Rectal Stool Surveillance Cultures to Guide Empiric Antibiotic Therapy in Patients with Hematologic Malignancies with or without Hematopoietic Stem Cell Transplantation

Contact Information:
Seema Mehta Steinke, MD, MSC
samehta82@gmail.com
Cell: 716-536-3151
Fax: 872-204-2746

Afrah S. Sait, MD, MAS[1], Shalom Patole[2], MBBS, MD, ScM, Kathryn Dzintars, Pharm D.[3] Sara Cosgrove MD, MS[1], Seema Mehta Steinke, MD, MSC[1]

Baltimore, MD, USA;
[1] Infectious Diseases, Johns Hopkins University School of Medicine; [2]Bloomberg School of Public Health, Johns Hopkins University; [3]Department of Pharmacy, The Johns Hopkins Hospital

Introduction

Patients with hematologic malignancies (HM) or hematopoietic stem cell transplant (HSCT) commonly receive broad-spectrum antimicrobials, and exposure to these agents can lead to colonization and infection with multidrug resistant organisms (MDRO). The risk of infection once an individual is colonized with an MDRO varies in incidence. Satlin et al demonstrated that 32% of HSCT patients colonized pre-transplant with extended spectrum β-lactamase producing Enterobacterales (ESBL-E), developed bacteremia due to ESBL-E during their transplant admission. Hefazi et al showed that 24% of patients colonized with vancomycin-resistant enterococcus (VRE) developed VRE bloodstream infection during the early period after HSCT.

Objectives

The objective of this study is to determine the role of rectal stool surveillance cultures (SSC) in predicting the development of a sterile site infection with the same MDRO as identified in the rectal stool culture.

Materials and Methods

The Johns Hopkins Hospital is a 1,154-bed tertiary care center in Baltimore, MD. Patients who are admitted to the oncology services with HMs or HSCT undergo weekly rectal stool surveillance cultures (SSC) for VRE, ESBL-E, carbapenem- resistant Enterobacterales (CRE), and other MDROs. MDROs are defined as any Gram-negative organism that tests non-susceptible to at least one agent in at least 3 antimicrobial classes. From 6/1/2017 to 2/28/2019, 1,758 patients were admitted and had SSCs performed. We randomly selected 300 patients and retrospectively evaluated sterile site infections (blood, CSF, peritoneal fluid, pleural fluid, and urine) and sputum/respiratory cultures in patients with evidence of pneumonia and stool surveillance culture data. 242 unique adult patients were identified, and a total of 732 SSCs were available for analysis. Demographics, stool surveillance cultures, and culture positive infections in the 3-month period following the last stool surveillance culture were collected from electronic medical records. 153 SSCs were excluded due to insufficient follow-up data (Figure 1). We assessed similarity between organisms identified in stool surveillance cultures and subsequent clinical sterile site cultures (including respiratory cultures) through comparison of susceptibility profiles. JMP Pro 14.3.0 and RStudio were used for statistical analyses including basic statistics, negative predictive value and positive likelihood ratio.

Results

Figure 1: Selection of stool surveillance cultures for analysis

1,758 Unique patients from 6/1/2017 – 2/28/2019 yielding 4,828 stool surveillance cultures

↓ Random selection

242 Unique patients with 732 stool surveillance cultures

→ 153 Stool surveillance cultures excluded (<3 months of follow-up data)

↓

579 Stool surveillance cultures analyzed

Table 1: Demographic data of patients with MDROs in stool surveillance cultures

Patient Data	N = 242 (%)
Gender	
Male	155 (64%)
Female	87 (36%)
Underlying Malignancy	
Leukemias	134 (55.4%)
Lymphomas	53 (21.9%)
Multiple Myeloma	25 (10.3%)
Other[Ω]	30 (12.4%)
HSCT Recipient	122 (50.4%)

[Ω]Other malignancies included myelodysplastic syndrome/myelofibrosis, post-transplant lymphoproliferative disorder, hemophagocytic lymphohistiocytosis , aplastic anemia, Kaposi's sarcoma, T-cell lymphoma/leukemia

Table 2: Multi-drug resistant organisms identified in stool surveillance cultures

Stool Surveillance Cultures	N = 579 (%)
SSCs with an MDRO present	251/579 (43.3%)
Break down of MDRO present in SSC (N = 579):	
• Vancomycin-resistant enterococci (VRE)	131 (22.6%)
• Extended-spectrum β-lactamase producing enterobacterales (ESBL-E)	56 (9.7%)
• Carbapenem-resistant enterobacterales (CRE)	11 (1.9%)
• Other MDRO	53 (9.1%)

Table 3: Culture/Infection data

Sterile Site Cultures	N = 384 (%)
Positive sterile site cultures	207/384 (53.9%)
Sterile site cultures with the same MDRO as in SSC	54/384 (14%)
Sites of infection with an MDRO (N = 54):	
• Blood	36 (66.7%)
• Urine	10 (18.5%)
• Respiratory (w/evidence of PNA)	5 (9.2%)
• Other	3 (5.6%)
MDROs identified in clinical cultures (N = 54):	
• VRE	26 (48.1%)
• ESBL	2 (3.7%)
• CRE	11 (20.4%)
• Other MDRO	15 (27.8%)

- The Negative Predictive Value (NPV) of the SSC is 95.1% (95% CI 0.93, 0.97). Therefore, of those patients with a negative SSC, 95.1% of those patients are unlikely to develop a StSI.
- The Positive Likelihood Ratio (+LR) of the positive SSC was 2.5 (95% CI 2.07, 3.02). Thus, indicating that a positive SSC increases the probability of having an StSI with the same organism as in the SSC by approximately 15%.

Conclusion

- Patients with negative SSCs for an MDRO have a lower probability of subsequent infection with an MDRO.
- SSCs positive for an MDRO have a low probability of having an StSI with the same MDRO.
- This data may be used to judiciously guide antimicrobial therapy and potentially decrease and/or avoid the unnecessary usage of broad-spectrum antimicrobials when no MDRO is identified in the SSC.

Future directions:

- Determine patient risk factors for developing StSIs with the same organism as in the SSC.

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