
Acute Respiratory Distress Syndrome in the Trauma Intensive Care Unit: the Other View

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Objective. To study the timeliness of the diagnosis of patients with acute respiratory distress syndrome (ARDS)/acute lung injury (ALI) at the Puerto Rico Trauma Center (PRTC) and to determine the overall 28 day mortality for ARDS during the study period.

Method. A retrospective review of all admissions to the Trauma Intensive Care Unit (TICU) from August 2000 to August 2001 was done. Patients with the diagnosis of ARDS/ALI were selected, records examined, and clinical data obtained for analysis.

Findings. Of the 537 patient admitted to the PRTC, 236 patient were admitted to TICU. Of these, 17 patients were identified as having hypoxemic ratios below 200 and 13 patients were identified as having ARDS as established by the American-European Consensus Conference of

1994. Their mean age was 41 years, the main cause of ARDS was due to pulmonary contusion due to blunt chest trauma. The 28-day survival for this group was 43%. Subgroup analysis showed that there was 86% mortality when the polytraumatized patient developed sepsis.

Conclusion. The majority of the cases of ARDS were correctly identified as such by caregivers at the time of diagnosis. Mortality as predicted by Injury Severity Score in our ARDS patients' correlates with overall mortality in our TICU. Mortality in this group is lower than that of reported literature, in sharp contrast to our medical ICU counterparts.

Key words: Respiratory distress syndrome, Intensive care, Respiratory care unit, Trauma Center

The acute respiratory distress syndrome (ARDS) was described by the first time in 1967 by Ashbaugh and his colleagues (1). Since then, various attempts have been made to try to define this syndrome. The latest accepted definition of ARDS was established by the American European Consensus Conference of 1994 (2). The consensus states that the clinical scenario that will fit the diagnosis should include a hypoxemic ratio equal or below 200, and bilateral pulmonary infiltrates on a chest radiograph. The pulmonary-artery occlusion pressure should be below 18 mm Hg or, in its absence, no clinical evidence of elevated left atrial pressure based on chest radiograph and other

clinical data should be present. The definition of acute lung injury includes the same three components, except that the hypoxemic ratio ranges between 201-300. As part of the definition, ALI/ARDS should have an acute onset. The NIH early estimates suggest an incidence of 75/100,000 (3). However, an abstract from the King County ARDS Study presented at the 98th American Thoracic Society (ATS) International Conference suggests that the incidence of ALI/ARDS may be as high as 99/100,000 (4). The majority of clinical series of ARDS indicate that severe sepsis is the most common culprit for this syndrome. These studies rank traumatic injury second only to sepsis as the leading cause of ALI/ARDS (5,6). Other risk factors associated with the development of ARDS are multiple transfusions, near drowning and disseminated intravascular coagulopathy (7, 8).

In multiple trauma, pulmonary contusion occurs in 17 % of patients. Its associated mortality could be as high as 25% of cases, often due to pneumonia or ARDS (6). The reported overall mortality of ARDS is approximately 50% (3).

Ongoing research has begun to unravel the pathophysiologic mechanism associated to this condition. When activated, the inflammatory response releases many

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mediators into the pulmonary and systemic circulation. This leads to injury of the alveolar and epithelial barriers of the lung, causing acute inflammation and protein rich alveolar edema which leads to respiratory failure (9). Recently the ARDS Network Trial showed that mortality was reduced by 22% in patients treated with a low tidal volume strategy (6 ml/kg) as compared to patients treated with a tidal volume of 12 ml/kg (10). The authors believe that these differences are most likely related to differences in inflammatory response, as there was a greater reduction in IL-6 levels in patients treated with lower tidal volumes (10). Today, multiple immunomodulatory agents are being used in research given this understanding and some of them are beginning to show positive results (11).

Research studies are also underway to determine ALI/ARDS incidence and mortality. How is the clinical data being applied by the medical community is another question that is currently being addressed. Considering all the above, our purpose was to study the timeliness of the diagnosis of patients with ALI/ARDS at the Puerto Rico Trauma Center (PRTC) and to determine the overall 28 day mortality for ARDS during the Study period.

Methods

A retrospective record review of all admissions to the Trauma Intensive Care Unit (TICU) of the Puerto Rico Trauma Center (PRTC) during a one-year period (August 2000 to August 2001) was done. Hypoxemic ratios gathered during that period were used to identify patients. All patients with a hypoxemic ratio of 200 or less as reported on their admission and 24 hr post admission note were selected for evaluation. The medical records of patients that met these criteria were reviewed and clinical data obtained for study purposes. Demographic data selected for evaluation-included age, sex, admission diagnosis, initial chest radiographic findings, A-a gradient, and PaO₂/FiO₂. We also sought to answer questions, such as, at what time was the diagnosis of ARDS made, whether or not the diagnosis of ARDS was recorded on the patient chart, what was the incidence of ARDS at the institution as well as the patient's 28 day mortality for that admission. In those patients with ARDS who died, the reason for death was recorded. All clinical data obtained was analyzed through data regression and chi-square analysis

Results

Of the 537 patients admitted to the PRTC, 236 patient were admitted to TICU. Of these, 17 patients were identified as having hypoxemic ratios below 200 and 13 patients were identified as having ARDS as established by the

American-European Consensus Conference of 1994. Their mean age was 41 year, with an average APACHE II Score of 16 and an Injury Severity Score of 22 (Table 1). The

Table 1. Demographic data of the evaluated population

	Male	Female	p Value
Number of subjects	7	6	
Average age	41	41	
Average Apache II score	18	13	P = 0.71
Average Injury Severity Score	22	21	P = 0.83

main cause of ARDS was pulmonary contusion due to blunt chest trauma secondary to traumatic falls or motor vehicle accidents (Figure 1). When medical records were

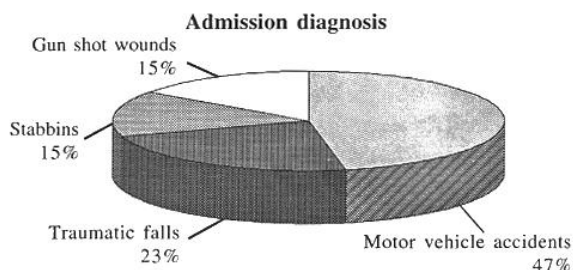


Figure 1. Admission diagnosis of the thirteen patients selected for our study.

evaluated, we noticed that 85% of the patients had the diagnosis on chart at the time of admission to the TICU (Figure 2).

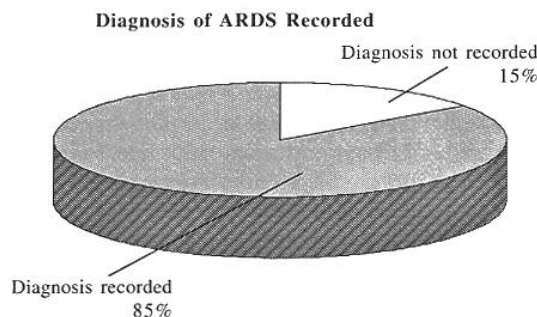


Figure 2. Percent of patient with a recorded diagnosis of ARDS on chart.

The alveolo-capillary gradients were compared against hypoxemic ratios in this group and a moderate correlation was observed ($p = .003$; $r = .45$) (Figure 3). Hypoxemic ratio did not correlate with mortality when Injury Severity Score (ISS) was evaluated. ISS did predict mortality in this group, however this correlation was not statistically significant (Figure 4). APACHE II Score also predicted mortality in

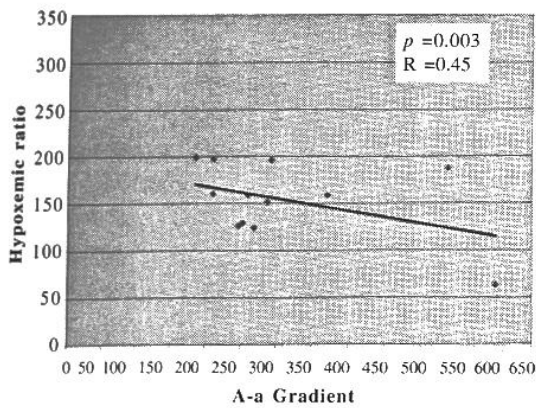


Figure 3. A-a gradient were compared against hypoxemic ratios in this group.

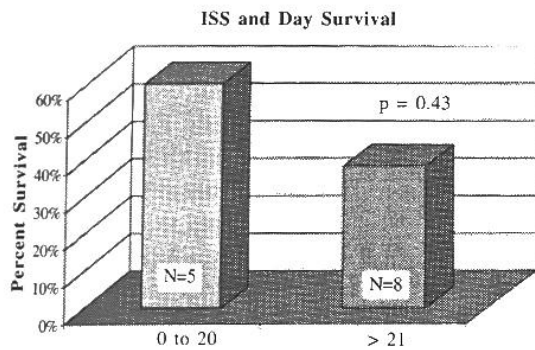


Figure 4. ISS and 28 day survival for population.

this group, although again, for our population the data was not statistically significant. Hypoxemic ratio had no correlation with mortality (Figure 5). The 28-day survival for this group was 70%. There was a 64% mortality in

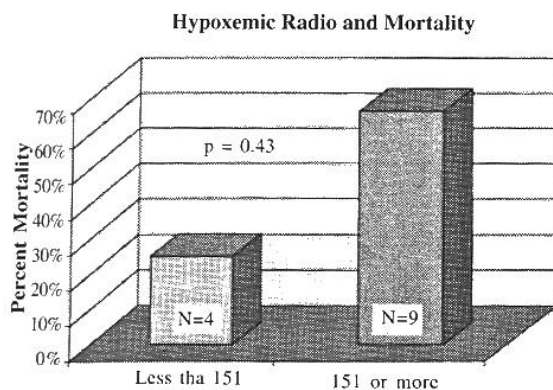


Figure 5. Hypoxemic ratio compared against mortality

patients with the diagnosis on chart. No mortality was recorded in patients that did not have the diagnosis recorded on chart. Subgroup analysis showed that there was 86% overall mortality when the polytraumatized patient developed sepsis.

Discussion

The majority of ARDS patients in our study were correctly identified as such by caregivers at the time of diagnosis. This sharply contrasts with the experience we obtained at our medical ICU (12). We can only speculate on the reasons for this to happen. Mechanism of injury (direct vs. indirect) may certainly play a role. Comorbid conditions such as age, alcohol, liver cirrhosis, tobacco use or the occurrence of a medical or surgical "misadventure" which have been linked to an increased risk for developing ARDS (13), were not evaluated for this study. Mortality as predicted by ISS in our ARDS patients correlates with overall mortality in our TICU. Contrary to a previously published study (14), gender did not seem to have a greater risk of developing ARDS when compared to males with the same ISS.

In our study, we found a significant reduction in the death rate in trauma patients when compared to our medical patients. We believe that this difference was due to the less comorbid conditions in our trauma patients and due to the application of lung-protection ventilation strategies. It is also likely that the reduction in the death rate in this study results from multiple advances in the care of critically ill patients. Our review found reduced death rates when compared to that of reported literature for this population.

There are several limitations to our study. We did a retrospective record review, in which only trauma patients were evaluated, and our population was small which may explain why our numbers failed to reach statistical significance. Potential strengths of this study were that the data came from a single institution and that the patient criteria for the diagnosis of ARDS were those defined by the American-European Consensus Conference.

Future avenues of research for ALI/ARDS areas include prospective evaluation of comorbid conditions associated to ARDS in surgical patients. Incidence, length of stay, management and mortality evaluations in view of new therapeutic modalities for these patients are also warranted. With the development of immunomodulatory agents (11), further study will be needed to evaluate short and long term outcomes. With a bright research future, of utmost importance still remains the development of tools to focus education on the identification of ARDS. It is a must have for any physician working in the ICU, a need for all patients in the ICU.

Resumen

El propósito de este estudio fue evaluar la prontitud con que el diagnóstico de síndrome de angustia respiratoria aguda/daño agudo pulmonar se hace en el Centro de Trauma de Puerto Rico (CTPR) y determinar la mortalidad a los 28 días durante el período estudiado. Se realizó una revisión retrospectiva de los expedientes médicos de todas las admisiones a la Unidad de Intensivo de Trauma (UIT) durante el período comprendido de agosto del 2000 a agosto del 2001. Se escogieron los expedientes de estos pacientes para análisis; de los cuales se obtuvo la data clínica. De los 537 pacientes admitidos al CTPR, 236 pacientes se admitieron a la UIT de los cuales se identificaron 17 pacientes con una razón hipoxemia menor de 200, mientras que en otros 13 pacientes se encontró que cumplían con el criterio de SARA según lo establecido por la Conferencia de Consenso Europeo-Americana de 1994. Su edad promedio era de 41 años, la causa principal de su angustia respiratoria aguda era la contusión pulmonar debido al trauma torácico. Cerca del 43% de estos pacientes sobrevivió a los 28 días. El análisis de subgrupo demostró que hubo un 86% de mortalidad en ese grupo cuando los pacientes desarrollaban sepsis. Concluimos que la mayoría de los casos del síndrome eran identificados correctamente por los médicos al momento del diagnóstico. La mortalidad observada en los pacientes admitidos a la UIT era consona con la esperada por el Contaje de Severidad de Daño ("Injury Severity Score"). La mortalidad en este grupo es menor que lo reportado en la literatura, en marcado contraste con nuestros contrapartes en las unidades de cuidado médico intensivo.

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