Fifteen-minute consultation: Chickenpox vaccine—should parents immunise their children privately?

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ABSTRACT

Varicella zoster virus primarily causes chickenpox, usually a mild self-limiting illness of childhood. However, complications occur in 1% with 4200 annual deaths. Since the first vaccination was developed in the 1970s, many countries have introduced universal mass immunisation, but the UK currently only routinely immunises 'at-risk' populations. With increasing availability of private varicella vaccination, this article reviews the pros and cons of whether parents should be immunising their children with the chickenpox vaccine privately.

INTRODUCTION

Since the first chickenpox vaccine was developed in Japan in the mid-1970s,[1] many countries have commenced universal mass immunisation (UMI) for healthy children (including USA, Australia, Canada, Germany and New Zealand). The UK currently only immunises at-risk populations including non-immune healthcare workers and household contacts of immunocompromised patients. Chickenpox vaccine is now easily available privately and parents are increasingly asking health professionals for advice about whether they should immunise their children.

This fifteen-minute review aims to explore various perspectives for and against varicella immunisation to enable you to empower parents to make the best decision for their child.

CHICKENPOX IS A MILD, SELF-LIMITING ILLNESS: WHY IS THIS EVEN BEING DISCUSSED?

Chickenpox is usually a mild illness of childhood lasting approximately 5 days, but 1% of children under 15 years experience a complication[2] shown in table 1. While the majority of complications are related to secondary bacterial skin infections, some of the rarer complications can be life-threatening and 2500 to 3000 children (less than 15 years) are admitted to hospitals in England every year.[3] Even in uncomplicated disease, studies have shown up to 50% of children will see a healthcare professional during their illness representing a significant burden particularly to primary care.[4] Caregivers have to take time off work as children cannot attend school or other childcare settings leading to a personal and wider economic impact.

DOES THE VACCINE WORK?

A meta-analysis of 42 epidemiological studies of varicella immunisation in immunocompetent patients showed 81% effectiveness after one dose (95% CI 78% to 84%) and 92% after two doses (95% CI 88% to 95%).[5] Subgroup analysis revealed higher effectiveness in preventing more severe cases of varicella (98% effectiveness; 95% CI 97% to 99%). The parameters used to assess effectiveness are varied including varicella incidence, hospitalisation rates, mortality, seroconversion and immunogenic profile. Further meta-analyses focusing on the individual usefulness and excluding herd immunity implications would be useful to help guide decision-making for individual vaccination.

HOW LONG DOES IT LAST? DOES IT WEAR OFF?

In Japan, studies have shown protective antibody levels have persisted for more than 20 years.[6] However, there is serological evidence and increased clinical breakthrough suggesting immunity wanes.[7] Breakthrough cases, defined as wild-type varicella occurring more than 42 days after vaccination, vary significantly across the world from 0.9 per 10 000 in America to 2770 per 10 000 in Turkey (high background varicella rate).[8] The risk of varicella breakthrough was 3.7-fold higher 5 years after vaccination.[8]

Table 1 Complications of chickenpox[2] and risks of chickenpox immunisation[14]

Complications of chickenpox (1%)	Risks of chickenpox immunisation (0.034%)
Secondary bacterial skin infections (especially group A haemolytic *Streptococcus*)—most common	Fever
Pneumonia/serious bacterial infection (4 per 10 000)	Rash
Acute cerebellitis/encephalitis (1 in 100 000)	Injection site reactions
Haemorrhagic complications	Febrile convulsions (increased risk if combined with MMR vaccine)
Hepatitis	Post-infectious arthritis
Septic arthritis	(Idiopathic thrombocytopaenic purpura)*
Reye's syndrome	(Acute cerebellar ataxia)*
	(Acute hemiparesis)*
	Avoidance of salicylates recommended for 6 weeks post-immunisation (due to theoretical risk of Reye's syndrome)

*Idiopathic thrombocytopaenic purpura , acute cerebellar ataxia and acute hemiparesis have all been reported rarely after varicella vaccination but have not been conclusively found to be caused by the vaccine.

MMR, measles, mumps and rubella.

However, breakthrough disease tends to be milder and less contagious, usually with less than 30 pox lesions.[9]

The USA saw the introduction of a two-dose schedule in 2006 attempting to minimise primary vaccine failure, slow waning immunity and reduce the risk of later breakthrough disease.[10] Vaccine effectiveness is greater and persists 5 years after the second dose, but longer-term assessment is still required.[11]

EVEN IF THE VACCINE WEARS OFF, THEY'LL JUST GET IT AS AN ADULT. WILL IT BE LESS SEVERE THEN?

This is a myth; varicella in adults is associated with higher morbidity and mortality than in children. Immunisation schedules need to provide adequate lifelong immunity to prevent an epidemiological shift to an older age associated with worse outcomes. Adults experience only 5% of all varicella cases, but experience more severe disease with 25-fold higher mortality although still relatively low at 0.0014%.[12]

With patchy uptake of immunisation, the basic reproduction ratio (R_0) would reduce but not enough to completely prevent ongoing spread (and therefore not provide herd immunity). Transmission rates would therefore slow, shifting age of varicella acquisition upward associated with an increased severity and complication rate. This is one of the biggest concerns of those who argue against varicella UMI and insufficient doses of individual private vaccines.

IS IT SAFE? ARE THERE ANY SIDE EFFECTS?

The majority of data comes from USA having introduced mass varicella vaccination first in 1995. The rate of serious adverse events is 2.6 to 2.9 per 100 000 doses of varicella vaccine[13] but milder effects such as fever, rash and injection site reactions occurring in 34 per 100 000.[14]

Febrile convulsions

Vaccine administration (including varicella vaccine) is the second leading cause of febrile convulsions (viral upper respiratory tract infections are the leading cause).[15] The risk of febrile convulsion is higher with the varicella vaccine than most other vaccines in the UK schedule and further increases when combined with MMR.

ITP

O'Leary *et al* found a potential link between varicella immunisation at 11 to 17 years old and increased risk of ITP, most of which were mild with no long-term sequelae.[16] Given the small number of cases, further investigation is required. Of note, no association was demonstrated when immunised at a younger age.

WHAT ABOUT HERPES ZOSTER (SHINGLES)?

There is uncertainty regarding the potential effects on herpes zoster (HZ) by immunising against chickenpox. Following initial infection with varicella zoster virus (VZV), the virus become latent in the dorsal root ganglia potentially reactivating with neuronal transfer to the skin manifesting as HZ. There is an increasing incidence into later life and a lifetime risk of 23.8% to 30%.[17] The characteristic rash and acute pain can lead to further complications in 21% to 48% of patients, most commonly post-herpetic neuralgia, which can be extremely debilitating.[17]

The immune system is stimulated when an individual encounters VZV. If they are immune due to previous wild-type chickenpox, this exposure boosts their immunity, known as exogenous boosting. There are concerns that widespread immunisation would reduce exposure to wild-type VZV thus reducing this exogenous boosting and potentially leading to HZ manifesting more with potential impact on public health.[18]

The attenuated vaccine virus can also become reactivated causing HZ, but the risk of this occurring appears to be lower than HZ risk following natural infection.[19]

Mathematical modelling predicts a short-term to medium-term increase in HZ followed by a longer-term reduction if UMI was introduced. Withholding varicella immunisation of proven benefit in the young to prevent more severe HZ in the older generation is an ethical debate, particularly with eventual longer-term reduction.

WHY ISN'T IT PART OF THE UK VACCINATION SCHEDULE?

Within limited public health budgets, introducing vaccines against human papilloma virus, rotavirus and

meningococcus type B has occurred in recent years. The argument that this is because chickenpox lacks the same emotive response from parents as meningitis is not true; very few parents were emotive about rotavirus vaccine! The introduced vaccines have all been shown to be cost-effective, something varicella vaccination has not been convincingly found to be.

From a public health perspective, the consideration of the impact of mass immunisation on HZ is important, as is the potential to shift varicella infection to a later age. These uncertainties have to be balanced against the benefits of immunisation of the young preventing wild-type disease and its potential complications.

In terms of cost-effectiveness, studies from Europe (France, Germany, Spain) deemed varicella immunisation a cost-saving intervention[20] in contrast to UK studies.[21] The direct medical costs for HZ are approximately twice that of chickenpox and cost benefit therefore hinges on estimated impact of varicella immunisation on HZ.[22]

Inclusion or exclusion of societal costs also impacts significantly; lost working days attributable to varicella were estimated to exceed US$1.5 billion annually in USA.[23] The overall vaccine price has to be less than €25.10 for vaccination of adolescents to be cost-saving for the National Health Service purely on direct treatment cost in Europe.[24] Including the societal impact would significantly lower this cost-effective vaccine price further.

Sheffer *et al* demonstrated chickenpox was milder in breakthrough disease leading to less absence from childcare further impacting on societal economics; 3.1 versus 8.1 days in vaccinated and unvaccinated cohorts, respectively (p=0.02).[25]

Further robust economic evaluations including the wider costs will determine whether cost-effectiveness can be proven enough to persuade the treasury to endorse UMI across the UK.

EVALUATION/CONCLUSIONS

In summary, the chickenpox vaccine has a good safety profile and provides high levels of immunity. At least a two-dose regime administered 4 to 8 weeks apart is required to achieve adequate protection and can be sourced privately for £65 per dose.

There is growing evidence against concerns that waning immunity will lead to higher complication rates due to an increased age of acquisition. Likewise, epidemiological concerns about the uncertain effect on HZ longer term have not been proven to be linked to varicella immunisation. Incorporation into the immunisation schedule in the UK is therefore a strong possibility. Until then, it is important to fully inform parents of the risks and benefits, allowing them to make an informed choice whether to vaccinate their children against varicella.

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