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Introduction of Pentavalent Vaccine in Universal Immunization Programme in Sikkim

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Abstract

Immunization is considered to be one of the most cost-effective public health interventions that has delivered excellent results in providing direct and effective protection against preventable childhood diseases such as tuberculosis, hepatitis B, poliomyelitis, diphtheria, pertussis, tetanus and measles. Pentavalent vaccine provides protection to a child against 5 life-threatening diseases – Diphtheria, Pertussis, Tetanus, Hepatitis B and Hib. DPT (Diphtheria + Pertussis + Tetanus) and Hep B are already part of routine immunization in India; Hib vaccine is a new addition. Together, the combination is called Pentavalent. Hib vaccine can prevent serious diseases caused by *Haemophilus influenzae* type b like pneumonia, meningitis, bacteraemia, epiglottitis, septic arthritis etc. Giving pentavalent vaccine reduces the number of pricks to a child, and provides protection from all five diseases. The pentavalent vaccine will replace the current Hepatitis B and DPT primary

vaccination schedule in the immunization programme first dose in 6 weeks, second dose in 10 weeks and third does in 14 weeks. Additionally, Hepatitis B birth dose will continue as before, in institutional birth within 24 hours of birth. DPT boosters at 16-24 months and 5-6 years will continue as before.

Keywords: Immunization,DPT,Pentavalent vaccine, Hepatitis B,Haemophilus influenza type b

Introduction

Following the WHO recommendation, India introduced six vaccines under the Expanded Program of Immunization (EPI) in 1978 to reduce child mortality. (Bacillus Calmette-Guerin (BCG), TT, DPT, DT, polio, and typhoid) in its EPI. Subsequently, in 1985 the Indian government included Measles vaccination and launched the Universal Immunization Programme (UIP) and a mission to achieve immunization coverage of all infants and pregnant women by the 1990's [1,2]. Kenya was the first country to introduce the pentavalent vaccine with the support of Global alliance for vaccines and immunization (GAVI) in 2001. WHO recommended in 2006 that Hib vaccines be included in all routine infant immunization programmes. Pentavalent vaccine under UIP was introduced in India first in the states of Tamil Nadu and Kerala in December 2011 [3]. The vaccine was subsequently introduced in a phased manner in all states and union territories of India. The launch of pentavalent vaccine in Sikkim on 7th October 2015 under UIP, aims to immunize children against Diphtheria, Pertussis, Tetanus, Hepatitis B and Haemophilus influenzae type b (Hib), The three pentavalent injections will replace the existing six injections of DPT and Hepatitis B. The vaccine not only limits the number of shots but also takes care of the increasing menace of Hib [4-6].

Haemophilus influenza- an upcoming cause of infant mortality

Haemophilus influenzae type b , a bacterium, is estimated to cause approximately 8.1 million cases of serious Hib diseases, and an estimated 371,000 deaths globally in the year 2000 [7]. In India, Hib is one of the leading causes of meningitis and pneumonia in children less than 5 years old. According to WHO estimates, 2.4 to 3.0 million cases of Hib disease occur annually in the country with total deaths estimated to be at 72,000 [5,7]. Hospital based

studies in India show that Hib contributes 40-50% of all meningitis and 25-30% of all pneumonia cases. Hib is the most common cause of meningitis and the second largest cause of pneumonia (after *Streptococcus pneumoniae*) in India. The case fatality ratio for the Hib meningitis and pneumonia is in the range of 10-30%. In addition to mortality, Hib causes a substantial morbidity burden with 25-30% of Hib meningitis survivors suffering from long term neurological sequelae [5]. Hib disease is a common infectious disease which can lead to serious morbidity and also mortality in pediatric age group Hib is a leading cause of bacterial meningitis among infants (357/100,000) and young children (0–4 y; 86/100,000) with case fatality ranging from 20 to 29%. Nearly 30% survivors of Hib meningitis suffer from major disabilities. A study estimated 72,000 deaths per year due to Hib dis [8-10].15-21. According to the National Technical Advisory Group on Immunization (NTAGI) subcommittee on Hib, there were an estimated 72,000 deaths attributable to Hib diseases. Under-five mortality figures [11] estimate that in India, 1,726,000 children die before reaching their fifth birthday in 2009. Using these two estimates, Hib associated deaths are 4% $[(72,000 / 1,726,000) * 100]$ of all under-five [12] .

Immunizing formulation

Hib vaccines are available in different formulations of liquid or lyophilised (dried powder), stand-alone (monovalent) and combination (DPT+Hib, DPT+HepB+Hib). The Hib vaccines in various formulations are licensed in India for almost a decade and widely used in the private sector. Under the National Immunization Programme the liquid pentavalent vaccine (LPV) having 5 antigens (DPT+HepB+Hib) in a single formulation was introduced. The liquid pentavalent vaccine (LPV) in the UIP is available as a multi-dose vial (10 doses) [13,14].

Cold chain management

The storage volume of pentavalent vaccine in 10 dose vials is approximately the same as currently used DPT or HepB vaccine in similar presentation. Hence, there would not be any additional cold chain space requirement, while introducing the pentavalent vaccine. It is stored at temperature of 2-8 degree Celsius, in the basket of Ice-Lined Refrigerator (ILR) and should never be frozen. Conditioned ice packs should be used during transportation to

to prevent freezing [15].

Vaccination schedule and ‘Phasing in’

During the initial months of pentavalent vaccine introduction, only those children who are coming for the first dose of DPT will be administered pentavalent vaccine. Infants who have already received either their first or second doses of DPT & Hep B (i.e., DPT1/HepB 1 or DPT2/HepB 2) will complete the schedule with DPT & HepB only. This is called 'Phasing in' of pentavalent vaccine in UIP[16].

The dose of pentavalent vaccine is 0.5 ml. The route of administration of pentavalent vaccine is the same as DPT vaccine. This is a liquid vaccine therefore, is used directly from the vial and given by intramuscular injection in the antero-lateral aspect of the mid-thigh in infants. Current scientific evidence suggests that protection is lifelong. A booster dose is not recommended in India [17].

As with other vaccines, severe allergic reactions and children with moderate or severe acute illness remains the major contraindications for administration of pentavalent vaccine:

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Adverse events following immunization

Pentavalent vaccine has not been associated with any serious adverse effects. However, redness, swelling and pain at the site of injection may occur in as many as 25% of those who have been vaccinated. Such reactions usually start within 1 day after immunization and last for 1–3 days[2]. Less commonly, children may develop fever or can become irritable for a short period.

Immunogenicity, efficacy and effectiveness

Pentavalent vaccine is safe and efficacious. It provide 85% to 95% protection after completion of the schedule. The vaccination reduces nasopharyngeal colonization – or carriage – of the organism, leading to substantially greater reduction in disease transmission

and incidence than can be directly attributed to the effects of the vaccine [18]. This indirect effect or 'herd immunity' has been demonstrated in several post introduction effectiveness studies.

Immunogenicity, Safety and Efficacy of Pentavalent Vaccine

Various immunogenicity studies have been performed in India, and have shown that immunogenicity against each of the vaccine component and reactogenicity is same as that of simultaneous but separate site administration of DPT, Hep B and Hib vaccines.²³⁻²⁴ In a study from India, on post-primary immunization with Serum Institute of India's (SII) and GSK's pentavalent vaccine, 100% seroprotection was detected for diphtheria, tetanus, hepatitis B and Hib components in both SII and GSK groups and for pertussis, efficacy was 96.1% in SII group and 95.4% in GSK group.²³ The vaccines have excellent tolerability profile with only minor adverse events^[19,20]. All the infants who reported common systemic reactions i.e., fever, irritability and unusual crying, recovered with symptomatic treatment. No vaccine-related neurological [21].

Open Vial Policy

The Government of India adopted the Open Vial Policy for pentavalent vaccine in UIP and the policy guideline was issued in October 2011. This policy is being followed for pentavalent vaccine in Kerala and Tamil Nadu. The Open Vial Policy for pentavalent vaccine will be implemented in all other states introducing this vaccine. Additionally, Open Vial policy in India is also recommended for institutional set up for Hepatitis B birth dose and Oral Polio Vaccine zero dose (OPV-0) since May 2011.




Scope

The use of pentavalent vaccine automatically raises the coverage level of hepatitis B and Hib vaccines. If the vaccines are provided individually, the coverage of hepatitis B and Hib vaccines usually lags behind DPT coverage. This gap can be filled by using pentavalent vaccine in routine immunization programs [22-24]. This will help India in combating a large but preventable burden of Hib disease as well as hepatitis B and achieving Millennium Development Goal 4 of reducing child mortality.

Current Immunization Schedule in India

AGE	VACCINES
Birth	BCG,OPV -0(within 15 days) Hepatitis B(within 24 hours)
6 weeks	(DPT-1 +Hep B-1) +OPV-1
10 weeks	(DPT-2 +Hep B-2) +OPV-2
14 weeks	(DPT-3 +Hep B-3) +OPV-3
9 months	Measles-1,JE-1 (wherever applicable)
16-18 months	DPT booster-1,OPV-Booster,Measles -2,JE-2(wherever applicable)
5-6 years	DPT-Booster-2

Post Pentavalent Introduction UIP schedule in India

AGE	VACCINES
Birth	BCG,OPV -0(within 15 days) Hepatitis B(within 24 hours)
6 weeks	(DPT-1 +Hep B-1) +OPV-1  Penta-1 +OPV-1
10 weeks	(DPT-2 +Hep B-2) +OPV-2  Penta-2 +OPV-2
14 weeks	(DPT-3 +Hep B-3) +OPV-3  Penta-3 +OPV-3+IPV
9 months	Measles-1,JE-1 (wherever applicable)
16-18 months	DPT booster-1,OPV-Booster,Measles -2,JE-2(wherever applicable)
5-6 years	DPT-Booster-2

Summary

The introduction of Pentavalent vaccine in the Universal Immunization Programme (UIP) in India would prevent the morbidity and mortality associated with Diphtheria, Pertussis, Tetanus, Hepatitis B but also Hib disease .It has been estimated that control of Hib related diseases would reduce U5MR by 4 percentage point. The reduction in child mortality will play a vital role for India to achieve its national and international child health related goals.

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