INFECTIOUS DISEASES AND IMMUNISATION

IN HONG KONG CHILDREN

by

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Introduction

Paediatricians should always advocate "Prevention Better than Cure". One of the effective ways of prevention of diseases is by immunisation. The object of immunisation is to produce without harm a degree of resistance in persons as great as, or greater than, that which follows the natural infection. The immediate goal of immunisation is to prevent the occurrence of diseases in individuals or groups. The ultimate goal is to eradicate the disease. Disease like smallpox, has been eradicated in the world because of effective immunisation. Immunisation can be carried out actively or passively.

Passive Immunisation

Passive immunisation, by administration of preformed antibodies, provides short-term protection. However there is a definite role of passive immunisation for the protection of certain individuals or groups of individuals. These include immunodeficient subjects or previously healthy persons for:

(a) post-exposure prophylaxis e.g. following measles, hepatitis B or rabies exposure;

(b) therapeutic purpose when a disease is already present as in the case of diphtheria and tetanus for neutralising the toxins.

Anti-sera or immunoglobulins are expensive and though mostly are of human in origin, are not without risk. Passive immunisation is not feasible for the mass population, and is not cost-effective. Hence for the protection of the community, active immunisation should only be considered.

Active Immunisation

A vaccine can be used for immunisation if it has been tested to be safe, immunogenic and efficacious. No vaccine is completely safe. There are risks associated with the use of all products, including killed vaccines, live-attenuated vaccines and toxoids. In recommending the use of vaccine, the safety factors have to be weighed against the benefits of the vaccine and the risks of the natural disease. In general, most vaccines are intended for use in healthy individuals. Immunisation should not ordinarily be performed during a febrile illness. The illness may be trivial, but it may be the harbinger of a more serious disease. The febrile illness may alter the immune response. Live viral vaccines are in general contraindicated in immunocompromised individuals. There are specific safety and contraindication considerations for individual vaccines. Hypersensitivity reactions to constituents of vaccines rarely occur. Only a few reactions are clearly associated with specific hypersensitivity. Severe egg sensitivity can result in systemic anaphylactic or urticarial reactions in allergic persons receiving vaccines containing trace of egg antigens as in measles, mumps and influenza vaccines. Oral poliovirus vaccine and live measles, mumps and rubella vaccines contain an extremely small amount of neomycin. Luckily allergic reactions to neomycin are extremely uncommon as neomycin is seldom used nowadays.

Immunisation Programme

In 1974 the World Health Organisation declared an Expanded Programme on Immunisation (EPI) for all infants and children of the world against 6 infectious diseases including tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis and measles. In Hong Kong immunisation against these 6 diseases was introduced to children in the 1950's and 1960's. The current programme of immunisation recommended by the Department of Health is shown in Table 1. The schedule includes immunisation against the 6 diseases as well as rubella, mumps and hepatitis B.

The majority of children in Hong Kong receive their immunization in hospitals soon after birth, and subsequently at the 50 maternal and child health centres and in primary schools. A small proportion of children receive the vaccines in private hospitals and private practitioners' clinics. Because immunisation is readily available throughout the territory and is free of charge in public hospitals, maternal and child health centres and schools, the coverage rate has been high. In 1997 the average coverage rate for most vaccines is above 90% as shown in Table 2, which shows the coverage in hospitals, maternal and child health centres and primary schools. In 2000 a study of children studying in kindergartens showed that over 98% of them had been adequately immunized.

Incidence of Infectious Diseases

There has been a significant and steady decline in the incidence of vaccine-preventable infectious diseases in Hong Kong in the past five decades as shown in Table 3. The impact of immunisation on the incidence of such diseases is illustrated in Table 4, which shows the maximum number of reported cases of each disease and the year in which it occurred in comparison with the number of cases in 2002. The years in which vaccines were introduced are also listed. Immunisation has been highly successful in eradicating diphtheria and poliomyelitis and in reducing the occurrence of pertussis, tetanus and measles. However, tuberculosis remained prevalent in 2002. The incidence of infectious diseases in children below 15 years of age during the period from 1993 to 2002 is shown in Table 5.

Diphtheria, Tetanus and Pertussis

. There has not been any reported case of diphtheria during the past two decades. 2 cases of tetanus occurred in 1987 and 1988 and both cases occurred in infants who were born at home and their mothers were illegal immigrants. The number of cases of pertussis notified has been small and there could be under-reporting as the presentations of the disease may not be typical. Currently the combined vaccine contains diphtheria toxoid, tetanus toxoid and inactivated whole-cell *B. pertussis.*

Poliomyelitis

The last case of poliomyelitis caused by wild virus occurred in 1983. Oral poliovirus vaccine (OPV) is used in Hong Kong. The use of OPV is associated with a risk of vaccine-associated paralytic poliomyelitis (VAPP) of about one in 2.4 million doses. Some countries have already adopted inactivated vaccine in their immunization programme. The last case of vaccine related poliomyelitis was reported in Hong Kong in 1995. The current surveillance of acute flaccid paralysis since 1997 is part of a World Health Organisation programme to document the

eradication of poliomyelitis caused by the wild virus. It also helps to identify cases of VAPP. The Western Pacific Region was declared free of indigenous poliomyelitis on 29 October 2000.

Tuberculosis

There were about 100 cases of tuberculosis reported in children annually with virtually no infant deaths. The notification rate in children has fallen to 8.5 per 100,000 in recent years. Over 99% of newborn babies are vaccinated with BCG at birth. The benefit of a second dose of BCG after tuberculin testing in later childhood has shown to be questionable and the tuberculin testing together with the second dose of BCG was discontinued in 2000. The decline of tuberculosis in children is due to the combined effect of improved socioeconomic conditions of the community, better treatment regiments, effective surveillance of the disease and the extensive use of BCG. However there should not be any complacency as tuberculosis is still a common disease in the adults, especially among the elderly and the new arrivals.

Measles, Mumps and Rubella

Measles is a serious disease in children and commonly accompanied by complications such as otitis media, laryngotracheobronchitis, bronchopneumonia and diarrhoea. Acute encephalitis occurs in about 1 of every 1000 cases. The last major outbreak of measles occurred in 1988 during which 3162 cases including 8 deaths were reported. In anticipating for another outbreak, a special immunization campaign was carried out in 1997 during which over 1.1 million people aged between 1 to 19 years received the vaccine. Measles vaccine is a live attenuated vaccine and is combined with rubella and mumps vaccines (MMR vaccine). The current schedule consists of one dose of the vaccine at the age of one year and a booster at the age of six year (primary one school students).

Rubella is usually a mild and often asymtomatic disease in children. Infection of a non-immune pregnant woman may result in congenital infection and congenital rubella syndrome. The aim of rubella immunization is to prevent congenital rubella infection. Rubella vaccine is a live vaccine. The immunization population was first targeted at pre-pubertal schoolgirls in 1978, and then extended to women of reproductive age. In 1990 rubella vaccine was introduced as part of the MMR vaccine given to children of both sexes at the age of one year. All primary one school children receive a booster dose since 1997. An outbreak of rubella occurred in 1997 when 4958 cases were notified. Among them 84% occurred in boys aged 8 and above. Two cases of congenital rubella and 3 cases of encephalitis were reported in 1997.

Mumps became a notifiable disease in Hong Kong in 1994, when 79 cases were reported that year. A serological survey in 1988 showed that 85% of children had acquired mumps antibody by their 15th birthday. In view of the common neurological complications of mumps, mumps vaccine, a live vaccine was included as a component of the MMR vaccine in the immunisation programme in 1990.

Viral Hepatitis

Viral hepatitis became a notifiable disease in Hong Kong in 1975. Between 500 and 800 cases were reported annually; about 10% of the cases occurred in children. Both hepatitis A and hepatitis B are endemic in Hong Kong. There are three peaks of hepatitis B infection in Hong Kong: in the perinatal period, adolescence and young adulthood. 10% of adults are carriers of HBsAg. In view of the fact that hepatitis B carrier state is associated with cirrhosis of liver and primary hepatocellular carcinoma and that 40% of the carriers acquire the infection in the perinatal period, a hepatitis B immunisation programme covering all newborn babies was introduced in 1988. The current vaccine is produced by recombinant DNA technology. All infants receive 3 doses of hepatitis B vaccine, at birth and then at 1 and 4 to 6 months of age. In addition infants born to carrier mothers receive one dose of hepatitis B immune globulin at birth. This scheme will hopefully eliminate the vertical route of transmission of hepatitis B.

Hepatitis A vaccine is an inactivated vaccine and is reported to be safe and immunogenic. Protective efficacy has been demonstrated in children above one year of age. The duration of protection is yet to be determined. Large-scale studies with long-term follow up are required before the vaccine could be recommended for widespread use.

Future Immunisation Practices

In the light of local and overseas experiences certain revision of the existing programme can be considered. Future programme may include some new vaccines.

Acellular pertussis vaccine containing different antigens derived from *B pertussis* has demonstrated comparable efficacy to whole cell vaccine and caused fewer adverse reactions. Acellular pertussis vaccine is now the preferred vaccine in many countries.

Hepatitis B vaccine administered to students will prevent horizontal infection in the adolescents and young adults.

Haemophilus influenza type b vaccine has been found to be effective in preventing invasive Haemophilus influenza infection in infants and young children. The inclusion of this vaccine in the childhood immunization programme of many Western countries has been associated with a dramatic decline of the infection in such countries. The local impression is that invasive infection caused by Haemophilus influenza type b is less common here than in western countries. While the vaccine offers personal protection, more accurate knowledge of the epidemiology of Hib infection is needed for a study of the cost-effectiveness of a universal Hib immunization.

Though varicella is a mild disease in children complications like bacterial superinfections are common. Serious complications occur in immunocompromised patients. Varicella became a notifiable disease again in 1999 and over 16000 cases were reported in 2002. Varicella vaccine, a live attenuated vaccine, has been found to be immunogenic, efficacious and safe in both healthy and immunocompromised children. The vaccine offers protection in children. It is therefore likely that future programme may include varicella vaccine.

As more vaccines are developed, other common childhood infections such as diarrhoeal diseases and respiratory tract infections may in future be prevented by active immunisation. On the other hand measures must be taken to control emerging infections such as avian flu, enterovirus infections, dengue fever and SARS before vaccines are developed for these life-threatening infections.

Table 1. Recommended Schedule for Active Immunisation of Normal Infants and Children, Hong Kong, 2000

Age	Immunisation
Newborn	BCG, OPV (Type 1), HBV
1 month	HBV
2-4 months	DPT, OPV
3-5 months	DPT
4-6 months	DPT, OPV
6 months	HBV
12 months	MMR
18 months	DPT, OPV
Primary 1	DT, OPV, MMR
Primary 6	DT, OPV

OPV = Oral poliovirus vaccine, trivalent, unless specified

DPT = Diphtheria and tetanus toxoids with pertussis vaccine

HBV = Hepatitis B vaccine

MMR = Live measles, mumps and rubella viruses vaccine

DT = Diphtheria and tetanus toxoids

Table 2. Coverage Rate of Immunisation, 1997

Immunisation	Coverage Rate (%)
BCG (Newborn)	99
OPV (Newborn)	98
(Infancy)	89
Hepatitis B (Newborn)	99
(Infancy)	89
DTP (Infancy)	90
Measles-Mumps-Rubella (one year)	87
OPV (Primary School)	99
DT (Primary School)	99
Measles-Mumps-Rubella (Primary six)	99

Table 3. NOTIFICATION OF INFECTIOUS DISEASES

Hong Kong 1951-2002

	1951	1961	1971	1981	1991	2001	2002
Tuberculosis	**13886**	**12584**	**9028**	**7719**	**6283**	**7262**	**6665**
Diphtheria	**574**	**1334**	**25**	**0**	**0**	**0**	**0**
Tetanus	**N.A.**	**N.A.**	**58**	**14**	**6**	**4**	**2**
Pertussis	**747**	**47**	**2**	**2**	**0**	**15**	**23**
Poliomyelitis	**28**	**184**	**2**	**3**	**0**	**0**	**0**
Measles	**528**	**1727**	**591**	**249**	**278**	**179**	**61**

Table 4. Incidence of Vaccine-Preventable Diseases

Hong Kong

Disease	Max. Cases (Year)	Cases 2002	Year Vaccine Introduced
Poliomyelitis	363 (1962)	0	1963
Diphtheria	2087 (1959)	0	1957
Pertussis	747 (1951)	23	1957
Tetanus	92 (1967)	2	1957
Measles	5459 (1965)	61	1967
Rubella	4958 (1997)	36	1978
Mumps	90 (2002)	90	1990
Tuberculosis	15253 (1961)	6665	1952

Table 5. Notification of Communicable Diseases in Children below 15 years, 1993 to 2002

	1993	1995	1997	1998	1999	2001	2002
Diphtheria	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Tetanus	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Pertussis	**5**	**8**	**11**	**3**	**5**	**13**	**22**
Poliomyelitis	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Tuberculosis	**123**	**96**	**99**	**99**	**81**	**87**	**54**
Measles	**24**	**27**	**200**	**46**	**26**	**123**	**33**
Viral Hepatitis	**107**	**82**	**76**	**66**	**67**	**59**	**23**