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ORIGINAL RESEARCH

Laryngoscope Investigative Otolaryngology

Tympanostomies and tonsillar surgery in children during the COVID-19 pandemic in Finland

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Abstract

Objective: To assess the impact of social restrictions due to COVID-19 on the number of tympanostomies and tonsillar surgeries in children.

Methods: Incidences were calculated per 100 000 children for tonsillar surgery and tympanostomies in 2020 and compared to the mean incidence of referral years 2017 to 2019 by incidence rate ratios (IRR) with 95% confidence intervals (CIs). Median waiting times were also compared.

Results: Before the lockdown, tonsillar surgery incidence was 33.4/100000 (IRR 1.14, CI 0.76-1.71) in February 2020. After the lockdown began, the incidence of tonsillar surgery was 1.4/100000 (IRR 0.04, CI 0.01-0.15) in April. In June, tonsillar operation incidence started to increase (20.4 per 100 000). The incidence of tympanostomies was 81% lower (IRR 0.19, CI 0.09-0.39) in April 2020 and 61% lower (IRR 0.39, CI 0.22-0.69) in August 2020 than in 2017-2019. These incidence rates remained lower all year (December 2020 IRR 0.13, CI 0.05-0.33). Median waiting time for tonsillar surgery was 3.3 months in 2020 and 1.6 months in 2017 to 2019; P <.001, and for tympanostomies 1.3 months in 2020 and 1.0 months in 2017 to 2019, P <.001. The referral rate to otorhinolaryngology during the severest restrictions was 35% lower in April and May 2020 compared with the reference years.

Conclusion: This study suggests that the restrictions against COVID-19 reduced the incidence rates of tonsil surgery and tympanostomies in children. Also, the lockdown and cancellations of elective operations in spring 2020 led to increased waiting times. These findings may help in preparing for future pandemics.

Level of evidence: Level 3.

KEYWORDS

coronavirus disease 2019, lockdown, tonsil surgery, tympanostomy tubes

1 | INTRODUCTION

In 2020, the global coronavirus pandemic (COVID-19) caused considerable changes in people's daily lives due to restrictions and recommendations to prevent the spread of the disease. Social distancing and lockdowns were the most commonly implemented strategies during the first wave of COVID-19. During the second wave, the restrictions were regional and based on COVID-19 infection rates in Finland.[1,2] The restrictions of the first wave decreased the number of pediatric respiratory infections and emergency room visits.[3-6] Similarly, hospitalizations decreased.[7,8]

Recurrent throat infections and obstructive disorders are indications for tonsillar surgery, while indications for tympanostomy are recurrent middle ear infections and persistent effusion.[9,10] In a survey of the tonsillectomy waiting list in the pediatric population, tonsillitis episodes diminished during the 2 months of social distancing in the UK.[11] Nevertheless, all patients from the waiting list were operated on electively either during or after the lockdown. Several studies have demonstrated a decrease in the number of acute otitis media in children during the lockdown,[3,4,12,13] also in recurrent cases.[14] However, further research is needed on the impact of the first and second coronavirus waves on the number of tonsillar surgeries and tympanostomies.

The aim of this study was to evaluate the influence of social restrictions on the trends of tonsillar surgery and tympanostomies in children in 2020 during the first and second waves of the COVID-19 pandemic.

2 | MATERIALS AND METHODS

2.1 | Materials

Data for this retrospective register study were collected over the period of 2017 to 2020 from the hospital discharge records of three Finnish hospitals: Tampere University Hospital (TAUH), Central Finland Hospital (CFH), and Mikkeli Central Hospital (MCH). These three hospitals provide care for a population of 150 000 children (one-sixth of the Finnish pediatric population).[15] TAUH acts as both a secondary- and a tertiary-level referral center, whereas MCH and CFH are secondary-level units. All the participating hospitals provide oto-, rhino-, and laryngology surgeries in their area.

Patients aged 0 to 15 years at the time of the operation were included. The following NOMESCO-classified operations were included for our study: *EMB10* tonsillectomy, *EMB15* partial tonsillectomy, *EMB20* adenotonsillectomy, *EMB30* adenotomy, *EMB99* other excision on tonsils/adenoids, and *DCA20* tympanostomy. We collected information on each patient's age, gender, operation date, waiting time, indication diagnosis, and operation code. Additionally, we collected all oto-, rhino-, and laryngology referrals to these hospitals from patients of all ages to describe how reduced infection and visit rates in primary health care affected the number of referrals to secondary/tertiary health care. The data were consistent and had no missing information.

This study has research permission from each participating hospital. The data were collected without identity information. No ethics committee statement was obtained due to the register-based study design. According to the Finnish research legislation and The Finnish National Board on Research Integrity, appointed by the Ministry of Education and Culture: "The review of the ethics committee is not required for the research of public and published data, registry and documentary data and archive data."[16] The Ethics Committee of Tampere University Hospital has waived ethical evaluation of all register-based studies, in which the participants are not contacted.[17] Institutional permissions were obtained from Chief doctors of each of the participating hospitals to access the hospital discharge register data. Informed consent from patients is not needed when retrospective register data is handled, and the participants are not contacted.

2.2 | Restrictions

The year 2020 was divided into four periods concerning restrictions: period before the lockdown (1 January-March 15, 2020), the lockdown (16 March-May 13, 2020), period of loosened restrictions in the summer (14 May-September 15, 2020), and period of regional restrictions for the remainder of the year (16 September-December 31, 2020).

At the time of the lockdown, schools were closed, and daycare was recommended to be arranged at home. Gatherings were limited to 10 persons, and public indoor premises were closed.[1] Good hand hygiene and avoiding close contact when having any infection symptoms were emphasized.[18,19] Recommendations to use facial masks were not given although their use was not prohibited. From March to June, avoidance of domestic travel was recommended, and international travel was restricted.

Schools were reopened in mid-May. In the early summer, the restriction on gatherings was raised to 50 persons, and public indoor premises started to open gradually on the 1st of June 2020. Later, on the 1st of August 2020, public events with more than 500 persons were allowed.[20] When the infection rates started increasing in August, Finnish Institute for Health and Welfare (THL) recommended facial masks for people over 15 years of age when keeping a safe distance was not possible.[21]

Since September, regional restrictions have been imposed based on COVID-19 infection rates. The epidemiologic situation was divided into three stages: base level, acceleration level, and spreading level.[2] At the base level, the recommendations were mostly for distancing and good hygiene; at the acceleration level, the recommendations for gatherings were tightened; at the spreading level, group leisure activities were recommended to be discontinued, and public places and upper secondary schools were closed if necessary.[22]

2.3 | Methods

We calculated monthly incidence with 95% confidence intervals (CIs) for the operations per 100 000 children by using Poisson exact

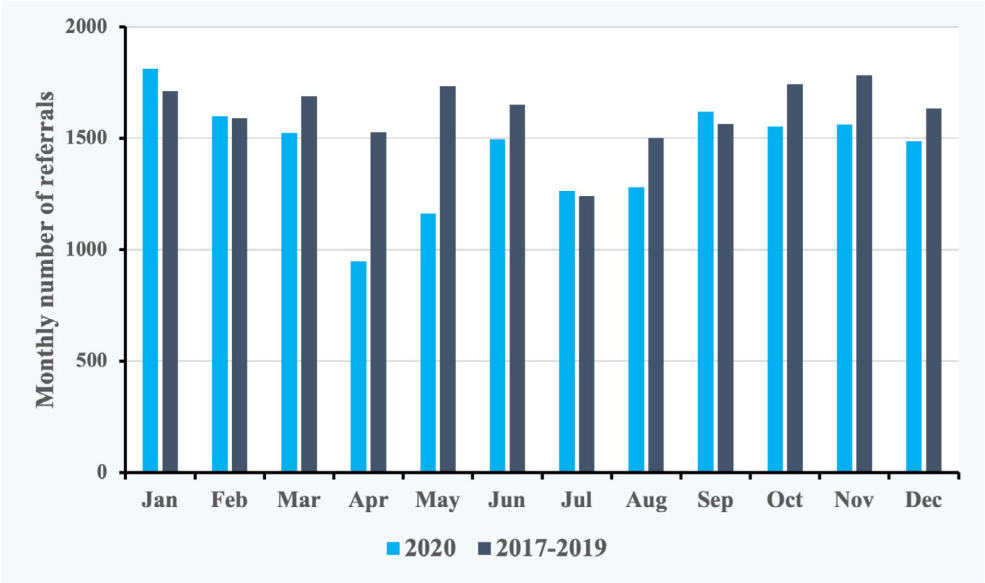

FIGURE 1 Overall monthly referral rate to otorhinolaryngology units, including patients of all ages

method. We then compared these figures with the mean incidence of corresponding periods in 2017 to 2019 by using incidence rate ratios (IRRs). The results for categorical variables are presented as counts and percentages and analyzed using chi square test. Statistical analyses were performed using the SPSS version 27.0 and graphic illustration using R version 4.0.3.

3 | RESULTS

3.1 | Overall

The data included a total of 3718 operations, of which 2060 were tonsillar operations and 1658 tympanostomies, during the study period between 2017 and 2020. Of these, 356 (17.3%) of the tonsillar operations and 212 (12.8%) of the tympanostomies were performed in 2020. The overall referral rate to otorhinolaryngology units decreased during the lockdown and returned to reference level in September, although it remained lower from October to December (Figure 1).

3.2 | Tonsillar surgery

The most common surgery in 2020 was combined tonsillectomy and adenoidectomy and in 2017 to 2019, the most common surgery was adenoidectomy (Table 1). Waiting times from referral to operation were longer in 2020 compared with the reference years (3.3 vs 1.6 months, P <.001; Table 1). The most common indications for tonsillar surgery in 2020 as well as in the reference years were infections and obstructive disorders.

Before the lockdown, in January 2020, the incidence of tonsillar surgery was 29% lower than in the previous years (IRR 0.71, CI 0.48-1.06; Figure 2). In February 2020, the incidence was 33.4 per 100 000 person-months, 14% higher than in the previous years (IRR 1.14, CI 0.76-1.71; Figure 2). During the lockdown, the incidence of tonsillar surgery was 66% lower than in the previous years (IRR 0.34, CI 0.25-0.46). The incidence was at its lowest in April at 1.4 per 100 000 person-months, which was 96% lower than in the corresponding years (IRR 0.04, CI 0.01-0.15; Figure 2). When the restrictions were loosened, the incidence was 41% lower than in the previous years (IRR 0.59, CI 0.43-0.80). In June 2020, tonsillar operation incidence started to increase (20.4 per 100 000 person-months; Figure 2). During the implementation of regional restrictions, the incidence was 20% lower than in the reference years (IRR 0.80, CI 0.65-1.00).

3.3 | Tympanostomies

In 2020, the median waiting time from referral to operation was longer (1.3 vs 1.0 months, P <0.001; Table 2). The incidence of tympanostomies was 27% lower than in the corresponding years before the lockdown (IRR 0.73, CI 0.53-0.99; Figure 3). During the lockdown, the incidence was 49% lower (IRR 0.51, CI 0.39-0.69) than in the corresponding years, and, in April, the incidence of tympanostomies was 81% lower (IRR 0.19, CI 0.09-0.39) than in the previous years. In May, the incidence of tympanostomies was 17.7/100 000, which was 35% lower than in previous years (IRR 0.65, CI 0.40-1.07; Figure 3). When the restrictions were loosened, the incidence from June to August was 72% lower than in the reference years (IRR 0.28, CI 0.18-0.43). During the regional restrictions period (September-December), the incidence of tympanostomies remained 68% lower than in the corresponding years (IRR 0.32, CI 0.23-0.44; Figure 3).

4 | DISCUSSION

The lockdown had a clear impact on decreasing the number of tonsillar operations and the number of tympanostomies performed in

TABLE 1 Background characteristics of tonsillar operations in children by year

Tonsillar operations					
	2017-2019		2020		Change between 2020 and 2017-2019
Total operations N (%)	568	(100)	356	(100)	−37.3%
Hospitals N (%)					
TAUH	306	(53.8)	206	(57.9)	−32.6%
CFH	187	(33.0)	111	(31.2)	−40.7%
MCH	75	(13.2)	39	(11.0)	−48.0%
Gender, male N (%)	329	(58.0)	206	(57.9)	−37.4%
Age in years, median (IQR)	6.3	(5.0)	7	(5.3)	
Waiting time in months, median (IQR)	1.6	(1.6)	3.3	(4.0)	
Operation code N (%)					
EMB10 tonsillectomy	133	(23.4)	91	(25.6)	−31.6%
EMB15 partial tonsillectomy	79	(13.8)	52	(14.6)	−33.9%
EMB20 adenotonsillectomy	130	(22.9)	111	(31.2)	−14.8%
EMB30 adenotomy	225	(39.6)	102	(28.7)	−54.7%
EMB99 other excision on tonsils/adenoids	1	(0.2)	0	(0)	−100.0%
Diagnosis of operation N (%)					
Obstructive disorders	92	(16.2)	66	(18.5)	−28.3%
Infections	432	(76.0)	271	(76.1)	−37.2%
Other/missing	44	(7.8)	19	(5.3)	−57.1%

Note: The numbers in 2017 to 2019 are mean values.
Abbreviations: CFH, Central Finland Hospital; MCH, Mikkeli Central Hospital; TAUH, Tampere University Hospital.

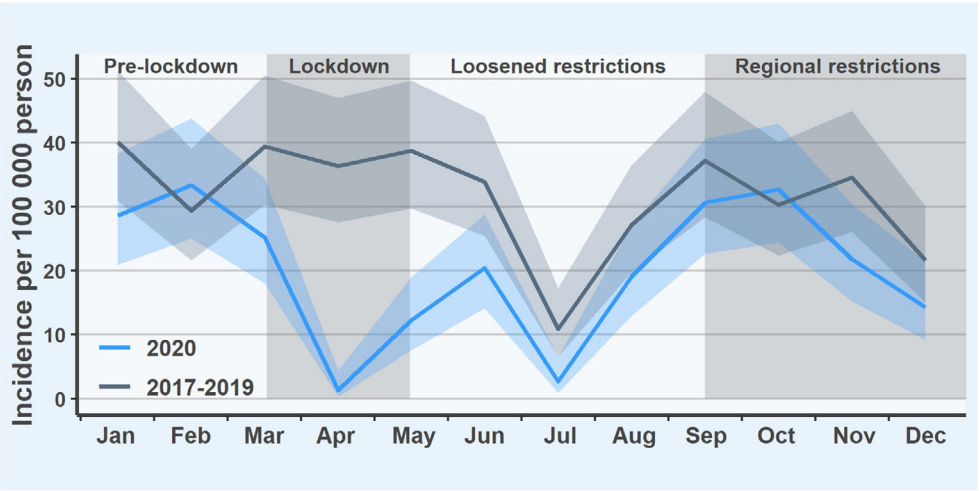

FIGURE 2 Incidence of tonsillar surgery with 95% confidence intervals in children, 2020 compared to three previous years

children. First, the primary pandemic wave decreased the number of operations, probably due to the reorganization of health care resources and cancellations of surgical procedures in March and April. Second, the lockdown most likely reduced the incidence of acute otitis media and tonsillitis, which led to a decrease in referral rates.

Indications for tonsillar surgery include recurrent throat infections and obstructive disorders, while persistent middle ear effusion and recurrent ear infections are indications for tympanostomies.[9,10] In our study, the number of operations due to obstructive disorders decreased less than those performed because of infections. In addition, several studies have shown a decrease in otitis media cases during the lockdown.[3,4,12-14] This is in line with our findings with fewer tympanostomies, which probably reflects a decrease in infections. The results show also a consistent decrease in the number of operations and referrals every year in July, and the decrease is due to the annual summer vacations of the hospital staff. In 2020, the numbers of tonsillar operations and tympanostomies were somewhat lower even before the lockdown. However, the number of referrals was not lower

TABLE 2 Background characteristics of tympanostomies in children by year

Tympanostomies					
	2017-2019		2020		Change between 2020 and 2017-2019
Total operations N (%)	482	(100)	212	(100)	−56.0%
Hospitals N (%)					
TAUH	234	(48.5)	117	(55.2)	−50.0%
CFH	187	(38.7)	75	(35.4)	−59.8%
MCH	61	(12.7)	20	(9.4)	−67.4%
Sex, male N (%)	297	(61.5)	140	(66.0)	−52.8%
Age in years, median (IQR)	3	(4.0)	4	(5.0)	
Waiting time in months, median (IQR)	1	(1.0)	1.3	(1.5)	
Operation code N (%)					
DCA20 tympanostomy	482	(100)	212	(100)	−56.0%

Note: The numbers in 2017 to 2019 are mean values.
Abbreviations: CFH, Central Finland Hospital; MCH, Mikkeli Central Hospital; TAUH, Tampere University Hospital.

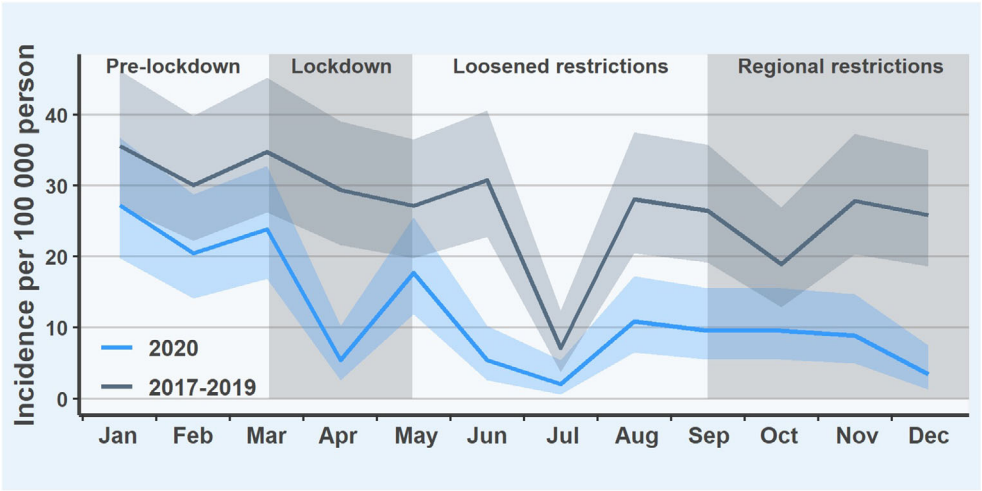

FIGURE 3 Incidence of tympanostomies with 95% confidence intervals in children, 2020 compared to three previous years

before the lockdown in 2020 than in the previous years. Lower number of operations in January 2020 may reflect the timing of Christmas holidays or just random variation.

In the spring of 2020, otolaryngologists were considered at high risk of COVID-19 infection due to close contact with the respiratory secretions of patients. Therefore, only urgent oto-, rhino-, and laryngology procedures were recommended, and many outpatient visits and oto-, rhino-, and laryngology operations were cancelled.[23] Operating room teams were retrained to work in intensive care units, and some operating rooms were closed.[24] Also, the number of operations was affected by a lack of personal protective equipment.[25] In Finland, over three million secondary and tertiary care level outpatient visits were cancelled, and medical treatment debt increased by approximately three billion euros in the spring.[26] Globally, during the first 12 weeks of the pandemic, over 30 million operations were cancelled, of which approximately 4 million were oto-, rhino-, and laryngology operations.[27] These cancellations added to the treatment backlog and might have cause decreased quality of life as the waiting times increased and treatments were delayed.

A broad population base including one-sixth of the Finnish pediatric population is clearly one of the strengths of this study. The tonsillar operation and tympanostomy rates in our data probably reflect the real incidence of these procedures, as the majority of these are performed in public hospitals in Finland. Although data for tympanostomies and tonsil operations performed in the private sector were not included, it is plausible that the rates for these operations have not changed in the private sector in relation to the public sector in 2017 to 2020. Also, health insurance is not as commonly used in Finland compared to the USA or Central Europe.

There are some limitations in the current study. The oto-, rhino-, and laryngology referral data included both children and adults, and we were unable to differentiate pediatric referrals, although the operation numbers were only for pediatric patients. It is possible that the decrease in referral rates was not evenly distributed between adults and children. However, a previous study showed a decrease in the number of oto-, rhino-, and laryngology operations in children and adults during the first wave of COVID-19.[28] Only the number of head and neck cancer surgeries remained stable.[26] Therefore, we believe

that the change in the number of overall otorhinolaryngology referral data also reflects the trend of children's oto-, rhino-, and laryngology referral rates.

5 | CONCLUSIONS

The restrictions enacted due to the COVID-19 pandemic had a major impact in decreasing the number of tonsillar surgeries and the number of tympanostomies, in children. Additionally, the lockdown and the cancelling of elective operations in spring 2020 led to increased waiting times for operations. These findings clarify the burden of infections as indications for surgery, and they may assist planning for future pandemics.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHOR CONTRIBUTIONS

Ilari Kuitunen and Marjo Renko had the original idea. Ilari Kuitunen, Mikko Uimonen, and Ville Ponkilainen gathered the data. Marjut Haapanen, Ilari Kuitunen, and Mikko Uimonen performed statistical analyses. Marjut Haapanen drafted the initial manuscript. Ville M. Mattila and Marjo Renko provided resources. All authors commented the manuscript and approved the final version. Marjut Haapanen and Ilari Kuitunen had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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