Adding *insalt* to injury: Evaluating the clinical consequences of sepsis protocols on patients with heart failure

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ABSTRACT

Background: Inpatients with acute decompensated heart failure (ADHF) frequently meet sepsis criteria defined by the systemic inflammatory response syndrome (SIRS). To meet CMS guidelines, they receive a fluid bolus and broad-spectrum antibiotics, like piperacillin/tazobactam (pip/tazo), within 3 hours of presentation. A daily regimen of pip/tazo can contain as much as 1040 mg, or half the recommended dietary intake, of sodium. The objective of this investigation was to evaluate volume overloading and clinical consequences of sepsis protocols in patients with ADHF.

Methods: We reviewed inpatients ≥18 years old with ADHF per ICD-10 codes and an IV loop diuretic order who were initiated on a sepsis bundle, identified by IV fluid bolus and IV antibiotic orders. Patients who received ≥16 g of pip/tazo consecutively were compared to those who received other antibiotics. Outcomes included change in fluid homeostasis defined by increase in diuretic dose or frequency, or a weight increase ≥1 kg within a calendar day after receiving antibiotics; discharge disposition, length of stay (LOS), and 30-day readmission.

Results: We identified 95 patients admitted from 2/1/19 – 8/1/19. Thirty-four received pip/tazo, 61 received other antibiotics. Average age was 75, and 70% of patients had an infectious diseases diagnosis on discharge. Fluid homeostasis was poorer in the pip/tazo group compared to the other antibiotics group, demonstrated by weight increase ≥ 1kg (42% vs. 38%) and/or increase in diuretic intensity (65% vs. 51%). 30-day readmission rate was 2.9% in the pip/tazo group and 4.9% in the other antibiotics group. Median LOS was 11.5 vs. 7 days for the pip/tazo group and other antibiotics group, respectively. Rate of mortality was 32.6% during this encounter.

Conclusions: Early initiation of fluids and antibiotics may be detrimental in those without an infectious syndrome based on disrupted fluid homeostasis. Given lower sodium burden associated with other antibiotic selections, this has implications for antimicrobial stewardship.

OBJECTIVE

To describe clinical consequences of sepsis protocols, particularly sodium contribution from pip/tazo, on acute decompensated HF patients at a single center

BACKGROUND

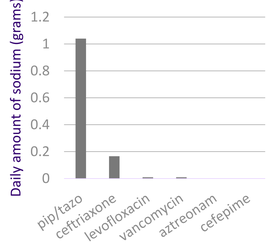
Components of VMC's Sepsis Protocol

> **Diagnostics**: cultures, lactic acid, CBC, CMP, ABG

> **Fluids**: sodium chloride 0.9% bolus (500-1000 mL or 30 mL/kg)

> **Empiric intravenous (IV) antibiotics**

AVERAGE DAILY SODIUM CONTRIBUTION OF ANTIBIOTICS[1]



Antibiotic (not including fluid for administration)

METHODS

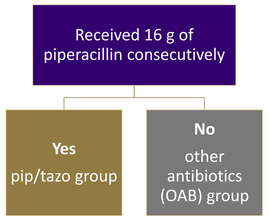
STUDY DESIGN

Single center retrospective medical chart review

PATIENT SELECTION

> Age ≥18 years old
> Inpatient admission from 2/1/19-8/1/19
> Acute decompensated HF
  > ICD 10 code
  > IV furosemide order
> Initiated on sepsis protocol
  > IV antibiotics
  > IV fluid bolus

STUDY GROUPS



OUTCOMES

> Sodium and fluid homeostasis, defined as:
  - Increase in diuretic dose or frequency, OR
  - Weight increase ≥1 kg within 1 calendar day of IV antibiotic initiation
> Hospital length of stay
> Infectious diagnosis upon discharge
> Discharge disposition
> Survival to discharge
> 30-day all-cause readmission rate

RESULTS

Table 1. Background characteristics

Measure	Pip/tazo (n=34)	OAB Other antibiotics (n=61)
Baseline		
Female gender (%)	**8** (23.5)	**37** (59)
Age (IQR)	**69.5** (61-80.5)	**79** (72-84)
Weight in kg (IQR)	**80** (69-95.5)	**76** (62.5-90.3)
SCr in mg/dL (IQR)	**1.6** (1.1-3.1)	**1.4** (1.1-2)
eGFR in mL/min (IQR)	**42** (19.3-64.8)	**41** (24-54)
Prior admission (%)		
Within 30 days	**5** (14.7)	**9** (13.4)
Within 31-90 days	**6** (17.6)	**13** (21.3)
Heart failure		
LVEF %, normal is ≥ 55% (IQR)	**35** (32.5-45)	**52** (37.5-57.5)
NYHA Class (IQR) (N = 21)*	**2** (2-3)	**2** (1-3)
BNP in ng/L (IQR)	**597** (240-1020)	**456** (249-1126)
Loop diuretics on admission (%)		
None	**19** (57.6)	**35** (56)
Furosemide ≤20 mg TDD	**4** (11.8)	**6** (9.8)
Furosemide 40-60 mg TDD	**7** (20.6)	**10** (16.4)
Furosemide ≥80 mg TDD	**3** (8.8)	**10** (16.4)
Sodium-restricted diet orders (%)	**20** (58.8)	**32** (52.5)
Sepsis/Infection		
Infectious diagnosis on admission (%)	**23** (37.6)	**33** (54.1)
PNA	**10** (43.5)	**20** (60.6)
GI/GU	**2** (8.7)	**8** (24.2)
SSTI	**6** (26.1)	**2** (6.1)
Unknown	**5** (21.7)	**3** (9.1)
Initial fluids given (%)		
NS 1L	**18** (52.9)	**27** (44.3)
NS 250-500 mL	**7** (20.6)	**23** (37.7)
NS 30 mL/kg	**6** (17.6)	**7** (11.5)
NS 2L-3L	**2** (5.9)	**1** (1.6)
LR 250mL-1L	**1** (2.9)	**3** (4.9)
Procalcitonin (IQR)	**2.98** (0.46-8.9)	**0.33** (0.13-2.24)

*only based on data from 21 patients, 9 of whom were in the pip/tazo group

Figure 1. Sodium and fluid homeostasis

Measures of sodium and fluid homeostasis within one calendar day of IV antibiotic initiation

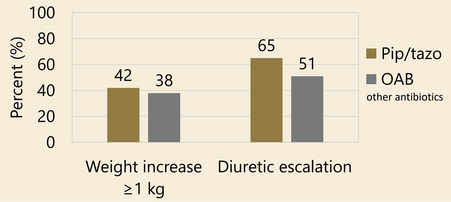


Figure 2. Hospital length of stay

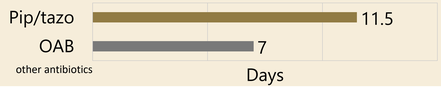


Figure 3. Infectious diagnosis upon discharge

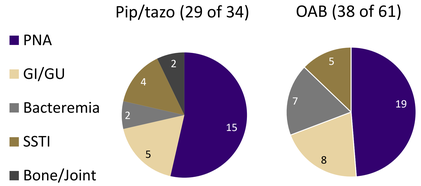
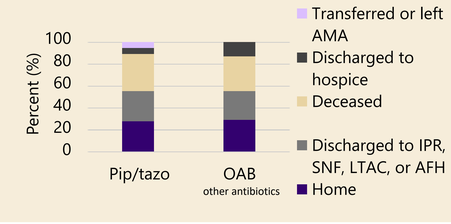
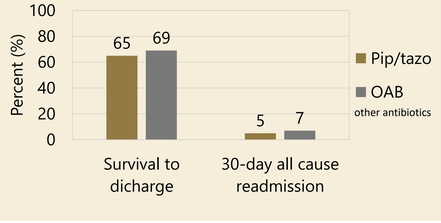


Figure 4. Discharge disposition



RESULTS, CONTINUED

Figure 5. Survival and readmission



CONCLUSIONS

1. HF patients with suspected sepsis was a highly morbid selection in our institution (43% hospice/deceased)
2. Use of pip/tazo may disrupt fluid homeostasis as evidenced by more weight increase and diuretic escalation

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