Mycoplasma pneumoniae vaccine protective efficacy and adverse reactions: systematic review and meta-analysis

Linchevski I, Klement E, Nir-Paz R

CRD summary
This review concluded that Mycoplasma pneumoniae vaccines showed a moderate protective effect against pneumonia regardless of cause, and a minor effect against mild respiratory disease. These conclusions appear justified, but should be treated with caution given the risk of language bias and their basis on a small number of trials conducted in specific USA populations.

Authors' objectives
To evaluate the protective efficacy and adverse reactions of Mycoplasma pneumoniae vaccines for various clinical outcomes.

Searching
PubMed, EMBASE and Web of Knowledge were searched up to January 2008. Search terms were reported. Contents tables of primary publications in the field and reference lists of included studies were also searched. Only studies written in English were included.

Study selection
Controlled clinical trials of Mycoplasma pneumoniae (M. pneumoniae) vaccines for pneumonia and respiratory diseases other than pneumonia were eligible for inclusion. There were no restrictions on the method of disease diagnosis or of detecting M. pneumoniae specific disease.

Outcomes were pneumonia (with or without fever), febrile disease not associated with pneumonia, and adverse reactions.

The trials included for vaccine efficacy were mostly conducted in young adults (marine or air force trainees), with two in paediatric populations only (nursery or kindergarten classes aged three to five years). The trials were conducted between 1964 and 1974 in the USA. Most used a monovalent formalin inactivated vaccine compared with saline, no vaccination, or an unclear control group. Outcomes were measured by passive surveillance for between seven weeks and 12 months, or by active surveillance twice a week for up to 20 weeks in the paediatric studies.

The authors did not state how many reviewers performed the study selection. [A: Two reviewers performed the study selection.]

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Vaccine efficacy and 95% confidence intervals (CI) were calculated for each trial using methods of extrapolation (details reported in the paper), so that the efficacy was based on the total trial population and not just the subgroup of ill patients who were tested for M. pneumoniae.

Data were extracted by three reviewers independently.

Methods of synthesis
Results were pooled using a Mantel-Haenszel fixed-effect model. Heterogeneity was assessed using a $\chi^2$ test. Separate analyses were conducted for diagnoses confirmed by culture or serology, as well as an overall analysis. Publication bias was assessed using Egger’s regression test.
Results of the review
Six trials were included for vaccine efficacy (n=67,268 participants; ranging from 403 to 21,199) and 17 for adverse reactions (number of patients unclear).

The efficacy results all came from controlled clinical trials. In total there were 504 cases of pneumonia, 139 cases of severe respiratory disease and 5,956 cases of respiratory diseases other than pneumonia. Pooled estimates of protective vaccine efficacy were 41% (95% CI 30 to 51; four trials) for pneumonia, 36% (95% CI 25 to 45; six trials) for pneumonia and febrile disease, and 18% (95% CI -11 to 40; two trials) for febrile disease alone. There was no evidence of statistical heterogeneity or publication bias. Vaccine efficacy was higher when *M. pneumoniae* was diagnosed by serology compared with culture (54% versus 42%). Efficacy for *M. pneumoniae* specific protection from respiratory diseases other than pneumonia detected by serology was 51% (95% CI 3 to 75; three trials), but it was not statistically significant for culture detection. Protective efficacy against respiratory disease other than pneumonia, either alone or in combination with non-febrile disease, or non-febrile respiratory disease alone was not statistically significant.

The most commonly reported adverse effects were: pain or tenderness at the injection site (between 10 and 100% of participants); induration, erythema and nodules (between 10 and 20%) for local adjuvant alum vaccines; and general malaise or fever for systemic vaccines.

Authors’ conclusions
This meta-analysis showed a moderate protective effect of *M. pneumoniae* vaccine against pneumonia regardless of cause, and a minor effect against mild respiratory disease.

CRD commentary
This review searched three relevant databases, as well as the contents of publications in this area. Restricting the review to articles published only in English increased the risk of language bias, but the authors tested for publication bias and found little evidence (although it was based on a small number of included trials). Data were extracted by three reviewers independently to reduce the chance of errors, but it was not reported if a similar process was used for selecting the studies.

Trial quality was not formally assessed, but all the trials included for efficacy appeared to be randomised placebo-controlled trials. The methods used for the meta-analysis appeared appropriate.

The authors’ conclusions seem justified by the evidence presented, but should be treated with caution given the risk of language bias and their basis on a small number of trials conducted in specific USA populations.

Implications of the review for practice and research
Practice: The authors stated that the development and use of inactivated *M. pneumoniae* vaccines should be reconsidered in high-risk closed community settings and possibly for the whole community, including the elderly.

Research: The authors did not state any recommendations for research.

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