An improved vaccine for bacterial meningitis and bloodstream infections

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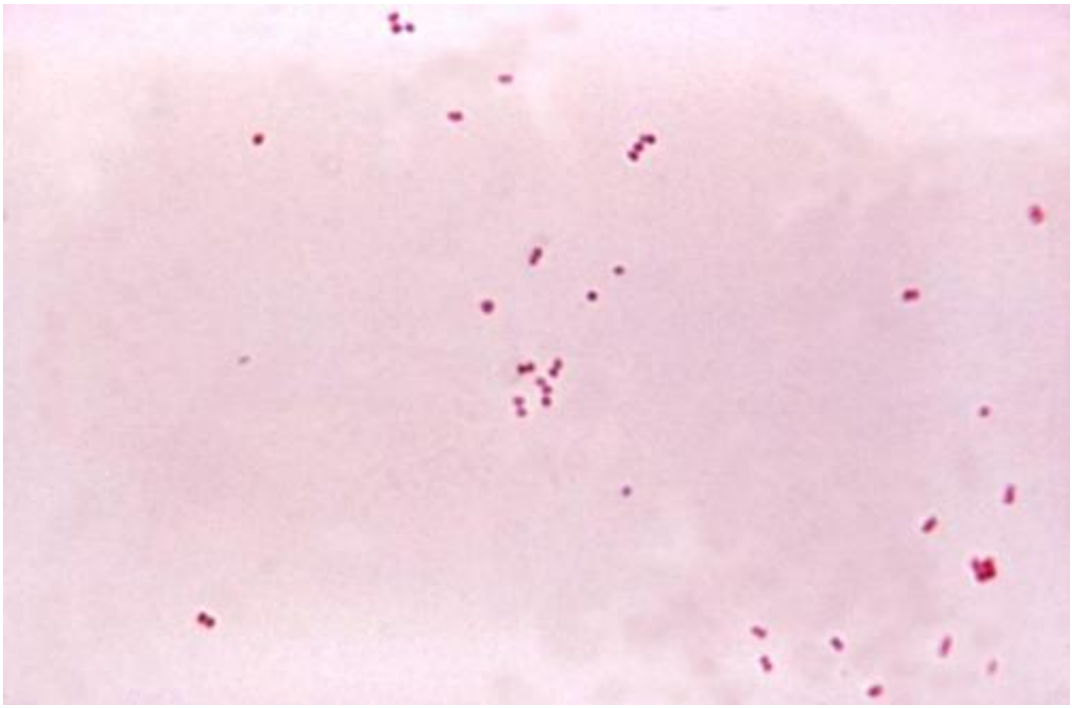

Gram stain of meningococci from a culture showing Gram negative (pink) bacteria, often in pairs. Credit: public domain

Researchers have now developed a new vaccine, a native outer membrane vesicle (NOMV) vaccine, for meningitis and bloodstream infections caused by "meningococcal group B" bacteria. This will allow younger people to be vaccinated and will address several limitations of the current vaccinations. The research is published this week in *mBio*, a journal of the American Society for Microbiology.

"We developed the improved version of the vaccine by making several genetic changes to the strain of bacteria used to produce the vaccine, resulting in a broadly protective vaccine rather than a strain-specific vaccine," said Peter Beernink, Ph.D., Scientist at the Center for Immunobiology and Vaccine Development, Benioff Children's Hospital Oakland.

There are currently only two licensed vaccines for prevention of meningitis and bloodstream infections caused by "meningococcal group B" bacteria, which are only licensed for use in people age 10 years and older. Both vaccines contain a bacterial protein known as Factor H binding protein (FHbp), which can bind to a host protein known as Factor H (FH). The licensed vaccines have several limitations, which include lack of effectiveness against some bacterial strains and low immune responses of infant humans.

The researchers immunized infant rhesus monkeys with the NOMV-FHbp vaccine, which induced higher levels of protective serum antibodies than a licensed vaccine against five of six bacterial strains tested. Two macaques immunized with the licensed vaccine, which contains FHbp that binds macaque FH, developed antibodies to the host FH protein whereas none of the animals given the NOMV-FHbp vaccine or a negative control vaccine developed such antibodies.

The monkey antibody responses to the vaccines were measured in the laboratory based on the ability of serum antibodies to kill the bacteria in a test that is widely considered to predict protection in humans. The sample sizes of animals were chosen such that the results are highly statistically significant.

"The experimental NOMV vaccine extends the approach of using outer membrane vesicle vaccines, which previously have been given to millions of persons during meningitis B epidemics in Norway, Cuba and

New Zealand," said Beernink.

Thus, in a relevant infant non-human primate model, the NOMV-FHbp vaccine elicited higher levels of protective antibodies than the licensed vaccine and anti-FH antibodies in fewer animals. "This shows that the vaccine has the potential to be developed into a more broadly protective vaccine for humans, to extend coverage to infants and toddlers, which are the age groups among the highest risk of developing meningococcal disease, and to increase vaccine safety," said Beernink.

More information: Peter T. Beernink et al, A Meningococcal Outer Membrane Vesicle Vaccine with Overexpressed Mutant FHbp Elicits Higher Protective Antibody Responses in Infant Rhesus Macaques than a Licensed Serogroup B Vaccine, *mBio* (2019). DOI: 10.1128/mBio.01231-19

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