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The impact of national guidelines on the diagnostics of sore throat in children

Johanna Jääskeläinen[1*], Marjo Renko[1,2] and Ilari Kuitunen[1,3]

Abstract

Background The Finnish treatment guidelines for sore throat were updated in June 2020. The aim of this study was to determine how the publication of these guidelines affected the treatment of pediatric patients, particularly through the use of the Centor criteria, C-reactive protein tests, and microbiological testing in the diagnosis of Group A β-hemolytic streptococci tonsillitis.

Methods We conducted a retrospective single-center before-and-after cohort study in Finland from 2019 to 2022. We included all patients who visited the pediatric emergency department and were diagnosed with tonsillitis or pharyngitis.

Results We included 246 patients who were admitted before the guidelines were updated and 219 patients after. Only two patients in the after group had a Centor score reported in their patient records. Rapid antigen tests were administered to 231 patients (93.9%) before the update and 202 patients (92.2%) after (proportion difference of 1.7%, CI -3.0–6.6%). C-reactive protein was taken from 193 patients (78.5%) before the update and 189 patients (86.3%) after (proportion difference of 7.8%, CI 0.1–14.7%).

Conclusions Centor scores were not used as recommended in the guidelines and did not impact the use of microbiological or C-reactive protein testing. More education and examining the preconceptions of health care personnel is required to implement the updated treatment guidelines in clinical practice.

Keywords Acute pharyngitis, Group A β-haemolytic streptococci (GAS), Centor score, Treatment guideline

Introduction

Acute pharyngitis is a common reason for seeking medical advice. The majority of pharyngitis cases are caused by viruses, and approximately 24–37% of children's pharyngitis is caused by Group A β-haemolytic streptococci (GAS) [1–3]. In high-income countries, rheumatic fever and rheumatic heart disease are rare complications of GAS infections, but they still impose a large disease burden in low-income countries [4]. GAS pharyngitis can lead to suppurative complications, such as peritonsillar and retropharyngeal abscess, as well as toxin-mediated complications, scarlet fever, and streptococcal toxic shock syndrome. These complications are rare in high-income countries, and GAS is usually self-limited; therefore, antibiotic treatment should not be started to only prevent suppurative complications or relieve symptoms in patients with mild symptoms [3].

The Finnish treatment guidelines for sore throat were updated in June 2020, and the Centor score was presented as a diagnostic tool for GAS pharyngitis. According to the Centor criteria, one point is given for each of

*Correspondence:
Johanna Jääskeläinen
johajaa@student.uef.fi
[1]Institute of Clinical Medicine, Department of Pediatrics, University of Eastern Finland, Kuopio, Finland
[2]Department of Pediatrics, Kuopio University Hospital, Kuopio, Finland
[3]Department of Pediatrics, Mikkeli Central Hospital, Mikkeli, Finland

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the following symptoms and clinical findings: absence of cough, tender and swollen submandibular lymph nodes, tonsillar exudate or swollen tonsils, and fever≥38˚C. In the guideline update Centor score is recommended to use to direct antibiotic treatment to patients with more severe symptoms and higher likelihood of GAS. Patients with mild symptoms and Centor score (0–2) are recommended to be treated symptomatically and patients with severe symptoms (3–4) are recommended to be treated based on microbiological test results. A new guideline for microbiological testing of GAS was also provided. The new guidelines recommend using a rapid antigen detection test in patients with a Centor score of 3 or more. Throat culture should only be used in patients with prolonged symptoms or in epidemic situations. The guidelines also recommend against using C-reactive protein (CRP) tests in the diagnosis of pharyngitis, as they are ineffective at distinguishing viral from bacterial pathogens [5, 6].

The aim of this study was to determine how the publication of the updated Finnish Current Care Guidelines affected treatment for pediatric patients, particularly the use of the Centor criteria, CRP tests, and microbiological testing in the diagnosis of GAS tonsillitis.

Methods

We conducted a retrospective single-center before-and-after cohort study. Participants were recruited from the Mikkeli Central Hospital pediatric emergency department. This pediatric emergency department is a 24/7 primary and secondary level emergency care unit that provides on-call general practitioner, pediatrician, and ENT specialist consultation services.

We included all pediatric patients (0–15 years) with an ICD-10 diagnostic code of J02* (pharyngitis) or J03* (tonsillitis) who attended the emergency department between July 2019 and June 2022. The study periods were prior to the publication of the latest national guidelines (July 2019 to June 2020) and after (July 2020 to June 2022). We calculated that 200 patients before and 200 patients after the update to the Finnish Current Care Guidelines would be a sufficient sample to represent changes in the diagnosis and treatment of pharyngitis. Since the COVID-19 pandemic reduced the circulation of respiratory pathogens in children in 2020 and 2021, we collected data for two years after the update to achieve the desired number of patients [7, 8]. Only primary visits were included.

We extracted the following information for every patient and visit: date, age, sex, previously diagnosed long-term illnesses, fever (measured or anamnestic), complaint of sore throat, complaint of cough, tonsillar status, swollen or sore cervical lymph nodes, Centor score, and rapid antigen, throat culture, and CRP test results (if taken). We calculated Centor scores based on the symptoms reported in the patient records and compared them and the number of rapid antigen tests taken in the before and after groups.

Our main outcomes were the use of Centor scores and laboratory tests (i.e., CRP and microbiological testing for GAS) in pediatric patients with pharyngitis or tonsillitis.

Statistics

We determined that it would be clinically significant if the publication of the Current Care Guidelines increased the use of Centor criteria in assessing the need for microbiological samples from 10 to 25%. We calculated that with a type I error of 5% and a type II error of 10%, we would need 147 patients before and 147 patients after the publication of the guideline to demonstrate this 15% absolute difference. Since complete information is not available in all patients' medical records, we included 200 patients before and 200 patients after the publication of the new guidelines.

We compared the rates before and after the guideline publication by calculating their difference in proportions and the 95% confidence interval for it.

Results

All 246 consecutive patients diagnosed with pharyngitis before the update of the guidelines acted as the before group, and 219 patients diagnosed with pharyngitis after the update acted as the after group. The study population included both primary and secondary care patients from which approximately 95% were primary care patients. The mean age in the before group was 8.1 years (SD=4.3) and 10.0 years (SD=4.2) in the after group. The gender distribution was similar in the before and after groups, 47% and 55% of the patients were females in the before and after groups respectively. The majority of the children included in the study did not have any long-term illnesses (Table 1).

Only two patients after the update had Centor scores calculated and reported in their patient records.

Table 1 Baseline characteristics of children with pharyngitis before and after publication of the updated guidelines

		Before (*n*=246)	After (*n*=219)
Age in years, mean (SD)		8.1 (±4.3)	10 (±4.1)
Gender	Female	129 (47%)	135 (55%)
	Male	144 (53%)	122 (49%)
No diagnosed long-term illnesses		207 (84%)	172 (79%)
Asthma, atopic disease		14 (5.7%)	15 (6.8%)
Rheumatoid arthritis, inflammatory bowel disease, cancer, other immunodeficiency		2 (0.8%)	1 (0.5%)
Type 1 diabetes		0 (0.0%)	1 (0.5%)
Other		23 (9.3%)	29 (13%)
Missing, not reported		0 (0.0%)	5 (2.3%)

Reported symptoms were similar in the before and the after groups, as well as the amount of incomplete reporting of the symptoms needed to calculate the Centor score. Absence of cough was more likely to be reported in the after group (Table 2).

No significant difference was found between the before and after groups when cases were pooled into groups based on reported symptoms determining the Centor score (Table 3). As shown in Table 3, the new guidelines were not followed when taking rapid antigen tests. Rapid antigen tests were taken from 231 patients (94%) in the before group and 202 patients (92%) in the after group (proportion difference of 1.7%, CI -3.0–6.6%). The use of CRP tests increased after the update. CRP tests were administered to 193 patients (79%) in the before group and 189 patients (86%) in the after group (proportion difference of 7.8% CI 0.1–14.7%). In the before group 4 patients and in the after group 3 patients were hospitalized.

Table 2 Number of children with symptoms determining centor -score in before and after groups

	Before ($n=246$)	After ($n=219$)
Cough	56 (23%)	55 (25%)
Yes, n (%)	39 (16%)	67 (31%)
No, n (%)	151 (61%)	97 (44%)
Not assessed or reported		
Fever over 38°C measured or	136 (55%)	96 (44%)
anamnestic	51 (21%)	69 (32%)
Yes, n (%)	59 (24%)	54 (25%)
No, n (%)		
Not assessed or reported		
Swollen lymph nodes	66 (27%)	52 (24%)
Yes, n (%)	79 (32%)	78 (36%)
No, n (%)	101 (41%)	88 (40%)
Not assessed or reported		
Tonsils	162 (66%)	150
Swollen or exudate, n (%)	73 (30%)	(69%)
Normal/redness, n (%)	11 (4.5%)	57 (26%)
Not assessed or reported		12 (5.5%)

Discussion

In this observational study, we found that the use of Centor scores and the reporting of scores according to the criteria of the updated treatment guidelines for sore throat in were not implemented in clinical practice. In the guidelines, the use of the Centor score was presented as a tool for practitioners to estimate the likelihood of GAS pharyngitis and to guide the use of microbiological tests. Centor scores were reported in only two patients after the update. Presence of cough and information on swollen lymph nodes were most often missing from the medical reports. We calculated the Centor score for each case from the reported symptoms to see if rapid antigen tests were indicated for patients with Centor scores of ≥3. As seen in Table 3, rapid antigen tests were administered almost equally in both groups, and no significant change was seen after the update.

The updated guidelines recommend against using CRP tests in diagnosing sore throat, as they are ineffective at distinguishing viral from bacterial pathogens. However, we did not see any change in the use of CRP tests between the before and after groups. Overall, the use of CRP tests was high in this patient series. Although administering CRP tests has benefits in clinical work—for example, in reducing antibiotic prescriptions for children with upper respiratory tract infections—it is not useful for predicting the presence of GAS [9, 10].

The previous Current Care guideline, published in 2013, recommended the use of Mclsaac score for screening of GAS, throat culture as a primary microbiological test and confirming of negative rapid antigen tests with culture. However, the use of Mclsaac score in Finland hasn't been reported and seemingly it hasn't been in common use. Our findings align with several previous studies, for example a study conducted in 2006 in Boston, where general practitioners were nonadherent to guideline strategies for streptococcal testing in adults [11]. A 2018 Australian study also showed that adherence to clinical practice guidelines is limited [12].

Table 3 Number of children with centor scores calculated based on reported symptoms and rapid antigen tests taken before and after publication of the updated guideline

Centor score	Before ($n=246$)		After ($n=219$)		Proportion difference, 95% CI
	n (%)	Test taken *n* (%)	*n* (%)	Test taken *n* (%)	0
0	31 (13)	23 (74)	28 (13)	25 (89)	15%, -5.4–34%
1	80 (33)	75 (94)	71 (32)	68 (96)	2.0%, 6.3–10%
2	88 (36)	86 (98)	70 (32)	62 (89)	9.2%, 1.3–19%
3	41(17)	41 (100)	44 (20)	42 (96)	4.6%, -4.6–15%
4	6 (2.4)	6 (100)	5 (2.3)	5 (100)	0%, -39–44%
Total	246	231 (94)	219	202 (92)	1.7%, -3.0–6.6%

The purpose of the Finnish Current Care Guidelines is to provide evidence-based treatment guidelines to help standardize nationwide treatment protocols. After publishing the updated guideline, a taskforce released a media briefing and news article in the Finnish Medical Library Handbook and on the Duodecim website and social media accounts, in addition to announcements in medical conventions, professional development days, and specialty societies. Based on the results of this study, these measures are insufficient to impact the diagnostic protocols of acute pharyngitis. Our results, as well as reports from other countries, show that the mere publication of guidelines will not immediately change previous practices, and thus implementation is necessary [13, 14]. An interview of Swedish GPs showed that guideline adherence was low especially if recommendation in the guidelines was not compatible with existing norms and preconceptions of the physicians [15]. Recent study showed that there is considerable mishandling of acute pharyngitis in Italian ERs [16]. A Finnish study that assessed whether published guidelines against the use of cough medication had an impact on prescriptions initially found that it did not [17]. However, the study group reported that after implementing a program with practical guidance for prescribing, the prescription rates reduced [18].

Educating general practitioners alone may not be sufficient to change the use of rapid antigen and CRP tests in patients with sore throat. In general, patients who come to the emergency department or make acute visits to primary care facilities first see a nurse, and depending on regional instructions, nurses administer tests at their own discretion. Thus, local protocols for testing such common infections are needed to reduce overdiagnosis, overtreatment, and costs.

Limitations

The main limitation of this study is that it included only patients from one hospital and health care region in Finland; thus, the results cannot be generalized to the entire country. The after period starts right after the publication of update and it is possible that changes can not been seen right after, although the data collection period spans over two years, some cases would have been recorded right after the publication of the guideline updates, so it is possible that changes may not have been seen immediately after. A further limitation is its retrospective design, as not all information was written in the records, which might have influenced the decision to test for GAS. However, the retrospective design enabled us to estimate the impact of the updated guidelines without implementing them in practice.

Conclusion

Centor scores were not used as recommended in the updated Finnish treatment guidelines for sore throat. The update did not change the use of microbiological testing in the diagnosis of GAS and these findings are in line with previous studies. Education at several levels of health care and considering the preconceptions of health care personnel even before the creation of new guidelines is required to better implement them in clinical practice.

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Author contributions

J.J. wrote the main manuscript text and prepared the tables. M.R. and I.K contributed to the discussion and methods and have reviewed the manuscript.

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Data availability

We are unable to provide and share the data in open repositories due to Finnish research law and the law on the secondary use of routinely collected healthcare data which both prohibit publication or sharing of pseudonymized data currently. Interested persons may contact the corresponding author for additional summary level information of our data. In order to gain access to the full data, an application should be sent to Mikkeli Central Hospital research committee (kirjaamo@etelasavonha.fi) but the current legislation does not allow the transformation of the data outside of the Finnish borders.

Declarations

Ethics approval and consent to participate

The ethical committee evaluation was waived by the Southern Savonia Health Care District ethical committee. According to the Finnish research legislation ethical committee evaluation is not needed when routinely collected healthcare data is analyzed and the participants are not contacted. All methods were carried out in accordance with relevant guidelines and Finnish regulations (Law on the secondary use of routinely collected healthcare data and Law of medical research). We obtained research permission from the chief of Mikkeli Central Hospital to gain access to the data. According to Finnish research law and the law on the secondary use of routinely collected healthcare data informed consent to participate is not required when institutional or national register data is analyzed retrospectively. Therefore, the need for informed consent was waived by the institutional review boards of the participating hospital, Mikkeli Central Hospital, of the Southern Savonia Health Care District.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Shaikh N, Leonard E, Martin JM. Prevalence of streptococcal pharyngitis and streptococcal carriage in children: a meta-analysis. Pediatrics. 2010;126(3):e557–64.
2. Danchin MH, Rogers S, Kelpie L, et al. Burden of acute sore throat and group a streptococcal pharyngitis in school-aged children and their families in Australia. Pediatrics. 2007;120(5):950–7.

3. Pelucchi C, Grigoryan L, Galeone C, et al. Guideline for the management of acute sore throat: ESCMID Sore Throat Guideline Group. Clin Microbiol Infect. 2012;18(SUPPL1):1–27.
4. Carapetis JR, Steer AC, Mulholland EK, et al. The global burden of group a streptococcal diseases. Lancet Infect Dis. 2005;5(11):685–94.
5. Fine AM, Nizet V, Mandl KD. Large-scale validation of the Centor and McIsaac scores to predict group a streptococcal pharyngitis. Arch Intern Med. 2012;172(11):847.
6. Käypä hoito-suositus. Nielutulehdus [Updated Finnish treatment guidelines for sore throat]. https://www.kaypahoito.fi/hoi38020. Accessed February 19, 2023.
7. Kuitunen I, Artama M, Haapanen M, et al. Respiratory virus circulation in children after relaxation of COVID-19 restrictions in fall 2021 – A nationwide register study in Finland. J Med Virol. 2022;94(9):4528–32.
8. Haapanen M, Renko M, Artama M et al. The impact of the lockdown and the re-opening of schools and day cares on the epidemiology of SARS-CoV-2 and other respiratory infections in children – A nationwide register study in Finland. EClinicalMedicine. 2021;34.
9. Lemiengre MB, Verbakel JY, Colman R, et al. Point-of-care CRP matters: normal CRP levels reduce immediate antibiotic prescribing for acutely ill children in primary care: a cluster randomized controlled trial. Scand J Prim Health Care. 2018;36(4):423.
10. Calviño O, Llor C, Gómez F, et al. Association between C-reactive protein rapid test and group a streptococcus infection in acute pharyngitis. J Am Board Fam Med. 2014;27(3):424–6.
11. Linder JA, Chan JC, Bates DW. Evaluation and treatment of pharyngitis in primary care practice: the difference between guidelines is largely academic. Arch Intern Med. 2006;166(13):1374–9.
12. Hibbert P, Stephens JH, de Wet C, et al. Assessing the quality of the management of tonsillitis among Australian children: a population-based sample survey. Otolaryngol Head Neck Surg. 2019;160(1):137–44.
13. Reinholdt KB, Rusan M, Hansen PR, et al. Management of sore throat in Danish general practices. BMC Fam Pract. 2019;20(1):1–7.
14. Grimshaw JM, Thomas RE, MacLennan G et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. Health Technol Assess. 2004;8(6).
15. Tyrstrup M, André M, Brorsson A, Gröndal H, Strandberg EL, Hedin K. A study of guidelines for respiratory tract infections and their references from Swedish GPs: a qualitative analysis. Scand J Prim Health Care. 2020;38(1):83–91. https://doi.org/10.1080/02813432.2020.1717073.
16. Milani GP, Rosa C, Tuzger N, et al. Nationwide survey on the management of pediatric pharyngitis in Italian emergency units. Ital J Pediatr. 2023;49(1):114. https://doi.org/10.1186/S13052-023-01514-8.
17. Kivistö JE, Poutanen R, Protudjer JLP, et al. Current care guidelines had no immediate effects on antitussive prescriptions to Finnish children. Acta Paediatr. 2021;110(8):2445–7.
18. Palmu S, Heikkilä P, Kivistö JE, et al. Cough medicine prescriptions for children were significantly reduced by a systematic intervention that reinforced national recommendations. Acta Paediatr. 2022;111(6):1248–9.

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