OUTCOMES OF COVID-19 PATIENTS WITH UNDERLYING ASTHMA AND COPD: ANALYSIS FROM A RURAL SETTING IN THE UNITED STATES

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Introduction:

- 20% of the US population resides in rural areas \(^1\)
  - Health disparities \(^2,^3\)
  - Chronic medical conditions\(^4-5\)

- Chronic diseases lead to worse outcomes in COVID-19\(^6-8\)

- Eastern North Carolina is an underserved rural area
  - Vidant Health system: 9 hospitals
  - A tertiary care center and 8 community hospitals
  - Catchment area: 29 counties
  - 3 hospitals are critical access
  - Only 1 community hospital has an in-house intensivist

Fig. 1: By September 2020, rates of COVID-19 were higher in smaller cities and rural areas than in urban areas. Source: CDC, COVID-19 stats\(^9\)
Methods:

- Retrospective chart review
- March 1, 2020, to July 15, 2020
- Patients admitted with COVID-19 into the Vidant health system
- COVID-19 like illness and positive RT-PCR from nasopharyngeal specimen
Key eligibility criteria and definitions:

• Inclusion criteria
  • Age ≥ 18 years
  • Symptomatic COVID-19
  • Asthma or COPD
  • Definite outcome

• Exclusion criteria
  • Asymptomatic patients
  • Missing values of key data

• COPD:
  • Reported history, plus
  • Supportive PFT, or
  • Emphysema on CT chest, or
  • Home use of inhalers

• Asthma:
  • Reported history, plus
  • Home use of inhalers
Clinical outcomes measured:

1. Rate of ICU admission
2. ICU LOS
3. Rate of Mechanical ventilation
4. Mechanical ventilation (MV) duration
5. Hospital length of stay (LOS)
6. Mortality
Objectives:

• **Primary objective:**
  - Prevalence of asthma and COPD in patients hospitalized with symptomatic COVID-19
  - Evaluate differences in clinical outcomes between patients with and without COPD and asthma

• **Secondary objective:**
  - To compare the clinical outcomes for obese versus non-obese asthmatics
Statistical analyses:

• Non-parametric tests (Mann-Whitney U Test)- analyze differences in:
  • Hospital LOS, ICU LOS and MV duration

• Binary regression analyses- analyze increased risk of:
  • Hospital LOS, ICU LOS, and MV duration above mean

• Kaplan Meier analyses: to assess differences in in-hospital survival

• p-value of less than .05 was considered to be statistically significant
Results- Baseline characteristics and comorbidities:

Table 1. Descriptive analysis of baseline characteristics for study population

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Asthma (N=47)</th>
<th>COPD (N=36)</th>
<th>Neither (N=222)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (female)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>158 (52.5)</td>
<td>35 (74.5%)</td>
<td>17 (47.2%)</td>
<td>109 (49.1%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>196 (65.1)</td>
<td>36 (76.6%)</td>
<td>22 (61.1%)</td>
<td>141 (63.5%)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>71 (23.6)</td>
<td>9 (19.1%)</td>
<td>13 (36.1%)</td>
<td>50 (22.5%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>34 (11.3)</td>
<td>2 (4.3%)</td>
<td>1 (2.8%)</td>
<td>31 (14%)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>142 (47.2)</td>
<td>14 (29.8%)</td>
<td>24 (66.7%)</td>
<td>107 (48.2%)</td>
</tr>
<tr>
<td>30-39</td>
<td>102 (33.9)</td>
<td>15 (31.9%)</td>
<td>11 (30.6%)</td>
<td>77 (34.7%)</td>
</tr>
<tr>
<td>&gt;39</td>
<td>56 (18.6)</td>
<td>18 (38.3%)</td>
<td>1 (2.8%)</td>
<td>37 (16.7%)</td>
</tr>
<tr>
<td>Not available</td>
<td>1 (0.003%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td>36 (12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>47 (15.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>155 (51.5)</td>
<td>22 (46.8%)</td>
<td>19 (52.8%)</td>
<td>115 (51.8%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>230 (76.4)</td>
<td>35 (74.5%)</td>
<td>31 (86.1%)</td>
<td>168 (75.7%)</td>
</tr>
<tr>
<td>Smoking history</td>
<td>109 (36.2)</td>
<td>16 (34%)</td>
<td>34 (94.4%)</td>
<td>62 (27.9%)</td>
</tr>
</tbody>
</table>
Results- Clinical characteristics and outcomes:

N=301 patients

Asthma, N=47 (16%)

- ICU admit, N=22 (47%)
  - Intubation, N=11 (50%)
  - Mortality, N=6 (13%)

COPD, N=36 (12%)

- ICU admit, N=20 (56%)
  - Intubation, N=13 (65%)
  - Mortality, N=7 (19%)

Neither, N= 222 (74%)

- ICU admit, N=85 (38%)
  - Intubation, N=43 (51%)
  - Mortality, N=36 (16%)

Figure 2. Descriptive flow chart of patients with and without asthma and COPD showing those admitted to ICU, those intubated, and mortality
ICU admission:

Figure 3. Risk of ICU admission and intubation associated with asthma and COPD compared to the group with neither condition. COPD was significantly associated with increased risk of ICU admission (OR=2.4, p=0.03)
Mechanical ventilation:

• Overall rate: 21.6% (n=65)

• Mean (± SD) age: 63.8 years (± 15.4 years)

• Rate was higher for patients with COPD (65%) compared to asthma (50%) and those with neither condition (51%)
  • The results were not statistically significant
Mechanical ventilation duration:

Figure 4. Comparison of mechanical ventilation duration for patients with and without COPD and asthma including mean and standard deviation showing no significant differences between groups using non-parametric tests (Mann-Whitney U Test)

- COPD: Mean= 9.6 days, p= 0.85
- Asthma: Mean= 10.5 days, p= 0.46
- Neither: Mean= 9.4 days
Figure 5. Comparison of hospital length of stays for patients with and without COPD and asthma including mean with standard deviation showing no significant difference between groups using non-parametric tests (Mann-Whitney U Test)
ICU length of stay:

Figure 6. Comparison of ICU length of stays for patients with and without COPD and asthma including mean and standard deviation showing no significant differences between groups using non-parametric tests (Mann-Whitney U Test)

COPD: Mean = 9.6 days, p = 0.32
Asthma: Mean = 9.6 days, p = 0.58
Neither: Mean = 8.8 days
Obese asthmatics:

Table 2. Binary logistic regression of asthmatics with and without obesity showing that obesity in patients with asthma did not significantly affect outcomes. BMI category 1=BMI 30.0 to 39.99. BMI category 2=BMI of 40 or more

<table>
<thead>
<tr>
<th>Obesity</th>
<th>ICU admission</th>
<th></th>
<th></th>
<th>Intubation</th>
<th></th>
<th></th>
<th>Mortality</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>p</td>
<td>95% CI</td>
<td>OR</td>
<td>P</td>
<td>95% CI</td>
<td>OR</td>
<td>p</td>
<td>95% CI</td>
</tr>
<tr>
<td>BMI category 1 or 2</td>
<td>0.55</td>
<td>0.36</td>
<td>0.16-2.0</td>
<td>2.7</td>
<td>0.29</td>
<td>0.43-16.4</td>
<td>0.37</td>
<td>0.26</td>
<td>0.06-2.1</td>
</tr>
<tr>
<td>BMI category 1</td>
<td>0.66</td>
<td>0.57</td>
<td>0.15-2.8</td>
<td>1.7</td>
<td>0.64</td>
<td>0.20-14.3</td>
<td>0.56</td>
<td>0.57</td>
<td>0.08-4.01</td>
</tr>
<tr>
<td>BMI category 2</td>
<td>0.48</td>
<td>0.31</td>
<td>0.12-2.0</td>
<td>4.2</td>
<td>0.20</td>
<td>0.47-36.7</td>
<td>0.22</td>
<td>0.21</td>
<td>0.20-2.35</td>
</tr>
</tbody>
</table>
Obese asthmatics:

Table 3. Results of independent samples t-test analysis to compare outcomes between asthmatics with and without obesity showing no significant differences between groups

<table>
<thead>
<tr>
<th></th>
<th>Asthmatics with obesity</th>
<th>Asthmatics without obesity</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>33</td>
<td>11.97</td>
<td>11.72</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>14</td>
<td>11.57</td>
<td>8.10</td>
</tr>
<tr>
<td>MV duration</td>
<td>8</td>
<td>11.5</td>
<td>6.00</td>
</tr>
</tbody>
</table>
Survival:

Figure 7. Risk of mortality associated with asthma and COPD compared to the group with neither condition.
Survival:

Figure 8. Kaplan Meier curves showing no significant difference in survival between groups (p=0.69)
Conclusion:

1. Our study, to the best of our knowledge, was the first one on this topic in a rural setting in the US.

2. In a rural population, asthma and COPD are among the less frequent comorbidities of COVID-19.

3. Asthma and COPD did not result in worse outcomes in patients with COVID-19.
References:


