Isolated rhinorrhea in the presentation of SARS-CoV-2 infection among preschool- versus school-aged children

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ABSTRACT

Objectives: Rapid identification and isolation of SARS-CoV-2 cases are priorities in school and child care settings to prevent further outbreaks. The objective of this study was to compare the clinical presentation of SARS-CoV-2 infections among preschool (<5 years) versus school-aged (≥5 years) children diagnosed with SARS-CoV-2 infection, and, specifically, the probability of presenting with an isolated symptom, such as rhinorrhea or sore throat.

Methods: Retrospective study of children (≤18 years of age) diagnosed with SARS-CoV-2 in the outpatient COVID-19 clinic or the Emergency Department at the Centre Hospitalier Universitaire Sainte-Justine (Montreal, Quebec, Canada) February through May 2020.

Results: Of 3,789 children tested, 105 (3%) were positive for SARS-CoV-2, and 104 included in the analysis (n=49 age <5 years and n=55 age ≥5 years). While fever was the most common presenting symptom across both age groups, in the absence of fever, the presence of a combination of two or more symptoms identified the majority (92%) of cases. Isolated single symptom presentations were uncommon (<5% of cases). Most importantly, not a single child in either age group presented with isolated rhinorrhea or sore throat.

Conclusions: While there are differences in the clinical manifestations of COVID-19 in preschool- versus school-aged children, in both age groups, isolated rhinorrhea was not a manifestation of SARS-CoV-2 infection. These results could help further guide testing criteria and exclusion criteria in child care and school settings.

Keywords: Clinical manifestations; Paediatric; SARS-CoV-2; Rhinorrhrea; Testing criteria.
Clinical signs and symptoms

The most common presenting symptom was fever (70%), followed by systemic symptoms (54%), gastrointestinal symptoms (48%), lower respiratory tract symptoms (45%), and upper respiratory tract symptoms (37%) (Table 1). Overall, 92% of children had either fever, or in the absence of fever, a combination of two or more individual symptoms (including two symptoms from the same system category, i.e., vomiting and diarrhea). Among the eight (8%) children who were afebrile and with less than two symptoms, five (6%) were asymptomatic, one (1%) had isolated vomiting, one (1%) isolated cough, and one (1%) isolated neurological symptoms (vertigo and ataxia). None presented with isolated rhinorrhea or sore throat.

Overall, younger children were more likely to have fever at presentation than older children (84% versus 58%, P=0.02), while older children were more likely to present with systemic symptoms (64% versus 48%, P=0.03), upper respiratory tract symptoms (49% versus 22%, P=0.008), and abdominal pain (20% versus 6%, P=0.006). Nonrespiratory bacterial co-infections were common (13% of all cases) and more frequent in younger children (22% versus 4%, P=0.006). These co-infections included urinary tract infection (n=8), otitis media (n=2), cervical adenitis (n=1), Group A streptococcus pharyngitis (n=1), and a branchial cleft cyst infection (n=1). Finally, there was a higher proportion of mild disease (no hospitalization or return/follow-up visit) among older children versus younger children (65% versus 39%, P=0.001), with a higher proportion of the younger children being scheduled for a follow-up in the outpatient clinic within a month of diagnosis (12% versus 5%, P=0.01).

DISCUSSION

In this study, we describe the clinical manifestations of SARS-CoV-2 infection in preschool- versus school-aged children with the aim of better understanding when to suspect SARS-CoV-2 in these different age groups. Overall, single symptom presentations of SARS-CoV-2 infection were rare (<5% of all cases), and no child presented with isolated rhinorrhea or sore throat. Perhaps most importantly, fever or a combination of two or more individual symptoms (other than fever) identified the majority (92%) of cases. These results suggest that in the absence of fever, isolated symptoms, notably rhinorrhea, were not a primary manifestation of SARS-CoV-2 infection in children. These findings mirror adult data showing that isolated rhinorrhea and sore throat are rarely associated with a positive SARS-CoV-2 nasopharyngeal swab (19,20).

These findings are consistent with previous studies reporting that children mainly present with fever and mild disease (6–10). Fever was the most common symptom across both age groups, followed by systemic symptoms, gastrointestinal manifestations, lower respiratory tract, and upper respiratory tract symptoms. The incidence of gastrointestinal symptoms was higher than in two paediatric meta-analysis (18% [21] and 23% [22]). Moreover, there were notable age-specific differences in clinical presentation. Fever stood out as the primary manifestation of SARS-CoV-2 infection in younger children, whereas older children presented with a wider constellation of symptoms, including both upper and lower respiratory tract symptoms and systemic manifestations. Of note, the only symptom
category that equally affected both younger and older children was gastrointestinal manifestations, potentially due to SARS-CoV-2 tropism for ACE-2 receptors lining the epithelium of the gastrointestinal tract in children (23). Ocular, dermatological, and neurological symptoms were not common features of infection in this cohort, and only one patient reported neurological symptoms (vertigo) in isolation. Finally, nonrespiratory bacterial co-infections were frequently reported (13% of cases), and may have been the primary cause of symptoms. While a few studies have evaluated the presence of viral co-infections in children, there are little reported data on concurrent urinary tract infections, especially among younger children (24).

### Table 1. Epidemiological and clinical characteristics of SARS-CoV-2 infection in children <5 versus ≥5 years of age

|                           | n=104* | Age <5 years | Age ≥5 years | P value† |
|---------------------------|--------|--------------|--------------|----------|
|                           |        | 6 years (6 days–18 years) | 1 (6 days–5 years) | 13 (5–18 years) | NA‡ |
| **Demographics**          |        |              |              |          |
| Age (median, range)       |        | 6 (years) | 1 (6 days–5 years) | 13 (5–18 years) | NA‡ |
| Female                    |        | 55 (53%)  | 25 (51%)      | 30 (55%)  | 0.72 |
| **Indications for testing (n=103)** |        |              |              |          |
| Travel and symptoms       | 7 (7%)  | 1 (2%)       | 6 (11%)       | <0.001   |
| Symptoms and known contact§ | 51 (50%) | 19 (39%) | 33 (60%) |          |
| Symptoms only             | 41 (40%) | 29 (59%) | 12 (22%)     |          |
| Pre-procedure screening   | 4 (4%)  | 0           | 4 (7%)        |          |
| **Symptoms**              |        |              |              |          |
| Fever                     | 73 (70%) | 41 (84%) | 32 (58%)     | 0.02     |
| Fever or ≥2 symptoms (excluding fever) | 96 (92%) | 47 (96%) | 49 (89%) | 0.17     |
| Fever alone               | 8 (8%)  | 7 (14%)      | 1 (2%)        | 0.02     |
| Systemic (headache, myalgia, or decreased oral intake) | 56 (54%) | 21 (48%) | 35 (64%) | 0.03     |
| Systemic alone            | 0       | 0            | 0             | NA       |
| Lower respiratory (cough, shortness of breath, wheeze) | 47 (45%) | 18 (37%) | 29 (53%) | 0.05     |
| Lower respiratory alone   | 1 (1%)  | 0            | 1 (2%)        | 1.0      |
| Upper respiratory         | 38 (37%) | 11 (22%) | 27 (49%)     | 0.008    |
| Sore throat               | 14 (14%) | 4 (8%)    | 10 (18%)     | 0.38     |
| Rhinorrhea                | 24 (23%) | 7 (14%)   | 17 (31%)     | 0.03     |
| Sore throat alone         | 0       | 0            | 0             | NA       |
| Rhinorrhea alone          | 0       | 0            | 0             | NA       |
| Gastrointestinal          | 50 (48%) | 23 (47%) | 27 (49%)     | 0.83     |
| Abdominal pain            | 14 (14%) | 3 (6%)    | 11 (20%)     | 0.006    |
| Vomiting                  | 22 (21%) | 12 (25%) | 10 (18%)     | 0.43     |
| Diarrhea                  | 14 (14%) | 8 (16%)   | 6 (11%)      | 0.44     |
| Gastrointestinal alone    | 1 (1%)  | 0            | 1 (1%)       | 1.0      |
| **Other symptoms**        |        |              |              |          |
| Ocular†                   | 4 (4%)  | 0            | 4 (7%)        | 0.05     |
| Dermatological¶           | 6 (6%)  | 5 (10%)      | 1 (2%)       | 0.22     |
| Anosmia                   | 5 (5%)  | 0            | 5 (9%)       | 0.03     |
| Asymptomatic              | 5 (5%)  | 1 (2%)       | 4 (7%)       | 0.37     |
| Co-infection#             | 13 (13%) | 11 (22%) | 2 (4%)       | 0.006    |
| **Outcomes**              |        |              |              |          |
| Death                     | 0       | 0            | 0             | NA       |
| Intensive care unit       | 2 (2%)  | 1 (2%)       | 1 (2%)       | 1.0      |
| Hospitalization ward      | 16 (15%) | 10 (20%) | 6 (11%)      | 0.07     |
| Duration of hospitalization: Median [range] (days) | 3 [2–6] | 3 [1–4] | 7 [3–9] | 0.006 |
| Emergency department return visit | 16 (15%) | 7 (14%) | 9 (16%) | 0.80     |
| Outpatient clinic follow-up | 15 (14%) | 12 (24%) | 3 (5%) | 0.01     |
| No return visit**         | 55 (53%) | 19 (39%) | 36 (65%) | <0.001   |

*Unless specified otherwise in the row header, results in the columns below are presented as ‘n (%)’;
†P<0.05 was considered statistically significant;
‡NA, nonapplicable;
§A contact was defined as a symptomatic individual or laboratory-confirmed SARS-CoV-2 infection;
¶Included ocular pain and conjunctivitis;
‖Included urticaria, macules, pustules, and petechiae;
#Co-infection diagnosed clinically (otitis media, cervical adenitis, branchial cleft cyst infection) or by a positive bacterial culture (urinary tract infection, pharyngitis);
**No return visit to the emergency department or follow-up at the outpatient clinic after screening positive in the COVID-19 clinic or the emergency department.
Our study is limited by the fact that the study occurred before the emergence of SARS-CoV-2 variants of concern (25), and may therefore not reflect the clinical presentation of these new variants. Moreover, due to its small sample size and its retrospective nature relying on self-reported symptoms, we may have underestimated the prevalence of some symptoms (i.e., anosmia), not recognized early on as manifestations of COVID-19. Finally, given that the indications for testing followed evolving public health guidelines, most of the children included in this cohort were symptomatic from their infection such that we have likely underestimated asymptomatic infections. Based on seroprevalence data obtained following the study period, an estimated 3.3% of Montreal’s 850,000 children acquired SARS-CoV-2 infection during the first wave, suggesting that there were many unrecognized infections (26). Nonetheless, whereas the majority of previous studies focused on symptoms among hospitalized patients (27) or report population-level epidemiological data (28,29), one of the main strengths of this study is the detailed information on clinical manifestations and outcomes captured for mildly symptomatic children in Canada.

In summary, our findings suggest that while there are differences in the clinical manifestations of SARS-CoV-2 infection in preschool- versus school-aged children, the majority (92%) of children across both age groups presented with a fever, or a combination of two or more symptoms other than fever. As such, an isolated symptom in the absence of fever is not likely to be a manifestation of SARS-CoV-2 in children. Most importantly, isolated rhinorrhea was not a manifestation of SARS-CoV-2 infection in this cohort. These results could help further guide testing criteria and infection control measures in child care and school settings, though further study among larger paediatric cohorts with the new variants of concern are needed.

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POTENTIAL CONFLICTS OF INTEREST

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