New evidence explains poor infant immune response to certain vaccines

April 1 2009

For years, researchers and physicians have known that infants' immune systems do not respond well to certain vaccines, thus the need for additional boosters as children develop. Now, in a new study from the University of Missouri, one researcher has found an explanation for that poor response. In the study, the MU scientist found evidence that the immune systems of newborns might require some time after birth to mature to a point where the benefits of vaccines can be fully realized.

Habib Zaghouani, a professor of molecular microbiology and immunology and child health at the MU School of Medicine, recently found that a slowly maturing component of the immune system might explain why newborns contract infections easily. In his work, Zaghouani studied newborn mice and how their immune systems reacted when they were repeatedly exposed to an antigen that simulates a virus.

Zaghouani found that while the antigen would prompt a response of the immune system, it was not the expected response. In the adult immune system, two major types of cells, known as T-helper 1 (Th-1) and T-helper 2 (Th-2) cells, are instrumental in the development of an effective immune response. Typically, Th-1 cells respond when dangerous microbes enter the body. The Th-1 cells then work to help destroy the foreign microbes. When an antigen from a vaccine enters a body with a mature immune system, Th-1 cells respond and, after destroying the invader, the Th-1 cells "remember" how to fight the antigen for future battles. Th-2 cells typically develop when the body is exposed to allergens. The responses of Th-2 cells are usually strong and manifest in

the form of allergic reactions.

When Zaghouani gave the newborn mice an antigen shortly after birth, he noticed the presence of both Th-1 and Th-2 cells. However, when he gave the antigen a second time, he noticed an abundance of Th-2 cells that responded to the antigen instead of Th-1 cells. Zaghouani was surprised to notice that the Th-2 cells worked to destroy the small contingent of Th-1 cells that had responded to the antigen given at birth.

"Perhaps we should test vaccines at a very early age in animals to establish a regimen with the most effectiveness," Zaghouani said.

When a baby first gets an infection, the immature immune system responds with both types of T cells. Unfortunately, Th-1 cells have an unusual receptor that binds to a specific hormone, which is deadly to the Th-1 cells. Ironically, this particular hormone is produced by the Th-2 cells. This results in an overabundance of Th-2 cells during the first few days of life.

"We found that after six days, the immune systems in the mice matured enough to stop the death of the Th-1 cells," Zaghouani said. "After those initial days, the immune system is producing Th-1 cells with diminished hormonal receptors, thus surviving the effect of the compound that the Th-2 cells make."

More information: Zaghouani's publication, "Delayed maturation of an IL-12-producing dendritic cell subset explains the early Th2 bias in neonatal immunity," was published in *The Journal of Experimental Medicine*.

Source: University of Missouri-Columbia (news : web)