

Tonsillitis in children: unnecessary laboratory studies and antibiotic use

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Background: The Finnish Current Care Guidelines on diagnostics and treatment of sore throat recommend the treatment of only group A streptococcus (GAS) positive cases with penicillin. The aim of the study was to evaluate how these guidelines are followed in the pediatric emergency unit.

Methods: We analyzed retrospectively the data on microbiological studies and blood tests done, and data on prescribing of antibiotics, of 200 children admitted for febrile exudative tonsillitis.

Results: After the clinical diagnosis of exudative tonsillitis, antigen test and/or culture for GAS identification was done in >95% of cases. All the 32 (16%) children with GAS infection, but also 52 (38%) of the 137 children without any evidence of bacterial infection received antibiotics. Additional laboratory studies were done in 96% of children. Serum C-reactive concentrations or white blood cell counts were not able to separate streptococcal from non-streptococcal tonsillitis. No serious bacterial infection was diagnosed.

Conclusions: The Finnish Current Care Guidelines lead to over-treatment with antibiotics. None of the 200 children returned after discharge, suggesting that under-treatment did not happen.

World J Pediatr 2016;12(1):114-117

Key words: exudative tonsillitis;
streptococcal antigen test;
streptococcal culture

Introduction

Most children with acute sore throat and even with exudative tonsillitis never seek doctoral consultation.^[1,2] The younger the child is, the more difficult it is for parents even to suspect throat infection as a cause for their child's fever; and the decision to seek medical care is usually based on the general appearance of the child. In case of sore throat, the goal in the health care is to treat group A streptococcal (GAS) infections and to eliminate complications, as rheumatic fever which currently is rare, or post-streptococcal glomerulonephritis which, however, seems not to be avoided with early antibiotic treatment.^[3] No doubt, the use of antibiotics decreases the risk of suppurative complications, like cervical lymphadenitis or throat abscess.^[4,5] On the other hand, the doctors should not order unnecessary studies or prescribe unnecessary antibiotics when the patient has viral infection.

The Finnish Current Care Guidelines on diagnostics and treatment of sore throat were updated in 2012.^[6] The guidelines recommend that all children with fever and throat symptoms should be tested for GAS, and that no other studies are needed.^[6] The British guidelines recommend that tonsillitis can be diagnosed and treated solely based on clinical findings, with no need to GAS identification.^[7,8] The Centor and McIsaac criteria have been developed to guide treatment decisions in patients with acute sore throat.^[9-11]

The aim of the present study was to evaluate, how the Finnish Current Care Guidelines are applied for patients admitted to the pediatric emergency room (ER), with special focus on the use of GAS identification tests, additional laboratory tests, and prescribing of antibiotics.

Methods

The design of the study was a retrospective hospital chart review. One of the authors (Kunnamo A) evaluated the records of 200 children who were consecutively treated because of febrile exudative tonsillitis in the pediatric ER or at the infectious disease ward at Tampere University Hospital, a referral center for a population of about 90 000 children, between June

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doi: 10.1007/s12519-015-0054-y
Online First November 2015

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4, 2009 and January 2, 2011.

Patients were collected from the electronic files of the hospital by using the international classification of diseases-10 codes J02 (acute pharyngitis), J03 (acute tonsillitis), J36 (peritonsillar abscess), and B27 (infectious mononucleosis). The case had to fulfil two criteria to be entered in the study: a history of fever $>38^{\circ}\text{C}$ and tonsillar exudate at inspection. Among the 200 children included in the study, 68 were treated as inpatients and 132 as outpatients.

The data collected from the patient records included age, sex, duration of fever before admission, presence of enlarged lymph nodes, presence of cough and/or runny nose, presence of abdominal complaints, otitis media diagnosis, pneumonia diagnosis, length of stay in hospital if hospitalized, serum C-reactive protein (CRP) if studied, white blood cells (WBC) if studied, and whether chest radiograph, urine culture or blood culture, or streptococcal antigen test and/or throat culture were examined, and the possible prescription of antibiotics. During the surveillance period, the antigen tests for GAS identification were Diaquick Strep A Cassette, Dialab, Wr. Neudorf, Austria, or Clearview Exact Strep A Cassette, Orion Diagnostica, Espoo, Finland. The streptococcal culture of the throat samples was performed by standard methods. When the clinical presentation was consistent with mononucleosis, Epstein-Barr virus (EBV) etiology was studied with enzyme-linked immunosorbent assay (EIA) (Enzygnost anti-EBV IgG/IgM, Siemens Healthcare, Marburg, Germany).

IBM SPSS for Windows version 20 (SPSS, Chicago, IL, USA) was used in the statistical analyses of the data. Student's *t* test was used for continuous variables and the Chi-square or Fisher's test for categorised variables.

Results

The median age of the 200 children was 3.9 years (range: 0.4-16.1), and 107 (54%) were boys. Children with positive GAS identification were older than children without such identification (Table).

Streptococcal antigen test (170 children) or culture (157) was obtained from all but seven children, and 32 (16%) had GAS identified in the throat (29 with antigen test and 23 with culture). Ten children had positive culture but negative antigen test, and two children had positive antigen test but negative culture. No G or C streptococcal strains were found in cultures. Twenty-nine (14.5%) children had EBV infection diagnosed with EIA.

The studies were limited to the evaluation of the microbiological etiology of the disease in only eight (4%) cases (Table). CRP was studied in 190 cases (95%). There were no significant differences between children with GAS [mean \pm standard deviation (SD): 80.7 \pm 62.4 mg/L] and non-GAS tonsillitis (mean \pm SD: 71.0 \pm 61.6 mg/L). WBCs were counted in 177 cases (88.5%), again without any significant difference between GAS and non-GAS cases (Table). Urine and blood cultures were negative in all cases. No throat abscess was diagnosed. Twelve patients had infiltrates compatible with pneumonia in chest radiograph, and CRP could not differentiate the 12 children (69.3 \pm 71.5 mg/L) with lung infiltrates from those 47 (98.3 \pm 72.4 mg/L) without such infiltrates.

Sixty-eight (34%) children were hospitalized, and the median length of stay was 2.0 days (range 1-8 days). The reasons for hospitalization were vomiting or dehydration (35.3%, 24 cases), high CRP value (13.2%, 9 cases), prolonged fever (10.3%, 7 cases), suspicion of pneumonia

Table. Clinical characteristics of children with exudative tonsillitis

Variables	Streptococcal tonsillitis (n=32)	P value	Non-streptococcal tonsillitis (n=161)	Total* (n=200)
Age (y), mean \pm SD (range)	6.3 \pm 3.7 (1.3-15.7)	0.05	4.8 \pm 3.9 (0.5-16.1)	5.0 \pm 3.9 (0.4-16.1)
Fever (d), mean \pm SD (range)	2.5 \pm 1.6 (0-7), n=31	0.09	3.4 \pm 2.9 (0-20), n=153	3.3 \pm 2.7 (0-20), n=190
Lymphadenitis, N/N recorded (%)	25/31 (80.6)	0.28	105/147(71.4)	132/183 (72.1)
Cough or runny nose, N/N recorded (%)	10/22 (45.5)	0.82	55/98 (56.1)	66/122 (54.1)
Abdominal complaints, N/N recorded (%)	8/32 (25)	1.00	38/153 (24.8)	48/191 (25.1)
Otitis media, n (%)	1 (3.1)	0.21	21 (13.0)	22 (11.0)
Pneumonia, n (%)	2 (6.3)	0.69	10 (6.2)	12 (6.0)
Tonsillitis diagnosis at basic health care, n (%)	15 (46.9)	0.60	76 (47.2)	91 (46.7)
Hospitalisation, n (%)	7 (21.9)	0.15	58 (36.0)	68 (34.0)
Hospital stay (d), mean \pm SD (range)	2.4 \pm 0.8 (2-4)	0.40	2.9 \pm 1.5 (1-8)	2.9 \pm 1.4 (1-8)
CRP (mg/L), mean \pm SD (range)	80.7 \pm 62.4 (11-240), n=31	0.40	71.0 \pm 61.6 (1-256), n=151	72.3 \pm 61.3 (1-256), n=187
Leukocytes cells ($\times 10^9$ /L), mean \pm SD (range)	15.8 \pm 6.8 (5.9-29.4), n=27	0.18	13.9 \pm 5.8 (3.9-38.3), n=145	14.4 \pm 5.9 (3.9-38.3), n=177
Imaging studies obtained, n (%)	6 (18.8)	0.10	56 (34.8)	65 (32.5)
Urine culture obtained, n (%)	13 (40.6)	0.85	62 (38.5)	78 (39.0)
Blood culture obtained, n (%)	8 (25)	0.82	36 (22.4)	46 (23.0)
Antibiotic treatment, n (%)	32 (100)	0.00	76 (47.2)	111 (55.5)

CRP: C-reactive protein; SD: standard deviation. *: includes 7 children in whom microbiological diagnostics was not done.

or pyelonephritis (10.3%, 7 cases), pending laboratory values (7.4%, 5 cases), febrile convulsion (5.9%, 4 cases) and suspicion of an abscess (4.4%, 3 cases).

All children with GAS identified in the throat sample were treated with antibiotics (17 with penicillin, 11 with 1st generation cephalosporin, 2 with amoxicillin, and one each with azithromycin or clindamycin). Seventy-six (47%) of the 161 children with no evidence of GAS infection received antibiotics: 24 of them because of potential bacterial infection, such as otitis media or pneumonia. Thus, 52 (38%) of 137 children without any evidence of bacterial infection received antibiotics.

Discussion

There are three main results in this retrospective study of the 200 children admitted for exudate tonsillitis to the ER of a children's hospital. First, antigen test and/or culture for GAS identification in throat samples were done in >95% of the cases, in agreement with the Finnish Current Care Guidelines. Second, additional laboratory tests were done also in >95% of the cases, in disagreement with the national guidelines, since complications were not diagnosed in any cases. And third, all children with GAS tonsillitis were treated with antibiotics, and penicillin or 1st generation cephalosporin was selected. However, 38% of those without any evidence of bacterial infection were also treated with antibiotics.

The Finnish Current Care Guidelines published in 2012 recommend GAS antigen testing and streptococcal culture in all children with fever and sore throat.^[6] This approach maximizes the diagnosis of GAS tonsillitis or pharyngitis, but unnecessary antibiotics are prescribed to streptococcal carriers. In a recent systematic review, the prevalence of GAS carriage among well children was 12%.^[1] In the present study, ten of the 32 GAS positive children presented with cough or runny nose, and they were merely GAS carriers than had GAS tonsillitis.

In the present study, the guidelines if they had been exactly followed, would have justified antibiotic treatment in only 32 (16%) patients with antigen- or culture-positive GAS infection, or in only 22 (11%) if the probable carriers were excluded, and in additional 24 children with evidence of another bacterial infection. In reality, 115 (57.5%) children received antibiotics, including 52 children with no evidence of bacterial infection.

In some countries like in the UK, no routine GAS identification is recommended, but antibiotics should be prescribed to patients who are unwell due to tonsillitis, and are suspected to have complications or have co-morbid conditions. In addition, antibiotics can be considered in patients with acute pharyngitis or tonsillitis when three of the four Centor criteria

are present.^[7,10] These criteria, developed to separate bacterial from viral throat infection, include the presence of tonsillar exudate, fever and swollen, tender anterior cervical nodes, and the absence of cough. McIsaac scores for children aged less than 15 years are Centor scores plus one.^[11] Thus, the presence of two of the four criteria mentioned above is enough to start antibiotics in children.

In the present study, 158 (82.3%) of the 192 cases, in whom the markings in the patient records were so exactly done that Centor scores could be retrospectively assessed, fulfilled at least three of them. Since exudative tonsillitis was an inclusion criterion, and all were or had been feverish, McIsaac score was two or more in all cases. Thus, the figures based on Centor and McIsaac criteria would have been clearly higher than the antibiotics prescription rate of 58% of the present study. On the other hand, our retrospective design did not allow to evaluate the tenderness of swollen lymph nodes, which is demanded in both Centor and McIsaac criteria.^[11]

CRP has been widely used for differentiating bacterial from viral infection.^[12,13] In this study, high CRP value was considered a warning sign in the pediatric ER, since children with viral infection who received antibiotics had higher CRP values than those who did not receive. However, CRP could not be used to separate GAS from non-GAS tonsillitis.

In previous studies, age over six years and the response of fever to antibiotics have been the only findings associated with streptococcal tonsillitis compared to viral tonsillitis.^[12,14] Though inflammatory markers, especially procalcitonin, have been elevated in children with streptococcal tonsillitis,^[15] they often are equally high in adenoviral tonsillitis.^[14,16] In addition, low values do not exclude GAS tonsillitis.^[15]

None of the 200 children returned after discharge suggesting that under-treatment did not happen. Finnish The Current Care Guidelines lead to over-treatment with antibiotics, but however less often than the guidelines, which are based on clinical observations alone without any bacteriological confirmation of GAS infection.

Funding: None.

Ethical approval: Not required for this retrospective study with only register-based data. The researches were not allowed to be in contact with the patients, but only checked the hospital electronic files or hospital cards.

Competing interest: None.

Contributors: Kunnamo A collected the data, performed the statistical analyses, and wrote the first draft of the manuscript. Korppi M participated in the planning of the study and was responsible for the final writing. Helminen M was responsible for the planning of the study and participated in the analyses and writing. Korppi M is the guarantor.

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Received October 24, 2014

Accepted after revision March 4, 2015