



# Bacterial infections of the oropharynx and deep neck spaces: an investigation of changes in presentation patterns during the COVID-19 pandemic

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## Key words

COVID, quinsy, SARS-CoV-2, tonsillitis.

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## Abstract

**Background:** The aim of this study was to investigate whether changes in practice during the COVID-19 pandemic altered clinical presentation characteristics among adults with bacterial throat infections.

**Methods:** A retrospective cohort study was conducted that included adult patients presenting with bacterial oropharyngeal infections to a tertiary level hospital in Melbourne, Australia. All patients presenting during the first phase of COVID-19 lockdown in Melbourne (1st April– 1st July in 2020), and those from the same period 12-months prior, were included.

**Results:** There were fewer presentations of bacterial throat infections during the pandemic period compared to the same time 1 year prior. There was a significantly reduced proportion of patients on oral antibiotics prior to their presentation in 2020, as compared to the same period 12-months earlier (30% vs. 50%, respectively;  $P < 0.01$ ), as well as a significant increase in the length of time patients were symptomatic before presenting to hospital (5 days vs. 4 days, respectively;  $P < 0.01$ ). Despite this, there was no significant increase in the number of representations post discharge from hospital, or the length of hospital admission.

**Conclusion:** The overall number of patients presenting with tonsillitis, pharyngitis, peritonsillar abscess and deep neck space infection were reduced during the pandemic period. Patients experienced symptoms for a longer period of time and fewer were on antimicrobial therapy prior to presentation. This study highlights a shift towards delayed patient presentation and reduced oral antibiotic commencement in cases of oropharyngeal infections as a result of the COVID-19 pandemic.

## Introduction

The COVID-19 pandemic has had a significant impact on health seeking behaviour of patients as well as the clinical practice of healthcare providers.<sup>1</sup> Patients have been less inclined to seek medical assessment for upper respiratory tract symptoms such as cough, fever and sore throat,<sup>1</sup> and primary health clinicians have had reduced capability to see patients face-to-face or to examine the throat. Odynophagia, difficulty maintaining adequate oral intake and oropharyngeal inflammation can be manifestations of COVID-19.<sup>2,3</sup> Whilst no consistent associations have been described between COVID-19 and acute tonsillitis or suppurative oropharyngeal infections (i.e., peritonsillar abscess), the ability to evaluate these patients has been impacted.<sup>2,4</sup>

There has been significant research undertaken in the way COVID-19 has impacted the daily practice of otolaryngologists. As the first hospital doctor fatality during the COVID-19 pandemic was an otolaryngologist, heightened fear and safety concerns has significantly impacted routine otorhinolaryngology practice.<sup>5,6</sup> However, there are no studies investigating the effects of this pandemic on presentation patterns for common upper airway bacterial infections.<sup>6,7</sup>

The first case of coronavirus in Australia was recorded on the 25th January 2020.<sup>8</sup> Following a gradual increase in infections, State and Federal government authorities in Australia implemented a stepwise increase in restriction measures during March 2020. This began on March 15 with all arrivals from overseas requiring to self-isolate for 14 days and cruise ship arrivals banned and culminated

in stage three restrictions implemented in the state of Victoria on the 30th March 2020. These lockdown measures included restrictions on reasons to leave the home being limited to those: for medical needs, work or study, exercise or shopping for food/essential supplies. Victorian restrictions began to ease in mid-late May 2020 coinciding with a national Government announcement on the 8th May outlining a three-step plan to ease restrictions. In Victoria, this easing of restrictions began on 1st June and included allowing gatherings of up to 20 people in households, public places, restaurants, cafes and community services and tourist accommodation including caravan and camping grounds opening.<sup>8</sup>

We investigated changes in clinical practice, symptomology, and hospital presentation for patients with bacterial infections and deep neck space infections during the COVID-19 pandemic in Melbourne, the capital city of the state of Victoria. We compared hospital admission characteristics for a 3-month period during the pandemic as compared to the same period in 2019 for patients presenting to a tertiary level health centre with oropharyngeal infections.

## Methods

### Participants

Eligible patients were aged 16 years or older at the time of presentation to Austin Health, Melbourne, Victoria. Eligible encounters occurred between 1st April–1st July in 2020 (pandemic period) or 2019 (control period) with at least one recorded diagnosis of bacterial infection of the oropharynx or deep neck spaces as per International Classification of diseases tenth revision (ICD-10) coding (Table 1). This study was approved by the Austin Health institutional ethics committee (reference: 20190417).

### Settings

All data were collected retrospectively from the Austin Health electronic medical record (EMR) system. Characteristics assessed included age, gender, comorbidities based on ICD-10 diagnoses, and discharge diagnosis. Each patient was designated a Charlson

Comorbidity Index (CCI) value based on comorbidity diagnoses as described elsewhere, with a higher score associated with increased 10-year mortality.<sup>9</sup>

Eligible encounters obtained by EMR query were reviewed to confirm ICD-10 diagnoses of bacterial infection of the oropharynx or deep neck spaces. These associated diagnoses were then independently verified based on review of hospital admission notes. Patients with suspected or confirmed dental abscesses or SARS-CoV-2 infection were excluded. Diagnoses were subsequently re-categorized as either 'tonsillitis or laryngopharyngitis' or 'peritonsillar abscess or other deep neck space abscess'. Verification of diagnosis of a suppurative infectious process required confirmation via needle aspiration/drainage, imaging (ultrasound, computed tomography or magnetic resonance imaging) or operative drainage.

### Main outcome measures

Infection and hospital admission characteristics investigated included symptom duration prior to presentation, antibiotic administration prior to presentation, length of hospital stay, documented fever ( $\geq 38^{\circ}\text{C}$  at any time during admission), encounter outcome (admission vs. discharge), and representation to Austin Health within 30 days of separation. Any subsequent encounters (i.e. representation events) were not included in the final analysis. Biochemical markers including white cell count (WCC) and C-reactive protein (CRP) levels were assessed as abnormal according to institutional reference ranges (WCC:  $\geq 12.0 \times 10^9/\text{L}$ ; CRP:  $\geq 5.0 \text{ mg/L}$ ).

Characteristics of included patients were summarized using descriptive statistics. All categorical variables were presented using frequencies and percentages. For continuous variables mean and standard deviation (SD) and median and interquartile ranges (IQR) were presented. Inferential statistics were computed using Fisher's exact test with two-tailed P-values (categorical variables) or unpaired *t*-tests (continuous variable). *P*-values  $< 0.05$  were considered statistically significant. All data analysis was conducted using STATA (version 13).

**TABLE 1** ICD-10 diagnoses for bacterial throat infections

ICD-10 code	Diagnosis
J02.9	Acute pharyngitis, unspecified
J03	Acute tonsillitis
J03.9	Acute tonsillitis, unspecified
J03.80	Acute tonsillitis due to other specified organisms
J03.81	Acute recurrent tonsillitis due to other specified organisms
J03.00	Acute streptococcal tonsillitis, unspecified
J03.01	Acute recurrent streptococcal tonsillitis
J06.0	Acute laryngopharyngitis
J35.01	Chronic tonsillitis
J35.02	Chronic adenoiditis
J35.03	Chronic tonsillitis and adenoiditis
J39.0	Retropharyngeal and parapharyngeal abscess
J39.1	Other abscess of pharynx
J36	Peritonsillar abscess
K12.2	Cellulitis and abscess of mouth

*Note:* ICD-10 codes used to screen all Emergency Department presentations and ward admissions.

## Results

There were 280 patients who presented to our institution with one of the designated ICD-10 codes as primary diagnosis between 1 April 20 to 1 July 20 and 1 April 19 to 1 July 19. Of these, 30 were excluded for suspected or confirmed dental abscesses and three for suspected or confirmed SARS-CoV-2. Hence, 247 cases were included in subsequent analysis. Cases were well matched, with no statistically significant differences between the 2019 and 2020 study cohorts in terms of baseline characteristics (Table 2). There was a non-significant trend towards more females presenting during the pandemic period (59% in 2020 vs. 48% in 2019;  $p = 0.08$ ).

Mean pre-hospital symptom duration was significantly longer among encounters in the pandemic period compared with the control period (5 vs. 4 days, respectively;  $p < 0.01$ ). A smaller percentage of patients had been prescribed oral antibiotics prior to hospital presentation during the pandemic period (30% vs. 50%;  $p < 0.01$ ).

**TABLE 2** Demographic characteristics of eligible encounters during control and pandemic periods

Characteristics	2019 <i>N</i> = 146	2020 <i>N</i> = 101
Age-years		
Mean ( $\pm$ SD)	30.3 ( $\pm$ 15.3)	32.2 ( $\pm$ 18.7)
Median (IQR)	24 (20, 36)	27 (19, 37)
Range	16–89	16–90
Gender- <i>n</i> (%)		
Female	70 (48.0)	60 (59.4)
Male	76 (52.1)	41 (40.6)
Charlson Co-morbidity Index		
0	72 (79.1)	44 (72.1)
1	7 (7.7)	4 (6.6)
$\geq$ 2	12 (13.2)	13 (21.3)
Final diagnosis- <i>n</i> (%)		
Tonsillitis or laryngopharyngitis	124 (84.9)	87 (86.1)
Peritonsillar/other deep neck space abscess	22 (15.1)	14 (13.9)

Note: SD = Standard deviation.

**TABLE 3** Infection and hospital presentation characteristics

Characteristics	2019 <i>N</i> = 146	2020 <i>N</i> = 101	<i>P</i> -value
Symptom duration prior to presentation- days			
Mean ( $\pm$ SD)	3.8 ( $\pm$ 2.7)	5.4 ( $\pm$ 6.1)	<0.01
Median (IQR)	3 (2.5)	3 (2.7)	
Range	1–14	1–30	
Antibiotics prior to presentation			
Yes	72 (49.7)	30 (29.7)	<0.01
No	73 (50.3)	71 (70.3)	
Length of hospital stay- hours			
Mean ( $\pm$ SD)	19.7 ( $\pm$ 43.5)	24.9 ( $\pm$ 38.7)	0.34
Median (IQR)	7 (3.20)	10 (3.25)	
Range	0–437	0–219	
Elevated WCC on presentation- $\times 10^9/L$			
12 or less	42 (42.9)	34 (48.6)	0.46
>12	56 (57.1)	36 (51.4)	
CRP on presentation- mg/L			
<5	2 (12.5)	3 (23.1)	0.45
5 or more	14 (87.5)	10 (76.9)	
Fever			
Yes	39 (26.7)	22 (21.8)	0.38
No	107 (73.3)	79 (78.2)	
Admitted to hospital			
Yes	102 (69.9)	60 (59.4)	0.09
No	44 (30.1)	41 (40.6)	
Representation			
Yes	16 (11.0)	15 (14.9)	0.36
No	130 (89.0)	86 (85.2)	

Note: WCC = white cell count. Elevated WCC defined as  $>12 \times 10^9/L$ ; CRP = C reactive protein. Elevated CRP defined as  $\geq 5$  mg/L; Fever defined as temp  $\geq 38.0^\circ C$  recorded at any time.

No significant differences were detected with regards to other characteristics investigated (Table 3).

## Discussion

### Key findings

This study provides the first epidemiological investigation of changes in presentation and treatment characteristics for patients

with oropharyngeal infections during the COVID-19 pandemic. These findings highlight important changes in community practices with regards to these infections and symptomology. These findings included significant increases in symptom duration as well as a significant decrease in the proportion of patients receiving antibiotic treatment prior to presenting to hospital.

### Changes in overall presentation numbers during the pandemic

There was a decrease in the overall number of cases of oropharyngeal infection presenting to our institution during the pandemic as compared with the same period the year prior. The proportion of these patients admitted to hospital also decreased by just over 10% compared to the same period 1 year prior. This was in keeping with previously reported reductions in health care attendance, including asymptomatic sexual health screening, cancer screening, emergency department attendances and overall presentations to health services.<sup>10–12</sup> Interestingly, reduced presentations were not solely lower in regions with high community transmission rates, with reductions in cancer screening attendance also noted in regions such as Taiwan where medical systems were not unduly affected by high COVID-19 case numbers.<sup>12</sup> In this case the authors postulated the influence of the populations perceived risk as a barrier to healthcare service attendance. It is likely this perceived risk also played a role in our study cohort given the relatively low community transmission rates during the study period.

### Admission practices

The overall reduction in patient admission rate for oropharyngeal infections did not result in a noticeable increase in representation rate within 30 days. This was also the case in a United Kingdom (UK) study that investigated adults with tonsillitis and peritonsillar abscess during the pandemic.<sup>2</sup> Whilst management of tonsillitis and peritonsillar abscess shifted towards outpatient-based care during the height of the UK pandemic, there was no significant increase in representation within 10 days for patients discharged from the emergency department compared to those admitted to hospital. The representation rate for tonsillitis and peritonsillar abscess patients for the UK study was 9.7% and 10.6% for those admitted from ED, respectively. In our study, representation rates were 19.6% and 28.6% for tonsillitis/laryngopharyngitis and peritonsillar abscess/deep neck space infection patients, respectively. The higher rates observed in this study were likely due to the longer period patients were monitored for representation (30 days compared to 10 days in the UK study) and the fact that we did not limit infections to tonsillitis and peritonsillar abscess alone.

### Pre-presentation practice changes

One notable finding of this study was the reduction in the number of patients prescribed oral antibiotics, and the concurrent increase in length of symptoms prior to hospital presentation. Whilst antibacterial therapy is sometimes required in cases of oropharyngeal infection, microbial stewardship represents an important consideration in a time of a worsening antimicrobial resistance crisis.<sup>13</sup>

Recent World Health Organization (WHO) guidelines regarding the inappropriate use of antibiotics during the pandemic have been made which discourage empiric antibiotic cover SARS-CoV-2 infections.<sup>14,15</sup> Whilst this relates to the empiric use of antibiotic in cases of SARS-CoV-2, the same can also be said of viral tonsillitis or pharyngitis.

Delays to presentation during the COVID-19 pandemic have been well established in many other clinical circumstances, including delayed access to care and late presentations in paediatric emergencies, stroke, necrotizing fasciitis and diabetes.<sup>16–19</sup> Reasons for delayed presentation during the pandemic have related to patient fears, strict lockdown orders, difficulty accessing primary health care for face-to-face review and waiting for community SARS-CoV-2 test results before seeking further medical attention. In our study cohort there were no significant increases in patient length of stay, representation rate, biochemical markers including WCC and CRP on presentation, incidence of fever or increase in abscess formation, though delays in presentation did increase the duration of pre-treatment symptom time.

### Drivers of observed practice changes

In our study we believe the reduction in case attendance to be secondary to a combination of perceived risk and fear amongst the general population during a period of increasing COVID-19 transmission as well as physical barriers to transport and healthcare services during increasing lockdown in Victoria during the 2020 study period. Furthermore, the observed reduction in pre-presentation antibiotic therapy was also likely multifactorial with patients less inclined to seek primary health care assessment, clinicians more likely to request COVID-19 testing rather than treat bacterial infection and a reduced capacity for face-to-face evaluation. These same factors were likely responsible for the increased symptom duration observed in this study. It was not clear if delays to early antimicrobial intervention also contributed to the extended duration of symptoms, though it is clear prescribing practices were affected. Whilst beyond the scope of this study, our experience does suggest there may be a role for modified care models to manage tonsillitis and peri-tonsillitis abscesses during non-pandemic times, though more research is required to fully evaluate safety and cost-benefit.

### Implications for future lockdowns

During the lockdown period a non-significant trend towards fewer admissions for adults with bacterial oropharyngeal infections was noted as compared with the same period 12 months prior (59.4% vs. 69.9% respectively;  $p = 0.09$ ). This was in keeping with a change in unit policy during the lockdown which included a focus on outpatient-based management. Peritonsillar abscesses were also managed differentially during lockdown including discharge the same day of drainage, preferencing needle aspiration over incision and drainage and performing aerosol generating procedures in dedicated negative pressure rooms with full PPE (personal protective equipment). There was no significant increase in re-admissions within 30-days nor in-hospital length of stay during the lockdown period compared to the same period in 2019.

Stansfield et al. reported on the management of otolaryngology emergencies during the COVID-19 lockdown in the UK.<sup>20</sup> The authors investigated enforced changes to pre-COVID-19 guidelines and included patients presenting with tonsillitis and peritonsillar abscess. New acute otolaryngology guidelines were used during lockdown (summarized in Appendix 1 of their article). Tonsillitis was diagnosed based on initial history and non-invasive examination. Emergency clinicians would then commence intravenous dexamethasone, antibiotics, fluid and analgesia. Cases of peritonsillar abscess were treated as per tonsillitis in the first instance without aspiration/drainage performed. In appropriate cases, patients were then discharged with oral antibiotics, analgesia and telephone follow up at 24 h. If patients were deemed unsafe for discharge they would be admitted. Upon follow-up, if peritonsillar abscess was still suspected, patients were then invited to face-to-face review and aspiration. In the UK study, 93% of patients with peritonsillar abscess were managed as out-patients during lockdown, compared to 20% during the same period in 2019. Despite this, only one patient from the 2020 cohort required a drainage procedure with the remaining 14 patients managed with antibiotics alone. None of the 2020 patients developed deep neck space infections, and all were clinically improved at 10-days follow-up. Despite these changes in management and an increased utilization of ambulatory care during lockdown there appeared to be no significant adverse outcomes noted, though the authors were unable to comment on complications or readmission rates beyond 10-days.<sup>20</sup> Whilst beyond the scope of our study and those discussed above, further review of the feasibility of introducing these modified care models during non-pandemic times should be undertaken. They may provide more efficient care at a lower cost for patients with bacterial oropharyngeal infections whilst maintaining similar levels of safety and efficacy.

### Conclusion

This study has identified key changes in patient symptomology and treatment practices for upper respiratory tract infections during the COVID-19 pandemic. These included a reduction in the number of presentations during the pandemic and the proportion of patients commenced on oral antibiotics before presenting to hospital. There was also an increase in the duration of symptoms patients experienced before presenting to hospital. This study also highlights several strategies that can be employed during future lockdowns when managing and treating patients with bacterial infections of the oropharynx. Future research should focus on the use of these modified care models investigating longer term safety, feasibility during non-pandemic times and cost benefit.

### Conflict of interest

None declared.

### Author contributions

**Jason Toppi:** Data curation; formal analysis; investigation; methodology; project administration; resources; writing – original draft;

writing – review and editing. **Jed Hughes:** Data curation; investigation; resources; writing – review and editing. **Damien Phillips:** Conceptualization; methodology; project administration; writing – review and editing.

### Data availability statement

The datasets used for the current study are available from the corresponding author on reasonable request.

### References

1. Snelson E, Roland D, Munro APS. Throat and ear infections in children: URTI in the time of COVID-19. *Arch Dis Child Educ Pract Ed.* 2021;**106**:172–4.
2. Smith ME. Admission avoidance in tonsillitis and peritonsillar abscess: a prospective national audit during the initial peak of the COVID-19 pandemic. *Clin Otolaryngol.* 2020;**46**:577–86.
3. El-Anwar MW, Elzayat S, Fouad YA. ENT manifestation in COVID-19 patients. *Auris Nasus Larynx.* 2020;**47**:559–64.
4. Sidell D, Shapiro NL. Acute tonsillitis. *Infect Disord Drug Targets.* 2012;**12**:271–6.
5. Al-Jabir A, Kerwan A, Nicola M, Alsafi Z, Khan M, Sohrabi C, et al. Impact of the coronavirus (COVID-19) pandemic on surgical practice - part 2 (surgical prioritisation). *Int J Surg.* 2020;**79**:233–48.
6. Krajewska J, Krajewski W, Zub K, Zatoński T. COVID-19 in otolaryngologist practice: a review of current knowledge. *Eur Arch Otorhinolaryngol.* 2020;**277**(7):1885–97.
7. Kowalski LP, Sanabria A, Ridge JA, Ng WT, de Bree R, Rinaldo A, et al. COVID-19 pandemic: effects and evidence-based recommendations for otolaryngology and head and neck surgery practice. *Head Neck.* 2020;**42**:1259–67.
8. Team C-NIRS. COVID-19, Australia: epidemiology report 18: fortnightly reporting period ending 7 June 2020. *Commun Dis Intell.* 2020;**44**:1–27.
9. Gabbe BJ, Harrison JE, Lyons RA, Edwards ER, Cameron PA. Victorian Orthopaedic trauma outcomes R. comparison of measures of comorbidity for predicting disability 12-months post-injury. *BMC Health Serv Res.* 2013;**13**:30.
10. Chow EPF, Hocking JS, Ong JJ, Phillips TR, Fairey CK. *Sexually transmitted infection diagnoses and access to a sexual health service before and after the national lockdown for COVID-19 in Melbourne.* Open Forum Infectious Diseases: Australia; 2020.
11. McDonnell T, Nicholson E, Conlon C, Barrett M, Cummins F, Hensey C, et al. Assessing the impact of COVID-19 public health stages on paediatric emergency attendance. *Int J Environ Res Public Health.* 2020;**17**:6719.
12. Peng SM, Yang KC, Chan WP, Wang YW, Lin LJ, Yen AMF, et al. Impact of the COVID-19 pandemic on a population-based breast cancer screening program. *Cancer.* 2020;**126**:5202–5.
13. Abelenda-Alonso G, Padullés A, Rombauts A, Gudíol C, Pujol M, Alvarez-Pouso C, et al. Antibiotic prescription during the COVID-19 pandemic: a biphasic pattern. *Infect Control Hosp Epidemiol.* 2020;**41**:1371–2.
14. World Health Organization Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected: interim guidance, 13 March 2020. World Health Organization, 2020.
15. Youngs J, Wyncoll D, Hopkins P, Arnold A, Ball J, Bicanic T. Improving antibiotic stewardship in COVID-19: bacterial co-infection is less common than with influenza. *J Infect.* 2020;**81**:e55–e7.
16. Lynn RM, Avis JL, Lenton S, Amin-Chowdhury Z, Ladhani SN. Delayed access to care and late presentations in children during the COVID-19 pandemic: a snapshot survey of 4075 paediatricians in the UK and Ireland. *Arch Dis Child.* 2020;**106**:1–2.
17. Schirmer CM, Ringer AJ, Arthur AS, Binning MJ, Fox WC, James RF, et al. Delayed presentation of acute ischemic strokes during the COVID-19 crisis. *J NeuroIntervent Surg.* 2020;**12**:639–42.
18. Chen RJ, Gillespie C, Jassal K, Lee JC, Read M. Delayed presentation of breast necrotising fasciitis due to COVID-19 anxiety. *ANZ J Surg.* 2020;**90**:1485–87.
19. Rabbone I, Schiaffini R, Cherubini V, Maffei C, Scaramuzza A. Has COVID-19 delayed the diagnosis and worsened the presentation of type 1 diabetes in children? *Diabetes Care.* 2020;**43**:2870–2.
20. Stansfield J, Dobbs S, Harrison R, Lee K, Sharma S, Okour K, et al. Management of ENT emergencies during the coronavirus disease 2019 pandemic. *J Laryngol Otol.* 2021;**135**:117–24.