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Working through the COVID-19 outbreak: Rapid review and recommendations for MSK and allied heath personnel

Aparna Viswanath*, Puneet Monga

Wrightington Hospital, Hall Lane, Appley Bridge, Wigan, WN6 9EP, United Kingdom

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ABSTRACT

The coronavirus (COVID-19) pandemic has caused the world to undergo unprecedented change in a short space of time. This disease has devastated the economy, infringed personal freedom, and has taken a toll on healthcare systems worldwide. This review aims to highlight aspects of this pandemic with a specific emphasis on musculoskeletal work within the secondary care setting.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic presents a significant challenge to the medical profession. The widespread effect of this pandemic and its influence on the practice of orthopaedic surgery and musculoskeletal work is the subject of this work. We discuss the issues revolving personal protection of musculoskeletal (MSK) healthcare workers, non-operative management of musculoskeletal conditions, remote consultations, trauma escalation stages, staff wellbeing and orthopaedic surgery for COVID-19 cases.

2. Personal protection of MSK and allied health professionals

Personal protection at the time of the COVID-19 pandemic is prime consideration for health workers, employers, department of health and patients. This issue is important to ensure the heath and well being of the personnel caring for musculoskeletal (MSK) patients, and also key for organisations to ensure continuity of patient care. MSK teams deal with a huge proportion of patients in the primary and secondary care. The aim of this document is to provide guidance towards personal protection for this group of health workers in a patient facing role, and secondarily to briefly review controversial topics and treatments. It would therefore be applicable to surgeons, radiologists, rheumatologists, nurses, physiotherapists, advanced practitioners, radiographers, ward clerks, receptionists, cleaning teams, porters, phlebotomists, pharmacists and all allied health professionals.

2.1. Understanding the mode of spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)

The spread of SARS-CoV-2 is predominantly via droplets (aerosol), but also via direct contact with contaminated surfaces (fomites). Any personal prophylaxis needs to consider both these modes. Also, one needs to consider the viral load to which the health worker is exposed which in turn influences the severity of disease, if acquired.

2.1.1. Aerosol spread

Aerosol (droplets from the patient's mouth or nose) spread from an infected patient to the health worker via a direct aerosol assault can vary in quantum from low level contamination – from encounters such as talking – to high level contamination – via coughing or sneezing. Such aerosol entry may be via the nose, mouth or eyes of the recipient. The distance of the source to the recipient influences the quantum. A safe distance of 6 feet is recommended when possible to minimize such aerosol spread during clinical encounters.[1]

SARS-CoV-2 is detectable in aerosols for up to three hours[2] and hence aerated rooms are safer than closed spaces. Regular ventilation of closed spaces is advisable.

* Corresponding author.
E-mail address: aviswanath@doctors.org.uk (A. Viswanath).

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Table 1
European nomenclature for filtering face pieces.

Filter Name	% of 300 nm particles filtered
FFP1 and P1	at least 80%
FFP2 and P2	at least 94%
FFP3	at least 99%
P3	at least 99.95%

Table 2
US nomenclature as per Centre for Disease Control.

Filter name	% of 300 nm particles filtered
N95	Al least 95%
N99	At least 99%
N100	At least 99.97%

A wide variety of aerosol filters (face masks) are available and sometimes the nomenclature can be challenging to understand.[2] The two main variables one needs to consider when one decides to choose such a mask is the filter efficiency and whether it provides an airtight fit around the personnel's mouth and nose. Filter efficiency is tested by assessing the proportion of a 300 nm (0.3 μm) aerosol challenge, which is filtered by the device. To understand the nomenclature mentioned in the following table, for example, a FFP2 filter will prevent at least 94% of the aerosol challenge from passing through. The European ratings are covered with two standards and the filters are classified as Filtering Face Piece (FFP) [FFP1, FFP2 or FFP3] or P1/P2/P3[2] – see Table 1.

The US healthcare lead by Centre for Disease Control (CDC) uses a different nomenclature, although the principle of testing is similar. For example, a N95 mask filters out 95% of particles sized 300 nm[3], see Table 2.

The size of coronavirus is around 100 nm (0.1 μm)[4] and hence simple mathematics would suggest that these particles would pass through most of these filters, which are tested for a 300 nm particle challenge. However, particles smaller than 300 nm do not travel in a linear motion; they travel using a zig-zag movement as they are bounced randomly by molecules of comprising air (Brownian motion).[2] Hence these particles are often trapped in filters with mesh sizes bigger than themselves. N95 masks are recommended for medium risk clinical encounters. For high-risk encounters, positive pressure suits are recommended.[2,5]

Many of the re-useable commercially available Facemasks (respirators) for protection during spray painting/woodwork/industrial fumes are FFP3/P3 category and would offer protection against a heavy viral aerosol challenge. However, most of these are not easy to sterilize and neither licensed for medical use. There is a risk of the virus staying alive on the respirator surface (up to 3 days on plastic)[6] and hence their repeated use cannot be recommended in the context of the COVID-19 pandemic. It may be too expensive for these to be used on a disposable basis (approximately £100 cost per piece), but in case of dire shortage of supplies, and if they can be mass-produced in the country, they will have a potential role in clinical encounters such as the subject of this document.

Surgical face masks are not designed for personnel protection and do not closely fit around the face and mouth. Their design is intended for preventing contamination of the surgical wound from the aerosols generating by the surgical team. When tested for personal protection, in lab settings, they provide a 35% protection against a standard lab aerosol challenge.[3] There are no clinical studies comparing N95/P2 masks to surgical masks for prevention against coronavirus but studies have compared these two masks in the setting of influenza virus (which is a similar sized virus and is also airborne).[7] Despite the differences we have seen in the lab settings, there seem to be no difference in infection rates between these two groups in the clinical setting (2 randomised trials). It is apparent that in the lab setting N95/P2 masks are superior but in the clinical setting such a difference is not seen.

Also, there is evidence to suggest that wearing a mask (either surgical mask or N95) reduces the risks of acquiring the 'flu by the close contacts of patients when compared to no protection (3 arm randomised trial),[8] Medical Research Council (Imperial College) suggests the use of masks can reduce the chances of developing disease, but notes that the compliance may be poor.[7]

In light of the above evidence, it can be inferred that the surgical masks are not a reliable protection against a known/suspected COVID-19 patient, but they are useful to prevent the personnel against an accidental aerosol challenge from an asymptomatic carrier of SARS-CoV-2 during the incubation phase. Equally if a health worker is in the asymptomatic incubation phase, this will reduce the aerosol challenge towards an uninfected patient or coworker.[5,7] By reducing the viral load acquired, such facemasks are protective for personnel as they are likely to reduce the severity of illness, especially at the height of the pandemic.

It is recommended that a known patient of COVID-19 wears such a mask to reduce viral shedding and hence this measure is protective to the health workers. These masks are also useful for symptomatic patients in self-quarantine to reduce viral load transmission to the rest of the members of family in quarantine.

Aerosols/droplet contamination via the eye can be prevented by routine use of glasses or visors.[6] Such protection would be useful when a direct aerosol challenge may occur such as clinic appointments, reception staff, clinical examination, physiotherapy, phlebotomy, radiology procedures etc.

2.1.2. Direct contamination

Direct contact with contaminated surfaces may also lead to inoculation, for example when the health worker examines the patient and then uses the contaminated hand to rub one's eye or touch their face. SARS-CoV-2 is detectable for up to 4 h on copper, up to 24 h on cardboard and up to two to three days on plastic and stainless steel.[6]

Hence hand washing with soap and water or disinfecting gel is advisable before and after every patient contact. A direct decontamination of all patient contact points is vital (chairs, door knobs, pens, clipboards etc.) many times each day. It is advisable to avoid touching one's eyes nose or mouth. It is advisable to cough or sneeze in a tissue and bin the tissue immediately. If tissue is not immediately available, it is best to cough and sneeze into the elbow.[9]

2.2. Recommendations

2.2.1. What should we be wearing?

The hospital should be divided into areas affiliated with a level of risk.[10]

Level 1 – Applicable to pre-exam triage and general outpatient dept.

Disposable surgical cap and mask
Work uniform
Disposable gloves and protective clothing

Level 2 – Applicable to A&E, isolation wards, fever clinics, ICU, specimen examination of suspected or confirmed cases, cleaning surgical instruments.

As above AND

Medical protective mask (N95)
Goggles

Level 3 – Applicable to surgical theatres on suspected or confirmed cases, intubation, tracheotomy, bronchoscopy, endoscopy, procedures with splash/spray secretions.

As above AND
Full face respiratory protective devices or powdered air-purifying respirator

Although surgical hoods (such as those made by Stryker) meet AAMI Level 4 personal protection, there has been no study looking at their effectiveness in COVID-19, and as such their use cannot be recommended.

Minimize aerosol related spread:

- A safe distance of 6 feet is recommended during clinical encounters
- Surgical masks are recommended during all clinical encounters with asymptomatic patients. Surgical masks are recommended for personnel working in areas where air exchange is < 3 h
- N95 masks/positive pressure suits are recommended for medium/high risk clinical encounters.
- Eye protection is recommended for all clinical encounters.

Minimize direct contamination

- Hand washing with soap and water or disinfecting gel is advisable before and after every patient contact.
- A direct decontamination of all patient/staff contact points is vital (chairs, door knobs, pens, clipboards, keyboard, mouse etc) many times during the working day.
- It is advisable to avoid touching one's eyes, nose or mouth. It is advisable to cough or sneeze in a tissue and bin the tissue immediately. If tissue is not immediately available, it is best to cough and sneeze into the elbow.

2.2.2. Operating room procedures

- Minimize personnel entering operating theatre.
- Ideally have a negative pressure operating area, a buffer zone and a clean zone.
- Put PPE on in the buffer zone; dispose of it in the buffer zone.
- Patients should have surgical masks and caps on.

2.2.3. Team working

Ideally divide into teams, with each team only being in a Level 2 or Level 3 area for 4 h at a time.[10]

2.2.4. Isolation zones

The hospital should have a 'fever clinic' running. i.e. anyone who enters A&E or MIU will have their temperature taken. Those with a fever are taken to a 'fever clinic' for further assessment: this is a level 2 zone.

2.2.5. Staff with comorbidities

There is no clear-cut guidance specifically related to staff with comorbidities. However, comorbidities that place individuals at greatest risk are:

Hypertension
Cardiac disease/cerebrovascular disease
Diabetes
Respiratory disease[11]
Malignancy and immunodeficiency
Those treated with ACE-inhibitors and ARBs are at greater risk[12]

COPD is the most strongly predictive comorbidity for both severe disease and ICU admission[13]

3. Non-operative management of MSK disorders during the pandemic outbreak

Long acting corticosteroid injections are often used in musculoskeletal conditions to control pain and relieve localised inflammation. There is concern regarding the use of such injections during a Pandemic as it may depress the immune system. Non steroidal anti-inflammatory medications (NSAIDs) have been linked with a more sever form of COVID19.

3.1. Local steroid injections

Methylprednisolone has been linked to prolonged viral shedding[14] and WHO advises against their use in COVID-19 except for patients with an associated acute respiratory distress. General corticosteroids have led to delayed viral shedding in MERS-CoV and SARS-CoV, as well as psychosis and avascular necrosis in SARS-CoV and increased mortality in influenza.[15]

In addition, a previous study of over 15,000 cases showed that intra articular steroid administration reduces the efficacy of the influenza vaccine and suggest susceptibility to viral load.[16]

To date there are no papers specifically looking at intra articular steroid administration in Coronavirus strain COVID-19, but the advice from WHO regarding steroids is to avoid them unless the patient is in ARDS.[17]

3.2. Using NSAIDs medications

The current advice is not to take NSAIDs in COVID-19 and to use paracetamol to treat symptoms.[18] There is speculation that the drug causes "cytokine storms". Taking the drug in the early stages of the disease may induce prolonged illness or more severe respiratory or cardiac complications.

4. Remote consultations

The effectiveness of virtual fracture clinics in the UK is now well-established.[19–21] The same research has not been done for elective orthopaedics. Certainly from a follow-up perspective, the virtual clinic is encouraged from the Royal College of Surgeons.[22] Many countries across Europe are now conducting telephone outpatient clinics in light of COVID-19.

GMC has some guidance on this, but it is limited. They suggest ensuring the patient being assessed has capacity, has a straightforward treatment request and that the clinician has all the necessary patient information to hand.The newest guidance from the British Orthopaedic Association suggests changing all, except the most essential, from face-to-face clinics to virtual or telephone clinics.[23]

5. Trauma escalation plan

Each hospital will have its own escalation plan, but in the first instance it is desirable for specialist teams to work within their own remit, albeit working in emergency mode. For example, orthopaedic surgeons could staff trauma lists, fracture clinics and minor injuries units to treat the walking wounded. At some point however

people will have to work outside their specialist area.

6. Staff wellbeing

There are studies emerging about the effects of this rapidly spreading disease on the mental health of health workers. It is important that we support each other and recognise that every one is working outside of their comfort zone. Ensure rest and respite between shifts, eat sufficiently and stay in regular contact with friends, family and colleagues.

7. Treating COVID-19 suspected patients

At some point soon, orthopaedic surgeons may have to step outside the comfort zone of trauma and orthopaedics and treat and triage any patient entering A&E. The Royal College of Surgeons has outlined this in its "Guidance for surgeons" and has set out 5 key phases:

Triage and deliver healthcare and protect the workforce
Maintain emergency surgery capabilities
Protect and preserve the workforce
Fulfill alternate surgical roles
Fulfill alternate non-surgical roles

It is therefore important that we:

Understand the basics of COVID-19
Recognise when to escalate to respiratory medics or ICU
Are able to treat acute or emergent medical conditions as needed

Key terms

COVID19 (Abbreviated from *Corona Virus disease 2019)* - Name of the disease caused with SARS-CoV-2)

SARS-CoV-2 (Abbreviated from *Severe acute respiratory syndrome coronavirus 2)*- Virus causing COVID-19.

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