Discussion

The current pandemic of SARS-CoV-2 infection globally has been associated with a variety of pediatric presentations depending on the stage of the disease, the prior health status, and the presence of comorbidities and other individual features, with more frequent asymptomatic infection in children than in adults [3]. Children may also present with mild pneumonia, Dong., *et al*. reported that 90% had mild to moderate form of the disease [4]. A metanalysis done by Assaker R., *et al*. also demonstrated that 16% of children were asymptomatic and 82% of them had mild to moderate infection [5]. However a review done in Wuhan Children's Hospital showed that 3 out of 1391 children required intensive care support and invasive mechanical ventilation but all had coexisting conditions (hydronephrosis, leukemia, and intussusception) [6].

In a retrospective study done in New York done by Zachariah P., *et al*. [7] showed that obesity was significantly associated with disease severity but asthma was not statistically significant factor for the disease severity. However, as our patient had a normal BMI of 20.5 kg/m^2. This study also showed that patients who presented with shortness of breath tend to be more sick, with elevated inflammatory markers in those with severe disease [7].

Given the lack of pediatric asthma and COVID-19 cases in the literature, and based on a systematic review done by Castro-Rodriguez and Forno [8] there were a very limited number of pediatric studies that reported specific pediatric asthma and COVID 19 data. Moreover, only two reports in children included information on asthma as a potential risk factor for COVID-19 infection, but not for severity or mortality [8].

To our knowledge, 2 cases in the literature were reported, the first by Barsoum Z. who reported a case of an asthmatic 12-year old girl that presented with cough, wheeze, and mild pneumonia due to COVID-19, she was discharged home 2 days following hospitalization [9].

On the other hand, the second case done by Aghdam MK., *et al*. who reported the case of a child with asthma who sought care for COVID-19 symptoms and whose condition did not improve despite appropriate treatment for asthma, pneumonia and COVID-19. Further examination revealed foreign body aspiration which has been removed by bronchoscopy [10].

We report the successful management of an 11-year-old asthmatic child with COVID-19 in Lebanon who require PICU admission. Our patient, with underlying well controlled asthma presented with fever, cough, tachypnea, shortness of breath and desaturation diagnosed as moderate to severe asthma exacerbation according to Pediatric Respiratory Assessment Measure (PRAM) [11] due to severe pneumonia secondary to COVID-19, and managed by intravenous dexamethasone, ipratropium bromide, albuterol and budesonide puffs, high flow nasal canula and non-rebreather face mask to maintain saturation above 93%. IV antibiotics was also used to treat the suspected superimposed bacterial infection. The patient was started on prophylactic anticoagulation, knowing that anticoagulation therapy was recommended according to an article discussing the benefits of such treatment in children with COVID-19 [12]. Conversely, a survey done in 174 centers, COVID-19 in children with underlying chronic respiratory diseases showed that infection with SARS-CoV2 in patients having asthma and cystic fibrosis was well tolerated, but a substantial minority of children with BPD and other conditions required ventilatory support indicating that these latter groups are at risk from SARS-CoV-2 infection [13].

Though, it also remains unclear if COVID-19 increases the risk of asthma exacerbations and if covid-19 could trigger a viral induced exacerbation of asthma in asthmatic children as showed by a serial of case series conducted by Abrams E and Szefler S [14]. Our case demonstrated that COVID19 may present with a clinical picture of asthma exacerbation in asthmatic children.

The Global Initiative for Asthma (GINA) on March 2020 recommends avoiding the use of nebulizers due to the increased risk of disseminating COVID-19 to other patients and health care staff; they thus recommend the use of pressurized metered dose inhalers (pMDI) as the preferred delivery system during asthma attacks [15]; therefore, our case was managed with inhaled Short acting beta-2 agonist, ipratropium bromide and budesonide.

GINA [15] and the British Thoracic Society [16] do not recommend avoiding corticosteroids for acute asthma attacks even if due to COVID-19. Hence our patient was managed by IV corticosteroids for its moderate to severe asthma exacerbation.

However further data is needed to identify whether childhood asthma (or other pediatric respiratory diseases) are associated

with COVID-19 risk or severity [8] and whether there is an increased risk of COVID-19 morbidity among children with asthma [14].

Conclusion

We suggest that the reported case supports assuming at the conclusion: The case related suggests that COVID-19 may increase the severity of asthma in children. Differentiating acute COVID-19 infection from asthma exacerbation, is challenging especially in pediatric age group. Therefore, further studies and collaborative international efforts are required to identify the impact of pediatric asthma on the course of SARS-COV-2 infection and to determine whether asthma in children is a potential risk factor for COVID-19 mortality and morbidity. As a result, families and pediatricians have an essential role in ensuring that asthmatic children maintain good asthma control during this global pandemic.

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