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Prescription of Antibiotics for upper respiratory infections in under-Five children in an Indian rural health centre: a record based study

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ABSTRACT

Development of drug resistance among bacteria is the result of over-use of antibiotics. Regarding upper respiratory infections (URI), in most cases, antibiotics are non effective in reducing the symptoms' length or strength. These issues being known, there are still evidences of over-use of antibiotics.The study was intended to assess antibiotic prescription in URI among under five children in the RHC of Ramanathapuram. The other objective was to identify factors influencing this prescription.A record based study was conducted by systematically reviewing all the under-five patients' records from RHC, JIPMER, Ramanathapuram in Puducherry. The data on symptoms, diagnosis and treatment of respiratory infections was collected for a period of one year from 01.12.2009 to 30.11.2010.

We found 692 visits regarding 250 children in patients' records, among which 21 were for lower respiratory infection and the other 671 for URI. Antibiotics were given 115 times (17%) among these 671 consults. Significant association between presence of fever and antibiotic prescription was found (OR = 4.32; CI = 1.27 14.71), as well as between a duration of symptoms greater than 3 days and antibiotic prescription (OR = 5.54; CI 95% = 2.16 14.24). Children brought for immunization were five time less likely to get antibiotics than others (OR = 0.20; CI = 0.08 0.46).We observed an inappropriate prescription of antibiotics in almost 20% of cases of URI, this prescription being based on presence of symptoms that are not validated criteria. This rate could be improved.

INTRODUCTION

Antibacterial resistance is one of the major worldwide public health problems. Many scientists have already sounded the alarm for this, notably in India [1]. Yet, a new antibiotic resistance mechanism coming from India was reported in September 2010 [2]. Development of drug resistance among bacteria is the result of overuse of antibiotics that are prescribed when not indicated [3], or misuse of second or third line therapy when first-choice antibiotic should have been preferred [4,5]. Regarding upper respiratory infections (URI), in most cases antibiotics are non effective in reducing the symptoms' length or strength [6-8]. This being known, there are still evidences of over-use of antibiotics, as shown in studies conducted in Indian primary care facilities [9].

We therefore wanted to describe antibiotic prescription among under five children with URI in a rural Primary Health Centre. First objective was to study the frequency of antibiotic prescription. Further objectives were to determine characteristics of this prescription.

MATERIALS AND METHODS

Study area:

JIPMER Rural Health Centre (JIRHC) is a Primary Health Centre (PHC) attached to a teaching institute, and located at a distance of 12 kms from Puducherry. JIRHC provides comprehensive health care free of cost to a population of almost 10000 persons distributed in four villages.

The OPD is run by interns who are posted there after completing their MBBS. During this one year period of internship, two months are compulsorily dedicated to Community Medicine, among which one month is spent in JIRHC. Interns see patients on a first come first serve basis. Every patient of the service area has a record that is part of a family folder. When patients arrive at the PHC, they are given their file so that they can present it to the doctor.

Study design:

This was a record based descriptive study among all under-five children who had a record in the health centre. The under-five children living in a non service area and consulting at the health centre were not included, as they don't have a record. Data for a

one-year period from first December 2009 to 30th November 2010 was collected. There were 830 under-five children in the service area at the time of study.

Study procedure:

All the family folders of the four areas have been retrospectively and systematically reviewed. Under-18 months children's charts are kept in a separate room and were all reviewed. Other under-five children's files are kept in another building inserted in family folders. All the family folders were opened. Under-5 children's files were extracted if at least one visit for any respiratory tract infection was found during the one-year period from first December 2009 to 30th November 2010.

A visit was considered as for respiratory infection when (a) any respiratory infection was mentioned as the diagnosis and/or (b) at least one of the following symptoms or clinical signs was reported: cough, expectoration, cold, running nose, sore throat. A visit was not considered as for respiratory infection if treatment prescribed was consistent (ex: cough syrup) but nothing was written regarding diagnosis nor symptoms. Patient data (age, sex, allergies or antibiotic-adverse reactions, chronic baseline diseases or risk factors), infectious disease data, treatment data (name, dose, duration) were collected and entered in an Excel file.

When diagnosis was missing, it was assumed to be a "lower respiratory infection" if at least one of the following signs was found: (a) crepitations (b) high respiratory rate (c) use of accessory muscles (sub-costal retraction, inter-costal retraction). Otherwise it was assumed to be a non specific "upper respiratory infection".

Data collection was done by only one investigator in a period of two weeks at the end of December, 2010. One more day in January 2011 was needed to collect weight of under-18 months children. This time was also used to assess the accuracy of data collection by verifying conformity of the data file compared to medical charts. After reviewing all the files, 692 visits were found eligible for 250 children.

Analysis:

MS Excel and SPSS were used to do the statistic analysis. Quantitative variables were not normally distributed. They were transformed into nominal categories. Binary logistic regression was used with nominal variables. Using multivariate regression, adjustment was done for the association of antibiotic prescription with "age category" and "purpose of visit being immunization". Then it was done for association of antibiotic prescription with "duration of symptoms higher than three days" and "presence of fever".

RESULTS

A number of 692 visits regarding respiratory infections were found in the one year period, for 250 children, which correspond to 30.1% of total number of children. The baseline characteristics are shown in table 1. There was no significant difference in number of visits according to gender (p=0.47).Among the 692 visits, 346 (50%) had a diagnosis explicitly written. After recoding diagnosis (as mentioned above), diagnosis distribution was 671 URI (97%), 20 lower respiratory infections (LRI) (2.9%), and 1 (0.1%) acute otitis media. All 20 children diagnosed with LRI were prescribed antibiotics except one. The one diagnosed with otitis media also received antibiotics. For further analysis of inappropriate antibiotic prescription, only the 671 cases with URI diagnosis were considered. Antibiotic prescription among children presenting with URI was found for 115 visit, that is 17.1% (95% CI : 14.4% 20.1 %). Among the 115 prescriptions, 58 were cotrimoxazole (50%), 54 were amoxicillin (47%), 2 doxycycline (2%) and 1 cloxacillin (1%). Duration of antibiotic prescription was available in 102 cases (89%), and was distributed as following : 32% were prescribed for 3 days, 9% for 4 days, 53% for 5 days and 6% for 7 days.

In order to assess the appropriateness of antibiotic dose prescription, when weight was available, that is in 29 cases (25%), dose of antibiotic per kilogram per day was calculated for Amoxicillin and Cotrimoxazole. The mean dosage was 44.42 mg/kg/day for Amoxicillin and 6.86 mg/kg/day of Trimethoprim for Cotrimoxazole. No significant association was found between antibiotic prescription and gender (p=0.069). None of the symptoms reported in records (that are "cough", "expectoration", "running nose", "sore throat") was statistically linked with antibiotic prescription (table 2).

Table 1: Baseline characteristics

	Male	Female	Total
Total number of children	136	114	250
(%)	(54.4%)	(45.6%)	
Mean number of visits	2.68	2.87	2.77
(Std. Deviation)	(2.05)	(2.26)	(2.15)
Mean age at visit (years and months)	1y 10m	2y 2m	2y
(Std. Deviation)	(1y 7m)	(1y 9m)	(1y 8m)

Table 2: Antibiotic prescription in children with various symptoms

Variables		Antibiotic prescribed	Antibiotic not prescribed	p-value
Cough	Yes	62 (19.7%)	253 (80.3%)	0.27
n = 321	No	0	6 (100%)	
Expectoration	Yes	18 (20.2%)	71 (79.8%)	0.80
n = 90	No	0	1 (100%)	
Running nose	Yes	47 (17.1%)	228 (82.9)	0.83
n = 276	No	0	1 (100%)	
Sore throat	Yes	4 (66.6%)	2 (33.3%)	0.71
n = 7	No	1 (100%)	0	

Table 3: Antibiotic prescription as per patients' characteristics

Factor	p-value	Unadjusted Odds Ratio CI 95%
Age category (cutting line : 18 months)	0.000	2.81
n = 671		1.81 – 4.35
Duration of symptoms (cutting line : 3 days)	0.001	3.66
n = 208		1.79 – 7.50
Presence of fever	0.01	2.60
n = 129		1.24 – 5.45
Coming for immunization	0.000	0.15
n = 671		0.07 – 0.32

Table 4: Antibiotic prescription for age and purpose of visit (n = 671)

Factor	p-value	Adjusted Odds Ratio CI 95%
Age category (cutting line : 18 months)	0.091	1.52
		0.94 – 2.48
Coming for immunization	0.196	**0.20**
		0.08 – 0.46

Table 5: Antibiotic prescription for symptoms duration and presence of fever (n = 129)

Factor	p-value	Adjusted Odds Ratio CI 95%
Duration of symptoms (cutting line : 3 days)	0.000	**5.54** 2.16 – 14.24
Presence of fever	0.019	**4.32** 1.27 – 14.71

Number of visits (n) included in each test is mentioned, and depends on availability of data in charts. Considering age at visit, proportion of antibiotic prescription was 10.1% (33 over 328 visits) for children under 18 months, and 23.9% (82 over 261 visits) for children above 18 months. This difference was statistically significant (table 3). Using unadjusted logistic regression, antibiotic prescription was more likely if symptoms lasted more than three days, fever was present, and purpose of visit was not immunization (table 3).

Using multinomial logistic regression, age category became not related with antibiotic prescription, whereas other variables remained statistically significant (table 4 and 5).

DISCUSSION

This record based study including all under-5 children followed in a PHC on a one-year period shows that 17% of them consulting with an URI received antibiotics, and that children with fever or more than three days history of symptoms were about five times more likely to be prescribed antibiotics. On the contrary, children whose first purpose of visit was immunization were five times less likely to get antibiotics.

Commenting and comparing results with existing literature

Antibiotic prescription rate for URI in literature is often expressed in terms of number per 1000 inhabitants of the service area [10], which is not the method used in this study. However, we could compare our rate of 17% to some other international studies. One showed a rate of approximately 10% of antibiotic prescription among children who visited there doctor for URI in 1999 in US [11]. It was 21.4% in a Lebanese study in 2009 [12], and 26% in a rural Canadian emergency department in 2005 [13]. Regarding India, in private practices in Chennai in 2005, 96.95% of children consulting for URI with fever were given antibiotics [14]. This highlights the difference between public and private medical facilities in India, particularly in terms of prescription habits [15]. The fact that this PHC is attached to a teaching institute and run by interns, who have been taught about rational antibiotic use during their undergraduate curriculum, can also explain a lower prescription rate than other health facilities.

Molecules prescribed are roughly 50% Amoxicillin and 50% Cotrimoxazole. It is not very accurate to comment on choice of molecule, as all these prescriptions appear to be non-justified. Nevertheless, Amoxicillin is first choice antibiotic in otitis media, acute bacterial sinusitis and non-sever pneumonia in children. Whereas Cotrimoxazole is undependable in treating pneumonia because of increasing resistance, but it can be considered in case of beta-lactam allergy [16].

In our study, antibiotics were never prescribed for less than three days, and in 59% they were prescribed for five days or more. Again these prescriptions are not validated and so duration is difficult to comment.

Information on antibiotic dosage is very few as children's weight was rarely reported in medical charts. In RHC, children are systematically weighed when coming for immunization but not in other cases. Dosage for Amoxicillin was roughly 45mg/kg/day, that is the commonest dosage for respiratory infection in absence of high risk of resistance. However we found a wide variation in the 15 dosages prescribed where weights were available, suggesting it is not always calculated by interns according to weight. For Trimethoprim, average dose in our study is close to 6.9 mg/kg/day, whereas recommendations are 6 mg/kg/day.

Regarding factors related with antibiotic prescription, significance of presence of fever, as found in our study, is also cited in other Indian studies [14,15].

The fact that antibiotics are five times less likely to be prescribed when purpose of visit is immunization is to be noticed. When parents bring their child for routine vaccination, they often take the chance to talk about non specific symptoms such as running nose. In that case, the doctor seems to be less worried than when a mother brings her child especially to complain about these very same symptoms. As most of immunization takes place before the age of 18 months, age at visit was a confounding factor that lost its significance when co-tested with immunization by multilogistic regression.

International guidelines exist regarding management of children's URI [6-8,17,18]. Neither presence of fever, nor three days duration of symptoms are validated criteria to prescribe antibiotics. Common cold, rhinitis (even mucopurulent), bronchitis and cough illness don't necessitate antimicrobial treatment. Antibiotics should be considered only if symptoms persist more than 10 to 14 days or if the child suffers from underlying condition.

Reasons why these guidelines are not always followed and antibiotics are still prescribed may be multiple [14,19]. Factors already described are, among others, pressure from parents, being real or at least felt as so by doctors, diagnostic uncertainty and insufficient knowledge. Prescribers being mostly interns in our particular RHC, these reasons may be increased due to lack of clinical experience. And furthermore, some study showed that

being aware of guidelines doesn't always go together with a good adherence to them [20]. In our case, adherence may be improved if some Indian national guidelines were given regarding antibiotic prescription, instead of external ones, so that physicians would perhaps be more confident to use them in their day to day practice [21].

Strength and limitations of our study

This study being record based, it is free from any kind of influence on prescribers. Covering a one year period avoids seasonal variation, as well as pharmacy supply variation and prescribers' quality variation (different batch of interns each month).

On the other side, it is exposed to missing data and the inability to check their validity, or drug deliverance's conformity to prescription.Among the 830 children followed in RHC, only 250 were found having seen a doctor for respiratory infection. Many visits are missed, as the pharmacy register enumerates 2149 prescriptions for respiratory infections in under-five children during the same period. Reasons can be that medical records clerk is not always present, as well as some families don't know their folder number. Additionally, children from non-service area are also coming to RHC. In all these cases, a slip is given to them on which doctors write their findings. Patients are asked to keep this paper and so it was not possible to include them in the record-based study.

Still when chart was present and filled in by doctors, another limitation was the poor quality in record maintenance. Pictures shown in methodology section reveal that in most cases, only the initial complain and treatment are reported on the medical chart. This may have led to a classification bias between Upper and Lower Respiratory Infection, as some crucial information such as presence of crackles may not be reported even though present under examination. It led also to missing cases, as we chose to ignore prescriptions relevant with respiratory infection when no complaint or clinical findings were reported.

It is difficult to assess if causes of missing cases (both from not being recorded in the chart or having too poor information reported) are in any way related with antibiotic prescription. We can think that having the medical chart instead of only one slip will influence your prescription, as you can see previous visits. For example, previous antibiotic prescription in the past few weeks will be taken into account in the decision process. Concerning records not correctly filled in (and so not included), it is likely that it concerns non severe cases where antibiotics were not felt necessary.

Recommendations

Studying this particular topic of antibiotic prescription in children suffering from URI highlights the need to go back to basic principles of good medical practice along with the importance of staying updated on evidence based knowledge. Ideally, enough time should be taken to get a good medical history from parents. Then examination should include among others: general inspection, weight of the child (in order to calculate the correct antibiotic dose if needed), actual temperature taken by nurses with thermometer anytime presence of fever is suspected, pulmonary examination including respiratory rate, and look at throat and ears with appropriate tools (torch and otoscope). All the findings should be correctly written in patients' medical charts. These are the good conditions in order to make a good diagnosis with enough certainty. According to this diagnosis, symptomatic treatment and/or antibiotics should be given with respect to validated guidelines. These guidelines could be displayed in PHC in a practical format as it already exists [18]. All this process shall be explained to the parents, insisting on reassurance along with education on warning signs that should lead to return to the doctor. Similarly, prescription should be commented so that dose, duration and mode of taking treatment are well understood. If doubts remain at any step, interns should always be able to refer to a senior doctor or CMO.

Some difficulties are encountered in the field that might make it difficult to follow these recommendations. There are material issues such as availability of medical instruments, or consultation in a noisy environment without enough privacy. Some psychological aspects are also there. Strong believes both from doctors and patients side remain, regarding power and necessity of antibiotics. The economic aspect is also to be taken into consideration. Cost of antibiotic prescription is considerable. Reducing inappropriate prescriptions would lead to substantial savings [22].

CONCLUSION

To conclude, an appraisal of antibiotic prescription in under-5 children for URI was made as complete as possible. It shows that antibiotics were prescribed in 17% of cases with no justification found in medical record and more likely if symptoms lasted more than three days and fever was present. Evidence exists to choose adequate treatment and avoid unnecessary antibiotic prescriptions, using simple clinical and history findings that should be adequately copied out in records. These principles should be reinforced within medical staff.

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