Managing theatre processes for planned surgery between COVID-19 surges

Tim Cook, Kathleen Ferguson, Helgi Johannsson and William Harrop-Griffiths

Context
As we emerge from the first pandemic surge, there is a widespread desire to restart planned surgery using patient pathways that seek to minimise COVID-19 risk to patients and healthcare workers (HCWs). Some hospitals are using colour-coded pathways but, since there is no standardised NHS nomenclature for these pathways, we will simply refer to emergency (unplanned) surgery pathways and planned surgery pathways. This document focuses on planned surgery pathways.

Purpose
We are aware that there is marked uncertainty amongst operating theatre team members as to which infection prevention and control precautions should be taken when treating screened patients in planned surgical pathways. This applies in particular to which personal protective equipment (PPE) to wear and whether or how long to wait for aerosols to be cleared from clinical areas by ventilation systems. This document seeks to provide pragmatic recommendations based on currently available guidance, knowledge and opinion.

Risk levels
Intrinsic risk
Risk of transmission of infection in theatre is dependent on:

- The risk of the patient having SARS-CoV-2, which is in turn dependent on the adequacy of isolation and screening, and on community transmission and prevalence rates. Recent evidence suggests that patient-facing HCWs show significantly higher rates of positive tests than those not working in these roles.

- Adherence to relevant standard infection control precautions (SICPs) and transmission-based precautions (TBPs). Patient preparation and screening must be adhered to strictly. Relevant community transmission and prevalence rates need to be understood to decide on levels of TBPs.

Current recommendations from Public Health England (PHE) define any operating theatre in which aerosol generating procedures (AGPs) are regularly undertaken as a higher risk acute area (‘hotspot’), and recommend airborne precaution PPE to be used routinely on a sessional basis where appropriate. As and when community and hospital prevalence of SARS-CoV-2 de-creases, it will at some point become reasonable to pull back from this designation and to re-vert to lesser precautions. It is for individual Trusts, hospitals and Boards, in consultation with HCW groups, to determine whether and when a theatre in which planned surgery is performed is no longer to be considered a hotspot, and this decision is central to the guidance that fol-lows.
**Individual risk**

The risk of individual staff members being infected and harmed by COVID-19 is dependent on certain factors. Most prominent among these are increased age, male sex, and black, Asian or minority ethnicity. A list of currently known and assumed risk factors is in Appendix 1.

Some staff members who have been proven to have had COVID-19 and recovered, i.e. confirmed by antigen or antibody testing, may consider themselves to be at low risk. However, we offer two cautions. First, a prior COVID-19 infection should not be assumed unless supported by antigen or antibody testing. Second, there is currently no certainty that reinfection cannot occur and such infection could pose a risk of infection to others. As a minimum, PPE for all staff should include a fluid-resistant surgical mask to minimise the risk of droplet dispersal.

**Overall risk**

This is a combination of intrinsic risk and individual risk. When intrinsic, individual or both risks are present, the safety of HCWs should be protected by working in a safe environment and paying scrupulous attention to appropriate infection control practices, to include hand-washing, social distancing and the wearing of appropriate PPE.

When either intrinsic risk is high or individual risk is high or both are raised, the safety of those with individually increased risk should be used to determine their safe working location and infection control practices. In some settings, it may be logical for individuals at higher risk to alter their work behaviour, eg location of work and/or level of PPE used. Risk assessment by Occupational Health departments should inform these decisions (see below).

**Decisions**

Decisions about the theatre processes for planned surgery pathways should be taken locally by Trusts, hospitals and Boards, and should be based on authoritative national guidance from PHE, NHS England/Improvement, and their devolved equivalents, and the four UK Chief Medical Officers, and should be supported by the consultant microbiologist responsible for infection prevention and control. Support for these decisions should be gained from HCW groups involved in surgical patient care and their representatives.

**Planned surgery pathways**

Many hospitals are developing planned surgical pathways in line with NHS recommendations. Strict self-isolation for 14 days before admission, screening for absence of symptoms and raised body temperature, and one or two negative antigen tests in the 24–72 hours before admission are common criteria for entry into the pathway. These criteria seek to minimise risk but must be seen as providing ‘low-risk’ rather than ‘no-risk’ patients: 14 days of self-isolation does not absolutely guarantee absence of COVID-19 infectiveness, and antigen tests currently have a false negative rate of up to 30%, although multiple tests offer more reassurance. Planned surgical pathways should also include antigen testing before discharge, as many patients are discharged to ongoing care facilities.

Guidance documents on surgical aspects of planned pathways and patient management during the COVID-19 pandemic have been published by the Royal College of Surgeons of England, the Association of Laparoscopic Surgeons of Great Britain & Ireland and an intercollegiate group of surgical organisations.
PPE and aerosol-generating procedures (AGPs)

PPE is described here as contact, droplet or airborne precautions in line with PHE guidance, with each level describing the transmission it seeks to protect against.

Airborne precautions are only needed when an AGP is performed on a patient known or suspected to be infected with SARS-COV-2 or in a ‘hotspot’ location as defined by PHE guidance. AGPs can be divided into respiratory AGPs and surgical AGPs. Surgical AGPs differ by aerosolising blood and tissue rather than respiratory secretions, and are likely to be of lower intrinsic risk, but may generate aerosols for longer periods. PHE lists AGPs here. Droplet precautions are indicated when moving to within 2m of the patient and are sufficient when AGPs are not undertaken, even when patients are known or suspected to be infected with SARS-COV-2.

Table 1 Aerosol generating procedures. This list of AGPs is based on PHE guidance and an evidence review cited by them.

<table>
<thead>
<tr>
<th>Evidence of AGP</th>
<th>No evidence of AGP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>Respiratory</td>
</tr>
<tr>
<td>● Intubation, extubation and related procedures, eg mask ventilation and open suctioning of any part of the respiratory tract.</td>
<td>● Supraglottic airway insertion.**</td>
</tr>
<tr>
<td>● Tracheostomy-related procedures: insertion, open suctioning or removal.</td>
<td>● Nasogastric tube insertion.</td>
</tr>
<tr>
<td>● Non-invasive ventilation (NIV) including CPAP.</td>
<td>● Chest drains.</td>
</tr>
<tr>
<td>● High-flow nasal oxygen (HFNO).*</td>
<td>● Sedation with inhalational agents.</td>
</tr>
<tr>
<td>● Bronchoscopy.</td>
<td>● Heavy exhalation during labour.</td>
</tr>
<tr>
<td>● ENT airway procedures that involve suctioning.</td>
<td>Other</td>
</tr>
<tr>
<td>● Upper gastro-intestinal endoscopy involving open suctioning of the upper respiratory tract.</td>
<td>● Diathermy.</td>
</tr>
<tr>
<td>● Some dental procedures, eg high-speed drilling.</td>
<td>● Irrigation during surgery.</td>
</tr>
<tr>
<td>● Induction of sputum.*</td>
<td>● Use of a manual saw during surgery.</td>
</tr>
<tr>
<td>Surgical</td>
<td>Pulsed lavage.</td>
</tr>
<tr>
<td>● Surgery involving high-speed devices.*</td>
<td>Abdominal suctioning.</td>
</tr>
<tr>
<td></td>
<td>Amputation with open arterial surgery.</td>
</tr>
<tr>
<td></td>
<td>Bone drilling (there is weak evidence for high-speed cutting).</td>
</tr>
<tr>
<td></td>
<td>Dental procedures not involving high-speed devices.</td>
</tr>
</tbody>
</table>

* The evidence for these AGPs is acknowledged to be weak.

** There is no robust evidence around use of an SGA and aerosol generation. Where an SGA is inserted on the first attempt, achieving a good seal and neither mask ventilation nor suctioning was needed during the insertion process, there is no reason to treat this as an AGP.
Aerosol Clearance Times (ACTs)

Previous PHE guidance recommended waiting for 20 minutes after the performance of an AGP before the theatre was deemed clear of the aerosol. This was subsequently changed to 5 minutes. Aerosol clearance is dependent on room ventilation rates, and most operating theatres have high ventilation rates. Each air change removes approximately 63% of airborne contaminants, with >99% being removed after five air changes. We support the view expressed in a letter published in the journal Anaesthesia that an ACT equal to the time taken for five air changes as measured for that theatre (ACT5) be left to allow aerosol clearance. An example for an operating theatre with 20 air changes per hour would be that ACT5 = 15 minutes. Laminar flow theatre ventilation systems can have up to 300 air changes per hour, for which ACT5 would be 1 minute. Air exchange rates are location-specific, and there is a statutory requirement for them to be checked every 14 months.

Consequences of risk determination for patients in planned surgical pathways

Determining that all patients in planned surgical pathways are of such low risk of SARS-COV-2 infection that they present minimal risks to the HCWs caring for them may obviate the need for:

- The wearing of airborne PPE at any stage in the treatment pathway, with consequent savings in time, cost and PPE resources.
- Waiting for ACTs.

However, this low level of risk can only be assumed if the criteria for admission to the pathways are strictly enforced and standard infection control precautions are exercised rigorously by all HCWs.

In determining the intrinsic risks involved, hospitals must also be mindful of the individual risks of HCWs, and should consider seeking Occupational Health advice on whether an individual HCW at high risk of the consequences of COVID-19 infection should wear airborne PPE for planned surgery pathways. The Faculty of Occupational Medicine has published a useful Risk Reduction Framework document.

Robust staff and patient testing protocols should underpin the safe introduction of lower levels of TBP that account for the lower risk of patient to HCW and HCW-to-HCW transmission of SARS-COV-2.
Recommendations

We make the following recommendations based on the currently available evidence:

1. Hospitals should decide on the transmission-based precautions to be used, including PPE to be worn by staff, for all patients who fulfil the criteria for admission to planned surgery pathways based on NHSEI and PHE (and their devolved equivalents) guidance after agreement with microbiologists and discussion with HCW groups.

2. Hospitals should determine locally whether and when a theatre in which planned surgery is performed is or is not designated a ‘hotspot’. This will depend both upon the criteria for pathway admission and knowledge of local transmission and prevalence rates.

3. Theatre teams should be allocated to the care of low-risk patients in planned surgery pathway for a whole working session and should not switch between low-risk planned surgery pathway patients and higher risk patients.

4. Hospitals should provide theatre teams with clarity about which procedures performed in theatres are to be treated as AGPs and which are not based on the information provided by PHE and summarised in Table 1.

5. The briefing before an operating list should be used as an opportunity for the whole theatre team to agree which category of PPE should be worn by whom and when.

6. The anaesthetic technique used should be determined using normal decision-making processes while bearing in mind that regional anaesthesia does not involve AGPs and the use of supraglottic airways may not involve aerosol generation.

7. If theatre team members are to wear airborne PPE throughout the surgical procedure, there is no need for staff wearing such PPE to wait for aerosol clearance before entering the theatre after an AGP occurring as part of induction of anaesthesia.

8. Patients can be taken out of the operating theatre immediately after the end of surgery and anaesthesia without waiting for aerosol clearance, as any aerosol remains in the air and does not travel with the patient.

9. If recovery team members plan to enter the theatre to recover the patient there, and plan to wear airborne PPE, there is no need to wait for aerosol clearance.
Appendix 1

Factors increasing risk of harm from COVID-19 and approximate hazard ratios (based on OPEN SAFELY study)

- Increasing age (6 x risk if aged >60 years, 3 x risk if aged 50-60 - compared to those aged <50).
- Male (2 x risk of females).
- Diabetes (2.3 x risk if poorly controlled, 1.5 x risk if controlled – compared to those without diabetes).
- Raised BMI (3 x risk if BMI >40 kg.m⁻², 2 x risk if BMI 35-39.9 kg.m⁻² – compared to BMI <30 kg.m⁻²).
- BAME (1.7 x risk compared to white population).
- Chronic, non-asthma respiratory disease (1.8 x risk).
- Cancer in last year (1.5 x risk increase, but 3.5 x risk if haematological).

Uncommon but significant risks

- Organ transplant.
- Longstanding neurological disease.
- Immunosuppression.
- Chronic renal disease.
- Liver disease.

Debated risks

- Hypertension.
- Asthma.
- Chronic heart disease.
- Rheumatological conditions.

Precautionary

- Pregnancy.