Introducing rotavirus vaccination to the Hong Kong Childhood Immunisation Programme

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Most children are infected with rotavirus by the age of 5 years, causing approximately 2 million hospitalisations and 352 000 to 592 000 deaths every year.[1] The World Health Organization recommends that rotavirus vaccination should be included in all immunisation programmes.[2] Infection rates in Hong Kong are steady throughout the year but peak between December and January.[3] Although rotavirus vaccines have been licensed and available in Hong Kong since 2006, they have not been included in the Hong Kong Childhood Immunisation Programme (HKCIP) and are therefore only available via private health care. This commentary evaluates the benefits and risks of introducing a rotavirus vaccine to the HKCIP based on the latest evidence in the literature.

Factors to consider

Burden of disease, other prevention and control measures, and public health priorities

A 2-year, prospective, hospital-based surveillance study of rotavirus disease published in 2005 estimated that 4.6% of all general paediatric admissions in Hong Kong were associated with rotavirus.[4] The incidence rate of rotavirus-associated admissions in children aged <5 years was 8.1 to 8.8 admissions/1000 children; in those <1 year of age, the rate was higher, at 15.4 to 18.4 admissions/1000 children.[4] These rates are higher than those in other developed countries prior to the implementation of rotavirus vaccination (eg, 5 admissions/1000 children in the United Kingdom[5]; 3.7/1000 in Sweden[6]; and 7.6–10.1/1000 in the United States[7]). It is also estimated that 1 in 24 children in Hong Kong have been hospitalised for rotavirus gastroenteritis by the age of 5 years.[4]

Although rotavirus mortality is exceedingly low in Hong Kong, it causes significant morbidity and economic burden to the healthcare system.[8] Data from acute surveillance studies conducted when Hong Kong was part of the Asian Rotavirus Surveillance Network estimated that 24% to 30% of cases of diarrhoea among hospitalised children and 10% of cases of diarrhoea in the community were due to rotavirus infection.[4,9] On average, families spend US$120 on medical costs when their child is admitted for a rotavirus-associated illness, which is equivalent to 10% of the monthly income of a typical unskilled or service worker.[9] The annual direct medical cost for rotavirus-associated admissions in Hong Kong is estimated to be US$4 million.[4]

Vaccine options, safety, efficacy, effectiveness, and availability

The first rotavirus vaccine became available in 1999 and was a tetravalent reassortant vaccine (RotaShield). However, it was withdrawn from the market by the manufacturer within a year of being licensed due to an increased risk of intussusception among vaccine recipients.[10] The second-generation vaccines RotaTeq (RV5) and Rotarix (RV1) have been licensed in Hong Kong since 2006. RotaTeq is a pentavalent vaccine containing five reassortant rotaviruses developed from human-bovine origin of the common circulating strains (G1, G2, G3, G4, and P1[8]).[11] Three doses of RV5 are given orally at 2, 4, and 6 months of age.[12] Rotarix, a monovalent vaccine, contains the attenuated G1P[8] human rotavirus strain and consists of two doses given orally at 2 and 4 months of age.[13]

Intussusception is a rare adverse effect that led to the withdrawal of RotaShield, with an excess risk of approximately 1 to 2 cases per 10 000 recipients.[14] RotaTeq and RV1 were only licensed after evaluation of large clinical trials (>60 000 infants) that were sufficiently powered to detect the rates of intussusception observed for RotaShield.[14] Findings of international post-licencing safety studies suggest that intussusception in vaccine recipients occurs at a rate of between 1/20 000 and 1/100 000 in high- and middle-income countries.[15] The benefits of rotavirus vaccination (including prevention of severe diarrhoea and death) exceed the risk of intussusception.[2]

Rotavirus vaccine is available in 194 countries, of which more than 113 have included it in their routine childhood vaccination programmes.[16] The vaccine is effective and has led to decreases in diarrhoea-associated mortality and cases of severe diarrhoea, lower rates of hospitalisation, fewer medical consultations, improvements in quality of life and, overall, reduced costs of care.[17] The effectiveness of the rotavirus vaccine varies

in different income settings (44%–80%); given the middle-to-high income level of Hong Kong, effectiveness of at least 80% can be expected.[18] As the vaccine is not universally available in Hong Kong, a case-control study was conducted during the peak rotavirus season to review its effectiveness. Analysis by age showed the vaccine to be highly effective among young children, with hospitalisation rates reduced by 96%.[8] Despite this effectiveness, the uptake rate was estimated to be low (33.3%) due to it only being available through private health care.[19] Apart from the direct protection provided to individuals receiving vaccination, it may also reduce nosocomial infection and provide indirect protection to the unvaccinated population, including older children and adults.[20]

Economic and financial criteria

A recent study using a decision-support model estimated that rotavirus vaccination in children aged <5 years in Hong Kong could prevent 49 000 hospitalisations for rotavirus gastroenteritis and seizures while causing around 50 cases of intussusception requiring hospitalisation.[19] The estimated benefit-risk ratio is around 1000:1,[19] which is higher than in other low-mortality countries in Asia (350 to 570:1).[21,22] Based on this study, adding rotavirus vaccination to the HKCIP is likely to be cost-saving (up to US$70-77 million) and have a favourable benefit-risk profile.[19]

Planning the immunisation programme

Target population and delivery strategy

Children aged <5 years are those primarily at risk, but those <1 year will be at the highest risk. As rotavirus is highly contagious, the primary aim of vaccination should be to provide direct protection rather than eradication. The target population should therefore be children aged ≤5 years due to the high rates of infection in this group and, especially in those aged <1 year, the increased risk of hospitalisation.

Policy and integration with the existing immunisation schedule

A pilot programme could be implemented to identify and address programmatic and logistical challenges. As Hong Kong is geographically small, any issues can be addressed easily prior to the rollout of the vaccination programme.[23] Because the efficacy and safety profiles of RV5 and RV1 are similar, consideration should be given to the cost effectiveness, product characteristics, number of doses, formulation, and packaging when deciding on which vaccine to implement.[23] The ideal immunisation schedule would require a minimal number of extra clinic visits beyond those for the existing schedule[23]; because the HKCIP has routine immunisation visits scheduled at 2, 4, and 6 months of age, neither vaccine should affect this.

Implementing rotavirus vaccination in Hong Kong

Standardisation and training of staff

Clear guidelines should be given to healthcare professionals about contraindications, such as a history of intussusception or being immunocompromised, and pharmacovigilance should be practised.[12] Patient educational resources should be prepared for caregivers, including information on recognising signs of intussusception after vaccination.

Strategies to ensure maximal uptake and public health promotion

Information about public knowledge, attitudes, and vaccination hesitancy, such as any perceived risk of intussusception, can be determined via survey. Prior to the launch of the vaccine, public health education and a vaccination promotion campaign should be planned to ensure the population receives necessary information about the benefits of vaccination.

Conclusion

Based on the evidence reviewed and considerations discussed, there is a strong case for the introduction of the rotavirus vaccine to the HKCIP, which could potentially reduce disease burden while also being cost-effective for the Hong Kong healthcare system. It has been 15 years since the first rotavirus vaccine was approved and Hong Kong's children deserve the best protection against potentially deadly rotavirus infections.

Author contributions

Both authors contributed to the concept or design of the study, acquisition of data, analysis or interpretation of data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. Both authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

As an editor of the journal, KL Hon was not involved in the peer review process. KKY Leung has no conflicts of interest to disclose.

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