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Clinical Profile and Outcomes of ARDS in Elderly vs Non-Elderly: A Prospective Observational Study

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Abstract: ***Background:*** *Acute Respiratory Distress Syndrome (ARDS) in the elderly is associated with increased morbidity and mortality due to age-related physiological changes and comorbidities. This study investigates the clinical profile, management, and outcomes of ARDS in elderly patients compared to non-elderly.* ***Objectives:*** *To compare the demographic and clinical characteristics (etiology, CCI, ARDS severity) and outcomes (ICU stay and in-hospital mortality) of ARDS between elderly (≥65 years) and non-elderly (<65 years) patients.* ***Methods:*** *A prospective observational study was conducted over two years in a tertiary care center. A total of 138 patients diagnosed with ARDS were enrolled and divided into elderly (≥65 years) and non-elderly (<65 years) groups. Parameters studied included demographics, comorbidities (Charlson Comorbidity Index), etiology, severity (SOFA score, Berlin criteria), ventilatory support, and outcomes (mortality, ICU stay).* ***Results:*** *The elderly group (n=72) had significantly higher CCI scores (3.5 vs 2.4, p<0.001) and SOFA scores at admission (8.2 vs 6.3, p=0.001). Sepsis was the predominant cause in the elderly (38.9%), while pneumonia was more frequent in non-elderly (60.6%). Elderly patients had poorer respiratory mechanics (higher PIP, PEEP, and plateau pressures, p<0.001). Mortality was higher among elderly with severe ARDS and multiple comorbidities. ICU stay was similar across groups.* ***Conclusion:*** *ARDS in the elderly presents with more severe disease, higher comorbidity burden, and worse outcomes. Age-specific management strategies are essential to improve survival and quality of life in this vulnerable group.*

Keywords: ARDS, elderly, SOFA score, Charlson Comorbidity Index, ICU mortality

1. Introduction

Acute Respiratory Distress Syndrome (ARDS) is a severe, life-threatening condition characterized by acute hypoxemic respiratory failure due to diffuse lung inflammation, often triggered by direct or indirect insults such as pneumonia, sepsis, or trauma[1].

First described in 1967 by Ashbaugh et al., ARDS remains a significant challenge in critical care medicine, with mortality rates ranging from 35% to 46% globally[2, 3]. The elderly population (≥65 years) is particularly vulnerable due to age-related physiological changes, immunosenescence, and a higher prevalence of comorbidities such as cardiovascular disease, diabetes, and chronic obstructive pulmonary disease (COPD)[4, 5]. These factors contribute to increased incidence, severity, and poorer outcomes in elderly ARDS patients compared to their younger counterparts[6].

Despite advances in critical care, the elderly face disproportionately worse outcomes, including higher mortality and long-term impairments in physical, cognitive, and psychological domains[11]. Factors such as reduced physiological reserve, higher comorbidity burden, and age-related lung changes (e.g., decreased elasticity and chest wall compliance) exacerbate these outcomes[12]. Previous studies have highlighted age as an independent predictor of mortality in ARDS, yet the specific clinical profile and prognostic factors in elderly patients remain underexplored[13]. This study aims to address this gap by comparing the clinical characteristics, etiology, ventilatory parameters, and outcomes of ARDS between elderly and non-elderly patients, providing insights to inform age-specific management strategies.

2. Methodology

This hospital-based prospective observational study was conducted in the Medical Intensive Care Unit (MICU) of the Department of General Medicine at Indira Gandhi Government Medical College and Hospital, Nagpur, India, from September 2022 to August 2024. The study received approval from the Institutional Ethics Committee, and written informed consent was obtained from patients or their responsible attendants prior to enrollment. Strict confidentiality of data and participant identities was maintained throughout the study.

Patients aged 18 years or older, admitted to the MICU with a diagnosis of ARDS according to the Berlin 2012 definition, and surviving for at least 48 hours were eligible for inclusion. The Berlin 2012 criteria require acute onset of respiratory symptoms within one week of a known clinical insult, bilateral opacities on chest imaging not fully explained by other lung pathologies, respiratory failure not due to cardiac failure or fluid overload, and a PaO2/FiO2 ratio ≤300 mmHg with a minimum positive end-expiratory pressure (PEEP) of 5 cm H2O[8]. Exclusion criteria included patients unwilling to provide informed consent and those under 18 years of age.

The sample size was calculated using the formula $n = [Z(\alpha/2)]^2 p(1-p)/d^2$, where $Z(\alpha/2) = 1.96$ (95% confidence level), d = 5% margin of error, and p = 89.8% (prevalence of ARDS based on a prior study by Sehgal et al.[14]). This

yielded a total sample size of 138 patients, equally divided into 69 elderly (≥65 years) and 69 non-elderly (<65 years) patients. Due to recruitment dynamics, the final sample comprised 72 elderly and 66 non-elderly patients.

Data collection involved categorizing patients into elderly and non-elderly groups and recording baseline demographics, etiology of ARDS, comorbidities (assessed using the Charlson Comorbidity Index [CCI]), and severity of ARDS (mild, moderate, or severe per Berlin 2012 criteria). Clinical examinations and laboratory investigations included blood pressure, random blood sugar, serum sodium, potassium, creatinine, bilirubin, arterial blood gas (ABG), and complete blood count (CBC). The Sequential Organ Failure Assessment (SOFA) score was calculated on admission and at 48 hours to determine delta SOFA. Ventilatory parameters, including peak inspiratory pressure (PIP), PEEP, plateau pressure (Pplat), and driving pressure (DP), were recorded for patients requiring mechanical ventilation. ARDS type (pulmonary or extrapulmonary) and outcomes (survivor/non-survivor and length of ICU stay) were noted in a standardized case record form.

Statical Analysis:
Statistical analysis was performed using Epi Info version 7.2.0.1 and SPSS student version 16.0 (SPSS Inc., Chicago, USA). Discrete variables were expressed as percentages, and differences were analyzed using the Pearson Chi-square test or Fisher's exact test, as applicable. Continuous variables were compared using the unpaired Student's t-test. A p-value <0.05 was considered statistically significant.

3. Results

The mean age of the study participants was 59.9 years (SD = 14.5). The mean age for the elderly group was 71.8 years (SD = 4.8) while the mean age for the non- elderly group was significantly younger at 46.8 years (SD = 9.4). The majority of participants (46.4%) were in the 65-79 years age group.

The mean CCI for the elderly was 3.5 (SD= 2.1) which is higher than the non-elderly group who had a lower mean CCI of 2.4 (SD= 1.8). This suggests that elderly participants have a greater overall burden of comorbidities compared to non-elderly participants.

The proportion of participants with mild ARDS was similar between the elderly (26.4%) and non-elderly (27.2%) groups. Moderate ARDS was the most common severity level in both groups, affecting 43.1% of elderly participants and 47% of non-elderly participants, with a total of 44.9% across both groups. Both groups had similar proportions of mild, moderate, and severe ARDS cases, suggesting that the severity of ARDS does not vary significantly by age.

In the elderly, mortality was strongly linked to IHD (56.3% vs 33.3%), CVE (29.2% vs 2.1%), renal failure (50% vs 12.5%), and COPD (45.8% vs 29.2%), while hypertension (54.2% vs 50%) and diabetes (52.1% vs 54.2%) showed little impact.

In the non-elderly, non-survivors had higher rates of diabetes (61.5% vs 45%), renal failure (42.3% vs 20%), liver failure, and AIDS (11.5% exclusive), whereas hypertension (46.2% vs 55%), COPD, and IHD showed smaller differences.

Overall, renal failure, COPD, diabetes, and IHD were consistently more frequent in non-survivors across both groups, highlighting the strong influence of comorbidities on mortality.

Elderly non-survivors had markedly higher admission SOFA scores (9.8 vs 4.9) and greater worsening (ΔSOFA +4 vs −0.2) compared to survivors, indicating more severe organ dysfunction. Similarly, in the non-elderly, non-survivors showed higher admission SOFA (7 vs 5.8) and increased ΔSOFA (+4.2 vs −0.43), confirming that rising SOFA scores strongly predicted mortality in both groups.

In the elderly, survivors had longer ICU stays than non-survivors (9.3 vs 7.7 days), suggesting prolonged recovery among those who survived. In the non-elderly, survivors also stayed slightly longer (9.1 vs 8.5 days), though the difference was less pronounced compared to the elderly group.

Table 1: Distribution of cases according to co-morbidities

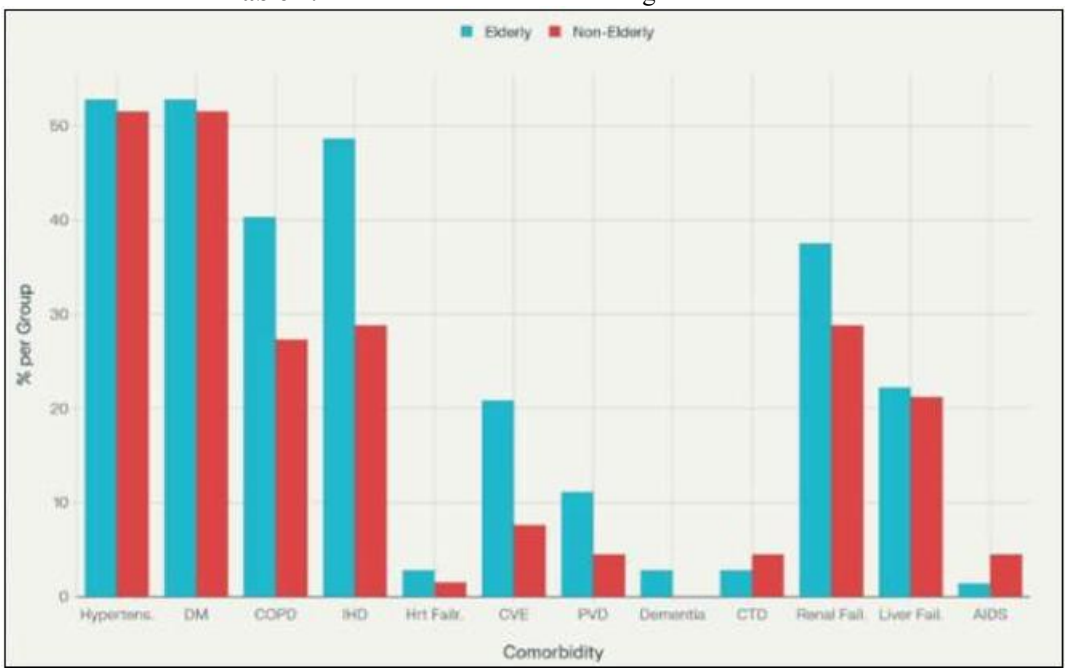


Table 2: Distribution according to Etiology and type of ARDS

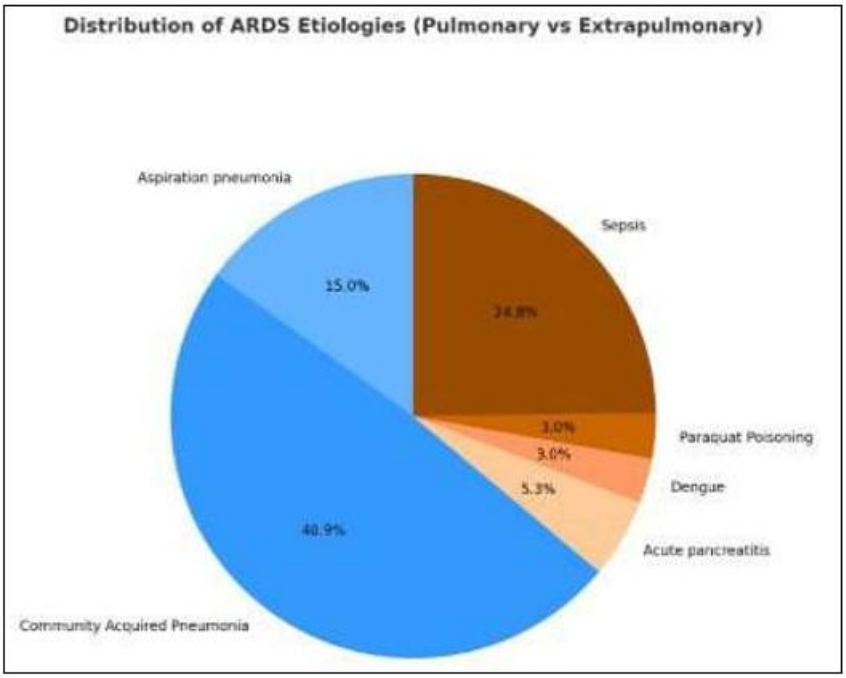


Table 3: Comparison of Individual components of SOFA Score in Elderly and Non-Elderly

Respiratory Parameter	Elderly Mean (SD)	Non-Elderly Mean (SD)	Total (N=138) Mean (SD)	p Value
P/F Ratio	162.1 (66.1)	170.1 (64)	165.9 (65.3)	p = 0.470
MAP	71.3 (11.2)	79.7 (10.9)	75.3 (11.8)	p = 0.000
GCS	11.5 (3.1)	12.7 (2.7)	12.1 (3)	P=0.017
Platelets (×103/µl)	192.1 (100)	223.8 (113.4)	207.3 (107.6)	p = 0.085
Serum Bilirubin (mg/dL)	1.9 (1.9)	1.8 (1.9)	1.9 (1.9)	p = 0.766
Serum Creatinine (mg/dL)	2.2 (1.4)	1.6 (1.1)	1.9 (1.3)	p = 0.024

Table 4: Comparison of Ventilatory Parameters in elderly and Non-Elderly Survivors and Non- Survivors

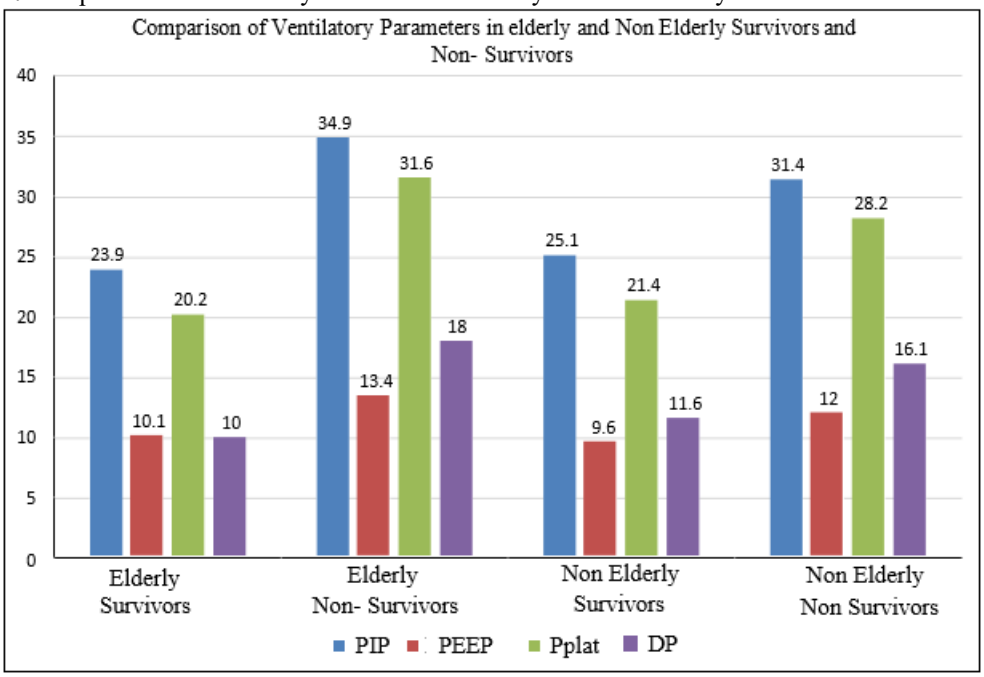
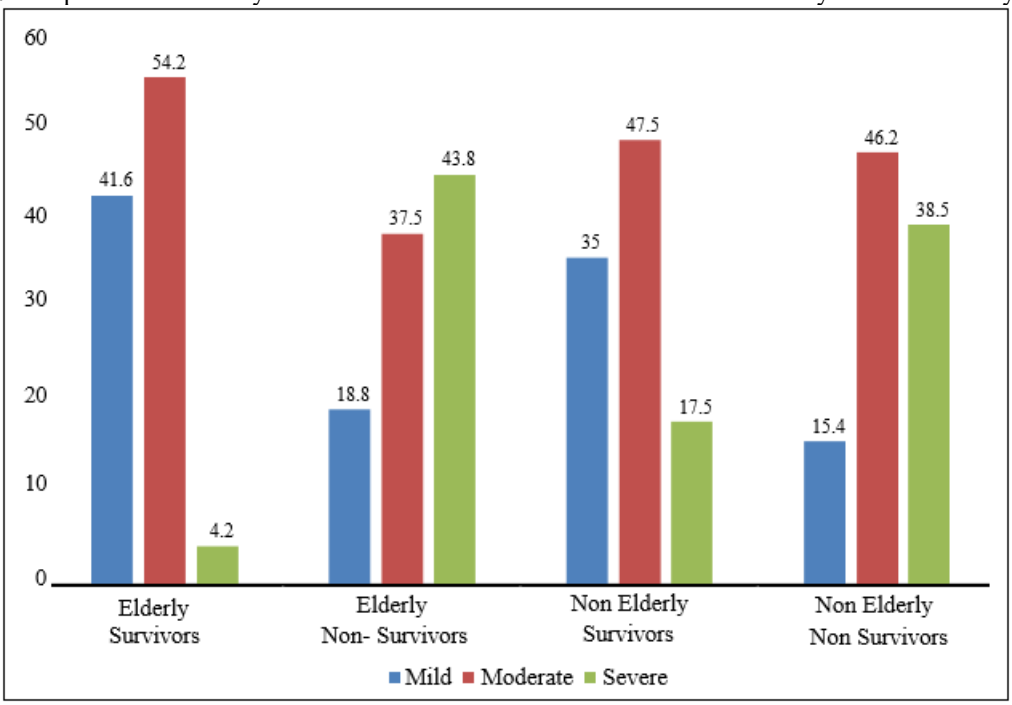


Table 5: Comparison of Severity of ARDS in Survivors and Non-Survivors in Elderly and Non-Elderly Groups



4. Discussion

This study highlights significant differences in the clinical profile and outcomes of ARDS between elderly (≥65 years) and non-elderly patients. Our findings demonstrate that elderly patients had a higher burden of comorbidities (as reflected by higher CCI), greater illness severity scores (SOFA), a predominance of pulmonary ARDS, and increased in-hospital mortality compared to their younger counterparts.

These results are consistent with the observations of Sehgal IS[6], who reported that elderly ARDS patients had higher mortality and more comorbid illnesses, although ARDS severity based on oxygenation indices was comparable between age groups. Similarly, Kao KC[10] identified Charlson Comorbidity Index, SOFA score, and peak inspiratory pressure as independent predictors of mortality in elderly ARDS patients, reinforcing our finding that baseline comorbidity burden and organ dysfunction are more predictive of outcome than age alone.

Our observation that pulmonary ARDS (commonly secondary to pneumonia) predominated in the elderly aligns with findings from Sehgal IS[6] and other Indian data, where community-acquired pneumonia was the leading trigger in older adults. In contrast, extrapulmonary ARDS due to sepsis was more frequent among non-elderly patients. This etiological distinction may partly explain outcome differences, as pulmonary ARDS in the elderly is often

compounded by pre-existing structural lung disease and reduced physiological reserve.

The higher mortality observed in the elderly group is in agreement with studies by Suchyta MR[9] and Eachempati SR[13], who demonstrated significantly increased mortality in older ARDS patients. However, our findings also support the perspective of Schouten LR that increased mortality in elderly ARDS patients is not solely mediated by exaggerated inflammatory responses but is more closely related to illness severity and organ dysfunction.

Furthermore, the association of advanced age with impaired physiological reserve and organ dysfunction, as described by Ranieri VM[3] and Brown R[5], provides mechanistic support for our clinical findings. Overall, our study reinforces that while age is an important risk marker, outcomes in ARDS are predominantly influenced by comorbidities, severity of organ failure, and ventilatory parameters rather than chronological age alone.

The study's findings have important clinical implications. The higher prevalence of extrapulmonary ARDS and comorbidities in elderly patients necessitates a multidisciplinary approach, integrating geriatric principles into ARDS management. Tailored ventilatory strategies, such as optimizing PEEP to balance oxygenation and lung protection, are critical to improving outcomes in this population[24]. Additionally, early recognition of atypical presentations in elderly patients can reduce diagnostic delays, enhancing timely intervention[25].

Future research should focus on multicenter studies to validate these findings and explore age-specific biomarkers and therapeutic interventions. Long-term follow-up studies are also needed to assess the impact of ARDS on physical, cognitive, and psychological outcomes in elderly survivors.

5. Conclusion

This study highlights significant differences in the clinical profile and outcomes of ARDS between elderly and non-elderly patients. Elderly patients exhibit a higher comorbidity burden, greater prevalence of sepsis-driven extrapulmonary ARDS, and increased ventilatory requirements, contributing to higher mortality rates. These findings emphasize the need for age-specific management strategies, including tailored ventilatory support and early recognition of atypical presentations, to improve outcomes in elderly ARDS patients. By addressing the unique challenges faced by this vulnerable population, clinicians can enhance survival and quality of life, reducing the substantial burden of ARDS in the elderly.

6. Limitations

Limitations of this study include its single-center design, which may limit generalizability, and the relatively small sample size, which may have underpowered some subgroup analyses.

Funding & Conflicts
No external funding. No conflicts of interest.

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