

## **Antenatal Administration of Pertussis and Influenza Vaccines: The Benefits for Young Infants**

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It is increasingly being accepted that maternal immunisations are an effective way to provide protection to young infants. They provide cover for that period between birth and before the primary infant immunisation programme commences. They were introduced<sup>1</sup> in the UK in 2012 and in Ireland in 2013.

While these antenatal immunisations are being actively encouraged, there is limited data on the efficacy and cover that they provide for infants.

Rowe et al<sup>2</sup> have just published an Australian population-wide cohort study comprising 186,962 mother-infant pairs over a 28-month period. 128,060 mothers (68.5%) received pertussis vaccine and 85,830 (45.9%) received influenza vaccine. The pertussis vaccine was administered after 28 weeks gestation, but this recommendation has now been reduced to 20 weeks gestation. The influenza vaccine was recommended at any stage during the pregnancy, but optimally before the influenza season. The vaccine effectiveness was calculated using the formula  $(1 - \text{the risk ratio}) \times 100\%$ .

The authors used record linkages to track infants with laboratory confirmed pertussis and influenza infection. The outcomes were stratified into two age groups, infants < 2 months and infants aged 2-6 months.

The results were encouraging particularly for pertussis immunisation. In the case of infants under 2 months the vaccine effectiveness for antenatal pertussis immunisation was 80.1%, and for infants aged 2-6 months it was 31.8%. In the case of antenatal influenza vaccination, the vaccine effectiveness was 56.1% for infants under 2 months and 35.7% for infants aged 2-6 months.

The findings indicate a high degree of effectiveness for antenatal pertussis vaccination, and a moderate effectiveness for influenza vaccination.

The cover was best for infants under 2 months which is encouraging. These are the infants at greatest risk when they contract pertussis. The lower effectiveness for infants aged 2-6 months is consistent with waning maternal antibody concentrations with age.

One of the drawbacks of the study was that the timing of the vaccination during the pregnancy was not documented and thus any time-varying effect could not be explored.

Pertussis is a toxin-mediated disease. The bacteria attach to the respiratory cilia and produce toxins which paralyse the cilia. This precipitates the distressing cough and the apnea that one encounters in young infants. Apnea is the most common factor that necessitates a hospital admission. The cough becomes paroxysmal in 90% of cases and can last for many weeks. Preterm infants are the most vulnerable age category<sup>3</sup>.

The lymphocytosis due to the pertussis toxin is encountered in infants but rarely in adolescents and adults. One possible explanation is that the latter have sufficient pertussis toxin neutralising antibodies or that they are able to generate them rapidly. The pertussis toxin inhibits the transit of lymphocytes from the blood vessels into the lymphoid tissues.

Lymphocyte counts over  $70 \times 10^9/L$  are particularly associated with pulmonary hypertension, pneumonia, and death. A US study found that there was a ten-fold increase in the risk of death when the lymphocyte count exceeded  $50 \times 10^9/L$ . The lymphocytosis causes a hyperviscosity syndrome. The pulmonary hypertension is caused by lymphocyte thrombi in the pulmonary blood vessels.

In 1950, in the pre-vaccine era, there were 3,612 cases of pertussis in Ireland. In 2019, there were 165 cases of pertussis, mostly in young infants. The last major outbreak was in 2012 when there was 458 cases with three deaths in infants under 3 months old. Almost all pertussis-related deaths occur in infants under age 4 months old. Preterm infants have higher severity index scores and more likely to require intensive care. They often present with apnea, episodes of cyanosis with coughing, and poor feeding.

The circulation of the *B. pertussis* organism is not controlled by immunisation; therefore, vaccination remains imperative.

Maternal vaccination will help to lower these case numbers among infants further. The combination of antenatal vaccination with the normal subsequent infant vaccination programme guarantees a high level of protection.

The antenatal influenza vaccine, while effective, it was not as protective as the pertussis vaccine. However, it provides significant cover even up to age 6 months. The overall vaccine effectiveness was 56.1%.

Hallissey et al<sup>3</sup> in a 34-point questionnaire found that mothers consider their GPs advice on the matter of vaccination. The health care provider is the most important tool to improve vaccination uptake. A survey of UK GPs found support for the embedding of the vaccination programme within the routine antenatal care programme<sup>4,5</sup>.

In summary, the study of Rowe et al confirms the value of maternal immunisation in the protection of young infants.

#### **References:**

1. O'Connell A, Tummon A, Coleman K, Jordon A, McCormack J, Kelly ME. Antenatal pertussis vaccination: why are general practitioners reluctant: a mixed method study. *Ir Med J.* 2017;110(9):634.
2. Rowe SL, Leder K, Perrett KP, Romero N, Nolan TM, Stephens N, Cowie BC, Cheng AC. Maternal vaccination and infant influenza and pertussis. *Pediatr* 2021;148(3):e2021051076
3. The national immunisation advisory committee. Pertussis. Chapter 15
4. Hallissey R, O'Connell A, Warren M. Factors that influence uptake of vaccination in pregnancy. *Ir Med J.* 2018;111(3):713.
5. Wilcox CR, Little P, Jones CE. Current practice and attitudes towards vaccination during pregnancy. *Brit J Gen Prac* 2020