ORIGINAL ARTICLE

Point-of-Prescription Intervention to Improve the Choice of Antibiotic in Acute Otitis Media in Children

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Abstract

Introduction: Antibiotic misuse is a serious problem and is directly related to the increase of bacterial resistance. Antimicrobial stewardship programmes can have a significant impact on the choice of antibiotic. This study evaluated the impact of a simple intervention on antibiotic prescribing for acute otitis media in the paediatric emergency department.

Methods: Prospective study that included all the children admitted to the emergency department for a year. The intervention consisted in placing a warning with information about the recommended antibiotic in children with the diagnosis of acute otitis media. The prescription of antibiotics in this disease was monitored before, during and after the intervention in different age groups and for several professional groups.

Results: During the study period, a diagnosis of acute otitis media was made in 5,695 children. The percentage of amoxicillin prescription increased significantly after the intervention. This increase occurred mainly due to an increase in prescription by paediatricians especially in the 6 months to 2 years age group. The percentage of amoxicillin prescription was lower in the group of general practitioners than in other groups ($p < 0.01$). These professionals significantly increased the percentage of amoxicillin prescription during the intervention, but it returned to the previous values after the intervention.

Discussion: A very simple measure can have a significant impact on the type of antibiotic prescribed in a paediatric emergency department. The impact of antimicrobial stewardship programs may be not the same for different professional groups. These programs should be maintained over time, otherwise their results may be lost.

Keywords: Anti-Bacterial Agents/therapeutic use; Antimicrobial Stewardship/methods; Child; Drug prescriptions; Inappropriate Prescribing/prevention & control; Otitis Media/drug therapy

Introduction

Antibiotic misuse is an increasing problem and it is directly related to the onset of adverse events and increased bacterial resistance, which, in turn, lead to high costs.[1-3] About one-fifth of all paediatric visits result in a prescription of antibiotics[4], and 80% of the prescriptions are made in the outpatient setting.[4,5] Many of those prescriptions are unnecessary, and there is also a large variability in the antibiotic prescribed, dose and duration of treatment for the same disease.[6]

Acute otitis media (AOM) represents the first cause of prescription of antibiotics in paediatrics.[7-11] There are recommendations regarding the treatment of this disease,[12-15] but several studies show that those recommendations are not always followed.[1,5,9,16] Amoxicillin is universally recommended as a first-line antibiotic in this condition in healthy children due to its microbiological spectrum, efficacy, safety, low cost and flavour.[12-15]

Antimicrobial stewardship programmes have been developed to improve and measure the appropriate use of antibiotics (including indication, dose, duration and route of administration) with the aim of improving the clinical prognosis, decreasing resistance and reducing the treatment costs.[3,9,17-20] Those programmes had a significant impact in changing attitudes, including the need of prescription,[3,10,19,21-24] choice of antibiotic[3,23-27] and treatment duration.[3,21] There is a consensus that those programmes should be directed to specific conditions,[5,17,25,27,28] but the most effective strategy[7,18,25-29] and the occupational group to be preferably focused on are still unknown.[9,19,24] The experience of implementation of those programmes in the paediatric age[3,19,24-26] and in outpatient settings, including patients attending the paediatric emergency department (PED), is generally limited.[3,10,27,29,30]

This study aims to evaluate the impact of a simple intervention in the prescription of antibiotics in AOM in the paediatric emergency department.

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Methods

This prospective study was conducted on a PED. All the children and adolescents attending the PED (maximum age of 17 years and 364 days), between 1 January and 31 December 2016, were included in the study.

The prescription of antibiotics in children with a diagnosis of AOM was monitored in order to evaluate the impact of a simple intervention in the prescription. Children treated exclusively with a topical antibiotic were excluded from the study.

The intervention consisted of introducing a removable warning in a visible location at the point-of-prescription with the following text, in accordance with the current recommendations[12-15]:

'In acute otitis media, whenever antibiotic treatment is necessary, amoxicillin is the first-line treatment after the neonatal period. Amoxicillin/clavulanic acid or cefuroxime axetil should only be used if the child was treated with amoxicillin in the 30 days prior to the diagnosis, if the child has recurrent otitis that is resistant to amoxicillin, or if the child has concurrent purulent conjunctivitis.'

The study was performed over 12 months and it was divided into three phases of four months: before, during and after the intervention.

The percentage of cases of acute otitis media treated with amoxicillin in the three phases of the study was calculated by comparing the total number of prescriptions, by age group (under 6 months, 6 months to 2 years, 2 to 10 years, and above 10 years) and by type of healthcare professional (paediatrician, paediatric registrar and general practitioner). All health care professionals participated in the three phases of the study. The percentage of exceptions for the use of amoxicillin, including the existence of an underlying condition or the presence of allergy to penicillin, was assumed to remain stable throughout the study period. Health care professionals were not informed of the existence of the study.

The different groups were compared using the chi-square test. *P* values < 0.01 were considered to be significant.

Results

56 health care professionals, including 24 paediatricians, 13 paediatric registrars, and 19 general practitioners participated in the study. The composition of each occupational group remained mostly unchanged throughout the study.

Throughout the study period, 65,613 children (53% male children) attended the PED, and the diagnosis of AOM was established in 5695 (54% male children). Of this group, 5,228 children (93.3%) were treated with an antibiotic. Tables 1 and 2 show the distribution by age group and by occupational group in the different phases of the study.

The percentage of amoxicillin prescription increased throughout the study (p = 0.002) due to an increase in the prescription by paediatricians (p = 0.004), as shown in Table 3.

Throughout the study, the percentage of amoxicillin prescription increased significantly only in the 6 months 2 years age group (p = 0.007), as shown in Table 4. In this age group, the increase in the percentage of prescription was due to higher prescription by paediatricians (p = 0.008), as shown in Table 5.

The overall percentage of amoxicillin prescription was similar between paediatricians and paediatric registrars (p = 0.052). However, the percentage of amoxicillin prescription was higher when any of these occupational groups was compared to general practitioners (p < 0.01). General practitioners increased the percentage of amoxicillin prescription during the intervention phase (p < 0.001), but that percentage returned to the previous values in the post-intervention phase (p = 0.76) (Table 3). This pattern was evident in the 6 months to 2 years age group, with an increase in the prescription during the intervention (p = 0.001), which returned to the pre-intervention values in the final phase of the study (p = 0.37) (Table 5).

Table 1. Antibiotic prescription for the treatment of acute otitis media in the different phases of the study by age group

Group	Total	Before the intervention	During the intervention	After the intervention
Total, n	5,228	2,090	1,277	1,861
Under 6 months, n	81	27	20	34
6 months to 2 years, n	2,023	852	449	722
2 to 10 years, n	2,805	1,105	695	1,005
Above 10 years, n	319	106	113	100

Table 2. Antibiotic prescription for the treatment of acute otitis media in the different phases of the study by occupational group

Group	Total	Before the intervention	During the intervention	After the intervention
Total, n	5,228	2,090	1,277	1,861
Paediatricians, n	2,829	1,083	675	1,071
Paediatric registrars, n	789	371	164	254
Family medicine, n	1,610	636	438	536

Table 3. Amoxicillin prescription for the treatment of acute otitis media in the different phases of the study by occupational group

Occupational group	Total	Before the intervention	During the intervention	After the intervention	*p**
Total, n (%)	3,399 (65.0)	1,335 (63.9)	807 (63.2)	1,257 (67.5)	0.002
Paediatricians, n (%)	2,200 (77.8)	826 (76.3)	505 (74.8)	869 (81.1)	0.004
Paediatric registrars, n (%)	643 (81.5)	299 (80.6)	135 (82.3)	209 (82.3)	NS
General practitioners, n (%)	556 (34.5)	210 (33.0)	167 (38.1)	179 (33.4)	NS

NS - not significant.
* *p* value obtained using the chi-square test, comparing the values before and after the intervention.
The percentage of amoxicillin prescription was calculated in relation to the total number of prescriptions of antibiotics in each occupational group and phase of the study.

Table 4. Amoxicillin prescription for the treatment of acute otitis media in the different phases of the study by age group

Age group	Total	Before the intervention	During the intervention	After the intervention	*p**
Total, n (%)	3,399 (65.0)	1,335 (63.9)	807 (63.2)	1,257 (67.5)	0.002
Under 6 months, n (%)	65 (80.3)	25 (92.6)	14 (70.0)	26 (76.5)	NS
6 months to 2 years, n (%)	1,456 (72.0)	576 (67.6)	343 (76.4)	537 (74.4)	0.007
2 to 10 years, n (%)	1,753 (62.5)	687 (62.2)	418 (60.1)	648 (64.5)	NS
Above 10 years, n (%)	125 (39.2)	47 (44.3)	32 (28.3)	46 (46.0)	NS

NS - not significant.
* *p* value obtained using the chi-square test, comparing the values before and after the intervention.
The percentage of amoxicillin prescription was calculated in relation to the total number of prescriptions of antibiotics in each occupational group and phase of the study.

Table 5. Amoxicillin prescription for the treatment of acute otitis media in the six months to two years age group in the different phases of the study by occupational group

Occupational group	Total	Before the intervention	During the intervention	After the intervention	*p**
Total, n (%)	1,456 (72.0)	576 (67.6)	343 (76.4)	537 (74.4)	0.007
Paediatricians, n (%)	896 (79.1)	339 (75.4)	199 (78.9)	358 (83.0)	0.008
Paediatric registrars, n (%)	263 (78.3)	123 (74.1)	63 (86.3)	77 (79.4)	NS
General practitioners, n (%)	297 (53.7)	114 (48.3)	81 (65.3)	102 (52.8)	NS

NS - not significant.
* *p* value obtained using the chi-square test, comparing the values before and after the intervention.
The percentage of amoxicillin prescription was calculated in relation to the total number of prescriptions of antibiotics in each occupational group and phase of the study.

Discussion

This study shows that a very simple measure (placement of information about the prescription of antibiotics at the point-of-prescription) can have a significant impact on the prescribed antibiotics in a paediatric emergency department. This study found that the percentage of cases of acute otitis media treated with amoxicillin increased significantly during and after the intervention informing physicians that amoxicillin is the first-line antibiotic in this condition. Furthermore, this impact was different in the various occupational groups, with only persistent change in the prescribed antibiotic by paediatricians, and not paediatric registrars or general practitioners. In these last two groups, whereas in the first group the percentage of amoxicillin prescription was always high throughout the entire study, in the general practitioner group the significant increase in the amoxicillin prescription during the intervention was not maintained after its discontinuation, rapidly returning to the values prior to the intervention.

As in other studies, this study also shows that health care professionals may be influenced by antibiotics stewardship programmes, and that these may result in

a more appropriate use of antibiotics.[9,10,17,19,23-27,31-35,30] Professionals adhere to these programmes spontaneously, not considering them as a limitation of their autonomy.[23,30,31]

The majority of these studies were conducted on adults, but there are some studies that address exclusively paediatric populations in outpatient settings[9,10,25,27,32,33] and/or inpatient settings[23-26,31-33] which analyse the performance of different occupational groups, emphasising paediatricians[9,10,25-27,31-33] as well as other professionals who work with children, including paediatric registrars[34] and general practitioners.[9]

Antimicrobial stewardship programmes have used different strategies to guide prescription, with an emphasis on the development of clinical guidelines,[3,12-15,36] their dissemination in clinical meetings[3,31,36] or their distribution in paper form[3,25,26,31,36] and/or online[10] to health care professionals. The dissemination of relevant messages at the point-of-prescription seems especially effective and it may take different forms, either on paper or with automatic computer messages.[29] The strategies to be used may vary in each case and, possibly, several strategies should be used at the same time for higher effectiveness.[3,36] The optimal duration of these interventions is still to be established, but interventions should probably be done regularly for long-lasting effects.[29]

Acute otitis media remains an important cause of prescription of antibiotics in paediatrics[7-11]and, therefore, it is an excellent model for intervention and monitoring. There are different recommendations,[12-15] but knowledge does not necessarily translate to compliance[1,8,9], as reported by others.[9,10] Some studies have shown similar results in other conditions such as acute respiratory infection,[10] community-acquired pneumonia[5,9,25,27,32] and skin infections.[9,33]

This study presents as a possible limitation being carried out in a single centre, but we believe that the high case number allows for overcoming that fact. In addition, the period of time during or after the intervention could be considered short (four months). Nonetheless, even with this duration, some interventions, despite their success at the time of implementation, were shown not to have long-lasting effects when they are discontinued. It fell outside the scope of this study the evaluation of the percentage of patients who did not receive an antibiotic treatment as well as the administered dose and the duration of treatment, which are very important aspects directly related to the correct use of antibiotics and which should be the subject of further study.

It is our conviction that antimicrobial stewardship programmes are extremely useful in the control of prescription, but the strategy to be used may be different depending on the occupational group to which it is intended, it should be prolonged in time, and it may require careful monitoring of medical prescriptions. It is only then that these programmes can fulfil their purpose of optimising antibiotic prescription and have a direct influence on the control of bacterial resistance and health-related costs.

WHAT THIS STUDY ADDS

- Antimicrobial stewardship programmes may include simple, but effective measures to guide prescription of antibiotics.
- The placement of clinical information at the point-of-prescription can affect the prescribed antibiotic class.
- The impact of stewardship programmes may not be identical in the different occupational groups.
- These programmes should be maintained over time, as their efficacy may eventually lower over time.

Conflicts of Interest

The authors declare that there were no conflicts of interest in conducting this work.

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There were no external funding sources for the realization of this paper.

Protection of human and animal subjects

The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

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Impacto de Uma Intervenção no Local de Prescrição na Escolha do Antibiótico na Otite Média Aguda em Pediatria

Resumo:
Introdução: O uso incorreto dos antibióticos é um problema grave estando diretamente relacionado com o aumento das resistências bacterianas. Os programas de apoio à prescrição de antimicrobianos podem ter impacto significativo na escolha do antibiótico a prescrever. É objetivo deste trabalho medir o impacto de uma intervenção simples na prescrição de antibióticos na otite média aguda no serviço de urgência pediátrico.
Métodos: Estudo prospetivo que incluiu todas as crianças que recorreram ao serviço de urgência durante um ano. A intervenção consistiu em colocar junto ao local de prescrição um aviso com informação sobre o antibiótico recomendado em crianças com o diagnóstico de otite média aguda. Foi monitorizada a prescrição de antibióticos nesta doença antes, durante e após a intervenção em diferentes grupos etários e para diversos grupos profissionais.
Resultados: Durante o período do estudo foi realizado o diagnóstico de otite média aguda em 5695 crianças. A percentagem de prescrição de amoxicilina aumentou de forma significativa após a intervenção. Este aumento ocorreu por aumento de prescrição por parte dos pediatras especialmente no grupo etário entre os 6 meses e os 2 anos. A percentagem de prescrição de amoxicilina foi inferior no grupo de médicos de medicina geral e familiar quando comparado com outros grupos ($p < 0,01$). Aqueles aumentaram significativamente a percentagem de prescrição de amoxicilina durante a intervenção, mas esta voltou aos valores anteriores após a intervenção.
Discussão: Uma medida muito simples pode ter um impacto significativo no tipo de antibiótico prescrito num serviço de urgência pediátrico. O impacto de um programa de apoio à prescrição pode não ser idêntico nos diferentes grupos profissionais. Estes programas devem ser prolongados sob pena de os seus resultados se perderem com o tempo.

Palavras-Chave: Antibacterianos/uso terapêutico; Criança; Gestão de Antimicrobianos/métodos; Prescrição Inadequada/prevenção e controlo; Prescrição de Medicamentos; Otite Média/tratamento farmacológicomacológico;