WHO/V&B/01.29
ORIGINAL: ENGLISH
DISTR.: GENERAL

Haemophilus influenzae type b immunization

Introducing Haemophilus influenzae type B (Hib) conjugate vaccine into national immunization services

Background

The bacterium, *Haemophilus influenzae* type B (Hib), is an important cause of infections in infants and young children; severe disease in adults due to Hib is uncommon. Where it has been studied carefully, Hib is typically the leading cause of acute bacterial meningitis in infants and children less than five years old, accounting for one-third to one-half of all cases of bacterial meningitis in this age group. Bacterial meningitis is fatal unless treated immediately with antibiotics. Even with proper treatment 3-25% of affected children may die. Permanent disability with sequelae that include deafness, learning disabilities, and difficulties in movement is not uncommon among those who survive infection. Studies have also shown that Hib accounts for up to one-quarter of the severe pneumonia cases in young children in developing countries. WHO estimates that without vaccination 400 000 children die each year of Hib disease.

Safe and effective vaccines against Hib infections exist. These vaccines have been routinely used to vaccinate infants in many countries for over 10 years. The experience with these vaccines has shown that they are very safe and highly effective for preventing severe Hib disease, including meningitis and pneumonia.

Studies have shown that vaccination reduces the risk of invasive Hib disease in young children by >90%, and in some cases, has even led to protection of unimmunized populations by "herd immunity".

Since 1998, WHO has recommended that Hib conjugate vaccine be included in routine infant immunization services in all countries where the resources permit its use and the burden of disease is established. This document provides an outline of information needed to implement a national decision to introduce Hib vaccine, with a particular focus on issues relevant to countries applying for support for the introduction of Hib vaccine from The Vaccine Fund.

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2001

Objectives

The primary objective of Hib immunization strategies should be to prevent severe Hib disease in infants and young children because nearly all severe Hib disease occurs in children less than five years of age, and the majority of the deaths occur among infants.

Immunization strategies

Universal infant immunization. Immunization of all infants through routine services is the highest priority for all countries. This strategy has been proven effective in many areas.

Catch-up vaccination of older children. (Note: The Vaccine Fund does not provide funding to purchase vaccine for catch-up vaccination.)

Children aged greater than 12 months can be protected with just a single dose of Hib conjugate vaccine. At the time of introduction, some countries have chosen to conduct one-time national campaigns to vaccinate all children 1 to 5 years of age with a single dose of Hib conjugate vaccine. This approach may provide some protection to older children but should be undertaken only if it does not draw resources away from infant immunization. Because the risk of Hib disease falls sharply after age 5 years, vaccination of persons older than age 5 years should not be undertaken.

Vaccine formulations

Hib conjugate vaccines are available in several different formulations. They can be obtained as a liquid or freeze-dried powder (lyophilized), in single or multi-dose vials, and as monovalent vaccines (Hib conjugate vaccine only) or in combination with other routine vaccines (e.g. DTP, DTP-hepatitis B).

The currently available pentavalent vaccine requires the reconstitution of lyophilized Hib conjugate vaccine with liquid DTP-hepatitis B vaccine. In this instance, *the Hib vaccine should be reconstituted **only** with the DTP-hepatitis B vaccine produced by the same manufacturer*. Similarly, there is at least one DTP-Hib combination that requires the reconstitution of the lyophilized Hib conjugate vaccine with liquid DTP vaccine, and *the Hib vaccine should be reconstituted **only** with the DTP vaccine produced by the same manufacturer.*

Combination vaccines that contain Hib conjugate vaccine:

- can be used anytime all of the antigens in the vaccine are indicated by the schedule;
- cannot be used before 6 weeks of age (e.g. for the birth dose of hepatitis B vaccine) because the immunogenicity of the DTP and Hib components will be reduced if given before this age.

Schedule

Immunization of infants with Hib conjugate vaccine is usually accomplished by giving the vaccine at the same ages as DTP vaccine, either as a separate injection or in combination. In general, infants should receive a primary dose schedule of 3 doses of Hib conjugate vaccine in the first year of life. Doses of Hib conjugate vaccine should be administered at least 4 weeks apart. Children older than one year of age require only a single dose of Hib conjugate vaccine. Booster doses of Hib conjugate vaccine may be given to children in the second year of life, but successful control of Hib disease does not require a booster dose.

Administration

Hib conjugate vaccine is administered by intramuscular or subcutaneous injection in the anterolateral aspect of the thigh (infants) or the deltoid muscle (older children). It can be given safely at the same time as other vaccines such as DTP, polio, hepatitis B, measles, BCG, and yellow fever vaccines. If given as a combination with DTP in the same syringe, it should be given intramuscularly.

Injection equipment

The injection equipment for Hib conjugate vaccine is the same type as that for DTP or hepatitis B:

- 0.5 ml (auto-disable), 1.0ml or 2.0ml syringe
- 25mm, 22 or 23 gauge needle

Sterile auto-disable (AD) injection devices are recommended.

Dosage

The standard paediatric dose is 0.5 ml.

Vaccine procurement

In most countries, Hib conjugate vaccine procured through The Vaccine Fund will be supplied through the UNICEF procurement mechanism.

The number of Hib conjugate vaccine doses required is estimated using the size of the birth cohort, the coverage rate for DTP and the number of doses in the immunization schedule. These calculations should also include wastage and the size of the reserve stock.

Presentation

Hib conjugate vaccines are generally available in single-dose and multi-dose (2 and 10 dose) vials, and in liquid and lyophilized formulations.

Storage and shipping volume

Storage volumes (vial plus packet containing the vial plus any other packaging) for some available vaccines are:

- 32.3 cm^3 per dose for liquid Hib in single-dose vials,
- 9.7 cm^3 per dose for lyophilized Hib in single-dose vials,

(Diluent for freeze-dried vaccines doubles the necessary storage space at the health centre level.)

- 13.8 cm^3 per dose for liquid Hib or DTP-Hib vaccine in 10 dose vials,
- 9.7 cm^3 per dose for DTP-HepB-Hib vaccine in 2 dose vials.

For comparison, the WHO standard storage volumes for DTP vaccine are 2.5 cm^3 per dose in 20 dose vials and 3.0 cm^3 per dose in 10 dose vials.

Cold chain issues

The storage temperature for Hib conjugate vaccines is the same as for DTP and hepatitis B vaccines, from 2°C to 8°C.

Adding Hib conjugate vaccine to the national immunization programme will require:

- an assessment of cold chain storage capacity and cold chain procedures at all administrative levels; and,
- development and implementation of plans to modify cold chain storage capacity and cold chain procedures, if needed.

Monitoring and reducing vaccine wastage

Monitoring vaccine wastage becomes increasingly important as the costs of the vaccine rise. Monitoring increases ordering accuracy and reduces wastage by providing reliable data for estimating the number and size of vials to be ordered.

It also serves as a tool for improving the practices of health centres when wastage rates are found to be unacceptably high.

Strategies to reduce vaccine wastage include the following:

- careful planning of vaccine ordering and distribution;
- use of both single-dose and multi-dose vials ;
- careful maintenance of the cold chain;
- implementation of WHO's multi-dose vial policy, when appropriate.

Injection safety

Hib conjugate vaccine procured through The Vaccine Fund will be supplied with auto-disable syringes and safety boxes. Additional disposable syringes will be needed for lyophilized vaccines that require reconstitution. Managers at each level are responsible for ensuring that adequate supplies are available at all times. Attention should also be given to the proper use and disposal of the safety boxes used to collect these materials.

Revision of reporting forms and training materials

An important element of integrating Hib vaccination into national immunization services is to revise training and informational materials, forms used to monitor and evaluate the programme, and vaccination cards.

Information, education, and communication needs

When introducing Hib conjugate vaccine into national immunization services, information, education and communication (IEC) efforts are important from the beginning in order to generate support and commitment for the new vaccine and to assure that the vaccine is appropriately handled and administered. The primary target audiences for IEC efforts are decision-makers/opinion leaders, health care staff, and the general public (including parents).

What information is needed to assess Hib disease burden?

Various tools are available from the WHO regional office which use existing local and regional data to estimate the burden of Hib disease. As a result, disease burden studies will not be needed in most countries.

How should Hib conjugate vaccine be phased into the existing infant immunization services?

The easiest way to introduce Hib conjugate vaccine is to simply begin vaccinating each infant that comes for routine DTP vaccination. Some countries may wish to consider one-time catch-up vaccination of older children (<2 years or <5 years of age). This will lead to a more immediate reduction in Hib cases but will be more expensive and somewhat more complicated to achieve.

Which type of Hib conjugate vaccine is most suitable?

The following issues should be considered when planning for the procurement of Hib conjugate vaccine:

- the existing immunization schedule and planned Hib conjugate vaccine schedule;
- the proper mix of monovalent/ combination vaccines in single/ multi-dose vials;
- formulation (lyophilized vs. liquid);
- total number of injections per visit;
- impact on local vaccine production; and
- cost.

Use of combination vaccines may offer certain programmatic advantages. These include:

- a decrease in the number of injections required per visit (and thus decrease the number of auto-disable needles and syringes required); and
- a decrease in the amount of space required for cold chain storage and transport.

How can the addition of Hib conjugate vaccine be used to strengthen the national immunization services?

The introduction of Hib conjugate vaccine into the routine services should be used as an opportunity to strengthen the existing services. Programme elements that need particular attention for the introduction of Hib conjugate include stock management, reducing vaccine wastage, and injection safety. Also, the introduction of this new vaccine against serious childhood illness represents an opportunity to renew community interest in all routine vaccinations.

Budgeting for Hib conjugate vaccine introduction

Capital and recurrent costs related to the introduction of Hib conjugate vaccine should be estimated and included in the annual EPI budget. Additional capital costs might include: investment in means of transport, cold chain equipment and sterilization equipment. Investment in an information campaign targeted at the general public should also be included. Additional recurrent costs include: vaccines, auto-disable injection devices, salaries, transportation (petrol and maintenance), training, cold chain maintenance, safe disposal of waste, disease surveillance and other supplies, such as laboratory media and stationery.

Ordering code: WHO/V&B/01.29
Printed October 2001

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