Editorial

Kicking on while it's still kicking off – getting surgery and anaesthesia restarted after COVID-19

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The UK National Health Service (NHS) has risen to the challenge posed by COVID-19 through Herculean efforts to expand capacity. This has included doubling or trebling intensive care (ICU) capacity within hospitals, augmenting this with Nightingale Hospitals, cancelling all non-emergency surgery and redeploying staff and equipment to focus on a single disease. At the same time, government and population efforts have – through social distancing then lockdown- successfully flattened the epidemic curve and so reduced demand. Together, these actions have enabled treatment of all those needing hospital care for COVID-19 and avoided the unfettered increase in mortality that would have accompanied an overwhelmed healthcare service. However, this has been achieved 'by the skin of our teeth' and until very recently, the threat of insufficient ICU beds [1] ventilators [2], and the need for triage [3,4] were all anticipated: a few hospitals were overcome by the surge of critically ill patents [5,6]. Now, political and social thoughts and actions are turning to loosening lockdown and determining what 'post-pandemic normality' will look like. Here we discuss the prospects and challenges of 'planned surgery' – both time-critical and wholly elective procedures.

Elective activity

While managing the pandemic, many people have been disadvantaged by reduced routine NHS activity. Hospital admissions and emergency department attendances are down by >30% [7,8]. Increases in mortality are not entirely explained by COVID-19 [9], and concern exists that some are not seeking or receiving the hospital care they need. The plight, particularly cancer patients awaiting treatment, is rightly high on the agenda of the NHS, professional bodies and the public [7, 10,11]. The NHS has described us entering the 'second phase of the pandemic', directed us to restart urgent work [7] and has declared itself 'open for business' [12].

Having weathered the COVID-19 storm, we are now being asked to assess the damage done, pick up the pieces and rebuild. However, this storm will rage for many months. Flattening the epidemic curve does not reduce the total number of cases but spread their burden over a longer period of time; this is 'delay' not 'mitigation' [13]. Increased pandemic-related hospital activity may last throughout 2020 and the secondary healthcare system impacts will likely be evident for several years.

Over the next few months we need to do a number of things at the same time:

- continue to manage the increased critical care activity associated with COVID-19;
- make hospitals safe for patients who have, may have and do not have COVID-19,
- ensure that all patients are treated fairly in terms of access and safety; and
- restore staff and services to as many pre-pandemic pathways as possible.

Concurrently, the lockdown will be loosened, though a level-4 national incident will remain [7,14]. Disease transmission precautions will continue including social distancing within hospitals, including between ward beds (significantly decreasing bed capacity), enhanced infection control practices and ongoing use of personal protective equipment (PPE) (dramatically slowing processes), all while staff will continue to fall sick (reducing staff numbers). These are major challenges, which we explore here.

Protecting patients and staff

While some medical care can be undertaken remotely, anaesthesia and surgery are physical acts and adherence to social distancing is impossible. This exposes staff and patients to the risk of infection from each other, so it will be necessary to attempt to create COVID-19-free and COVID-19-affected pathways [7,15]. Ideally, pathways would keep staff in cohorts that either manage COVID-19 and emergency work, or elective non-COVID-19 work. There are challenges in ensuring COVID-free staff (see below) and whether staff will be willing to be in a cohort undertaking only 'higher risk care' for prolonged periods of time is uncertain. Equally important, emerging evidence points towards poor outcomes and high mortality from even relatively minor surgery undertaken when a patient is SARS-CoV-2 infected [15,16].

Meticulous pre-operative patient isolation for 14 days combined with antigen testing, i.e. detecting viral RNA with reverse transcriptase polymerase chain reaction (RT-PCR) tests and ensuring no symptoms or pyrexia in the last week is recommended by many, and aims to deliver a patient who is not infected or incubating COVID-19. However, the 95% confidence interval for the upper limit of the incubation period can stretch to two weeks [17]. Virus can be shed by for up to 5 days before symptoms [18] and by asymptomatic patients [19]. The false negative rate for RT-PCR tests ranges between 3% and 40%, being dependant on disease time-course, the individual's virus shedding characteristics and testing technique [20,21]. Although respiratory viral loads (and probably disease transmission) generally peak within the first week of illness [22] and although quantitative viral shedding probably correlates with disease severity [23], this is not clear-cut [22] and respiratory viral shedding can persist for two weeks after mild disease [22-4], beyond a month during severe disease [24,25] and may even stop and restart [22]. The prolonged, variable incubation period, the potential to infect while asymptomatic, unreliable antigen tests and extended duration of viral shedding mean that isolation and screening based on symptoms and antigen tests, while reassuring and pragmatic, will not guarantee a COVID-19 free patient. Some are using pre-operative computerised tomography (CT) chest scanning as part of screening for COVID-19. However, chest CTs are normal in 39-56% of patients in the early stages of COVID-19 [26,27] and in 20% of symptomatic hospitalised patients [26,27]. Further, CT abnormalities when present are

heterogeneous and non-specific [26,27]. A normal chest CT, especially one done more than 48 hours previously, does not exclude coronavirus infection. The surgical Colleges and Royal College of Radiologists currently advocate pre-operative CT for elective surgical cases who will require critical care postoperatively, but it should not be a routine pre-operative test [28,28].

Antibody testing too could have value in identifying patients and staff who have had and recovered from COVID-19. It is not yet widely available and antibody responses appear inconsistent and possibly transient (https://www.medrxiv.org/content/10.1101/2020.04.15.20066407v1.full.pdf). Evaluation of antibody responses and detection methods suggest detectable antibody responses take approximately 10 days to develop (https://www.medrxiv.org/content/10.1101/2020.04.25.20074856v1) and that a method that detects both IgM and IgG antibodies is likely preferable [22]. Laboratory-based testing using an enzyme-linked immunosorbent assay (ELISA) has a sensitivity of approximately 85%, but putative home-testing point of care testing techniques using lateral flow immunoassay (LFIA), have rather disappointing sensitivities as low as 55% and imperfect specificity (false positive rate approximately 5%). Patient isolation for 2 weeks and antigen testing within 48 h of surgery creates practical problems for peri-operative preparation. Attendance for blood tests and other pre-operative investigations may need to be undertaken before the 2-week isolation starts. Cross-matching of blood may be a particular challenge as may ensuring sufficient and safe transfusion supplies [30].

The value of the above tests and whether risk reduction approaches are sufficient, is greatly dependent on the prevalence of SARS-CoV-2 in the community and therefore the risk of expected infection, i.e. the pre-test probability of a positive result. This is currently unknown and almost certainly varies widely between regions but is perhaps where large-scale antigen and antibody testing may have their greatest benefit, through determining population prevalence of disease and convalescence in the community and among hospital staff.

Proportionate PPE

For the time being then, we cannot be certain whether patients presenting for planned surgery or staff treating them are infected. The risk is likely low in most settings, but many will correctly assert that it cannot be zero for some time.

Current PPE strategies in the UK appear to be protecting anaesthetists and intensivists from the worst effects of COVID-19, with no deaths reported in those working in anaesthesia or intensive care [31]. The question then arises of which infection prevention and control practices should be adopted in theatres undertaking planned surgery and when should current transmission prevention practices be

relaxed. If the prevalence of the virus in the community is very low, the patient has been isolated and screened, and the teams similarly screened and perhaps isolated, then it is reasonable to assume a low risk of viral transmission. However, how low must the prevalence be before all staff will be prepared to accept lower levels or abandonment of PPE? Flattening the curve means disease prevalence will be sustained for many months and loosening lockdown may increase this: the transition back to pre-pandemic behaviour will take time. Of course, maintaining widespread transmission control precautions will reduce theatre efficiency and increase demand on the limited supplies of PPE. This demand will be exacerbated by restarting non-medical industries that use PPE as an alternative to social distancing [14] and if there is widespread community use of facemasks [32].

As PPE use will be prioritised for the management of known COVID-19 patients elsewhere, any inability to identify low-risk patients accurately and scale down PPE use may be a further barrier to increasing planned surgery activity.

Bringing back staff and resources

Increasing critical care capacity to cope with the COVID-19 surge has leant disproportionately on many key elements of the planned surgery pathway. Anaesthetists and some surgeons, theatre teams, operating theatres and recovery rooms, anaesthetic machines and target-controlled infusion (TCI) pumps have all been re-purposed as ICU resources. Repatriation of these key elements to their proper places in peri-operative pathways is a prerequisite to any return to pre-pandemic levels of planned surgery. However, repatriation will not be easy as it will be necessary to maintain critical care capacity above pre-pandemic levels for some months. Temporary ICUs in locations within surgical pathways need to be emptied and relocated: new space must be found. Anaesthetists and operating theatre staff must return to theatre duties but will need to be replaced or additional staff employed, if they can be found. Extra ventilators suitable for complex COVID-19 patients will be needed. Demand for drug including opioids, propofol, neuromuscular blocking drugs and vasopressors will increase but supplies are already critically low [33,34].

Above all, there will need to be an understanding that although equipment such as anaesthetic machines and TCI pumps can be decontaminated, serviced and pressed back into service within hours, human beings will need more care if they are to continue to work effectively, efficiently and safely. Increased hours, disruptive shift patterns, working outside of specialty 'comfort zones', missed leave and moral injury will all combine to produce a workforce that cannot be driven straight back to full-time work in peri-operative pathways [35]. There will be a pressing need for rest, recuperation and therapy without which bold plans for dramatic increases in the delivery of planned surgery will founder [33].

Prioritisation of surgery

The combination of reduced availability of anaesthetic and theatre staff, slowed theatre processes, supply chain factors and reduced hospital bed capacity are likely to severely limit planned surgical capacity for many months. Displacement of surgical or other activity to alternative locations such as independent sector hospitals, mobile facilities and Nightingale Hospitals may help, but these mainly provide space. The staff and resources required to service these areas are generally the same that are now servicing the NHS and can be only in one place at a time.

This all points to a need for clear and fair prioritisation of surgery. The surgical colleges have already published advice on this, creating five levels of surgical priority (1, 1a and 2-4) ranging from 'operation needed within 24 h' to 'can be delayed for more than 3 months' [36]. This guidance is well thought out, detailed and can be used to create a roadmap for different services and for communicating realistic expectations to patients. However, waiting for three months may underestimate the reality, and non-urgent surgery may be delayed much longer.

Ethics

Ethical considerations may return to prominence. The move from a health service focused on one single disease to one that continues that challenge while also addressing all the other health needs of the population may be even harder than that the crisis phase that preceded it. There may be more urgent or time-dependent surgery than the new system can cope with, through a backlog of untreated pathology and lack of staff, space, beds or kit. The needs of all patients must be balanced: not just COVID-19 positive vs COVID-19 unaffected, but also surgical and non-surgical, physical and mental health. The need for careful adoption of ethical frameworks, fair allocation of resources and even triage may not yet be something with which we can dispense during this pandemic.

Conclusions

A superficial appraisal of the situation regarding resumption of planned surgery reveals that we have all we need: patients who need surgery and surgeons who can perform it. This may understandably foster calls for swift action to restore surgical normality. However, these are the only intact parts of complex surgical pathways. All other elements have been repurposed, relocated, exhausted, overused or in other ways adversely affected. Restoration of these pathways will be a large part but not the totality of a return to planned surgery. Perhaps even more important will be the creation of new pathways that work much more effectively and efficiently in a world in which we have to co-exist with SARS-CoV-2. Those who

create, test, develop and implement these pathways will need investment and support if planned surgery is to return to the level we would all wish. It is right and proper that we rise to this new challenge. To do so, anaesthetists, peri-operative physicians, surgeons and all other team members will need to use all of their vision, skills, experience and compassion if we are going to kick on while it's still kicking off.

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