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Recurrent otitis media and tonsillitis: common disease predisposition

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Summary

Objective: To estimate the relative contribution of genetic and environmental effects to the association between recurrent otitis media and recurrent tonsillitis.
Methods: Self-report questionnaire data from a population-based cohort of 9479 Norwegian twins born from 1967 to 1979. Recurrent otitis media and recurrent tonsillitis were main outcome measures. Structural equation modelling was used to fit alternative biometric models to the twin data and to estimate the relative contribution of genetic and environmental effects to the association between otitis media and tonsillitis.
Results: The lifetime prevalence was 11.7% (95% CI: 11.0—12.3) for recurrent tonsillitis and 11.2% (95% CI 10.5—11.9) for recurrent otitis media. Tetrachoric correlations were greater in monozygotic than in dizygotic twins in both males and females. A model specifying additive genetic effects and individual environmental effects for otitis media and tonsillitis and non-additive genetic effects for tonsillitis yielded the best fit. There was no evidence for sex differences in the genetic source or magnitude of the genetic effects. There was a substantial overlap in genetic factors influencing variation in liability to otitis media and tonsillitis.
Conclusion: Common genetic factors contribute substantially to comorbidity between recurrent otitis media and recurrent tonsillitis.

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1. Introduction

Otitis media is an infectious disease, resulting from the interplay between microbial load and immune response. The high incidence and the high rate of spontaneous recovery suggest that otitis media could be considered part of the natural maturation of the immunological system in children [1].

As early as 1957 upper respiratory disease was considered to play an important role in the aetiology of middle ear disease [2] suggesting that the whole respiratory tract, including the middle ear, should be seen as a unit liable to the same physiological changes. The close relationship between otitis media and tonsillitis has been demonstrated in more recent epidemiological studies [3–5]. In addition, a prospective study of preschool children [5] suggested that tonsillar infections accompany common colds in some children, while others seem to be predisposed to subsequent middle ear disease. Kvaerner et al. reported a moderate but significant association between recurrent otitis media and tonsillitis both in a cross-sectional study of preschool children [4] and a in a retrospective questionnaire-based study of Norwegian twins [3]. These analyses, using twin data from a sub sample of the present study population, did not explore the extent to which the association between otitis media and tonsillitis was attributable to common genetic or environmental factors. A substantial genetic predisposition for otitis media [6–8] and tonsillectomy [9] has previously been reported. Heritability estimates of otitis media [10] and tonsillitis [11] based on the present study population has also previously been reported. Genetic effects, comprising both additive and non-additive effects, explained 62% of the liability to recurrent tonsillitis and there were no sex differences in the genetic source or in the size of the genetic effects. Regarding otitis media, the heritability comprised only additive genetic effects. There were no sex differences in the genetic source but a slightly greater genetic effect in males (0.72) compared to females (0.61) was suggested. A model without these sex differences, where genetic effects explained 66% of the disease variability in both males and females, gave almost equivalent fit to the data. The utilisation of twin studies to estimate the genetic and environmental causes of covariation contributes to better understanding of upper respiratory comorbidity.

The present study addresses the question of shared aetiology in otitis media and tonsillitis, using a bivariate twin design. The aim of our study was to investigate whether shared genetic or environmental factors contribute to the association between otitis media and tonsillitis. Furthermore, we will estimate the proportion of genetic and environmental effects that are common and specific to the two phenotypes.

2. Materials and methods

2.1. Sample

The Norwegian Institute of Public Health Twin Study is a dynamic cohort study. The current database includes information on twins born in 1967–1979 identified through the Medical Birth Registry of Norway. The Regional Ethics Committee reviewed the study. Two questionnaire studies have been conducted, in 1992(q1) and 1998(q2) with individual response rates of 73% and 63% and pair wise response rates of 64% and 52%, respectively. The q1 was sent to all twins born during 1967–1974, who were at least 18 years old and for whom a current address in Norway was obtained. The q2 was sent to all twins receiving q1, plus to five new birth cohorts including twins born during 1975–1979. The combined q1 and q2 sample includes 9 479 twins who responded to at least one of the questionnaires. 4 430 twins participated in both studies. Table 1 shows the number of pairs participating in the q1, q2 and the combined sample by sex and zygosity. In q1 and q2 there were 724 and 1377 pairs from whom only one twin responded, respectively. Pairs where one twin responded to q1 and the co-twin responded to q2 or vice-versa are treated as pair responders in the combined sample. The twin research program, including procedures and zygosity determination, is described in detail elsewhere [12,13].

2.2. Measures

Both questionnaires included the following items about ear infections and tonsillitis: "Do you have

Table 1 Number of pair responders by sex and zygosity

Group	Q1 pairs(N)	Q2 Pairs(N)	Combined sample[a] pairs(N)
MZM	416	526	677
MZF	528	777	904
DZM	387	397	592
DZF	443	655	789
DZU	796	979	1285
total	2570	3334	4247

Q1, 1992 questionnaire; Q2, 1998 questionnaire; MZM, monozygotic males; MZF, monozygotic females; DZM, dizygotic males; DZF, dizygotic females; DZU, dizygotic unlike sex.

[a] The combined sample includes twins who have responded to either questionnaire 1, questionnaire 2 or both.