General Medicine

A Study of Etiology and Outcome of Acute Respiratory Distress Syndrome in a Rural Tertiary Care Center

Dr. Poola Sriharika[1], Dr. R. Lakshmi Visruja[2*], Dr. Srinivasa Rao[3], Dr. Y. J. Visweswara Reddy[4]
[1]Postgraduate Resident, Department of General Medicine, PESIMSR/NTRUHS, Kuppam, India
[2]Assistant Professor, Department of General Medicine, PESIMSR/NTRUHS, Kuppam, India
[3,4]Professor, Department of General Medicine, PESIMSR/NTRUHS, Kuppam, India

Abstract: Acute respiratory distress syndrome (ARDS) is one of the major causes for acute respiratory failure characterized by bilateral chest infiltrates and decreased lung compliance. Several etiological factors cause ARDS, both direct and indirect injury to lungs. It has a high mortality rate. This study was a prospective observational study and included 50 patients with a diagnosis of ARDS. This study was undertaken to elucidate the causes and outcome of patients admitted with ARDS in the intensive care unit (ICU) of a tertiary care center. New Berlin criteria were used to classify them as Mild, Moderate and Severe ARDS. Severe ARDS was found in 30%, moderate ARDS in 58% and mild ARDS was seen in 12% of subjects. Pneumonia followed by tropical infections was the major etiological causes. Tropical infections contributed to 26% of ARDS, of which Dengue fever contributed to 12% of ARDS in the subjects and malaria was seen to be causing ARDS in 8% of subjects. Most of the patients (96%) required ventilator support, 52% of them requiring invasive ventilation and 44% requiring non – invasive ventilation. Mortality was 62% in this study. Higher mortality rates were seen in age groups above 40 years and males had slightly higher mortality rates than females. ABG (Arterial blood gas analysis) showed higher $PaCO_2$ (partial pressure of carbon dioxide) and lower PaO_2/FiO_2 (PaO_2-partial pressure of oxygen/ FiO_2- fraction of inspired oxygen) were seen in non-survivor group. Tropical infections, especially in rural areas, contribute significantly to ARDS which needs to be stressed up on. These findings may help intensivists in instituting early effective empirical regimens depending on the regional tropical diseases.
Keywords: Acute respiratory distress syndrome, Berlin criteria, Arterial blood gas, PaO_2/FiO_2.

INTRODUCION

In 1967, Ashbaugh first identified acute respiratory distress syndrome (ARDS), described 12 patients who had bilateral chest infiltrates and reduced lung compliance [1] with acute respiratory failure refractory to oxygen therapy. ARDS can be caused by direct and indirect injury. The direct causes most commonly are lung related infection and aspiration pneumonia. Indirect causes are extra pulmonary among which systemic sepsis is the most common one [2].

Chronic liver disease, non-pulmonary organ dysfunction, sepsis and advanced age have been identified to predict the risk of death in ARDS [3, 4]. Significant causes of ARDS other than pulmonary, in rural areas are tropical infections like malaria, dengue and leptospirosis [5].

Mortality rates for ARDS vary widely; according to a few studies it was about 58 % [3, 4]. Several studies have shown that initial oxygenation level does not have any prognostic significance in determining mortality, but if there is no improvement in oxygenation it further leads to poor outcome.

This study was undertaken to elucidate the causes and outcome of patients admitted with ARDS in the intensive care unit (ICU) of a tertiary care and medical college hospital catering to a rural population of south India.

MATERIALS AND METHODS

The study done was a prospective observational study conducted in ICU of PESIMSR (Peoples education society institute of Medical Sciences and Research) during the year 2016-2017. The hospital

is located in a rural area (Kuppam) of Andhra Pradesh, south India.

A total of 50 patients aged above 18years with a medical diagnosis leading to ARDS were included in the study. Patients with surgical causes of ARDS like trauma and burns were excluded.

Diagnosis of ARDS was done based on history, physical examination, chest radiograph and arterial blood gas analysis. Based on the New Berlin criteria [6], ARDS was categorized into mild, moderate and severe ARDS. Echocardiography was done for all the patients to rule out cardiac causes. Relevant laboratory investigations were done. Bacterial pneumonia was diagnosed by chest radiograph and examination of sputum. Viral pneumonia was diagnosed when total leukocyte counts were normal, chest radiograph suggestive of pneumonia and all other tests including gram stain, culture and sensitivity tests were negative.

The ethical committee of the medical college hospital approved this study. The data were entered into MS Excel sheet and SPBS software was used for statistical analysis. Descriptive inferential statistical analysis has been carried out. Chi-square/ Fischer exact test has been used to find the significance of study parameters on categorical scale between groups .P value < 0.05 was taken as significant value.
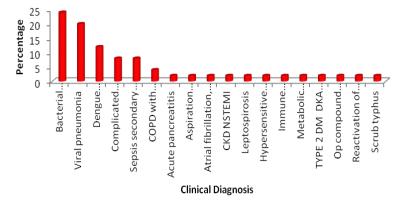
RESULTS

During the study period, 50 patients were admitted with ARDS as diagnosis to medical ICU. Most of the subjects were relatively young with a mean age of 41.78 ± 16.87years. Nearly a quarter of them were in the age group 31-40 years (24%) and 21-30 years (22%) each. Distribution of Male (52%) and female (48%) were as shown in table 1.

Table-1: Correlation of age & gender with incidence of mortality of patients

variables	Mortality		Total (n=50)	P value
	No (n=19)	Yes (n=31)		
Age in years				
• <20	2(10.5%)	2(6.5%)	4(8%)	0.013*
• 20-30	8(42.1%)	3(9.7%)	11(22%)	
• 31-40	6(31.6%)	6(19.4%)	12(24%)	
• 41-50	1(5.3%)	7(22.6%)	8(16%)	
• 51-60	0(0%)	7(22.6%)	7(14%)	
• >60	2(10.5%)	6(19.4%)	8(16%)	
Gender				
• Female	10(52.6%)	14(45.2%)	24(48%)	0.608
• Male	9(47.4%)	17(54.8%)	26(52%)	

Most of them presented with respiratory complaints (80% of subjects) with 54% of subjects presenting with breathlessness. Majority (90%) of them did not have pre-existing lung diseases. Patients were classified according to New Berlin Criteria based on arterial blood gas (ABG) as mild, moderate and severe ARDS. Severe ARDS was found in 30%, moderate ARDS in 58% and mild ARDS was seen in 12% of subjects.

Significantly large number of patients presented with infections. (As shown in the Figure1). The commonest etiology was pneumonia (44%). Tropical infections contributed to 26% of ARDS, of which Dengue fever contributed to 12% of ARDS in the subjects and malaria was seen to be causing ARDS in 8% of subjects.

Fig-1: Clinical Diagnosis with ARDS

Most of the patients (96%) required ventilatory support, 52% of them requiring invasive ventilation and 44% requiring non – invasive ventilation. Mortality was 62% in this study. Higher mortality rates were seen in age groups above 40 years and males had slightly higher mortality rates than females did (52% vs 48%). Mortality rates for patients on mechanical invasive ventilation were 48.4% compared to 44% in patients on non-invasive ventilation.

ABG showed significant PCO_2 (Partial pressure of carbon dioxide) and PaO_2 / FiO_2 (PaO_2- partial pressure of oxygen, FiO_2- fraction of inspired oxygen) ratio in the present study. $PaCO_2$ was higher in non-survivor group as compared to survivor group (37.28±12.77 VS 28.23±4.94) which was statistically significant (as shown as table 2).

Table-2: Comparison of ABG according to Mortality of patients

Parameters	Mortality		Total	P value
	No	Yes		
pH	7.23±0.21	7.10±0.28	7.15±0.26	0.070+
PaO2	99.36±24.14	90.39±48.08	93.80±40.61	0.454
PaCO2	28.23±4.94	37.28±12.77	33.84±11.33	0.005**
HCO3	19.07±4.34	17.46±3.65	18.07±3.96	0.165
PaO2/FIO2	212.14±61.00	166.92±55.23	184.10±61.04	0.010**

PaO2-partial pressure of oxygen, PaCO2- partial pressure of carbondioxide, HCO3- Bicarbonate, FiO2- fraction of inspired oxygen

PaO_2/FiO_2 ratio was lower in non-survivor group (166.92 ± 55.23) and had high mortality as compared to survivor group (212.14±61) was seen in severe ARDS (as shown in table 3).

Table-3: Comparison of PaO2/FIO2 with incidence of mortality of patients

PaO2/FIO2	Mortality		Total
	No	Yes	
<100 SEVERE ARDS	3(15.8%)	12(38.7%)	15(30%)
100-200 MODERATE ARDS	11(57.9%)	18(58.1%)	29(58%)
>200-300 MILD ARDS	5(26.3%)	1(3.2%)	6(12%)
Total	19(100%)	31(100%)	50(100%)

PaO2-partial pressure of oxygen, FiO2- fraction of inspired oxygen

DISCUSSION

This study focused on the etiology and outcome of ARDS. Mean age of the subjects was 41.78years (SD ± 16.87). This was similar to studies from other parts of India [2,7]. A few studies showed high mean age above 50 years [8-10]. Our study showed near equal distribution in males and females which is unlike some national and international studies [2, 8, 9, 11].

The commonest presentation was with respiratory complaints, breathlessness being present is 54% of subjects [12], followed by cough in 24% of subjects. Most of the patients did not have co-morbidities. Most of our patients were in moderate ARDS (58%) as described by the New Berlin criteria [6].

Infective pneumonia was the commonest cause of direct lung injury (44%) [2]. Dengue, malaria and

systemic sepsis contributed majorly to indirect lung injury [2]. High incidence of tropical infections was noted (26%). This may be because of favorable climate for infective agent and the vector. One more study from South India showed similar results, 26% of total ARDS cases were contributed by tropical infections [8]. Streptococcus pneumonia was the commonest organism isolated in culture- positive cases in our subjects followed by pseudomonas.

Non – infectious causes contributed to 22% of the etiology. Acute pancreatitis, aspiration pneumonia, organophosphorus poisoning contributed 2% each to the etiological causes of ARDS. Dengue fever contributed to 12% of the etiology. Recently many dengue related ARDS case reports have been reported [13]. Wang _et al_. found an incidence of 1.8% ARDS in a total of 606 dengue patients [14]. A few other studies have shown that dengue hemorrhagic fever can result in ARDS [15-17].

Malaria contributed to 8% of the ARDS cases. ARDS has been described as a major cause of death in adults with severe malaria [18, 19]. Mortality is as high as 80% in malaria associated ARDS, without ventilatory support [19]. Ventilatory support was required in 52% of the ARDS patients. Mortality rate estimated in many studies varied between 37% and 57 % [2, 7, 20]. In our study, mortality rate was 62% in 2007. Lancet review mentioned 25-30% as the mortality rates [21] while in 2008, Phua et al described it to be around 30-60% [22]. Our study had a higher mortality rate probably due to differing baseline characteristics, etiology and differing severity of ARDS compared to other studies. Higher mortality rates were seen in age groups above 40 years.

Higher mortality rates were seen in patients with severe ARDS (12 out of 15 patients expired) followed by moderate ARDS (18 out of 29 patients expired).Only one patient with mild ARDS succumbed out of 6 patients [7]. Severity can be considered as individual predictor of mortality, findings similar to patients in a study conducted by Bhadade and Rajbanshi [7, 12]. ABG revealed significant association with PCO2/FiO2 ratio in the present study.

LIMITATION
This study had some limitations. The study was an observational study and sample size was small. APACHE, Lung injury scoring was not done. Due to the lack of institutional facility we could not do viral PCR.

CONCLUSION
The commonest cause of ARDS is pneumonia. Tropical infections, especially in rural areas, contribute significantly to ARDS which needs to be stressed up on. Lower PaO_2/FiO_2 ratio contributed to higher morality. These findings may help intensivists in instituting early effective empirical regimens depending on the regional tropical diseases.

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