Outcomes Related to the Initial Fluid Resuscitation Strategy in a Congestive Heart Failure Population Treated for Sepsis

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Introduction

According to the CDC, nearly 270,000 people die with sepsis every year.[1] Sepsis remains a very deadly condition, carrying upwards of 40% mortality rate. Along with early targeted antibiotics, a core component of treatment is rapid and early fluid administration. However, certain populations can be at increased risk of fluid overload, such as those with congestive heart failure. There exists conflicting data regarding fluid administration in this population. Prior studies have found although these patients are at higher risk of fluid accumulation, when given the appropriate initial 30cc/kg fluid bolus, the incidence of adverse clinical events was similar for patients with and without congestive heart failure treated for sepsis.[2] However, other studies have shown excess fluid administration in these vulnerable patients can lead to significant symptoms related to vascular congestion and fluid accumulations in the lungs, abdomen, or extremities, all of which have been shown to lead to increased use of medical interventions and increased hospital mortality.[3]

Thus, there remains uncertainty in this population regarding outcomes related to initial fluid resuscitation strategy.

Hypothesis

Congestive heart failure patients admitted for sepsis will have significantly shorter lengths of stay when treated with conservative fluid resuscitation than those treated with aggressive fluid resuscitation. Additionally, patients treated with conservative fluid resuscitation will have improved mortality and lower utilization of advanced respiratory support including NIPPV and intubation.

Methods

- An IRB approved retrospective analysis via electronic medical record data extraction from 2013 to 2019.
- Inclusion: All patients were >18 years old, who had a preexisting diagnosis of congestive heart failure, and were admitted for sepsis.
- The patients were divided in to two groups:

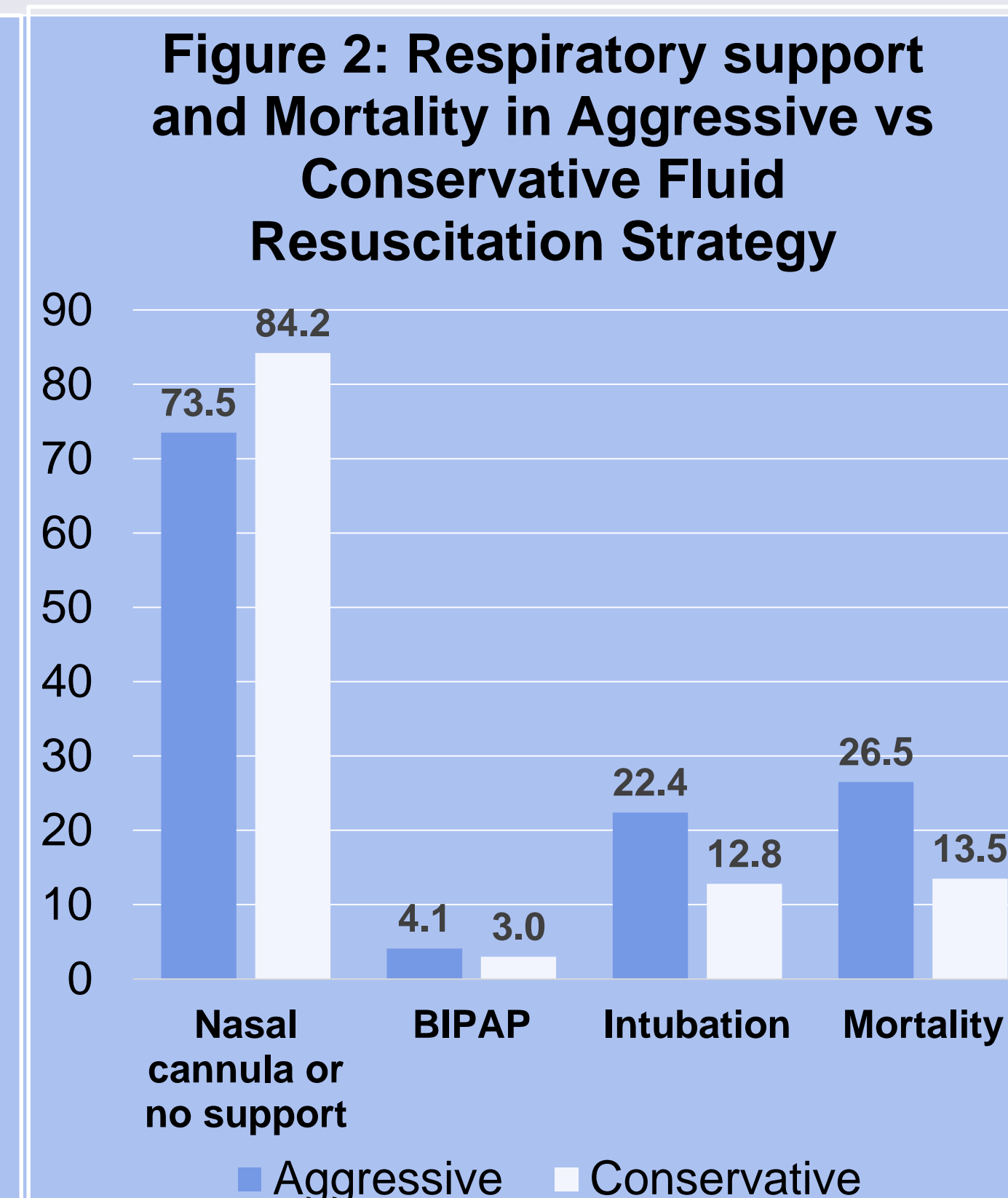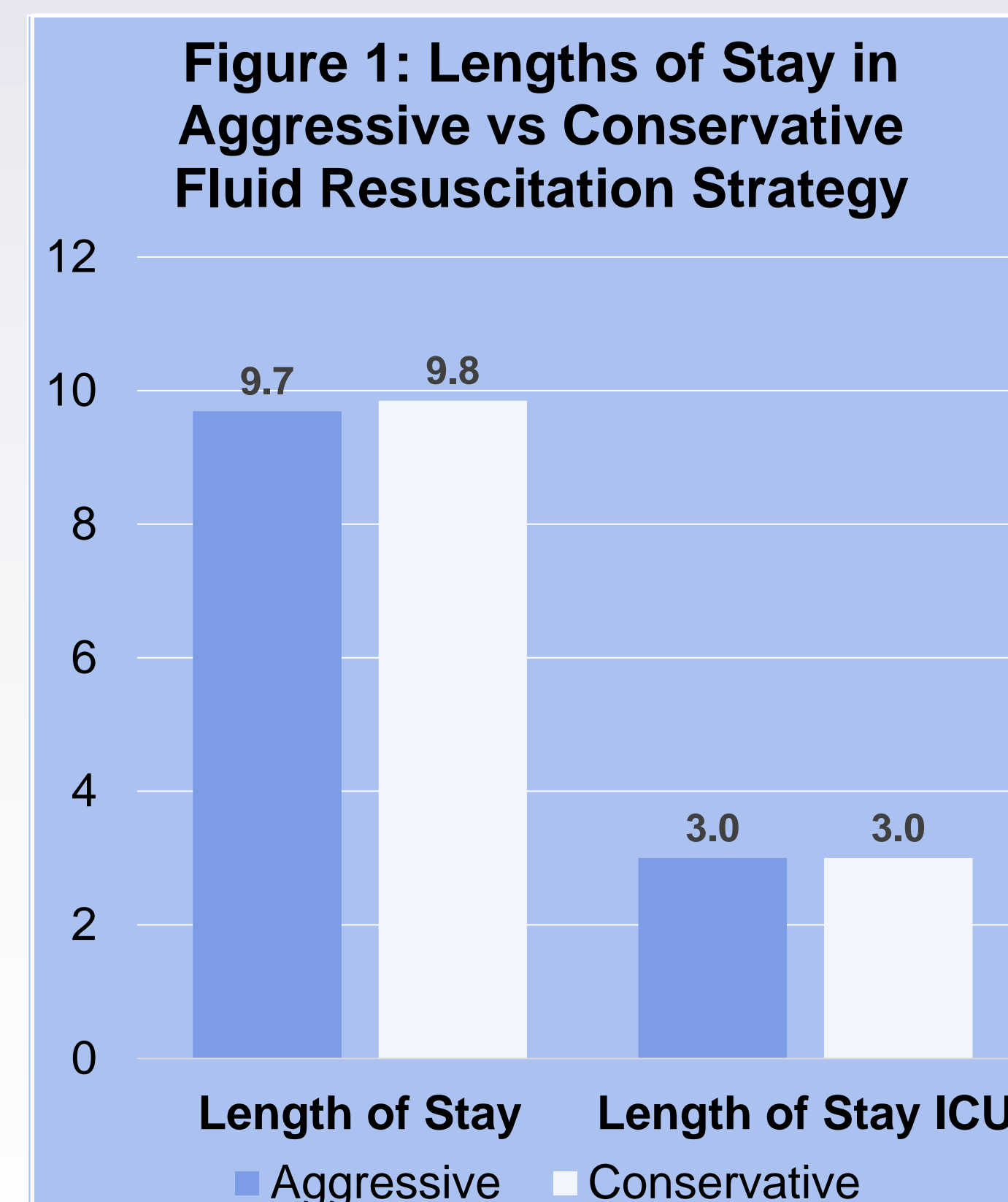| Group 1:	Group 2:
The aggressive group, those in which orders for normal saline boluses in the first 24 hours met or exceeded the recommended 30cc/kg ideal bodyweight recommendation.	The conservative group was any cumulative normal saline bolus of less than the recommended 30cc/kg ideal bodyweight over 24 hours.

- Variables collected: age, gender, race, select comorbidities, any available echocardiogram during the admission, LOS, ICU LOS and required respiratory support.
- Length of stay differences were compared by an Independent Student's t-Test (Mann Whitney-U), as were levels of respiratory support comparisons, and a Chi square analysis was used to evaluate mortality between groups.

Results

- Total patients who met inclusion: 608
- Total patients excluded due to no fluid order: 426
- Total study sample: 182
- Group 1: Aggressive fluid, n=49
- Group 2: Conservative fluid, n=133
- The patient demographics are shown in Table 1.
- Among these two groups, there was a nonsignificant difference between length of stay (9.7 days vs 9.8 days, p=0.77) and ICU length of stay (3.0 days vs 3.0 days, p=0.90), Figure 1.
- Although there were some differences in respiratory support, none of these differences were significant (Figure 2).
- There was a significant difference in mortality. The patients treated with the aggressive fluid resuscitation strategy resulted in a higher in-hospital mortality (26.5% vs 13.5%, p=0.04) (Figure 2).

Table 1: Patient Demographics and Comorbidities

	Aggressive (n, %)	Conservative (n, %)
Total patients	49	133
Male	25 (51)	68 (51.1)
Age (years)	68.8±12.4	72.6±12.3
Race		
Caucasian	42 (85.7)	109 (82.0)
African American	7 (14.3)	23 (17.3)
Other	0 (0)	1 (0.8)
Ejection Fraction		
EF<40%	11 (22.4)	16 (12.0)
EF>40%	16 (32.7)	38 (28.6)
Comorbidities		
Hypertension	15 (30.6)	42 (31.6)
Diabetes	23 (46.9)	64 (48.1)
CVA	2 (4.1)	6 (4.5)
Cirrhosis	0 (0)	6 (4.5)
COPD	17 (34.7)	75 (56.4)
CKD/ESRD	28 (57.1)	73 (54.9)

Figure 1: Lengths of Stay in Aggressive vs Conservative Fluid Resuscitation Strategy

Length of Stay: Aggressive 9.7, Conservative 9.8
Length of Stay ICU: Aggressive 3.0, Conservative 3.0
Aggressive / Conservative

Figure 2: Respiratory support and Mortality in Aggressive vs Conservative Fluid Resuscitation Strategy

Nasal cannula or no support: Aggressive 73.5, Conservative 84.2
BIPAP: Aggressive 4.1, Conservative 3.0
Intubation: Aggressive 22.4, Conservative 12.8
Mortality: Aggressive 26.5, Conservative 13.5
Aggressive / Conservative

Discussion

- The findings of the study describe that there were no significant differences in lengths of stay to the hospital or the ICU for the aggressive and conservative resuscitation strategies, though there was a significant difference in mortality and a nonsignificant trend of higher intubation rates in the aggressive group.

- Notably, the average lengths of stay for both groups was nearly 10 days, whereas the measured data only ranged over the first 24 hours, leaving plenty of time for confounding variables among patient treatment regimens to account for the lack of significant differences.

- There was a higher percentage of patients in the conservative group diagnosed with COPD compared to the aggressive group, potentially explaining an initial decision to consider volume overload more carefully in a patient with preexisting lung conditions.

- This may suggest that initial volume resuscitation should be assessed on an individual basis, weighing risk of volume overload with respect to severity of illness and relevant comorbidities.

- Limitations with this study include:
  -There was a large majority of patients that could not be assigned to either group for comparison, as they did not have any documented fluid administration order in the electronic medical record, leading to smaller sample sizes.
  -It was impossible to determine the exact fluid administered, and orders for fluid were extracted instead. For future research, a potential avenue could be a prospective cohort study to better monitor how much volume each patient receives over the course of the hospital stay.

Conclusion

There is no significant difference between length of stay or ICU length of stay in patients with congestive heart failure admitted for sepsis based on the initial fluid resuscitation strategy. However, there may be a relationship between aggressive initial volume resuscitation and worsened mortality in this population

References

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