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Original Research Article

Update on Seroprevelance of Bortedella Pertussis Antibodies in Saudi Mothers and the Risk on Unvaccinated Infants

Hind Mohammed Bakheet[1*], Abdulkarim Fahad Alhetheel[2], Elham Essa Bukhari[3]

[1]M.D, King Saud Medical City, Riyadh, Riyadh Saudi Arabia
[2]Associate Professor, Department of Microbiology, King Saud Medical City, Riyadh, Riyadh Saudi Arabia
[3]Professor, King Saud Medical City, Riyadh, Riyadh Saudi Arabia

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***Corresponding author:** Hind Mohammed Bakhee

Abstract

Background: Pertussis is a life-threatening type of infection in non-immune infants younger than six months of age. Vaccination of pregnant women with tetanus, diphtheria, and pertussis vaccine (Tdap) may facilitate the transfer of maternal antibodies to the fetus, this method may provide protection against pertussis in these newborns. This study will examine the seroprevelance of Bortedella pertussis antibodies in pregnant Saudi females. ***Methods:*** This is a cross-sectional study in which 258 pregnant females of different age groups in the second and third trimesters who underwent antenatal checkups at King Saud University Medical city, Riyadh, between April 2017 and March 2018 were enrolled. Serum levels of B. pertussis antibody were measured using the enzyme-linked immunosorbent assay (ELISA) technique. ***Results:*** From 258 blood samples,234(90.69%) females between 28 and 45 years of age were non immune to pertussis,12(4.6%) showed borderline immunity, and 12(4,6%) were immune. ***Conclusion*:** The majority of tested pregnant Saudi females were non-immune to B.Pertussis despite the expanded Saudi program of immunization (which recommends that the last dose of DTap be given to preschool-age children). This study emphasizes the importance of implementation of Tdap vaccination program in pregnant Saudi females.

Keywords: Seroprevelance of B.pertussis antibodies.

INTRODUCTION

Whooping cough is a vaccine-preventable disease. It is known to cause high morbidity and mortality worldwide among unimmunized infants [1].

The Ministry of Health in Saudi Arabia recommends hexavalent vaccines for children at two, four, and six months of age followed by two booster doses at 18 months of age and at preschool entry [2].

Young infants who did not complete their primary DTap series are at increased risk of pertussis complications such as severe pneumonia and pulmonary hypertension [3].

One of the major complications among infants is requirement for Intensive care admission because of respiratory complications, which may require intubation and mechanical ventilation, and sometimes results in death [4].

Adolescents and young adults play a major role in transmission of this highly contagious infection to non-immune infants [5].

Underreporting of pertussis cases and less sensitive laboratory techniques in some centers and atypical form of disease in young adults may play a significant role in obscuring the true number of reported pertussis cases, so the risk of adults harboring pertussis disease is still there in the community, this in turn carries a high risk of transmission on the newborn infants [6].

The Centers for Disease Control and Prevention (CDC) recommends administration of the TdaP in pregnant women at 27 to 36 weeks of gestation irrespective of their previous pregnancy Tdap vaccination status in order to enhance the transfer of maternal antibodies to their newborns, this method provides an optimal way of protecting the mother and newborn against this prolonged respiratory tract infection [7].

We did not come across any data that was reported from Saudi Arabia recently, regarding the seroprevelance of maternal antibodies against Bortedella Pertussis in Pregnant females. This study will elucidate whether Tdap vaccination among those pregnant females is required or not.

METHODS

This is a cross-sectional study in which 258 pregnant females who came for antenatal checkups to King Saud Medical City, Riyadh, between April 2017 and March 2018 were enrolled. Serum level of B. Pertussis antibody (IgG) was measured using the enzyme-linked immunosorbent assay (ELISA) technique.

Inclusion Criteria

Serum samples were obtained from mothers who tested negative for human immunodeficiency virus (HIV) antibody, hepatitis C and B viruses (HCV antibody and HBsAg, respectively), between 18and 45 years during the second and third trimester .

Exclusion Criteria

- Women who tested positive for HIV and HCV antibodies and HBsAg were excluded from the study.
- Antibody levels >50 IU/ml were considered positive, 40-50 IU/ml were borderline and < 40IU/ml were non negative.

Detection of Bortedella Pertussis Ig antibodies

B. Pertussis- specific IgG antibodies were detected by ELISAo using ELISA kits (SERION, Germany) in accordance with the manufacturers' instructions. Briefly, Samples were prepared by diluting 10 µL of serum with 1000 µL of sample diluent. Following samples preparation, 100 µL of diluted samples or controls were dispensed into 96-well plates pre-coated with B.Pertussis antigens. The plate was then incubated for 30 minutes at 37 °C to allow formation of antigenantibody complexes. The plate was washed 4 times, and 100 µL of alkaline phosphatase conjugate was added and incubated for a further 30 min at 37 °C. Thereafter, a washing step was performed, and 100 µL of substrate solution [Para-nitrophenylphosphate] was added and incubated for 30 min at 37 °C. Finally, the reaction was stopped using 100 µL of stop solution (<0.1 N sodium hydroxide, 40 mM EDTA) and the colorimetric signal was measured by excitation at 405 nm using a spectrophotometer.

RESULTS

TOTAL # 258

One-hundred twenty-five samples (48.45%) had antibody titers below the detection level (<10IU/mL) One-hundred thirty-three samples (51.55%) had antibody titers above the detection level (>10IU/mL) with an average antibody titer of 27.4 IU/mL See Table-1.

A total number of 258 pregnant women were included in this study with a mean age of 31.5(18 45).

Table 1:

Total number of samples	Undetectable antibody<10IU/ml	>10IU/ml Detectable antibody Average antibody titre (27.4IU/ml)
258	125	133
Percentage	48.45(%)	51.55(%)

Among the detectable antibody titer, 12 samples (9.02%) were positive with average antibody titer 86 IU/mL, 11 samples (8.275%) were borderline with average antibody titer 44.9 IU/mL, and 110 samples (82.71%)were non-negative with average antibody titer of 19.2 IU/mL Table-2.

Table-2:

Antibody titre status	Non immune 10-40IU/ml	Borderline 40-50IU/ml	Immune >50IU/ml
Number of samples 133	110 82.71(%)	11 8.27(%)	12 9.02(%)
Average antibody titre	19.2IU/ml	44.9IU/ml	86 IU/ml

DISCUSSION

Pertussis has a cyclical pattern with peaks every three to five years, in 2017 the World Health Organization (WHO) estimated that there were around 144,000 pertussis cases and 89,000 deaths of children less than five years of age [8].

According to the Ministry of health in Saudi Arabia, the number of the reported pertussis cases has been reduced significantly in the last five years [9].

On the other hand, countries such as the United States of America (USA) have reported a resurgence of pertussis cases in comparison to the several last decades in which 45,000 cases were reported in 2012. One of the leading factors for this high number of cases was the waning immunity to the a cellular pertussis vaccine which was introduced recently, in comparison to the whole cellular pertussis vaccination [10].

A retrospective analysis in one of the hospitals of the eastern province of Saudi Arabia between 1996 and 2004, showed a total of 156 confirmed cases of B.*pertussis*, 52% of the patients were less than six months of age [11].

Previous results collectively showed that most of the tested pregnant Saudi females were nonimmune to B.Pertussis.

Similarly, data from an Iranian study showed that out of 288 pregnant females, only 35% were seropositive for B.*pertussis*, and the rest were seronegative as the Tdap vaccine for pregnant ladies has not yet been implemented yet in Iran [12].

In a cross-sectional study conducted in Argentina between 2011 and 2014 in which Tdap vaccination for pregnant women was introduced in 2012, the presence of pertussis antibody in infants born to vaccinated mothers and unvaccinated mothers,92% of infants born to vaccinated mothers were immune, where as 100% of infants born to unvaccinated mothers were nonimmune [13].

A systemic review evaluated the efficacy of immunizing pregnant ladies with Tdap vaccine on the protection of their newborn infants, results showed significant reduction in the incidence of pertussis in infants born to vaccinated mothers in comparison to infants born to non-vaccinated mothers (odds ratio 0.07, confidence interval:0.03-0.19)) [14].

Between 2011 and 2015, several countries implemented Tdap vaccination for pregnant women including USA, United Kingdom, Ireland, Mexico, Argentina, Uruguay, New Zealand, Australia, Portugal, Israel, Costa Rica and Colombia. In 2015 the WHO supported this strategy and recommended that the vaccine should be given during the third trimester up until 15 days prior to delivery [15].

This strategy provides a significant protection from pertussis infection in the first three months of life by approximately 90% [16].

Furthermore, Tdap is an inactivated vaccine with no theoretical harm to the fetus, thus delaying its administration until the end of pregnancy may be of benefit, so that the pooled concentration of immunoglobulin from mom to the newborn will be of high levels and provide more protection to the newborn [17].

A retrospective study showed no increment in the incidence of prematurity or growth restriction after administration of the Tdap vaccine to the pregnant females [18].

Moreover, another study showed no association between autism in children born to Tdap vaccinated mothers [19].

All previous data strongly support vaccination of pregnant Saudi females during the third trimester during each pregnancy regardless of their Tdap immune status during previous pregnancies. Moreover, studies have shown the vaccine's relative safety and no adverse effects in newborns.

CONCLUSION

Pertussis carries a high risk of morbidity and mortality in infants less than three months of age. Vaccination of pregnant females during the third trimester with the Tdap vaccine per CDC and WHO recommendation help protect these newborns. Our study showed that more than 90% of pregnant Saudi females are non-immune to pertussis, had no detectable antibody level, so we strongly recommend the initiation of this strategy for optimal protection of our future infants.

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