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[Intervention Review]

Vaccines for measles, mumps and rubella in children

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ABSTRACT

Background

Mumps, measles and rubella (MMR) are serious diseases that can lead to potentially fatal illness, disability and death. However, public debate over the safety of the trivalent MMR vaccine and the resultant drop in vaccination coverage in several countries persists, despite its almost universal use and accepted effectiveness.

Objectives

To assess the effectiveness and adverse effects associated with the MMR vaccine in children up to 15 years of age.

Search methods

For this update we searched the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2011, Issue 2), which includes the Cochrane Acute Respiratory Infections Group's Specialised Register, PubMed (July 2004 to May week 2, 2011) and Embase.com (July 2004 to May 2011).

Selection criteria

We used comparative prospective or retrospective trials assessing the effects of the MMR vaccine compared to placebo, do nothing or a combination of measles, mumps and rubella antigens on healthy individuals up to 15 years of age.

Data collection and analysis

Two review authors independently extracted data and assessed methodological quality of the included studies. One review author arbitrated in case of disagreement.

Main results

We included five randomised controlled trials (RCTs), one controlled clinical trial (CCT), 27 cohort studies, 17 case-control studies, five time-series trials, one case cross-over trial, two ecological studies, six self controlled case series studies involving in all about 14,700,000 children and assessing effectiveness and safety of MMR vaccine. Based on the available evidence, one MMR vaccine dose is at least 95% effective in preventing clinical measles and 92% effective in preventing secondary cases among household contacts.

Effectiveness of at least one dose of MMR in preventing clinical mumps in children is estimated to be between 69% and 81% for the vaccine prepared with Jeryl Lynn mumps strain and between 70% and 75% for the vaccine containing the Urabe strain. Vaccination with MMR containing the Urabe strain has demonstrated to be 73% effective in preventing secondary mumps cases. Effectiveness of Jeryl Lynn

containing MMR in preventing laboratory-confirmed mumps cases in children and adolescents was estimated to be between 64% to 66% for one dose and 83% to 88% for two vaccine doses. We did not identify any studies assessing the effectiveness of MMR in preventing rubella.

The highest risk of association with aseptic meningitis was observed within the third week after immunisation with Urabe-containing MMR (risk ratio (RR) 14.28; 95% confidence interval (CI) from 7.93 to 25.71) and within the third (RR 22.5; 95% CI 11.8 to 42.9) or fifth (RR 15.6; 95% CI 10.3 to 24.2) weeks after immunisation with the vaccine prepared with the Leningrad-Zagreb strain. A significant risk of association with febrile seizures and MMR exposure during the two previous weeks (RR 1.10; 95% CI 1.05 to 1.15) was assessed in one large person-time cohort study involving 537,171 children aged between three months and five year of age. Increased risk of febrile seizure has also been observed in children aged between 12 to 23 months (relative incidence (RI) 4.09; 95% CI 3.1 to 5.33) and children aged 12 to 35 months (RI 5.68; 95% CI 2.31 to 13.97) within six to 11 days after exposure to MMR vaccine. An increased risk of thrombocytopenic purpura within six weeks after MMR immunisation in children aged 12 to 23 months was assessed in one case-control study (RR 6.3; 95% CI 1.3 to 30.1) and in one small self controlled case series (incidence rate ratio (IRR) 5.38; 95% CI 2.72 to 10.62). Increased risk of thrombocytopenic purpura within six weeks after MMR exposure was also assessed in one other case-control study involving 2311 children and adolescents between one month and 18 years (odds ratio (OR) 2.4; 95% CI 1.2 to 4.7). Exposure to the MMR vaccine was unlikely to be associated with autism, asthma, leukaemia, hay fever, type 1 diabetes, gait disturbance, Crohn's disease, demyelinating diseases, bacterial or viral infections.

Authors' conclusions

The design and reporting of safety outcomes in MMR vaccine studies, both pre- and post-marketing, are largely inadequate. The evidence of adverse events following immunisation with the MMR vaccine cannot be separated from its role in preventing the target diseases.

PLAIN LANGUAGE SUMMARY

Using the combined vaccine for protection of children against measles, mumps and rubella

Measles, mumps and rubella (MMR) are three very dangerous infectious diseases which cause severe morbidity, disability and death in low-income countries.

Based on the evidence provided by three cohort studies (3104 participants), vaccination with one dose of MMR vaccine is at least 95% effective in preventing clinical measles among preschool children; in schoolchildren and adolescents at least one dose of MMR vaccine was 98% effective in preventing laboratory-confirmed measles cases; one or two MMR doses were respectively 92% and 95% effective in preventing secondary measles cases.

At least one dose of MMR vaccine is effective in preventing clinical mumps among children and adolescents when prepared with Jeryl Lynn strains (vaccine effectiveness = 69% to 81%, one cohort and one case-control study, 1656 participants), as well as when prepared with Urabe strain (vaccine effectiveness = 70% to 75%, one cohort and one case-control study, 1964 participants). Effectiveness against laboratory-confirmed mumps in children and adolescents was estimated to be between 64% to 66% for one and 83% to 88% for two doses of Jeryl Lynn MMR (two case-control studies, 1664 participants) and 87% for Urabe-containing MMR (one cohort study, 48 participants). Vaccination with Urabe MMR confers protection against secondary mumps infection (vaccine effectiveness = 73%, one cohort study, 147 participants).

We identified no studies assessing the effectiveness of MMR vaccine against clinical or laboratory-confirmed rubella.

Results from two very large case series studies involving about 1,500,000 children who were given the MMR vaccine containing Urabe or Leningrad-Zagreb strains show this vaccine to be associated with aseptic meningitis; whereas administration of the vaccine containing Moraten, Jeryl Lynn, Wistar RA, RIT 4385 strains is associated with febrile convulsion in children aged below five years (one person-time cohort study, 537,171 participants; two self controlled case series studies, 1001 participants). The MMR vaccine could also be associated with idiopathic thrombocytopenic purpura (two case-controls, 2450 participants, one self controlled case series, 63 participants).

We could assess no significant association between MMR immunisation and the following conditions: autism, asthma, leukaemia, hay fever, type 1 diabetes, gait disturbance, Crohn's disease, demyelinating diseases, or bacterial or viral infections. The methodological quality of many of the included studies made it difficult to generalise their results.

The glossary of study designs is available in the full-text review.