440
20-11	34	89.18	18.14	24.560
30-21	20	11.11	13.16	59.580
40-31	64	56.35	22.17	23.630
50-41	14	78.70	60.19	54.680
60-51	5	78.20	5.22	1.720
70-61	4	22.20	24.80	98.730
80-71	4	22.20	49.26	85.000
90-81	5	78.20	48.29	106.000
100-91	8	44.40	8.22	1.119
>100	4	22.20	3.26	1.128
Total	180	100.00	41.21	97.630

p = 0.019, p = 0.091

### DISCUSSION

Scoring systems primarily developed for estimating prognosis in critically ill patients have not been well validated in mechanically ventilated patients. Modified Organ System Failure (OSF) score had been shown that be superior to the Apache score in predicting mortality (Eapen *et al.*, 1997).

So, suggested that Apache II score measured at admission is significant independent predictor of mortality in the patients on mechanical ventilation (Sudarsanam *et al.*, 2005). This study was done on patients to compare Apache II and Apache III scores as predictor factors for mechanical ventilation and mortality rate and duration of mechanical ventilation and remaining in ICU.

The data show that 76.11% of patients admitted to ICU needed mechanical ventilation that is more than sudarsanam study (Sudarsanam *et al.*, 2005) (76.11% vs. 41%)

Our patients had more critical conditions. Patients with respiratory failure and lower mean arterial pressure, comorbid condition (Spicher and White, 1987; Menzies *et al.*, 1989), high blood urea (Ludwigs *et al.*, 1991) and requiring ventilation within first 24 h (Portier *et al.*, 1992). Lower serum albumin and lower FEV1, had been found to have poorer prognosis but were not shown to independently predict outcome (Sudarsanam *et al.*, 2005). Among patients with type I respiratory failure, sepsis, multi-organ system failure, cardiac failure, higher bronchoalveolar fluid interleukin 8 concentrations (Miller *et al.*, 1992), worsening renal function (Sloane *et al.*, 1992), a longer duration of mechanical ventilation, medically ill patients with sepsis and multiple transfusions as compared with trauma patients with the above comorbidities (Hudson, 1989) were all found to have an adverse affect on outcome. (Sudarsanam *et al.*, 2005). Present study showed that Apache III as compared with Apache II causes significant longer duration of mechanical ventilation (Spicher and White, 1987). Then patients with higher Apache III will

had more poor prognosis compared with others and could be consider as a predictive factor for prognosis (Suchyta *et al.*, 1992). Gupta *et al.* (2001) had shown an Apache III score of >57 predicted a poor outcome but Sudarsanam *et al.* (2005) believed that Apache II score is a factor that had prognostic significance on out come Nevins and Epstein (2001) have also shown that the Apache II associated comorbidities predicted a poorer outcome for COPD patients requiring mechanical ventilation (Menzies *et al.*, 1989). Present study showed that Apache III is more important predictive factor in ICU stay and duration of mechanical ventilation than Apache II (Ludwigs *et al.*, 1991). Some other studies shown that Apache III score couldn't be used as well as the Apache II for predict outcome because arterial PH, as a significant predictive value (Diener and Burrows, 2001), is not included in the Apache III scoring system and additional variables in the Apache III such as billirubin and glucose may not have any bearing on the population (Sudarsanam *et al.*, 2005). However our study had shown that Apache III is more significant to predict ICU stay as an important predictive factor to weaning time (Woods *et al.*, 2000).

In conclusion, we have noted that Apache III and Apache II both could be used to predict outcome and need to intubation and mechanical ventilation but Apache III is more significant index as a predictive factor for ICU stay and duration of mechanical ventilation.

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