Content available at: https://www.ipinnovative.com/open-access-journals

IP Indian Journal of Immunology and Respiratory Medicine

Journal homepage: https://www.ijirm.org/

Original Research Article

To evaluate different demographical and clinical characterstics in patients suffering from ARDS/ALI

Raju CH[1], Motapalkula Sreenivas Varma[2,*]

[1]*Dept. of Pulmonology, Maheshwara Medical College, Hyderabad, Telangana, India*
[2]*Dept. of Pulmonology, Sapthagiri Institute of Medical Sciences, Bangalore, Karnataka, India*

ARTICLE INFO

Article history:
Received 07-02-2021
Accepted 17-02-2021
Available online 25-02-2021

Keywords:
Acute respiratory distress syndrome (ARDS)
Pulmonary edema
Acute respiratory failure

ABSTRACT

Introduction: Acute lung injury (ALI) remains a significant source of morbidity and mortality in the critically ill patient population. Defined by a constellation of clinical criteria (acute onset of bilateral pulmonary infiltrates with hypoxemia without evidence of hydrostatic pulmonary edema). Pathogenesis of ALI is explained by injury to both the vascular endothelium and alveolar epithelium.

Materials and Methods : This was a prospective, observational and cross-sectional study conducted in the medical ICU of Department of Pulmonology at tertiary care teaching hospital between May 2018 and April 2019. Patients with ALI/ARDS were identified through a prospective daily ICU surveillance, based on the American-European Consensus Conference criteria (AECC).

Result : In our study, we had a total of 59 patient, out of which 43 survived. We had a mortally rate of 27.2%. Most of the patients were 25-60 years i.e., 23 out of 43, followed by <25 years, i.e., 23 out of 43 alive patients in number. The risk factors for developing ALI/ARDS were pneumonia (26 patients), postoperative sepsis (14 patients), poly trauma (12 patients), tuberculosis (1 patients), poisoning (1 patients) and neurological disorder (patients).

Conclusions: Pneumonia and tropical diseases are the common risk factor for the ARDS/ALI. The presence of co-morbid conditions also affects the outcome of ALI/ARDS patients. MODS of >4, LIs >2 and APACHE II >2 had associated with higher mortality.

1. Introduction

Acute lung injury (ALI) and the acute respiratory distress syndrome (ARDS) describe clinical syndromes of acute respiratory failure with substantial morbidity and mortality. Even in patients who survive ALI, there is evidence that their long-term quality of life is adversely affected.[1] Recent advances have been made in the understanding of the epidemiology, pathogenesis, and treatment of this disease. However, more progress is needed to further reduce mortality and morbidity from ALI and ARDS.[2] Because this syndrome of acute respiratory failure is so common in the worldwide, it is fair to say that ALI=ARDS is an unmet medical need. In other words, novel therapies need to be developed to further improve clinical outcomes.[3]

Multiple risk factors for the development of ARDS have been identified. The sepsis syndrome appears to be the most common, but the overall risk increases with multiple factors. Blood transfusion is an independent risk factor. Advanced age and cigarette smoking are associated with an increased risk of developing ARDS, while alcohol consumption appears to have no influence.[4] A review of the 1993 National Mortality Follow Back Study Database determined that the annual ARDS mortality is slowly declining, but that men and blacks have a higher mortality rate compared with women and other racial groups.[5]

In ARDS, the injured lung is believed to go through three phases: exudative, proliferative, and fibrotic, but the course of each phase and the overall disease progression

* *Corresponding author*.
E-mail address: varmamotapal@gmail.com (M. S. Varma).

https://doi.org/10.18231/j.ijirm.2021.010

is variable. In the exudative phase, damage to the alveolar epithelium and vascular endothelium produces leakage of water, protein, and inflammatory and red blood cells into the interstitium and alveolar lumen. These changes are induced by a complex interplay of proinflammatory and anti-inflammatory mediators.[6] Type I alveolar cells are irreversibly damaged and the denuded space is replaced by the deposition of proteins, fibrin, and cellular debris, producing hyaline membranes, while injury to the surfactant-producing type II cells contributes to alveolar collapse. In the proliferative phase, type II cells proliferate with some epithelial cell regeneration, fibroblastic reaction, and remodeling. In some patients, this progresses to an irreversible fibrotic phase involving collagen deposition in alveolar, vascular, and interstitial beds with development of microcysts.[7]

2. Materials and Methods

This was a prospective, observational and cross-sectional study conducted in the medical ICU of Department of Pulmonology at tertiary care teaching hospital between May 2018 and April 2019. Patients with ALI/ARDS were identified through a prospective daily ICU surveillance, based on the American-European Consensus Conference criteria (AECC).

2.1. Inclusion criteria

Patients of either gender above 18 years of age.

Patients with a medical diagnosis leading to ALI/ARDs were included.

2.2. Exclusion criteria

Patients with burns, trauma, and postoperative status were excluded.

Patients having contraindication for Pulmonary function test, history of recent myocardial infarction and active hemoptysis were excluded from the study.

Patients with ALI/ARDS were identified based on history, physical examination, chest radiography, and arterial blood gas analysis. All patients had central venous pressure monitoring at admission and echocardiography was performed in all patients during their ICU stay to rule out cardiogenic causes of respiratory distress. Patients were assessed twice during their hospital stay—first, at time of admission and again at the time of discharge from ICU or at the time of death. Baseline characteristics, including comorbidities, history, biochemical and microbiological investigations, and acute physiological, age and chronic health evaluation II (APACHE II) scores, were documented in an Excel sheet. Also, duration of hospital stay, duration of mechanical ventilation, inotrope use, and ultimate hospital outcome were documented at the time of discharge or death.

2.3. Statistical analysis

Statistical analyses were done using SPSS Statistics 25^{th} version. Wherever applicable, descriptive statistical analysis was done.

3. Results

In our study, we had a total of 59 patient, out of which 43 survived. We had a mortally rate of 27.2%.

Table 1: Distribution of genderbetween alive patients and dead patients

Gender	Alive patients in no.	Dead patients in no.
Male	26	11
Female	17	5
Total	43	100

Table 2: Distribution of age groups between alive patients and dead patients

Age (in years)	Alive patients in no.	Dead patients in no.
<25	13	2
25-60	23	13
>60	7	1
Total	43	100

In our study, most of the patients were 25-60 years i.e., 23 out of 43, followed by <25 years, i.e., 23 out of 43 alive patients in number.

Table 3: Smoker and Alcoholic of ARDS/ALI (both survivors and non-survivors)

Parameter		Alive patients in no.	Dead patients in no.
Smoker	Yes	4	3
	No	39	7
Alcoholic	Yes	9	7
	No	34	3

Table 4: Diagnosis of ARDS/ALI (both survivors and non-survivors)

Diagnosis	Alive patients in no.	Dead patients in no.
Pneumonia	17	9
Post-operative sepsis	11	3
Poly trauma	9	3
Neurological Disorder	1	0
TB	1	0
Poisoning	1	0
Tropical diseases	3	1

The risk factors for developing ALI/ARDS were pneumonia (26 patients), postoperative sepsis (14 patients), poly trauma (12 patients), tuberculosis (1 patients), poisoning (1 patients) and neurological disorder (patients).

Table 5: Sign and symptoms of patients with ARDS/ALI (both survivors and non-survivors)

Sign and Symptoms		Alive patients in no.	Dead patients in no.
Time since onset	<10 days	27	13
	>10days	16	3
Fever	No	9	2
	<8days	34	14
Cough	No	13	1
	<8days	24	14
	>8days	6	1
Breathlessness	No	7	1
	<8days	28	13
	>8days	8	2
Bleeding	Yes	9	2
	No	33	14
	Epistaxis	1	0
Respiratory disease	COPD	1	0
	Byssinosis	1	0
	Bronchiectasis	1	1
	Bulla	0	0
	Nil	40	0
Temperature O^oC		37.96	37.13
Pulse (/min)		1.7	114
Respiratory rate (/min)		34	37
Glasgow coma scale		14	12
Pallor	Yes	17	3
	No	26	13
Cyanosis	Yes	7	2
	No	36	14
Skin Rash	Yes	39	15
	No	4	1
DIC	Yes	9	2
	No	34	14
Liver dysfunction	Absent	13	3
	Present	30	13
Renal dysfunction	Absent	17	4
	Present	26	12
P/F ratio		173	119

4. Discussion

The ARDS is a disease with a high mortality and is a common cause of admission into intensive care units (ICUs) all over the world. The American-European Consensus Conference definition of ALI and ARDS was published in 1994. This definition is simple to apply in the clinical setting and also recognizes that the severity of clinical lung injury varies according to the severity of arterial hypoxemia.[8]

Table 6: Blood investigation of patients with ARDS/ALI (both survivors and non-survivors)

Investigation		Alive patients in no.	Dead patients in no.
Platelets in lacks		3.1	1.9
PT/APTT	Normal	1	0
	Deranged	42	16

Table 7: Clinical details of patients with ARDS/ALI (both survivors and non-survivors)

Parameter		Alive patients in no.	Dead patients in no.
SOFA	<5	24	15
	>5	19	1
MODS	<4	26	13
	>4	17	3
LIS	<2	16	3
	>2	27	13
APACHE II	<12	23	14
	>12	20	2
Steroids taken	Yes	2	1
	No	41	15
Days on ventilator		2	6

The risk factors for developing ALI/ARDS in our study were Pneumonia (44.06%), Tropical diseases (6.77%), Postoperative sepsis (26.4%), Poly trauma (20.33%), Tuberculosis (1.69%), Poisoning (1.69%) and Neurological disorder (1.69%). In the study by Amato MB et al., the common risk factors for ALI/ARDS were pneumonia (30%), recent surgery in abdomen (10%), septicemia with MOF (18%), and trauma (12%).[9] Other significant causes were pancreatitis, thermal burns> 40% (6%), peritonitis, falciparum malaria and poisoning. Similar findings were also find in the studies by Guerin C et al.,[10] When compared with the risk factor associated with the non-survivors in our study, it is observed that the most common risk factor is pneumonia and that the incidence of sepsis, poly trauma is quite similar in both the studies however the incidence of tropical diseases is much higher in our study.

The presence of co-morbid conditions also affects the outcome of ALI/ARDS patients. In our study 15% of the patients had respiratory diseases, 7.7% of the patients had hypertension, 6.2% of the patients had diabetes mellitus, 3% of the patients had HIV and 1.5% of the patients had ischemic heart disease. It was observed that 18.5% of the patients used to consume alcohol. However, none

of the above factors affected the outcome of the patients significantly. In the study by Cavalcanti AB et al., it was observed that cirrhosis of the liver (20%), HIV infection (10%), active malignancy (24%) and organ transplantation (9%) were the common co-morbid conditions in the patients dying due to ALI/ARDS.[11] In the study by Mekontso D et al., 20% of the patients had hypertension, 8% of the patients had diabetes mellitus and 3% of the patients had coronary artery disease.[12] The low incidence of the co-morbid conditions like malignancy, HIV infection in our study could represent a lack of awareness and early detection of these conditions in the general population.

An attempt was made to analyze the presenting clinical features of the patient and the impact they had on the outcome. It was observed that most of the patients presented within 10 days of the onset of the symptoms. Dyspnea was present in almost all cases. Fever was seen in majority of patients with duration of 2 to 4 days. History of wading through water was present in 27(73%) cases, this can be attributed to the similar frequency of leptospirosis 22(59.5%) which is water borne infection. 11(29.7%) patients had history of hemoptysis. Duration of cough related with the outcome of disease. Prognosis was better in patients with duration of cough less than 10 days. Hence early detection of symptoms like cough could alter the outcome of the disease.

Systemic abnormalities were found in majority of cases in the form of hematological, renal and liver dysfunction. These finding in our study show similar pattern as in the study carried out by Slutsky AS et al.[13] In a study by Caironi P et al., renal and Hematological dysfunction have been shown to be independent predictors of mortality.[14] The organisms that were commonly isolated in cultures (blood and sputum) were pseudomonas and Klebsiella. A similar organism's pattern was seen in patient's studies by Goligher EC et al.[15]

A number of studies had found a direct association between poor oxygenation and mortality whereas other studies have failed to identify a correlation.[16] When tested prospectively, increasing severity of lung injury (using LIS Score), measured at 24, 48, and 72 hours, wasn't associated with increased mortality.[17] We also observed that a MODS of >4, LIs >2 and APACHE II >2 had higher association with mortality. The mean score in non-survivors were as follows: MODS 5.3, LIS 2.3 and APACHE II 17.6 these scoring systems were equally effective in predicting mortality in ALI/ARDS due to tropical diseases. The SOFA score was not found to be useful in predicting the outcome. It should be noted that we had used the scores only during assessment of the patients on the first day of admission in our ICU. The mean P/F ratio was 208 in survivors and 167 in non-survivors in our study. However, no significant difference has been found in the P/F ratio in survivors and non-survivors in other studies.[18]

In our study 60% of the patients required mechanical ventilation. The patients were ventilated using ACMV (Assist control mechanical ventilation) or control mode and a lung protective strategy with tidal volume of 8ml/kg was given with PEEP whenever required. Inverse ratio ventilation and prone pressure ventilation were also attempted in a few cases. The significant finding was that survivors spent lesser number of days (mean 2.74 days) on ventilator than non-survivors (mean 8.73 days). Also 50% of the deaths were within the first 24 hours. In the study by Constantin JM et al., duration of ventilation was less than 7 days in 80% of the patients (dead) while the same was 66% in non-survivors in our study and 71% in survivors.[19] The use of steroids in our study did not reduce the mortality as in other studies.[20] In the survivors, a PFT was done in 34% of the patients. It was seen that overall 43% has an obstructive and restrictive pattern 28.5% had an obstructive pattern and 28.5% had a normal PFT. It was also seen that none of these patients had preexisting respiratory disease. Mean pO2 on discharge was 81 mm of Hg so a long-term prospective trial is essential to look at the long-term effects of ALI/ARDS patients in the survivors of this condition.

5. Conclusions

Pneumonia and tropical diseases are the common risk factor for the ARDS/ALI. The presence of co-morbid conditions also affects the outcome of ALI/ARDS patients. MODS of >4, LIs >2 and APACHE II >2 had associated with higher mortality.

6. Abbreviation

APTT: Activated Partial Thromboplastic time; PT: prothrombin Time; DIC: disseminated intravascular coagulation; P/F: SOFA Score: Sequential Organ Dysfunction Assessment; MODS: Multiple Organ Dysfunction score; LIS: lung injury score; APACHE: Acute Physiology and Chronic Health Evaluation.

7. Acknowledgement

None.

8. Source of Funding

No financial support was received for the work within this manuscript.

9. Conflict of Interest

The authors declare they have no conflict of interest.

References

1. Bellani G, Lafey JG, Pham T, Fan E, Brochard L, Esteban A, et al. Epide miology, patterns of care, and mortality for patients with acute respira tory distress syndrome in intensive care units in 50 countrie. *JAMA*. 2016;315(8):788–800.

2. Gattinoni L, Marini JJ, Collino F, Maiolo G, Rapetti F, Tonetti T, et al. The future of mechanical ventilation: lessons from the present and the past. *Crit Care*. 2017;21(1):183. doi:10.1186/s13054-017-1750-x.
3. Nin N, Muriel A, Penuelas O, Brochard L, Lorente JA, Ferguson ND, et al. Severe hypercapnia and outcome of mechanically ventilated patients with moderate or severe acute respiratory distress syndrome. *Intensive Care Med*. 2017;43(2):200–8.
4. Walkey AJ, Goligher EC, Sorbo LD, Hodgson CL, Adhikari NKJ, Wunsch H, et al. Low tidal volume versus non-volume-limited strategies for patients with acute respiratory distress syndrome. A systematic review and meta-analysis. *Ann Am Thorac Soc*. 2017;14(4):S271–9.
5. Needham DM, Yang T, Dinglas VD, Mendez-Tellez PA, Shanholtz C, Sevransky JE, et al. Timing of Low Tidal Volume Ventilation and Intensive Care Unit Mortality in Acute Respiratory Distress Syndrome. A Prospective Cohort Study. *Am J Respir Crit Care Med*. 2015;191(2):177–85. doi:10.1164/rccm.201409-1598oc.
6. Lafey JG, Bellani G, Pham T, Fan E, Madotto F, Bajwa EK. Potentially modifable factors contributing to outcome from acute respira‑ tory distress syndrome: the LUNG SAFE study. *Intensive Care Med*. 2016;42(12):1865–76.
7. Jong AD, Cossic J, Verzilli D, Monet C, Carr J, Conseil M, et al. Impact of the driving pressure on mortality in obese and non-obese ARDS patients: a retrospective study of 362 cases. *Intensive Care Med*. 2018;44(7):1106–14. doi:10.1007/s00134-018-5241-6.
8. Villar J, Martin-Rodriguez C, Dominguez-Berrot AM, Fernandez L, Ferrando C, Soler JA, et al. A quantile analysis of plateau and driving pressures: efects on mortality in patients with acute respiratory distress syndrome receiving lung-protective ventilation. *Crit Care Med*. 2017;45(5):843–50.
9. Amato MB, Meade MO, Slutsky AS, Brochard L, Costa EL, Schoenfeld DA, et al. Driving Pressure and Survival in the Acute Respiratory Distress Syndrome. *N Engl J Med*. 2015;372(8):747–55. doi:10.1056/nejmsa1410639.
10. Guérin C, Papazian L, Papazian L, Reignier J, Ayzac L, Loundou A, et al. Effect of driving pressure on mortality in ARDS patients during lung protective mechanical ventilation in two randomized controlled trials. *Crit Care*. 2016;20(1):384. doi:10.1186/s13054-016-1556-2.
11. Cavalcanti AB, Suzumura EA, Laranjeira LN, Paisani DM, Damiani LP. Efect of lung recruitment and titrated positive end-expiratory pressure (PEEP) vs low peep on mortality in patients with acute respiratory distress syndrome: a randomized clinical trial. *JAMA*. 2017;318(14):1335–45.
12. Dessap AM, Boissier F, Charron C, Bégot E, Repessé X, Legras A, et al. Acute cor pulmonale during protective ventilation for acute respiratory distress syndrome: prevalence, predictors, and clinical impact. *Intensive Care Med*. 2016;42(5):862–70. doi:10.1007/s00134-015-4141-2.
13. Slutsky AS, Ranieri VM. Ventilator-Induced Lung Injury. *N Engl J Med*. 2013;369(22):2126–36. doi:10.1056/nejmra1208707.
14. Caironi P, Carlesso E, Cressoni M, Chiumello D, Moerer O, Chiurazzi C, et al. Lung Recruitability Is Better Estimated According to the Berlin Definition of Acute Respiratory Distress Syndrome at Standard 5 cm H2O Rather Than Higher Positive End-Expiratory Pressure. *Crit Care Med*. 2015;43(4):781–90. doi:10.1097/ccm.0000000000000770.
15. Goligher EC, Kavanagh BP, Rubenfeld GD, Adhikari NK, Pinto R, Fan E, et al. Oxygenation Response to Positive End-Expiratory Pressure Predicts Mortality in Acute Respiratory Distress Syndrome. A Secondary Analysis of the LOVS and ExPress Trials. *Am J Respir Crit Care Med*. 2014;190(1):70–6. doi:10.1164/rccm.201404-0688oc.
16. Cavalcanti AB, Suzumura EA, Laranjeira LN, Paisani DM, Damiani LP, Guimaraes HP, et al. Efect of lung recruitment and titrated positive endexpiratory pressure (PEEP) vs low PEEP on mortality in patients with acute respiratory distress syndrome: a randomized clinical trial. *JAMA*. 2017;318(14):1335–45.
17. Meade MO, Young D, Hanna S, Zhou Q, Bachman TE, Bollen C, et al. Severity of Hypoxemia and Effect of High-Frequency Oscillatory Ventilation in Acute Respiratory Distress Syndrome. *Am J Respir Crit Care Med*. 2017;196(6):727–33. doi:10.1164/rccm.201609-1938oc.
18. Klapsing P, Moerer O, Wende C, Herrmann P, Quintel M, Bleckmann A, et al. High-frequency oscillatory ventilation guided by transpulmonary pressure in acute respiratory syndrome: an experimental study in pigs. *Crit Care*. 2018;22(1):121. doi:10.1186/s13054-018-2028-7.
19. Constantin JM, Godet T, Jabaudon M, Bazin JE, Futier E. Recruitment maneuvers in acute respiratory distress syndrome. *Ann Transl Med*. 2017;5(14):290. doi:10.21037/atm.2017.07.09.
20. Jabaudon M, Godet T, Futier E, Bazin JE, Sapin V, Roszyk L, et al. Ration; ale, study design and analysis plan of the lung imaging morphology for ventilator settings in acute respiratory distress syndrome study (LIVE study): study protocol for a randomised controlled trial. *Anaesth Crit Care Pain Med*. 2017;36(5):301–6.

Author biography

Raju CH, Associate Professor

Motapalkula Sreenivas Varma, Associate Professor

Cite this article: Raju CH, Varma MS. To evaluate different demographical and clinical characterstics in patients suffering from ARDS/ALI. *IP Indian J Immunol Respir Med* 2021;6(1):44-48.