Analysis of Clinical Outcomes of the ARDS Patients in the Intensive Care Unit

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ABSTRACT

Objective: During the follow-up of acute respiratory distress syndrome (ARDS) patients in intensive care units (ICU), there are many changing parameters such as clinical findings, vital signs, laboratory values, and treatment. In this article, we analyzed some data of some ARDS patients that we followed in our ICU, on the 1st day of admission to our ICU and the last day when they were discharged from our ICU (departure to the ward or exitus).

Materials and Methods: We retrospectively reviewed 32 ARDS patients followed in our ICU in the tertiary ICU between January 2015 and January 2020.

Results: Glasgow coma scale (GCS), heart rate (HR), mean arterial pressure (MAP), and albumin median levels were compared at the first admission and discharge from ICU. There was statistically significant difference between admission and discharge values of GCS, HR, MAP, and albumin. Analysis of laboratory findings including PCO_2, lymphocyte, total bilirubin, sodium, APTT, and lactate also showed meaningful difference according to admission levels.

Conclusion: Clinical findings, vital signs, laboratory values, and treatment during the follow-up of patients in ICU s with ARDS are still not sufficient. Therefore, determining the clinical findings, vital signs, and some laboratory values in terms of the course of ARDS are very important for the follow-up and treatment of patients.

Keywords: Acute respiratory distress syndrome, clinical outcomes, intensive care unit

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INTRODUCTION

Acute respiratory distress syndrome (ARDS) is a devastating clinical syndrome caused by various conditions such as infection and trauma.[1] A better understanding of the epidemiology, pathophysiology, and pathogenesis of ARDS over the past 50 years has led to new treatment strategies that significantly improve survival. However, the mortality of severe ARDS is still over 40%. Early recognition and optimal management of ARDS is crucial to improving outcomes.[2] It has been 50 years since Ashbaugh et al.[3] defined "ARDS as a syndrome with acute onset, characterized by tachypnea, hypoxemia, and loss of compliance after various factors" in 1967. Since then, there has been a lot of discussion in the definition of ARDS, up to the "Berlin definition." According to the Berlin criteria, new or worsening respiratory distress occurring within 1 week, bilateral opacity unexplained by the underlying disease, and hypoxemia as assessed by a positive end-expiratory pressure (PEEP) level ≥5 cmH_2O were divided into three according to the severity of the PaO_2/FiO_2 ratio. The predictive validity for mortality was significantly improved by the Berlin definition of ARDS.[4]

ARDS treatment, which is difficult, laborious, and long-term, includes early recognition, early intervention, and correct mechanical ventilation practices. In this study, it was aimed to evaluate the clinical and laboratory findings of the patients followed up with the diagnosis of ARDS in our ICU department during admission and discharge and to reveal the effect of these findings on morbidity and mortality.

MATERIALS and METHODS

After obtaining ethics committee approval for this retrospective study from the Hospital Ethics Committee, patients

diagnosed with ARDS that we followed up in our intensive care unit (ICU) between January 2018 and January 2020 were retrospectively screened. Inclusion criteria for the study were as follows: age range 18–80 years, patients diagnosed with ARDS according to the Berlin diagnostic criteria and followed up in the ICU. Exclusion criteria from the study were as follows: the age range was outside the range of 18–80, the patients did not meet the Berlin diagnostic criteria, the patients followed in the post-operative period, and the patients with a hospital stay in the ICU for <24 h.

Demographic data, age, clinic, laboratory, and treatment data of the first hospitalization and discharge date were recorded from the digital and physical files of the patients retrospectively.

RESULTS

About 50% of the ARDS patients followed were male and 50% were female. The mean age was found to be 49.7 (20–55) years. The mean length of stay in the ICU was found to be 22.7 (8–35) days. The patients were followed as extubated for 4.6 (1–8) days and intubated for 18.1 (4–35) days on average. In the follow-ups, the mean of the highest peep values was determined as 11.7 (8–15) mmHg. The maximum Fio_2 average was found to be 72.3 (60–100). The mean PaO_2/FiO_2 ratio of the patients was found to be 75.8 (45–150). The Apache II score average of the patients was found to be 21.8 (10–45). Prone position was applied to 6 patients during their treatment. It was determined that the disease had a mortality rate of 56.3% (Table 1).

In ARDS patients, the median of the 1st day measurement of Glasgow coma scale (GCS) value was found to be statistically significantly higher than the median of the last day measurement (p<0.05). It was determined that the median of the 1st day measurement of heart rate (HR), mean arterial pressure (MAP), and albumin levels in ARDS patients was statistically significantly higher than the median of the last day measurement (Table 2).

It was determined that the median of the last day measurement of PCO_2, lactate levels, lymphocyte counts, and serum sodium levels in ARDS patients was statistically significantly higher than the median of the 1st day measurement. It was found that the median of the last day measurement of the APTT value in ARDS patients was statistically significantly higher than the median of the 1st day measurement. It was determined that the median of the last day measurement of total bilirubin value in ARDS patients was statistically significantly higher than the median of the 1st day measurement. Saturation value, temperature, arterial blood gas values (Ph, PaO_2, HCO_3, and BE), hemoglobin, white blood cell value, neutrophil, monocytes, basophil and platelet values,

Table 1. Evaluation of variable in ARDS patients [a]Wilcoxon Signed-Ranks Test, [b]Student-t Test, [c]Only intubated patients were evaluated.

	n	%
Sex		
Male	16	50.0
Female	16	50.0
Additional morbidite	32	100.0
Prone position	6	18.00
Mortality	18	56.3
	Mean median	**SD IQR**
ICU stay (day)	22.7 (8–35)	20.3
Extübe[a]	4.6 (1–8)	6.2
	1.0	6
Intubated	18.1 (4–35)	20.7
	17.0	17
Peep[c,b]	11.7 7 (8–15)	3.8
Fio_2[b]	72.3 (60–100)	18.7
PaO_2/FiO_2[a]	75.8 (45–150)	44.1
	65.5	26.0
Age	49.7 (20–55)	20.6
	47.5	36
APACHE II	21.8 (10–45)	12.8

SD: Standard deviation; IQR: Interquartile range; ICU: Intensive care unit; PaO_2: Arterial partial pressure of oxygen; FiO_2: Fraction of inspired oxygen; APACHE II: Acute physiology and chronic health evaluation II

CRP, procalcitonin values, PT, INR values, AST, ALT, glucose values, creatinine, GFR, potassium, calcium values, CK, and troponin I values were not statistically significant in terms of the 1st day or last day values of the data (Table 3).

DISCUSSION

We still have limited information on the course of many data such as clinical findings, vital signs, laboratory values, and treatment during the follow-up of ARDS patients in ICUs. Therefore, determining the clinical findings, vital signs, and some laboratory values in terms of the course of ARDS are very important for the follow-up and treatment of patients. In our study, GCS, HR, and MAP evaluated on the 1st day were higher than the last-day evaluations, while the last-day measurement averages in the laboratory evaluation were statistically significantly higher than the 1st-day measurement averages. Data: PCO_2, lymphocyte, albumin, total bilirubin, sodium, APTT, and lactate.

Table 2. Data in which the median of the first day measurement is statistically significantly higher than the median of the last day measurement in ARDS patients

	First day		Last day		p
	Mean median	SD IQR	Mean median	SD IQR	
GCS[a]	12.4 (10–15)	3.7	8.8 (7–13)	5.6	**0.003**
	15.0	5	5.5	12	
Heart rate[b]	108.1 (60–150)	25.6	84.5 (50–120)	18.9	**0.001**
MAP[b]	88.7 (55–100)	18.1	75.9(45–100)	19.8	**0.01**
Albümine[a]	4.2 (2.2 –5)	5.4	2.4 (1.8 –3.2)	0.6	**0.001**
	2.8	1.3	2.5	0.9	

[a]: Wilcoxon signed-ranks test; [b]: Student's t-test. ARDS: Acute respiratory distress syndrome; SD: Standard deviation; IQR: Interquartile range; GCS: Glasgow coma scale; MAP: Mean arterial pressure

Table 3. Data in which the median of the last-day measurement are statistically significantly higher than the median of the first-day measurement in ARDS patients

	First day		Last day		p
	Mean median	SD IQR	Mean median	SD IQR	
PCO_2[a]	43.1 (30–55)	12.3	51.0 (48–70)	15.6	**0.02**
	42.0	14	48.5	17	
Lactate[b]	1.8 (1.6 –3)	1.4	4.9 (2–10)	4.9	**0.02**
	1.4	0.7	2.5	7.6	
Lymphocyte[a]	1.4 (1–2)	2.1	2.0 (1.5 –3)	1.6	**0.04**
	0.8	0.9	1.7	2.0	
Sodium[b]	136.7 (128–146)	7.7	140.9 (130–150)	5.7	**0.02**
APTT[a]	28.4 (25–33)	15.4	43.9 (33–50)	31.5	**0.02**
	25.0	9	31.5	33	
Total Bilirubin[a]	1.1 (0.5 –1.5)	3.1	1.3 (0.6–1.7)	1.6	**0.007**
	0.5	0.3	0.6	0.9	

[a]: Wilcoxon signed-ranks test; [b]: Student's t-test. ARDS: Acute respiratory distress syndrome; SD: Standard deviation; IQR: Interquartile range; PCO_2: Partial carbon dioxide pressure; APTT: Activated partial thromboplastin time

In the study conducted by Cressoni et al.,[5] patients were classified as mild moderate and severe ARDS in 2013. He worked with a total of 148 patients, and the mean age of these patients was found to be 59.1, and 33% of them were female. In our study, the mean age was 49.7 years and 50% of them were female. The findings do not exactly overlap with our study. This situation makes us think that there may be racial and socioeconomic differences.

In the study conducted by Saguil et al.,[6] in 2020, it was determined that patients with ARDS spent an average of 16 days in the ICU and a total of 26 days in the hospital. In our study, it was found that patients with ARDS stayed in the ICU for an average of 22.7 days. In our study, the average number of days spent intubated by the patients was found to be 18.1. The findings do not exactly overlap with our study. This makes us think that each clinic may have a different approach to ARDS (such as the preference for early intubation).

Gattinoni et al.[7] studied 304 patients with ARDS in their 2001 study. They applied prone position to 152 of these patients. In our study, it was determined that six patients were given prone

position. One of the risk factors affecting the diagnosis of ARDS is concomitant heart failure. The high comorbidities of the patient group we included in the study suggested that there was a delay in early diagnosis and that there might be a difference in approach. The mean PaO_2/FiO_2 ratio of the patients was 127. In our study, the average PaO_2/FiO_2 ratio of the patients was found to be 75.8. This suggests that we are clinically following severe ARDS patients. Moreover, in this study, the disease was found to be 50.7% mortal. In our study, the disease was found to be 56.3% mortal. This finding is consistent with our study. ARDS is still a disease with a high mortality rate.

In the study conducted by Taylor et al.[8] in 2017, patients with ARDS were examined in two groups as APRV (airway pressure relief ventilation) and LTV (low tidal volume lung protective ventilation). We did not categorize patients in this way in our study. The Apache II score of the patients was 22 in the APRV group and 20 in the LTV group. In our study, the Apache II mean of the patients was found to be 21.8. This value is consistent with this study. When arterial blood gases were evaluated at the beginning, the PCO_2 value was found to be 40.1 in the APRV group and 41.7 in the LTV group. In our study, the average of the 1st day measurement of this value was 43.1 and the average of the last-day measurement was 51.0, and it was found that the average of the last-day measurement was statistically significantly higher than the average of the 1st day measurement. Although the study of Taylor et al. does not exactly overlap with our study, the average of the 1st day measurement of the PCO_2 value is the same as our study. In our study, it was found that the last-day mean measurement of PCO_2 value was statistically significantly higher. This makes us think that as the lung damage of the patients increases, CO_2 excretion becomes more difficult, and they tolerate higher CO_2 values.

In the same study conducted by Taylor et al.,[8] they looked at the baseline and 3rd day data of some values in the APRV and LTV groups in 2017. The mean HR baseline value of the patients was found to be 105 beats/min in the APRV group and 110 beats/minute in the LTV group. In our study, the mean HR value on the 1st day of the patients was found to be 108 beats/min. In the APRV and LTV groups, the mean HR value on the 3rd day was found to be 92 beats/min and 103 beats/min, respectively. In our study, the mean HR value on the last day of the patients was found to be 84.5 beats/min. These findings are consistent with our study. The reason for the decrease in HR values during the follow-up of the patients may be due to the high peep values used and the drugs used for sedation.

The baseline and 3rd day data of some values in the APRV and LTV groups were examined. The mean baseline MAP value of the patients was 87 mmHg in the APRV group and

84 mmHg in the LTV group.[8] In our study, the mean MAP value of the patients on the 1st day was 88.7. In the APRV and LTV groups, the mean MAP value on the 3rd day was found to be 92 mmHg and 87 mmHg, respectively.[8] In our study, the mean MAP value of the patients on the last day was 75.9 mmHg. These findings are not consistent with our study. In our study, we found that the MAP value on the 1st day was statistically significantly higher than the average on the last day. The reason for the decrease in MAP values during the follow-up of the patients may be due to the high peep values used and the drugs used for sedation.

In a previous study, patients were analyzed at different time intervals (between 7 and 13. days and 14–28). Patients were divided into two groups as placebo and corticosteroid users. The mean GCS of the patients between 7 and 13 days was found to be 8.7 in the placebo group and 8.1 in the corticosteroid group. The mean GCS of the patients between 14 and 28 days was found to be 8.9 in the placebo group and 9.1 in the corticosteroid group.[9] Although this study did not exactly match our study, we also examined the patients' mean GCS on the 1st day and GCS on the last day. The mean GCS of the patients on the 1st day was 12.4, and the mean GCS on the last day was 8.8. The fact that the GCS values of the patients were lower on the last day made us think that the patients may also be affected neurologically during the course of this disease. It would be appropriate to evaluate the neurological examinations during the follow-up of the patients.

Steinberg et al.[9] found the mean values of albumin in patients between 7 and 13 days to be 2 g/dL in the placebo group and 1.9 g/dL in the corticosteroid group. In our study, the mean albumin values of the patients between 14 and 28 days were found to be 2 g/dL in the placebo group and 1.9 g/dL in the corticosteroid group. Although this study did not exactly match our study, we also examined the average of the albumin values of the patients on the 1st day and the average of the albumin values on the last day. The average of the albumin values of the patients on the 1st day was 4.2 g/dL, and the average of the albumin values on the last day was 2.4 g/dL. We thought that the fact that the average of the albumin values of the patients was lower on the last day, and that albumin was a negative acute phase reactant, might show parallelism with inflammation in the patients.

In a study conducted by Nanda et al.[10] in 2009, they compared the lactate values on the 1st day and the 5th day of patients with ARDS and septic shock. The average of the lactate values of the patients on the 1st day was 2.2 mmol/L and the average of the lactate values on the 5th day was 2.6 mmol/L. Although this study did not exactly match our study, we also

examined the average of the patients' 1st-day lactate values and the average of their last-day lactate values. The mean of lactate values on the 1st day of the patients was 1.8 mmol/L, and the mean of lactate values on the last day was 4.9 mmol/L. The fact that the lactate values of the patients were higher on the last day suggests that tissue hypoxia deepens in the course of this disease.[10–14]

Our present study has some limitations. First, it was a single-center retrospective study that included a small number of cases, which may cause this bias and limit the reliability of our result. Second, some clinical and laboratory data from the ICU were missing, and we included only the values for the first day of admission to the ICU and the last day to discharge from the ICU.

CONCLUSION

The definition and treatment of ARDS still faces challenges, and early diagnosis and intervention is crucial to improve the outcome of ARDS. The ICU mortality of our ARDS patients is 56%. The presence of underlying comorbidities and sepsis/septic shock in the ICU is independent risk factors that increase mortality in ARDS patients. More clinical trials are needed to improve early detection and appropriate treatment.

Disclosures

Ethics Committee Approval: The study was approved by the University of Health Sciences, Kanuni Sultan Süleyman Training and Research Hospital Ethics Committee (No: 2021.01.06, Date: 28/01/2021).

Informed Consent: Written informed consent was obtained from all patients.

Peer-review: Externally peer reviewed.

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