Guidelines: Anaesthesia in the context of COVID-19 pandemic☆,☆☆

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A B S T R A C T

Objectives: The world is currently facing an unprecedented healthcare crisis caused by the COVID-19 pandemic. The objective of these guidelines is to produce a framework to facilitate the partial and gradual resumption of intervention activity in the context of the COVID-19 pandemic.
Methods: The group has endeavoured to produce a minimum number of recommendations to highlight the strengths to be retained in the 7 predefined areas: (1) protection of staff and patients; (2) benefit/risk and patient information; (3) preoperative assessment and decision on intervention; (4) modalities of the preanaesthesia consultation; (5) specificity of anaesthesia and analgesia; (6) dedicated circuits and (7) containment exit type of interventions.
Results: The SFAR Guideline panel provides 51 statements on anaesthesia management in the context of COVID-19 pandemic. After one round of discussion and various amendments, a strong agreement was reached for 100% of the recommendations and algorithms.
Conclusion: We present suggestions for how the risk of transmission by and to anaesthetists can be minimised and how personal protective equipment policies relate to COVID-19 pandemic context.

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Introduction

The outbreak of COVID-19 (SARS-CoV-2) has been spreading globally outside the first Chinese outbreak since January 2020 and the World Health Organization (WHO) declared a pandemic situation on March 11, 2020. The epidemic situation has led to a drastic reduction in hospital activities. The evolution of the pandemic allows us to resume some of these activities. Beyond this resumption, the persistence of the virus defines a new situation that will have to be taken into account for the care of patients in the coming months.

The size and type of activities that will resume depend on many factors outside the organisation of care within our establishments. These factors include the availability of personal protective equipment, anaesthesia/critical care drugs, and critical care beds. Finally, it seems important to point out that the epidemic situation is fluctuating not only in time but also in space, so it will be necessary to modulate the recommendations according to the region of exercise and the incidence of COVID-19 cases.

We need to organise access to this care by meeting a dual imperative:

- providing access to quality care for patients whose procedures cannot (or can no longer) be postponed;
- limiting the risk of contamination of these patients and healthcare professionals.

The choice of specific measures to be implemented for the management of a patient in this context will be guided by the risk associated with the patient and the risk associated with the procedure.

The persons at risk of serious forms of COVID-19 are:

- people aged 70 years and over (although people aged 50 to 70 years should be monitored more closely);
- people with a history of cardiovascular disease: complicated high blood pressure, history of stroke or coronary artery disease, heart surgery, NYHA stage III or IV heart failure;
- insulin-dependent diabetics who are unbalanced or have secondary complications;
- people with chronic respiratory disease that may decompensate for a viral infection;
- patients with chronic renal failure on dialysis;
- patients with active cancer under treatment (excluding hormone therapy);
- people with congenital or acquired immunosuppression:
  - drug: cancer chemotherapy, immunosuppressive therapy, biotherapy,
  - and/or immunosuppressive dose corticosteroid therapy,
  - uncontrolled HIV infection or with CD4 $< 200/mm^3$,
  - following a solid organ or haematopoietic stem cell (HSC) transplant,
  - related to a malignant haemopathy being treated;
- patients with cirrhosis at least stage B of the Child-Pugh classification;
- people with morbid obesity (body mass index $> 30\ kg/m^2$);
- concerning the risk related to surgery, two situations have been identified:
  - surgery with a high-risk of contamination of caregivers by aerosolisation of SAR-CoV-2 (intervention with opening or exposure of the airways: lung resection surgery, ENT surgery, neurosurgery of the base of the skull, rigid bronchoscopy),
  - major surgery, with a high-risk of postoperative critical care stay, where the perioperative respiratory risk inherent to surgery and anaesthesia is likely to be increased by SARS-CoV-2 infection or even porting.

Purpose of the recommendations

The objective of these guidelines is to produce a framework to facilitate the partial and gradual resumption of intervention activity in the context of the COVID-19 pandemic. The group has endeavoured to produce a minimum number of recommendations to highlight the strengths to be retained in the 7 predefined areas. The basic rules of universal good medical practice in perioperative medicine were considered to be known and were therefore excluded from the recommendations.

Fields of the recommendations

The recommendations made concern 7 fields:

- protection of staff and patients;
- benefit/risk and patient information;
- preoperative assessment and decision on intervention;
- modalities of the preanaesthetic consultation;
- specificity of anaesthesia and analgesia;
- dedicated circuits;
- containment exit type of interventions.

Method

These recommendations are the result of the work of a group of experts brought together by the French Society of Anaesthesia and Intensive Care (SFAR). The approach used to draw up these recommendations was deliberately pragmatic and logical. Initially, the organising committee defined the issues to be addressed with the coordinators, and then designated the experts in charge of each of them. Due to the topic addressed, (perioperative organisation in the context of the resumption of surgical activity scheduled during the COVID-19 pandemic), and the lack of evidence in the literature for a certain number of issues to date, it was decided prior to the drafting of the recommendations to adopt a format of expert opinion. The recommendations were then drafted using the terminology "experts suggest doing" or "experts suggest not doing". Proposed recommendations were presented and discussed one by one. The aim was not to necessarily arrive at a single, convergent expert opinion on all the proposals, but to identify points of agreement and points of divergence or indecision. Each

recommendation was then evaluated by each of the experts and subjected to an individual rating using a scale ranging from 1 (complete disagreement) to 9 (complete agreement). The collective rating was based on a GRADE grid methodology. In order to validate a recommendation, at least 70 percent of the experts had to express a favourable opinion, while less than 20 percent expressed an unfavourable opinion. In the absence of validation of one or more recommendations, the recommendation(s) was/were reformulated and submitted again for scoring with the aim of reaching consensus. The experts' synthesis work resulted in 51 recommendations. After one round of scoring, a strong agreement was reached for 100% of the recommendations and algorithms.

Patients and staff protection

Universal safety measures

R1.1.1 – Experts suggest implementing strict safety measures for hospital staff and patients during the COVID-19 pandemic. General measures include hand hygiene with alcohol-based hand rub; avoiding touching your eyes, nose, and mouth; the routine use of a surgical mask type II or IIR and social and physical distancing measures by maintaining a minimal distance of one meter between staff members when wearing a mask is not possible (lunch breaks).

R1.1.2 – Experts suggest setting up a strategy in order to conserve supplies of personal protective equipment (PPE) in case of present or future shortages.

Rationale

Healthcare professionals working in anaesthesia and critical care departments, anaesthesia units, intermediate care units and critical care units face an elevated risk of COVID-19 exposure [1–3].

In order to protect them during this pandemic, strict safety measures should be implemented. These measures should be carried out all throughout the patient's healthcare pathway: preanaesthetic assessment, operating theatres, recovery rooms, intermediate care units and critical care units.

These safety measures will be implemented directly by providing healthcare professionals with adequate PPE, but also indirectly by supplying patients with the right equipment.

Administrative measures (patient information, preoperative laboratory testing, check-up modalities, anaesthesia modalities, dedicated healthcare pathways, patient and surgery selection), which also help protecting staff members, will be detailed in the following/other chapters.

Staff members should apply strict social and physical distancing measures when not caring for patients (team rounds, discussions about patients, hand-offs, breaks, meals...): they must keep at least 1 to 2 meters apart from one another, especially during times when wearing a mask is not possible.

Table 1

Table 1
Personal protective equipment (PPE) depending on the place and the procedures that are performed in adult patients and healthcare professionals.

Safety measures	Preanaesthetic assessment	Operating rooms, interventional platforms?	Recovery room	Critical care units or intermediate care units
Healthcare professionals		Caring for a known or suspected case of COVID-19		
	Hand disinfection with a hydro-alcoholic based hand gel, wearing a surgical mask type II/IIR and safety goggles Surfaces and material disinfection	N95 or FFP2 respirator, head cap, fluid resistant long-sleeved gown (or failing that, a surgical gown) + plastic apron, disposable gloves and a face shield (or failing that, safety goggles) A dedicated COVID-19 operating theatre or an operating room that is well identified with poster on the entrance door		N95 or FFP2 respirator, head cap, fluid resistant long-sleeved gown (or failing that, a surgical gown) + plastic apron, disposable gloves and a face shield (or failing that safety goggles) PARPs mask when performing high transmission risk procedures (tracheotomy) Setting up a closed suction system when the patient is intubated and if possible
		Caring for non-COVID patients		
	Hand disinfection with a hydro-alcoholic based hand gel, surgical mask type II/IIR Surfaces and material disinfection	Intubation and extubation: N95 or FFP2 respirator, head cap, plastic apron, disposable gloves and a face shield (or failing that, safety goggles)	Extubation (not recommended in recovery rooms): N95 or FFP2 respirator, head cap, plastic apron, disposable gloves and a face shield (or failing that, safety goggles)	Surgical mask type II/IIR In the case of a body fluid exposition: head cap + face shield or safety goggles When managing the airway (intubation/extubation, endotracheal suctioning, bronchoscopy): N95 or FFP2 respirator, head cap, face shield or safety goggles
Patients		Known or suspected case of COVID-19		
	Hand disinfection with a hydro-alcoholic based hand gel, a surgical mask type II/IIR	Patients must wear a surgical mask type II/IIR when leaving their unit and heading for the OR Coded COVID-19 dedicated routes should be followed		Surgical mask type II/IIR
	Non-COVID patients Hand disinfection with a hydro-alcoholic based hand gel, surgical mask type II/IIR	Patients should wear a surgical mask type II/IIR when leaving their unit and heading for the OR	After extubation, patients should wear a surgical mask type II/IIR	No mask, except if the patient is presenting with COVID-19 symptoms → surgical mask type II/IIR

Preanaesthetic assessment/check-up

R1.2.1 – Experts suggest that all patients coming in for a preanaesthetic assessment perform hand disinfection using alcohol-based hand rub and put on a surgical mask type II/IIR when entering a hospital. This also applies to kids for whom fitted masks should be provided.

R1.2.2 – During preanaesthetic assessment, experts suggest performing hand hygiene using alcohol-based hand sanitiser before and after every contact with the patient or his surroundings, in addition to wearing a surgical mask type II or IIR and eye protection (goggles) during any clinical examination, which requires the patient to take off his mask.

R1.2.3 – Experts suggest applying the following universal safety measures in order to organise medical consultations:

- setting up waiting lines and making sure patients are spaced at least a meter apart (by putting up social distancing posters and markers on the floor...);
- restricting the number of patients in waiting rooms and organising seats in such a manner so there is at least a one-meter distance between seats;
- putting up posters promoting general hygiene instructions/tips;
- providing alcohol-based hand rub at room entrances;
- setting up a safety distance in addition to specific physical distancing devices (like temporary plexiglass barriers, interphones...) for those whose work position requires them to be in physical proximity to other people. These devices should be cleaned frequently, following the same cleaning procedures that are used on other surfaces;
- removing magazines, documents and other commonly used objects from waiting rooms and common areas, including children's toys;
- regularly cleaning surfaces (counters, computers, phones...) and equipment (blood pressure cuffs, pulse oximeter, stethoscopes...) after each patient.

Rationale

During this COVID-19 pandemic, every patient could potentially be contaminated and should therefore protect other patients and hospital staff by applying alcohol-based hand gel and wearing a surgical mask type II or IIR [1–3]. By blocking large droplets, surgical masks protect staff members from droplet and contact transmission [4]. Surgical masks can provide protection for healthcare professionals against droplet transmission within a one-meter radius of the patient. Four RCTs compared the efficiency of N95 or FFP2 masks and surgical masks in healthcare workers performing non-aerosol-generating procedures [5–8]. A meta-analysis including these studies reported no significant difference in the occurrence of viral respiratory infections (RC: 1.06; 95% IC: 0.90–1.25) between the 2 types of mask [9]. Only one study specifically evaluated coronaviruses and reported no significant difference between the 2 types of masks in non-aerosol-generating procedures [6].

Operating theatre

R1.3.1 – Experts suggest that healthcare professionals involved in airway management (intubation, extubation, supraglottic airway insertion and/or removal...), or those who could be brought to do so in some given situations, wear a fit-tested respirator mask (respirator N95 or FFP2 standard, or equivalent) in addition to a disposable face shield or at least, in the absence of the latter, safety goggles, regardless of the patient's COVID-19 status.

R1.3.2 – Experts suggest wearing these additional PPE during airway management (intubation, extubation, supraglottic airway insertion and/or removal...) of all known or suspected cases of COVID-19:

- a fluid resistant long-sleeved gown in addition to a plastic apron or, in the absence of the latter a surgical gown;
- a disposable head cap;
- single-use disposable non-sterile gloves.

R1.3.3 – Experts suggest disposing of contaminated equipment in the operating theatre where the intervention is taking place, as close as possible to the door. PPE should be disposed in dedicated well-identifiable containers for infectious risk health waste (IRHW):

- remove the apron and/or the surgical gown, roll them into a ball before tossing them. Afterwards, take off the fluid resistant long-sleeved gown;
- remove and discard the gloves;
- apply an alcohol-based hand rub;
- remove the head cap;
- remove the face shield or the safety goggles;
- apply another alcohol-based hand rub.

R1.3.4 – Experts suggest minimising the number of staff required for airway management in the operating theatre during these procedures to only one, regardless of the patient's COVID status.

Rationale

There is a great risk of becoming infected during airway management. Therefore, strict safety measures should be applied during aerosol-generating procedures, such as bag mask ventilation, endotracheal intubation, open/endotracheal suctioning and extubation. The use of a respirator filtering face piece mask (FFP) type 2 is recommended by the French Society of Hospital Hygiene (SF2H) and the French-Speaking Society of Infectious Disease for all healthcare professionals manipulating the airway [10]. Respirators are tight fitting masks, designed to create a facial seal that protect the person wearing them from droplets and airborne particles inhalation. However, wearing this type of mask can bring more discomfort than wearing a surgical mask (overheating, respiratory resistance...). They have the advantage of blocking at least 94% of aerosol particles (total inward leaking $< 8\%$) and are more effective than surgical masks type

II/IIR in blocking < 5 μm particles [11]. Nonetheless, a poorly fitted N95 or FFP2 respirator does not protect more than a surgical mask. A leak test must be performed systematically. Furthermore, a beard (even a stubble one) reduces the mask's adherence to the face and thus decreases its global efficiency.

In case of N95 or FFP2 respirators shortage, some experts suggested using N99 or FFP3 respirators, which block at least 99% of aerosol particles (total inward leaking < 2%). However, the problem with these respirators in that the air is most often exhaled through an expiratory valve without being filtered. They do not filter the wearer's exhalation, only the inhale. This one-way protection puts others around the wearer at risk, in a situation like COVID-19.

COVID-19 can also be transmitted by aerosol contact with conjunctiva [12] and lead to a respiratory infection [13]. The fact that unprotected eyes increase the risk of transmission has been demonstrated with coronaviruses [14]. Face shields provide a barrier against high velocity aerosol particles and are commonly used as alternatives to safety goggles as they provide greater face protection [15]. Using a droplets simulator loaded with influenza viruses (mean droplet diameter: 3.4 μm) and a breathing simulator, it was demonstrated/shown that the use of a face shield reduces the risk of aerosol inhalation by 70% [16]. When spraying fluorescent dye (particle diameter = 5 μm) from a distance of 50 cm towards a mannequin head equipped with an N95 respirator and a face shield, no contamination was noted in either nostrils nor eyes nor mouth folds. The same researchers found that using safety goggles in combination with an N95 respirator did not prevent some eye contamination [17]. Face shields also contribute to sparing N95 or FFP2 respirators by limiting their contamination with aerosol projections. N95 or FFP2 respirators can be used for up to 8 hours [18].

Recovery rooms

R1.4.1 – Experts suggest performing extubation and supraglottic airway removal in the operating theatre, regardless of the patient's COVID-19 status. Extubation in recovery rooms should remain exceptional.

R1.4.2 – Experts suggest giving out surgical masks type II/IIR to patients post-extubation and before leaving the operating theatre, regardless of their COVID-19 status.

R1.4.3 – If an extubation or supraglottic airway removal should exceptionally be carried out in the recovery room, experts suggest wearing an N95 or FFP2 respirator, a head cap, disposable gloves, and a face shield or, failing that, safety goggles during the procedure. In other cases, experts suggest wearing a surgical mask type II/IIR.

R1.4.4 – Experts suggest maintaining a minimal one-meter distance between each patient in recovery rooms during the pandemic period, and a minimal distance of 7–8 meters if an extubation is performed in the recovery room.

Rationale

Whenever possible, in order to spare N95 or FFP2 respirators and to protect staff members and other patients, extubation should be performed in the operating theatre by the person who performed the intubation. If this is not possible, the same precautions should be taken in the recovery room for staff protection. In the latest World Health Organization (WHO) recommendations for COVID-19, healthcare personnel and other staff are advised to maintain a one-meter distance away from a person showing symptoms of disease [19]. The Centre for Disease Control and Prevention recommends a two-meters separation [20]. However, these distances are based on estimates of range that have not considered the possible presence of a high-momentum cloud carrying the droplets long distances Recent work has shown that exhalations, sneezes and coughs emit turbulent multiphase flows that can contain pathogen-bearing droplets of mucosalivary fluid [21]. When sneezing or coughing, these droplets/gas clouds can travel in the air for up to 7 to 8 meters [22]. This new understanding of respiratory emissions dynamics has implications on social distancing strategies during the COVID-19 pandemic. Similarly, swabs taken from air exhaust outlets in COVID+ patients' rooms were found to contain RNA fragments, suggesting that small virus-laden droplets may be displaced by airflows [23]. However, in this study, no viral culture was done to demonstrate virus viability. For these reasons, extubation should remain exceptional in the recovery room, and giving out surgical masks type II/IIR to patients after their extubation is essential.

Critical care units/intermediate care units

R1.5.1 – Experts suggest always/continuously wearing a surgical mask type II/IIR in common areas. Barrier measures should be followed strictly during medical and paramedical team rounds, hand-offs and breaks (opening additional spaces for lunch breaks).

R1.5.2 – Experts suggest wearing an N95 or FFP2 respirator, a head cap, non-sterile disposable gloves, a face shield (which has the advantage of protecting the respirator) and/or safety goggles when performing aerosol-generating procedures in patients whose COVID-19 status is unknown. A fluid resistant long-sleeved gown + a plastic apron or, failing that a surgical gown, should be added when dealing with a known or suspected case of COVID-19. Procedures at risk of aerosolisation are:

- endotracheal intubation and extubation;
- performing a tracheotomy;
- endotracheal suctioning without a closed suction system;
- caring for patients who are receiving non-invasive pressure ventilation or high-flow nasal oxygen therapy;
- administration of nebulised treatment by a device other than vibrating membrane nebulisers.

R1.5.3 – When the patient's COVID-19 status is unknown, experts suggest using a closed suction system for tracheal suctioning. If this system is unavailable, it is necessary to interrupt the patient's ventilation during suctioning, ideally with the help of a second operator.

Rationale

Respiratory droplets are the main source of contamination in healthcare professionals [2]. During aerosol-generating procedu-

res, there is a consensus on the efficiency of N95 or FFP2 respirators (see questions 1.3) and the wear of protective gear such as a fluid resistant long-sleeved gown or a combination of a conventional gown and a plastic apron [10,24]. The number of asymptomatic patients carrying the virus is high [25], which is why caregivers should systematically use protection during high-risk procedures [10,24,25].

Paediatric particularities

R1.6.1 – Experts suggest allowing only one parent to be present during kids' preanaesthetic assessment.

R1.6.2 – Experts suggest that all clinical anaesthesia personnel wear a surgical mask type II or IIR, safety goggles and gloves, when performing any procedure with a high transmission risk, particularly when examining the oral cavity.

R1.6.3 – Experts suggest wearing an N95 or FFP2 respirators, a head cap, a gown with an apron, gloves and a face shield or, failing that, protective goggles, when performing airway procedure in children who are awake in the recovery room, regardless of their COVID status.

Rationale

During this COVID-19 pandemic, applying enhanced safety measures for the paediatric population is justified due to the existence of a significant proportion of possibly asymptomatic COVID+ children (up to 16% depending on the series) and the likely difficulty in complying with social distancing and safety measures (difficulty of continuous wearing of the surgical mask) by children [26–28]. These findings imply that anaesthesia staff should wear a surgical mask type II/IIR, protective goggles (or a face shield) and gloves when performing any procedure with a high-risk of transmission, and particularly when examining the oral cavity during anaesthesia consultation.

Benefit and risk of operating, and patient information

R2.1 – In asymptomatic patients, during a COVID-19 pandemic, experts suggest evaluating the benefit/risk ratio of the intervention according to criteria related to the patient, the pathology and the procedure (Table 2).

Rationale

The circulation of SARS-CoV-2 in the population and the existence of asymptomatic carriers affect the risk-benefit ratio of performing a planned surgical procedure during the COVID-19 pandemic and require rigorous evaluation. This consideration must integrate three types of criteria related to the patient, the pathology and the procedure. The data in the literature, although heterogeneous and with a low level of evidence, identify several patient-related risk factors for serious forms of COVID-19 potentially associated with an increase in postoperative complications: ASA class, obesity, age (> 65 years, < 1 year), underlying respiratory (asthma, COPD, cystic fibrosis) or cardiovascular (hypertension, coronary artery disease and chronic heart failure) pathology, obstructive sleep apnea syndrome, diabetes, and immunosuppression [29,30]. This increase in perioperative risk is, however, offset by the potential deleterious effect of cancelling or postponing the procedure on the patient [31]. The loss of chance in the absence of intervention must be estimated and the effectiveness and availability of therapeutic alternatives (curative or waiting) explored. Finally, two types of factors related to the surgical procedure must be considered: resource utilisation and the risk of transmission of SARS-CoV-2 to the healthcare team. Surgical time and expected length of stay provide an indication of the staff and hospital resources required. For each intervention, the foreseeable use of postoperative management in a critical care area must be anticipated in order to adapt surgical activity to the supply available at the time. Transfusion needs must also be assessed due to the difficulties of public access to blood donation collection points. The number of personnel required must be taken into account as it increases the risk of contamination of the healthcare team due to the impossibility of complying with the recommendations for intraoperative distancing. Finally, the risk related to the type of anaesthesia and the type of surgery must be evaluated. Upper airway management has been identified as a high-risk event for potential transmission of the aerosolised airway secretion virus that persists several minutes after the procedure [32,33]. The same risk is observed for upper aerodigestive tract and thoracic procedures. Finally, the risk related to the surgical site must take into account the probability of postoperative mechanical ventilation, the consequences of which could be aggravated in the context of an infection, or even portage, with SARS-CoV-2.

Table 2
Criteria for assessing the benefit/risk ratio of surgical intervention in a patient during the COVID-19 pandemic.

Factors
Related to the patient
ASA class
Obesity (IMC $\geq 30\,kg/m^2$)
Age (> 65 years, < 1 year)
Underlying respiratory (asthma, COPD, cystic fibrosis) or cardiovascular (hypertension, coronary artery disease and chronic heart failure) pathology
Obstructive sleep apnea syndrome
Diabetes
Immunosuppression
Related to the disease
Possible therapeutic alternatives
Loss of chance in the absence of intervention
Related to the procedure
Operating time
Duration of stay
Need for critical care
Transfusion needs
Number of staff needed in the operating room
Anaesthesia modality
Surgery site

R2.2 – Experts suggest informing, orally and in writing, the patient and/or his legal representatives of the specific circumstances related to the COVID-19 pandemic. In particular, information regarding the evaluation of the risk/benefit ratio related to the intervention and the anticipated patient path should be delivered. This information should be written in the patient's medical records (Appendices 1–3).

Rationale

During the preanaesthetic consultation, detailed information must be provided to the patient and/or his/her legal representative about the perioperative strategy decided regarding his specific situation in the context of COVID-19 pandemic. The message must be clear, objective and based on the currently available data, while trying to be reassuring for the patient and/or his legal representative. This message must be given orally during the consultation but also disseminated through a document (established and validated by each structure), which can be given to the patient and/or his legal representative during the preoperative consultation (surgical or preanaesthetic). This information must appear in the medical record. In the appendix, based on current data, we propose examples of model documents (Appendices 1–3). In the event of cancellation or postponement of the intervention, it is essential to keep in touch with the patient, mostly through the surgical teams, and to reassess the possible alternatives and the feasibility of the procedure according to the evolution of the circumstances. If the decision of postponement or cancellation of the surgery is taken by the patient, it must be recorded in the medical record.

Preoperative assessment and decision regarding surgery

R3.1.1 – Experts suggest using a standardised questionnaire to search for symptoms compatible with a SARS-CoV-2 infection before any surgery in adults and children (Appendices 4 and 5).

Rationale

The use of a standardised questionnaire increases the completeness of the symptom collection and the reproducibility of the medical examination. It is an appropriate tool for collecting accurate information from a large number of subjects. The data collected are easily quantifiable and traceable. The essential qualities of such a questionnaire are acceptability, reliability and validity. The questions must be formulated to be understood by the largest number of patients, without ambiguity, and be based on validated items. Because of the wide variety of symptoms attributable to the SARS-CoV-2, the questionnaire should be designed to look for the most frequent symptoms (fever, dry cough, etc.) and/or the most evocative ones (anosmia, ageusia, etc.), without however declining all the unusual symptoms that have been reported in the literature. An example of a standardised questionnaire distinguishing between major and minor symptoms is proposed for adults in the Appendix 4 and for children in the Appendix 5.

R3.1.2 – In adults and children, the experts suggest searching systematically symptoms compatible with a SARS-CoV-2 infection at the minimum during the preanaesthetic consultation/teleconsultation and during the preanaesthetic visit. Whenever possible, searching symptoms during a phone call with the patient or his legal representative 48–72 hours before the intervention is also recommended to avoid a last-minute postponement of surgery.

Rationale

Assessment of specific perioperative risk during the COVID-19 pandemic requires, as in the usual situation, the joint consideration of the surgical, patient and anaesthetic risks. In addition, searching usual and/or evocative symptoms of SARS-CoV-2 infection is an important time of the preanaesthetic consultation in the current pandemic context and during the first months following the easing of the lockdown. The presence of major (i.e. very frequent or relatively characteristic) and/or minor (i.e. more inconsistent and/or less specific) symptoms allows to orient the preoperative COVID-19 status assessment, and then to estimate the benefit/risk balance of maintaining or postponing the surgery, taking into account the risk of contamination of health personnel and others patients within the care structure [34]. The integration of these different risks must be collectively weighed against the potential consequences of postponing or cancelling a scheduled intervention [31].

This search for symptoms compatible with a SARS-CoV-2 infection must take place at the time of the preanaesthetic consultation in order to discuss the postponement of the intervention, if possible, and to anticipate the protective measures that should be applied for the health personnel, and the care circuit that should be used. The questionnaire can be completed by the patient himself, by a nurse just before the consultation or by the anaesthesiologist during the consultation. Then, it must be explained that the patient must immediately contact the anaesthesia team, without waiting for admission to the hospital, in case one or more symptoms compatible with a SARS-CoV-2 infection appear between the preanaesthetic consultation and the day of the intervention. It will also be necessary to explain the importance of the strictest compliance with protective measures, particularly hand-washing and wearing systematically a face mask outside home, between the preanaesthetic consultation and the day of the intervention. If the local organisation allows it, a contact with the patient 48 to 72 hours prior to its admission to the hospital, to ensure that no symptoms have appeared, can also be planned. This timeframe can be adapted locally, the objective of this contact being to have a PCR performed and its results available before coming to the hospital for surgery if the patient has become symptomatic since the preanaesthetic consultation. However, taking into account that the delay between the preanaesthetic consultation and the intervention may correspond to the incubation period of the disease, and that spontaneous reporting by the patient of the onset of symptoms since the consultation will not be systematic nor exhaustive, the search for these same symptoms must be systematically renewed during the “physical” preanaesthetic visit the day before or on the day of surgery.

R3.1.3 – In adults and children, the experts suggest measuring objectively the temperature and collecting at the same time whether or not an antipyretic medication has been taken by the patient, during the preanaesthetic consultation/teleconsultation (by the patient himself or the parents for children), as well as during the preanaesthetic visit or on arrival at the D0 unit.

Rationale

Fever, although non-specific, is a very common symptom of symptomatic SARS-CoV-2 infections, present in 75% to 95% of cases [35–38]. The presence of fever is a major symptom and an important warning sign that should raise the suspicion of a possible SARS-CoV-2 infection during the current pandemic.

However, since the sensation of fever is highly imperfectly correlated with the temperature objectively measured [39], it is suggested that patient’s temperature should be measured during the preanaesthetic consultation. In addition, antipyretic drug intake should also be systematically collected at the same time as the temperature measurement because acetaminophen (or even NSAIDs when taken as self-medication by the patient) can normalise the patient’s temperature. As the delay between the preanaesthetic consultation and the intervention may correspond

to the incubation period of the disease, an objective measurement of the patient's temperature must be renewed during the preanaesthetic visit the day before or on the day of the intervention.

R3.1.4 – In adults, the experts suggest using the following two algorithms for the preoperative COVID-19 status assessment and perioperative strategy before scheduled or emergency surgery.

Figs. 1 and 2

Rationale

These two algorithms are the result of a work that tried to take into account a maximum number of clinical situations in a maximum number of structures, while trying to keep it simple. If local provisions, linked to access to diagnostic tests, to the typology of patients, to the prevalence of the virus in the geographical area concerned, or to an agreement between the different specialties at the local level, have led to propose a local algorithm different from those proposed, we suggest that the local algorithm may take precedence over those proposed here.

The algorithms in Figs. 1 and 2 take into account:

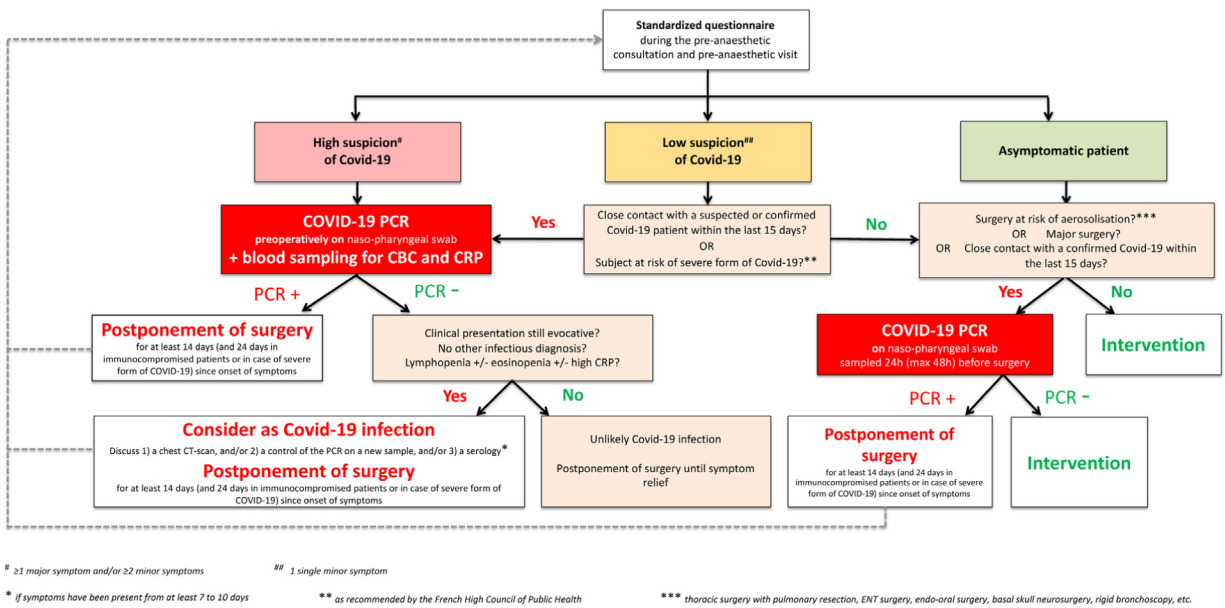

Fig. 1. Scheduled surgery.

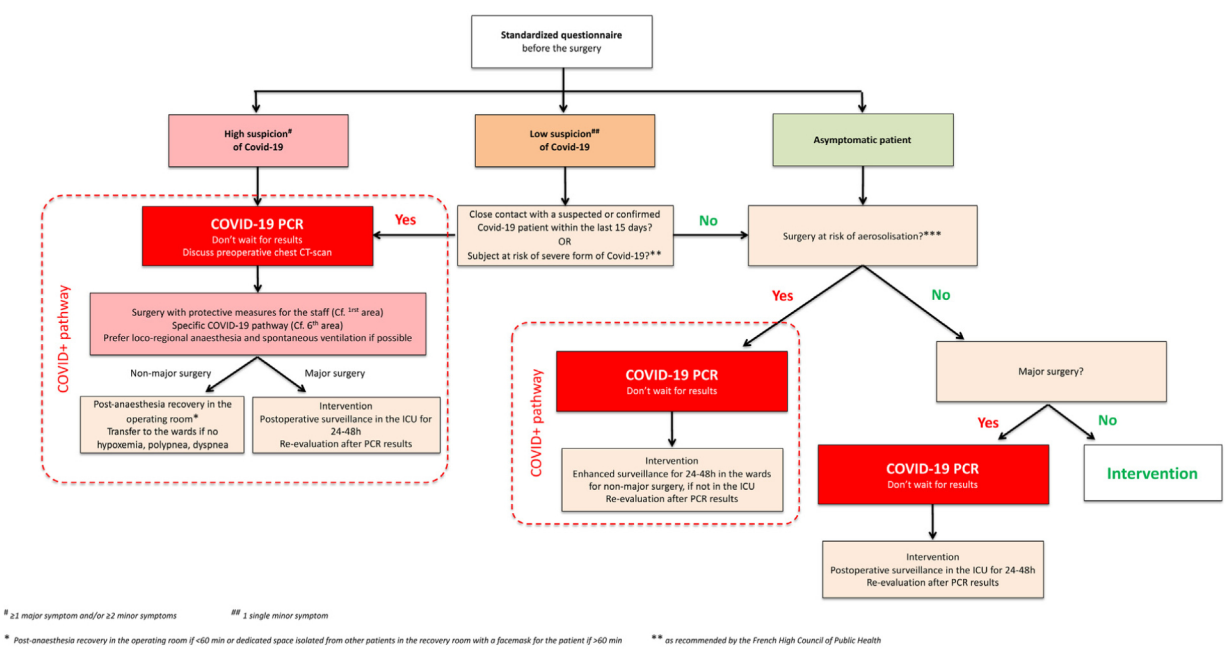

Fig. 2. Emergency surgery.

- the presence of major and/or minor symptoms of SARS-CoV-2 infection;
- the presence of risk factors for severe forms of SARS-CoV-2-infection (as defined by the memo of the French High Council for Public Health dated March 31, 2020 and recalled in the introduction section of these recommendations);
- the risk of serious forms of COVID-19 in the postoperative period, in particular due to a possible synergy between perioperative pulmonary injury and SARS-CoV-2 infection;
- the possibility to postpone the intervention.

For planned surgery (Fig. 1)

In a symptomatic patient, it seems reasonable to postpone the intervention for 24–48 hours to obtain the results of the SARS-CoV-2 PCR performed on a nasopharyngeal swab.

If the PCR is positive, COVID-19 infection requires postponing the intervention until patient's recovery, which is set for a period of at least 14 days after symptom onset, extended to at least 24 days in immunocompromised patients or patients with a severe form of COVID-19, in whom clearance of the virus may be longer [40,41]. At the end of this postponement period, the patient returns to the first line of the algorithm: recollection of a nasopharyngeal swab if symptoms persist or, in the absence of symptoms, in the case of surgery at risk.

If the PCR is negative, and taking into account the existence of false negative results, if the clinical presentation is evocative, especially if it is reinforced by characteristic paraclinical signs (lymphopenia 35–70% of cases; eosinopenia 50–65% of cases; high CRP with normal PCT 60–90% of cases [35–38,42]), it should be considered that the patient has a proven SARS-CoV-2 infection. Then, the diagnostic probability may be reinforced, especially in the case of major surgery at risk of severe postoperative forms of COVID-19, by:

- a thoracic CT-scan, which has a high negative predictive value to rule out COVID-19 in symptomatic patients (approximately 85–95%) [43,44];
- a control of the PCR on a second sample, taking maximum care to ensure that the new oropharyngeal swab is performed by a team trained in the proper execution of swabbing;
- a COVID-19 serology, only if the symptoms have been present for at least 7 to 10 days. This serology will only be of value if it is positive, and it will only indicate that the patient has been in contact with the virus, without being able to date the infection or conclude on the possible protective nature of the antibodies detected (*see explanations below*) [45].

It is therefore advisable to be particularly vigilant if the serology is the only positive test, as the patient may have a history of SARS-CoV-2 infection and another current virus or pathology.

If the patient presents with signs compatible with a SARS-CoV-2 infection but that the PCR is negative, the evocative paraclinical signs are absent, the CT-scan shows no signs of SARS-CoV-2 viral pneumonia, and the serology performed after at least 7–10 days of symptoms is negative, a differential diagnosis is then the most likely, and the intervention will be postponed until this other pathology has recovered.

In a patient with mild symptoms (i.e. with only one minor symptom), the presence of a close contact in the past 15 days with a person with suspected or proven SARS-CoV-2 infection increases the likelihood that the patient has a SARS-CoV-2 infection. His/her management becomes then similar to that of a patient with a more suggestive clinical presentation. Similarly, the presence of risk factors for a severe form of COVID-19 in a paucisymptomatic patient encourages further preoperative investigations to confirm or deny the diagnosis of SARS-CoV-2 infection.

In a completely asymptomatic patient, a distinction should be made between:

- surgeries with opening or exposure of the airways (ENT surgery, thoracic surgery, oral surgery, surgery of the base of the skull, rigid bronchoscopy, etc.) for which there is a significant risk of aerosolisation for the operating theatre staff, motivating the realisation of a PCR even in an asymptomatic patient as long as the virus is circulating in the population;
- surgeries for which a SARS-CoV-2 infection could have serious postoperative consequences, thus motivating PCR testing. These surgeries can probably be summed up as "major" surgeries (open-heart surgery, major abdominal or pelvic surgery, organ transplantation, etc.), particularly due to their frequent respiratory impact, since the risk of synergy between SARS-CoV-2 and perioperative lung injury is not known. To date, this preoperative screening for COVID-19 indicated by the type of surgery is based on PCR and there is no indication to perform a thoracic CT-scan in this context.

In these two situations, the PCR will ideally be performed in the 24 hours preceding the intervention, at most 48 hours, in order to have an idea of the viral carriage as close as possible to the high-risk procedure while taking into account the time required to obtain the results in each structure in order to have them available before the intervention.

Finally, non-major surgeries in an asymptomatic patient can be performed in a conventional non-COVID-19 circuit [46]. If possible, it is suggested that the close contacts of these patients (such as the immediate neighbours in the postoperative recovery room) should be traced to facilitate contact tracing if the patient develops symptoms consistent with SARS-CoV-2 infection in the days following surgery.

It should be noted that if the presence of antibodies in the plasma of a convalescent patient 7 to 10 days after the onset of symptoms has been reported, the positivity of the serology is sometimes later (up to several weeks). In addition, the antibody titre and their neutralising character against SARS-CoV-2 may vary depending on the patient [47–52]. Furthermore, diagnostic performances vary greatly depending on the type of kit used in the laboratory. Finally, the neutralising character of the detected antibodies depends on the viral antigens against which the detected antibodies are directed [47–52]. Consequently, the only place of serology in the diagnostic strategy to date is in addition to a chest CT-scan and a new PCR sample if the first PCR in a symptomatic patient is negative and the symptoms have been evolving for at least 7 to 10 days. New data may change its place in the diagnostic algorithm in the future, especially if it allows the formal detection of patients who are genuinely cured and protected against re-infection, so that surgery can be performed without risk for the patient and staff.

For emergency surgery (Fig. 2)

By definition non-deferrable, the surgery has to take place. However, PCR sampling should be performed in symptomatic or mildly symptomatic patients who have had close contact with a COVID-19 patient within the last 15 days, or who themselves have risk factors for severe forms of COVID-19 or are operated from surgery with postoperative respiratory risk. Surgery is performed without waiting for the results. In the case of major surgery, a postoperative surveillance in the intensive care unit (potentially

already justified by the complexity of the surgery and/or the patient's comorbidities) may be considered, especially in a symptomatic patient, as a risk of synergy between perioperative lung injury and infection/carry of SARS-CoV-2 cannot be excluded at this time.

R3.1.5 – Paediatric Specificity: In children scheduled for a surgical procedure in a conventional hospital setting, given the large number of asymptomatic forms of SARS-CoV-2 infection, experts suggest that a PCR screening test be routinely performed in the hours prior to the procedure (Appendix 6). When the child is scheduled for an outpatient procedure, the experts suggest that the COVID-19 status should be sought, at a minimum by using the standardised questionnaire (paediatric version, Appendix 5) at the call on Day-1. If the interview proves positive, the procedure is rescheduled at least 15 days later. If the questioning does not appear to be interpretable, the child will, depending on the degree of urgency of the procedure, either be rescheduled or hospitalised with a PCR screening test.

Rationale

Severe forms of COVID-19 are uncommon in children compared to adults, with an estimated incidence of resuscitation of 0.6% of symptomatic forms [53]. Clinical manifestations are generally limited to a mild form with fever, myalgia, dry (or productive) cough, runny nose and digestive disorders (nausea, vomiting, diarrhoea, abdominal pain) in 54% of cases [53–55]. Finally, more specific to COVID-19 is the presence of anosmia and/or ageusia without nasal obstruction, which are strongly suggestive of this pathology [1,2]. The presence of skin signs such as pseudo frostbite or urticarial elements are also signs suggestive of COVID-19 in children and adolescents. In all cases, the majority of reported paediatric cases are familial in origin and a history of COVID-19 in the family environment should be considered a risk factor for this disease in children, even if the child is asymptomatic [56,57]. Radiological signs are identical to those in adults but are inconsistently found (43% of cases on average) and therefore do not contribute much to the diagnosis in this population [56,57]. The same limitation applies to pulmonary ultrasonography given the lack of studies in the paediatric population [58]. Biologically, the published series show lymphopenia or hyperlymphocytosis associated with increased CRP [56].

It is important to note that recent studies conducted on cohorts of individuals on an epidemiological basis tend to show that for one person expressing the disease, seven people are asymptomatic, which reflects the limitations of the clinic to screen all potentially contaminating patients (prepublication study 1) [9,10].

Taking into account these elements and the asymptomatic or paucisymptomatic nature of the disease, the problem of the preoperative assessment in paediatrics is above all that of diagnosing this pathology in children, given the risks incurred by caregivers (representing between 3 and 15% of COVID-19 infections) [6], but also that of nosocomial contamination of other patients given the particularly high number of reproductions of this condition (between 2 and 3.5) [56,57]. In the same vein, ambulatory surgery should in theory be favoured in order to avoid cases of nosocomial contamination.

It is therefore proposed to perform a PCR test for the virus for each paediatric patient before surgery.

In the context of the emergency department, PCR is carried out on admission of the child, but surgery can be performed before the results are obtained.

Preanaesthetic patient assessment

R4.1.1 – During the COVID-19 crisis, the experts suggest that telemedicine is an alternative to face-to-face consultation and must be used to reduce patient in-visit.

Rationale

The current outbreak of COVID-19 has placed a heavy burden on global medical systems, particularly with regard to the preoperative assessment of patients for surgery. For all elective surgeries in France and in many countries for major surgery, preoperative physical assessment by physicians had become a standard of care. The current crisis has reduced this possibility because patients should not be exposed to potentially contagious structures. In this context, telemedicine is an alternative to face-to-face consultation. The World Health Organization now defines telemedicine "as the provision of healthcare services via the use of communication technology for the diagnosis and treatment of diseases and for continuing education of healthcare providers in settings where distance is a factor, and now COVID-19".

Since the years 2000–2005, telemedicine, or the use of video and audio devices to provide medical advice and perform visual examinations of patients, has become a rapidly advancing specialty. Utilisation of secured Internet networks (including password) and video cameras have allowed specialists in distant geographic locations to take full medical histories and perform thorough clinical evaluations and physical examinations [59,60]. Recently, with the rise of 4 and 5G, reliable video and audio communication can now enable telemedicine consultation. In this context, utilising only the telephone may provide a reasonable secondary plan during the crisis, but airway and physical evaluations could not be performed. A large variety of equipment and communications products are available along a wide range of price points, meaning equipment can be scaled to practice-specific needs in an efficient manner.

For physicians, many existing telemedicine videoconferencing technologies are already on the market. Recent units provide the highest level of detailed patient interaction and enable a pertinent preoperative physical examination to be performed, with specific focus on cardiopulmonary and airway examinations equipment malfunction, such as loss of video imaging or audio, could require backup solutions to be in place. The duration of teleconsultation is about 20 min, and data have to be transmitted in a secure document or survey.

For patients, prior agreement to carry out a telemedicine evaluation is a mandatory step. It is advisable to send beforehand a guide to prepare the teleconsultation (including: connection modalities, health questionnaire on current treatments, information documents...) to facilitate the smooth running of the consultation. If necessary, a person close to the patient or an interpreter may, if present during the TLC, assist the doctor in carrying data of the clinical examination within the limits of his or her competence. Not all patients desire remote evaluation, and the exact reasons for this have not been elucidated. Patient selection is an important step for virtual preoperative evaluation. For example, patients in whom arranging travel is complicated underwent successful telemedicine preoperative evaluation before oral and maxillofacial surgery with no complications, highlighting this patient population as one in whom remote evaluation may be beneficial. The use of telemedicine preoperative evaluation has been studied in a variety of patient

populations. All types of surgery can be performed with telemedicine evaluation but major surgery (cardiac, vascular, thoracic, etc.) and patients with many comorbities or treatment are obstacles to the development of this technique. Similarly, patients must be able to connect to a platform and know how to use the software. Failure to undergo a preoperative anaesthesia evaluation may contribute to day of surgery cancellation, which has a negative financial impact on both patients and hospitals. Up to 25% of day of surgery cancellations are due to inadequate preoperative workup, and it is well established that preoperative clinics reduce risk of such cancellations and delays. With telemedicine, we found a 1.3% last minute cancellation rate, consistent with the international average, in patients who underwent telehealth evaluation as opposed to an in-person visit, thus suggesting an equivalent performance between the 2 evaluation options.

Teleconsultation is carried out using tools that guarantee the security of patient data. It is carried out in conditions that must guarantee: authentication of the healthcare professionals involved in the procedure; Identification of the patient; Access by healthcare professionals to the patient's medical data required to perform the procedure; Access by the patient to his/her own medical data required to perform the procedure. Informed consent is an important factor in surgery and telemedicine itself is no different.

The evaluation of the practices is advised to optimise these new modalities.

Modalities of anaesthesia and analgesia

As stated in the introduction, in the context of the COVID-19 pandemic, the resumption of surgical activity is subject to several major limitations: the strain on the supply of certain anaesthesia drugs, the change in hospitalisation capacities, the risk of contamination of healthcare providers and patients and the application, throughout the patient's journey, of the "distancing" principle. In addition, some peculiarities of COVID-19 patients (risk of drug interactions, worsening of the condition, etc.) are to be taken into account.

These limitations lead us to propose an adaptation of anaesthesia procedures. Favour strategies that reduce the exposure of health professionals to a risk of contamination while maintaining optimal safety conditions for the patient is one of the most important objectives. When safety conditions are met (especially for postoperative follow-up), outpatient management should probably be prioritised.

Is it necessary to adapt the anaesthesia modalities?

R5.1.1 – In a context of resumption of surgical activity and COVID-19 pandemic, experts suggest that drug-saving anaesthetic strategies (for propofol, midazolam, myorelaxants) should be preferred in adults and children.

R5.1.2 – Experts suggest giving priority whenever possible to regional anaesthesia. Regional analgesia and infiltration techniques should also be considered.

Rationale

Tensions on drug stocks and even shortages of drugs such as propofol, midazolam, atracurium, cisatracurium or rocuronium require the choice of anaesthesia protocol that spares these drugs, which are otherwise subject to quotas.

To do so, the experts propose several principles:

- prefer regional anaesthesia (RA) for anaesthesia and analgesia, rather than general anaesthesia. In the context of COVID-19 pandemic, there are many advantages for choosing RA if it is possible. General anaesthesia (GA) exposes to the risk of contamination during periods of upper airway management [61]. Peripheral and central RA techniques have a favourable risk/benefit ratio [62] and allow for the maintenance of patient protection measures (mask use) and decreased caregiver exposure during anaesthesia and surgical procedures [63,64];
- RA reduces the consumption of drugs under supply pressure (propofol, midazolam, atracurium, cisatracurium and rocuronium). In children, RA and infiltration techniques can also be proposed in combination with general anaesthesia or sedation to reduce the use of drugs that are in short supply;
- peripheral and topical local anaesthesia allow postoperative follow-up directly in the room or in a dedicated space, without going through the recovery room in accordance with regulations. This facilitates compliance with distancing measures specific to the current epidemic context [65]. In children, since RA techniques are regularly associated with general anaesthesia or sedation, they do not make it possible to bypass the recovery room;
- when GA is required, inhaled anaesthesia should probably be preferred in this context to intravenous target-controlled anaesthesia;
- monitoring of the depth of anaesthesia when possible, and of curarisation may be required in order to best adapt drug dosages [66].

These recommendations apply to both elective and emergency care. In conjunction with the institution's pharmacy, it is important to monitor local stock trends.

Are there any particularities for airway management?

R5.2.1 – Regarding airway management during intubation of a COVID+ or highly suspicious patient, the experts refer to the ''expert recommendations on the resuscitation management of patients during SARS-CoV-2 epidemics'' published by the SRLF-SFAR and to the ''airway management principle'' sheet, which are also applicable in the operating theatre.

Rationale

During the COVID-19 pandemic period, the intubation of a COVID+ patient in the operating theatre is based on the same rules as those issued in critical care units, due to the risk of spraying of the virus during this risky procedure. In order to minimise the risk of aerosolisation and contamination of personnel, it is necessary to:

- limit the number of staff present in the operating theatre;
- avoid ventilating the patient with a face mask during the preoxygenation phase;
- stop oxygen before removing the bag valve mask;
- intubate the patient by the most experienced senior using a video laryngoscope;
- connect the ventilator after inflating the intubation tube balloon.

R5.2.2 – Experts suggest that rapid sequence induction is preferred for airway management of a COVID+ or highly suspected patients.

R5.2.3 – The experts suggest performing induction according to usual airway management for a non-COVID patient.

Rationale

If general anaesthesia is required, the patient's clinical condition and COVID-19 status should be considered in the airway management strategy.

If the patient is COVID+ or highly suspected: the procedure described by SFAR [46] should be followed with rapid sequence induction and intubation. Special attention should be paid to tracheal extubation with the same barrier precautions as for intubation. This applies to patients under emergency management when the COVID-19 status is unknown. Special attention should also be paid to hand hygiene.

If the patient is non-COVID or asymptomatic, there is no need to modify usual procedures because of the COVID-19 pandemic. Routine airway management is recommended. If intubation is chosen, conventional induction is recommended according to standard recommendations, with adaptation of the induction sequence according to haemodynamic conditions, drug contraindications, and compliance with fasting conditions and the patient's age. The frequency of anaphylaxis related to atracurium has been estimated to be 1/22,451 administrations. The frequency of anaphylaxis due to fast-acting myorelaxant is about 10 times higher (succinylcholine: 1/2080 and rocuronium: 1/2499) [67]. The severe over-risk of allergy to the patient linked to a rapid sequence induction does not seem to be justified by the sole risk of SARS-CoV-2 contamination of the caregivers, this risk being low when protective measures are well respected (cf. item 1). Readers are invited to refer to the "Guidelines on muscle relaxants and reversal in anaesthesia" [66]. In a non-COVID patient, spontaneous ventilation anaesthesia or the use of supraglottic devices such as laryngeal masks is possible.

We insist on the importance during the preoperative checklist to share with the operating theatre staff, in addition to the usual information, the COVID status of the patient, which will determine his perioperative circuit and the strategy adopted by the anaesthesia team for airway management.

Are there any particularities for medication management in the perioperative period?

R5.3.1 – In the perioperative period, the experts suggest a systematic evaluation of possible drug interactions, particularly in the case of treatment with antiviral drugs.

Rationale

COVID+ patients are likely to be treated with antivirals. A table of drug interactions with drugs used against SARS-CoV-2 is available online from the University of Liverpool [68]. A summary is provided below for drugs frequently used in the perioperative period (Table 3). The hydroxychloroquine has multiple cardiac adverse events, including significant QT prolongation. Combinations with other drugs that prolong the QT interval, frequently used in the perioperative period such as halogenated drugs, droperidol, ondansetron, or hypothermia related to surgery and anaesthesia may increase the risk of developing a serious arrhythmia, such as ventricular fibrillation. The combination of hydroxychloroquine and azithromycin, proposed by some, carries a risk of additive/synergistic QT interval prolongation. ECG monitoring is essential.

In addition, the combination of lopinavir/ritonavir carries a risk of overdosage with amide type local anaesthetics (lidocaine, levobupivacaine, bupivacaine, prilocaine, mepivacaine, ropivacaine), ketamine, midazolam, sufentanil, oxycodone or tramadol due to ritonavir-related cytochrome P3A inhibition, but also to underdosage of propofol and morphine due to increased biotransformation of products metabolised by cytochrome P2C9 and P2C19 or by glucuronidation. Remdesivir, tocilizumab, and interferon beta do not show significant interactions with drugs normally used perioperatively, nor do they have cardiac effects.

Are there any particularities for postoperative care, including outpatient care?

R5.4.1 – Experts suggest applying the usual strategies for multimodal analgesia and prevention of nausea and vomiting, including outpatient treatment.

R5.4.2 – Experts suggest taking into account the benefit/risk balance when prescribing postoperative care for patients with COVID-19. The use of NSAIDs should be avoided in COVID+ or suspected patients but remains possible in other cases.

Rationale

Pain and postoperative nausea and vomiting (PONV) are the most common complications of the ambulatory route. They are the source of medical consultations and hospitalisation, exposing the patient to a new risk of viral transmission [69].

NSAIDs may be associated with worsening of symptoms during respiratory viruses, with an increased risk of empyema [70]. Despite recent alerts, there is no scientific evidence to date linking NSAID use to the aggravation of SARS-CoV-2 infection. A precautionary principle applies [71]. Thus, in a patient with an established or strongly suspected SARS-CoV-2 infection, the prescription of NSAIDs will be avoided. However, in asymptomatic patients, there appears to be no contraindication to their use if their benefit is established [72,73].

Discontinuation of corticosteroids is not recommended in patients on long-term therapy [70]. Steroid treatment of patients with COVID-19 is controversial and is not currently recommended [74]. The single intraoperative injection of dexamethasone, at the usual recommended doses, does not appear to present an over-risk in the asymptomatic patient.

Are there any specific considerations for anaesthesia and analgesia in the obstetrical context?

R5.5.1 – Experts suggest that analgesic management of obstetrical labour should not be modified in parturient who are not infected with SARS-CoV-2 or who have an asymptomatic infection.

Table 3
Possible drug interactions between drugs used in perioperative care and anti-SARS-CoV-2, based on https://www.covid19-druginteractions.org/.

	Lopinavir/ritonavir	Remdesivir	Hydroxychloroquine	Tocilizumab	Interferon beta
Bupivacaine	↑[b]	⟷[d]	⟷[d]	↓[c]	⟷[d]
Lidocaine	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Propofol	↓♥[b]	⟷[d]	⟷♥[b]	⟷[d]	⟷[d]
Kétamine	↑[b]	⟷[d]	⟷[d]	↓[c]	⟷[d]
Thiopental	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Midazolam IV	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Midazolam per os	↑[a]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Sevoflurane	⟷♥[b]	.[d]	⟷♥[b]	.[d]	.[d]
Desflurane	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Clonidine	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Dexmedetomidine	↓♥[b]	⟷[d]	⟷♥[b]	⟷[d]	⟷[d]
Suxamethonium	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Vecuronium	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Atracurium	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Cisatracurium	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Rocuronium	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Fentanyl	↑[b]	⟷[d]	⟷[d]	↓[c]	⟷[d]
Remifentanil	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Sufentanil	↑[b]	⟷[d]	⟷[d]	↓[c]	⟷[d]
Morphine	↓[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Hydrocodone	↓ ↑♥[b]	⟷[d]	↑♥[b]	⟷[d]	⟷[d]
Codeine	↑[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Dextropropoxyphene	↑[a]	⟷[d]	⟷[d]	↓[c]	⟷[d]
Oxycodone	↑ (160%)[b]	⟷[d]	⟷[d]	↓[c]	⟷[d]
Tramadol	↑♥[b]	⟷[d]	⟷♥[b]	⟷[d]	⟷[d]
Paracetamol	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Diclofenac	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Ibuprofene	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Enoxaparine	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Dabigatran	↓ or ↑[b]	⟷[d]	↑[b]	⟷[d]	⟷[d]
Rivaroxaban	↑[a]	⟷[d]	↑[d]	↓[c]	⟷[d]
Apixaban	↑[a]	⟷[d]	↑[d]	↓[c]	⟷[d]
Fondaparinux	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Heparine	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Haloperidol	↑♥[b]	⟷[d]	⟷♥[b]	⟷[d]	⟷[d]
Alprazolam	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Bromazepam	↑	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Diazepam	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Oxazepam	⟷[d]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Zolpidem	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Hydroxyzine	↑[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]
Droperidol	↑♥[b]	⟷[d]	⟷♥[b]	⟷[d]	⟷[d]
Odansetron	↑♥[b]	⟷[d]	⟷♥[b]	⟷[d]	⟷[d]
Dexamethasone	↑+[b]	⟷[d]	⟷[d]	⟷[d]	⟷[d]

♥: risk of cardiac toxicity; ↑: increased drug exposure; ↓: decreased drug exposure; : decrease in antiviral exposure; ⟷: no effect.
[a] Significant interaction, association not recommended.
[b] Possible interaction, dose adjustment or monitoring recommended.
[c] Low intensity interaction, no adjustment required.
[d] No significant interaction.

R5.5.2 – For women with a symptomatic condition, experts suggest eliminating thrombocytopenia prior to epidural analgesia.

R5.5.3 – Experts suggest avoiding nitrous oxide for obstetric labour analgesia during a COVID-19 pandemic.

R5.5.4 – Experts suggest that neuraxial anaesthesia should be preferred for caesarean section. If general anaesthesia is indicated, experts suggest that rapid sequence anaesthesia be performed regardless of the patient's COVID-19 status.

R5.5.5 – Experts suggest avoiding the postpartum prescription of NSAIDs in COVID+ or highly suspected women.

Rationale

In the context of COVID-19 pandemic, obstetric patients present two particularities.

First, unlike scheduled surgical activities, obstetrical activity in essence cannot be postponed and therefore remained at its usual level at the peak of the pandemic. The organisation of care had to be adapted, with the establishment of specific care channels for women infected with SARS-CoV-2 or suspected of being infected, not only to optimise the care of these women, but also to avoid the contamination of other pregnant women and of caregivers

working in maternity wards. These COVID-positive or suspected COVID-positive/non-COVID channels are logically maintained as long as the pandemic persists.

Second, unlike maternal infections with H1N1, SARS-CoV-1 or MERS, cohort studies of pregnant or postpartum women infected with SARS-CoV-2 do not suggest an increased risk of severe forms of infection in the obstetric population [75,76]. Therefore, there is no need for specific measures for pregnant or postpartum women infected with SARS-CoV-2 (outside those related to the obstetrical setting) as compared with the analgesic and anaesthetic management of patients in the general population infected with SARS-CoV-2.

Labour analgesia: the analgesic strategy for obstetrical labour, dominated by epidural analgesia in France, should not be modified in women not infected with coronavirus or presenting a non-severe or asymptomatic infection. Epidural analgesia may even be beneficial in COVID+ parturients, by limiting the exacerbation of respiratory symptoms associated with labour pain, and the use of general anaesthesia for caesarean section during labour. However, given the evidence of haemostasis disorders in severe forms of SARS-CoV-2 infection (mainly thrombocytopenia) [77], it is necessary to check the normality of the haemostasis before epidural analgesia is performed in women with severe COVID-19. The use of inhaled nitrous oxide should be avoided in the context of a COVID-19 pandemic, because of the potential aerosolisation risk associated with this technique, which has limited analgesic efficacy anyway.

Anaesthesia for caesarean section: in the general population, it is recommended that locoregional anaesthesia (LRA) should be preferred in the context of the COVID-19 pandemic, in order to limit the risk of contamination of healthcare workers, and to optimise the management of drugs used for induction and maintenance of general anaesthesia. Caesarean section anaesthesia is no exception, especially since neuraxial anaesthesia is the first-line technique recommended for scheduled or emergency caesarean section, except in the rare situations requiring foetal extraction in extreme emergency [63]. Indeed, general anaesthesia for pregnant women is associated with higher risks of pulmonary aspiration and difficult intubation as compared with the general population. Finally, post-caesarean section analgesia is of better quality after neuraxial anaesthesia than after general anaesthesia. However, women with severe forms of maternal SARS-CoV-2 infection may request general anaesthesia for caesarean section, especially in case of associated haemostasis abnormalities or major respiratory distress contraindicating neuraxial anaesthesia.

When general anaesthesia is indicated, the technique will be little affected by the COVID-19 status of the pregnant woman, and quite similar to the anaesthesia technique recommended outside the obstetrical setting in COVID+ or suspect patients: if extubation is envisaged, it will be performed in the operating theatre, with a limited number of people present in the room; finally, in the absence of need for postoperative transfer to the ICU, postoperative monitoring will be organised in order to limit patient movements and to avoid the risk of contamination (in the operating theatre or labour ward for example).

Post-caesarean section analgesia follows the same rules of adaptation according to COVID status as for the general population. For non-COVID women, the analgesia strategy will not be changed from the usual management of women undergoing caesarean section. For women with SARS-CoV-2 infection, the postoperative use of NSAIDs should be avoided.

In view of the increased risk of thromboembolic events observed in patients infected with COVID-19 and in pregnant women, the indications for thromboprophylaxis should be extended for pregnant and postpartum COVID+ women, including after vaginal delivery, as proposed by the CARO-CNGOF [78] and the GIHT [79].

Specific hospitalisation pathways

The resumption of surgical activity during the COVID-19 outbreak exposes no-COVID-19 patients and healthcare workers to contamination. The following expert proposals should be discussed within each institution in a collegial manner (Extended Executive Board, Operating Theatre Committee, Healthcare Infection Control Practices Advisory Committee) and lead to protocols that take into account the specific characteristics of each institution (architectural constraints, recruitment) and the local incidence of COVID-19 infection. Appropriate signage has to be applied throughout the specific COVID-19 pathway.

Which specific pathway for the management of COVID+ patients?

R6.1.1 – Experts suggest, for hospitals treating adults and paediatric patients COVID+, that a specific COVID+ pathway be implemented for their management, from the time they are admitted until they leave the operating theatre or the intensive care unit

This pathway must be secure (with adequate protective measures for patients and health workers); identified with visible signage; dimensioned to limit interference with conventional pathways; contain at least one identified postoperative room, in particular for intensive care unit (Fig. 3).

Rationale

Surgery remains possible for COVID+ patients in case of emergency or decrease in prognosis. The infectiousness of COVID+ patients requires the establishment of dedicated pathway, using 5 concepts [80]:

- security: healthcare workers are among the people most at risk of contamination [3], and should be protected (cf. 1); similarly, other patients must be protected in the establishment by a specific pathway used for COVID+ patients;
- the signalling of the pathway with explicit and uniform signage warning the health workers the presence of a COVID+ patients in the interventional room;
- the optimisation of the pathway to isolate the COVID+ patients from others as much as possible using analysis of inflow and outflow of patients to avoid the crossing of COVID+ patients with others;
- the identification of one or more operating theatres dedicated to the care of COVID+ patients using dedicated materials.

After surgery, postoperative care should be conducted in dedicated units for COVID+ patients in surgical unit or ICU unit using cohorting [81].

R6.1.2 – Experts suggest that, in addition to the extubation of adult and paediatric COVID+ patients in the operating theatre, their post-interventional care should be ensured, as far as possible, in the operating theatre or in another COVID+ dedicated protected area.

Rationale

Cough frequently occurred following extubation, which is at high-risk of spread of SARS-CoV-2 [82], explaining a dissemination

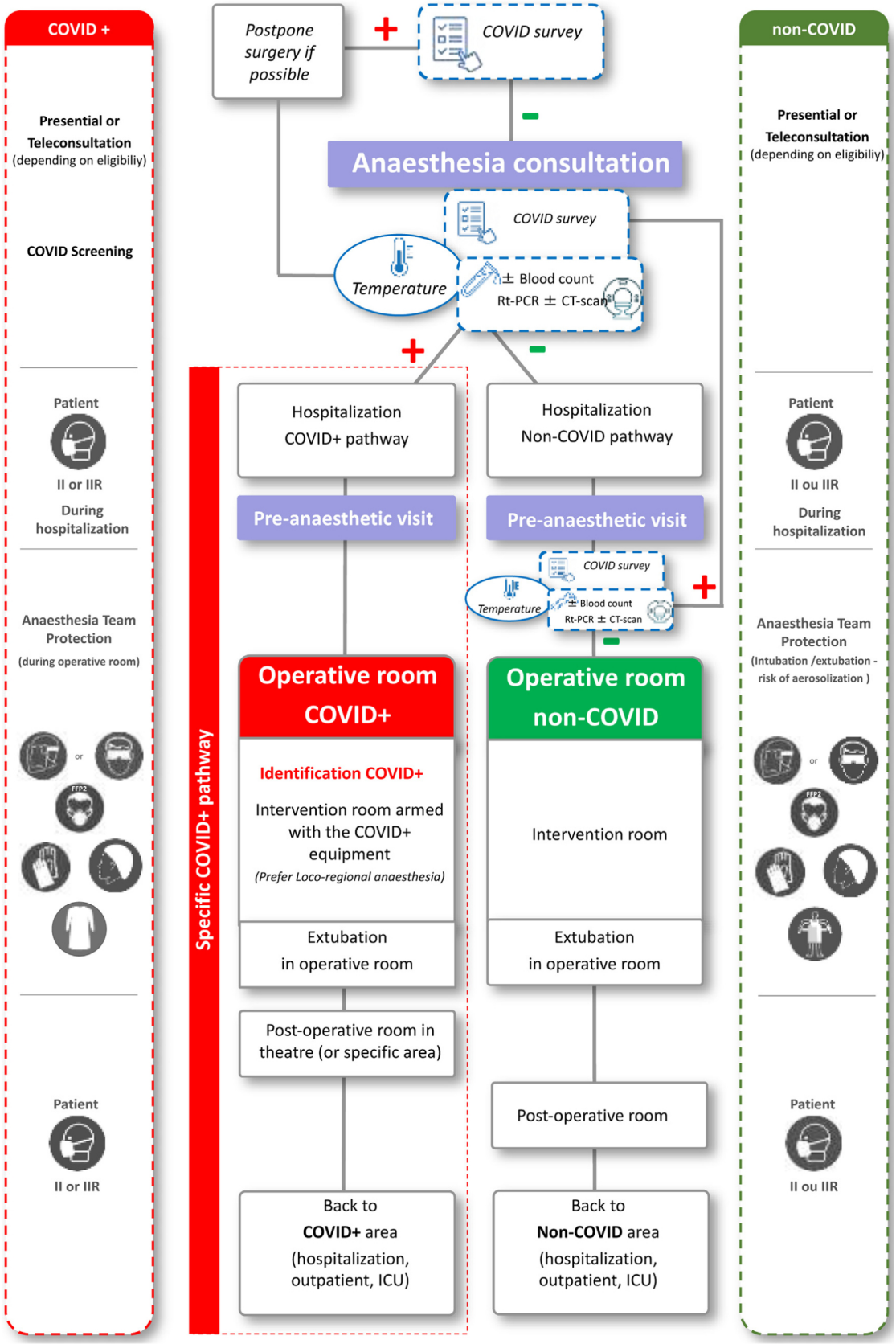

Fig. 3. Suggested patient pathway based on COVID status.

until 8 meters [22,83]. While some methods have been described to decrease the risk of dissemination during the extubation procedure [84,85], health workers should use PPE (especially N95 or FFP2 respirator and face shield). To protect other patients and health workers, it seems preferable to conduct the extubation and post-interventional care in the interventional room or in a dedicated protected area [86]. A surgical mask should be placed on the face of adult patients following extubation while nasal oxygenation could be used. For paediatric COVID+ patients, the surgical mask use could be difficult.

Which specific pathway for the management of non-COVID patients?

R6.2.1 – Experts suggest that adult and paediatric non-COVID patients undergoing scheduled surgery (outpatient, conventional or heavy surgery requiring critical postoperative care) should be managed in an isolated pathway from the COVID+. The entire care pathway for these patients must comply with the protective measures mentioned above.

Rationale

In the context of non-COVID patients management in the operating theatre, the aim of this guideline was to avoid both the occurrence of nosocomial SARS-CoV-2 infection [87] and the contamination of caregivers by asymptomatic patients [88]. For any planned surgical procedure, the risk/benefit balance must be discussed in a multidisciplinary manner, given the probably high postoperative morbidity and mortality in this epidemic context [88]. Management of "non-COVID" patients must be considered in a specific pathway [89]. This pathway covers the entire patient's hospitalisation day: from the anaesthesia consultation to discharge from the hospital after surgery, following the guidelines for protection (chapter 1).

R6.2.2 – Experts suggest that for both adults and children, priority should be given to outpatient treatment and enhanced recovery after surgery as much as possible.

Rationale

In the context of COVID-19 outbreak, outpatient management should be considered and preferred to conventional hospitalisation when feasible. Outpatient management reduces the length of stay, thereby reduces the risk of patient exposure and the risk of contamination in case of asymptomatic infection [90]. Outpatient management of surgical emergencies should be considered whenever possible [91].

Outpatient pathways for resumption of activity during the pandemic period need to consider several points:

- the planning and convocation schedules should be staggered to avoid waiting times and gathering of patient;
- the use of single or isolated rooms should be preferred to wait or exit lounges;
- limit admissions in the postoperative recovery room must be applied as much as possible, in particular after performing locoregional anaesthesia.

Depending on the local outpatient surgery units, this recommendation may limit the number of patients treated. Finally, waiting areas for companions should be arranged in order to respect the safe distances [91,92]. The number of companions should be limited to one person per patient (adult or child).

In case of conventional hospitalisation, enhanced recovery after surgery should be preferred as far as possible in order to reduce, once again, the length of stay. In the same way, hospitalisation on the day of surgery should be considered if the healthcare institution ensures that there is no risk of infected patient by the COVID-19 (for example by a phone call the day before hospitalisation).

Resumption of surgical activity after the covid-19 pandemic and the end of lockdown

What is the timing and pattern of resumption of surgical activity after the end of lockdown?

R7.1 – Experts suggest considering a timeline for the resumption of elective surgery when authorised by local agencies AND when the facility has an appropriate number of critical/intermediate care and conventional beds, personal protective equipment (PPE), ventilators, drugs, blood products, and staff trained to treat all elective patients without resorting to a crisis care organisation.

Rationale

The rapidly changing COVID-19 pandemic situation requires a periodic review of the measures taken and an analysis of the clinical, social and economic context derived from each decision.

The resumption of surgical activity will be gradual and spread over time. The objective is to summarise, as a priority and progressively, those activities that prove decisive in limiting the loss of chance for patients awaiting cancer or non-cancer surgery [93].

The gradual deployment of surgical activity in a controlled number of operating theatres will make it possible to achieve efficiency in open operating theatres and facilitate compliance with reinforced hygiene rules to ensure the safety and protection of patients and caregivers.

Experts suggest that public and private facilities agree to propose a common approach to the provision of care adapted to the population and regional conditions of the COVID-19 pandemic.

The pace of rescheduling elective surgery in children and adults will vary according to geographical location, epidemiological pressure, and the possibility of redeploying staff from critical care to operating theatres. Elements to be evaluated for the resumption of surgical activity are the following:

- timing of resumption: there should be a sustained reduction in the rate of new COVID-19 cases in the geographical area concerned for at least 14 days before the resumption of elective surgery [94];
- any resumption must be authorised by the relevant regional and national health authorities;
- facilities are able to safely treat all patients requiring hospitalisation without the need for a crisis care organisation;
- the facility has an appropriate number of critical and non-critical non-COVID and COVID+ beds, PPE, ventilators, drugs, blood products and all necessary medical and surgical equipment.

The facility has a number of trained and educated staff appropriate to the planned surgical procedures, the patient

population and the facility resources. Healthcare staff fatigue and the impact of stress must be considered in order to perform planned procedures without compromising patient safety or staff safety and well-being.

How to coordinate within each institution the resumption of surgical activity after the end of lockdown? (Role and operation of the regulation cell)

R7.2.1 – Experts suggest setting up in each facility a multidisciplinary weekly regulation committee, expanded according to current constraints, which will collegially establish the operating schedule for the next week according to patient prioritisation and scheduling criteria (Fig. 4).

R7.2.2 – Experts suggest that the operating schedule control committee should be composed of those in charge of surgery/anaesthesia-critical care and nursing care in the operating theatre.

R7.2.3 – Experts suggest defining criteria to prioritise patients by specialty (colleges), which should be based on the recommendations provided by colleges or societies and local agencies.

R7.2.4 – Experts suggest conducting an inventory by specialty and by ward of patients waiting or deferred during lockdown to assist in prioritisation and scheduling.

Rationale

Experts suggest setting up, in each facility, a multidisciplinary surgical activities regulation committee, expanded according to the constraints related to the COVID-19 pandemic. This regulatory committee meets weekly and is in charge of making decisions on the production of a restricted operating schedule consistent with the other guidelines. Depending on the size of the facility, several regulatory committees may exist, coordinated by a central regulatory committee. The composition of the regulatory committee must, as a minimum, include the following persons and coordinate with the management of the facility:

- a surgeon;
- an anaesthesiologist-intensivist;
- an operating theatre regulator;
- and/or a surgical planning regulator;
- and/or a medical coordinator of the operating theatre.

At the time of the meeting, the regulatory committee must know the facility's capacity in terms of downstream critical/intermediate care and conventional beds, the stocks of PPE, drugs and blood products, as well as the equipment needed to carry out the intervention. Regulatory committee's decisions must be documented and should account for the following [29,94]:

- list of previously cancelled and postponed cases, by specialty and ward;
- objective assessment of priorities (e.g. MeNTS instrument) with a proposed maximum rescheduling time not to be exceeded by the different specialties (Fig. 4) [30];
- prioritisation of specialties (oncology especially);
- defining operating shifts during the day (e.g. duration of opening hours, type of surgery);
- identification of essential health professionals and medical device representatives by procedure;
- strategy for the gradual opening of intervention rooms:
  - identify the capacity objective for activity's resumption (for example, 25% or 50% of the usual activity),
  - ambulatory patients come before those who are hospitalised,
  - the simultaneous opening of all operating theatres requires more staff, downstream critical and conventional care beds, PPE, drugs and blood products, as well as the equipment needed to perform the procedure.

To gradually increase the activity, the regulation committee will have to ensure the following elements:

- availability of staff according to the workload (surgeons, anaesthesiologist-intensivist, nursing, housekeeping, engineering staff, sterile processing…);

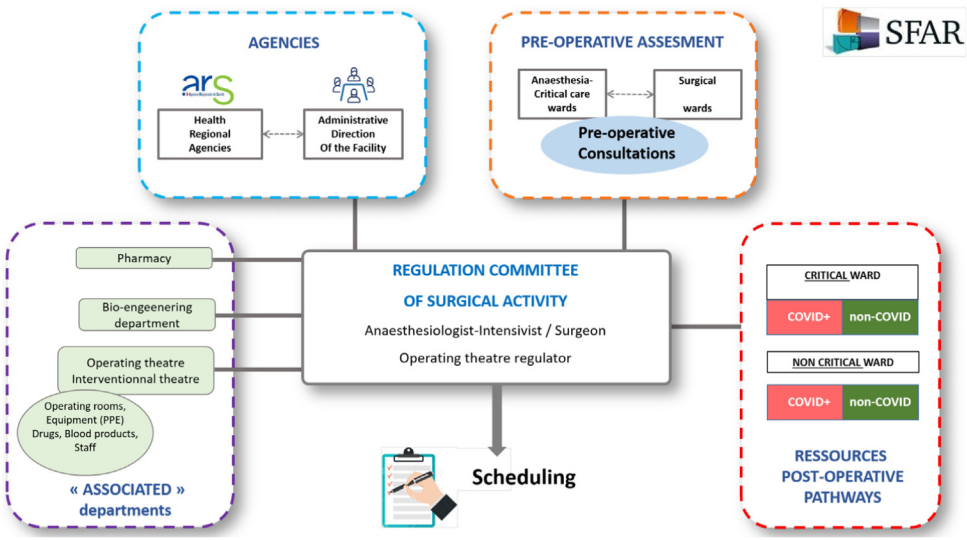

Fig. 4. Interactions of the Multidisciplinary Regulatory Committee.

- availability of "associated" staff (e.g. radiology, pathology...);
- delivery of needed equipment, consumables, medical devices (e.g. anaesthesia-intensive care drugs, sutures, single-use or disposable surgical instruments...);
- sufficient availability of critical/intermediate care and conventional beds, ventilators for the expected postoperative care;
- training of new staff.

The criteria for prioritising the surgeries to be scheduled will be based on:

- criteria of emergency or non-deferrable surgeries (essential surgery). Triage remains as important at this stage as during lockdown;
- an inventory and reassessment by surgeons of patients who could not be operated during lockdown to validate whether their status may have changed from deferrable to non-deferrable;
- the presence of risk factors for increased susceptibility to SARS-CoV-2 infection and severity;
- clinical evaluation on a case-by-case basis depending on whether the patient has reached the tolerance limits of their disease (non-deferrable) either by disease progression, risk of decompensation or pain [93] or by the age of the child in paediatric;
- the risk/benefit balance of postoperative exposure of immunocompromised patients (± oncological criteria) and viral risk [95];
- the perioperative risk for patients in the virus incubation phase [87].

What assessment of the resumption of surgical activity after end of lockdown based on updated data?

R7.3.1 – Experts suggest that policies and procedures, within each institution, should be re-evaluated frequently, based on COVID-19 related data collected, resources, trials and other clinical information.

Rationale

Institutions must collect and use relevant data completed by data from local authorities and government agencies, where appropriate [94]:

- COVID-19 numbers (screening, positive cases, availability of inpatient and critical care beds, intubated patients, patients requiring intervention/procedure, new cases, deaths, COVID+ caregivers, location, follow-up, isolation and quarantine policy);
- availability of the facility's beds, PPE, critical care, drugs and ventilators;
- quality of care metrics (mortality, complications, readmission, errors, near misses, other – especially in the context of increased activity).

Disclosure of interest

The authors have not supplied their declaration of competing interest.

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