Shifting from nasopharyngeal swab to sputum for mass screening of COVID-19 patients in India- A public health perspective

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Abstract: Unusual pneumonia of unknown cause was detected in December in the province of Wuhan; China and soon the local epidemic evolved into a rapidly spreading pandemic affecting multiple countries all over the globe, later given the name COVID-19. The most important aspect of the disease control in COVID-19 has been early detection of those who are positive for SARS-CoV-2 infection. The strategic sampling methods as recommended by the Centre for Disease Control, US (CDC) include detection of SARS-CoV-2 virus from either upper respiratory or lower respiratory tract. Most of the countries follow collecting nasopharyngeal and oropharyngeal swabs for viral detection by the trained healthcare worker. In the current phase of the pandemic in India, where the screening modality has been shifted from RT-PCR to Rapid Antigen Test mostly because of surge in single day cases, high cost of RT-PCR, and need for a higher coverage for detection of COVID-19 cases. Policy makers need to consider the sputum testing modality for COVID-19 as an alternative because of the low sensitivity of the rapid antigen test compared to the sputum test and an added advantage of already established tuberculosis network with trained human resources. For such a situation, considering a collection of sputum samples for investigation of COVID-19, at the community level based on the scientific evidence this will be an effective choice for India with more than 1.3 billion population and limited resources.

Keywords: sputum, mass screening, COVID-19

Introduction

Unusual pneumonia of unknown cause was detected in December in the province of Wuhan; China and soon the local epidemic evolved into a rapidly spreading pandemic affecting multiple countries all over the globe.(1) Initially, on 30th January 2020, the World Health Organisation (WHO) declared this epidemic a public health emergency of international concern. On 11th February 2020, WHO named this disease as COVID-19.(2) With the increase in the viral spread over days to come and that too at an alarming rate, WHO declared COVID-19 a global pandemic on 11th March 2020.(2) As of now (01/05/2020), 3221029 cases have been affected by COVID-19 all over the world and 228252 people have died.(3) The most number of single day deaths were reported on 27th April 2020 (1). The toll was astonishing 4982 death reported from all over the world. Initially, the disease was more prevalent in urban areas due to the higher population but now it’s equally prevalent in rural populations as the workers from urban areas migrated back to their homes in rural areas causing the viral spread.(4)

The most important aspect of the disease control in COVID-19 has been early detection of those who are positive for SARS-Cov-2 infection. The strategic sampling methods as recommended by the Centre for Disease Control, US (CDC) include detection of SARS-CoV-2 virus from either upper respiratory or lower respiratory tract.(5) Nasopharyngeal/Oropharyngeal swab, Nasopharyngeal wash/aspirate, Oral aspirate, Nasal mid turbinate (NMT) swab and Specimen from the anterior nares are usually collected from the upper respiratory tract while bronco alveolar lavage, Tracheal aspirate, Pleural fluid, Lung biopsy, and Sputum sample can be collected from the lower respiratory tract. Most of the countries follow collecting Nasopharyngeal/Oropharyngeal swab for viral detection because of its simplicity and less invasive procedures involved. One only known drawback is that the sampling highly involves expertise technique. If the right technique is not followed while sample collection, it may result in false-negative results and can have the worst scenario on the management of COVID-19.(6) Moreover, the bad technique can result in aerosol formation if the patient sneezes or vomits in-between the procedure. Here the question arises, is there any other effective method of sampling and particularly specimen which has greater sensitivity and specificity and involves less expertise and is safe for the handlers?

A study from China conducted by C. Chen et al. on 545 samples collected from 22 COVID-19 positive cases taken over some time. The samples included 209 pharyngeal swab samples, 262 sputum samples, and 74 faecal samples. It was observed that the pharyngeal samples turned out to be negative among the cases but sputum and faecal samples collected from them were tested positive for SARS-CoV-2 on RT-PCR on day 13 and 39 respectively.(7)

Another study by Anne L. Wyllie et al on the comparison of Salivary and Nasopharyngeal samples reported that salivary sampling is an appealing alternative to nasopharyngeal swab sampling. The method involves non-invasive technique and is easy to self-administer. RT-PCR detection of respiratory pathogens suggests comparable diagnostic sensitivity between the two sample types. The findings indicated that RNS of SARS-CoV-2 can be detected from the saliva of COVID-19 patients and self-collected saliva samples have comparable SARS-CoV-2 detection sensitivity to nasopharyngeal swabs collected by healthcare workers from mild and subclinical COVID-19 cases.(6)
Another Study by Wenling Wang et al over 1070 specimens collected from 205 patients with COVID-19 reported sensitivity of 93% for Bronchoalveolar lavage fluid specimens, followed by sputum (72%), nasal swabs (63%), fibro bronchoscope brush biopsy (46%), pharyngeal swabs (32%), feces (29%), and blood (1%) respectively.(7)

From the above studies, it is quite evident that sample collection and appropriate specimen for testing plays an important and pivotal role in the diagnosis of COVID-19. Another aspect of the diagnosis of COVID-19 cases is the readiness of the healthcare system to incorporate changes within it to test more and detect more cases. The Indian healthcare system is one of the largest and robust healthcare network systems spreading to more than 700 districts all over the country. Primary health care is provided from sub-centers and primary health centers. Secondary health care through community health centers, sub-district hospitals, and district hospital and tertiary care through medical college.(8) The Indian health system is unique in itself. For every endemic disease, there is a specific national program running at the national level. One of them is the National Tuberculosis Elimination Programme (NTEP), previously called RNTCP. The unique features to NTEP are that there are supervisory staffs at the sub-district level and a sub-district unit for a population of 5 lac each. The program is decentralized with community participation. Screening of cases of tuberculosis is done almost at the doorsteps of the patients. There is regular monitoring of patients on drug therapy with sputum microscopy and CBNAAT (cartridge-based nucleic acid amplification test). There is also a network of more than 2000 CBNAAT machines in India.(9)

Recently, experts from India were of the view to modify these CBNAAT machines for COVID-19 testing using a different cartridge. This decision was taken given limited testing facilities for COVID-19 in India.(10) As the cases of COVID-19 are on the rise in India, we believe community transmission might be the possible cause behind that. For such a phase of the pandemic i.e., Phase III, mass screening of the community is advised. The most worrisome fact behind the mass screening is the fear and stigma associated with the COVID-19 itself. The scarcity of personal protective equipment (PPE) and limited logistics and infrastructure make it cumbersome for the health care professional to deal with such a highly communicable disease.(11)

The nasopharyngeal specimen and the technique involved make it more difficult and a risky affair for the healthcare workers. We hypothesize that using the current infrastructure, manpower, and logistics of the NTEP in the fight against COVID-19 will result in maximum effectiveness in early detection of cases and overall containment of the disease. Instead of the expert technique of collecting nasopharyngeal swabs and transporting them in Viral Transport Media (VTM), a simple sputum sample can be self-collected by those with symptoms of influenza-like illness (ILI) in small plastic containers and get that delivered to the nearest tuberculosis unit for CBNAAT analysis. While we compare the nasopharyngeal sample with the sputum sample, the following can be observed:-

1) The collection of sputum samples is a simple procedure. Be it in tertiary care centers of urban areas or a sub-center of a rural area. Health care workers can easily aid in collecting sputum samples.

2) The procedure of sputum collection involves less expertise and there is less chance of aerosol or droplet generation. This reduces the possibility of health care workers getting infected. The procedure can be done either at home or at an open space in the health care facility.

3) Sputum sample only requires a sterile container, whereas nasopharyngeal or Oropharyngeal swab collection require sterile swab stick along with a sterile container, and the person who is collecting the sample should wear PPE. The cumulative cost is much higher than the cost of a sputum collection.

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4) Both common people and health care workers are already familiar with the process of collecting of sputum. In India under NTEP, all peripheral health workers are already sensitized to the process of sample collection and they have already received training regarding the process. From this perspective, it will be easier to adopt an established older system rather than a completely new system.

5) When SARS-CoV-2 positive patients are in-home quarantine with milder symptoms to prevent the spreading of infection. During that time, we also supposed to do RT-PCR to decide about the duration of home quarantine and virus shedding. In that period if we can confine that person at home, and collect the sample from home, we can stop spreading of infection to the community.

**Conclusion:** In the current phase of the pandemic in India, where the screening modality has been shifted from RT-PCR to Rapid Antigen Test mostly because of surge in single day cases, high cost of RT-PCR, and need for a higher coverage for detection of COVID-19 cases. Policy makers need to consider the sputum testing modality for COVID-19 as an alternative because of the low sensitivity of the rapid antigen test compared to sputum and an added advantage of already established tuberculosis network with trained human resources. For such a situation, considering a collection of sputum samples for investigation of COVID-19, at the community level based on the above-mentioned scientific evidence will be an effective choice for India with more than 1.3 billion population and limited resources.

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**References**


