ORIGINAL RESEARCH PAPER

Medicine

ADULT IMMUNISATION

KEY WORDS: .

Dr.Rahul Kumar Assistant Professor, Department of Geriatric Medicine, Patna Medical College, Patna 800004

Dr.Pankaj Hans Assistant Professor, Department of General Medicine, Patna Medical College, Patna 800004

ADULT IMMUNISATION

Although childhood vaccination is the first priority, but probability of exposure to infectious agents in adults has increased due to immunosenescene ,increase in travel opportunities between two countries and Globalisation

Adult vaccination has never been considered a preventive strategy likely to have great impact on population health ,but time has now come to urgently address need for adult immunisation.

WHY NOT USUALLY RECOMMENDED

- Still not very clear whether vaccine preventable disease are **really a major health problem**.
- Doubt regarding **safety and efficacy** of vaccines in elderly.
- Adult vaccines are **selective** ,have different target groups not universal as in children.
- Vaccination is **difficult** as it is hard to reach adults for vaccine

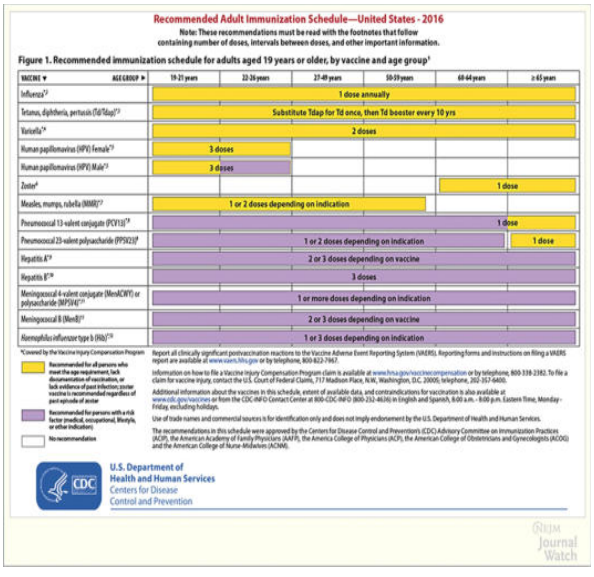
Guidelines for vaccination in healthy adults vary from region to region depending upon-

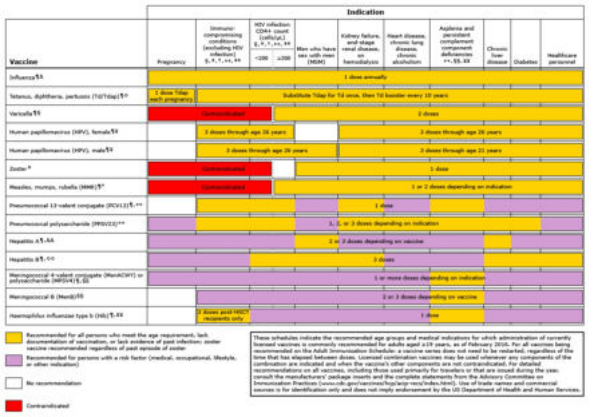
- Prevalence of communicable diseases
- Resources available
- Cost benefit ratio
- Immunisation received in childhood

Major guidelines authorities are-(1)

- **ACIP** –Advisory Committee on Immunisation Practices from CDC(2)
  (Centre of Disease Control And Prevention)
- **API** (Expert Panel Guidelines)
- **WHO** Guidelines

For developing countries as India ,International Guidelines' do not address much on Optimal Strategy





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

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

Hepatitis B Vaccine

Its a recombinant vaccine [ENGERIX –B 20mcg/ml [RECOMBIVAX HB 10mcg/ml]

Schedule-Primary immunisation at birth 10 mcg is given I/M in children at 0,1,6 months. Booster after 5 years(3)

In Adults- 20 mcg i.e. 1 ml given over deltoid at 0,1,6 months .No booster in immunocompetant persons.

DOSAGE AND ADMINISTRATION Recommended Dose and **Standard schedule** for ENGERIX®-B at 0, 1 and 6 months.

For more **Accelerated protection** a three dose schedule (0, 1, 2 with a booster dose at month 12) results in the development of protective anti-HBs titres by 3 months.

Rapid induction of protection is required, e.g. persons travelling to areas of high endemicity and who commence a course of vaccination against hepatitis B within one month prior to departure,a schedule of three intramuscular injections given at 0, 7 and 21 days may be used. Booster at 12 months

Dosage:

Adults 20 years and over: 20 µg of antigen protein in 1.0 mL

Neonates, infants, children and adolescents up to 19 years inclusive:
10 µg of antigen protein in 0.5 mL suspension.

Patients with renal insufficiency including patients undergoing haemodialysis
: Four double doses (2 x 20 µg) at elected date, 1 month, 2 months and 6 months from the date of the first dose.

To ensure that the anti-HBs antibody titre remains above the accepted protect**Patients** ive level of 10 mIU/ml

40mcg i.e. 2 ml administered at 0,1,2,6, months

Immunocompromised patients:
A 2.0 mL (2 x 1.0 mL) dose of ENGERIX®-B 40 µg (2 x 20 µg) is recommended (TWINRIX) (A+B)

3 DOSES-
0,1,6 M OR 0,7,21-30 days and 12 months(booster)

Indications in adults-
- All unvaccinated adults at risk of HBV infection and all adults seeking protection
- Patients with percutaneous or mucosal exposure to blood and patients with sexual exposure should be vaccinated ,if not done in childhood
- IV drug users
- Household contacts with chronic HBV infection
- Occupational exposure as –Dialysis staff, Laboratory staff, Blood bank staff, Nurse, OT staff, Doctors
- HIV Positive
- CLD,CKD
- People requiring repeated BT as Haemophiliacs ,leukaemia, Hemoglobinopathies, Aplastic anaemia
- Sexual Exposures- Especially Homosexual, promiscuous heterosexuals, commercial sex workers, sex partners of HbsAg + ve
- Persons with age <60 years with diabetes as soon as feasible after diagnosis, for diabetics >60 yrs its discretion of clinician depending on likelihood of acquiring HBV infection

Interrupted vaccination schedule-
If interrupted after 1 st dose -2 nd should be administered as soon as possible,3rd should follow 8 weeks later to 2 nd dose.

If only 3 rd dose interrupted then administer it as soon as possible.

Pre vaccination screening is not cost effective in India.

Post Vaccine Exposure Screening
- Immunocompromised patients
- Sex partners of HBsAg +ve patients
- Health care workers

Anti Hbs titre should be >10 mIU /ml(done at least 1-2 months after last dose of vaccine)

Non Responders
Who are HBsAg and anti-HBc –ve should receive further full course of vaccination as **fourth, fifth and sixth doses**.

Retesting should be done 1-2 months after last dose.

If still no response then **40 mcg** of recombinant vaccine is administered at 0,1,6 months.

If still non-responder then alternate strategies of protection must be explored.

Booster HBV vaccine is not indicated in healthy adults. However booster maybe given if

Anti HBs titre <10 mIU/ml and
>65 years old adults.

Post Exposure Prophylaxis-
Single I/M dose of Hep B immunoglobulin (HBIG).06ml/kg as soon as possible(<48 hrs) ,followed by full course of vaccination.
Routine vaccination with Hep B also protects against Hep D which always occurs in presence of Hep B

Hepatitis A
Inactivated vaccine as HAV antigen .Universal immunisation with Hep A –Not Recommended

High Risk Groups-
- Illicit drug abusers
- Persons who work with HAV infected persons or with HAVirus in Laboratory
- CLD
- Male Homosexuals
- ESRD with Hep B or Hep C
- Haemophiliacs
- Food handlers
- Received or awaiting liver transplant

Immunisation Schedule
HAVRIX- two doses I/M at 0,6-12 months
1-18 yrs 0.5 ml(720 ELU)
>18 yrs 1 ml (1440 ELU)

TWINRIX(Both A+B)-Three doses I/M at 0,1,6 months(>18 yrs) OR 0,7,21-30 days ,booster at 12 months

PNEUMOCOCCAL VACCINE

PSV 23	ADVANTAGES	DISADVANTAGES
	*Long Experience (licensed in 1983) *Not Expensive *High efficacy(50-70%) against Invasive Pneumococcal disease in imunocompetant elderly *Cost effective	*No effect on nasopharyngeal carrier *Response declines in 3-5 yrs and no amnestic response at revaccination *Week immunogenicity *No impact in decreasing overall disease burden

PCV13	ADVANTAGES	DISADVANTAGES
	*Long duration of response and high boosting effect at revaccination *High efficacy against invasive Pneumococcal disease in children(80-90%) *Potential reduction in Pneumococcal disease burden *Effective in reducing nasopharyngeal carriers *Significant efficacy against Pneumococcal Pneumonia(CAPiTA Study)	*Short experience (since 2011) *Expensive *Relatively small serotype coverage for invasive Pneumococcal disease in elderly(30-40%)

PPSV23 indicated in-
Age
>65,CKD,CAD,COPD,DM,Cirrhosis,HIV,Lupus,Cancer,those on chemotherapy or radiotherapy, long term steroid , Asplenia or splenectomy, Immunocompromised conditions.

CDC ACIP Guidelines
Adults aged 19-64 with immunocompromised condition mentioned below needs vaccination. Needs revaccination onetime after 5 yrs

At age of 65 –
All elderly persons should receive single dose vaccine

Dose-

PPSV23-0.5 ml (contains 25 mcg of each capsular polysaccharide antigen).
Revaccination recommended for increased risk.
PCV13- 0.5ml I/M over deltoid

Immunocompromised conditions indicated for Pneumococcal vaccine-

- Congenital or acquired immunodeficiency
- Complement deficiency
- Phagocytic disorders excluding chronic granulomatous diseases
- HIV
- CKD
- HD
- Nephrotic Syndrome
- Leukemia
- Lymphoma
- Malignancy
- Multiple myeloma
- Solid organ transplant
- Long term steroid therapy
- Chemo/radiation therapy

Anatomical or Functional Asplenic conditions indicated for Pneumococcal vaccine-

- Sickle cell disease and other haemoglobinopathies
- Congenital or acquired Asplenia
- Spleenic dysfunction
- Spleenectomy

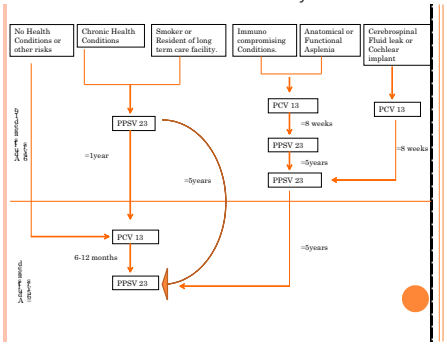
Adults >65 yrs(immunocompetant) who-

1. Have not received PCV13 or PPSV23- Administer PCV 13 Followed by PPSV23 at least 1 yr after PCV 13
2. Have not received PCV 13 but have received PPSV23 at age >65-Administer PCV 13 at least 1 yr after PPSV23
3. Have not received PCV13 but have received one or more does of PPSV23 at age <65-Administer PCV13 at least 1 yr after most recent dose of PPSV 23 ,Then administer a dose of PPSV23 at least 1 yr after PCV 13 and at least 5 yrs after most recent dose of PPSV23.
4. Have received PCV13 but not PPSV23 at age <65 –Administer PPSV23 at least 1 yr after PCV 13
5. Have received PCV13 and one or more dose of PPSV23 at age <65-Administer PPSV23 at least 1 yr after PCV 13 and at least 5 yrs after the most recent dose of PPSV23

- PCV should be administered at least 1 yr after PPSV23
- PPSV23 should be administered at least 1 yr after PCV13

EXCEPT adults with immunocompromised conditions as-Asplenia, CSF leakage, cochlear implants in whom the difference should be atleast 8 weeks

- When both PCV 13 and PPSV23 indicated –
- PCV13 should be administered first, never co administered
- The interval between two PPSV23 doses should be at least 5 yrs
- No additional dose of PPSV23 required if adult is vaccinated with PPSV23 at age >65
    - If PPSV23 was administered at age <65- Administer another dose of PPSV23 at least 5 yrs later of first dose



Administer Pneumococcal vaccine at least 2 weeks before immunosuppressive therapy or elective spleenectomy And as as soon as possible to adults who are newly diagnosed with asymptomatic or symptomatic HIV infection.

Administer PPSV23 TO **Adults aged 19 through 64** with-

- Chronic Heart Disease(CCF,Cardiomypopathies,excluding HTN)
- COPD ,Asthma
- Chronic Liver Disease /Cirrrhosis
- Alcoholism
- DM
- Smoker

At Age 65-

Administer PCV13 at least 1 year after PPSV 23 followed by second dose of PPSV23 at least 1 year after PCV13 and at least 5 yrs after last dose of PPSV23(as revaccination with PPSV23 within 5 yrs leads to hyporesponsiveness

INFLUENZA VACCINE

In India killed virus vaccine (TIV ,Trivalent Inactivated Influenza Vaccine)to be given I/M is available. Other vaccine include Nasal spray vaccine, containing Live attenuated influenza vaccine(LAIV)(FLUMIST).

As influenza virus constantly mutates-a new batch is prepared every year. It becomes effective against influenza virus 2 weeks after administration hence given every year during Oct-Nov and lasts till May.

Single dose inactivated Flu Vaccine 0.5 ml I/M or intra dermal is given over deltoid . It can be given to anyone more than 6 M age.

Indicated in high risk subjects- Side effects-Allergic reaction, GBS

- COPD
- CKD
- Cardiac or lung disease
- Pregnancy
- Diabetes Mellitus
- Health Care Personals
- immunocompromised states
- Age 65 or more

Children age 6 months to 5 years
High risk individuals as above should not receive Nasal Spray Flu Vaccine.

Vaccine provides adequate protection against H1N1

In 2012 WHO recommended that Seasonal Influenza Vaccine should be made from three vaccine viruses , hence called Trivalent

1. H1N1 like virus(A/California/7/2009)
2. H3N2 like virus
3. B vaccine virus

TIV is 70-90% effective in healthy young people and 30-70% in elderly

Meningococcal Vaccine

N. Meningitidis is an aerobic gram –ve cocci having 12 identified serotypes based on differences in capsular polysaccharides. Most common are A,B,C,Y and W 135.A,B,C accounts for 90%of meningococcal disease. In India serotype A is most common. Human nasopharynx is the reservoir,transmitted by aerosol or secretions.

- Bivalent vaccine(A and C Antigen)
- Quadrivalent Vaccine(50mcg each of A,C,Y,W135)

1. MPSV4
2. MCV4

Meningococcal Polysaccharide Vaccine (MPSV4)	Meningococcal Conjugate Vaccine(MCV4)

Does not induce Herd Immunity	Provides Herd Immunity,has diphtheria toxin as carrier protein
No effect on Nasopharyngeal carriage	Reduces Nasopharyngeal carriage
Only in those >2 yrs age	Provides long lasting immunity after 28 days of vaccination but cannot be used for people>55 yrs
Preferred for adults >56 yrs or older who have not received MCV4 previously and who require a single dose only(eg. travellers)	For those below 55 yrs or >56 who are previously vaccinated with MCV4and are recommended revaccination or >56 for whom multiple doses are anticipated. cannot be used for people >55 yrs

Indications for vaccination-

- During Outbreaks
- Single dose of Bivalent Vaccine maybe given to

health care workers,
laboratory workers,
close contacts of cases

- Persons living in

Dormitories, Military recruits ,Jail Inmates

- immunocompromised individuals as complement deficiency
- Splenectomy
- smoker
- SLE
- HIV
- Multiple Myeloma
- Travel to hyper endemic countries .e.g. Mecca travellers during Hajj

Dose- 0.5ml SC deltoid (single dose).Revaccination every 5 yrs as immunity is conferred for only 3-5 yrs. Due to short duration of protection ,not routinely recommended in India.

2 doses at 0 and 2 months for functional or anatomical Asplenia

For travellers (e.g.. Hajj Pilgrims) –single dose Quadrivalent Polysaccharide vaccine is recommended 10-14 days before schedule visit.

*These vaccines do not protect against menningococcus Gr. B or Meningitis due to other organisms
*Revaccination with MCV4 is recommended for adult previously vaccinated with MCV4 or MPSV4 who remain at increased risk as Asplenia

Serogroup B Meningococcal (MenB)vaccine
is available as a 2 dose series of MenB-4C vaccine administered at least 1 M apart(1)

or

3 dose series of Men B –FHbp vaccine administered at 0,2,6 M(Not in India). Approved for persons >10 yrs who are increased risk for serogroup B meningococcal disease. Revaccination not needed.

Can be given concomitantly with MPSV4 but at different site.

There is interference of PCV13 and MCV4 in patients with asplenia.PCV 13 is given first and 1month interval recommended.

Chemoprophylaxis-for prevention of secondary disease among close contacts, given as early as possible after onset of disease in index patient to reduce risk of secondary disease but not after 14 days. Tab Rifampicin 600 BD for 2 days/Ciprofloxacin 500 single dose/inj.ceftriaxone 250 mg I/M single dose

Rabies Vaccine
Tissue Culture Vaccine-

- HDCV(Human Diploid Cell Vaccine)
- PDEV(Purified Duck Embryo Vaccine)
- Purified Vero Cell Rabies Vaccine(PVRV)new and less expensive

Pre Exposure Schedule-3 doses –Days 0,7,28 for high risk groups as-
Veterinarians,
Laboratory personal working with Rabies Virus,
Health care workers treating Rabies patients ,
Dog catchers,
Forest staff,
Zookeepers,
Postman,
Policeman,
Courier boys

Indication- Dog bites, Rats/Rodents bite maybe considered
HDCV or PCECV (1ml) or
Purified Vero Cell Rabies vaccine(0.5 ml) I/M over Deltoid or anterolateral thigh (not gluteal).

The reconstituted tissue culture vaccine (0.1ml) can be given Intradermal over deltoid.

Antibody titre should be **6 monthly** monitored in persons working with live virus in labs, research work.

In other professions at permanent risk of exposure of rabies ,as animal handlers, wild life officers ,antibody titre should be measured **annually**

Booster dose should be administered when titre falls below 0.5 IU /ml.

Post Exposure Prophylaxis-
Person exposed but have Never been Vaccinated against rabies should get 5 dose of Rabies Vaccine 0,3,7,14,28,90(optional)days (1 ml I/M or 0.1 ml I/D)

Also receive Human Rabies Immunoglobulin (20IU/kg body wt. Up to max 1500 IU) at same time as first dose.

One who has been previously vaccinated should get 2 dose – 0 and 3 rd day

When needed rabies immunoglobulin should be infiltrated as much as possible into and around the wound and remaining should be given I/M at a different site to vaccine administration.

Re-exposure Management-
On re-exposure 2 booster doses should be administered on days 0 and 3 irrespective of Cat. of exposure or time that has elapsed since previous vaccination. All who have been incompletely vaccinated should be treated as fresh cases.

If Rabies immunoglobulin not available-
Double dose of 1st dose of vaccination maybe administered in following situation-

- Cat III exposure
- Malnourished
- Patients receiving steroids, anti cancer drugs and anti malarial
- Patients with HIV /AIDS with CD4 count <200/mm3
- If feasible, antibody titre should be monitored and booster given if titre is <0.5 IU/ml

*Antibody titre should be checked after immunisation in immunosupressed persons. Sera should be collected around day 14 of vaccines series and at time of completing prophylaxis
*Animals in question should be observed for 10 days.PEP can be discontinued if animal is healthy after 10 days
*Both rabies vaccine and immunoglobulin are safe in pregnancy, lactation and immunosupressed persons as HIV

Human Papilloma Virus Vaccine(HPV)
HPV is the most common STD. Associated with >95%Cervical Cancers.(2)

Protects against cervical cancers, anogenital warts, vaginal wart ,

vaginal cancer

Most effective when administered before onset of sexually active life i.e young males and females between 9-26 years.

9-14 yrs—2 dose recommended at interval of 6M

>15 – 26 yrs– 3 dose 0.5 ml I/M at 0,1,6 months.

Two types-
- **HPV 4 Quadrivalent vaccine**(Gardasil)active against HPV type 6,11,16,18
- **HPV2 Bivalent Vaccine**(Cervarix) active against HPV type 16,18

Females—HPV4/HPV2 both recommended for routine vaccination at age 11 or 12 for those age 13 through 26(if not previously vaccinated)

Males– only HPV4 is recommended for routine vaccination at age 11 or 12 and for those age 13 through 21 (if not previously vaccinated).

Males age 22 through 26 maybe vaccinated. Male having sex with males maybe benefitted by prevention of Wart (condyloma)and anal cancer.

Contraindication: Pregnancy, Hypersensitivity
- Screening for cervical cancer should be continued even if HPV vaccinated
- Indicated only for prevention of cervical cancer/anogenital warts-no role in established patients
- HPV vaccine for males is not recommended at present. Instead primary target population of young adolescent girls are expected to be more cost effective in reducing cervical cancer than vaccinated in males.

Tetanus, Diphtheria, Pertusis Vaccine
Acellular Pertusis Vaccine (DTaP) should be used in older children instead of whole cell vaccine (DTwP) as it has neurological complications.

For more than 10 yrs age –
TdaP(Tetanus Toxoid, reduced or low dose diphtheria toxoid and acellular Pertusis) 0.5 ml deltoid.

DTaP or DTwP vaccine should be used for first booster at **18 M** while TdaP(reduced or low dose diphtheria toxoid and acellular Pertusis) maybe used for 2 nd booster **at 5 yrs and 10-15 yrs**

For **adults between 18-64 yrs**—who have completed primary vaccination schedule—booster dose of Td vaccine is indicated once every 10 yrs till age of 65.

one dose of TdaP vaccine maybe given in place of Td vaccine.

For **adults >18 yrs**—Not immunised against DPT—3 dose of Td vaccine indicated. Two dose at least 4 weeks apart and 3rd dose 6-12 M after 2nd dose. TdaP vaccine can substitute any one dose of Td For Adults—Not received TdaP vaccine and are **likely to come in contact with infants suffering from diphtheria or Pertusis** ,a single dose of TdaP vaccine should be given 2 weeks before the contact with the infant if 2 yrs or more have elapsed since last dose of Td vaccine.

Health care Personals—those in direct contact with patients who have not received TdaP vacccine should receive a single dose of TdaP vaccine if 2 yrs or more have elapsed since last dose of Td vaccine.

Women Planning Pregnancy-receive one dose of TdaP vaccine if not received previously.

Pregnant women-
- Who have received the Td vaccine >10 yrs ago should receive one dose of Td vaccine in 2nd or 3rd trimester of pregnancy.
- Who have received Td vaccine within last 10 yrs –one dose of TdaP in the immediate post partum period if the last dose of Td was given more than 2 yrs ago.
- Not received previous vaccine—3 doses of Td vaccine indicated in 2nd or 3rd trimester ,first dose at least 4 w apart and third 6-12 M after 2nd dose.

Post transplant needs full dose(no dose adjustment required).

Contraindication:
a. TdaP/Td contraindicated for persons with h/o anaphylaxis to any component.
b. TdaP Vaccine contraindicated in adults with h/o encephalopathy within 7 days(not attributable to other causes) of administration of vaccine with Pertusis component—should receive Td vaccine instead
c. Adults with moderate or severe acute illness and with those with unstable neurological condition as stroke—TdaP vaccine deferred till acute illness resolves.

Precautions:
a. In adults with h/o Arthus reaction with previous dose of tetanus /diphtheria containing vaccine—TdaP/Td is administered only after 10 yrs after last dose.
b. GBS within 6 weeks after previous dose of TT containing vaccine
c. Pregnancy

d. Schedule:
e. 0.5 mL intramuscular (IM) deltoid
f. Primary: 3 doses; 0, 1, 6–12 months
g. For contacts: Single dose 2 weeks before contact
h. Outbreak: Single dose if 2 years or more have elapsed from the last Td Vaccination
i. Booster: Once every 10 years

j. Indications:
k. In all adults not immunized earlier
l. Contacts with infants suffering from diphtheria or pertusis and last Td vaccine dose > 2 years ago
m. Adults who are in close contact with infants
n. Health care personnel
o. During pertusis outbreak
p. In pregnant patient:
q. – Td within 10 years: Booster in immediate postpartum period
r. Td > 10 years: Booster in 2nd or 3rd trimester
s. Not immunized: 3 doses in 2nd or 3rd trimester

Post exposure prophylaxis:
– Minor/uncontaminated wound: One booster dose of TT given if last dose taken > = 10 years back
– Major/contaminated wound: One booster dose of TT given if last dose taken more than 5 years back

- **Indications for TIG(penetrating,complicated ,soft tissue damage)-**
- Unknown immune status
- Incomplete Course of Toxoid
- Complete Course of Toxoid : Last Booster > 5 years ago

Dose-
For prophylaxis-250 I.U.given I/M in patients 7 years and older (500 I.U. if 24 hours have passed since injury or if there is a risk of heavy contamination)

For established tetanus- 500 IU to 6,000 IU intramuscularly and / or 250 IU - 500 IU intrathecally in adults and children.

Typhoid Vaccine(5)
- Live Oral Ty21a Vaccine(Liquid suspension sachets /enteric coated capsule) -3 doses on alternate days ,Repeated once in
- every 3 years as a booster dose

Liquid formulation recommended over Enteric coated capsules, Sachet given with 100 ml water with a buffer to protect against gastric acidity

- Vi Capsular Polysaccharide Vaccine -Single S/C OR I/M dose of 0.5 ml .Booster dose every 3 yrs

Indications:--
* Routine immunisation in adolescent.
Both have comparable efficacy(51% vs 55% at 3 yrs)and both are equally safe.
* Vaccination of entire community during outbreak
* Recommended for travellers to moderate to high risk of exposure to Salmonella typhi, lab workers and household contacts of S.typhi carriers.

Not recommended for adults residing in typhoid endemic areas

Currently routine immunisation of adults not recommended due to insufficient data

Contra indications:--
Ty21a—Pregnancy immunocompromised state as transplant recipient
age <6 yrs
ViCPS :-- <2 yrs age

Japanese Encephalitis
- PHK– Primary Hamster Kidney Cell Cultured(4)
- Live attenuated Vaccine (e.g.**SA 14-14-2 vaccine**)

Indication:-
- Primarily in Paediatric age group
- Not recommended in adults for routine immunisation

Dose –
- 0.5 ml S/C as single dose, booster maybe given at 1 yr

GOI Strategy:
Onetime Mass campaign targeting all children between 1-15 yrs age in all districts Followed by The children will be administered the JE vaccine between 1-2 yrs of age with DPT booster under routine immunisation programme.

Varicella(Chicken Pox)
Live attenuated (OKA Strain)(7)

Indications:--
1. Persons >13 yrs without evidence of Varicella immunity
2. Strongly indicated in those having –

- Close contacts with persons at high risk for severe disease e.g. Health care workers family contacts of persons with immunocompromising conditions, non Pregnant women of child bearing age
- Recommended for outbreak control.
- Recommended for **post exposure prophylaxis** within 3 days of exposure to Varicella rash and can be given up to 5 days of exposure to rash.

*70-90% effective in preventing Varicella and 95% effective in preventing severe Varicella

Schedule:-- 0.5 ml (2 doses S/C over deltoid)4-8 weeks apart (for >13 yrs) For <13 yrs –1st dose at 12-15 M
2nd dose at 4-6 yrs Booster not required

Contraindication:--
- Pregnancy
- Severe immunodeficiency ,Radiotherapy, Chemotherapy
- H/O Hypersensitivity reaction to Gelatine or Neomycin
- Severely ill people
- Received blood products or transfusion in last 5 M
- Patients on systemic immunosuppressive therapy including oral corticosteroids >2 mg/kg or >20mg /day of Prednisolone or its equivalent for persons >10 kg, when administered for >2 weeks.
- HIV +ve or anyone with CD4 count <200 cells/mcL

Varicella vaccine is safe and effective in **Nephrotic Syndrome** and should be given to all with varicella titre negative. It is ideally given when in remission or on low dose alternative therapy or off corticosteroids therapy.

It is recommended for all **CKD** and those on **HD.**

VZIG—within 96 hrs of exposure at a dose of 125 units/10 kg body wt. Max. 625 units. Patients should be monitored for Varicella for 28 days after exposure as VZIG prolongs incubation period.

Indicated for Post exposure Prophylaxis for immunodefecient patients and Pregnant females

Rotavirus
After age of 6 weeks. 2 doses at 10 weeks and 14 weeks.
Not recommended for adults.

Cholera
Oral Cholera Vaccine(DUKORAL) (Monovalent inactivated killed whole cells of vibrio cholerae 01 plus recombinant cholera toxin B subunit)

*Not for routine adult immunisation
*Not recommended for prevention of outbreaks during emergency.

Schedule– 1-6 weeks apart 2 doses(3 ml vaccine mixed in 150 ml water)

Not recommended for <2 yrs.1 booster after 2 yrs

Bivalent Inactivated Vaccine (not in India)only in Vietnam.

Bivalent killed whole cell oral cholera vaccine (RCT phase 3 at Kolkata awaited).

MMR
Live attenuated vaccine(3).**Indications:** all adults **except**-
- Those having suffered from all the 3 disease.
- Those who have received 2 doses of Measles, Mumps Rubella (MMR) vaccine in childhood.
- Especially recommended for Health care workers during outbreaks, recent exposure to these infection ,women who could become pregnant, college students.

Schedule: 0.5 mL SC in deltoid, 2 doses 28 days apart

Contraindications:
H/O immediate hypersensitivity reaction to gelatine or neomycin
Pregnancy
Severe immunodeficiency
Patients with active febrile illness
Avoid pregnancy for 3 months after vaccination

Dengue Vaccine(4)
At present only one live attenuated tetravalent dengue vaccine is in phase 3 trial.(**CYD-TDV (Dengvaxia)** for use for age 9 and above (0,6,12 M)

This vaccine was found to be effective against three of the four dengue serotypes.(61.2% type1 ,81.9% type 3, 90% type 4.

DENVax -- is a recombinant chimeric vaccine with DENV1, DENV3 and DENV 4 components on a dengue virus type 2 DENV2 backbone.(under phase 1 and 2 trials)

Malaria Vaccine(8)
Vaccine for Plasmodium Falciparum Malaria has been invented.

Consists of P.falciparum circumsporozoites protein from pre erythrocytic stage of parasites.

The RTS,S/AS01(RTS,S) vaccine (phase 3)provided protection against both clinical and severe malaria in African children. It has found to be effective in age group of 5 -17 M(four doses).Its proposed by WHO to be launched in 3 selected countries in 2018.

HIV Vaccine
60 vaccine candidates are in Phase I trial . 30 candidates are in phase II trial.

Research is going on broadly neutralizing antibodies (bNAbs), a type of antibody that can be found in blood of HIV patient, capable of stopping the HIV virus from entering blood cells and replicating, thereby arresting HIV infected person's progression to AIDS. Though mutable, parts of HIV are relatively change resistant, this is a key to its ability to infect white blood cells and multiply, these are parts of HIV that bNAbs target.

VaxGen gp120 protein subunit vaccine is in phase III trial at present.

HEPATITIS C Vaccine
Presently in phase II trial.

HEPATITIS E Vaccine
It was developed in China and was approved in June 2012. Recombinant HEV vaccine (HEV 239):

3 doses (30 μg of purified recombinant hepatitis E antigen per dose) of HEV 239 administered at months 0, 1 and 6 resulted in 100% efficacy at 1 year in a Chinese study.

Zoster (Shingles)
Live attenuated Varicella Zoster Virus (VZV) (Oka strain)(7)

Indications:
Adults aged 60 years and older (regardless of whether they report a previous episode of herpes zoster) Persons with chronic medical illnesses.

Schedule: Single 0.65 ml dose SC in the deltoid region

Contraindications:
Age < 60 years
Pregnancy
Known severe immunodeficiency
History of immediate hypersensitivity reaction to gelatine or neomycin

Presently herpes zoster vaccine is not recommended for use in adult population, with or without co morbid conditions as reliable **epidemiological data are not available from India** regarding the burden of herpes zoster.

Anthrax Vaccine
Indications: (3)
Anthrax vaccine is recommended for people 18 through 65 years of age who might be exposed to large amounts of Bacillus Anthracis bacteria, e.g.: –
Laboratory workers
People handling animals or animal products
Military personnel

Schedule: 5 doses IM: 0 and 4 weeks and 6, 12 and 18 months

Post exposure prophylaxis: 3 doses SC 0, 2 and 4 weeks Annual booster doses are recommended for ongoing protection

Contraindications:
Allergic reactions
History of GBS
Moderate or severe illness

Plague
Killed whole cell plague vaccine-

Indications: (3)
All laboratory and field personnel who are working with Yersinia pestis

Persons engaged in aerosol experiments with Y. pestis

Persons engaged in field operations in areas with enzootic plague

Schedule: IM 3 doses: 0 (1 mL), 1 (0.2 mL) and 6 (0.2 mL) months
Accelerated dose: 0.5 mL 3 doses 1 week apart Booster: 3 doses at 6 monthly intervals

Live attenuated vaccine--A subunit vaccine based on the F1 and V antigens is being developed

Yellow fever
Live attenuated virus(17D Vaccine)(3)

Indications:
* Persons 9 months through 59 years of age travelling to or living in an area where risk of yellow fever is known to exist, or travelling to a country with requirement to vaccinate before entry
* Laboratory personnel who might be exposed to yellow fever virus or vaccine virus

Schedule: Single shot 0.5 ml SC
Immunity begins to appear on the 7th day and lasts for more than35 years, probably whole life but according to WHO Booster dose is recommended every 10 years

Precautions:
Allergy to any component of the vaccine, including eggs, chicken proteins, or gelatine
< 6 months of age
Immunocompromised
Pregnant and nursing mothers

"International Certificate of Vaccination or Prophylaxis" (yellow card) is issued after vaccination. This certificate becomes valid 10 days after vaccination and is good for 10 years

Haemophilus Influenzae Type b (Hib) vaccine(6)
Hib (Polysaccharide vaccine)
Hib (Polysaccharide-protein conjugate vaccine)
The vaccine antigen is outer membrane protein (OMP),and carrier is tetanus toxoid conjugate .
It usually affects children below 5 yrs.—(2)
Has Nasopharyngeal spread—Menningitis ,Pneumonia
The vaccine is scheduled at 6,10,14 weeks of age according to National Immunisation Schedule along with DPT.
The vaccine is not generally offered to children aged more than 24 months.

Indication:
Sickle cell disease
Leukaemia
Splenectomy (given at least 14 days before)if they have not previously received Hib vaccine,
Corticosteroid use
CSF leak
DM
Pregnancy
Alcoholism
Immunosuppression due to bone marrow or kidney transplant, (should receive 3 doses of Hib in at least 4 weeks interval 6-12 M after transplant regardless of their Hib history.
Chemotherapy.
HIV

Dose- Single dose of 0.5 ml of Hib conjugate vaccine is administered I/M

REFERENCES

1. APIGuidelines "Executive SummaryTheAssociationofPhysiciansofIndia Evidence-Based Clinical Practice Guidelines on Adult Immunization" Expert Group of the Association of Physicians of India on Adult Immunization in India JAPI. 2009;57:345-56.
2. Schuchat A, Jackson LA. Immunization principles and vaccine use. In: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J (Eds). Harrison's Principles of Internal Medicine, 18th edn. New York: McGraw-Hill; 2011. pp. 1031-41.
3. Centers for Disease Control and Prevention (2012). Recommended adult immunization schedule—United States – 2012. [online] CDC website. Available from www.cdc.gov/vaccines/schedules/downloads/ adult/adult-schedule.pdf [Accessed December 2012]. 4. Dengue Vaccine Initiative (2012). [online] DVI website. Available from www.denguevaccines.org [Accessed December 2012]. 4a. Operational Guide Japanese Encephalitis Vaccination in India, September 2010 ministry of health and family welfare.
5. Pegues DA, Miller SI. Salmonellosis. In: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J (Eds). Harrison's Principles of Internal Medicine, 18th edn. New York: McGraw-Hill; 2011. pp. 1277-8.
6. Centers for Disease Control and Prevention (2012). What you should know for the 2012-2013 influenza season. [online] CDC website. Available from www.cdc.gov /flu/ about/season/flu-season-2012-2013. htm [Accessed December 2012].
7. Whitley RJ. Varicella-zoster virus infections. In: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J (Eds). Harrison's Principles of Internal Medicine, 18th edn. New York: McGraw-Hill; 2011. pp. 1465-6.
8. PATH Malaria Vaccine Initiative (2012). [online] MVI website. Available from www.malariavaccine.org [Accessed December 2012].