Rapid Multiplex PCR Gastrointestinal Panel Can Enhance Pathogen Identification (ID) and Improve Hospital Infection Prevention (IP) Practices in Pediatric Patients with Diarrhea

Ishminder Kaur, MD[1,4,5], Jennifer Vodzak, MD[1,4,5], Jane M. Gould, MD[1,2,4,5], Michael Heard, MT[3,4], Sarah S. Long, MD[1,4,5], Alan T. Evangelista, PhD[3,4]
Section of Infectious Diseases[1], Department of Infection Prevention[2], Department of Microbiology, Virology and Molecular Diagnostics[3]
St. Christopher's Hospital for Children[4] and Drexel University College of Medicine[5], Philadelphia, PA

Background

- Gastroenteritis accounts for >450,000 US hospitalizations annually; etiology is found in <50%
- Multiplex PCR could provide rapid, simultaneous ID of multiple pathogens not suspected clinically or not detectable by standard tests (ST)
- Enhanced ID could impact IP practices
- There are few studies of stool PCR testing in children with diarrhea

Objective

- Compare BioFire FilmArray® GI Panel with standard tests (ST) for pathogen ID
- Compare diagnostic yield of physician selected ST versus nonselective GI Panel
- Assess the impact of rapid, enhanced ID on IP practices

Methods

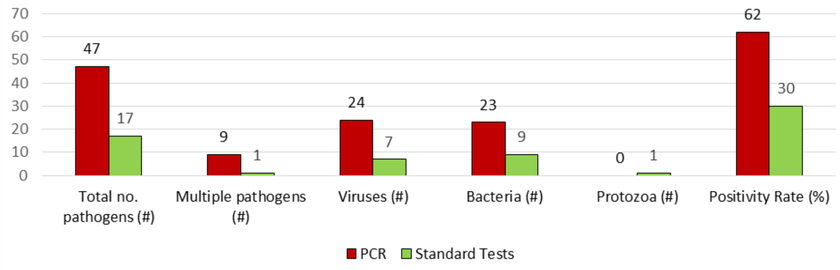
- Convenience sample of liquid stool specimens submitted to clinical lab for ST from Mar '14-Mar '15 were studied
- ST performed per physician orders (ST could include stool culture, parasite microscopy, and enzyme immunoassays (EIA) for rotavirus, adenovirus, *C. difficile* (w/reflexive NAAT), Shiga-like toxin-producing *E. coli* (STEC), *Cryptosporidium*, *Giardia*)
- GI PCR Panel performed as validation study, with one specimen test per patient per encounter; results were not available in real time. GI panel tests for 22 pathogens (13 bacteria, 5 viruses, 4 protozoa)
- Medical charts reviewed retrospectively to assess clinical data and isolation measures

Results

- 51 patients had 53 unique stool specimens analyzed
- Majority of patients were hospitalized (91%)
- Median age was 4 years (range 10 days-17 years)
- 55% had chronic medical conditions
- Diarrhea predominantly had community onset (CO-85%)
- Median of 3 (range 1-7) ST ordered/stool specimen

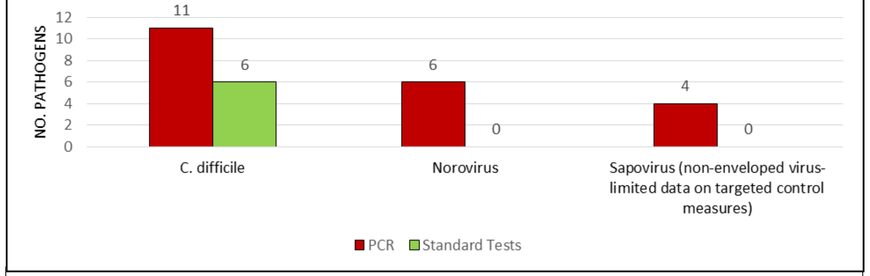
- Of 40 hospitalized patients with CO-diarrhea, only 85% were placed in enteric isolation
- Of 8 hospitalized patients with hospital-associated diarrhea, *C.difficile* was identified in 3 patients (both PCR and ST positive); only one out of these 3 patients with *C. difficile* diarrhea was placed in high-level enteric isolation

Fig 1. Pathogen ID Comparsion: PCR vs Standard Tests



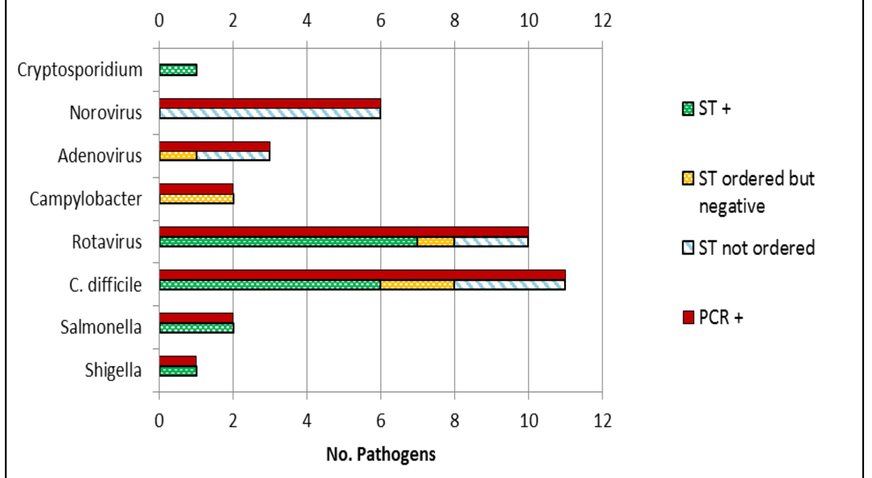
PCR identified pathogens in 62% of specimens vs 30% for ST (p <0.005). PCR identified 23 additional pathogens among 17 ST-negative specimens (Fig 1)

Fig 2. Potential IP Impact: Identification of pathogens requiring high level enteric isolation (soap and water hand hygiene and bleach disinfection of patient rooms)



ST missed 15 pathogens that should have led to high-level enteric isolation per hospital policy (Fig 2). 15 missed pathogens in Fig 2 equated to 11 patients (average length of stay 4.5 days) who were not placed in high-level enteric isolation

Fig 3. Diagnostic Yield: Physician-Selected Standard Tests (ST) vs PCR



Physician-selected ST missed 19 pathogens even when ST available: ST not ordered in 68% and ST false negative in 32% (Fig 3). PCR failed to detect *Cryptosporidium* in one culture-positive stool specimen

Conclusions

- PCR enhanced pathogen ID >2 fold
- Use of PCR could optimize isolation practices
- Low yield of ST is due both to insensitivity and to inadequate physician selection of tests