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Review Article

Importance, indication and safety of maternal immunization

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ABSTRACT

Vaccination is a very important spectrum for building immunity to fight certain infections. Doing vaccination on the mother as well as the baby, which safeguards both of them, is known as maternal immunization. After childbirth, babies are prone to get infected by many diseases as their immunity is inferior during that time. Over the years, numerous studies have shown that vaccinating mothers can effectively reduce the risk of illnesses such as smallpox, polio, etc. This vaccination process helps strengthen the body's system and enables it to combat these diseases effectively when necessary. This approach works by boosting the transfer of antibodies from the person to the fetus through the placenta, providing passive immunity to the infant during their initial months of life until they become eligible for their own vaccines. In addition to protecting infants, maternal immunization can also help prevent complications for individuals caused by infections that could impact their health and pregnancy outcomes. This review focuses on discussing the significance, indications, and safety of immunization for diseases that pose a high risk to both pregnant individuals and their infants.

Keyword: Infant, Infectious diseases, Maternal immunization, Pregnancy, Vaccine

INTRODUCTION

For the protection of babies and mothers, vaccinating is essential. For that reason, maternal vaccination is a critical practice in which administering vaccines to individuals for the well-being of both mother and child. Throughout history, maternal vaccination has proven effective in preventing illnesses like smallpox, polio, influenza, and pertussis.[1,2] The mechanism behind this approach lies in boosting the transfer of antibodies from the expecting mother to her fetus via the placenta, offering immunity to the newborn during their initial months when they are not yet eligible for their own vaccinations.[3] Moreover, maternal vaccination can also shield individuals from complications arising from

infections that could impact both their well-being and pregnancy outcomes. Thus, it is strongly recommended for diseases that pose a risk to both expectant mothers and their infants. Most trusted organization WHO suggested that pregnant mothers should take the tetanus toxoid vaccine during their pregnancy period as this vaccine helps protect against tetanus caused by an infection in the cord. Getting vaccinated four weeks before giving birth during the second or third trimester of pregnancy is advisable. Additionally, the WHO also recommended to get a hepatitis B vaccine in order to prevent transmission of the virus from mother to child in areas that are moderately prevalent to hepatitis B virus.[4,5] Within a 24 hour of child birth immediate vaccination should be done. Even though there are several recommendations available, each country may have their specific guideline of vaccination which may depend upon their own epidemiology and resource. In the United States, it is advisable for individuals to get both the influenza and Tdap vaccines throughout their pregnancy. The influenza vaccine helps safeguard both individuals and their infants against complications linked to influenza, such as birth, low birth weight, and other associated health risks. It can be administered at any time during pregnancy, but preferably before flu season begins.[6,7] On the other hand, Tdap vaccination guards against pertussis (cough), a highly contagious respiratory illness that poses severe risks for infants, including complications and even death. The ideal timing for administering the Tdap vaccine is during the 27th week of pregnancy. The recommendations for immunization may vary across countries due to variations in disease prevalence and vaccine accessibility. In the study, it is estimated that flu is experienced by over 90% of individuals, and it's some of the most common symptoms include fever and cough. Other frequent symptoms occurring in 30-50% of patients are sore throat, muscle pain (myalgia), and headache. If pregnant women have a fever above 100° F along with a throat or cough without any known causes, they can be presumptively diagnosed with the flu and should begin treatment.[8] While rapid tests are available, their limited sensitivity makes them less useful for high-risk populations like women. Confirmatory tests such as culture or polymerase chain reaction (PCR) are highly sensitive for diagnosing the flu; however, their reporting delay and limited availability reduce their practicality.[9,10] The CDC recommends not delaying treatment while waiting for test results. Nonetheless, confirmatory testing is still necessary to monitor health trends related to flu strains and identify patterns of drug resistance. In some cases, some individuals may experience conditions like fever and headache, but these are also generally mild and short-term. Severe adverse reactions, like anaphylaxis, are exceptionally uncommon and can be effectively handled with attention.[11] Currently a lot of research have been done but there is no evidence suggest that maternal immunization leads to miscarriage, stillbirth, premature birth, or delays in mental growth. In fact, there is some evidence suggesting that maternal immunization can actually benefit pregnancy outcomes by preventing infections and their complications in both individuals and their infants. Immunizing individuals and their babies against diseases is crucial to keeping them safe from potential harm. In fact, it can even offer immunity to newborns in their months when they are not yet eligible for their own vaccines. Many reputable organizations, including the WHO, UNICEF, ACOG, and ACIP, strongly support the practice of immunization. To overcome all the barriers, it is very much essential to encourage acceptance of immunization while also conducting further research on its safety and effectiveness in pregnancy. Therefore, this study aims to review current information regarding maternal immunization's importance, indication, safety, and management.

LITERATURE SEARCH

On September 23, 2023, we searched for information about maternal immunization. To carry out this search, we explored the Medline and PubMed databases, employing medical subject headings and various related terms in each database. For this, we searched relevant keywords of maternal immunization and other terms like vaccination, immunization of mother, safety of maternal immunization, etc. Additionally, we manually searched Google Scholar. Utilized the reference lists of retrieved papers as a starting point. To ensure precision in our findings, we set inclusion criteria, such as excluding papers published prior to 2008 and above and prioritizing English language publications. We did not impose any restrictions based on age or publication type.

DISCUSSION

Although the vaccination is recommended to all the mothers but to view the improving rate, it is crucial for mothers to take the vaccine willingly as the improving rate totally depends upon it. It has been observed that certain groups, among women, are more prone to not receiving vaccines.[12] Studies conducted both domestically and abroad have indicated that pregnant women who have status, limited educational attainment, and belong to racial or ethnic minority groups are less inclined to receive vaccinations.[13] The reasons behind this phenomenon can be attributed at partially to psychological factors that influence a mother's willingness to accept vaccines, as similar patterns have been observed in non-pregnant populations.

Importance of maternal immunization

The importance of immunization of mothers is necessary to fight against infections. Some routine vaccination during pregnancy gives all the necessary protection by enhancing the transmission of antibodies through the placenta and breast milk, which keep both mother and fetus safe.[14] Factors like preterm birth, HIV infection, and malaria can affect how antibodies are transferred across the placenta. Additionally, different germs can potentially cause birth defects. Resulting in underweight

babies.[15]According to the world health organization (WHO), millions of infants sadly lose their lives, and they are stillborn each year due to these germs. One effective measure to safeguard both the mother and her baby from these germs is receiving vaccinations during pregnancy. Think of antibodies as soldiers that aid your body in fighting off germs. These antibodies can shield your baby from falling ill during their months of life until they're able to receive their own vaccines. Vaccines have been proven safe and effective for babies as they help prevent or lower the risk of infections along with their complications.

Indicator of maternal immunization

There are several indicators, including vaccine effectiveness, nature of the vaccine, administration route of vaccine, etc., should be considered as the indicator of maternal immunization. Even some special recommendation is done by WHO which is essential to follow considering both mother and baby's safety. The suggested time for completing the tetanus toxoid vaccine is at the beginning after four weeks and between 6 to 12 months, and it is also recommended to administer the Tdap vaccine of one dose of Td during the gestation period, between 27 and 36 weeks. Those who are pregnant as well as live in an area where the hepatitis B virus is prevalent, are strongly recommended to take the hepatitis B vaccines immediately since neglect can spread this virus to the entire community through different route.[16,17] The hepatitis B vaccine should ideally be given as soon as possible after diagnosis; the usually preferable time period is within 24 hours after birth. Different countries may have their guidelines for maternal immunization based on their unique epidemiological situations and available resources. For instance, it is compulsory to vaccinate pregnant mothers for tetanus toxoid and Tdap throughout their pregnancy in the US.

Safety of maternal immunization

Maternal immunization usually works by stimulating the mother's antibodies generation process, and thus combat against infections. These antibodies are then passed on to the baby through the placenta, providing a shield against illnesses during the months before they can receive their own vaccinations.[18] Maternal vaccination holds significance for both the well-being of the mother and the baby. Some diseases, like influenza and pertussis, can pose heightened risks in women, leading to complications such as birth, low birth weight, and even mortality. These adverse outcomes can be mitigated by opting for vaccination while safeguarding the mother's health. Additionally, maternal vaccination acts as a shield for newborns against life-threatening diseases like pertussis and tetanus. It offers defense until they reach an age (around two months) to receive their scheduled immunizations. Maternal immunization emerges as one of the means to safeguard a baby's health right from inside the womb throughout their early stages of life.

Clinical manifestation

Throughout pregnancy numerous infectious diseases may present with signs and symptoms. In pregnancy, some common indications of diseases include fever, rash, unwell headache, cough, sore throat, nausea, vomiting, diarrhea, stomach pain, vaginal discharge, urinary problems and swollen lymph nodes.[19] These manifestations may resemble those experienced by pregnant individuals but could also be influenced by the physiological changes that occur during pregnancy. For instance, pregnant individuals may experience even absent fever compared to non-pregnant individuals. Additionally, pregnant people might have severe rashes due to increased blood volume and heightened skin sensitivity. Coughing may also be more frequent or productive in individuals due to increased secretions and reduced lung capacity. If a pregnant woman catches rubella infection it may result in abnormalities such as cataracts, hearing loss or heart defects due to disruptions, in development and activation of programmed cell death.[20] Infections containing toxoplasmosis can produce harmful effects by developing congenital anomalies like hydrocephalus, chorioretinitis or seizures.[21] If a person gets affected by syphilis through their hand it can have consequences such, as stillbirth, neonatal death or the development of congenital syphilis. This occurs when the infection spreads to the placenta causing inflammation and decreased blood circulation to the organs of the growing baby. In cases of HIV infection, the virus can be transmitted to the baby either during pregnancy or delivery, weakening their system function and making them more susceptible to infections. These infections fall under the umbrella term "TORCH" infections, which collectively comprise a group of infectious diseases. TORCH infection is very dangerous to the fetus as it consists of several infections: Toxoplasmosis, rubella, cytomegalo virus, and herpes simplex.[22,23] Pregnant individuals usually acquire these infections through contact with infected animals (such as cats for toxoplasmosis) droplets (for rubella) fluids (for CMV) or genital lesions (for HSV). While some pregnant individuals may not experience symptoms or only have symptoms like fever, rash or swollen lymph nodes these infections can have severe consequences if they occur during critical periods of organ development or immune system formation, in the fetus. These effects can occur, such as miscarriage giving birth prematurely having a baby, with weight, birth defects problems, with the system or even death.

Management

Disease diagnosing gets challenging during pregnancy as this may involve a variety of methods. This method includes procedures such as gathering history, conducting physical examinations, performing laboratory tests, utilizing imaging studies, or employing invasive procedures. The choice of method depends on factors like the suspected infection type, test availability and

accuracy, risks, and benefits of the procedure involved, and consent; for instance, collecting history can unveil information about exposure history, onset and duration of symptoms, travel records, or vaccination status of the individual. Physical examination can detect signs of infection such, as fever, rash, swollen lymph nodes, or other indications. Lab tests may include blood tests, urine tests, and swabs from the throat, nose, or vagina as tests on amniotic fluid or placental tissue to identify antibodies, antigens, microbes, or genetic material related to the pathogen. Imaging concentrates on like ultrasound, X-ray, CT sweep, or echocardiography could be utilized to picture the inner systems and capability of organs and recognize any anomalies or complexities coming about because of the disease. Intrusive methodologies like amniocentesis, chorionic villus inspecting, cordocentesis, or biopsy might be performed to get tissue or liquid examples for examination and determination.[24] The choice of treatment depends on factors such as the type and severity of the infection the effectiveness and availability of the treatment its safety and acceptability as recommendations from healthcare authorities. The most important thing is that the occurrence of any viral infections may require medications. Immunoglobulins offer protection against infections like tetanus, hepatitis B, or rabies for individuals, including infants. Vaccines provide immunity to infections like influenza, pertussis, or hepatitis B for both individuals and infants. Isolating mothers or infants can help prevent the spread of diseases such as tuberculosis, measles, or chickenpox. Changing the approach and schedule of delivery can also help in avoiding the spread of infections like viral infections. Monitoring maternal and fetal well-being during infectious diseases in pregnancy may involve various methods such as vital signs measurement, fetal heart rate monitoring, biophysical profile, non-stress test, or contraction stress test. Through biophysical profiling, different fetal condition including fetal movements, tone, breathing, amniotic fluid volume, and heart rate reactivity etc. can be assessed easily.[25] Non-stress tests may assess the fetal heart rate response to fetal movements. A contraction stress test may assess the fetal heart rate response to uterine spontaneous movement. These methods can help detect any signs of fetal distress or compromise caused by infection and guide appropriate interventions. There are lot of methods have been introduced for intervention as well as preventing complications and long-term effects of infectious diseases during pregnancy. These methods include ensuring hydration, providing nutrition, administering fever-reducing medications (antipyretics), using pain relievers (analgesics), employing anti-inflammatory agents, or resorting to surgical interventions if necessary. Analgesics may relieve pain and inflammation caused by infection. Important medication like anti-inflammatory drug poses the ability to reduce the body's inflammatory response and they can also minimize the damage caused by an infection which helps in reducing inflammatory responses from the body. In certain situation surgical interventions may become very essential as it helps to eradicate abscesses, remove the affected tissue, or even perform amputations on infected limbs. These interventions are most used procedure which helps to prevent complications like dehydration, malnutrition, anemia, septic shock organ failure, wound infections, gangrene formation, or even the need for amputation.

CONCLUSION

Vaccinating expecting mothers plays a role in protecting the well-being of both mothers and their babies from infectious diseases. There are multiple diseases like tetanus, hepatitis B, influenza, and pertussis can pose risks to both the mother and child. The great news is that getting vaccinated during pregnancy is generally considered safe and doesn't have any effects on pregnancy outcomes or the development of the infant. Moreover, it offers infants immunity during the months of life when they are ineligible for their own vaccinations. Maternal immunization has garnered support from national organizations like WHO, UNICEF, ACOG, and ACIP. Nonetheless, several barriers, including vaccine hesitancy, lack of awareness restricted access to vaccines, need to be addressed to promote maternal immunization. It is crucial to bolster efforts in promoting the acceptance and coverage of immunization while generating evidence regarding its safety and efficacy throughout pregnancy.

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