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DELIVERING TB VACCINE INTRAVENOUSLY VASTLY IMPROVES EFFICACY: STUDY

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The tuberculosis vaccine, known as BCG(Bacille Calmette-Guérin) is a live, weakened form of vaccine that protects infants from deadly forms of TB but the protection wears off and the vaccine does not protect adults from the most common form of TB — pulmonary TB — especially in people living in endemic countries.

But a study carried out in rhesus macaques, which are even more susceptible to TB than people, shows that a higher dose of the vaccine administered intravenously confers very high level of protection to monkeys when exposed to TB-causing bacteria six months after vaccination.

The researchers found that by merely changing the route of vaccine administration from skin (intradermal) to directly injecting it into blood flowing in the vein(intravenous) conferred greater protection to monkeys. Nine of the 10 animals that received the vaccine were highly protected when exposed to the bacteria six months after vaccination. And six of the 10 monkeys did not show any detectable signs of infection.

The research was carried out by a team of researchers led by scientists from the University of Pittsburgh School of Medicine, Pittsburgh, U.S. and the National Institute of Allergy and Infectious Diseases (NIAID), U.S. and the results were published in the journal *Nature*.

“When we compared the lungs of animals given the vaccine intravenously versus the standard route, we saw a 100,000-fold reduction in bacterial burden. Nine out of 10 animals showed no inflammation in their lungs,” Prof. JoAnne Flynn from the University of Pittsburgh School of Medicine, Pittsburgh and one of the senior authors of the paper says in a University release. “The reason the intravenous route is so effective is because the vaccine travels quickly through the bloodstream to the lungs, the lymph nodes and the spleen, and it primes the T cells before it gets killed,” Prof. Flynn says.

The safety and efficacy of the vaccine when administrated intravenously is yet to be tested on humans. But when such trials on humans is undertaken, the most likely candidates will be children about 10 years old, as they have more mature immune systems, Dr. Robert A. Seder from NIAID and corresponding author of the paper told *The New York Times*.

The researchers next plan to test whether lower doses of intravenous BCG vaccine could offer the same level of protection without the side effects, which mostly consist of temporary inflammation in the lungs.

The study provides a “paradigm shift towards developing vaccines focused on preventing TB infection to prevent latency, active disease and transmission” in adolescents or adults, which could have the greatest effect on reducing tuberculosis transmission. However, more skill would be needed to administer intravenous vaccine. It also carries a higher risk of infection, the release says.

According to *The New York Times*, the reason why the intravenous route was tested is because Dr. Seder had used the same strategy in the case of the experimental malaria vaccine, which showed better priming of the immune system.

For the trial the researchers administered the vaccine at standard and higher dosage and through five different routes:

While animals that received the vaccine through the skin or by aerosol showed “partial protection”, nine of the 10 monkeys that received the vaccine directly into the blood were completely protected. The researchers studied granuloma formation in the lungs after TB infection to understand active disease. By four weeks, granulomas were seen in monkeys in all groups, including those that received the vaccine intravenously. However, animals in the intravenous group had fewer granulomas compared with the normal dose intradermal group, and six of the 10 animals did not show any granuloma throughout the infection.

When the researchers sacrificed the animals at the end of the study, no detectable TB bacteria in any organ were found in six of the 10 monkeys that received the vaccine intravenously; three other monkeys from the same group had fewer colonies of TB bacteria within just one granuloma.

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