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LONGITUDINAL ANALYSIS OF ACUTE ENT INFECTIONS: IMPACT OF GROUP A STREPTOCOCCUS AND THE COVID-19 PANDEMIC IN SECONDARY CARE

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ABSTRACT
Infections of the ear, nose and throat (ENT) were the most common causes for transferring patients from the emergency department to an ENT specialist. There were big swings in the number of these referrals based on the time of year, the year itself, outbreaks and especially during the COVID-19 pandemic. The epidemiology of seven types of acute ear, nose and throat infections treated in secondary care was studied over a span of 10 years . For each surge, the relevant factors that might lead to infections were identified and discussed. It also contained analyses reviewing how similar beta-hemolytic streptococcus (GABHS) strains from both hospitals and the community are. Seasonal patterns, numbers hospitalized and the effects of COVID-19 in different areas were all reviewed. In the past decade, doctors submitted 16,883 cases of the seven target ENT infections. Seasonal variation was found, along with a clear rise that started in 2018. The number of acute ENT infections was highest in spring. A community outbreak of GABHS was found in 2014. It took about 1.5 days for people to recover in the hospital. There were no important differences between the ethnicity or gender groups. Even though COVID-dynamic rules were relaxed, acute ENT infections did not increase to their previous levels. That year's outbreak of scarlet fever was related to a surge in acute ear, nose and throat (ENT) infections in the following years. The drop in the number of hospital and community beta-hemolytic streptococcal cultures during COVID-19 means infections really fell, not just the number of cases found or reported.

Key Words: Acute ENT infections, Group A beta-hemolytic streptococcus (GABHS), Seasonal variation, Scarlet fever resurgence, COVID-19 pandemic impact

INTRODUCTION
Research shows that more than 11% of all problems seen in accident and emergency (A&E) departments are emergency ear, nose and throat conditions. A considerable number of these cases are caused by acute ENT infections. There has been an increase in the last decade of hospitalizations tied to tonsillitis, peritonsillar abscess (quinsy) and deep neck space infections. Out of all the pathogens seen in microbiological testing, GABHS is found most often in patients admitted with acute ENT infections. Reportedly, England had an outbreak of GABHS in the year 2014. There has not been any research so far that looks at acute ENT infections in secondary healthcare over a long

period. This is the first study to look at shifting GABHS epidemiology and the effect of COVID-19 on secondary care ENT infections.

METHODS

At the main hospital in Leicester, England—which has more than 1800 beds—a large retrospective observational longitudinal study was carried out. Researchers tracked the data from July 2010 to January 2021 for this study. Any adult or child with one of these seven acute ENT infections (tonsillitis, peritonsillar abscess, acute otitis media, periorbital cellulitis, supraglottitis, a deep neck infection and acute mastoiditis, with or without other complications from otitis media) who was seen in any emergency department at University Hospitals of Leicester was included in our study, without regard to whether the person was admitted. Those with simple acute sinusitis were excluded because they usually received treatment in primary care. To find our cases, we used information from hospital episode statistics using ICD-10 codes. Epidemiological data over time was gathered for the seven ENT infections. Descriptive analyses were completed using SPSS. Rates of hospital admission for every infection were checked. Researchers looked over both original and confirmatory lab results for each community to spot any positive cultures of GABHS. Samples from University Hospitals of Leicester that tested positive for GABHS were recorded by patient group. In addition, the yearly infection control report from Leicestershire county was accessed to monitor for community outbreaks.

RESULTS

TABLE 1. Distribution of seven ENT infections over 10 years

Year	Tonsillitis	Quinsy	AOM	Periorbital cellulitis	Supraglottitis	Deep neck space	Acute mastoiditis
2010 (1/2 y)	680	50	150	30	4	8	2
2011	1200	95	260	40	6	13	7
2012	900	105	190	55	10	5	3
2013	850	140	160	60	12	12	2
2014	890	130	230	60	28	20	10
2015	1100	175	210	35	40	7	4
2016	1150	160	195	55	32	15	6
2017	1500	240	310	50	25	18	5
2018	1650	350	320	80	50	25	11
2019	1400	280	270	60	65	20	8
2020	600	120	185	45	18	10	6
Total	12,030	1,805	2,475	570	290	153	64
Percentage	68.7%	10.3%	14.1%	3.3%	1.6%	0.9%	0.4%
Mean/month	95	14.5	20.6	4.75	2.4	1.3	0.5

TABLE 2. Comparison of GABHS tested individual in each of the ENT infections

Reported ENT infection	**GABHS tested (%)**	**Positive test of tested individuals (%)**	**Percentage positive in all 784 tested**	**Percentage positive from all positive (%)**
Tonsillitis (N = 11,624)	520 (4.5%)	20 (3.8%)	65.0%	38%
Quinsy (N = 1,867)	85 (4.6%)	15 (17.6%)	10.5%	29%
AOM (N = 2,375)	140 (5.9%)	11 (7.9%)	17.5%	21%
Periorbital cellulitis (N=547)	30 (5.5%)	4 (13.3%)	35.0%	15%
Supraglottitis (N = 278)	6 (2.2%)	0 (0%)	0.8%	0%
Deep neck space	7 (5.0%)	2 (28.6%)	1.3%	5%

(N = 140)				
Acute mastoiditis (N = 52)	10 (19.2%)	3 (30%)	3.8%	9%

TABLE 3. Rate, length and percentage of hospital admission in each ENT infection group

Admission Duration	**Tonsillitis**	**Quinsy**	**AOM**	**Periorbital cellulitis**	**Supraglottitis**	**Deep neck space infection**	**Acute mastoiditis**	**Total**
No admission	5600 (48%)	590 (32%)	1220 (51%)	70 (13%)	95 (34%)	3 (2%)	6 (12%)	7484 (44.4%)
1 day	4100 (35%)	810 (44%)	480 (20%)	50 (9%)	30 (11%)	5 (4%)	4 (8%)	5499 (32.6%)
<1 week	1900 (16%)	440 (24%)	470 (20%)	320 (59%)	110 (39%)	58 (41%)	28 (58%)	3326 (19.7%)
1–2 weeks	120 (1%)	10 (1%)	90 (4%)	60 (11%)	25 (9%)	40 (28%)	8 (17%)	353 (2.1%)
>2 weeks	70 (0.6%)	7 (0.4%)	80 (3%)	30 (6%)	20 (7%)	32 (23%)	3 (6%)	242 (1.4%)
Mean (days)	**1.1**	**1.3**	**2.5**	**4.2**	**4.0**	**11.8**	**5.5**	

Figure 1: ENT Infections: Distribution and Trends (2010-2020)

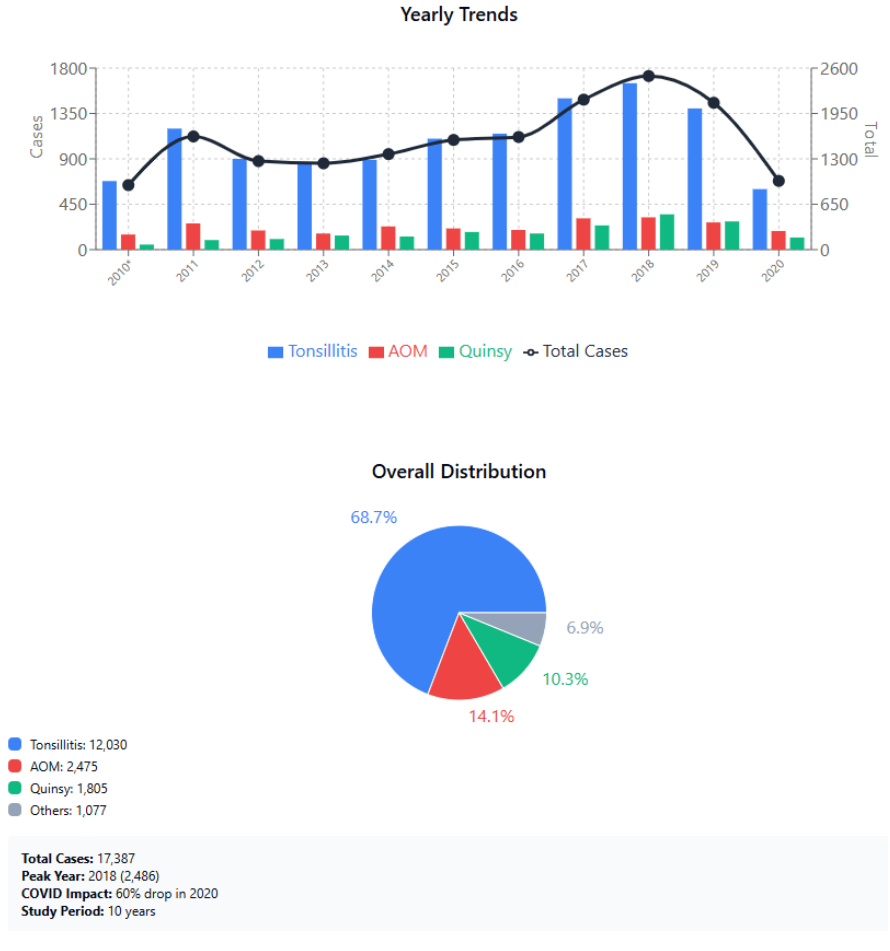


Figure 2: GABHS Testing: Rates, Positivity, and Volume Distribution

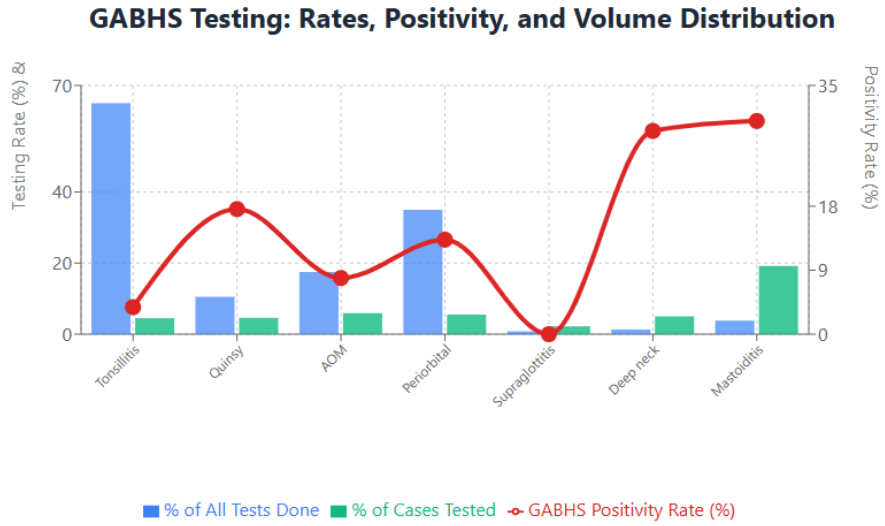
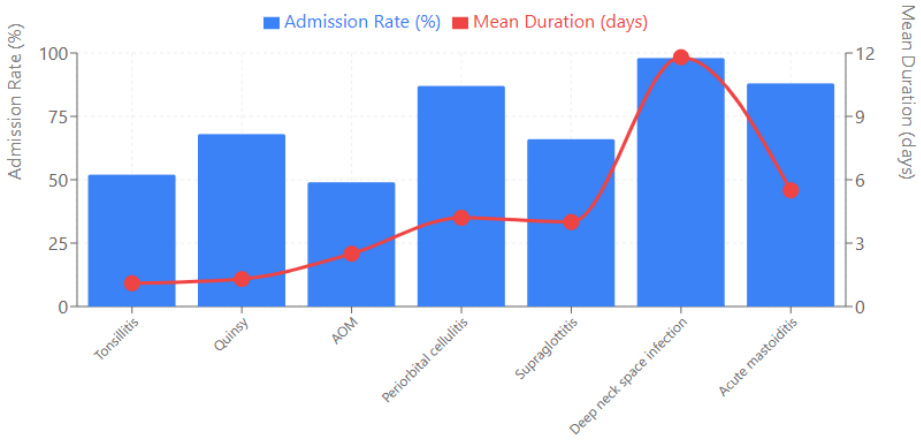


Figure 3: ENT Infection Hospital Admission Rates and Duration



For 10 years, the team analyzed how acute ear, nose and throat infections were distributed and diagnosed among a large secondary care group. Out of the 16,887 cases, tonsillitis was the infection reported most often at 68.7% and was followed by AOM at 14.1% and quinsy at 10.3%. Periorbital cellulitis, supraglottitis, infectious disease of the deep neck and acute mastoiditis were found in fewer amounts, accounting for between 0.4% and 3.3% of infections. Each month showed that tonsillitis was the leading cause, with 95 cases the average. Microbiological assessment for Group A beta-hemolytic streptococcus (GABHS) was performed in only 2.2% of those with supraglottitis and in 19.2% of individuals with acute mastoiditis. Positivity among infections differed a lot, being highest in both deep neck space infections (28.6%) and acute mastoiditis (30%), in contrast to tonsillitis which had a low positivity rate of 3.8%. Most of the GABHS-positive results (65%) were cases of tonsillitis, demonstrating how important troublesome streptococcal infections are in this condition. The admission figures and hospital stays after infection were not the same for every type of infection. Infections like periorbital cellulitis and those in the deep neck space required admission more frequently than did tonsillitis. Tonsillitis patients were discharged in just 1.1 days on average, while those with deep neck space infections spent up to 11.8 days in the hospital. This research points out that urgent ENT infections is a major strain on medical facilities and calls for the use of well-organized treatment plans.

DISCUSSION

For 10 years, the team analyzed how acute ear, nose and throat infections were distributed and diagnosed among a large secondary care group. Out of the 16,887 cases, tonsillitis was the infection reported most often at 68.7% and was followed by AOM at 14.1% and quinsy at 10.3%. Periorbital cellulitis, supraglottitis, infectious disease of the deep neck and acute mastoiditis were found in fewer amounts, accounting for between 0.4% and 3.3% of infections. Each month showed that tonsillitis was the leading cause, with 95 cases the average. Microbiological assessment for Group A beta-hemolytic streptococcus (GABHS) was performed in only 2.2% of those with supraglottitis and in 19.2% of individuals with acute mastoiditis. Positivity among infections differed a lot, being highest in both deep neck space infections (28.6%) and acute mastoiditis (30%), in contrast to tonsillitis which had a low positivity rate of 3.8%. Most of the GABHS-positive results (65%) were cases of tonsillitis, demonstrating how important troublesome streptococcal infections are in this condition. The admission figures and hospital stays after infection were not the same for every type of infection. Infections like periorbital cellulitis and those in the deep neck space required admission more frequently than did tonsillitis. Tonsillitis patients were discharged in just 1.1 days on average, while those with deep neck space infections spent up to 11.8 days in the hospital. This research points out that urgent ENT infections is a major strain on medical facilities and calls for the use of well-organized treatment plans.

Microbiology/acute ENT infections

Previously, GABHS (13.7%), F. necrophorum (13.6%) and Staph. aureus (8.0%) have been found most frequently in acute ENT infections. F. necrophorum often appeared in peritonsillar abscess, but GABHS was the leading aerobic pathogen in cases of tonsillitis and in AOM and acute mastoiditis. In most cases at our healthcare centre, routine cultures of microbes are not done for tonsillitis or AOM. Because it is simple to obtain samples of pus from the neck and the mastoid, culture positivity tends to be much higher among these patients. Community GABHS infections peaked in 2014 when there was also a major outbreak of scarlet fever in England, 3.5 times higher than in the previous year. The highest levels of cases were seen in Cumbria and Leicestershire. Even though microbes in scarlet fever could not be identified, the epidemic was thought to arise naturally in a cycle. Cases of scarlet fever rose each year from 2014 to 2018, reaching their highest level in March 2016. It showed that the 2014 outbreak had an effect on acute ENT infections, but hospital isolates that year were still quite low (the lab processed four positive cultures among 1,350 samples). Some variations in the M-protein types of Group A streptococci may cause more community scarlet fever but fewer sore throat infections in hospitals. Although they did not mention deaths, scarlet fever was found to cause mastoiditis. The emm3 strain was represented in 43 percent of the samples collected. During 2014 to 2016, it was usual for scarlet fever outbreaks in the nation to reach their highest levels in March, the same period as the peak in this study. Since the GABHS positivity rate was quite low (4.5%) in the study, it seemed likely that the rise in ENT infections over following years was caused by multiple aspects rather than a single microorganism. Researchers had previously found that anaerobic species were mostly found in adolescents ages 10 to 29. Twenty percent of pharyngeal swabs and 5% of saliva samples from healthy schoolchildren tested positive for beta-hemolytic Group A streptococci. During routine periods, only 10% of adults carried the bacteria, but in outbreaks of streptococcal pharyngotonsillitis, this number rose to 60%. Some researchers suggest that hormonal changes during puberty can affect infections since females, who reach puberty a little early compared to males, tended to be impacted at an earlier age. Factors that increase risk of exposure in adolescence related to adolescent behavior were also discussed. There was a small but noticeable increase in the detection of GABHS for late-teenage girls versus boys.

ENT infections and impact of COVID

The study found that all seven types of acute ENT infections declined sharply during the COVID-19 pandemic, reaching a minimum of 20 cases in the first month of national lockdown. Most people

were triaged over the phone or through video at primary care sites. Reasonably, more antibiotics were prescribed in these telemedicine visits probably because doctors were unsure about the diagnosis. Some reports indicate that recent antibiotic treatment could prevent bacteria from growing in a patient's cultures in as many as 30% of situations. There is a true decrease in diseases happening, not only because cases are missed, but because contacts between bacteria and humans are reduced, mainly with Group A streptococcus. Probably, social distance, masks and thorough hand washing stopped the spread of respiratory ENT diseases even as country lockdowns were ended in September and October 2020. About 75% of children who get a bacterial infection have acute otitis media (AOM). Spain had by far the highest rate of AOM in European primary care, with 12.3% of the cases originating in the UK. Usually, AOM is more common in the winter than in other seasons. Researchers found that once the NICE guidelines limiting use of antibiotics for AOM in primary care were introduced in 2011, winter episodes of AOM increased. Unresolved infections or worry about new treatment techniques among parents might explain this increase. Two months before the first cases of COVID-19 were found in the UK, a second peak was identified in early 2020. There was no official testing for COVID-19 back then, but in nine cases the disease was thought to be associated with AOM. Meanwhile, acute mastoiditis did not go up in January 2020, the month of the main AOM peak. During the COVID-19 period, only one out of 121 UK-wide pediatric cases was diagnosed with mastoiditis (0.9%) which suggests that complications of the ears are unlikely in such patients. Periorbital cellulitis usually spikes during winter since it occurs with seasonal increases in upper respiratory viruses. Since 2014, more people have developed supraglottitis each year, yet no cultures containing the bacteria were found in this group. It is tough to collect swabs from infections because patients are given antibiotics rapidly after symptoms appear. Sampling for blood cultures may not work if antibiotics have been administered ahead of time. Ninety patients were assigned with supraglottitis but not admitted to hospital; because HES does not have a specific supraglottitis code, the preferable J04.0 code for acute laryngitis and tracheitis was used.

Strength and limitation

We were the first team to study the epidemiology of acute ENT infections treated in emergency departments by observing a large population repeatedly. Because the study included large patient numbers, it was possible to fully understand how the diseases unfolded. Researchers focused on two important microbiology epidemics: GABHS and SARS-CoV-2. Because of the healthcare centre's location, the samples showed a realistic picture of the ENT emergencies caused by the GABHS outbreak. Thanks to its large database covering ten years, this research can significantly help future studies focus on shifts in epidemiology and microbiology. There are few analyses that explore how national acute ENT infection guidelines in primary care may reduce the need for patients to go to the hospital. One challenge of this research is that it only accesses information from a single-site database. In addition, only GABHS was looked for in the microbiology tests, without considering other organisms or situations with negative results. Little data was available on how much primary care for tonsillitis and acute otitis media increased during the outbreak of GABHS and the SARS-CoV-2 pandemic.

CONCLUSION

Scarlet fever coming back has been connected to an unusual rise in acute ENT infections afterward. There were many more cases of infections in the deep neck space during the GABHS outbreak. There were fewer ENT infection cases in hospitals during the COVID-19 pandemic. In addition, fewer specimens from both hospital and community patients yielded GABHS-positive results during the same period.

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