Clinical profile of patients with acute respiratory distress syndrome in a tertiary care centre

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Introduction: ARDS continues to be a major cause of morbidity and mortality in patients admitted to ICU. Clinical profile of patients with ARDS in India could be different from that of the western population due to the higher incidence of infectious diseases that cause ARDS. However, there are not many studies have been done in India on ARDS. Our aim was to study the clinical profile of patients with ARDS in South-Indian population.

Methods: Prospective observational study was conducted in a tertiary care hospital on patients who were admitted to ICU with ARDS. Consecutive patients with ARDS were screened for inclusion and exclusion criteria and were included in the study. Data on demographic details, comorbidities, smoking and alcohol history, microbiological data, the outcome were recorded.

Results: Of the 60 patients, Thirty-one were males (51.6%). The mean age of the population was 40.3 ± 6.5 years. Comorbidities were noted in 45% of those patients. Diabetes Mellitus (52%) was the most common comorbidity. Twenty-five percent of them were smokers and 30% were alcoholics. Pneumonia (60%) was the most common cause of ARDS among the subjects. Most common extra-pulmonary cause of ARDS was Pancreatitis (20%). Twenty-eight patients (46.6%) required invasive ventilation. *Acinetobacter baumanii* (28.3%) was the most common organism isolated. Mean duration of ICU stay and hospital stay was 5.5 ± 2 days and 9.5 ± 2.8 days respectively. The mortality rate was 40%.

Conclusion: Pneumonia was the most common cause of ARDS followed by Pancreatitis. *Acinetobacter baumanii* was the most common organism isolated in these patients with ARDS. We observed high mortality rate of 40%.

Key Words: ARDS; Pneumonia; Comorbidity

INTRODUCTION

Acute Respiratory Distress Syndrome (ARDS) is a syndrome of inflammation and increased permeability that is associated with a constellation of clinical, radiological and physiologic abnormalities that cannot be explained by but may co-exist with, left atrial or pulmonary hypertension (1). Gas exchange is severely compromised due to both intrapulmonary shuntings of blood and ventilation-perfusion inequalities contributing to the increased dead space and refractory hypoxemia (1). ARDS is a well-recognized complication of diverse conditions, including both direct injuries to the lungs and systemic disorders. In many cases, a combination of predisposing conditions is responsible (e.g., shock, oxygen therapy, and sepsis). Non-pulmonary organ dysfunction may also be present in severe cases (2-5). Infection, Inflammation and Direct Toxicity are the three major hypotheses about the mechanism of acute lung injury, which have been tested in animal models and in vitro studies (6-9).

Recently there has been a substantial increase in the understanding of the pathogenesis of ARDS but yet ARDS continues to be a major cause of morbidity and mortality in patients admitted to ICU. Numerous studies have been done on ARDS in western countries on its incidence, natural history, morbidity, and mortality factors have been studied (10-12). Clinical profile of patients with ARDS in India could be different from that of the western population due to the higher incidence of infectious diseases (13). However, there are not many studies have been done in India on ARDS. Our aim was to study the clinical profile of patients with ARDS in South-Indian population.

MATERIALS AND METHODS

A Prospective observational study was conducted at a tertiary care hospital in the department of Pulmonology in patients who were admitted to ICU with ARDS from July 2016 to May 2017. All the patients with ARDS were screened for inclusion and exclusion criteria and were included in the study after obtaining informed consent. Inclusion criteria were adult patients who were diagnosed as ARDS as per Berlin definition with PaO_2/FaO_2 is ≤ 300. Patients <18 years of age and who did not consent for the study were excluded from the study.

Data was collected during the first 24 hours of recognition of ARDS after admission to hospital. Data included demographic data, Chest X-Ray, Complete blood count, Renal function test, Liver function test, Serum electrolytes, Arterial blood gas analysis, Urine output, Glasgow coma score, and Pao_2/FiO_2 ratio was measured. Details of comorbidities like Diabetes, Hypertension, Asthma, Obesity, Tuberculosis, COPD, Chronic renal disease, Chronic Liver disease, HIV were also recorded. History of smoking and alcohol consumption were also noted. Arterial blood gas analysis was done in ABL FLEX 800 machine, Serum electrolytes were analyzed in DIESTRO electrolyte analyzer, Liver function test and renal function tests were analyzed in TOSHIBA TBA 120 FR a fully automated chemistry analyzer. Complete blood count was analyzed in NIHON KOHDEN (5 part differential cell counter) and also in SYSMEX (6 part differential cell counter).

The Institutional Ethics Committee approved the study and the procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 2000. Informed consent from the patient/legal representative was taken prior to inclusion in the study.

Statistical Analysis: Descriptive data are presented as frequencies (percentages) for discrete variables and as means (SDs) for continuous variables. Chi-square test was used to evaluate categorical factors. Receiver Operating Characteristic (ROC) curve was constructed for various variables and the cut-off value with the highest sensitivity and specificity was selected as the threshold. All statistical tests were 2-tailed, and factors were

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considered statistically significant at p<0.05. IBM SPSS version 22 and CDC Epi Info version 7 was used for analysis.

RESULTS

During the study period, a total of 120 patients were admitted to the ICU; 80 patients were included for further analysis. 20 patients were excluded from the analysis for one of the following reasons: death within 24 hours; ambiguity in the diagnosis and etiology of lung injury; and the absence of complete data. Finally, 60 cases were included for analysis. Thirty-one were males (51.6%). The mean age of the population was 40.3 ± 6.5 years (Table 1).

TABLE 1 Baseline characteristics of the cohort

Variables	Total (n=60)
Age (years), Mean (SD)	40.3 (6.5)
Gender, Male, n (%)	31 (51.6)
Pack years, Mean (SD)	10.85 (16.99)
Alcoholics, n (%)	24
Comorbidities, n (%)	27 (45)
Systolic BP, Mean (SD)	102 (25)
Mechanical Ventilation, n (%)	28 (46.6)
Vasopressor use, n (%)	27 (45)
Mean duration of hospital stay, Mean (SD)	9.5 (2.8)
Mean duration of ICU stay, Mean (SD)	5.5 (2)
Ventilator associated pneumonia, n (%)	12 (20)
SAPS score, Means (SD)	40.9 (26.37)
Blood Sugar (mg/dl)	98 (35.2)
24-hour urine output (ml)	1054 (942.9)
Serum Creatinine (mg/dl), Mean (SD)	2.45 (3.0)
Bilirubin (mg/dl)	0.88 (2.59)
Albumin (g/dl)	2.24 (0.46)
Platelet count (105cells/µl)	1.34 (1.16)
pH	7.26 (0.11)
$PaCO_2$ (mm Hg)	44.32 (15.29)
HCO_3 (mm Hg)	17.01 (5.16)
PaO_2/FiO_2 ratio	160.59 (59.68)
Tidal Volume (ml/kg)	339.83 (100.83)
PEEP (cm H_2O), Mean (SD)	11.6 (1.8)
Mortality, n (%)	24 (40)

Co-morbidities were noted in 45% of those patients. Diabetes Mellitus (52%) was the most common comorbidity followed by COPD (19%), Hypertension (15%), Obesity (10%). Twenty-five percent of them were smokers and 30% were alcoholics. Pneumonia (60%) was the most common cause of ARDS among the subjects.

Most common extra-pulmonary cause of ARDS was Pancreatitis (20%) (Table 2). Twenty-eight patients (46.6%) required invasive ventilation and rest were managed with non-invasive ventilation.

Ventilator-associated pneumonia was noted in 20% of patients and barotrauma in 2 patients. *Acinetobacter baumanii* (28.3%) was the most

common organism isolated followed by *Klebsiella pneumonia* (23.3%), *Pseudomonas aeruginosa* (11.6%), *Staphylococcus aureus* (8.3%) (Table 3).

TABLE 2 Etiology of patients with ARDS

Etiology	N (%)
Sepsis	
Pneumonia	32 (60)
Malaria	3 (5)
H1N1 influenza	4 (6.6)
Dengue	3(5)
Leptospirosis	1(1.6)
Tuberculosis	1(1.6)
Non-Sepsis	
Pancreatitis	12 (20)
Burns	2 (3.3)
Snake bite	1 (1.6)
Head Injury	1 (1.6)

TABLE 3 dy fluids in patients with ARDS

Organism	N (%)
Acinetobacter baumanii	17 (28.3)
Klebsiella pneumoniae	14 (23.3)
Pseudomonas aeruginosa	7 (11.6)
Staphylococcus aureus	5 (8.3)
Escherichia coli	4 (6.6)
Enterococcus	1 (1.6)
Candida	1 (1.6)
Streptococcus pneumoniae	1 (1.6)

Piperacillin/Tazobactam was the most common antibiotic used. Mean duration of ICU stay was 5.5 ± 2 days and the mean duration of hospital stay was 9.5 ± 2.8 days. The mortality rate was 40%.

DISCUSSION

Acute respiratory distress syndrome is associated with significant morbidity and mortality throughout the world. It causes a great economic burden on patients especially in developing countries like India. ARDS is caused due to various reasons either directly (pneumonia, tropical infections, toxic gas inhalation) or indirectly (sepsis, burns, trauma) which differs from the western population (14). Clinical profile of patients with ARDS also differs from western countries. Majority of the subjects in our study were males (51%) with most of them in their middle age. A Study done in South India by Rahul et al. found the mean age of the study population to be 42.9 years similar to our study (15). Other studies done by Vigg et al. from Hyderabad and Bhadade et al. from Mumbai found mean age of the cohort 39.2 years and 37.2 respectively which were also similar to our study (13-16). However, western studies reported higher mean age of 60 years (17,18). The lower mean age of ARDS patients in our cohort, when compared to western countries, may be explained by the higher incidence of infectious diseases as a cause of ARDS.

We found comorbidities in 45% of patients with ARDS which was higher than studies done in Manipal (24%) (15), but lower compared to studies done in Jakarta (74.4%) (19), Japan (89.4%) (20). This difference could be

due to the higher mean age of the study population in those latter studies. In our study, 30% of nonsurvivors had comorbidities compared to survivors who had preexisting comorbid illness in 15%. These findings were in terms with a study done in the United States where the occurrence of comorbid illness was more frequent in non-survivors (17).

We found most of the patients with ARDS had an infectious cause for ARDS (73.3%, n=44). Most common cause was pneumonia followed by H1N1 influenza, malaria, and dengue. Most common noninfectious cause for ARDS was pancreatitis (20%, n=12). Various studies done in western countries have also found pneumonia to be the most common cause of ARDS. A study done by Herridge et al. found 58% of the cases with ARDS had pneumonia as an etiological factor (21) Similarly, another study done Gong et al. found 43% of patients had Pneumonia as the source of ARDS (22) Indian studies have also found Pneumonia as an important cause of ARDS. A study done in South India found 23% of patients had pneumonia as a cause for ARDS (15). Another study Vigg et al. found that 30% of cases of ARDS were due to pneumonia and rest due to gastrointestinal disease (25%) and polytrauma (12%) (16). Bhadade et al. in India found a significant percentage of cases of ARDS secondary to tropical infections like Malaria (27%), Leptospirosis (20%) (13). We did not find a high percentage of tropical infections may be due to variations in the geographical area the study was done.

In the present study, we could isolate the causative organism in 83.3% (n=50) of the cases. Highest isolation of organisms was obtained from Tracheal aspiration (55%), followed by blood culture (30%) and sputum culture (15%). A study done by Rahul et al. could isolate causative organism in only 28.6% of patients which was lower compared to our study and found the highest number of microbiological diagnosis from blood culture (34%) followed by Endotracheal Aspirate (30.1%) (15). Similarly, another study was done by Vigg et al. also found a lower percentage of organism isolation (49%) and highest isolation was from the blood (21.5%) followed by endotracheal aspirate (14%) (16). The low yield in these studies may be due to prior use of antibiotics and a higher percentage of tropical infections like Malaria, Leptospira, scrub typhus. We found *Acinetobacter baumanii* (28.3%) as the most common organism isolated followed by *Klebsiella* (23.3%). Our finding was similar to the study done by Rahul et al. who found *Acinetobacter* (27.1%) and *Klebsiella* (25.4%) to be the most common organisms (15) But, other studies found *Pseudomonas* to be the most common organism (16-23).

We observed the mean duration of hospital stay to be 9.5 ± 2.8 days. Our results are in agreement with studies by Bersten et al. and Agarwal et al. who have reported a mean hospital stay of 10.5 days and 9.4 days respectively (24,25). The mean duration of ICU stay was 5.5 ± 2 days which lower compared to a Spanish study (28.5 days). This difference could be due to inclusion criteria of the latter study which included only trauma patients with ARDS (26).

Mortality in ARDS varies between 36% to 44% in studies done across the globe (27). Mortality in ARDS has remained unchanged in the past two decades despite the use of advanced ventilatory strategies and improved nursing care (28). The mortality rate in our study was 40%. Various studies done across India show varied mortality rates depending on availability of advanced ventilation strategies. A study done by the ARDS network in 2005 noted a mortality rate of 26% (29). A study done by Rahul et al. found a mortality rate of 44% similar to our study (15). Bhadade et al. found a mortality rate of 57% in their study (13).

The limitations of this study are: It is a Single Centre study with small sample size hence our results may not be generalized to the population at large. We did not use critical illness score like SOFA score, APACHE II score for prognosticating the patient. We did not have advanced ventilation strategies like High-frequency ventilation and ECMO.

CONCLUSION

Pneumonia was the most common cause of ARDS followed by Pancreatitis. *Acinetobacter baumanii* was the most common organism isolated in these patients with ARDS. We observed high mortality rate of 40%.

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