

# Acute Tonsillitis and Bronchitis in Russian Primary Pediatric Care: Prevailing Antibacterial Treatment Tactics and Their Optimization

Vladimir Tatochenko<sup>1, \*</sup>, Eugenia Cherkasova<sup>2</sup>, Tatjana Kuznetsova<sup>3</sup>, Diana Sukhorukova<sup>4</sup>, Maya Bakradze<sup>5</sup>

<sup>1</sup>National Medical Research Centre of Child Health, Moscow, Russia

<sup>2</sup>Pulmonology and Allergology Department, S. I. Kruglaya Clinical Research Centre, Oryol, Russia

<sup>3</sup>Internal Disease Department, Medical College, I. S. Turgenev State University, Oryol, Russia

<sup>4</sup>City Pediatric Polyclinic No.4, Medical College, I. S Turgenev State University, Oryol, Russia

<sup>5</sup>Diagnostic Department, National Medical Research Centre of Child Health, Moscow, Russia

## Email address:

tatovk@yandex.ru (V. Tatochenko)

\*Corresponding author

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**Abstract:** Inappropriate use of antibiotics in children with acute tonsillitis (AT) and bronchitis is an important cause of the microbial resistance. The aim of the study was to find out pediatricians' motives in prescribing antibiotics and the extent of their inappropriate use in these cases, as well as maternal attitudes to the use of antibiotics in acute viral respiratory infections (ARI). We also studied in the context of regular primary pediatric care the acceptability to parents of a judicious use of antibiotics. Pediatricians (n=97) attitudes to antibiotics and their practices were studied by a questionnaire in 4 cities of Russia, mothers' attitudes to antibiotics (n=107) and antibiotic use frequencies were studied in an Oryol polyclinic. Optimization of treatment studies (acute tonsillitis 1577 child-years, acute bronchitis 3303 child-years of observations) were conducted by two co-authors in their capacity of primary pediatric providers (for about a 1000 children each) in a polyclinics of Oryol. Antibiotics were given only to AT cases found positive for hemolytic streptococcus (GABHS) by an express-test. Patients with acute bronchitis and bronchiolitis were treated by inhalation of 0.9% or 3% saline solutions. Most (95-100%) pediatricians consider tonsillitis (without bacteriological evidence obtained at the point of care) to be of bacterial origin and treat it with antibiotics - for the fear of GABHS complications, self-protection or as a traditions. About a half of mothers would add antibiotics to whatever else pediatrician prescribes for ARI, 1/3 mothers prefer self-treatment with antibiotics if body temperature is over 38°C. Of tonsillitis patients 80.5% and of bronchitis over 70% - are treated in the outpatient setting with antibiotics. The incidence of tonsillitis was 80 per 1000 children of all ages, the proportion of GABHS-tonsillitis - 27% - only in children above 4 years of age (population incidence 7.5 per 1000). 87% of mothers of GABHS negative children accepted treatment without antibiotics. Similarly, 88.5% of parents of children with bronchiolitis (incidence 113 per 1000 0-2 years old) and acute bronchitis (61 per 1000 0-18 years old) agreed to use only saline inhalations. We conclude that additional attention to mothers (explaining results of the express-test, or teaching how to do inhalation) overcome their fears of withholding antibiotics.

**Keywords:** Acute Tonsillitis, Bronchiolitis, Acute Bronchitis, Children, Antibiotics. Pediatricians' Views and Perceptions, Maternal Attitudes

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## 1. Introduction

Development of antibiotic resistance by pathogens causing community acquired infection is to a considerable degree linked to inappropriate use of antibiotics in pediatric practice [1]. Of particular importance is an excessive use of antibiotics for treatment of acute viral respiratory infections (ARI), and among them acute tonsillitis (AT)<sup>1</sup>, acute bronchitis and bronchiolitis - in spite of recommendations in international and national guidelines to limit antibiotics use [2-5]. It reflects the fear of some pediatricians to miss cases of AT caused by group A  $\beta$ -hemolytic streptococci (GABHS) that - if untreated - could cause both local suppuration and complications such as acute rheumatic fever, chorea minor, glomerulonephritis etc. An excessive prescriptions of antibiotics may reflect the wish to start treatment before the results of the throat culture (if any) are known [6].

The high incidence of bronchitis (in Russia 75-200, in the USA 56 per 1000 children per year [7, 8]) cause 25-40% of all pediatric primary care visits [9]. Frightening for many parents manifestations (fever, cough, wheezing) raise the demand for antibiotics though practically all of them are caused by respiratory viruses [4]. Bacteria cause bronchitis in children in about 5% of cases (mostly in school age), they are mainly *Mycoplasma pneumoniae* and *Chlamydia pneumoniae* [6, 8, 10, 11]. Hence antibiotics have no place in the majority of bronchitis and bronchiolitis cases, and it is proven by a number of conclusive studies [10, 11], and recommendations to this effect are found in international and national guidelines [3, 5, 13]. Nevertheless antibiotics are widely used in bronchitis – in Europe in 40 – 67.5% [4, 5, 12, 13]. In the USA up to 1/3-1/2 of antibiotics in the lower respiratory tract infections considered to be used inappropriately [14, 15].

In Russia we have a similar picture. Pharmaco-economic study in a regional pediatric hospital showed that 85% of children with bronchitis would get antibiotics, in 30% - 2 courses; antibiotics took the biggest share of total costs [16]. An audit program of treatment modalities in 21 pediatric hospitals in 4 regions of Russia had shown that 64-77% of all children with fever (the majority of them with ARI) are treated with antibiotics (in 85% the parenteral ones). Practically all children with bronchitis and bronchiolitis get antibiotics, in 95% of them the 3d generation cephalosporins, the rest – aminoglycosides, carbopenems, cefepim [17]. Similar situation was found in 7 pediatric hospitals in 2 additional regions audited by one of co-authors (MB – to be published).

Our aim was to study the prevailing practices of antibiotic use in acute tonsillitis and bronchitis by pediatricians, as well as parental attitudes to antibiotics for ARI. We also studied the acceptability of a recommended judicious use of antibiotics for this conditions by parents in the context of regular practices of primary care by (E. C. and D. S.) as

ouchastok pediatricians working in a city of Oryol polyclinic<sup>2</sup>.

## 2. Material and Methods

To study pediatricians' knowledge about antibiotic treatment of AT we conducted by questionnaire to 97 pediatricians in the cities of Oryol, Archangelsk, Vladivostok and Petropavlovsk-Kamchatsky. We also conducted a survey of attitudes and practices with respect to antibiotics in 107 mothers in an Oryol polyclinic.

In AT treatment study were included all children in one ouchastok of a pediatric polyclinics of Oryol cared for by one co-author (EC) for 2 years (1577 child-years of observations). All 140 cases of AT diagnosed were tested with their mothers present by an express-test for GABHS<sup>3</sup>; the test had been previously compared to culture and found by us to be 99% concordant [18]. Antibiotics were given only to patient with a positive test, parents of children negative for GABHS were persuaded to accept only symptomatic treatment for their children.

The bronchitis and bronchiolitis study was also conducted in one polyclinic ouchastok in Oryol cared for by one of co-authors (DS) for 3 years (3303 child-years of observations). All children with bronchiolitis (51) and acute bronchitis (142 with 202 episodes) were included. Their treatment regimens included sodium chloride solutions (0.9 or 3%) inhalations without antibiotics<sup>4</sup>. All parents were instructed how to perform saline inhalations at the time of diagnosis by pediatrician or the nurse; they were warned of a possible increase in coughing after the first inhalation of 3% saline. The treatment results were compared to those in 3 groups of similar patients at the adjacent ouchastok treated with systemic antibiotics and/or a broncholytic (fenoterol + ipratropium bromide diluted by normal saline) inhalations.

## 3. Results

### 3.1. Attitudes of Pediatricians to AT

A survey conducted in 4 cities of Russia showed considerable lacunae in pediatricians' knowledge of etiology of AT and of indications for antibiotics [19]. Independent of the region, in- or outpatient place of work and the length of practice 85 to 100% of pediatricians would treat AT with antibiotics - considering bacterial infection to be an obligatory element of AT etiology. Similarly the majority of pediatricians answered that they would give antibiotic for "a preventive purpose" (meaning, rather self-overprotection - "to be on a safe side"). As a motive appealing to the

2 Pediatric polyclinic in Russia provides primary health and medical care, each pediatrician supported by a nurse serving about 1000 children (age 0-18 years) in the neighborhood called "ouchastok" (a town quarter).

3 Streptatest, Laboratoires Dectra Pharm & Sbh, France.

4 3% sodium chloride inhalations had shown promising result in the treatment of bronchitis in the National Medical Centre for Childrens' Health and elsewhere [20].

1 Acute inflammation of tonsils and surrounding mucous membranes often referred to as acute tonsillo-pharyngitis.

traditions of a medical establishment was more characteristic (93%) to pediatricians with less than 5 years in service due to their relative lack of independence; for those over 15 years in service (88%) such practice means just to follow a stable stereotype.

Fear of reprimands for “insufficiently intensive therapy” without antibiotics was admitted by 93% of doctors with less than 5, and by 61% with 5-10 years in practice; the frequency of this motive rapidly decreases with increasing years in practice - to 7%.

**Table 1.** Tonsillitis' signs and symptoms considered by in- and outpatient pediatricians as indication for antibiotic therapy (%).

Signs and symptoms	Outpatient n=77	Inpatient n=20
Tonsils with visible follicles, exudate or film	97.4	95.0
37-38°C	49.4*	85.0*
1-2 dais	80.5	75.0
> 3 dais	81.8	95.0
Thro at redness, TOC	89.6	100.0
38-39°C	96.1	100.0
1-2 dais.	32.5	55.0
>39°C	92.2	90.0
>1 dais.		
Red conjunctivae		
Aphthous stomatitis		

\* P=0.003.

Respondents had been asked about symptoms that prompt them to prescribe antibiotics. Results are shown in tabl.1. Pediatricians of any length of practice considered AT to be bacterial if patients had:

1. red throat with follicles, exudate or a film on tonsils plus T 39°C (practically all doctors);
2. AT with the temperature above 37.5°C (over one half);
3. AT with conjunctivitis (about one third);
4. AT with aphthous stomatitis (71% - 100% of respondents).

The only significant difference was found in patient with 1-2 days long subfebrile temperature – in hospitals they are twice as likely to be given antibiotics. There were some regional differences with respect to conjunctivitis – it was considered as a sign of bacterial infection by 78% of Archangelsk and the Far east cities and only by 7.5% in Oryol (P= 0.001)..

This study has clearly shown that pediatricians were not following guidelines repeatedly published in Russia and abroad – apparently since without bacteriological evidence of the AT etiology obtained at the point of care the majority of AT patients would be started on antibiotics as dictated by the fear of GABHS-AT complications and/or reprimands from

administration, or by the institutions' tradition.

### 3.2. Maternal Attitudes Towards Antibiotics for ARI

A survey of maternal attitude to antibiotics for their children was conducted by us parallel with AT study. About a half of 107 mothers interviewed admitted that they would add antibiotics to whatever else pediatrician prescribes for ARI, 1/3 of mothers prefer self-treatment giving antibiotics based on their own experience or on advice of relatives and neighbors. Temperature over 38°C was considered to be an indication for antibiotics by 33% of mothers interviewed.

### 3.3. Reducing Antibiotics for Acute Tonsillitis

The analysis we conducted on another ouchastok of our polyclinic that followed an old traditions of AT treatment showed that of 135 AT cases antibiotics were given to 108 (80.5%).

We included in our study all children with AT from one ouchastok for 2 years seen personally by one of co-authors (EC) (Table 2). To diagnose GABHS-AT we express tested all children diagnosed with AT.

**Table 2.** Acute tonsillitis in children 0-18 years old on one pediatric ouchastok (1755 person years of observation)\*.

Age	6-11 mo	1-3 y	4-6 y	7-10 y	11-14 y	15-18 y	Total
Number of AT/Population	7/117	85/283	31/275	7/373	7/393	3/314	140/1755
Incidence per 1000	82	341	78	15	10	7	84 (95% CI: 71-97)
Number of GABHS-AT/all AT	-	-	13/48 (27%)**				13/140 (9.2%)

\* two cases of PFAPA-syndrome were excluded.

\*\* including 3 cases of scarlet fever.

AT was diagnosed in 9.7% of children with ARI with seasonal picks in February - March and September in both years of observation when most cases of GABHS-AT occurred. GABHS-AT was not found in children below 4 years of age, 13 cases were diagnosed in children 4-18 years of age - that is in 27% (95% CI: 14.5-41.5%) of AT in this age group. (Of AT in all age groups GABHS-AT were found in 9.2% (95% CI: 7.8-41.5%) with population incidence of 7.5 per 1000 (95% CI: 3.2-11.6).

Of children tested negative for GABHS infectious

mononucleosis was diagnosed in 6 (by PCR for EBV), adenovirus (by RIF) – in 21 of 56 children tested.

We used our data to test the diagnostic value of W. McIsaac's scale [21], All GABHS-AT children had scores above 2 that gives sensitivity of 100%. However only 8% of children with viral AT had the score 0-1, 12% scored 2-3 and 80% -  $\geq 4$  – it corresponds to specificity of only 7.7%.

All 13 children with GABHS-AT were successfully treated with amoxicillin for 10 days. Among 127 children with viral AT antibiotics were given by us to 5 with otoscopic feature

of otitis media and to one who recently had a cardiac surgery. On insistence of parents 8 children were started on antibiotics, but after 48 hours seeing no effects they yielded to pediatrician's advice to stop them. Parents of three patients (two of them with infectious mononucleosis) asked to be referred to a hospital where they traditionally were given antibiotics. Thus, out of 127 patients in the viral AT group we could withhold antibiotics in 111 (87%). In total antibiotics were given to 29 patients of 140 (21%) – 4 times less than 80.5% found in our survey of other ouchastoks of the same polyclinic.

The small number of mothers that hesitated to stay off antibiotics for their children with the negative express test was unexpected given the results of our survey. Apparently on the spot diagnosis of non-GABHS-AT is convincing for a majority, and those who hesitated to accept it soon found that antibiotics were not effective and agreed to drop them.

### 3.4. Reducing Antibiotics for Acute Bronchitis and Bronchiolitis

This 3 year study was aiming at minimizing the use of antibiotics for both bronchiolitis and acute bronchitis by providing symptomatic treatment that included inhalations of sodium chloride 0.9% or 3% solutions at home. The first inhalation was conducted under the instruction of the pediatrician at the time of diagnosis. During 3 years we diagnosed 51 case of bronchiolitis - the population incidence 108 (95% CI: 80-136) per 1000 0-2 years old children, We also diagnosed 202 episodes of bronchitis in 142 children (61 (95% CI: 53-69) per 1000 0-18 years old) of which 75 children had 108 wheezing episodes - 33 (95% CI: 27-39) per 1000. Among patients with bronchitis 75% were children below 5 years of age, and among wheezing ones - 60%.

Of 51 patients with bronchiolitis 10 with the SaO<sub>2</sub> <93% and/or severe dispnoe were sent to hospital, 41 were treated at home randomly divided to receive inhalations of normal saline (19) or 3% sodium chloride solution (21). The results (published previously [22]) were compared to a similar group treated with antibiotics and/or a bromcholytic showed that antibiotics were inferior to inhalations:

1. of 3% saline with regards to the duration of tachypnea and dyspnea, O<sub>2</sub> desaturation and the time of rales' clearance on auscultation,
2. of 0.9% saline inhalations – to the duration of dyspnea.
3. of broncholytic inhalation – to the duration of tachypnea and dyspnea.

Inhalation of broncholytics had no statistically valid advantages to either saline inhalation on all above counts.

Of 202 episodes of acute bronchitis we gave antibiotics to 10 children with otitis media and UTI; in 17 school children we suspected *M. pneumoniae* infection (confirmed in 5 cases by PCR) and gave macrolides with quick clinical effect. Parents of only 3 wheezing children asked to be referred to a hospital where they were given antibiotics. Thus antibiotics were given to 15% of patients, inappropriately – in 3 of 175 episodes – about 1.5%.

The rest of 172 episodes of bronchitis were treated at home;

non-wheezing episodes (78) were treated by inhalations of normal saline, those with wheezing (94) - with 3% sodium chloride solution. Results were compared to those on an adjacent ouchastok where antibiotics were given to 70 patients (in 21 with wheezing – plus a bronchodilator) whereas 23 patients with normal temperature were given only bronchodilator inhalations. We found that percentage of children with bronchitis treated with antibiotics in this ouchastok (about 70%) is representative for other polyclinic pediatricians that would withhold antibiotics only to patients with normal temperature.

Statistical analysis had shown that antibiotics provide no advantages as compared to saline solution inhalations independent of the criteria used (duration of fever, tachypnea and the time of rales' clearance on auscultation). Inhalation of 3% saline alone was superior to bronchodilator (with antibiotics or alone) when evaluated for the velocity of the rales' clearance.

## 4. Discussion

Our study (as a similar by I. Dronov, [23]) shows that pediatricians in Russia - young or experienced, no matter in what region or in in- or outpatient settings, would treat 85% and more AT cases with antibiotics since they consider bacteria as obligatory agents of its etiology. Most of them consider tonsillar exudate and red throat with an elevated temperature as a sign of bacterial inflammation. These situation, whatever motives pediatricians claim in not following guidelines, is clearly due to non-availability till very recently of a convenient express test for GABHS. Laboratories for throat culture, particularly in outpatient setting are not easily accessible, and even if so, the results come 1-2 days later and antibiotics in the meantime seem to be a good practice. Moreover, laboratories instead of giving “negative for GABHS” result often mention commensal bacteria grown (such as *Staphylococci*, *Streptococcus viridnce*) that may support the idea of AT bacterial etiology. Introduction of express tests should change the situation.

Our experience with an express test shows that its application on the spot of care influences the decision of mothers whose high acceptance of non-antibiotic treatment of AT was at discordance with their reported attitudes to antibiotics.

Though express tests for GABHS are not very expensive (about \$4 each) with a high incidence of AT (84 per 1000) and a low proportion (9.2%) of GABHS-AT among them the total cost of testing on 1 ouchastok of 1000 children per year may come up to \$320. Our data shows that testing children below 4 years of age is not necessary, in older children those with 0-1 score on W. McIsaac's scale could also be excluded. Our calculations show that with this approach economy on antibiotics by far exceeded the cost of testing.

Attitudes towards bronchitis and bronchiolitis being a bacterial infection that require antibiotics in Russia are prevailing among pediatricians as it is in the case of AT. In the real practice only 20-30% of children with bronchitis – those

with normal temperature may escape an antibiotic prescription. There is no express test to select cases of bronchitis of bacterial origin, routine throat and sputum cultures often grow *S. pneumoniae* and *H. influenzae*, that does not help pediatricians to abstain from antibiotics. Clinical features of *M. pneumoniae* allow to diagnose these cases (due to a high carriage rate PCR and serology may only increase false positivity). Our experience with saline solutions' inhalation therapy allowed to limit antibiotics to 15% of all cases. Moreover we demonstrated advantages of 3% saline solution inhalations to use of a broncholytic in wheezy bronchitis.

Success in persuading mothers to abstain from antibiotics (as in the case of no antibiotics for non-GABHS AT) was to a considerable degree a result of closer than at a routine visit interactions with the pediatrician in the process of inhalation instructions. Positive results of the treatment provided support to mothers in the acceptance of "no antibiotics for bronchitis" offered by doctor with appropriate explanations.

## 5. Conclusion

A high (70-80%) antibiotic prescription rate for acute tonsillitis and bronchitis in primary pediatric care often result from "to be on a safe side" prescribing, fear of reprimands for "insufficiently intensive therapy" and traditions - coupled with maternal pro-antibiotic attitude. We showed that diagnostic (on-the-spot test for GABHS) and treatment (saline inhalation instructions) interventions reduce maternal uncertainty regarding the nature of the illness and results in a drastic reduction of antibiotic use.

## Disclosure

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