Association Between Bacterial Virulency and SBP Patient Outcomes

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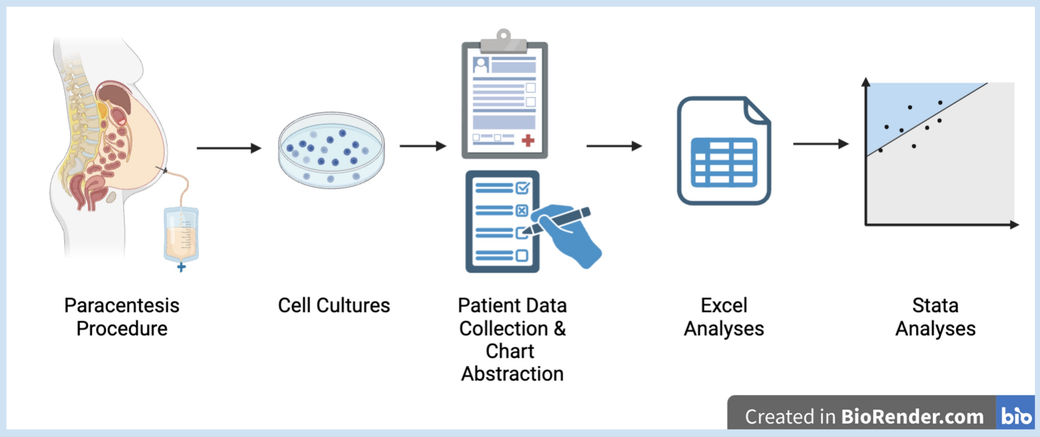
ABSTRACT: Spontaneous bacterial peritonitis, commonly referred to as SBP, is an infection caused by an accumulation of abdominal fluid particularly seen in patients with cirrhosis (fibrosis of the liver). It's theorized that these patients are prone to translocation of bacteria from their intestinal tract into their abdomens. A study was conducted regarding the effects of the time of treatment of antibiotics on patient outcomes for SBP-afflicted patients, namely those of length of stay and discharge disposition. It was hypothesized that microorganisms with more virulent mechanisms of action would lead to longer length of stay and a more severe discharge disposition amongst patients with SBP. Peritoneal fluid was removed from the abdomen of patients with SBP, and the various strains of bacteria within each sample were cultured and used for data analysis. There was a trend ($0.05 \leq p < 0.10$) towards worse patient outcomes in SBP patients whose cultures were positive for Micrococcus, Enterococcus, and Candida, which may be indicative of a more severe mechanism of action. However, none met statistical significance ($p \leq 0.05$). The small sample size ($n = 95$) used in the study meant many associations were unable to be established. Thus, future studies regarding this topic should entail larger sample sizes to better establish possible associations.

Introduction

- Spontaneous bacterial peritonitis (SBP) is infection relating to abdominal fluid accumulation common in patients with cirrhosis due to these patients commonly having accumulations of abdominal fluid and bacteria in the digestive tract
- Symptoms of SBP include fever and abdominal pain; however, patient may have vague symptoms that are not apparent
- SBP diagnosis is attained via paracentesis, in which peritoneal fluid in the abdomen is removed via a syringe
- The Hospital Medicine Team at UNC Chapel Hill is conducting a study about how the time of treatment of antibiotics affects patients with SBP, and since different strains of bacteria affect the body differently and in different ways, the study will observe the effects of these various strains on patients with SBP
- **Hypothesis**: Strains of microorganisms with more harmful mechanisms of action (i.e. toxin release) will lead to more severe patient outcomes in patients with SBP, namely length of stay and discharge disposition

Methods



The Hospital Medicine Team performed the first 3 steps, and the resulting data and information were supplied for this project. Data clean up and analyses were performed afterward.

Results (Patient Characteristics)

We analyzed n = 95 positive cultures from n = 1624 unique patient encounters to determine significant associations between variables.

Sex, %

Female	40
Male	60

Race, %

Asian	2.11
White	67.37
Black	21.05
Other	9.47

Ethnicity, %

Hispanic/ Latino	8.42
Non-Hispanic/ Non-Latino	91.58

Bacterial Strain, %

Micrococcus	9.47
Streptococcus	8.42
Staphylococcus	24.21
Klebsiella	6.32
Enterococcus	8.42
Candida	9.47
E. Coli	12.63

Other Variables

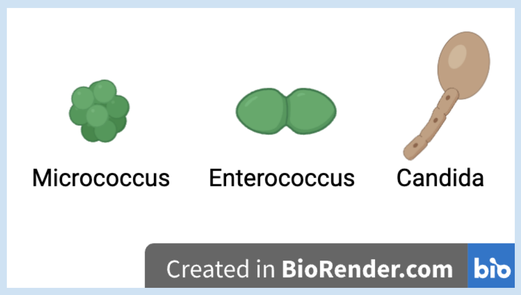
Expired, %	26.32
Hospice, %	14.74
Mean Length of Stay (LOS)	23.76 days
LOS ≥ 14 days, %	49.47
Mean Age	57.22 years
Age ≥ 65 years, %	29.47
Mean MELD	21.39
MELD ≥ 24, %	36.84

MELD score is an indicator of patient's survival of liver disease, ranging from 6 - 40 (24 is the median value, chosen to signify heightened severity).

Associations with LOS ≥ 14 days, MELD ≥ 24, Mortality or Discharge Status (Hospice & Expired)

Mid-Significance ($0.05 \leq p < 0.10$)

LOS ≥ 14 days & Candida
LOS ≥ 14 days & Micrococcus
Hospice & Enterococcus
MELD ≥ 24 & Micrococcus



Low Significance ($0.10 \leq p < 0.25$)

LOS ≥ 14 days & Hispanic/Latino
MELD ≥ 24 & Micrococcus
LOS & Micrococcus
LOS & Staphylococcus
LOS & E. Coli
Expired & Klebsiella
Expired & Candida
Hospice & Micrococcus
Hospice & Staphylococcus

Conclusion

- There was a trend towards significance (mid-significance associations, $0.05 \leq p < 0.10$) in Micrococcus, Enterococcus, and Candida strains, indicative that these may be the most virulent of the cultured strains.
- Micrococcus is not typically presented as a pathogen, but when it does, it sometimes presents with minimal response to common antibiotics (Zhu et al.), thus potentially explaining its associations with many variables.
- Moreover, Enterococcus, while part of the normal gut bacterium, can be pathogenic outside of this environment. Moreover, it secretes many proteins, including a lytic toxin, and includes many drug-resistant strains (Yuen and Ausubel)**.** This results in a more persistent infection, explaining the hospice outcomes.
- Additionally, the increased virulence of Candida can be explained by the mechanism of action, which consists of an organism that resides in the body without harm and can transition to be pathogenic; it has multiple paths of invasion, involving adhesion proteins and lysing enzymes that further degrade the integrity of the host cell, which can explain the increased virulence of organisms from the genus Candida (Mayer et al.). This may explain the longer LOS and MELD score, as well as the more severe outcomes of expiry.
- Many significant associations could not be determined due to the limitation of having a small sample size. Conducting further analyses with a larger sample size could help to reveal more significant associations between particular strains and variables.

Acknowledgements

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References

To see references. please scan the QR code.