Respiratory Function Testing During Endemic COVID-19

Introduction

Respiratory function testing is key to the diagnosis, management and monitoring of respiratory disease and as an assessment of surgical risk. The required tests will depend upon the underlying clinical problem, but, for the majority of patients, it will involve breathing into equipment. This often produces a cough and as such is potentially an aerosol generating procedure (AGP) with the need for appropriate precautions. Useful tests such as blood gases and simple field exercise tests; i.e. shuttle walk test and 6 minute walk tests are not deemed to be AGPs (unless the patient is coughing), but precautions are still necessary, along the lines of standard PPE used in the out-patient setting together with standard infection control procedures (SICPs). This document addresses predominantly adult testing, but several aspects are applicable to children.

For most respiratory services restoration is not possible without respiratory function testing facilities being available. For example:

- Spirometry is essential for assessment of obstructive lung diseases.
- Spirometry coupled with the detailed assessments of gas transfer and cardiorespiratory exercise testing are essential for lung cancer.
- Spirometry coupled with gas transfer is needed in assessing interstitial lung diseases.

Problems in restoration

As we move into the restoration phase, there are considerable problems for respiratory physiology as there is a "perfect storm" of:

1. An increased demand for physiology testing around the need and ongoing requirements for oxygen therapy for patients recovering from COVID-19, especially recognising silent hypoxia.
2. More tests needed to determine the presence and nature of the lung damage that has occurred in a large number of COVID-19 positive patients, probably over 20%.
3. The need for physiologists/scientists to continue supporting the acute use of CPAP/NIV on wards as the endemic COVID-19 will now be managed predominantly by respiratory teams and ITU.
4. The huge backlog that has arisen as a consequence of respiratory physiology services ceasing early, coupled with the huge turnover that normally occurs; e.g. an estimated 10,000 sleep studies; 20,000 spirometry tests; 15,000 full respiratory function tests are performed per month in England.

5. The demands of respiratory function testing in important research studies of COVID-19 patients required to understand future coronavirus effects on respiratory function.

These matters need to be considered in the setting of workforce capacity. On top of the long-standing staff shortages in respiratory physiology, there are those who are currently absent from work with COVID-19 or shielding. Additionally, a significant proportion of the workforce is from a B.A.M.E. background, and more senior staff tend to be older with possible associated co-morbidities.

The lack of capacity in respiratory physiology is being exacerbated by the above factors, which will impact on restoration of respiratory medicine.

New considerations

When tests need to be performed there are several considerations:

1. All individuals referred for testing should be assumed to be COVID-19 positive.
2. There should be no "routine" tests and all requests should be vetted by a senior physiologist/scientist. This can enable a check of previous test results to prevent duplication, or to recommend if a different test that is less likely to generate an aerosol can provide the same/similar information.
3. Ensure patients and staff are at the lowest possible risk by:
   - Undertaking a pre-attendance questionnaire, including validating the contact app.
   - Checking the patient's temperature as they attend the department. If > 37.3°C, organise swabbing and rebook the patient at a later date.
   - Social distancing in waiting rooms or ask patients to wait in their car. One-way flow through departments will help minimise direct face to face exposure.
   - Ensure the environment allows only one test per room, minimising the risk of viral transmission between patients. Where possible, screens should be used to limit direct exposure between patient and clinician.
   - Some organisations may pre-screen, recognising that there is a significant false negative rate.
   - Hot and cold sites may be considered, recognising there is still a risk.
4. ***Full PPE must be worn (including FFP3 mask or equivalent)***. PHE has not stated if routine respiratory function testing is or is not a cause of aerosol generation. This is in contrast to the majority of professional bodies across the world, where full PPE is recommended. In the absence of robust, peer-reviewed evidence, and in the interests of protecting our workforce, this document follows the expert opinion/guidance from the European Respiratory Society [1] and UK advice from the Royal College of Physicians [2].
5. Ensure the tests are performed with the appropriate lung function filters in situ. There needs to be recognition that, for some tests, this may affect the results; e.g. cardiorespiratory exercise testing.
6. Modify how tests are performed to reduce the risk of inducing coughing; e.g. relaxed rather than forced vital capacity when possible, and minimise the tests where possible; e.g. if

alveolar volume (V_A) is already known from previous measurements of gas transfer, use this as a marker for lung volumes in some (non-obstructive) lung diseases to reduce the need for additional tests.

7. Following the investigation, the equipment and environment needs to be cleaned appropriately and full PPE removed safely. Consideration needs to be given to the role of additional cleaning staff to support this process.
8. The time between the successive patients attending for the next test will be a function of the number of room air changes. PHE recommends 6 Air Changes per Hour (ACH) for rooms where AGPs occur, which most respiratory function tests will be. Respiratory function departments need to confirm their airflow changes in all testing rooms to determine how long the rooms need to be left empty before re-use by a new patient. Where the testing room does not meet the PHE recommended air change requirement, or there are significant doubts, the room should be left empty after cleaning for a period of at least three hours [3].
9. Use of alternating rooms (if available) will ensure some efficiency and continuity of services.

Conclusions

Respiratory function tests are likely to be an AGP and need to be respected as such. Consequently:

- Full PPE should be used for undertaking testing; if this is not available tests should not take place.
- Patient and staff safety is paramount, with the need to behave differently. Consider all patients to have COVID-19 infection
- "Routine" respiratory function testing should no longer occur in primary care practices unless part of a coordinated Hub, based around PCNs with all the appropriate precautions.
- Recognise the inefficiencies to ensure patients are booked appropriately to allow the equipment to be cleaned. This may mean different time slots for different tests.
- Colleagues should refer to previous documents from ARTP, BTS and ERS for more detailed information.
- This is an evolving field and more research into risks and procedures is needed. Hence, this document will be updated when such information becomes available.

Acknowledgment

This document has been developed with expert colleagues from the British Thoracic Society and reflects a broad range of opinion. As new evidence becomes available, the document will be revised to reflect this.

References

1. Lung function testing during COVID-19 pandemic and beyond - Recommendation from ERS Group 9.1 (Respiratory function technologists /Scientists). European Respiratory Society Groups 9.1 and 4.1 https://ers.app.box.com/s/zs1uu88wy51monr0ewd990itoz4tsn2h
2. Evaluating the national PPE guidance for NHS healthcare workers during the COVID-19 pandemic. Thomas JP et al. Clinical Medicine 2020 Vol 20, No 3: 242-7
3. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. van Doremalen N, Bushmaker T, Morris DH, et al. N Engl J Med 2020; 382:1564-1567