Prevention of Chronic Hepatitis B Infection

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Introduction

Chronic hepatitis B infection (HBV) is a major health problem in Hong Kong with approximately 8% of the population being chronic carriers. Vertical and horizontal transmissions are the commonest routes of acquiring the infection. High-risk sexual behaviour, sharing of contaminated needles in intravenous drug abusers, accidental needle stick injury in health-care workers and very rarely contaminated blood or blood products account for the rest.

Strategies for Prevention of HBV Infection

Control of HBV infection forms a major part of public health policy in Hong Kong. Measures adopted for control of HBV infection include:

- Mandatory reporting of acute hepatitis cases (including acute hepatitis B) to the Department of Health.
- Setting up "The Scientific Working Group on Viral Hepatitis Prevention" to advise the government on the control and prevention of viral hepatitis (since 1992).
- Public health education and health promotion.
- Screening for HBsAg in blood donors and expectant mothers.
- Immunoprophylaxis targeting high-risk groups (such as infants of infected mothers).
- Universal vaccination of newborns.

HBV Vaccination

Universal vaccination has the greatest benefit, as it can potentially eradicate the infection and is most cost effective.

HBV vaccination was first introduced in Hong Kong in 1983 that initially targeted at high-risk groups. This was extended to all newborn infants in 1988, followed by a "catch-up" vaccination program for 6-year old children in 1992. The first vaccine was plasma-derived, but newer vaccines are manufactured using recombinant technology that has the advantage of being free from potential infectious pathogens. The efficacy of the two different types of vaccines is comparable, producing over 95% seroprotection (>10 mIU/ml anti-HBs titer) in infants when the standard 3-dose vaccine is given intra-muscularly at 0, 1 and 6 months. However, the immunogenicity and seroprotection rates are significantly lower in certain groups, including:

- Old age
- Male sex
- Obesity
- Diabetes mellitus
- Smoking
- End-stage renal failure
- Immunocompromized states (e.g. HIV and post-transplantation).
- Liver cirrhosis
Chronic hepatitis C infection

In addition, a significant minority of immunocompetent adults (about 5%) does not achieve an adequate immunological response. Serious adverse effects are extremely rare although minor reactions such as pain and swelling at injection site and occasionally fever can occur. Fears in the western countries of HBV vaccines being associated with multiple sclerosis has recently been discredited. Eighty-five percent of vaccinees have persistent high anti-HBs antibody levels 10 years after vaccination, and so current recommendations do not support post vaccination serological testing or booster doses. However, active vaccination and post-vaccination testing serological testing is recommended for all susceptible health care workers.

Infants Born to Infected Mothers

Babies born to HBeAg-positive carriers have a 90% chance of becoming chronically infected. However, the administration of hepatitis B immunoglobulin (HB Ig) followed by a standard course of HBV vaccination can ensure 85-95% protection from HBV infection. In Hong Kong, all neonates born to infected mothers are given HB Ig and the standard HBV vaccination, irrespective of the mother's HBeAg status.

Healthcare Workers

Healthcare workers are screened early in their professional career for HBsAg/anti-HBs titers. HBV vaccination is given to those without previous exposure to HBV. Non-responders (anti-HBs titer 0 miu/l) and hyporesponders (anti-HBs 0-10 miu/l) are advised to undergo a second course of vaccination. Approximately 18-25% of vaccinees will respond after a second course. In those who fail to respond, they should practice universal precaution when handling potentially infected material or patient at all times, and receive immunoprophylaxis in the event of a needle-stick injury. Newer vaccines that incorporate pre-S1 and pre-S2 proteins have been shown to produce significant seroprotection rates in hypo- and non-responders. A recent study has suggested that intradermal instead of intramuscular injection was associated with significant response in previous non-responders.

Impaction of HBV Vaccination

The result of these preventative measures has been impressive. Data from the Hong Kong Red Cross Blood Transfusion Service have shown the prevalence of HBsAg in new blood donors decreased from 9.2% in 1988 to 5.57% in 1996. In Taiwan, where universal vaccination was introduced much earlier, the HBsAg seropositive rates in children age 1-10 years decreased from 9.8% in 1984 to 1.3% in 1994, and the anti-HBc antibody seropositive rates declined from 26% to 4% over the same period of time. In addition, a significant reduction in the incidence of childhood hepatocellular carcinoma has been documented.

Vaccine Escape Mutants

Although universal vaccination has led to a dramatic fall in the incidence of childhood HBV infection, vaccine-escape mutants have emerged as a potential problem. These mutants have changes in the critical region of the "a" determinant of the S gene and so "escape" the protective effect of anti-HBS antibody generated by conventional vaccine. Studies from Taiwan and Singapore have reported these mutants can be transmitted by vertical and horizontal routes. The overall significance of vaccine-escape mutants is, however, uncertain.
New Development

Recent development includes incorporating HBV vaccine with other childhood vaccines so that the number of injections and costs are reduced. For example, the immunogenicity and safety of a quadrivalent vaccine (diphtheria, tetanus, pertussis and hepatitis B) were found to efficacious. Also, in adults, the combination of hepatitis A and B vaccine was found to be just as effective compared with separate vaccines.