Impact of the BioFire FilmArray® Gastrointestinal Panel in Children Hospitalized for Acute Gastroenteritis

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ABSTRACT (REVISED)

Background: Molecular assays can improve the diagnosis of acute gastroenteritis (GE) by increasing detection of pathogens, timelines of results, and appropriate patient management. This study assessed the impact of the FilmArray® Gastrointestinal (GI) Panel on patients with GE.

Methods: A pre-post-intervention study was conducted on patients <18 y old between 3 pediatric ICUs with chief complaints of GE. During the pre-intervention period (PRE), clinicians ordered standard of care stool culture and/or rapid test (SOC). In contrast, FilmArray GI Panel was performed and results reported in real-time to the hospital information system. The impact of the FilmArray GI Panel on the clinical management of patients was determined.

Results: Of the 1158 subjects enrolled in the study to date (532 PRE and 586 POST), 177 (15.5%), 81 PRE and 96 POST were hospitalized for management of GE symptoms. 36.1% patients hospitalized (HOSP) had an underlying condition compared to 24.3% of patients discharged (DIS) (p = 0.018). In the PRE period, 29 (24.7%) HOSP had SOC testing ordered and 5 (1.6%) were positive for pathogens including: E. coli (15/17) (17.6%), C. difficile (2), and norovirus. In contrast, 68 (77.7%) HOSP had at least 1 pathogen detected on FilmArray GI Panel in the POST period (29 cases with ≥2 pathogens). The most common pathogens detected were norovirus (28), adenovirus (9) and C. difficile (21). SOC testing ordered by clinicians would have missed 25 positive cases in the POST period. The mean turn around time decreased by 32.3 (46.3 h to 14.2 h, p < 0.001) using FilmArray GI Panel during POST period. In the PRE period, antibiotics were initiated in 13 (18.6%) patients upon admission despite SOC testing ordered on only 5 (45.5%). Antibiotics were not discontinued in 2 patients despite detection of E. coli C.DIFF and norovirus. Of the 13 (3.5%) treated in the POST period, antibiotics were discontinued in 8 (61.5%) and appropriately initiated in 2 (15.4%) patients in < 24 h of FilmArray GI Panel result; 3 patients had C. difficile and virus detected and none were treated for C. difficile infection.

Conclusions: The FilmArray GI Panel enabled rapid and definitive diagnosis of acute gastroenteritis in the majority of patients admitted with GE. This may allow for prompt but appropriate use of antibiotics.

BACKGROUND

Acute gastroenteritis (GE) is a significant cause of morbidity and mortality worldwide. In the United States, GE accounts for 3.5 million outpatient visits, 200,000 hospitalizations and 300 deaths annually.

The advent of multiple molecular assays can improve diagnosis of GE by increasing detection of virulent pathogens and time to result, allowing clinicians to appropriately manage patients.

The FilmArray® Gastrointestinal (GI) Panel is a fully automated ~1 hour cycle to answer the primer-based test for identification of 22 different pathogens, including bacteria, viruses, viruses, and viruses from stool specimens.

It is a unique if more rapid and comprehensive diagnosis will improve patient management and outcome.

This study assessed the impact of the FilmArray GI Panel on pediatric patients presented on admission at five pediatric emergency department (ED).

- Nationwide Children’s Hospital
- Children’s Hospital of Los Angeles
- Children’s Mercy Hospital
- Children’s Hospital of Philadelphia
- Rhode Island Hospital.

METHODS

Pre-intervention period (PRE):
- Clinicians ordered standard of care (SOC) testing at their discretion.
- Patients admitted for further management PRE and POST were assessed for positive results by SOC and FilmArray GI panel.
- Antibiotic therapy were evaluated to determine the impact of testing results on optimization or discontinuation of antibiotic therapy.
- Statistical significance was calculated using t-test and all p values > 0.05 were considered statistically significant.

Post-intervention period (POST):
- FilmArray GI panel performed and reported in real-time to the hospital information system.
- Patients admitted for further management PRE and POST were assessed for positive results by SOC and FilmArray GI panel.
- Antibiotic therapy were evaluated to determine the impact of testing results on optimization or discontinuation of antibiotic therapy.
- Statistical significance was calculated using t-test and all p values > 0.05 were considered statistically significant.

RESULTS

- There were 10 (76.9%) co-infections with C. difficile in the POST period, 12 with viral etiologies and 5 with bacteria or toxin (Figure 5).
- Norovirus was the most common (9, 16.3%) patients
- Antibiotics were discontinued in 2 patients (80%)
- Antibiotics were not initiated in the 7 patients (all ≤ 2 y old).
- The 3 patients that were treated for C. difficile infections were ≤ 1 and 13 years old (Table 1). C. difficile was the only pathogen detected.
- This highlights the benefit of broad-panel testing to identify true pathogens versus C. difficile colonization.

Table 1. Patients Treated With Antibiotics in PRE Period

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Antibiotics Change</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenovirus</td>
<td>Initiated same day as result</td>
<td>72 hours</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>Initiated same day as result</td>
<td>72 hours</td>
</tr>
<tr>
<td>C. difficile</td>
<td>Discontinued based on result</td>
<td>≤ 24 hours</td>
</tr>
<tr>
<td>E. coli</td>
<td>Initiated same day as result</td>
<td>72 hours</td>
</tr>
<tr>
<td>Unknown</td>
<td>Discontinued based on result</td>
<td>≤ 24 hours</td>
</tr>
</tbody>
</table>

Figure 1. Patient Enrollment Distribution

- A total of 1158 pediatric patients were enrolled in the study and 177 of patients were hospitalized (Figure 1).
- Co-morbidities: 36.7% hospitalized patients vs. 24.3% discharged patients (p = 0.018).
- SOC testing were evaluated in 247 (20.9) and 42.7% (all patients) hospitalized patients in the PRE and POST period, respectively.
- PRE: only 0 (0.0%) positive by SOC testing.
- POST: 12 (3.5%) and 68 (7.7%) were positive by SOC testing and FilmArray GI panel, respectively.
- 25/68 patients (34.8%) polymicrobial infections in the POST period (Figure 4).
- In the POST period, the most common pathogens detected by FilmArray GI panel were Norovirus (28) and C. difficile (21).
- In contrast, based on SOC testing, the most common pathogen detected by FilmArray GI panel was Salmonella species and C. difficile (4 pathogens each).
- 33 positive patients would have been missed in the POST period if any SOC testing was available, including all cases of Norovirus.

Table 2. Patients Treated With Antibiotics in POST Period

<table>
<thead>
<tr>
<th>Pathogen</th>
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</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
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<td>72 hours</td>
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<tr>
<td>C. difficile</td>
<td>Discontinued based on result</td>
<td>≤ 24 hours</td>
</tr>
<tr>
<td>Adenovirus</td>
<td>Initiated same day as result</td>
<td>72 hours</td>
</tr>
<tr>
<td>Norovirus</td>
<td>Discontinued based on result</td>
<td>≤ 24 hours</td>
</tr>
<tr>
<td>Unknown</td>
<td>Discontinued based on result</td>
<td>≤ 24 hours</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- An significant increase in number of patients were detected using the FilmArray GI panel on patients admitted to the hospital for further management of GE.
- The FilmArray GI panel results led to early discontinuation or initiation of antibiotics in 813 patients.
- The ability to detect additional pathogens alongside C. difficile prevented unnecessary treatment of patients colonized with C. difficile.
- Overall, the FilmArray GI Panel enabled rapid and definitive diagnosis in the majority of patients admitted with GE. This may allow for prompt but appropriate use of antibiotics.

ACKNOWLEDGEMENT

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