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Immunization in Special Circumstances

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Abstract

Immunization schedule is not simple as before. Many new vaccines are introduced, many yet to come. Immunization in special situations like organ transplantation, immuno suppressed conditions, travel to in/outside, are common and schedule is confusing. Pediatricians should aware about newer vaccinations in common practice and how to advice immunization in special situations.

Keywords: Immunization; Special circumstances; Vaccine; Immunization schedule.

Introduction

Updates in immunization schedule and vaccines have always been hot topics in academic programmes. There has been advent of many new vaccines during last few years. There has been an increase in number of patients undergoing transplantation, immunosuppressant therapy and chemotherapy and increased survival of HIV and other immunosuppressed children. All these situations will affect the immunization schedule of not only the child but also his contacts.

Vaccination schedule will vary from country to country and also from time to time. Many diseases were eradicated in many developed countries but many other diseases are still prevalent in developing countries. Our vaccination schedule has burgeoned from a list of vaccines against 5 diseases in the EPI in 1978 to vaccines against 10 diseases in the current UIP. In developing countries liked India morbidity and mortality due to diseases like pneumonia is very common. But the costly vaccine against pneumonia is not included in our schedule. Effective vaccine against hepatitis A and chickenpox are available but they are also not included. Diarrhea due to rotavirus is common here, but mortality can very well be prevented by ORS solution and zinc. So the author feels that immunization against pneumonia should be given priority before rotavirus vaccine.

Traveling abroad is so common that everybody should have at least have some knowledge about the vaccination schedule of the particular country to which he would like to travel.

Nowadays parents are more aware about the vaccines (and their complications). Antivaccine lobby in our country is spreading the message against immunization. So a treating physician should have a thorough knowledge about different vaccines, the nuances of indications, contraindications and special circumstances regarding a particular vaccination.

National immunization schedule guidelines are different from that of Indian Academy of Pediatrics (IAP). Many vaccines like pneumococcal vaccine, varicella vaccine and hepatitis vaccines, etc. are recommended by IAP but not included in National immunisation program.[1]

IAP Recommended Vaccines for high-risk children are given in Table 1.

Table 1: IAP Recommended Vaccines for High-Risk Children

• Influenza vaccine
• Meningococcal vaccine
• Japanese Encephalitis vaccine
• Cholera vaccine
• Rabies vaccine
• Yellow fever vaccine
• Pneumococcal polysaccharide vaccine (PPSV 23)

Immunization of Preterm or Low Birth Weight Babies

After stabilization and preferably at the time of discharge, BCG and birth dose of OPV can be safely and effectively given. Reduced dose for preterm baby is not recommended.[2]

Hepatitis B Vaccine for Preterm

If the baby is less than 2 kg; birth dose should be delayed for 1 month. Even after one month if the child has not gained a weight of 2 kg(e.g., birth Wt 1.4 kg, and after 1 month it is 1.9 kg),still one can give hepatitis B with adequate seroconversion.[3]

If the baby is <2 kg, and the mother is Hepatitis B positive: HBV should be given with HBIG with in 12 hours. We have to give 3 more doses at 1, 2 and 6 month.

Immunization with History of allergy

Allergic reactions are more attributable to vaccine components than to the antigen itself. So one should be careful and should take necessary precaution to treat anaphylaxis, if any unexpected situation arises.[4]

Vaccines are contraindicated with history of serious hypersensitivity/anaphylaxis in the past. Mild reactions are not a contraindication for vaccination.

After vaccination one has to observe for at least 20–30 minutes. Also all resuscitation equipment should be kept ready.

Table 2 shows common chemicals present in certain vaccines.

Table 2: Vaccines and Chemicals Along with Vaccine

• MMR and varicella: Neomycin
• IPV: Neomycin, streptomycin and polymyxin B
• MMR, YF, inactivated and live influenza vaccine: Egg antigens
• MMR, varicella, and YF: Gelatin
• Hepatitis: Thiomersal, Aluminium salt

Immunization during Illness

One of the most common practices for the postponement of immunization is fever or some other illness. Minor illness is not a contraindication for vaccination. Vaccinations are to be postponed only during serious illness.[1]

Table 3: Showing Situations where One Need not Postpone the Immunization

• Low grade fever
• Upper respiratory infection
• Otitis media
• Mild diarrhea
• Antibiotic therapy
• Disease exposure or convalescence
• Pregnancy in the household
• Breastfeeding
• Premature birth
• Allergies to products not in vaccine
• Need for TB skin testing
• Need for multiple vaccines

Lapsed Immunization

Due to above-mentioned reasons or some other reasons child may not have completed the full course of a vaccine. For example child had taken first dose of Pentavac and but did not come for second dose. In such a case there is no need to restart the vaccine series, regardless of time lapsed.[5] We can continue the schedule and restart with next (second) dose of Pentavac.

If the child is older (e.g. 6 years) we have to give many injections at a time. One has to remember that the minimum period of interval between 2 doses should not be less than 26 days. Some general principle of catch up vaccination is given in Table 4.

Table 4: General Rules for Catch Up Immunization

- If the immunization status is unknown or documentation not available, consider it as case of unimmunized
- Minimum interval between 2 doses should be more than 26 days
- Doses preferably given at minimum possible interval
- Any number of vaccines live/inactivated may be given on the same day, singly or in combination maintaining a gap of 5 cm
- BCG and measles/MMR should not be given on the same day
- OPV, rotavirus and typhoid vaccines may be given at any time in relation to any live/inactivated vaccine
- Serological testing not usually advised

Upper age limit for BCG is 1 year (IAP recommends up to 5 years), OPV is 5 years and DPT is up to 7 years. After 7 years we have to give Tdap or Td (Table 5). For vaccines like Hepatitis B there is no age limit.

Table 5: Catch up Vaccination Schedule

Visit	Suggested vaccines
First visit	— Measles (MMR if more than 12 month) — DTwP1/DTaP1 (Tdap if more than 7 yrs) —OPV1/IPV1 (only if less than 5 yrs) —Hib 1 (only if less than 5 yrs) — Hep B1
Second visit (1 month after first visit)	— BCG (only in less than 5 yrs) —DTwP2/DTaP2 (Td if more than 7 yrs) —OPV2 (if OPV is given earlier) —Hib 2 (only if less than 15 month) —Hep B2
Third Visit (1 month after second visit)	—OPV 3/IPV2 —MMR(if more than 12 month) —Typhoid(if more than 2 yrs)
Fourth visit (6 month after first visit)	—DTwP3/DTaP3(Td if 7 yr more) —OPV4/IPV B1 —Hep B3

Table 6: Catch Up Immunization in Adolescents (IAP)

Vaccine	Schedule
MMR	2 doses at 4–8 weeks interval
Hepatitis B	3 doses, 0,1,6 months
Hepatitis A	2 doses, 0,6 months
Typhoid	1 dose
Varicella	2 doses at 4–8 weeks interval
HPV	2/3 doses

Interval Between Two Vaccines

The interval between 2 doses of the same vaccine should be minimum of 26 days. At the same time there should be an interval of 4weeks between two live vaccine if they are not given on the same day. Table 6 showing interval between different (live or killed) vaccines.[1]

Table 7: Minimum Interval Between two Doses of Vaccines

Antigen combination	Recommended minimum interval
Two inactivated vaccines	May be administered simultaneously or at any interval between doses
Inactivated and live vaccines	May be administered simultaneously or at any interval between doses
Two live vaccines	28 days minimum interval if not administered simultaneously

Interchangeability of Brands

If previous brand is not known or no longer available, any brand may be used. The vaccination should not be delayed/cancelled. The brands of Hib, Hep B and Hep A may be safely interchanged. As far as possible vaccination with DTaP should be completed with the same brand.[6]

Immunization for Travelers

The immunization schedule of a country is based on the diseases prevalent in that particular area. In many western countries tuberculosis and poliomyelitis is not a major problem, so there is no BCG or OPV in their schedule. In India where Japanese Encephalitis is endemic (e.g., UP), JE vaccine is mandatory. Immunization for travelers depends on country and duration of stay. Auniform recommendation is not possible. General guidelines are given in Table 8.

Table 8: Immunization for Travelers

Travelers to India:
Typhoid, HAV, HBV, Varicella, Rabies and JE (JE endemic areas in JE season)

Travelers from India:
—Yellow fever (South Africa)
—Meningococcal meningitis (Haj pilgrimage)

Immunization in Pregnancy

All live vaccines are generally contraindicated. Measles, MMR and varicella vaccine can be safely given to contact of pregnant women.

Immunization in Lactation

All inactivated vaccines (conjugated, toxoid or subunit vaccines) are safe in breastfeeding women.

Although live vaccines multiply in the body of the mother, most pose no harm to the babies as they are generally not excreted in breast milk.

Rubella vaccine may be excreted in milk but does not infect the baby or if at all it causes mild asymptomatic infection. The only exception to live vaccine use is yellow fever vaccine.[7]

Vaccination in an Immunocompromised

Immunization in immunocompromised (IC) children is a unique and difficult situation. IC children are in greater need for immunization because they are more susceptible to infection. While the adverse effects with live vaccines are common and life threatening, the response to killed vaccine is low or ineffective. It is preferable to vaccinate an immunocompromised person and obtain a less-than-optimal response than to withhold the vaccine and obtain NO response.[1,8]

General Principles

Revaccination following Immunosuppressive therapy is not routinely needed because immunity to vaccine-preventable diseases established prior to immunosuppression is not lost because of the immunosuppression (except in HSCT recipients).

- Severe immunodeficiency—live vaccines contraindicated
- Inactivated vaccines—may be given but immunogenicity low
- Higher doses, more number of doses may be required (Hepatitis B)
- Antibody titers should be checked post-immunization
- Regular boosters may be needed
- Household contacts of IC should NOT receive transmissible vaccines such as OPV
- All household contacts should be fully immunized including varicella, rota and influenza to reduce risk of transmission
- Immunoglobulins (RIG, TIG, HIG) may be needed in some situations.

In severe B cell immunodeficiency

- All live vaccines contraindicated
- Inactivated vaccines may be given, but ineffective
- In less severe B cell immunodeficiency, only OPV contraindicated

In severe T cell deficiency

- All live vaccines contraindicated and all vaccines are not effective

Combined immunodeficiency: (Di George syndrome, Wiskott Aldrich syndrome, Ataxia -telengiectasia)

- Live vaccines contraindicated, inactivated vaccines may be given[9]

Complement deficiency

- All vaccines can be safely administered
- More prone to Hib, pneumococcal and meningococcal infections. So we have to administer all these vaccines

Phagocytic defect

- Live bacterial vaccines contraindicated. Live viral vaccine can be used

Secondary Immunodeficiency States

Commonest cause for secondary immunodeficiency state is use of corticosteroids. There is no immunosuppression if the dose of prednisone is <20 mg/day or less than 2 mg/kg in children. Also no immunosuppression with short course steroid of less than 2 weeks duration. Killed vaccines are safe but less efficacious.[1]

No live vaccine until 1 month after discontinuation of corticosteroids and better to assess individual vaccine responses.

Vaccines are safe and efficacious in the followingconditions where one will use low dose steroid like:

- Inhalation therapy
- Long-term, alternate day treatment
- Maintenance physiologic doses
- Topically (skin or eyes)
- Intra-articular, bursal injection

Vaccination after Treatment with Steroids

No live vaccine should be given until 1 month after discontinuation of corticosteroids. Always better to assess individual vaccine responses.

Vaccination of the Patient with Cancer/ Chemotherapy

All live vaccines should be avoided during and at least 3 months after chemotherapy and radiotherapy.

Vaccinate with varicella and MMR before initiation or >3–6 months after chemotherapy.

Solid Organ Transplant

- Immunize prior to transplant in accelerated schedule. Live vaccine—before 2 weeks[10]
- Document seroconversion
- In the post transplant all live vaccines are contraindicated
- Inactivated vaccines can be given after 6 months
- Annual influenza vaccine
- All household contact should be immunized against influenza and varicella
- Revaccination may be needed

Vaccination and Immune Modulators

- Children on colony stimulating factors, interferons, interleukins, cyclosporine, etanercept, tacrolimus-effects not elucidated
- Live viral vaccines avoided for 3 months of treatment

Low Dose Immunotherapy

No immunosuppression with low dose immunotherpay, e.g.:

- Methotrexate (<0.4 mg/kg/week)
- Azathioprine (<3.0 mg/kg/day)
- 6-mercaptopurine (<1.5 mg/kg/day)

Issues with HIV positive child

They are at increased risk of complications from infection. Many vaccines have impaired effectiveness. Risk of adverse events from live vaccines.[11] Loss of prior immunity (lack of CMI).

Vaccination in HIV Infected Children

- All killed vaccines can be administered
- Live vaccines: weigh the risks Vs benefits
- Vaccination safe and effective during early infancy
- Double the dose of vaccines like Hep-B and give extra doses if no seroconversion
- Check for seroconversion

In general practice, HIV will manifest after 6–9 months, before which we can administer all routine vaccines.

Asplenia, Sickle Cell Disease, Splenectomy

Risk of mortality from septicemia:

- Post-traumatic splenectomy: x 50
- Sicklecell disease, thalassemia: x 350

So all children undergoing splenectomy for thalassemia or hereditary spherocytosis should take vaccination against capsular organisms before 4 weeks or at least 2 weeks prior to surgery.[12]

Risk higher in younger (< 5y)

Vaccination initiated 2 wks prior to splenectomy

If not vaccinated before surgery, to be done when the child stabilizes

Need immunization with pneumococcal, meningococcal and varicella vaccine

Bleeding disorder

Unless contraindicated, subcutaneous route ideal

Aluminum adjuvanated (DPT, DT, TT, Hepatitis A and B, HPV, PCV) vaccines- schedule after replacement therapy

Use <23G needles

Apply firm pressure without rubbing

Immunization in Relation to Antibody Containing Products

- Antibody containing products and inactivated vaccines safely administered
- Live vaccines including measles containing vaccine and varicella avoided for 3 months

- If life vaccine given first then avoid antibody containing products for 2 weeks
- Rota virus vaccine avoided for 6 weeks

Interval between antibody containing products/ blood and time interval for live vaccines (MCV and varicella) given in Table 9.[13]

Table 9: Immunization in Relation to Antibody Containing Products

Product	Dose	Recommended interval
Tetanu IG	250 U IM	3 month
Hepatitis A	0.02 ml/kg	3 month
HBIg	0.06 ml/kg	3 month
Rabies IG	20 U/kg	4 month
Measles prophylaxis	0.25–0.5 ml/kg	5–6 month
Washed RBC PRBC Whole blood Plasma/platelets	10 ml/kg	Nil 6 month 6 month 7 month
IVIG	400 mg/kg 2 g/kg	8 month 10 month

Immunization for the elderly-the best gift to grandparents

- Annual influenza vaccine recommended for all above 60
- Pneumococcal (PCV followed by PPV23 single dose) vaccine to all above 65
- Hepatitis B vaccine to all if not vaccinated earlier

Tdap for Adults: Indications

- In all adults not immunized earlier
- Contacts with infants suffering from diphtheria or pertussis and last Td vaccine dose > 2 years ago
- Adults who are in close contact with infants
- Health care personnel
- During pertussis outbreak

Schedule of Tdap

- 0.5 ml IM, deltoid
- Primary: 3 doses; 0, 1, 6–12 months
- For contacts: Single dose 2 weeks before contact
- Outbreak: Single dose if 2 years or more have elapsed from the last Td vaccination
- Booster: Once every 10 years

Hepatitis B Schedule: API Guidelines

- 1 ml IM (deltoid) at 0, 1 and 6 months
- For patients with CKD and other immunosuppressed patients, 40 µg (2 ml) is administered at 0, 1, 2, and 6 month.
- Routine boosters not recommended except in immunocompromised who have lost detectable antibodies and persons who are at high risk of repeated inoculation, e.g. CKD patients requiring hemodialysis
- Anti-HBs levels should be maintained above 10 mIU/ml (for CKD 100 mIU/ml)

Hepatitis B- Non Responders with Normal Immunity

- Non-responders 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
- Postexposure prophylaxis: Single IM dose of hepatitis B immune globulin (HBIG) 0.06 ml/kg as soon as possible, followed by full course vaccination

Concurrently Administering Antimicrobial Agents and Vaccines

- Within limits, antimicrobial agents not contraindicated
- Withhold Ty21a typhoid vaccine, until 24 hours after antimicrobial
- Mefloquine affects immune response to oral Ty21a vaccine. So withhold Ty21, at least 24 hours

Anti Viral Agents and Vaccination

- Live attenuated influenza vaccine not to be administered until 48 hours after anti-influenza drugs.

- Antiviral medication not be administered for 2 weeks after live attenuated influenza vaccine administration.
- Antiviral drugs (acyclovir) reduce the efficacy of varicella vaccine. Discontinue for at least 24 hrs before varicella vaccine

Postexposure prophylaxis

Postexposure prophylaxis for certain diseases with vaccine and Immunoglobin are given below:[12]

Table 10: Postexposure prophylaxis for Certain Diseases with Vaccine and Immunoglobul

Disease	Vaccine	Ig
Measles	Vaccine within 72 hrs	In infants give Ig G 0.25 ml/kg within 6 days of exposure. Not needed in older children
Varicella	Vaccine within 72 hrs	VIG as early as possible
Hepatitis B	Unimmunized: start vaccination series Immunized: no treatment required	HBIG (0.06 ml/kg)
Hepatitis A	Vaccinate if ongoing exposure is likely	Give Ig as soon as possible
Tetanus	TT immediately	TIG immediately
Rabies	Vaccine immediately	Ig immediately

Summary

- Vaccines are the most costeffective health tool available
- Vaccination schedule vary from country to country and from time to time and with different clinical scenarios
- Immunization schedule, dose, etc. will vary according to immunosuppressed, HIV, bleeding child and clinical situations. So get an expert opinion before vaccinating them
- Regular updates and education to treating physicians should be done regarding vaccines and special situations in vaccination
- Vaccination is not contraindicated during minor illnesses
- Beware of anti-vaccine propaganda

The best way to get more than 90% immunization coverage is to make

"Compulsory immunization card before school admission"

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