

Can oscillometry be a substitute to spirometry in the indigent?

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ABSTRACT

The practical difficulties of using spirometry in a 3-year-old girl are highlighted, especially during the COVID-19 era. Oscillometry, a tidal breath-based technique, has shown promising future to reliably assess lung functions in the vulnerable cohort. A simple algorithmic approach has been provided till reference values can be established with multicenter studies.

KEY WORDS: Airway reversibility, oscillometry, spirometry

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INTRODUCTION

Spirometry is the established cornerstone investigation to determine pulmonary functions.^[1] The anthropometry-matched reference values for various ethnicities are widely available. Despite standardization, only 21% of primary care physicians are using this technique in their routine practice, due to operational difficulties.^[2] This led to both under- and over-diagnosis of asthma.^[3] This scenario highlights a pressing need for a widely acceptable reliable alternative.

CASE REPORT

A 3-year-old, 14 kg, female child was brought to the outpatient department with complaints of repeated cough and breathing difficulty for the last 1 year with seasonal exacerbations. Her father was a known asthmatic. The child used to respond partially to intermittent nebulized bronchodilators. On chest examination, end-expiratory

polyphonic wheeze was heard bilaterally with symmetrical air entry. Her chest X-ray suggested well-inflated lung fields without any obvious abnormality. Parents were in complete denial regarding the possible diagnosis of asthma in the young girl and were noncompliant with controller medications in the past. Spirometry, which requires significant cooperation for the forceful respiratory maneuver, was impractical due to young age of the child. Furthermore, due to the potential risk of higher aerosol generation from repeated airway opening, this technique has been limited to selected cohort in COVID times.

We have used forced oscillation technique (FOT), with much ease, to determine her lung functions by using Resmon™ Pro FOT machine. The baseline high airway resistance (R_s), reactance (X_s), and resonant frequency (F_{res}) were suggestive of marked airway obstruction which reverted back to near-normal after inhaled short-acting β_2 agonist (SABA), proving diagnosis of asthma in the

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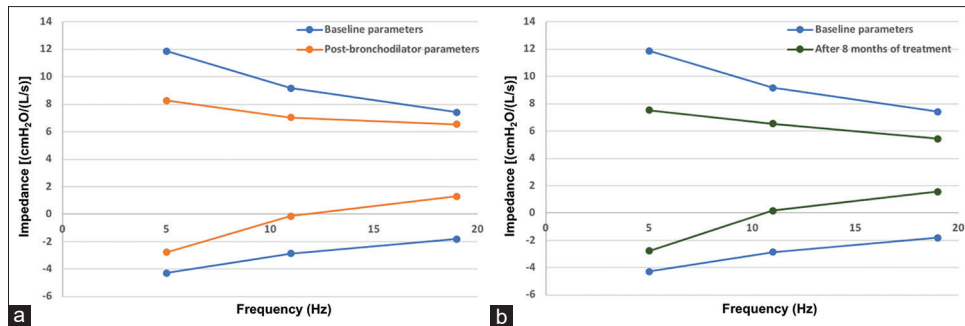


Figure 1: (a) Oscillometric parameters at the time of diagnosis. (b) Comparison of oscillometric parameters at diagnosis and follow-up

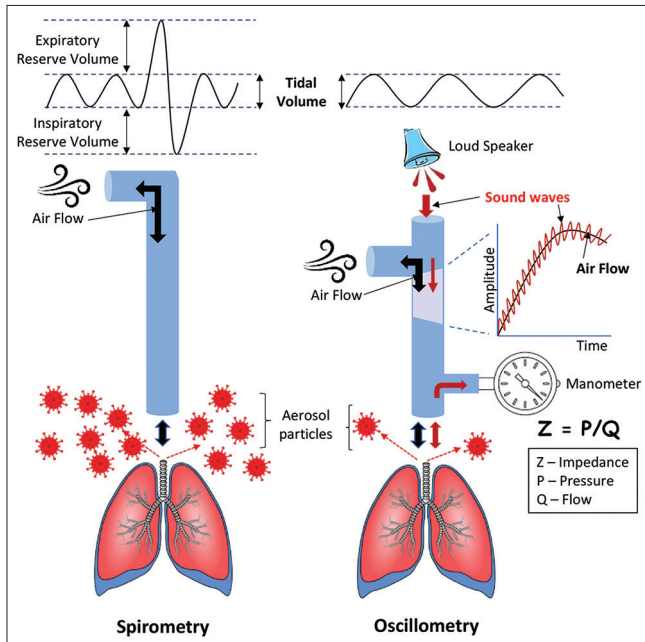


Figure 2: Comparison of spirometry and oscillometry for aerosol generation

child [Figure 1a]. The parents were counseled and convinced with the help of oscillometry graphics, and she was started on regular inhaled steroids (budesonide 400 mcg/day) and as and when required SABA (salbutamol 200 mcg) via spacer with mask. Gradually, her symptoms resolved over the next 6 weeks, and budesonide dose was reduced to 200 mcg/day. Her repeat oscillometry after 8 months suggested significant improvement in airway parameters [Figure 1b], and she remained asymptomatic till the last contact at 9 months of follow-up.

DISCUSSION

The worldwide prevalence of asthma, 300 million, is a huge underestimate due to knowledge gap among physicians and destitution of diagnostic modalities.^[4,5] Documented reversible airflow obstruction along with the suggestive symptoms is essential for making a correct diagnosis.^[1] Spirometry, the standard of care flow-based technique for monitoring pulmonary functions, is impractical in young children and elderly due to requirement of vigorous

respiratory efforts.^[6] Poor sensitivity to detect peripheral airway and parenchymal diseases are known shortcomings of this technique.^[3] Large amount of aerosol generation is another major drawback of spirometry, restricting its utility to selected section in the current COVID-19 pandemic.^[7] There is an urgent hunt for an effective and safe alternate to quantitate lung functions in the needy.

Oscillometry, a tidal breath-based technique, can be a suitable surrogate in the vulnerable population.^[8] Only passive cooperation is needed to detect respiratory impedance in terms of resistance, reactance, and resonant frequency which makes it a practical option for preschoolers, elderly and in patients with neuromuscular weakness, post cardio-thoraco-abdominal surgery, on mechanical ventilation and during sleep.^[8] This sound-signal-based technique has an extra edge over spirometry as being more sensitive for the detection of peripheral airway obstructive and pulmonary restrictive diseases.^[9] Risk of aerosol generation is almost negligible with minimum disturbance of peripheral lung tissues at tidal breathing efforts^[7] [Figure 2]. Apart from diagnosis of asthma, this technique can be quite useful in monitoring patients with COVID-19-related lung complications, including postinfectious pulmonary fibrosis.

There are few studies available till date to provide baseline respiratory characteristics in different communities, mainly for adult population. Age- and height-matched reference values for different ethnicities are lacking for oscillometric parameters. Gupta *et al.* have recently assessed airway reversibility in asthmatic North Indian children by using FOT.^[10] King *et al.* have standardized the bronchodilator reversibility cutoff values using various oscillometric parameters.^[11] There is no standard approach available for interpreting the FOT results. We are following an oscillometry algorithm, based on the current literature evidence, in our unit with excellent clinical satisfaction [Figure 3].^[8,11]

CONCLUSION

Being the tidal breath-based technique, pulmonary functions can be reliably measured with slightest efforts and minimal aerosol generation, which makes oscillometry a safer and feasible alternate to spirometry, especially in

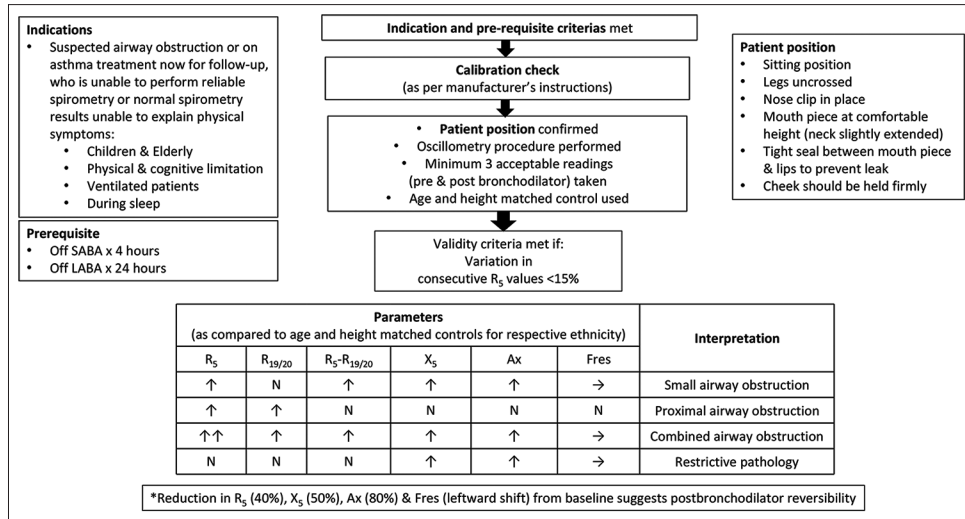


Figure 3: Algorithmic approach to a patient with oscillometry

vulnerable patients during viral pandemics. An easy and reliable algorithm has been provided till more data is available for its standardization.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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