Childhood vaccination - Part 1

Passive and Active Vaccination

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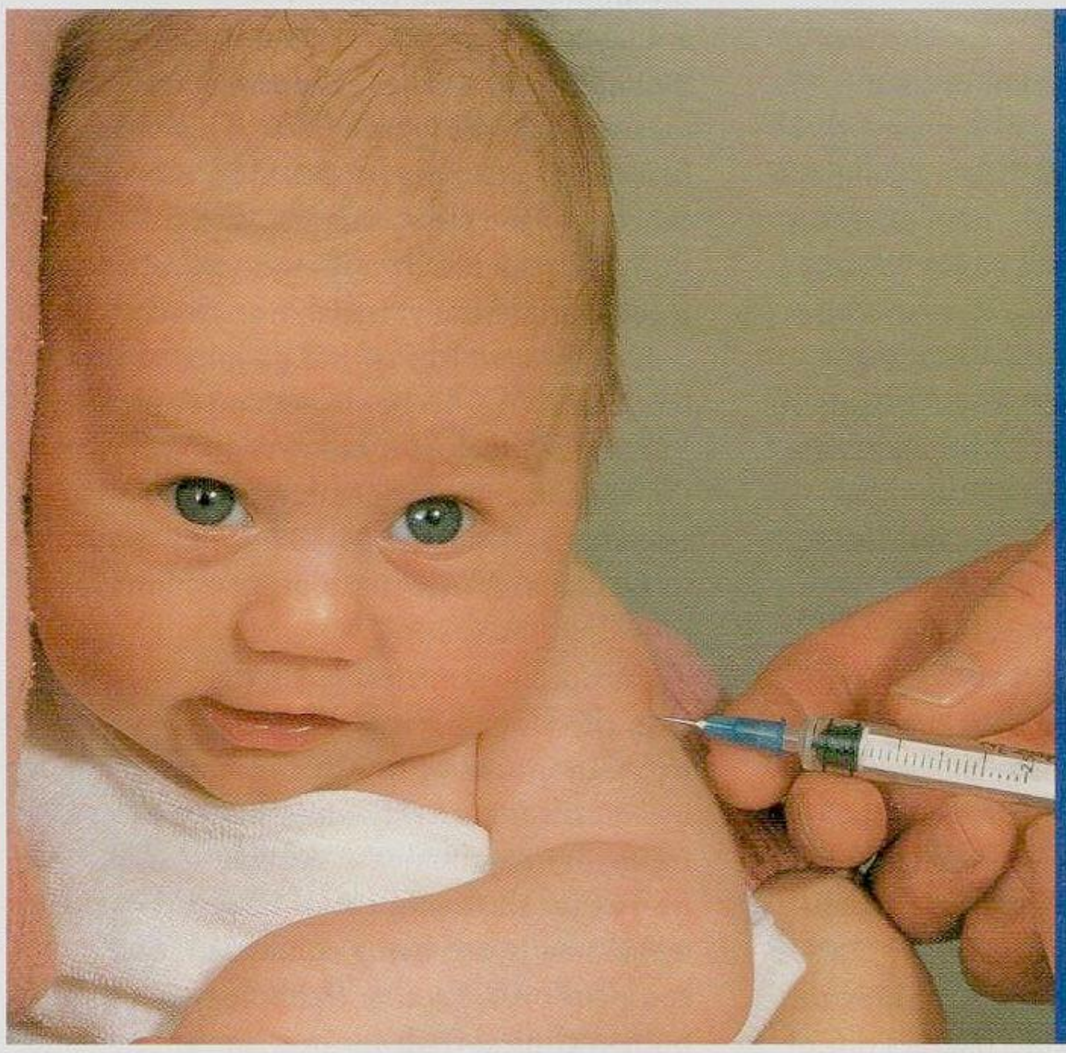

Vaccination in the upper arm of a 10 week-old baby girl. Vaccines that provide protection against many infectious diseases are available to babies and young children as part of their recommended immunization schedule.

Vaccination of two types: Passive vaccination & Active vaccination. A vaccine is a suspension of attenuated (live) or inactivated (killed) micro-organism or fractions thereof, administered to induce immunity and thus prevent infectious diseases. It may be a single-component or mixed combined vaccine. The basic principle of vaccination is that a disease-causing agent is given to a person in a killed or weakened form (or in the form of proteins genetically engineered to look like a disease-causing agent), in order to stimulate the production of antibodies to fight off the disease.

Introduction

Before vaccines became widely available, many infectious diseases like measles, mumps, and whooping cough, etc. were common in childhood, and thousands died or were left blind, deaf, or brain-damaged by them. Today, vaccines have totally or nearly eradicated several diseases, such as smallpox, diphtheria, polio, and Hib infections, according to the national Centers for Disease Control and Prevention. However, other diseases persist, mostly in unvaccinated babies and toddlers: some infectious diseases are nearly epidemic in communities with low vaccination rates. That's why you should take these diseases seriously and recommend that your patients protect their children through immunizations.

Immunization as a method to prevent disease forms an important constituent of a health care situation and a number of communicable diseases can be combated by timely immunization. There are possible side effects and complications associated with vaccination, but they can be minimized by considering contraindications. Some parents do not immunize their children because they fear a serious reaction from a vaccine. Typically, reactions to vaccines are very minor. In general, the benefits far outweigh the risks.

In order to understand vaccination properly, it is important to have a rapid understanding of immunity and its different types.

Immunity is concerned with the specific mechanisms by which living tissues react to foreign biological materials (including invading microorganisms) so that resistance or immunity develops. It is of two types:

Natural Immunity	Species Immunity	
	Racial Immunity	
	Individual Immunity	
Acquired Immunity	Active	- Natural
		- Artificial
	Passive	- Natural
		- Artificial

The terms vaccination and immunization are often used synonymously and interchangeably. Vaccination is strictly only the administration of vaccines, while immunization is providing immunity by using any type of biological agent.

Vaccination is concerned with the acquired immunity, which is divided into two types: active and passive.

A- Passive vaccination:

Administration (IM or IV injection) of prepared antibodies to enhance the patient's immune competence. Protection depends on the serum half-life of the injected antibody and is limited to several weeks to several months for each administration (human sera). Passive vaccination is useful for:

Table 1 Some materials available for passive immunisation

Illness	Vaccine	Rationale*
Intramuscular		
Black widow spider bite	Black widow spider antivenom (equine)	Prophylaxis, therapy
Hepatitis B (HBV)	Hepatitis B immune globulin (HBIG).	Prophylaxis
Diphtheria	Diphtheria antitoxin (equine)	Prophylaxis, therapy
Measles	Immune globulin IM (IGIM)	Prophylaxis, therapy
Varicella	Varicella-zoster Immune globulin (VZIG)	Prophylaxis and therapy in immunocompromised individual
Tetanus	Tetanus Immune globulin (TIG)	Prophylaxis
Hypogammaglobulinemia	IGIM	Therapy for antibody deficiency
Snakebite	Polyvalent antivenom (equine)	Prophylaxis, therapy
Intravenous		
Hypogammaglobulinemia	Intravenous immune globulin (IVIG)	Therapy for antibody deficiency
Chronic lymphocytic leukemia	IVIG	Therapy for antibody deficiency

*Food and Drug Administration (FDA)-approved uses; many others currently in trials.
Notes: Passive immunotherapy or immunoprophylaxis should always be administered as soon as possible after exposure to the offending agent. Immune antisera and globulin are always given intramuscularly unless otherwise noted. Always question carefully and test for hypersensitivity before administering animal sera.
In general, administration of live virus vaccines should be delayed at least 2 months after passive immunization with pooled human gamma globulin preparations.

1- individuals unable to form antibodies (e.g., congenital agammaglobulinemia)
2- prevention of disease when time does not permit active immunization (e.g., postexposure).
3- treatment of certain diseases normally prevented by immunization (e.g., tetanus).
4- treatment of conditions for which active immunization is unavailable or impractical (e.g., snakebite).

B- Active vaccination:

Administration (intramuscular, subcutaneous, intradermal, or oral) of one or more antigens designed to stimulate the immune system to produce specific immune response. This response generates antibody, activated T cells, and specific memory. Protection through memory varies with the vaccine, but immunity is long-lasting.

Active vaccinations is generally preferable to passive vaccination, because host resistance is better (higher levels of antibody present at the time of exposure; co-existing cellular immunity in some cases) and the procedure need not be repeated as frequently. However, active vaccination is associated with complications that do not occur with passive vaccination, largely related to administering foreign proteins (e.g., allergy, nonspecific toxic reactions).

The onset of protection with active immunization is slower than passive immunization but lasts for many years or even for life.

Vaccination aims can be summarized as follows:

Vaccination (the administration of vaccines)
↓
Produces Or Enhances
↓
Immunization (Antibodies)
↓
To fight off the disease

The following recommended immunization schedule is based on the schedule published on January 15, 1999 (MMWR 1999;48(01):8-16) and the schedule of the AAP as of August 1999.

This schedule is subject to change, and so, if you look at different medical and childcare books, you may see slightly different schedules. Changes include the addition of a new vaccine for Haemophilus influenzae B, the addition of the hepatitis B vaccine to the schedule, and the addition of a second dose of MMR at entry to primary or middle school, in response to an increased incidence in measles among teenagers, and the addition of the chickenpox vaccine to the schedule.

The FDA approved several new vaccines in 1993: a combination of Haemophilus influenzae B vaccine and DTP vaccine, and a new dosage for the hepatitis B vaccine. In 1992, a new acellular pertussis vaccine was approved. In 1995, the varicella zoster (chickenpox) vaccine was approved. On July 12, 1996, ACIP recommended that this vaccine be added to the schedule. The newly approved hepatitis A vaccine was *not* added to the schedule; this vaccine was recommended only for people at particular risk, such as travelers to countries where hepatitis A is more prevalent (more recently, it has been recommended in states where hepatitis A is particularly prevalent). In 1996, an acellular pertussis vaccine was approved for the earlier shots in the pertussis series (previously it had only been approved for the fourth and fifth shots), so that it is now the preferred vaccine for all shots.

As a result of progress in the global eradication of polio; in 1997, ACIP recommended that the first doses of polio vaccine use the inactivated polio vaccine (IPV) rather than the oral polio vaccine (OPV). In January, 1999, the AAP recommended that all doses use IPV, and on June 17, 1999, the ACIP followed suit (this new ACIP recommendation became effective on January 1, 2000). Rotavirus vaccine was added to the schedule at 2, 4, and 6 months, after its approval on August 31, 1998, but on July 7, 1999, this recommendation was suspended, pending collection of further data, based on early surveillance reports of intussusception (a type of bowel obstruction), and on October 15, 1999, the vaccine was withdrawn from the market.

Table 2 Recommended schedule for active vaccination for infants and children:

Commonly administered (FDA)-Approved active vaccines. (DTP= diphtheria and tetanus toxoids and pertussis vaccine; DT=diphtheria and tetanus toxoids; Td=tetanus and diphtheria toxoids, adult type; and T=tetanus toxoid.)[1]

Vaccine	Target Population*	Route of Administration	Duration of Effect	No. of Vaccinations	Schedule	Notes
Live, attenuated viral						
Oral polio (OPV; trivalent)	Infants, children, health and day care workers	Oral	Permanent	4	2, 4, 15-18 months; one at school entry	Approximately 1 in 2.6 million risk of vaccine -induced paralysis
Measles, mumps, rubella (MMR)	Infants, children	Subcut	Permanent	2	15 months (<12 months if high risk); one at school entry	Generally affords lifelong immunity
Rubella	Adolescent girls not previously vaccinated	Subcut	Permanent	1	Postpuberty	Protects future fetus from congenital rubella injury
Bacterial						
BCG tuberculosis	Persons exposed to sputum-positive tuberculosis patients	Intradermal or Subcut (per manufacturer's recommendation)	? Permanent[4]	Varies	Depends on success of initial vaccination	Unpredictable effectiveness; induces cell-mediated immunity
Killed, inactivated viral						
Influenza (tri- or polyvalent)	Geriatric patients, health care workers, those at risk for complications of flu	IM	1-3 years	1/year	Annually for maximal protection	Variant strains may appear each year; vaccine must be updated annually
Hepatitis B (HBV)	Newborn of carrier mothers, preadolescents	IM	Years	1 with boosters	Booster every 5 years for those with continuing risk	HBsAg from plasma of chronic carriers; routine infant vaccination now approved
Inactivated polio (IPV; trivalent)	Immunodeficient children and families; as booster in health and day care workers	IM	2-5 years perhaps longer	4	2, 4, 15-18 months; one at school entry	No sIgA; thus, reduced protection; no paralysis risk
Rabies (HDCV)	Animal care workers	IM	Unknown probably >2 years	4 or 5+ with boosters	7 days apart; boosters as required to maintain immunoglobulin (Ig)	Two doses to exposed, already immune individual
Bacterial						
Diphtheria, tetanus, pertussis (DTP)	Infants, children	IM	10 years[2,3]	4 with boosters	2, 4, 15-18 months; one at school entry	Tetanus toxoid (Td) booster every 10 years or on exposure through a wound
Tetanus and diphtheria toxoids (Td)	Children 7 years or older, adults with no vaccination	IM	10 years[2,3]	3 with boosters	Second dose in 4-8 weeks; third dose 6 months later	Td booster every 10 years or on exposure through a wound
Haemophilus b (Hib)	Infants, children, HIV-infected adults	IM	Uncertain	Depends on formulation	Depends on formulation	Polysaccharide capsule is poor antigen; conjugate vaccines enhance potency
Pneumococcus (polyvalent)	At-risk adults or children 2 years or older (e.g., immunocompromised patients, geriatric patients)	Subcut, IM	Uncertain probably at least 5 years	1 or 1/year	As necessary in at-risk patients; not given during active infection; 1/year in geriatric patients	Poor response polysaccharide antigen in children younger than 2 years old
Subunit						
Recombinant HBV	See hepatitis B	IM	Years	See hepatitis B	See hepatitis B	Generally interchangeable with plasma-derived vaccine

BCG = bacille Calmette-Guerin; HBsAg = hepatitis B surface antigen; HDCV = human diploid cell vaccines; HIV = human immunodeficiency virus; sIgA = secretory immunoglobulin A.

* Entire target population is not listed in all cases + Five doses to already exposed individuals

Notes:

[1] Dosages for the specific product, including variations for age, are best obtained from the manufacturer's package insert. Immunizations should be given by the route suggested for the product. [2] A single dose is a sufficient booster at any time after the effective duration of primary immunization has passed. [3] For contaminated or severe wounds, give booster if more than 5 years has elapsed since full immunization or last booster. [4] Test for PPD conversion 2 months later and reimmunize if there is no conversion.

Table 3 Recommended immunization schedule

Vaccine	Birth	2 months	4 months	6 months	12 months	15 months	18 months	4-6 years	11-12 years	14-16 years
Hepatitis B	HB-1	HB-2			HB-3					
Diphtheria, tetanus, pertussis		DTaP	DTaP	DTaP		DTaP		DTaP	DT	
H influenza type b		Hib	Hib	Hib	Hib					
Poliovirus		IPV	IPV		IPV			IPV		
Measles, mumps, rubella					MMR			MMR		
Varicella (Chicken pox)						Var				

Notes:
(1) At 11-12 years, hepatitis B, MMR, and Varicella vaccines to be assessed and administered if necessary.
(2) Hepatitis B vaccine schedule in infants depends on the mother's hepatitis B surface antigen status; where this status is positive or unknown, hepatitis B vaccination is recommended within 12 hours of birth, but where this status is negative, the vaccine may be given at any time between birth and 2 months.
(3) Three different Hib conjugate vaccines are licensed. Depending on which is used, the dose at 6 months may or may not be required.
(4) As of July, 1999, the AAP recommended a temporary delay (until thiomersal-free Hepatitis B vaccine is available), for children of Hepatitis B surface antigen negative mothers, in the first shot, to six months. The CDC continues to recommend that the shot be given at from 2-6 months. As of September, 1999, a hepatitis B vaccine without thiomersal has become available, so, as supplies of this vaccine are distributed, the temporary delay should come to an end.
(5) In 1999, ACIP recommended hepatitis A vaccine for all children aged 2 years and older in the 11 Western states where incidence is especially high. (Not added - For travelers).

The second part of this article on Childhood Vaccination will deal with Combination vaccines and issues relating to the use and administration of vaccines.

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Eye Health and age

Many problems with vision can be related to old age and develop as part of the ageing process. Some diseases can become serious and affect vision, but most diseases do not produce any symptoms or pain so early diagnosis and treatment is the cornerstone to prevent blindness. As a result, the eye should be screened regularly to detect any problems before they become exaggerated in order to prevent any loss of vision.

Common eye problems with age

Presbyopia: An age-related loss in the ability to see close objects; in most cases, corrected with glasses.

Floaters: Tiny spots that float across the field of vision; in most cases, the eye is normal but it may be a sign of danger.

Cataracts: Clouding of the lens of the eye, which leads to blurred vision and loss of eyesight; it can be solved or corrected by surgery.

Glaucoma: an increase of pressure in the eye, which can lead to tunnel vision and blindness.

Diabetic retinopathy: most common complication experienced by diabetics in which the blood vessels stop delivering blood to the retina properly, which affects eyesight and can lead to blindness. This complication is associated with poor diabetic control and increased blood sugar.

Who should be screened

People between age 20-29 should have an eye examination at least once during this time period, which includes retina examination and dilation of the pupils, with an Ophthalmologist.

People aged 40-64 should have an eye examination every two years.

People aged 65 and over should have an eye examination every year.

During an eye examination, the specialist can do some tests on visual acuity or how sharp the vision is, evaluate the eye muscles, the pupils' response and the fluid pressure inside the eye, and assess the intraocular structure.

Pharmacists should encourage patients to have regular eye examinations, especially in older age.