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Onset of Asthma as a Post COVID Complication-A Case Study

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ABSTRACT

COVID-19 the global pandemic is caused by the virus known as SARS-CoV with accumulating data pointing to a number of long-term repercussions impacting numerous people. Among these, respiratory consequences have received a lot of attention, particularly for the onset or worsening of asthma in those who have had COVID-19 infection. This abstract investigates the emergence of asthma as a possible post-COVID consequence, focusing on the causes, medical consequences, and potential risk factors. According to studies, SARS-CoV-2 infection can cause a variety of pulmonary problems, such as Acute Respiratory Syndrome (ARDS), persistent symptoms of breathing, and altered immunological responses. In some individuals, these respiratory consequences appear as new-onset asthma or aggravation of pre-existing asthma. The pathophysiological mechanisms underpinning this relationship are complicated. Involving immunological dysregulation, airway inflammation, changes in the lung microbiota, and even Viral-induced damage to epithelial cells in the airway. Post-COVID asthma symptoms may include wheezing, feeling short of breathe, and enhanced hyper responsiveness of the airways, necessitating rapid diagnosis and treatment. As the long-term consequences of COVID-19 unfold, healthcare practitioners must keep an eye out for new respiratory symptoms in patients recovering from COVID-19, particularly those with a history of respiratory disease or viral infection. This article includes a case study of a patient with asthmatic symptoms after recovering from COVID-19 infection, as well as a review of cases are documented in this manuscript.

Keywords: Asthma, COVID-19, Post-COVID complications, Angioedema, Airway inflammation, Allergy.

INTRODUCTION

Millions of people worldwide are suffering with asthma, a common chronic inflammatory respiratory disease that is difficult to diagnose and treat. In 2019, asthma affected about 455,000

people worldwide and impacted an estimated 262 million people, according to the World Health Organization (WHO). Even with medical advancements, asthma is still underdiagnosed and undertreated, particularly in low- and middle-income nations where access to medical care and inhaled drugs may be restricted. The management of asthma is made more difficult by the variety of symptoms, overlapping respiratory disorders, and varying patient reactions to treatment. The mark of this respiratory disorder is airway inflammation, which results in bronchial hyperresponsiveness and occasional airflow blockage. Bronchial asthma and COPD are common obstructive pulmonary diseases affecting millions globally. While they differ in etiology, symptoms, inflammation type, and treatment response, they also share similarities-especially in severe cases, where both may respond well to combined LABA/ICS therapy. Despite advances, both conditions remain underdiagnosed and undertreated. Improved understanding, earlier diagnosis, and future therapies may enhance patient outcomes and quality of life[1]. Coughing, wheezing, and shortness of breath are the classic symptoms of asthma, and they are often made worse by triggers that range from viral infections to allergens. A complicated interaction between environmental and genetic factors determines the prevalence and severity of asthma. It is a disease with common symptoms of Cold, fatigues, cough, breathlessness and joint pains. However, people with mediate to long term COVID may experience the Post Covid symptoms like, lower respiratory problems like COPD, Asthma, Angioedema, skin problems and continuous cold and cough. Asthma has been associated to other conditions including eczema and hay fever, and it frequently appears in childhood. The severity ranges from irregular symptoms to potentially fatal airway closure. Using the patient's medical history, physical examination, pulmonary function tests, and the proper laboratory testing, medical practitioners arrive at a conclusive diagnosis. The main diagnostic procedure is spirometry with a post-bronchodilator response (BDR). The mainstays of treatment include availability to fast-acting bronchodilators, regular symptom evaluation, ongoing education, and controller drugs that are appropriate for the severity of the disease. Disparities in asthma care still exist despite improvements in therapy, with various populations having varying access to diagnosis, care, and patient education.[2]

Asthma

Asthma is a chronic lung illness that damages the airways. The illness is characterized by inflammatory changes that contribute to constriction of airways, which can produce symptoms such as wheezing, coughing and breathlessness.The triggers for asthma include exercise, allergies and respiratory infections.

In low- and middle-income countries, asthma is often under-diagnosed and untreated. Those with asthma that has not been adequately treated may experience sleep disturbances, daytime tiredness, and reduced focus. The severity of asthmatic symptoms can lead to emergency care such as hospitalization for treatment and monitoring. In the most severe cases, asthma can be fatal.

Epidemiology

Worldwide the over 261 Million people were estimated to get effected by Asthma[3]. There are many different phenotypes associated with asthma, which are probably caused by complex interactions between genetic and environmental variables[4,5]. According to recent studies, the prevalence of asthma varies among[17] countries. For example, people of all ages in India, Taiwan, Kosovo, Nigeria, and Russiarange from 3.4% to 6%, while in Honduras, Costa Rica, Brazil, and New Zealand are higher, ranging from 17% to 33%. Even though data from 2001 to 2015 show a continuous decline in the death rate due to asthma, the condition still causes over 420,000 fatalities annually[6]. A higher chance of developing asthma may be related to numerous conditions, yet it is frequently challenging to identify a single, definitive cause. People who also have allergy disorders, such as eczema and rhinitis (hay fever), are more prone to develop asthma[7].

- Asthma prevalence increased with urbanization, mainly due to lifestyle factors. Early life experiences could impact the development of lungs and increase the risk

of getting asthma. Among of these include prematurity, low birth weight, tobacco smoke and other forms of air pollution, and viral respiratory infections.

- It is also believed that exposure to a variety of environmental allergens and irritants trigger an increased risk of developing asthma, such as dust mites in the home, mould growth, and exposure to dust, fumes, or chemicals at work.
- Obese or overweight people, notably children, are more prone to acquire asthma[8].

Patho Physiology

The disease known as asthma is characterized by a variety of underlying processes and complex interactions between resident and inflammatory airway cells. Still the evaluation is undergoing from 25 years. These processes result in hyper responsiveness of the bronchi, occasional blockage of airflow, and inflammation of the airways. Acute asthma symptoms typically result from bronchospasm and are treated with bronchodilators. Anti-Inflammatory drugs may also be used Figure 1.

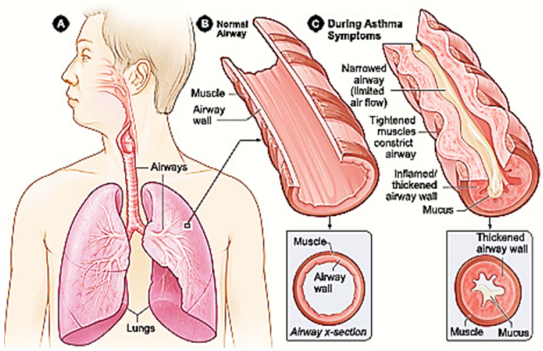


Fig. 1. The underlying cause of asthma. The positions of the lungs and airways within the body are shown in Figure A. A cross section of a typical airway is displayed in Figure B. A cross section of an airway during asthma symptoms is shown in Figure C. Health National Institutes[9]

Symptoms

Asthma symptoms can differ from person to person. Sometimes the symptoms worsen dramatically. We call this an asthma attack. Oftentimes, symptoms worsen at night or during physical activity.

- Asthma symptoms commonly manifest as a chronic cough, particularly during the night; wheezing during exhalation and occasionally during inhalation; dyspnea or dyspnea at rest; and tightness in the chest that makes it difficult to breathe deeply.
- When the temperature changes or when they have a cold, some people will have worsening symptoms. Dust, smoke, fumes, pollen from grasses and trees, animal fur and feathers, harsh soaps, and perfume are some other triggers.
- Some illnesses can also be the cause of the symptoms. Those who experience symptoms ought to consult a medical professional[10].

Comparative studies

It is believed that viral infections such as respiratory syncytial virus, rhinovirus, and human metapneumovirus increase a child's risk of developing asthma[8]. Even though, the association between Few studies have examined the relationship between adult new-onset asthma and viral infection. A study reported that lower respiratory tract infections are associated with asthma in adults. The risk of new asthma was significantly increased in adult patients with a lower respiratory tract infection in the past 12 months, Rantala *et al.,* suggesting causation. -and-effect relationship between viral infection and new-onset asthma in adults[11].

According to Al-Shamrani A *et al.,* they had surveyed the case reports in pneumologist clinic for 3-6 months for the post covid symptoms in 46 patients in an outpatient After a month of recovery, patients reported symptoms associated with asthma, such as fatigue (35%), cough (22%), chest tightening (22%), irregular spirometry (9%), and irregular exhaled nitric oxide levels (39%). Case studies demonstrate that long-lasting post-COVID-19 symptoms are not restricted to severe illness or hospitalization and often afflict people with mild to moderate disease at first. Focusing on the unique rehabilitation care requirements of COVID-19 survivors, especially those with minor to moderate disease, and managing their symptoms are crucial for fostering a quick recovery[12].

According to Hyun Lee *et al.,* A COVID

infection is a rare cause of asthma, which may be due to inflammation produced by the eosinophils. The diagnosis of subacute or chronic respiratory symptoms following COVID-19 should be made differentially by clinician.[13]

According Götzinger F *et al.,* During the pandemic 69 pediatrics were admitted with the symptoms of COVID-19, and tested positive. All the dates were documented in the laboratory and they were discharged after treatment. later many of the children were come up with the diagnosis of Asthma in post covid about 41.5% of COVID-19 patients. His study indicates that post COVID symptoms like asthma may be a risk factor which is associated with the previous family history of asthma or may be previous history of asthma[14].

According to Swathi M. *et al.,* Along with these symptoms people are also suffering from Angioedema in post Covid[15].

The most common persistent symptoms reported after recovery from COVID-19 were insomnia, cough, fatigue, shortness of breath, loss of taste and/or smell, and headache[16]. After the acute phase, there are residual symptoms of COVID-19, ranging from mild to severe, which some authors call prolonged COVID-19[17].

So far, data has shown that 15.6 million people worldwide have been affected by COVID-19 in children and adolescents. Most (80-90%) are mild to moderate, have a low mortality rate, and may even be asymptomatic[18,19]. According to Asseri *et al.,* Cough the residual symptoms of COVID-19 infection is (4%) and fatigue (2%)[20].

As Xiong Q *et al.,* described that Adult patients who encountered lower respiratory infections within the previous twelve months had a significantly higher probability of being diagnosed with asthma, which indicates that there is a link between viral infection and new adult-onset asthma[21].

Case Report

In 2022, A women with age of 28 years, got severe cough and it persisted for 3 days, she visited the general physician and he prescribed the cough syrup i.e, CHLORPHENIRAMINE-2MG+DEXTROMETHORPHAN-15MG+PHENYLEPHRINE-5MG (5 mL 3 times daily). When she began taking the syrup, her cough did not persist. She was brought to the hospital as a result of her persistent cough. For the purposes of the study, the following patient data were extracted: Age, gender, body mass index (BMI), history of COVID-19, and complaint of asthma-like symptoms, including cough, wheeze, tightness in the chest, and SOB, are the first four factors. He asked for an X-ray of his chest. According to the x-ray reports, she had a serious case of pneumonia. The pulmonogist suggested her to take the test done for Spirometry, the spirometry results shown that she is unable to hold the breath during spirometry. We have taken the results shown by the Jeffrey M.H in his writings as a reference[22].

Spirometry (BTPS)		Pre Bronchodilator					
		Actural	Range		Predicted	% Pred	Z-score
Start Time		17.03	----	----	----	----	----
FVC	L	3.20	2.42	3.80	3.10	103	0.25
FEV,	L	2.71	1.95	3.03	2.50	108	0.66
FEV,/FVC	%	85	70	90	81	105	0.67

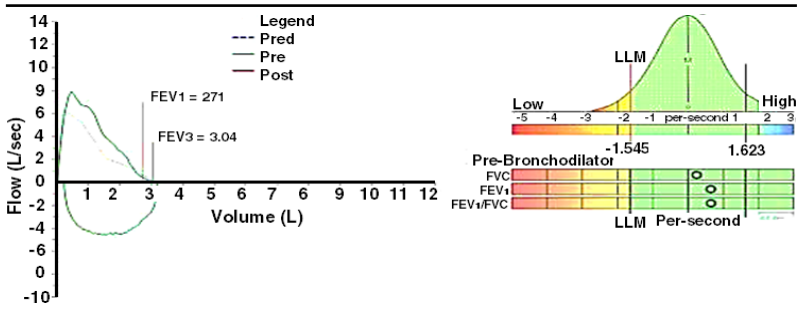


Fig. 2. Normal Spirometry Results[20]

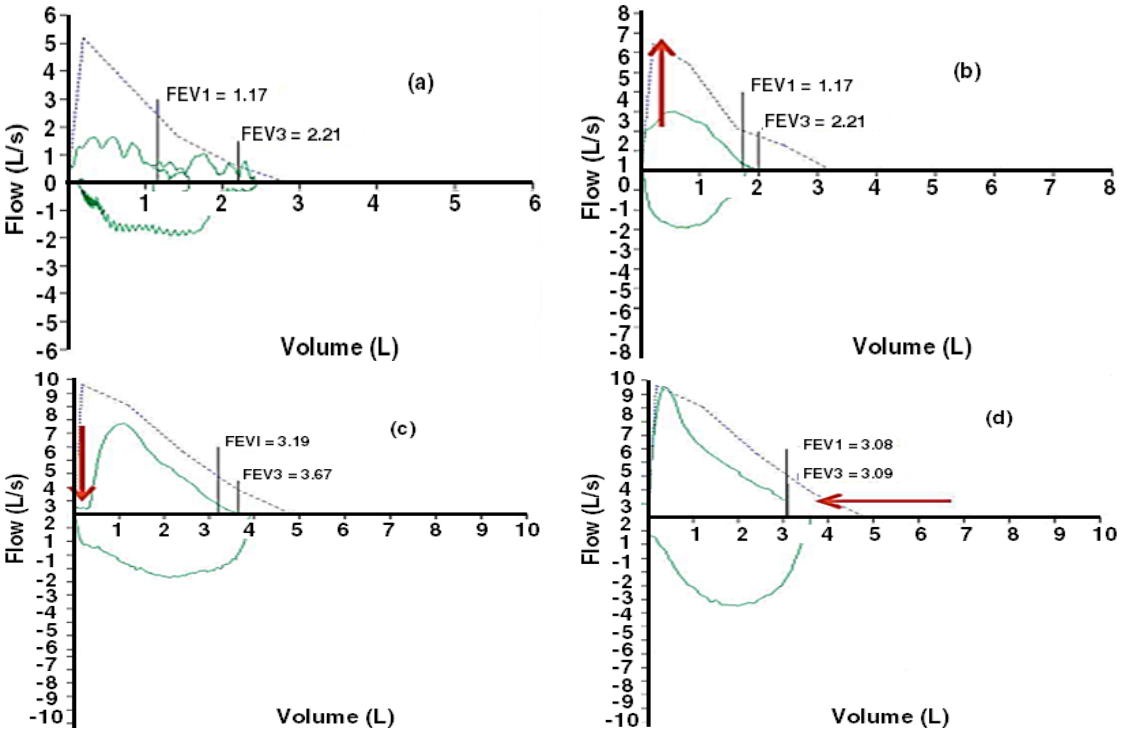


Fig. 3. Spirometry results of asthamatic patient[20]

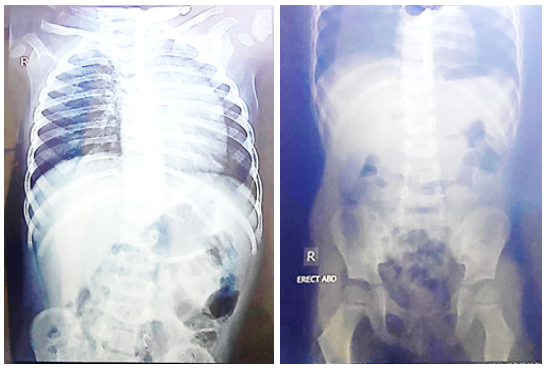


Fig. 4,5. X-Ray Report of hyperinflation characteristic of asthma

The subsequent investigative determines were also taken as part of the clinic's routine investigation panel: (i) FeNO levels; Fractional exhaled Nitric Oxide, levels are typically measured in parts per billion (ppb). A normal range for adults is generally below 25 ppb, while children may have a slightly lower normal range. Levels between 25 and 50 ppb in adults (or 20-35 ppb in children) are considered intermediate, and levels above 50 ppb (or 35 ppb in children) are considered high, suggesting possible airway inflammation (ii) absolute eosinophil levels; (iii) serum IgE; and (iv) spirometry results. The clinic's standard practice was to provide bronchodilators (long-acting beta agonist+inhaled corticosteroids) to post-COVID patients who were displaying asthma-like symptoms. At the time of follow-up, any symptom relief was evaluated. For comparisons made within the study, FeNO reference ranges are as follows: ≤25 ppb is regarded as normal, while >25 ppb is regarded as abnormal[23]. In a similar way absolute eosinophil counts are categorized as pathological when they exceed 1 x 109/L and as normal when they are less than 1 x 109/L. In addition, the reference ranges for serum IgE are set at ≤112 IU/mL as normal and >112 IU/mL as abnormal. The World Health Organization's (WHO) classification system was used to group the BMI ranges. She was obsessed[18].

Doctor enquired about family histories, allergies, previous infections etc., and the patient confirmed that she got effected with COVID-19 and during post COIVD-19 she pertained with angioedema[14].

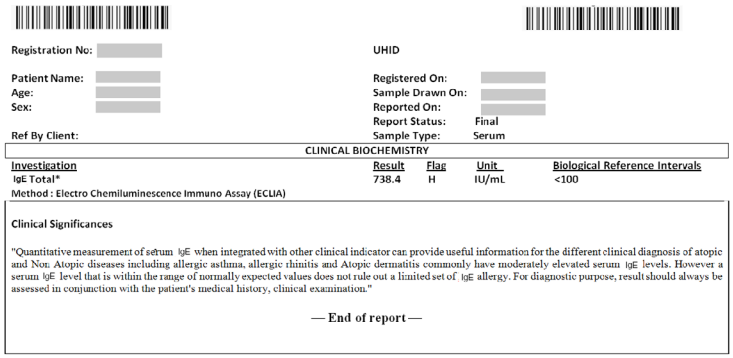
Doctor confirmed by deep examination of the reports of FeNO results and spirometry results confirmed that patient got effected with Asthma which is a chronic inflammatory condition.

Pulmonologists didn'tconfine that, Asthma

is a post covid symptom but his patient was 40-50% are with these symptoms.

Medication prescribed: Formoterol Fumarate and Budesonide Powder Inhalation IP. 200mg.

Reports



Registration No: UHID

Patient Name: Registered On:
Age: Sample Drawn On:
Sex: Reported On:
Report Status: Final
Ref By Client: Sample Type: Serum

CLINICAL BIOCHEMISTRY

Investigation	Result	Flag	Unit	Biological Reference Intervals
IgE Total*	738.4	H	IU/mL	<100

Method : Electro Chemiluminescence Immuno Assay (ECLIA)

Clinical Significances

"Quantitative measurement of serum IgE when integrated with other clinical indicator can provide useful information for the different clinical diagnosis of atopic and Non Atopic diseases including allergic asthma, allergic rhinitis and Atopic dermatitis commonly have moderately elevated serum IgE levels. However a serum IgE level that is within the range of normally expected values does not rule out a limited set of IgE allergy. For diagnostic purpose, result should always be assessed in conjunction with the patient's medical history, clinical examination."

— End of report —

Fig. 6. Report of Ige levels

Discussion

All things considered, there was a significant but not exactly a correlation between the asthma-like symptoms after COVID-19 infection, which was linked to an improvement following bronchodilator therapy. This suggests that anti-asthma therapy, such as bronchodilator therapy, may be useful in treating post-COVID asthma-like symptoms. While these results are clinically significant, they derive from a single patient case and thus cannot be broadly applied without further investigation. Individual variability, comorbidities, and the evolving nature of long COVID presentations make it essential to interpret such findings with caution.."Further comprehensive research, employing rigorous methodology and larger sample sizes, is recommended to validate and expand upon these preliminary findings."

In order to clarify the processes and long-term consequences of post-COVID respiratory symptoms, multicenter studies and longitudinal follow-ups will be very helpful.

CONCLUSION

The COVID-19 pandemic has introduced new complexities in understanding and managing respiratory conditions, including asthma. As research evolves, it is increasingly evident that asthma can be a significant post-COVID-19 symptom, manifesting in both individuals with a pre-existing diagnosis of asthma and those with no prior history of the disease. The inflammatory reaction brought on by the SARS-CoV-2 infection might worsen asthma symptoms or cause the development of new asthma-like disorders, which are typified by chronic coughing, wheezing, and dyspnea during post covid period.

The connection between COVID-19 and asthma highlights the need for integrated care approaches, where both viral-induced respiratory issues and chronic asthma are managed concurrently. Asthma management in the post-COVID era requires adaptation, with increased attention to minimizing exposure to respiratory viruses, ensuring optimal use of inhalers, and considering new therapeutic options to address viral-induced inflammation.

In conclusion, asthma as a post-COVID symptom presents unique challenges, requiring a multidisciplinary approach to care. In order to improve outcomes for those afflicted by both disorders, it will be essential to comprehend the long-term implications of COVID-19 on respiratory health in order to design more effective preventative and treatment measures. Continued research into the intersection of asthma and COVID-19 will be essential in shaping future healthcare protocols.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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