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Guidelines for vaccination in normal adults in India

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The immunization of an adult depends on the previous immunization received in childhood. Unlike the Pediatric Immunization Guidelines, given by the Indian Academy of Pediatrics and the National Immunization Programs,[1,2] the guidelines for vaccination in healthy adults vary from region to region.

The major guidelines are:

- The Advisory Committee on Immunization Practices (ACIP) guidelines from Centers for Disease Control and Prevention[3,4,5]
- WHO guidelines[6]
- Association of Physicians of India – Expert panel guidelines [Tables 6 and 7].[7]

Table 6.

Vaccines recommended for all healthy adults

DPT
MMR
Influenza (>50 years)
Pneumococcal (>65 years)
Human papillomavirus (9-26 years)
Zoster (>60 years)

DPT: Diphtheria, pertussis, and tetanus, MMR: Measles, mumps, and rubella

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Table 7.

Vaccines recommended in high-risk individuals

Hepatitis B
Hepatitis A
Meningococcal
Varicella
HiB
Typhoid
Rabies
Cholera and Japanese encephalitis vaccines are routinely not indicated due to lack of adequate evidence

HiB: *Haemophilus influenzae* b

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Hepatitis B vaccine

Vaccine

Hepatitis B vaccine is a recombinant vaccine. Plasma- derived vaccine is not used due to risk of transmission of infections.

Schedule

Primary immunization at birth: In normal individuals, the dose is 10 μg in children given intramuscularly at 0, 1, and 6 months and a booster after 5 years. In adults, the dose is 20 μg. Booster is not needed in immunocompetent adults.[8,9,10,11]

Indications of hepatitis B vaccine in Indian adults

Adults at high risk, e.g., patients with percutaneous or mucosal exposure to blood and patients with sexual exposure should be vaccinated if not immunized in childhood. Percutaneous or mucosal exposure can occur in intravenous drug users; household contacts of persons with chronic hepatitis B virus (HBV) infection; inmates and staff of institutions for developmentally disabled persons in long-term care facilities; persons at risk for occupational exposure to HBV (such as dialysis staff, laboratory staff dealing with blood samples, blood bank staff, nurses working in intensive care units, operation theaters, and surgeons and other doctors at high-risk); patients who are human immunodeficiency virus (HIV)-seropositive, patients with chronic liver disease (CLD), chronic kidney disease (CKD); and diseases where blood products or multiple blood transfusions are required such as hemophilia, aplastic anemia, leukemia, hemoglobinopathies, and patients awaiting major surgeries. Sexual exposure is a risk factor for HBV infection in patients presenting to sexually transmitted disease clinics, homosexuals; promiscuous heterosexuals; commercial sex workers; and sex partners of hepatitis B surface antigen (HBsAg)-positive persons.

Prevaccination screening in general population has not been found to be cost-effective in India.

If the vaccination schedule is interrupted after the first dose, the second dose should be administered as soon as possible and the second and third doses should be separated by an interval of at least 8 weeks. If only the third dose has been delayed, it should be administered as soon as possible.

Postexposure screening is not indicated for most adults, except in immunocompromised persons, sex partners of HBsAg-positive persons, and health care workers at high risk for continued percutaneous or mucosal exposure to blood or body fluids. When indicated, postexposure

screening should be performed 1–2 months after administration of the last dose of the vaccine series. The anti-HBs titer should be maintained above 10 mIU/ml in all healthy adults.

Nonresponders who are HBsAg and anti-HBc-negative should receive a further full course of vaccination as fourth, fifth, and sixth doses. Retesting should be done 1–2 months after the last dose. If there is no response, 40 μg of recombinant vaccine is administered at 0, 1, and 6 months. Retesting should be done 1–2 months after the last dose. If the person remains a nonresponder, alternative strategies for protection must be explored.

Booster doses of HBV vaccine are not indicated in persons with normal immune status. A booster dose may be administered when anti-HBs levels decline to <10 mIU ml and >65 years.

Pneumococcal vaccine

Pneumococcal vaccine is available in two forms:

- Polysaccharide vaccine consisting of polysaccharides from 23 serotypes. This vaccine is less immunogenic, does not affect carrier rates, promote herd immunity, or protect from respiratory tract infections as there is no mucosal immunity
- Conjugated Vaccine with 13 serotypes consists of capsular polysaccharides covalently bound to diphtheria toxoid, which is highly immunogenic but nontoxic. This combination results in mucosal immunity and lifelong immunity.[3,4,5,12,13]

Table 8 summarizes the key differences between Pneumococcal Polysaccharide Vaccine (PPSV23) and Pneumococcal Conjugate Vaccine (PCV13).[14]

Table 8.

Key differences between pneumococcal polysaccharide vaccine23 and pneumococcal conjugate vaccine13

Vaccine	Advantages	Disadvantages
PPSV23	Long experience (licensed in 1983) Not expensive At present, relatively high serotype coverage for IPD in elderly (60-70%) Considerable efficacy proven against IPD (50-70%) in immunocompetent elderly Cost-effective proven for elderly people even if it only prevents IPD	T-cell-independent immune response (IgM antibody produced, response declines in 3-5 years and no anamnestic response at revaccination) Decrease in memory B cell frequency after PPV23 Weak immunogenicity in some individuals Unclear (null to small) efficacy against nonbacteremic pneumococcal pneumonia No effect on nasopharyngeal carriage No efficacy demonstrated in reducing nasopharyngeal carriage No impact proven in reducing overall pneumococcal disease burden
PCV13	T cell-dependent immune response (larger duration and boosting effect at revaccination) High efficacy (80-90%) against vaccine type IPD proven in children Significant efficacy against pneumococcal pneumonia (CAPiTA study) Potential efficacy in reducing nasopharyngeal carriage Considerable impact in reducing all pneumococcal disease burden shown by prior PCV7	Short experience (approved in 2011) Expensive At present, relatively small serotype coverage for IPD in the elderly (30-40%) Future reduction of vaccination impact in adults/elderly (because of probable indirect effects from PCV13 pediatric use)

PPSV: Pneumococcal polysaccharide vaccine, PCV: Pneumococcal conjugate vaccine, IPD: Invasive pneumococcal disease

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PCV13 is approved in several countries worldwide, including the US, EU, and India, for use in adults aged >50 years for the prevention of pneumonia and/or invasive disease caused by *Streptococcus pneumonia* serotypes included in the vaccine.[14] In immunocompetent adults, PPSV23 is indicated in those over the age of 65. The vaccine is also indicated for those with CKD, chronic obstructive pulmonary disease (COPD), cirrhosis, diabetes, HIV, lupus, cancer and those on chemotherapy or radiotherapy, long-term steroid, asplenia, or splenectomy.

A single dose PPSV23 is recommended in immunocompetent adults. In those who have received primary immunization, vaccination is done with PPSV23 0.5 ml single dose IM. In those who have not received primary vaccination, PCV13 can be given followed by PPSV23 after a minimum interval of 8 weeks. If PPSV23 has been given earlier PCV can be given after 1 year.

Revaccination can be done with PPSV23 at least 5 years after the first dose. Revaccination with PPSV23 within 5 years leads to hyporesponsiveness. Monitoring for seroconversion is not needed.

In the year 2014, ACIP recommended routine use of PCV13 among adults aged ≥ 65 years.[15] This was based on the results of the CAPiTA trial that supported the evidence on the efficacy of PCV13 against noninvasive pneumococcal pneumonia among adults.[16] As per this recommendation, both PCV13 and PPV23 should be routinely administered in series to all adults aged ≥ 65 years. ACIP recommendations for use of PCV13 (high risk) in adults aged ≥ 19 years with immunocompromising conditions, functional or anatomic asplenia, cerebrospinal fluid leak, or cochlear implants remain unchanged.

The recommendations for usage of both the vaccines is mentioned in Table 9.[14]

Table 9.

Advisory Committee on Immunization Practice recommendations for the use of pneumococcal conjugate vaccine 13 and pneumococcal polysaccharide vaccine 23

Indications	Indications
Pneumococcal vaccine-naïve persons Adults aged ≥65 years who have not previously received pneumococcal vaccine or whose previous vaccination history is unknown	One dose PCV13 followed by a dose of PPSV23 PPSV23 should be given 6-12 months after PCV13 If PPSV23 cannot be given during this time window, the dose of PPSV23 should be given during the next visit The two vaccines should not be co-administered, and the minimum acceptable interval between PCV13 and PPSV23 is 8 weeks
Previous vaccination with PPSV23 Adults aged ≥65 years who have previously received ≥1 doses of PPV23	Should receive a dose of PCV13 if they have not yet received it A dose of PCV13 should be given ≥1 year after PPSV23 For those for whom an additional dose of PPSV23 is indicated, it should be given 6-12 months after PCV13 and ≥5 years after the most recent dose of PPSV23

PPSV: Pneumococcal polysaccharide vaccine, PCV: Pneumococcal conjugate vaccine

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The ACIP recommendation was amended in 2015 to simplify the spacing between PCV13 and PPSV23 in adults >65 years.[17] The old ACIP recommended that PPSV23 can be given after 6-12 months after PCV13. The new recommendation states that the recommended interval for adults receiving PCV13 and PPV23 to be at least 1 year apart, regardless of sequence. In summary, this means that PCV13 is given first followed by PPSV23 with spacing at least 1 year. If the adult above 65 years received PPSV23, he will receive PCV13 after 1 year as the older recommendation [Tables 10 and 11].

Table 10.

Immunization for all adults with normal immune status

		Immunized	Not immunized	Vaccine	Dose and route	brands
DPT	Universal except if contraindicated	18 to 64 years booster dose of Td vaccine once every 10 years till the age of 65 years	3 doses of Td vaccine; 2 doses are administered 4 weeks apart 3rd dose 6 to 12 months after the second dose	Td (one dose can be Tdap)	0.5 cc IM	Boostrix GSK Adacel –sanofi Triple Ag SI
MMR	Recommended in adults but contraindicated in pregnancy and immunosuppressed states	Not indicated	Single dose SC	Live vaccine	0.5 cc SC	Tresivac- SI GSK
Influenza	For all, esp high risk	Every year	Every year	Inactivated	0.5 cc IM	Fluvac
Pneumococcus	For all >65 years <65 years in those at risk	Single dose >65 years	Single dose >65 years		0.5 cc IM	Pneumococcal polysaccharide 23 Protein conjugate-13
Varicella	For all who are not immune	For those already immunized in childhood booster doses are not needed if titres are adequate	two doses administered 4 to 8 weeks apart	attenuated live VZV (Oka strain) in both	2 doses 0.5 ml in deltoid area SC	Varilrix (GlaxoSmithKline Biologicals) Okavax (Pasteur Mérieux) Varibed MSD Biovac chinese
Papilloma	For young adults	For adults who are already immunized, booster dose is not needed. For non immunized, 3 doses given	In age group 9-14 years 2 doses are recommended at an interval of 6 months. For 15-26 years at 0,1 and 6 months		dose is 0.5 ml intramuscularly	GSK Cervarix- bivalent MSD Guardasil -4 valent
Zoster	in>60 years	>60 years single dose	>60 years single dose	Live attenuated	0.65 ml subcutaneous in deltoid	

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Table 11.

Vaccination in special situation in adults

Insert vaccines	Risk groups	Immunized	Not immunized	Vaccine	Dose and route	Brands
Hepatitis B	At high risk	Not indicated	0, 1, and 6 months if not immunized in childhood	Recombinant and plasma-derived	Single dose	Shanta biotech
Hepatitis A	At risk	Single dose if high risk	2 doses 6 months if not immunized in childhood	Inactivated and live		Inactivated single antigen (HAV antigen) vaccine, e.g., havrix (GSK) and vaqta (merck and co); combination vaccine, e.g., Twinrix (HAV + HBV)(GSK)
Meningococcal	Not recommended routinely High risk Travelers and epidemic	Single dose	2 doses <16 years >16 years single dose	Meningococcal conjugate (not for<2 years or >55 years) Meningococcal polysaccharide	0.5 cc SC <55 years 2 doses 1 month apart >55 1 dose	
HiB	At risk	Single dose of HiB in high risk	Single dose of HiB in high risk	Ag is polyribose phosphate or outer membrane protein and carrier is tetanus toxoid conjugate or diphtheria CRM protein	0.5 ml IM	GSK
Rabies	Not routine as prophylaxis. Only for high-risk groups Indiacted postexposure	Preexposure for high risk For those immunized 0, 3rd days no immunoglobulin	Pre exposure 0, 7, and 28 days IM Postexposure 0.3, 7, 14, and 28 days (90 days optional) with RIg ID 0, 3, 7, and 28 days over deltoid	HDCS PCECV Verorab (not for pre exposure)	1 ml IM 0.1 ml ID 0.5 cc IM	
Cholera	High-risk patients Two currently available vaccines are not recommended in India	For high risk 2 separate doses, 1 to 6 weeks apart for those aged over 6 years	For high risk 2 separate doses, 1–6 weeks apart for those aged over 6 years	2 oral vaccines Dukoral (WC/rBS) Recombinant B-subunit	2 separate doses, 1 to 6 weeks apart 2 separate doses given 1 week apart	Dukoral (WC/rBS) Recombinant B-subunit (Vabiotech)
Typhoid	High-risk Travelers or outbreak	If immunized booster every 3 years	Three doses of typhoid 21a capsules/sachets are administered on alternate days Series repeated once in every 3 years as booster dose Vi vaccine single SC/IM dose of 0.5 ml. Revaccination every 3 years			Live oral typhoid 21a vaccine- suspension or capsule (not in India) Injectable Vi polysaccharide vaccine Typhoid conjugate – bharat biotech
Varicella	Those who did not have chickenpox	For those already immunized in childhood booster doses are not needed if titers are adequate	Two doses administered 4 to 8 weeks apart	Attenuated live VZV (Oka strain) in both	2 doses 0.5 ml in deltoid area SC	Varilrix (GSK Biologicals) Okavax (Pasteur Mérieux) Varibed MSD Biovac Chinese
Japanese encephalitis	Not routine	Single dose and booster dose may be given at 1 year		Mouse brain-derived inactivated vaccine (NA) cell-culture, live-attenuated vaccine	0.5 ml SC Booster at 1 year	
Polio	Adults traveling to polio infected countries	Single dose of IPV	3 doses of IPV/OPV spaced by 1 month	Oral sabin IM killed salk		Chiron - old protect Sanofi - immumax polio
Rotavirus	Not routinely recommended for adult immunization			Live vaccine		Rotarix GSK Rotatech MSD

ID: Intradermal, IM: Intramuscular, SC: Subcutaneous, GSK: GlaxoSmithKline, IPV: Inactivated polio vaccine, OPV: Oral poliomyelitis, NA: Not available, VZV: Varicella-zoster virus, PCECV: Purified chicken embryo cell vaccine, HDCS: Human diploid cell strains, HiB: *Haemophilus influenzae* b, HAV: Hepatitis A vaccine

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Influenza vaccine

The available vaccine in India is a killed virus vaccine to be given intramuscularly.[18,19] Other vaccines include nasal spray vaccines (containing live attenuated virus). As the influenza virus constantly mutates, a new batch is prepared every year. The vaccine becomes effective against influenza virus 2 weeks after administration. Since the peak influenza season begins in October and lasts till May, October-November are the best times to receive vaccination.[18,19]

A single dose of inactivated flu vaccine in dose of 0.5 ml is given intramuscularly into the deltoid muscle.

Vaccination is indicated in high-risk subjects, e.g., those with COPD, CKD, cardiac or lung diseases, hepatic, metabolic diseases (diabetes), hematological diseases, pregnancy, nursing homes, health care personnel, household contacts of children <5 years or adults >50 years, diseases which impair respiratory functions, and immunosuppressed individuals.

Side effects include allergic reactions, Guillain Barre syndrome. High-risk individuals (see above) should not receive nasal spray live flu vaccine. The vaccine provides adequate protection against HINI infection. Antibody monitoring is not required.

Meningococcal vaccine

The quadrivalent vaccines contain 50 μg of each of the antigens A, C, Y, and W135 whereas the bivalent vaccine has only A and C antigens. Two types of quadrivalent vaccines are available. The meningococcal polysaccharide vaccine (MPSV4) does not induce herd immunity, has no effect on nasopharyngeal carriage, and can be used only in those >2 years age. The meningococcal conjugate vaccine (MCV4) provides herd immunity, reduces nasopharyngeal carriage, provides long-lasting immunity after 28 days of vaccination, but cannot be used for people >55 years. These vaccines do not protect against meningococcus groups B or meningitis due to other organisms. MCV4 (conjugated) is preferred for adults who are aged 55 years or younger as well as for adults aged 56 years or older who (a) are vaccinated previously with MCV4 and are recommended for revaccination, or (b) for whom multiple doses are anticipated. MPSV4 is preferred for adults aged

56 years or older who have not received MCV4 previously and who require a single dose only (e.g., travelers).[20]

Vaccination is indicated in specific situations, such as during an outbreak. A single dose of vaccine (A + C) may be given to health care workers, laboratory workers, and close contacts of cases. Vaccination may be given to personnel living in dormitories, military recruits, jail inmates, immunocompromised individuals, such as those suffering from terminal complement component deficiency, splenectomy, active and passive smokers, systemic lupus erythematosus, HIV, and multiple myeloma (2 doses separated by 2 months for adult <55 years).

For travelers, a single dose is recommended 10-14 days before the scheduled visit depending on the prevalent serotype in the visiting country. As a national policy, the National Institute of Communicable Diseases, New Delhi, administers quadrivalent polysaccharide vaccine to the Haj pilgrims to fulfill the requirements of the Government of Saudi Arabia.

Rabies vaccine

The sheep brain-derived nerve tissue vaccine “semple vaccine” is no longer used. Tissue culture vaccines (TCV) such as human diploid cell vaccine, purified chicken embryo cell vaccine (PCECV), and newer and less expensive vero cell-purified rabies vaccines are now available. TCV are used for pre- and post-exposure prophylaxis. They are easy to administer, highly immunogenic, and have a good margin of safety.[7]

Pre-exposure schedule

Pre-exposure schedule for rabies vaccination is 3 doses at days 0, 7, and 28 and is recommended for high-risk groups such as veterinarians, laboratory personnel working with rabies virus, medical and paramedical personnel treating rabies patients, dog catchers, forest staff, zookeepers, postmen, policemen, courier boys, and schoolchildren in endemic countries. The human diploid cell culture vaccine [HDCV] and purified chick embryo cell culture PCECV (1 ml) or purified vero cell rabies vaccine (0.5 ml) are administered by intramuscular route in the deltoid region or the anterolateral thigh. The reconstituted tissue culture vaccines (0.1 ml) can be administered by the intradermal route over the deltoid region.

Antibody titers should be monitored every 6 months in persons working with live virus in diagnostic, research, and vaccine production laboratories. In other professions at permanent risk

of exposure to rabies, such as veterinarians, animal handlers, and wildlife officers, antibody titers in the serum should be monitored annually. Booster dose should be administered when the titer falls below 0.5 IU/ml. The duration of immunity by two injection vaccination course is 2-3 years.

Postexposure prophylaxis

A person who is exposed and has never been vaccinated against rabies should get five doses of rabies vaccine at 0, 3, 7, 14, and 28 days. They should also get human rabies immune globulin (20 IU/kg body weight; up to a maximum of 1500 IU) at the same time as the first dose. A person who has been previously vaccinated should get 2 doses – 1 on 0 day and another on 3rd day.

When needed, the rabies immunoglobulin should be infiltrated as much as possible into and around the wounds and the remaining should be given intramuscularly at a site away from the site where vaccine has been administered.

Management of re-exposure

On reexposure, 2 booster doses should be administered on days 0 and 3 irrespective of category of exposure or time that has elapsed since previous vaccination. All subjects who have received incomplete vaccination should be treated as fresh cases.

If rabies immunoglobulin is not available, double dose of the first dose of vaccination may be administered in the following situations: (i) category III exposure, (ii) patients who are malnourished and patients receiving corticosteroids, anticancer drugs, and antimalarials, and (iii) patients with HIV/AIDS with CD4+ count <200/mm^3. If feasible, antibody titers should be monitored and boosters given if titer is less than 0.5 IU/ml.

Immunosuppressed patients should avoid activities for which rabies preexposure prophylaxis is indicated. Antibody titer is checked after immunization in an immunosuppressed person. Sera should be collected around day 14 of vaccine series and at the time of completing prophylaxis.

Human papillomavirus vaccine

The vaccine protects against human papillomavirus (HPV) types responsible for most cervical cancers and genital warts. It is most effective when administered before onset of sexual activity. [21]

It can be given to young males and females between the ages of 9 and 26 years. In age group 9-14 years, 2 doses are recommended at an interval of 6 months. For >15 years, the dose is 0.5 ml intramuscularly at 0, 1, and 6 months.

Tetanus, diphtheria, and pertussis vaccine

Full dose diphtheria, tetanus, and pertussis are used in children (DPT). Acellular pertussis vaccine (DTaP) should be used for older children instead of whole cell vaccine (DTwP) because it is associated with less neurological complications. Two new tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccines (Tdap) are available for use in those who are more than 10 years of age.[22,23]

The vaccination schedule varies with status of primary immunization. The dose is 0.5 ml given IM preferably in deltoid. DTaP (acellular pertussis) or DTwP (whole cell pertussis) vaccine should be used for first booster at 18 months while Tdap (low dose diphtheria and acellular pertussis) may be used for the second booster at 5 years and 10-15 years.

For adults between 18 and 64 years who have completed their primary vaccination schedule, a booster dose of Td vaccine is indicated once every 10 years till the age of 65; one dose of Tdap vaccine may be administered in place of Td vaccine. For adults >18 years who have not received prior vaccination against diphtheria, pertussis and tetanus, three doses of Td vaccine are indicated; two doses are administered at least 4 weeks apart, and the third dose is given 6-12 months after the second dose. The Tdap vaccine can substitute any one of the Td doses.

For adults who have not received Tdap vaccine and are likely to come in contact with infants suffering from diphtheria or pertussis, a single dose of Tdap vaccine should be given 2 weeks before the contact with the infant if 2 years or more have elapsed since the last dose of Td vaccination. Health care personnel, especially those in direct contact with the patients, who have not received Tdap vaccine should receive a single dose of Tdap vaccine if 2 years or more have elapsed since the last dose of Td vaccination. Women planning pregnancy should receive one dose of Tdap vaccine if they did not receive it previously. Pregnant women who have received the Td vaccination more than 10 years ago should receive one dose of Td vaccine in the second or third trimester of pregnancy. Pregnant women who have received Td vaccination during the preceding 10 years should receive one dose of Tdap in the immediate postpartum period if the last dose of Td was administered more than 2 years ago. For pregnant women who have never received previous vaccination, three doses of Td vaccine are indicated; in the second or third trimester of pregnancy, two doses are administered at least 4 weeks apart, and the third dose is given 6-12 months after

the second dose. Following minor trauma in non immunized individual or those immunized more than 10 years if major wound both Td/Tdap and TIG should be given; if immunized >5 years and <10 years ago only Td/Tdap is given and TIG is not required. Modified dose vaccine is not effective post transplant and full dose is needed.

Precautions

Tdap/Td vaccines are contraindicated for persons with a history of anaphylaxis to any component. The Tdap vaccine is contraindicated in adults with a history of encephalopathy not attributable to an identifiable cause within 7 days of administration of a vaccine with pertussis component; these persons should receive Td vaccine. In adults with moderate or severe acute illness and those with unstable neurologic conditions (e.g., stroke, acute encephalopathies), Tdap vaccination is to be deferred until the acute illness resolves. In adults with a history of Arthus reaction with the previous dose of tetanus/diphtheria containing vaccine, Tdap/Td is administered only after 10 years since the last dose.

Haemophilus influenzae

The vaccine antigen is polyribose phosphate or outer membrane protein (OMP), and carrier is tetanus toxoid conjugate or diphtheria CRM protein.[7]

Vaccination is a part of primary immunization. Adults at high risk such as patients with asplenia, HIV, hematological malignancies, corticosteroid use, CSF leak, trauma, diabetes, pregnancy, alcoholism, immunosuppression due to bone marrow or kidney transplant, cancer, radiation, or chemotherapy should be vaccinated.

A single 0.5 ml dose of haemophilus influenza b (HiB) conjugate vaccine is administered intramuscularly.[7]

Hepatitis A

Vaccines against hepatitis A virus (HAV) include inactivated vaccines as single antigen (HAV antigen) vaccines or combined with HBV antigens.

Universal immunization for hepatitis A is not recommended. The following groups of adults are considered at high risk for acquiring hepatitis A: persons who use illicit drugs; persons who work

with HAV-infected primates or with HAV in a laboratory; people who receive clotting factor concentrates; persons infected with other hepatitis viruses; persons with CLD who are not already immune to HAV; persons who have received, or are awaiting a liver transplant; food handlers; and men who have sex with men. Hepatitis A vaccine is indicated for all transplant candidates with CLD or those patients of end-stage renal disease (ESRD) who have chronic hepatitis B or C because of increased risk of fulminant hepatic failure.[9,10]

Typhoid vaccine

The available vaccines for typhoid fever include inactivated whole cell vaccine, live oral Ty21a vaccine, injectable Vi polysaccharide vaccine, and Vi-rEPA vaccine. The lyophilized oral Ty21a vaccine is available in two formulations: A liquid suspension (in sachets) or enteric coated capsules. The Vi polysaccharide vaccine is a subunit vaccine composed of purified Vi capsular polysaccharide.[7]

Three doses of Ty21a capsules/sachets are administered on alternate days. This series should be repeated once in every 3 years as a booster dose. The capsule formulation should be taken orally with safe water. The sachet should be given with 100 ml of safe water with buffer to protect the B-subunit against gastric acidity. The Vi vaccine is given as a single subcutaneous or intramuscular dose of 0.5 ml, with revaccination every 3 years. Typbar conjugate vaccine is now recommended between 9 and 12 months.

Entire community at risk should be vaccinated during an outbreak. If immunization of the entire community is not possible, individuals aged 2-19 years should be specifically targeted. Ty21a should not be used during pregnancy. Vaccination policy for renal disease patients is same as for normal population. Live oral typhoid is contraindicated in transplant recipient.

Cholera

Vaccines for cholera are available as injectable killed whole cell vaccine; and oral cholera vaccine. The injectable killed whole cell vaccine has a poor efficacy with short-lasting protection and is not recommended.

Among the oral cholera vaccines, Dukoral (WC/rBS) is approved for use in persons aged over 2 years. Dukoral is administered in three separate doses, 1–6 weeks apart for 2–6-year-old children

and as two separate doses, 1–6 weeks apart for those aged over 6 years. It confers 85–90% protection for 6 months among all age groups which declines over 6 months to 2 years.[7]

Japanese encephalitis

The vaccines used for immunization against Japanese encephalitis (JE) are mouse brain-derived inactivated vaccine and cell-cultured, live-attenuated vaccine. With effect from 2007, the production of the mouse brain-derived inactivated vaccine has been stopped. The live attenuated vaccine is currently in use in India. It is administered subcutaneously as a single 0.5 ml dose, with a booster dose at 1 year.[7]

The JE vaccine is primarily useful in the pediatric age. The issue of adult immunization against JE in case of major outbreaks needs to be reviewed.

Varicella vaccine

Two vaccines, both containing an attenuated live VZV are currently available in India.[20]

All adults who have never had chickenpox should receive 2 doses 0.5 ml in deltoid area subcutaneously. For <13 years of age, the first dose is administered at 12-15 months and the second dose at age 4-6 years. For people older than 13 years, the two doses are administered 4-8 weeks apart. For those already immunized, booster doses are not needed if titers are adequate. In resource-limited countries at least the females in reproductive age group, people at high risk for exposure to varicella, i.e., health care workers, household contacts, etc., should be vaccinated.[20]

Varicella vaccines should not be administered to persons receiving HD systemic immunosuppressive therapy, including oral corticosteroids >2 mg/kg of body weight or a total of more than 20 mg/day of prednisone or its equivalent for persons who weigh >10 kg, when administered for >2 weeks; HIV-seropositive adult or adolescent with CD4 + T-lymphocytes count <200 cells/μL; persons with a family history of congenital or hereditary immunodeficiency in first-degree relatives (e.g. parents, siblings). It is also contraindicated in those with gelatin allergy, neomycin allergy, people on radiotherapy or chemotherapy, people who have received blood products or transfusions during past 5 months. Varicella vaccination has been shown to be effective in patients with nephrotic syndrome and should be given to all patients with negative varicella titers. It is ideally administered when in remission or on low-dose alternative days or off corticosteroid therapy. It is recommended for all CKD patients and those on dialysis.

Patient groups at risk for severe disease and complications from varicella can receive varicella zoster immunoglobulin (VZIG). These include those with immune-deficiency disorders; neoplastic diseases; on immunosuppressive treatment and pregnant women. VZIG should be administered within 96 h of the exposure at a dose of 125 units/10 kg body weight, up to a maximum of 625 units. Patients should be monitored for varicella for 28 days after exposure as VZIG prolongs incubation period.[24]

Rotavirus

The vaccine can be given after the age of 6 weeks- 2 doses at 10 weeks and 14 weeks. It is not routinely recommended for adult immunization. The vaccine is recommended for pediatric solid organ transplant candidates before transplantation.[1,2,3]

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