Study of etiology of ARDS in a tertiary hospital of Dakshina Kannada: A retrospective study

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Abstract

Objectives: The etiology of acute respiratory distress syndrome (ARDS) in tropical countries is different from western countries. To study the etiology of illness causing ARDS. **Study Design:** A retrospective study. **Setting:** Teaching hospital in a rural urban fringe location. **Patients:** Patients above 18 years, admitted between January 2011 to December 2016. **Result:** Study had 53 patients. Malaria was the commonest cause (14/53) and tropical infections contributed to 49% of total cases. Non survivors were generally older, had shorter duration of illness, a non tropical infection, and higher total WBC counts, required longer duration of ventilation. The mortality rate of ARDS was 30.18% (16/53) in our study. **Conclusion:** Tropical infections form a major etiological component of ARDS in a developing country like India. Etiology and outcomes of ARDS may vary depending upon the geographic location and seasonal illnesses.
Key Words: etiology, ARDS.

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INTRODUCTION

Acute respiratory distress syndrome (ALI/ARDS) is a spectrum of inflammatory lung injury often seen in critically ill patients causing hypoxemic respiratory failure. The etiology of ARDS can be divided into pulmonary (direct) and extra-pulmonary (indirect) causes. Infective and aspiration pneumonia are the commonest pulmonary causes of ARDS, whereas systemic sepsis is the predominant extra pulmonary cause of acute lung injury[1]. Medically, a significant proportion of cases in tropical climes are likely to be the result of problems common in the rural tropics: infections such as malaria, scrub typhus, enteric fever, and leptospirosis or injuries gained by poisoning, near hanging, and near-drowning. Inequalities among various ethnic groups are known with respect to mortality rates in ARDS[2]. Mortality rates in the North Indian and Western Indian population were 47.8%[1] and 57%[3], respectively. This study aimed to study the medical causes and outcome in patients admitted with acute lung injury/ ARDS in a hospital located rural-urban fringe of Dakshina Kannada, Mangalore, Karnataka.

MATERIALS AND METHODS

This was a retrospective study conducted in Yenepoya Medical College. Data was collected from year 2012 to 2016 who were diagnosed with acute lung injury/ARDS. This teaching hospital is located on a rural landscape 10 kilometres from the nearest town, Mangalore, Dakshina Kannada, Karnataka. Patients with ARDS were identified and classified based on the Berlin Criteria. Patients above 18 years of age with a medical diagnosis of ARDS were studied. Patients with burns and trauma were excluded. Baseline characteristics, including co morbidities, biochemical and microbiological investigations were noted. Ultimate hospital outcome were documented.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics 20 for Windows. Independent-samples -test was performed for continuous variables and was expressed using the mean ± SD and the median (range and interquartile range (IQR)). Chi square test (or Fischer's exact test) was performed for categorical data.

RESULTS

In our study 53 patients were admitted with a diagnosis of ARDS, directly from the emergency department, or had been transferred from the wards when they required respiratory support. The subject cohort was relatively young, with a mean age of 44.52 ± 12.35 years. In the study population there were 31 males and 22 females. Tropical infections including dengue, malaria, leptospirosis and scrub typhus contributed to 49.01% (n=25/51) of infective causes (Table 1). In the infectious group, neutrophilic leukocytosis, and elevated creatinine were more commonly observed in leptospirosis and bacterial infections, whereas significant thrombocytopenia was seen in leptospirosis and malaria. ESR elevation was highest in tuberculosis and increased liver transaminases were consistently seen in Rickettsial, Leptospiral, and malarial infections.

Table 1: Etiology and survival of patients in our study

Direct injury	Number of cases	Survived	Indirect injury	Number of cases	Survived
Pneumonia			Sepsis		
(1) CAP	6	5	(1) Malaria	14	12
(2) HAP	2	1	(2) Klebsiella pneumoniae	1	0
(3) H1N1	1	0	(3)E. coli	1	0
(4) Leptospirosis	4	3	(4) Unidentified	8	2
(5) Scrub typhus	2	2	Pancreatitis	3	2
(6) Aspiration	3	2	Near-hanging	1	1
Dengue	5	5			
Tuberculosis	2	2			
Total	**25**	**20**	**Total**	**28**	**17**

The mortality rate in our study was 30.18% (16/53). Among tropical infections, one case of leptospirosis and 2 cases of malaria did not survive (3/25), compared to 13 deaths among nontropical infections (13/28). Older age, smoking and alcohol, comorbid conditions like diabetes, and hypertension were significantly related with mortality.

DISCUSSION

Our study had focused on the etiology of ARDS and its outcome. In this study, Berlin Definition criteria had been used to classify patients[4]. A male predominance in our study was similar to both national and international studies described previously[1, 5-8]. Mean ages of our study subjects were 44.52 ± 12.35. This was closer to that reported from studies in North India and Western India[1,3]. This could be partially explained by the variation in the age demographics among ICU admissions in our setup. Bhadade et al. described that young men involved in work where environmental exposure to vectors of tropical illnesses is high contributed to the male predominance and younger age of patients in their study of ARDS[3]. Younger patients with non-infectious etiologies like pancreatitis, near hanging and infections such as dengue, scrub typhus, and H1N1 influenza probably contributed to the lower mean age in our study. We did not record occupational history of our patients. The commonest cause of direct lung injury in our study was infective and aspiration pneumonia, while systemic sepsis and malaria were the main contributors of indirect lung injury, a finding shown in many studies[1]. Infections in our study were common causes of ARDS. 96.22% of patients had ARDS with an infectious etiology. Pneumonia is the commonest underlying condition of ARDS[8]. Streptococci pneumonia, Staphylococcus. aureus, Mycoplasma, Coxiella, and Gram-negative bacilli are the common etiological agents of pulmonary infections that cause ARDS and the spectrum of isolated pathogens are similar in America and Europe[8, 9]. There were six patients with community acquired pneumonia (CAP). The etiology of CAP may vary depending on the geographical area and that the microbiology of one-third of cases may remain unidentified[9]. Since ventilator associated pneumonia (VAP) may complicate the course of ARDS that required mechanical ventilation[8], some primary causes of ARDS may have been unidentified in the cases of VAP seen in our study. ARDS is one of the commonest complications of H1N1 infection requiring ICU care. Incidence of ARDS among patients infected with H1N1 admitted into the ICU was 65.4% according to one study[10]. Kumar et al., in 2012, described 32 patients with ALI/ARDS with 20 cases of ARDS succumbing to illness[11]. There was 1 H1N1 case in our study. Dengue is a major seasonal health problem in tropical countries, but the incidence of ARDS is very low, albeit with high mortality[12]. Pulmonary manifestations of dengue infection such as pleural effusion and pneumonitis are rare, but, of late, many case reports of dengue-related ARDS have been described[13]. In our study five cases of ARDS were due to dengue fever (9.43%) and all of them survived. Wang et al. evaluated 606 dengue patients and reported an incidence of 1.8% ARDS in their study[12]. Individually, O.

tsutsugamushi was the commonest cause of ARDS. In our study there was 2 cases (3.77%) of scrub typhus and both survived. Scrub typhus related ARDS has been described mostly as case reports[14]. A 2007 study of ARDS in scrub typhus had eight cases with 25% mortality [14]. ARDS is a rare complication of malaria with the prevalence ranging from 2.1 to 29.1% among various studies from India. ARDS can occur with infection of Plasmodium falciparum, P. vivax, or P. ovale. Aspiration pneumonia, concomitant Gram-negative sepsis, and fluid overload may also contribute to ARDS in malaria[15,16]. Malaria accounted for 14 cases in whom 2 didn't survive. Malaria was the most common tropical infection causing ARDS in our study. In this study, malaria was the leading cause for ARDS. Four cases of leptospirosis causing ARDS were seen, one of whom did not survive. Ninety percent of patients with leptospirosis manifest with an acute febrile illness with an excellent prognosis. Weil's disease and pulmonary manifestations are seen in the remaining 10%, many of whom progress to ARDS[17]. An ICU study from Western India revealed that leptospirosis and malaria contributed to 20% and 27.6% of ARDS cases, respectively[3]. This and our study was the only study where tropical infections formed the majority group instead of pneumonia. We had 12 cases of pneumonia and 25 cases of tropical infections causing ARDS. In an Indian study of 187 patients with ARDS, tuberculosis accounted for 4.9% of the total cases[18]. ARDS is generally associated with miliary TB or tuberculous bronchopneumonia[15]. There were no cases of animal bite, poisoning or enteric fever related ARDS in our study. H1N1 infection was a seasonal occurrence. There was one case of H1N1 in our study. Thus the etiology of ARDS may vary depending on the geographical location, seasonal epidemics and diagnostic capabilities of the ICU/hospital; hence extrapolation of data of western countries may not be applicable in tropical developing nations. A greater proportion of tropical infections (10/16) had mild ARDS when compared to nontropical infections (8/30) which may suggest that acute lung injury is milder with tropical infections and easier amenable to therapy. Near-hanging patients can develop various pulmonary complications such as ARDS or cardiogenic pulmonary edema due to myocardial stunning. Pulmonary complications are due to neurogenic causes or secondarily due to negative intrathoracic pressure following acute airway obstruction. Hypoxia induced hyperadrenergic states can result in translocation of blood from systemic to pulmonary circulation and can cause an increase in both pulmonary vascular resistance and increased pulmonary vascular permeability[19]. Acute pancreatitis is a common cause of ARDS in ICU patients. Increased gut permeability causes translocation of

bacteria and endotoxin and activation of inflammatory mediators all of which contribute to the development of ARDS[20]. Mortality rates for ARDS vary widely but have, of late, shown reducing trends[21]. Most such data are from tertiary care teaching hospitals in major cities [21]. According to a Lancet review in 2007[22], it was around 25–30%, while the mortality rates described by Phua et al. in 2008 were 30–60%[23]. The overall mortality rate of ARDS was 30% (n=16) in our study. Our study had a lower mortality, possibly due to the fact that the baseline characteristics of the subjects (e.g., younger age) were different compared to the other studies and the varied etiologies of ARDS (e.g., tropical diseases) could have altered the outcome. The mortality rate in this study is in keeping with those reported by Erickson et al. Nontropical diseases had a higher relative risk (1.83) of mortality. Limitations of our study were the small sample size. The study was retrospective and ventilator settings such as tidal volumes, PEEP, and plateau pressures which were not recorded. Lung Injury Score was also not recorded. Studies focusing on ARDS among rural patients were not available for comparison. Serological tests for atypical pneumonia like Legionella, Mycoplasma, and relevant microbiological investigations for other viruses could not be done due to dearth of such facilities in our institution which could have further given clues of patients with unknown etiology.

CONCLUSION
Tropical infections commonly cause ARDS in rural tropics. Tropical infections have lesser fatalities when compared to other infections. Mortality rates are decreasing in rate when comparing to previously described studies. In this study malaria was the leading cause of ARDS which is different from other studies. This may help in creating awareness among physicians and to start treatment effectively. This study also shows endemicity of tropical infections like malaria, dengue, leptospirosis and scrub typhus.

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