Children with bloodstream infections caused by methicillin-resistant Staphylococcus aureus (MRSA), a common antibiotic-resistant bacteria, are less likely to die than adults with this condition and have different risk factors for treatment failure, a new study led by a Children's National Health System clinician indicates. However, the multi-center study shows that young patients have high rates of complications that increase significantly each day infections linger untreated, highlighting the urgent need for effective intervention.

"Knowing that the risk of complications increases with every additional day the bacteria are detected in the bloodstream highlights the importance of early and aggressive therapy for these infections," says Rana F. Hamdy, M.D., M.P.H., M.S.C.E., an attending physician in the Division of Infectious Diseases, director of the Antimicrobial Stewardship Program at Children's National and lead study author.

MRSA is an ongoing public health problem, causing more than 80,000 infections and more than 11,000 deaths annually in the United States. In adults, MRSA infections that reach the bloodstream are responsible for numerous complications and fatalities, killing 10 percent to 30 percent of patients. An important predictor of morbidity and mortality in adults is the blood concentrations of vancomycin, the antibiotic of choice to treat this condition.

Although findings in adults have guided treatment recommendations for children for years, little has been known about how this condition might uniquely affect a pediatric population.

In the new study, published May 5 in *Pediatrics*, Dr. Hamdy and colleagues studied the outcomes of children with MRSA bacteremia, or blood infections, in patients younger than 18 from three large, regional children's hospitals. These 232 patients were hospitalized at centers in Philadelphia, Baltimore and Salt Lake City from 2007 to 2014, after having positive blood cultures for MRSA.

Unlike adults, who commonly experience hospital-acquired infections, in children almost 80 percent of MRSA infections are community acquired. Using the pediatric patients' electronic health records, the researchers extracted epidemiological and outcomes data, such as how many patients died, had infections that were not adequately controlled or developed complications from their infections. They also used this chart information to better understand risk factors that led to treatment failure.

Their results showed that only 2 percent of pediatric patients died from their infections. However, about one-quarter developed serious complications, including blood clots caused by an immune response to the infection or infection that spread to distant sites, such as the heart.

The median duration of bacteremia in children was two days, compared with seven days for adults.
With each passing day, the researchers found, the risk of developing a complication rose by 50 percent for kids.

Overall, about one-third of children experienced treatment failure, defined by bacteremia that persisted longer than three days, a recurrence of bacteremia within 30 days after the start of treatment or death from this condition. Unlike adults, whose risk of treatment failure was greatest with low concentration of vancomycin or infections in the heart, pediatric patients most likely to experience treatment failure had MRSA infections in their muscles, bones or blood vessels, or concurrent critical illnesses. Vancomycin concentrations appeared to have little bearing on treatment failure in children, the authors write.

"This is an important finding," Dr. Hamdy adds. "In order to achieve high concentrations of vancomycin, children are given high doses. These high doses, however, can be associated with kidney injury. If there is no clear benefit in clearing the bacterial infection, these high doses may place children at risk unnecessarily."

The study team notes that their findings also underscore the need for dedicated studies to better understand clinical characteristics and outcomes specific to a pediatric population. Future studies to determine the best vancomycin dose, duration and approach for monitoring concentrations, they write, could help optimize patient outcomes.

"This was the first step, but additional data are needed," she says. "Future studies should pinpoint exact concentrations of vancomycin we should achieve in children so that the medicine clears infections effectively without causing additional harm."

Provided by Children's National Medical Center


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