

Course Name: Adolescent Health and Well-being: A Holistic Approach

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Lecture 09 – Adolescent Immunization

Hello everyone. So, I am back again today with the new topic of adolescent immunization. Now this is a very important issue as far as adolescents are concerned. The various concepts that we will be covering in today's lecture are, what is vaccination and what is immunization, what is active and passive immunity, what is the need for vaccinating adolescents, the vaccine schedule for adolescents, the high risk group and vaccine for special circumstances in adolescents and what are the various challenges in adolescent immunization and the way forward. These are various keywords of my presentation. Vaccination, immunization, Human papillomavirus vaccine, Tdap vaccine, Hepatitis A vaccine and Hepatitis B vaccine.

Now let's see the beginning of immunization, the dawn of immunization. So, from ancient times to modern medicine, the story of immunization is extremely fascinating. This is one of determination, innovation and hope. The history of immunization spans a millennium.

From Egyptians using smallpox scabs to inoculate children to Chinese physician Hua Tuo, who in the 2nd century crushed the smallpox scabs to obtain a powder used for protective inoculation, we have come a long way. Now no story of immunization is complete without the mention of Edward Jenner, the one in this figure here. Now in the 18th century Edward Jenner upon noticing that milkmaids were immune to smallpox invented vaccination and laid the foundation for the modern era of immunization. Now before vaccination, variolation or inoculation with smallpox material though was practiced in Africa and Asia with varying degrees of success and danger as well. Now the smallpox vaccine and beyond.

So, the smallpox vaccination was a major breakthrough as far as vaccination is concerned. The smallpox vaccination campaigns beginning in the 19th century quickly saved millions of lives and halted epidemics as well. Expanding horizons; technological advances and scientific research have created vaccines for more and more diseases such as polio, measles and rubella and most recently COVID-19. Now what is vaccination and immunization? So, vaccination basically is the process of administering a vaccine while immunization is the

antibody response which is mounted against any particular disease post vaccination. So basically vaccination being the process while immunization is the antibody response to any particular disease post vaccination.

Now what is active immunity and passive immunity? So active immunity is acquired when exposure to a disease organism triggers the immune system to produce antibodies to that particular disease. Now this could be natural immunity or vaccine induced immunity. Now natural immunity is acquired through exposure to the disease organism through infection with the actual disease. Now suppose for an instant let's see an individual is infected with measles, so he will be naturally immune against measles. Now let's consider vaccine induced immunity.

So this is acquired through introduction of a killed or weakened form of the disease organism through vaccination. So again, if we take the example of measles, so administration of the measles vaccine would give vaccine induced immunity to that particular individual. Now what is passive immunity? So when a person is given antibodies to a disease rather than producing them through his or her own immune system. So the examples of this can be a newborn baby who acquires passive immunity from its mother through the placenta and people can also get passive immunity through antibody containing blood products such as immunoglobulin which may be given when immediate protection from a specific disease may be required. Now the examples of passive immunity here can be Hepatitis B immunoglobulin, Tetanus immunoglobulin, Rabies immunoglobulin as well.

So there is a popular belief among the majority that immunization is only for infants and children under 5 but this is completely wrong. Immunization is not just for infants and children under 5 anymore. Adolescents and young adults have to be given equal importance as well. Now what is the need for vaccinating adolescents? Why do we need to vaccinate them at first? So, the immune protection which is induced by vaccines given during the infancy slowly and gradually wanes over the years. Now what this leads to is higher than expected incidence of vaccine preventable diseases during adolescents and young adults.

The need for vaccinating adolescents is to protect them against the diseases that have higher morbidity during the adolescent period such as Hepatitis A and varicella. To protect them against the diseases that have higher incidence during the adolescent period such as mumps and meningococcal infections. To provide protection against diseases such as cervical cancer which appear during adulthood. Now there is a tendency of the adolescents to indulge in high risk behavior. So this can be substance abuse, this can be intravenous administration of drugs and this exposes them to certain diseases which are vaccine preventable diseases such as Hepatitis B and Human papilloma virus infection that is HPV infection.

Now the adolescents may travel, may go abroad to study, so there are certain specific vaccines that might be required in this situation as well. Again the need for vaccinating

adolescents can be as a catch up who have missed the previous opportunities during the early phase of their lives. So, what are the recommended adolescent vaccination in India? So, this is as per the IAP guideline that is Indian Academy of Pediatrics. The routine vaccination as per IAP is Tdap that is Tetanus, Diphtheria, and acellular Pertussis, HPV that is human papilloma virus vaccine. The catch up vaccines as recommended by IAP is MMR, hepatitis A, hepatitis B vaccine, typhoid vaccine and varicella vaccine.

The high risk vaccines or special circumstances vaccines, these are pneumococcal vaccine, influenza vaccine, meningococcal vaccine, Japanese encephalitis, cholera, rabies and yellow fever vaccine. So, coming to the routine vaccines, let's first go through Tdap or Td. So basically, what are the factors that result into rise in the pertussis cases? There is the waning of immunity as we have already discussed. There is a changing antigen structure. Also, in the primary series acellular pertussis is given.

The acellular pertussis vaccines, these have shown to provide shorter lasting protection than the whole cell pertussis vaccine concerned. Now it is also observed during USA in 2005 and Australia in 2008-2009 that the Tdap vaccine given to adolescents have decreased the incidence of pertussis cases in these respective places. Now what is the recommended age group of giving Tdap vaccine is 10 years of age. One dose is generally given. This has to be followed up with Td dose every 10 years.

So the importance is the follow up is with Td and not Tdap. So Tdap has to be used only once at the age of 10 years. Coming to the HPV vaccine, the human papillomavirus is the most common genital tract infection virus. Almost 1 out of 4 women who die due to cervical cancer is an Indian. These are alarming numbers indeed.

The incidence for cervical cancer in India is 22.9 per 1 lakh women per year. The HPV vaccines protect against infection with human papillomaviruses and provide protection against cervical cancer as well. Now coming to the schedule and the availability of vaccines. So basically, bivalent and quadrivalent these two vaccines are available and this is available for administration to girls.

The license for these vaccines for males is still not available in India. So, the bivalent vaccine is Cervarix active against HPV 16 and HPV 18. Quadrivalent vaccine is Gardasil active against HPV 16, 18, 6, and 11. Now coming to Cervarix. So the dosage of this vaccine when given to the age group of 9 to 14 year girls is 2 doses given at 0 and 6 months while 15 years older and till 26 years it is 3 doses that has to be given at 0, 1 and 6 months interval.

The quadrivalent vaccine Gardasil again from the age group 9 to 14 years if it is given to girls it is 2 doses given at 0 and 6 months interval and if it is 15 till 26 years it is given 3 doses at 0, 2, and 6 months interval. Now coming to MMR vaccine. Now mumps is generally a disease of school going children. The outbreaks are quite common with mumps and the immunity as we have discussed wanes away quite fast in mumps. Now rubella is another

important disease which causes congenital rubella syndrome affecting the cardiac, auditory, ophthalmic and neurological systems causing great disability and morbidity.

Now all school going children and adolescents must receive at least 2 doses of MMR vaccine and adolescents who have not received the MMR in the past so 2 doses of MMR at 4 to 8 weeks interval must be administered and under MR campaign mode this vaccine is given till 15 years of age. Coming to Hepatitis B vaccine. The prevalence of hepatitis B in adolescents is 2 to 7 percent in India. The adolescents are more prone to hepatitis B due to indulgence in sexual activities due to other high risk behaviors such as indulgence in substance abuse as well. The vaccination for hepatitis B must be given for prevention of horizontal and perinatal that is prevention of mother to child transmission as well.

The individuals who are non-vaccinated or their status is unknown the 3 dose schedule of 0, 1, and 6 months for Hepatitis B is to be followed. A combination of hepatitis B and hepatitis A may also be used with the same schedule of 0, 1, and 6 months interval. Now coming to hepatitis A there is a shift in epidemiology as far as hepatitis A is concerned there is increased incidence that is observed among adolescents and young adults. This hepatitis A causes severe disease with more complications among the adolescents and outbreaks are also known to occur with hepatitis A. The universal immunization for hepatitis A is not recommended yet in India.

Now there are 2 types of hepatitis A vaccine live attenuated H2 strain hepatitis A vaccine and killed inactivated hepatitis A vaccine. Now the schedule for hepatitis A vaccine 2 doses for inactivated vaccine or it is only one dose for the live vaccine. If they are vaccinated or diseased previously there is no need to give these vaccine and if the age is greater than 10 years, so there can be testing for the hepatitis A antibodies. Now coming to the typhoid vaccine. Now India has a very high incidence of typhoid fever.

Now among the adolescents, there is a fad nowadays to go outside, consume outside food, consume junk food. Now this leads to a lot of incidence of typhoid fever among the adolescents. There is recurrent infections and relapses in typhoid as well. The recommendation for typhoid is single dose of typhoid conjugate vaccine. The Vi- conjugate vaccine is generally preferred over the VI polysaccharide vaccine.

Now coming to varicella - chicken pox. So again there is a shift in epidemiology as far as varicella is concerned. The serological susceptibility is nearly 20 to 30 percent for 11 to 20 years of age. Now most of these cases are mild but adolescents and adults are at risk of severe disease and the outbreaks among adolescents are more severe. Now this varicella vaccine is given in two doses when it is up to children under 12 years of age.

Minimum these doses are 3 months apart and when the age group is greater than 12 years the minimum doses schedule is 4 weeks apart. Now coming to the pneumococcal vaccine. Now we all know that streptococcus pneumoniae is a common cause of morbidity and

mortality and this causes high case fatality in extremes of age. The high risk individuals are extremely susceptible for pneumonia. So, this has to be given to immunocompromised individuals and those having implants such as cochlear implants.

So there are two types of vaccines available. The pneumococcal vaccines are of two types. The pneumococcal conjugate vaccines available in the form of PCV 10 and PCV 13. Pneumococcal polysaccharide vaccine the PPSV 23. The PCV 10 is a part of national immunization schedule for the children up till 5 years of age.

Now the adolescents the PCV 13 can be given up to 18 years for the high risk groups and the scheduling for the pneumococcal vaccine is when there is no prior PCV 13 or PPSV 23 given. So, one dose of PCV 13 has to be followed by a dose of PPSV 23 after 1 year or if it is early necessary at least a difference in dose of 8 weeks later has to be there. And if the children have received one or more doses of PPSV 23 then one dose of PCV 13 one or more year after the previous PPSV 23 dose has to be administered. And if the vaccination history is uncertain then one dose of PCV 13 should be administered.

Now coming to the influenza vaccines. Now the flu can be serious even for healthy adolescents and this influenza causes severe morbidity and mortality in extremes of age and for high-risk individuals. Now there are two influenza viruses, type A and type B. So type A basically has subtype based on two surface antigens Haemagglutinin that is H and neuraminidase that is N. Now there are two types of flu vaccines that are available. First is in the form of injectable that is trivalent inactivated killed influenza vaccine and intranasal that is live attenuated influenza vaccine that is LAIV.

Annually one dose of influenza vaccine is recommended and it is recommended to go for the latest available vaccine and preferably in the pre-monsoon dose. Now coming to the meningococcal vaccines. Now the epidemics of meningococcal disease have occurred in 20 years cycle previously and now this frequency has been seen to be rising. The meningococcal disease has a high case fatality rate. Now there are two types of vaccines for the meningococcal disease.

The polysaccharide vaccines where we have the bivalent which is protective against the types A and C and quadrivalent which is protective against the types A, C, Y and W135. When we have conjugate vaccines we have quadrivalent and monovalent as well and generally the conjugate vaccines are preferred. The schedule for meningococcal vaccine for less than 16 years of age is two doses given five years apart and when the age group is more than 16 years one dose only is sufficient. Now coming to Japanese encephalitis. Now Japanese encephalitis vaccination this is recommended for adolescents who live in such endemic districts, also in adolescents who plan to visit such endemic districts till their 18 years of age.

The vaccine is given in two doses intramuscularly four weeks apart. Now coming to

cholera, generally cholera is not routinely recommended in healthy individuals. It is recommended for adolescents who reside in highly endemic areas and also in people who travel to areas where the risk of transmission is very high such as we have the Kumbh Mela where the risk of transmission is very high. This cholera vaccine is available as inactivated whole cell vibrio cholera vaccine and this is given as two doses two weeks apart.

Now coming to rabies, a very fatal disease. Everyone of us is susceptible for this disease. This is more common with young children and adolescents. Now the high risk among adolescents are children and adolescents having pets at their home and those who fall under the risk of stray dog menace. Now what are the WHO approved vaccines for rabies? So, we have the purified chick embryo cell vaccine, the human diploid cell vaccine and the purified Vero cell vaccines. The post exposure prophylaxis for rabies is five doses intramuscularly at 0, 3, 7, 14 and 28 days if it is intramuscular and if it is interdermal it is four visits but eight doses that is on 0, 3, 7 and 28 days.

The pre-exposure prophylaxis consists of three doses either intramuscular or intradermal at 0, 7 and 21 or 28 days. Now coming to yellow fever. Now yellow fever occurs in sub-Saharan Africa and tropical South America where it is endemic and intermittently epidemic. The 17D live attenuated yellow fever vaccine is the only commercially available vaccine for yellow fever. The contraindications for administration of yellow fever vaccine are infants who are aged less than 9 months, the individuals having history of hypersensitivity and people with acquired immunodeficiency syndrome.

A single subcutaneous injection of live attenuated vaccine should be administered 10 days before the travel date. The period of validity of yellow fever international vaccination is life time which begins 10 days after vaccination and immediately after revaccination. So basically, after administration of vaccine the validity is 10 days after vaccination up to a life time. Now coming to what are the various challenges in adolescent immunization. First of all there is lack of awareness, there is lack of awareness among the parents, there is lack of awareness among the healthcare providers about the importance of adolescent immunization.

Now there are access barriers, the adolescent face multiple barriers to accessing healthcare facilities and receiving immunization services. During infancy and early childhood there is contact with healthcare providers, there is more frequent contact I would say and during adolescence the frequency is reduced. So also, on part of the healthcare provider their chance to vaccinate them reduces. Vaccine hesitancy, now vaccine hesitancy is another important challenge as far as adolescent immunization is concerned. The high cost of the adolescent vaccines, the fear of side effects are another challenges that adolescent immunization faces.

Now what is the way forward when we look at adolescent immunization in India. Expanding the immunization program, now expanding the existing national immunization program to include more vaccines for adolescents is the need of the hour. Strengthening the healthcare infrastructure, now strengthening the healthcare infrastructure to improve access to immunization for adolescents again would go a long way to solve the adolescent immunization problems in India. Advocacy and outreach, so there is more engagement in advocacy and outreach efforts to increase awareness among the parents and healthcare providers about the importance of adolescent immunization. Building a vaccine confidence, so there should be building a vaccine confidence through more effective communication, more effective community engagement efforts to make people realize the importance of adolescent immunization so that more people come forward, more parents are aware of it, more adolescents aware of it and we have a greater coverage of adolescent immunization.

So coming to the take home message, adolescent immunization is a very important issue but a neglected one. There is a need for vaccinating adolescents, the reasons we have seen, the waning of immunity over the years, various peculiar circumstances, the high risk behaviors and higher morbidity amongst certain diseases that occur in adolescents. The recommended vaccination for adolescents as per the IAP criteria, the routine vaccinations of Tdap and HPV, the catch up vaccinations of MMR, hepatitis A, hepatitis B, typhoid and varicella, the high risk vaccinations or special circumstances, pneumococcal vaccine, influenza vaccine, meningococcal, Japanese encephalitis, cholera vaccine, rabies and yellow fever vaccine.

So, these are a few of my key references, so that is all from my end. Thank you so much.