Shigellosis: Past, Present, and Future
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In 1898, a young microbiologist named Dr. Kiyoshi Shiga\(^1\) isolated a gram-positive bacillus from patients suffering from sekiri, or “red diarrhea.” That organism, now known as Shigella, is responsible for an estimated 1.1 million deaths a year worldwide. The disease is characterized by fever, malaise, and watery diarrhea, sometimes followed by bloody dysentery. Complications and long-term sequelae include encephalopathy, convulsions, hemolytic uremic syndrome (HUS), and reactive arthritis.\(^2\)

There are four species of Shigella: \(S.\) dysenteriae (group A), \(S.\) flexneri (group B), \(S.\) boydii (group C), and \(S.\) Sonnei (group D).\(^3\) After ingestion of a minimum inoculum—10 or more Shigella organisms—the bacteria colonize M cells in the colon. From there, they invade macrophages and dendritic cells, leaping into adjacent epithelial cells through rapid actin polymerization. Shigella bacteria further manipulate the host inflammatory response to cause disruption of the colonic mucosa.\(^4\)

Definitive diagnosis of shigellosis follows positive identification of the organism from rectal swabs or stool cultures.\(^5\) Shigella is initially cultured on media with low sensitivity and may be isolated by growth on selective media. In addition to the distinct appearance of Shigella colonies on selective media, the diagnosis may be confirmed by biochemical properties of Shigella organisms.\(^3\) Speciation and subtyping of Shigella is typically performed by sequential agglutination of bacteria with polyclonal or monoclonal antisera.\(^5\) National Shigella Reference Laboratory at the Centers for Disease Control and Prevention (CDC) may further analyze bacterial isolates that are unusual or untypeable.\(^3\)

Treatment of shigellosis varies, depending on the severity of infection. While mild cases can be managed with supportive care, severe cases are treated with antibiotics.\(^4\) A growing number of cases, however, are resistant to both first-line and second-line antibiotics.\(^2\) This is particularly worrisome as the CDC has classified Shigella as a Category B agent.\(^6\) Pathologists can prevent a potential epidemic by submitting Shigella isolates to public health laboratories.\(^3\)

The CDC monitors Shigella infections by both passive and active methods. Significantly, specimen attributes are recorded by the Laboratory-based Enteric Disease Surveillance (LEDS)
system, while antibiotic resistance is tracked by the National Antimicrobial Resistance Monitoring System (NARMS). These precautions allow the CDC to quickly identify and quarantine regions or patients of concern. When outbreaks occur, Shigella organisms are “fingerprinted” with pulsed-field gel electrophoresis (PFGE) to determine if each case is linked by a common Shigella strain.

Research is ongoing for development of a safe and effective vaccine. This is particularly true for infants and children in developing countries, who comprise many of the deaths associated with Shigella. Development of a vaccine has been hampered by multiple factors, including the necessity of addressing multiple Shigella serotypes and subserotypes, the absence of a small animal model, and the possibility of long-term complications such as reactive arthritis. Ultimately, researchers hope to develop a serotype-based or conserved antigen vaccine to eliminate the threat of future epidemics.

References


