

## BACKGROUND

- Acute congestive heart failure (CHF) is a common admission, often requiring aggressive intravenous diuresis.<sup>1</sup>
- Patients admitted for heart failure frequently have a concomitant diagnosis of chronic obstructive pulmonary disease (COPD).
- Diuretics are known to induce a metabolic alkalosis due to their pharmacologic mechanism, and this manifests as an elevated bicarbonate level.
- It is not well defined to what degree metabolic alkalosis affects clinical outcomes in hospitalized patients treated for acute CHF.<sup>2</sup>
- Previous studies have demonstrated the benefit of utilizing acetazolamide as an adjunct diuretic in acute CHF populations, as this medication helps to reduce bicarbonate levels via renal excretion. Such studies have neglected to compare those with COPD as a comorbid condition to those without.<sup>3</sup>

## OBJECTIVES

- To assess the bicarbonate levels of patients with COPD versus patients without COPD who are admitted for acute CHF, then to further assess for potential differences in clinical outcomes regarding these different patient populations.

## METHODS

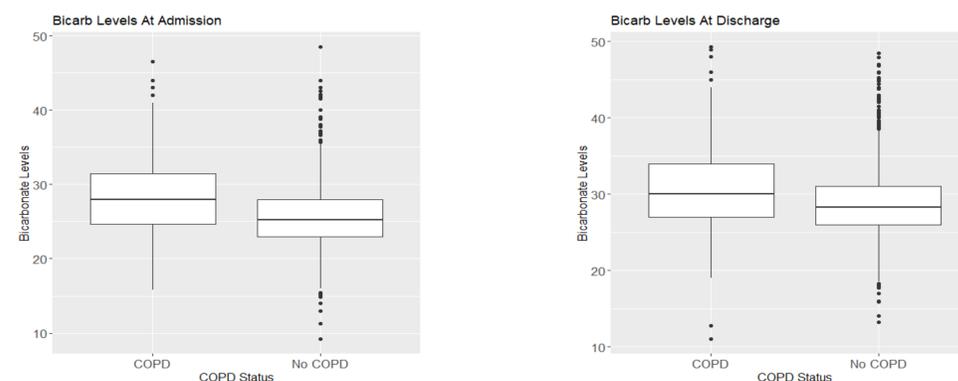
- A retrospective chart review was performed via the electronic health record.
- Data was gathered for all patients admitted to our hospital system for acute CHF. Analysis was performed comparing patients with and without a concomitant diagnosis of COPD.
- Exclusion criteria: obesity hypoventilation syndrome, administration of acetazolamide during the patient's hospitalization, a diagnosis of end stage renal disease or hemodialysis.
- Primary outcomes: bicarbonate level at the time of admission and at the time of discharge, length of hospital stay, 30 day readmission rate, and 90 day mortality rate.
- Sub-analysis: age, sex, tobacco use, and CKD status

## RESULTS

- A total of 1,611 CHF related hospitalizations were included. Of these, 14.6% of patients (N=235) had COPD at the time of admission and 85.4% (N=1376) did not.
- Study Aim 1: Assess the bicarbonate levels of patients with COPD versus patients without COPD who are admitted for acute CHF**
  - When adjusting for age, sex, tobacco use, and CKD in a linear regression model, COPD was significantly associated with increased bicarbonate levels at admission (Average difference = 2.7, 95% CI =2.1-3.4, p<0.001) and at discharge (Average difference = 2.1, 95% CI =1.3-2.8, p<0.001). See Table 1.
- Study Aim 2: Compare the length of hospital stay, 30-day readmission rate, and 90-day mortalities for COPD versus non-COPD patient populations**
  - Hospital LOS, 30-day readmission rates, and 90-day mortality rates did not significantly differ across CHF patients with vs without COPD. See Table 2.

	Patients with COPD (N=235)	Patients without COPD (N=1376)	P-value <sup>1</sup>
Average Age (SD)	74.6 (10.4)	75.4 (13.7)	0.29
Min, Max	40, 96	25, 103	
Sex % (N)			
Male	53% (124)	52% (722)	0.99
Female	47% (111)	48% (654)	
CKD % (N)	35% (82)	17% (230)	<0.001
Tobacco user % (N)	23% (53)	15% (211)	0.01
Bicarbonate Level Recorded % (N)			
Bicarbonate level available at admission	99.6% (234)	99.6% (1370)	0.99
Bicarbonate level available at discharge	97% (229)	97% (1334)	0.84
Average Bicarbonate level at admission (SD)	28.3 (5.6)	25.7 (4.5)	<0.001
Min, Max	15.8, 46.5	9.2, 48.5	
Average Bicarbonate level at discharge (SD)	30.8 (5.9)	28.8 (5.0)	<0.001
Min, Max	11, 49.3	13.2, 48.5	

Table 1. Study population characteristics: <sup>1</sup>P-values are from Wilcoxon Signed Rank test for Bicarbonate Level Timing; Two Sample T-test for Age and for bicarbonate levels at admission and discharge; Chi-squared tests for all other variables (Fisher's Exact Test for bicarb levels recorded, due to small N).



	Patients with COPD (N=235)	Patients without COPD (N=1376)	P-value <sup>1</sup>
Average Hospital LOS (SD)	5.2 (5.9)	4.7 (4.1)	0.33 <sup>2</sup>
Min, Max	0, 70	0, 34	
30-day Readmission % (N)	16% (38)	13% (181)	0.25
90-day Mortality % (N)	22% (51)	23% (320)	0.66

Table 2. Length of hospital stay, 30-day readmission rate, and 90-day mortalities for COPD versus non-COPD patients: <sup>1</sup>P-values are from Wilcoxon Signed Rank test for LOS and from Chi-squared tests for readmission and mortality  
<sup>2</sup>When excluding the one patient with LOS=70, this is still insignificant (p=0.39)

## CONCLUSIONS

- Our study demonstrated a statistically significant difference between the bicarbonate levels of CHF patients with and without a concomitant diagnosis of COPD. The bicarbonate level was 2-3 points higher in COPD patients both at the time of admission and at discharge. While our study did not yield any clinical difference in outcomes, this may be because our population size was too small to reach statistical significance. For example, 30-day readmission rates were 13% for patients without COPD and 16% for patient with COPD. With a larger patient population, perhaps this difference would have been statistically significant.
- Patients with concomitant COPD had a statistically significant higher level of CKD prevalence. Further research regarding the potential significance of this is a point of interest.
- Further sub-analysis regarding patient's with abnormally elevated bicarbonate levels (>30) is a future consideration, as these patients are likely at increased risk for poor outcomes. It may be hypothesized that differences in clinical outcomes will be more pronounced in this higher-risk patient population.

## FUTURE IMPLICATIONS

- Further research with larger patient populations is needed to further elucidate potential differences in clinical outcomes between these patient populations.
- A future study at our hospital may include a trial assessing the use of acetazolamide versus a control group for both COPD and non-COPD populations.

## REFERENCES

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