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Educational Intervention for Parents and Healthcare Providers Leads to Reduced Antibiotic Use in Acute Otitis Media

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We used a controlled before-and-after design with the aims of reducing both the total consumption of antibiotics and the use of broad-spectrum antibiotics against acute otitis media (AOM), and to study to what extent prescriptions for antibiotics against AOM were dispensed. Information on evidence-based treatment of uncomplicated AOM was provided to doctors and nurses, and written guidelines were implemented. Pamphlets and oral information concerning symptomatic treatment and the limited effect of antibiotic use in AOM were given to parents. Eligible patients were 819 children aged 1–15 y. The proportion of patients receiving a prescription for antibiotics was reduced from 90% at baseline to 74% during the study period. The proportion of prescriptions for penicillin V increased from 72% at baseline to 85% during the study period. There were no significant changes at the control site. The proportion of dispensed prescriptions was 70% both at baseline and during the study period. Educational efforts reduced the total consumption of antibiotics and the use of broad-spectrum antibiotics for AOM in children aged 1–15 y at an emergency call service. Data on antibiotic use in AOM based only on prescribing overestimates the use of antibiotics.

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INTRODUCTION

There is a well-documented association between antibiotic use and the emergence and spread of antibiotic-resistant pathogens. Acute otitis media (AOM) is a frequent diagnosis in general practice and the proportion of patients receiving antibiotic treatment for AOM varies between 31% in The Netherlands and 98% in the USA, Australia and New Zealand (1). Recent reports suggest that early use of antibiotics among patients aged >1–2 y provides only modest benefits, with only 1 child deriving any benefit out of 7–17 children receiving treatment (2–6). Several investigators have proposed symptomatic treatment only for 8–72 h before starting antibiotic therapy (2, 3, 5), with the aim of producing a substantial reduction in antibiotic use.

The aims of this study were to reduce the proportion of patients with AOM receiving an antibiotic prescription, to increase the relative use of penicillin V and to study to what extent prescriptions for antibiotics were dispensed.

MATERIALS AND METHODS

Demographic data

Tromsø (population 58,100; 12,500 aged between 0 and 15 y) and Harstad (population 23,000; 4,800 aged between 0 and 15 y) are situated in Northern Norway. Both cities are similar with respect to age and gender distributions of the population and geographical and socioeconomic factors.

Study design

We used a controlled before-and-after design to assess the impact of educational and guideline interventions. The baseline period was December 1997 to March 1998, and the intervention period December 1998 to March 1999. The Emergency Call Service (ECS) in Tromsø was the intervention site and the ECS in Harstad served as the control site.

The intervention

A symposium on evidence-based management of AOM was given to doctors and nurses at the ECS in Tromsø 1 month before the study period. Written guidelines focusing on the diagnosis of AOM, the use of analgesics and nose drops for symptomatic treatment, the choice of narrow-spectrum antibiotic therapy and the possible use of delayed prescription of antibiotics were given to all physicians. The guidelines emphasized that patients who were not prescribed antibiotics should have easy access to follow-up.

Pamphlets emphasizing that antibiotics benefit only a small proportion of patients in this age group and that $\approx 80\%$ of patients will recover within a few days without antibiotics were available in waiting rooms. The pamphlet also provided information on the use of analgesics and nose drops for symptomatic treatment and stated that unnecessary use of antibiotics increases the emergence and spread of antibiotic-resistant bacteria. Parents of children with suspected AOM who contacted the ECS by telephone received the same information.

At the ECS in Harstad, no attempts were made to educate doctors or nurses and no pamphlets containing information on symptomatic treatment were made available to patients.

ECS

There is 1 ECS in each city which provides 24-h healthcare services during weekends and between 16.00 and 08.00 on weekdays. Both

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ECSs use the same software (Profdoc®) for the registration of demographic and clinical data. The diagnosis is classified according to the International Classification of Primary Care system.

Patients eligible for intervention

Patients aged 1–15 y diagnosed with AOM were eligible for intervention. The criteria for clinical diagnosis of AOM were (i) acute ear-related symptoms (fever, otalgia, irritability) and signs of middle ear fluid (MEF); (ii) redness and bulging of the tympanic membrane; or (iii) perforation of the tympanic membrane and discharge of MEF. The variables extracted from the Profdoc® files using software designed for the project were the name of the patient, date of birth, date of consultation, code for the diagnosis and the medical therapy coded according to the Anatomical Therapeutic Chemical Classification System (ATC). The variables were encrypted using the MD 5 algorithm before being released from the ECS (7).

Dispensing of antibiotics

There are 5 pharmacies in Tromsø, all of which use the same software for handling prescriptions. Amongst the data registered are the name of the patient, date of birth, date of dispensing and the dispensed pharmaceuticals coded according to the ATC. All records with ATC code J01 (antibiotics for systemic use) during the baseline and study periods were extracted, together with the variables mentioned above. The variables were encrypted using the same algorithm as used at the ECS before being released from the pharmacies. The data from the ECS were linked to the data from the pharmacies and matches of names and birth dates were identified. The dispensing of antibiotics was investigated only in Tromsø.

Categorical data were tested using the χ^2 test (EpiCalc 2000®). All tests were 2-sided, and $p \leq 0.05$ was considered significant.

RESULTS

The proportion of patients with AOM in Tromsø who received a prescription for antibiotics was reduced from 318/355 (90%) at baseline to 155/209 (74%) during the study period ($p \ll 0.01$). The proportion of patients with AOM in Harstad who received a prescription for antibiotics was unchanged as a result of the study: 126/133 (95%) at baseline vs. 114/125 (91%) during the study period ($p = 0.5$) (Table I).

There was an increase during the study in the proportion of patients who received penicillin V in Tromsø from 230/318 (72%) at baseline to 131/155 (85%) during the study period ($p < 0.01$). In Harstad there was a non-significant increase from 86/126 (68%) at baseline to 89/114 (78%) during the study period ($p = 0.09$).

The proportion of prescriptions dispensed was 70% during both the baseline and study periods.

There was no change in the age distribution of the patients diagnosed with AOM as a result of the study either in Tromsø ($p = 0.105$) or Harstad ($p = 0.43$) (Table I). The age distribution of the patients who received a prescription for antibiotics changed significantly in Tromsø between the baseline and study periods ($p < 0.05$). There was no corresponding change in Harstad ($p = 0.31$).

During the intervention period there was a significant reduction in the proportion of patients diagnosed with AOM in Tromsø from 351/9247 (3.8%) to 209/9298 (2.3%) ($p \ll 0.01$). There was no corresponding change in the proportion of patients diagnosed with AOM in Harstad during the study period (124/3582 vs. 133/4720) ($p = 0.09$).

No cases of mastoiditis were registered at Tromsø University Hospital during either the baseline or study periods.

DISCUSSION

There is no standard definition of AOM and a large proportion of physicians are unsure of the accuracy of their diagnosis of the disease (1). Factors influencing the outcome of AOM are numerous but there is no consensus regarding their relative importance (8).

AOM is normally a self-limiting infection. Antibiotic treatment is given to shorten the severity and duration of

Table I. *Effect of the intervention on the prescribing rate of antibiotics for AOM and various age groups*[a]

		Age (y)								
		1–2		3–6		7–15		1–15		1–15
	Total No. of patients	No. with AOM	No. receiving PR	No. with AOM	No. receiving PR	No. with AOM	No. receiving PR	No. with AOM	No. receiving PR (%)	No. with PR on penicillin V (%)
Tromsø (baseline)	9,247	93	82	204	184	54	52	351	318 (90)	230 (72)
Tromsø (study period)	9,298	52	38	111	84	47	33	210	155 (74)	131 (85)
Harstad (baseline)	4,720	32	31	71	66	30	29	133	126 (95)	86 (68)
Harstad (study period)	3,582	23	20	76	70	26	24	125	114 (91)	89 (78)

[a] Age distribution of AOM in Tromsø: $p = 0.11$. Age distribution of AOM in Harstad: $p = 0.43$. Age distribution with prescription in Tromsø: $p = 0.04$. Age distribution with prescription in Harstad: $p = 0.31$. Proportion receiving penicillin V in Tromsø: $p < 0.01$. Proportion receiving penicillin V in Harstad: $p = 0.09$.
PR = prescription.

pain and to avoid complications, but the benefits are modest in children aged 1–15 y (2, 9, 10). A reduction in the use of antibiotics against AOM may increase the incidence of suppurative complications, but in societies with a well-developed healthcare system this is a limited risk (3, 7, 11). The 1991–98 incidence rate of acute mastoiditis in Norway was 3.5/100,000 person-years in children aged ≤ 14 y (11). Otitis media can be the focus of meningitis, but at present there is no evidence that oral antibiotic treatment prevents this complication (9, 12).

Antibiotic resistance is a limited problem in Norway and penicillin V is the first choice against common respiratory tract pathogens. The use of penicillin V in Norway is increasing (13), in compliance with national recommendations. The proportion of patients in Tromsø who received penicillin V during the study period compared with baseline increased by 13%. In Harstad the corresponding increase was 10%. It is possible that the intervention increased the effect of secular trends.

There has been a focus in the media on the emergence of antibiotic-resistant bacteria and it is possible that this has generated growing awareness amongst the general population concerning the side-effects of unnecessary use of antibiotics. The finding that the proportion of prescriptions dispensed was unaffected by the intervention probably indicates the combination of a rapid effect of symptomatic treatment and intelligent non-compliance. Unfulfilled prescriptions will contribute to overestimation of the actual use of antibiotics against AOM if only data from the physician's office are considered. Data on compliance in collecting prescriptions for antibiotics against AOM from pharmacies are scarce.

The proportion of patients in Tromsø diagnosed with AOM was significantly reduced during the study period, but remained unchanged in Harstad. A possible explanation is that patients may have refrained from consulting their doctor after receiving information by telephone consultation or from the pamphlet, but this was not registered in the study.

We conclude that educational efforts and written guidelines can reduce both the consumption of antibiotics and the use of broad-spectrum antibiotics against uncomplicated AOM in an ECS setting, with limited use of resources.

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