Clinical Profile of ARDS

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Abstract

Objectives: Several studies have been published in Western literature on incidence, prevalence, clinical course, outcome and mortality in patients with acute respiratory distress syndrome (ARDS). There are very few studies on the pattern of ARDS seen in Indian population. There are anecdotal reports of ARDS associated with different tropical diseases and the exact association of these life-threatening disorders with ARDS is not clearly described in the Indian literature. The study was carried out to identify the clinical pattern of Indian patients who died of ARDS.

Methods: This was a three and a half year retrospective study comprising of 98 patients who died of ARDS in the intensive care unit of Apollo Hospital, a tertiary care referral centre between January 1999 to June 2002. The present study looked at only those patients who died from ARDS and did not evaluate the clinical outcome or survival pattern of ARDS patients. The criteria used for diagnosis of ARDS was based upon American/European consensus statement for definition of acute lung injury (ALI) and ARDS. The patient demographic data consisted of age, sex, associated major illness in the part, clinical disorders associated with ARDS, length of hospital stay, use and duration of mechanical ventilation and the presence of sepsis and organ failure defined by ACCP/SCCM consensus conference definition. Seventy patients were ventilated with volume control mode and 28 patients with pressure control ventilation. Lung protective strategy was used in all the cases comprising of low tidal volumes at the rate of 5-ml/kg-body weight. Statistical analysis of the data was done by SPSS 10 for windows (SPSS, Inc., Chicago, Illinois).

Results: There were 98 patients during the study period who died of ARDS. Fifty one males and 47 female patients. Thirty patients had primary pulmonary infection, 18 had severe sepsis with multiorgan failure, 12 patients had polytrauma and 10 each had recent abdominal surgery and pancreatitis. Length of ICU stay was less than 10 days in 58 patients whereas in 40 patients it was more than 10 days. Duration of mechanical ventilation was less than seven days in 80 patients and more than seven days in 18 patients. Positive body fluid cultures were obtained in 42 out of 98 patients and of these, 14 patients had microbiological diagnosis established by blood culture, another 14 by endotracheal secretion culture, eight by urine culture and in the remaining six patients based upon wound cultures. The commonest organisms isolated from the body fluids were Pseudomonas and Klebsiella.

Conclusion: Primary pulmonary infection was associated with ARDS is one-third of patients. Multiorgan failure was seen in 18% of patients who died from ARDS. Severe sepsis was identified as a significant risk factor for ARDS.

INTRODUCTION

Acute respiratory distress syndrome (ARDS) is a devastating clinical disorder that is seen in critically ill patients with broad range of clinical disorders characterized by widespread inflammatory response. Several studies have been published in Western literature on incidence, prevalence, clinical course outcome and mortality in patients with ARDS. Extensive animal research suggests that parenchymal lung injury and an inflammatory response may be caused and perpetuated if mechanical ventilation results in alveolar units with tidal breathing. On the basis of this work, pressure-limited, lung-protective mechanical ventilatory strategies have been proposed for acute respiratory distress syndrome (ARDS), emphasizing the need to “open the lung and keep it open” while avoiding alveolar over-distention. Amato and
colleagues\(^7\) in a randomized controlled trial recently found reduced mortality in ARDS patients managed with such an approach. Because conventional ventilation strategies have been associated with lung injury, current objectives include optimization of gas exchange and prevention of further injury to the lung. By definition, “conventional” ventilator settings has usually implied high airway pressures and tidal volumes in the range of 15 ml per kg body weight. Recent studies have altered physiologic thinking and clinical practice by showing better outcomes with lower tidal volumes and airway pressure limits.\(^8\) Strategies for “protective ventilation” of lungs in ARDS have been characterized not only by reduced tidal volume, higher levels of positive end-expiratory pressure but also by tolerance of higher levels of PaCO\(_2\) than those associated with conventional settings. Despite newer strategies of inhaled nitric oxide and prone position\(^9\) the overall mortality from ARDS continues to be high even in the best of the medical centres.

There are very few studies on the pattern of ARDS seen in our country. There are anecdotal reports of ARDS in Indian literature associated with different tropical diseases\(^10-13\) and with the certain rare metabolic disorders.\(^14\) The exact association of these life-threatening disorders with ARDS is not clearly described in the Indian literature. In this study we have attempted to evaluate the clinical course of patients who died from ARDS in the intensive care unit of our hospital. The aim was to study the clinical course of Indian patients who died of ARDS.

**Material And Methods**

This is a three and a half year retrospective study carried out on 98 patients who died of ARDS in intensive care unit of Apollo Hospital, a tertiary care referral centre between January 1999 to June 2002. The present study looked at only those patients who died from ARDS and did not evaluate the clinical outcome or survival pattern of ARDS patients.

Only those patients were included in the study who had died of ARDS. The criteria used for diagnosis of ARDS was based upon American/European consensus statement for definition of ALI and ARDS\(^15\) which includes:

1. Acute onset
2. Bilateral infiltrates on chest radiographs
3. Absence of clinical signs of left atrial hypertension or if PA catheter is present then pulmonary artery opening pressures <15 mmHg.

Routine standard care offered to these critically ill patients comprised of intensive nursing care, haemodynamic monitoring, central venous pressure line, arterial line, nasogastric tube aspiration, endotracheal intubation, mechanical ventilatory support, total parenteral nutrition (TPN), intravenous crystalloid infusion with serial monitoring of haematological and biochemical parameters including monitoring for DIC.

The patient demographic data consisted of age, sex, associated major illness in the past, clinical disorders associated with ARDS, length of hospital stay, use and duration of mechanical ventilation and the presence of sepsis and organ failure defined by ACCP/SCCM consensus conference definition.\(^16\) Severity of illness was measured by the acute physiology and chronic health evaluation II (APACHE II) scores. The multiple organ dysfunction (MOD) score was determined on the day of onset of ARDS for all patients. Presence or absence of tracheostomy, lung injury scores, elective versus emergency surgical procedure were the other variables recorded in detail. Seventy patients were ventilated with volume control mode and 28 patients with pressure control ventilation. Lung protective strategy was used in all the cases comprising of low tidal volumes at the rate of 6 ml/kg body weight. Statistical analysis of the data was done by SPSS 10 for windows (SPSS, Inc., Chicago, Illinois).

**Clinical Scores**

**Acute Physiology and Chronic Health Evaluation (APACHE) Score**

Developed first in 1981 by Knaus et al,\(^17\) the APACHE score has become the most commonly used survival prediction model in ICUs worldwide. The APACHE II score, a revised and simplified version of the original prototype,\(^18\) uses a point score based on initial values of 12 routine physiologic measures, age and previous health status to provide a general measure of severity of disease. The maximum possible APACHE II score is 71 and high scores have been well correlated with mortality. The APACHE II severity-of-disease classification was devised to stratify prognosis in groups of critically ill patients and to determine the success of treatment.

**Multiple Organ Dysfunction Score**

The multiple organ dysfunction (MODS) scoring system was developed by a literature review of clinical studies of multiple organ failure from 1969 to 1993.\(^19\) Optimal descriptors of organ dysfunction were thus identified and validated against a clinical database. Six organ systems were chosen and a score of 0-4 allotted for each organ according to function (zero being normal function through to four for most severe dysfunction) with a maximum score of twenty-four. The worst score for each organ system in each 24 hour period is taken for calculation of the aggregate score. A high initial MODs correlated with ICU mortality. In a recent study of 368 critically ill patients, the MODs was found to better describe outcome groups than the APACHE II or the organ failure score, although the predicted risk of mortality was similar for all scoring systems.\(^20\)

**Lung Injury Score**

In 1988, Murray and colleagues\(^21\) proposed a system to grade the extent of lung injury known as the lung injury score (LIS), to be used for patients with established or at-risk diagnoses. The four components include: the chest roentgenogram score, hypoxemia score, PEEP score and respiratory system compliance score. The final value obtained
by dividing the aggregate sum by the number of components used. An LIS greater than 2.5 indicates severe lung injury or ARDS. It has been shown that the initial LIS correlates fairly well with mortality.

**RESULTS**

There were 98 patients during the study period who died of ARDS. Fifty one were males and 47 were female patients. Age distribution was as follows:

- <20 years = 10
- 21-40 years = 54
- 41-60 years = 20
- >60 years = 14

As shown above clearly the majority of the patients were between 20-60 years.

Thirty one patients had past history of NIDDM, 20 had hypertension, eight had coronary artery disease and 39 patients had underlying respiratory problems such as COPD (n=22), bronchial asthma (n=10), tuberculosis (n=3) and interstitial lung disease (n=4), HIV infection was seen in two patients and both were positive by ELISA technique. They were coincidentally detected to be HIV positive. CD4,CD8 count was not done in both cases.

No. of patients with tracheostomy : 40
No. of patients who developed ARDS : 37 following surgery
  a) after elective surgery : 9
  b) after emergency surgery : 28

The mean lung injury score (LIS), mean multiple organ dysfunction (MOD) score and the mean APACHE II scores have been all grouped together in Table 1.

Length of ICU stay was less than 10 days in 58 patients whereas in 40 patients the length of ICU stay was more than 10 days.

**DISCUSSION**

Much of the available data on clinical course of patients of ARDS is from Western literature.1-3 Thorough literature search has shown very few studies on ARDS in Indian literature which are mainly on ARDS with various tropical infections like malaria, miliary tuberculosis and dengue infections.10-14

In the present study majority of patients were males (n=51, 52%) and mean age was 39.2 ± 2.5 years which is similar to reports from other studies.3 We still do not know why some people progress to ARDS while in others who sustain similar indistinguishable insult/injury the lungs remain relatively unaffected.

In our study microbiological diagnosis could be obtained in only 49 out of 98 patients (49%) as shown in Table 3. The maximum yield was from blood cultures followed by endotracheal secretions culture. The commonest organism isolated from various blood cultures was *Pseudomonas* species followed by *Klebsiella* as shown in Table 4.

Risk factors for ARDS included primary pulmonary infection in 29.4% (n=30), gastrointestinal disease in 25% (n=25), polytrauma in 12% (n=12) and other disorders in 44%. When compared to the study by Estenssoro et al2 from South Africa which showed sepsis in 44%, shock in 5%, trauma

<table>
<thead>
<tr>
<th>Scores</th>
<th>Mean value</th>
</tr>
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<tbody>
<tr>
<td>Mean lung injury scores (LIS)</td>
<td>2.76 ± 1.8</td>
</tr>
<tr>
<td>Mean multiple organ dysfunction (MOD) score</td>
<td>9 ± 2.0</td>
</tr>
<tr>
<td>Mean APACHE II scores</td>
<td>28 ± 3.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underlying diseases</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Primary pulmonary infection</td>
<td>30</td>
</tr>
<tr>
<td>Recent (less than 2 weeks) abdominal surgery</td>
<td>10</td>
</tr>
<tr>
<td>Severe sepsis with multiorgan failure</td>
<td>18</td>
</tr>
<tr>
<td>Peritonitis</td>
<td>5</td>
</tr>
<tr>
<td>Polytrauma</td>
<td>12</td>
</tr>
<tr>
<td>Thermal burns &gt; 40%</td>
<td>6</td>
</tr>
<tr>
<td><em>Plasmodium falciparum</em> malaria</td>
<td>4</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>10</td>
</tr>
<tr>
<td>Acute viral fulminant hepatitis</td>
<td>2</td>
</tr>
<tr>
<td>Organophosphorus poisoning</td>
<td>1</td>
</tr>
</tbody>
</table>

Duration of mechanical ventilation was less than seven days in 80 patients and more than seven days in 18 patients.

Severe sepsis with multiorgan failure was seen in 18 patients and all these patients had overt disseminated intravascular coagulation (DIC).

Primary pulmonary infection was seen in 30 out of 98 patients (30%) as shown in Table 2. Gastrointestinal disorders accounted for 25% of patients. Out of these pancreatitis alone was associated with ARDS in 10% of patients (Table 2).
11%, gastric aspiration 10% and others 34%. Our results are slightly at variance. Recently Alberti et al\textsuperscript{2} showed crude incidence of severe sepsis in ICUs to be around 24% and septic shock around 30%, whereas in the present study, severe sepsis with multi-organ failure was seen in 18% and shock in 27%.

In majority of our patients (n=58), the length of stay in ICU was less than 10 days and patients succumbed to their illness within 10 days, which is similar to the study by Estenssoro et al\textsuperscript{2} in which one third of patients died within three days of ARDS.

The risk factors that led to ARDS are similar to the ones seen in other studies as are the predictors. The predictive factors for mortality were both pulmonary i.e. (P_{a}O_{2}/F_{i}O_{2} ratio) and extra-pulmonary i.e. sequential organ failure. Prognosis depends on timing the specific nature of the injury mechanism as well as the overall severity of illness.

One of the limitations of this study is that it is a retrospective study and did not compare with patients who survived after developing ARDS and to overcome this we are in the process of conducting a prospective study involving comparison with the controls.

**CONCLUSION**

Primary pulmonary infection was associated with ARDS in nearly one-third of patients. Multi-organ failure was seen in 18% of patients who died from ARDS. Severe sepsis was identified as a significant risk factor for ARDS. Early recognition, prompt treatment of sepsis and routine use of lung protective ventilatory strategy may help to reduce mortality due to ARDS.

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**REFERENCES**