Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
COVID-19: Preliminary recommendations from the SFORL

COVID-19 and ENT Surgery

V. Couloigner a, S. Schmerber b, R. Nicollas c, A. Coste d,e, B. Barry f, M. Makeieff g, P. Boudard h, E. Bequignon d,e, N. Morel i, E. Lescanne b,∗, French Society of Otorhinolaryngology, Head, Neck Surgery (SFORL) French College of Otorhinolaryngology, Head, Neck Surgery, French Syndicate of ENT Specialists (SNORL),

Article Info

Keywords:
COVID-19
SARS-CoV-2
Personal protective equipment (PPE)
Droplet-based transmission
Infectious disease

Abstract

In Otorhinolaryngology – Head and Neck Surgery, clinical examination and invasive procedures on the respiratory tract and on airway-connected cavities, such as paranasal sinuses and the middle ear, expose people to direct transmission of SARS-CoV-2 by inhalation or ocular projection of contaminated droplets, and to indirect transmission by contact with contaminated hands, objects or surfaces. Estimating an R0 of COVID-19 at around 3 justified postponing non-urgent face-to-face consultations and expanding the use of teleconsultation in order to limit the risks of SARS-CoV-2 infection of patients or health workers and comply with the lockdown. The health authority recommends cancellation of all medical or surgical activities, which are not urgent as long as this does not involve a loss of chance for the patient. The purpose of this cancellation is to significantly increase critical care capacity, prioritise the reception of patients with COVID-19, prioritise the allocation of staff and provision of the equipment necessary for their medical or surgical management, and contribute to the smooth running of downstream critical care within their establishment. Another goal is to reduce the risks of patient contamination within healthcare facilities. This document provides guidance on how to proceed with and adapt ENT surgery in the current pandemic context, as well as on the management of postponed operations. This best practice advice must of course be adapted in each region according to the development of the epidemic and pre-existing arrangements. Their local application can only be decided within the framework of collaboration between the ENT teams, the operational hygiene units and all the other specialties concerned.

© 2020 Elsevier Masson SAS. All rights reserved.

1. Introduction

First reported in Wuhan, China, on 31 December 2019, the outbreak of coronavirus 2019 (COVID-19) constitutes the greatest public health emergency of this century. The international spread of the epidemic, mainly due to the extremely contagious nature of the SARS-CoV-2 virus, made it inevitable that the virus would actively circulate throughout France and put unprecedented pressure on health organisations. In common with many countries, one of the national health priorities has been to minimise person-to-person transmission, including among healthcare workers.

In the ENT field, clinical examination and invasive procedures on the respiratory tract and on airway-connected cavities (paranasal sinuses, middle ear) expose people to direct transmission of SARS-CoV-2 by inhalation of contaminated droplets or ocular projection, or to indirect transmission by contact with contaminated hands, surfaces or objects. Medical and surgical procedures are therefore considered to put practitioners and nursing staff at high risk
when they come into contact with patients either confirmed or suspected to have COVID-19 [1]. In countries already affected by the pandemic, preparing for the epidemic wave or living with the virus, specific recommendations have been necessary to adapt ENT indications and medical-surgical procedures to the pandemic. In France, estimating an R0 of COVID-19 at around 3 justified postponing non-urgent face-to-face consultations and expanding the use of teleconsultation in order to limit the risks of SARS-CoV-2 infection of patients or health workers and comply with the lockdown. In response to Early Warning and Response System (EWRS) Messages from the French Directorate-General for Health, notices issued by the French High Council for Public Health (HCSP) and the French Society for Hospital Hygiene (SF2H), the scientific committee of the French Society of Otorhinolaryngology (SFORL), the French College of Otorhinolaryngology and the French Syndicate of ENT Specialists (SNORL) issued best practice advices relating to indications and conditions for conducting specific medical and surgical treatment appropriate to the risk. Urgent ENT surgical procedures, which cannot be postponed due to the patient’s state of health, should go ahead if delaying the operation involves too high a risk of loss of chance in terms of the risk-benefit balance.

This article proposes guidelines that will need to be adapted according to the region and pre-existing arrangements. ENT specialists, in collaboration with the operational hygiene teams and

| Group A | Surgery that cannot be postponed | Pathology, symptoms | Recommended approach |
|---------|---------------------------------|---------------------|----------------------|
| **Group B**<br>Risk of prognostic impact if treatment delayed for more than a month | Cancers in the mucus lining of the upper aerodigestive tract<br>Progressive salivary gland cancers<br>Progressive skin cancers | Emergency treatment<br>Group B1: tracheotomy<br>Treatment without further delay<br>All procedures and investigations (scans, dental treatment, etc.) done together during one hospital visit<br>If the timescale cannot be adhered to, refer the patient to a referral facility<br>Group B2: tracheotomy required<br>If possible, postpone surgery while continuing to monitor the patient regularly or prioritise a non-surgical therapeutic alternative | |

| Group C<br>No significant prognostic impact if treatment delayed for a minimum of 6 to 8 weeks | Well-differentiated thyroid cancers<br>Non-progressive skin cancers (e.g.: basocellular carcinomas)<br>Slow-growing salivary gland cancers<br>Atypical nodules in the saliva glands not formally classified as malignant during the preoperative assessment<br>Leukoplakia lesions on the vocal cords | Postpone surgery<br>Reassess the patient after 6 to 8 weeks and adapt the treatment programme according to the course of the disease and the spread of the COVID-19 pandemic | |

**Table 2**<br>Otologic and oto-neuroologic surgery: best practice advice in relation to the COVID-19 pandemic (adapted to take account of [9]).

| Group A | Surgery that cannot be postponed | Pathology or type of procedure | Recommended approach |
|---------|---------------------------------|-------------------------------|----------------------|
| **Group B**<br>Risk of prognostic impact if treatment delayed for more than a month | Middle ear cholesteatoma with mildly symptomatic CSL fistula<br>Osteo-meningeal breach<br>Tympanoplasty for uncomplicated cholesteatomas, tympanic retraction pockets, perforated eardrums, grommet insertion, ossiculoplasty, ear implant | Postpone surgery<br>Reassess the patient after 1 month and adapt the treatment programme according to the course of the disease and the spread of the COVID-19 pandemic | |

| Group C<br>No prognostic impact if treatment delayed for a minimum of 6 to 8 weeks | All other cases | Postpone surgery<br>Reassess the patient after 1 month and adapt the treatment programme according to the course of the disease and the spread of the COVID-19 pandemic | |

*Degree of urgency to be discussed on a case-by-case basis.
Table 3

Endonasal surgery: best practice advice in relation to the COVID-19 pandemic.

| Group                        | Pathology or type of procedure                                                                 | Recommended approach                      |
|------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------|
| Group A                      |                                                                                                 |                                          |
| Surgery that cannot           | Sinusitis with complications (cavernous sinus, uncomplicated, or on fragile terrain, invasive    | Emergency treatment                      |
| be postponed                  | fungal sinusitis, neuromeningeal damage) or on fragile terrain, invasive fungal sinusitis         |                                          |
|                              | Complicated mucocoele (neurological or ophthalmic signs)                                          |                                          |
|                              | Very displaced nasal fracture, foreign body in the nasal cavity                                    |                                          |
|                              | Nosebleed not controlled by a balloon catheter when radioembolisation is not possible            |                                          |
|                              | Osteo-meningeal breach\(^a\)                                                                     |                                          |
| Group B                      | Risk of prognostic impact if treatment delayed for more than a month                             |                                          |
|                              | Inverted papillomas                                                                              | Postpone surgery                         |
|                              | Allergic fungal sinusitis in immunosuppressed patients                                            | Reassess the patient after 1 month and   |
|                              | Mucocele without compression                                                                      | adapt the treatment programme according  |
|                              | Osteo-meningeal breach\(^a\)                                                                     | to the course of the disease and the     |
| Group C                      | Surgery which can be postponed for a minimum of 6 to 8 weeks without significant prognostic     | Postpone surgery                         |
|                              | impact                                                                                            | Reassess the patient after 6 to 8 weeks  |
|                              | Nasosinus polyposis                                                                              | and adapt the treatment programme        |
|                              | Aspergillus sinusitis, otor-antral fistula                                                        | according to the course of the disease   |
|                              | Benign lesion to be removed via endonasal route                                                  | and the spread of the COVID-19 pandemic   |
|                              | Rhinosepsplasty                                                                                  |                                          |
|                              | Dacryo-cystorrhinostomy via endonasal route                                                        |                                          |

\(^a\) Degree of urgency to be discussed on a case-by-case basis.

Box 1: The 10 key points of ENT surgical activity during the COVID-19 pandemic.

1. Categorise procedures according to their degree of urgency.
2. Assess the risks and benefits of all ENT surgical procedures according to the prevalence of COVID-19 and regional health conditions with regard to the pandemic.
3. Defer any ENT surgical procedure whose postponement does not result in a loss of chance for the patient.
4. In cases where the decision to postpone surgery is particularly tough, this decision should ideally be made after discussion with colleagues and notified with a written report. Multidisciplinary consultation meetings to discuss cancer management should be held virtually.
5. If a procedure is postponed, carry out interim reassessments of the patient on a case-by-case basis, in particular by teleconsultation, and alter the degree of surgical urgency if necessary.
6. In cases where surgery has been postponed, CT-scan can be helpful to monitor the progress of diseases such as tumours or cholesteatomas.
7. Protect the surgeon and operating theatre staff by topping up the standard precautions with additional “air” and “contact” precautions (enhanced epidemic and biological risk (EBR) precautions), in line with the updated operational recommendations from the French Society for Hospital Hygiene (SF2H).
8. Use the COVID-19 recommendations from the French Society of Anaesthesia & Intensive Care Medicine (SFAR) during intubation and extubation, and take all perioperative precautions designed to prevent the risk of aerosolisation of viral particles.
9. For procedures deemed at high risk of contamination, favour a non-surgical therapeutic alternative if possible.
10. Adapt the precautions regarding ENT surgery to the evolution of the COVID-19 epidemic, to new scientific data concerning this infection and its treatment, to the updating of the protocols recommended by the health authorities and to the regular modifications of organisations and technical and human resources available locally.

These facilities are organised so that they can offer dedicated treatment routes for COVID-positive patients and have established non-COVID-19 areas of the hospital. In April 2020, the healthcare organisation at the French Directorate-General for Health announced that it would be relying on pathways and cooperation between existing structures (GHT, public-private partnerships, etc.) or that need to be set up (surgical team from one establishment working in another establishment) in order to [3]:

- mobilise surgical teams, both in hospitals and private practice;
- organise access to fully-equipped operating theatres and post-anesthesia care units;
- reserve post-surgical or post-anaesthetic beds, and if necessary medical beds, but also continuous monitoring, intensive care and critical care beds, follow-up and rehabilitative care or home care spaces, as appropriate depending on whether the patient’s status is COVID-negative or COVID-positive.

Depending on the local context, treatment procedures adapted to available resources define the methods for conducting and returning PCR tests on patients suspected be infected [3].

We recommend continuing to hold multidisciplinary consultation meetings for ENT oncology virtually (video or teleconference) to avoid delays in treating patients and prevent participants being exposed to the risk of infection [4].

2. Best practice advice

2.1. General considerations

Faced with the outbreak of SARS-CoV-2 (pandemic phase of COVID-19), a recommendation was made in March 2020 to cancel all non-urgent surgical or medical ENT activity where this did not involve a loss of chance for the patient [2]. The purpose of this cancellation was to significantly increase critical care capacity, prioritise the reception of patients with COVID-19, prioritise the allocation of staff and provision of the equipment necessary for their medical or surgical management, and contribute to the smooth running of downstream critical care within their establishment or support for establishments mobilised by their territorial hospital groups (GHT) to respond to COVID-19. Another goal was to reduce the risks of patient and healthcare workers being contaminated within healthcare facilities.
We recommend that minutes be written after a discussion with colleagues or multidisciplinary ethics committee meetings, should postponements pose complex clinical ethical questions [5]. The French National Professional ENT Council (CNPORL) intends to answer questions from healthcare teams while helping to organise consultation meetings by digital means along with its ethics committee (ceorl@sforl.org).

At this stage where we are living with SARS-Cov-2, every precaution is taken so that patients not infected with the virus are received in the best possible conditions and the risk of contamination is avoided. There must be no withdrawal of essential care and the ENT specialist should resume contact with the most vulnerable patients to ensure they continue to be monitored and detect any risk of worsening of their illness (contact with the patient by video teleconsultations or over the phone). The use of CT-scans can help monitor the evolution of pathologies such as tumours or cholesteatomas.

For a number of reasons, it is impossible to establish exhaustive lists of treatments that should be continued or postponed during the COVID-19 pandemic: varying degrees of severity for the same pathology; associated co-morbidities; the patient’s wishes; local availability of operating theatres, intensive care and continuing care units, or medical and paramedical staff. Some surgical emergencies must of course be treated without delay: severe traumas, infections and abscesses that are complicated or which fail to respond to medical treatment, foreign bodies and severe obstructions of the upper airway, ingestions of caustic substances. Conversely, some procedures can be postponed, such as facial plastic surgery. Recommendations concerning scheduling timescales have been published or posted on the SFORL website regarding ENT cancer treatment [4–6], otologic and otoneurologic surgery [7] and paediatric surgery [8]. Without claiming to be exhaustive, Tables 1–3 give examples of best practice advice in relation to which specific surgical activities should go ahead or be postponed during the pandemic. In addition, the indications for tonsillectomies, which should not be postponed, are listed in the paragraph below. Finally, it should be remembered that depending on what occurs during the teleconsultation, clinical examinations in the surgery or paraclinical examinations, the ENT specialist is still the one to decide whether hospitalisation is required for medical or surgical treatment that has not been postponed.

In this ever-changing context of the COVID-19 pandemic where it is particularly difficult to take medical decisions, recommendations concerning treatments that should be continued or postponed have been published [6] or posted on the SFORL website regarding ENT cancer treatment [7,8], otologic and otoneurologic surgery [9] and paediatric surgery [10]. This advice applies to all surgical activity that is usually scheduled. Without exhaustively covering all procedures and illnesses covered by the specialty, Tables 1–3 give examples of best practice advice in relation to which specific surgical activities should go ahead or be postponed during the pandemic.

2.2. Preoperative diagnostic assessment

It is advisable to check the COVID status of the patient shortly before surgery if he has signs suggestive of this infection (fever, cough, headache, myalgia, anosmia without nasal obstruction, dysgeusia, digestive disorders) or in case of ENT operations relating to the airway or its connected cavities (middle ear, paranasal sinuses), in particular endoscopies and oral, pharyngeal, laryngotracheal, endonasal, otological and otoneurological surgical procedures. Indeed, these interventions are at high risk of contamination because they promote the aerosolisation of SARS-CoV-2 [11,12].

In the current pandemic context, untested patients should be considered infected, even in the absence of symptoms.

2.3. Precautions in the operating theatre

We recommend setting up an organisation that will marshal a limited number of health professionals to deal with patients suspected to be infected, both possible and confirmed, to minimise exposure and use of personal protection equipment (PPE).

We recommend wearing PPE whenever entering the operating theatre. Health professionals in direct contact with patients should receive local training or a refresher course in techniques for putting on and removing their PPE given by the operational hygiene team [2]. Ideally, access should be restricted to the most experienced practitioners, with minimal access by health professionals still undergoing training and medical students [2].

All surfaces of the furniture in the operating theatre should be cleaned using bleach (ready-to-use or dilutable) or using virucidal detergent/disinfectant products (standard EN 14476), to minimise virus transmission on people’s hands [13].

We recommend that healthcare workers treating patients who are possibly or certainly infected with SARS-Cov-2 take additional “air” and “contact” precautions (enhanced epidemic and biological risk (EBR) precautions), as outlined below [14,15]:

- wearing respiratory protection in the form of an FFP2 (CE-marked) or N95 (US FDA-approved) mask, ensuring that it is sealed around the face. This applies to all healthcare staff before they enter the operating theatre;
- protecting their uniform with a long-sleeved single-use gown; this gown should be impervious if likely to get wet or dirty during care;
- prevention of possible splashing in the eyes by routine use of protective goggles;
- wearing headwear that completely covers the hair (mob cap, theatre hat, etc.);
- wearing single-use gloves is restricted to situations where there is contact or risk of contact with blood, biological liquids, mucus or damaged skin;
- disposal of this PPE in an infectious medical waste (IMW) receptacle before leaving the operating theatre, except for the goggles and mask which should be removed after leaving the operating theatre. If there is a shortage of FFP2 masks, they do not have to be thrown away immediately, because they are still effective for up to 8 hours provided they are not removed and then put back on the face.

In addition to the mask and protective goggles, the local operational hygiene teams can provide face shields (helmets with transparent visors) to protect wearers from droplets and aerosols produced by the patient. These shields have the advantage of being able to be removed with minimal risk of touching the face. Both sides should therefore be cleaned regularly and staff should avoid bringing their hands to their face under the visor [16].

2.3.1. ENT surgical procedures that generate aerosols

We recommend teamwork between anesthesiologists and surgeons to optimise the effectiveness of the precautions taken during airway procedures (intubation, extubation, ventilation, etc.) [12].

ENT surgical procedures on the airway and on its connected cavities (middle ear, paranasal sinuses) involve a high risk of contamination because they encourage aerosolisation of SARS-CoV-2 [11,12]. This applies particularly to endoscopies and oral, pharyngeal, laryngotracheal, endonasal, otological and otoneurological surgical procedures.
We recommend that positive-pressure ventilation and filtration in operating theatres is maintained [13]. The PPE should include: FFP2 (N95) mask, cap, eye protection (goggles and possibly helmet with transparent visor), long-sleeved impervious gown, and gloves [14].

Other specific surgical facilities (suspension of a transparent surgical drape above the patient) can be discussed with the local operational hygiene team to minimise aerosolisation of contaminated tissue micro-fragments. Until we have more specific knowledge of the risks associated with SARS-CoV-2, use of electro-surgery (monopolar, bipolar, radiofrequency, coablation) and laser surgery should be treated with caution. The aerosolisation of viral particles in the smoke plume generated by these technologies has indeed already been demonstrated [17,18].

2.3.2. Endoscopies and pharyngo-laryngotracheal surgery

It is recommended to:

- adjust the mask with both hands to minimise leaks during periods of manual ventilation [19];
- avoid using high-flow nasal oxygen and high frequency jet ventilation;
- keep the gas flow to the minimum required to maintain oxygenation or even stop ventilation temporarily while an endoscope is inserted in the larynx and trachea, or while the trachea is open;
- perform video-endoscopy to keep the surgeon at a distance from the patient during the endoscopy procedure;
- stop ventilation during extubation;
- avoid using a laser or monopolar electric scalpel, which could increase the spread of contaminated suspensions in the operating theatre.

2.3.3. Endonasal surgery [20]

It is advised to:

- use instruments that minimise the risk of aerosolisation or spray from tissue micro-fragments contaminated by the virus. Drilling and microdebrider should be avoided.
- prioritise alternatives to the endonasal approach if they allow drilling or the use of the microdebrider to be avoided: external paracanalisch paralateronasal or sub-labial routes.

2.3.4. Otolaryngology [9]

It is recommended to avoid drilling as much as possible since this might elicit aerosolisation or spray from tissue micro-fragments that have been contaminated by SARS-CoV-2 [21,22].

2.3.5. Tonsillectomy and adenoidectomy (T & A) [10]

The indications to carry out T & A without delay in the current context of pandemic are enlarged tonsils and adenoids with severe obstructive sleep apnoea syndrome (OSAS). In children, an additional argument to maintain the scheduling of this operation is the existence of comorbidities such as sickle cell anaemia where there is a risk of vaso-occlusive crisisagravated by OSAS [23]. In adults, tonsillectomy for severe OSAS can still go ahead, without prior sleep endoscopy, where there is a high probability of therapeutic success. This situation corresponds to Stage I of the Friedman classification which combines grade 34 enlarged tonsils with a grade ½ Mallampati score, without associated hypertrophy of the base of the tongue [24]. In this specific case, surgery would be preferable to starting continuous positive airway pressure (CPAP) treatment as the latter involves a risk of spreading the virus into the surrounding air [25].

No data is currently available concerning tropism of SARS-CoV-2 for the tonsils, nor on specific contamination risks linked to the various techniques (partial or total tonsillectomy) or instruments (electrocoagulation, radiofrequency, coablation, etc.) that might be used in a tonsillectomy. We do not therefore recommend altering the usual technique for this surgery, apart from the microdebrider whose use should be avoided in line with similar recommendations for endonasal surgery.

Key points of the organisation of ENT surgical activity during the COVID-19 pandemic are summarised in Box 1.

The proposals in this notice, resulting from collaboration between SFORL, SNORL and the College are based on currently available knowledge and are likely to be amended as scientific knowledge evolves concerning spread of the COVID-19 pandemic.

Disclosure of interest

The authors declare that they have no competing interest.

References

[1] Givi B, Schiff BA, Chinn SB, Clayburgh D, Iyer NG, Jalisi S, et al. Safety recommendations for evaluation and surgery of the head and neck during the COVID-19 pandemic. JAMA Otolaryngol Head Neck Surg 2020, http://dx.doi.org/10.1001/jamaoto.2020.0780.
[2] Préparation à la phase épidémique COVID-19–16 mars 2020; 2020 [Accessible sur : http://solidarites-sante.gouv.fr/IMG/pdf/pdf/guide-covid-19-phase-epidemique-v5.1-16032020.pdf (consulté le 08/04/2020)].
[3] Organisation des soins hors COVID-19–8 mars 2020; 2020 [Accessible sur : http://solidarites-sante.gouv.fr/IMG/pdf/pdf/soins-hors-covid-19.pdf (consulté le 13/03/2020)].
[4] Conseils sur l’organisation des réunions de concertation pluridisciplinaire (RCP) en cancérologie dans le contexte de l’épidémie COVID-19–18 mars 2020; 2020 [Accessible sur : https://www.e-cancer.fr/professionnels-de-sante/Coronavirus-COVID-19/Conseils-sur-l-organisation-des-reunions-de-concertation-pluridisciplinaire-RCP-en-cancerologie-dans-le-contexte-de-l-epidemie-COVID-19 (consulté le 13/03/2020)].
[5] CNCE – Contribution du CNCE à la lutte contre COVID-19 : enjeux éthiques face à une pandémie; 2020 [Accessible sur : https://www.ccne-ethique.fr/fr/publications/la-contribution-du-cnce-a-la-lutte-contre-covid-19-enjeux-ethiques-face-une-pandemie (consulté le 07/04/2020)].
[6] Vukkadala N, Qan ZJ, Holsinger FC, Patel ZM, Roenthal E. COVID-19 and the otolaryngologist – preliminary evidence-based review. Laryngoscope 2020, http://dx.doi.org/10.1001/j.ani.2020.04.008 [pii: s1017-9996(20)30098-3].
[7] Falcky N, Schultz P, Morinière S, Breuskin I, Bozea A, Vergez S, et al. Consensus français sur la pratique de la chirurgie oncolgique ORL pendant la pandémie de COVID-19. Ann Fr Otorhinolaryngol Pathol Cerv Fac 2020 [Accepté pour publication].
[8] Société française d’ORL (SFORL). Cancérologie ORL épidémique COVID-19 : état des lieux le 25 mars 2020; 2020 [Accessible sur : https://www.sforl.org/wp-content/uploads/2020/03/SFCFP-SFORL-COVID-19-V4.pdf (consulté le 08/04/2020)].
[9] Société française d’ORL (SFORL). Conseils de bonne pratique chirurgie otologie et oto-neurologique; 2020 [Accessible sur : https://www.sforl.org/wp-content/uploads/2020/04/AFON-SFORL-2ieme-article.pdf (consulté le 06/04/2020) Société française d’ORL (SFORL)].
[10] AFOP. COVID-19 and ORL pédiatrique : conseils de bonne pratique de l’AFOP et du CNPORL 28 mars 2020; 2020 [Accessible sur : https://www.sforl.org/wp-content/uploads/2020/04/AFOP-COVID-19-pdf (consulté le 08/04/2020)].
[11] Tran K, Cimon K, Severn M, Pesaiva-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. PLoS One 2012;7:e35797, http://dx.doi.org/10.1371/journal.pone.0035797.
[12] Haut Conseil de la Santé Publique. Les actes invasifs ou manœuvres au niveau de la sphère respiratoire ou ORL pouvant provoquer cette aerosolisation de particules infectantes nécessitant le port d’un masque de type FFP2. Avis du 10 mars 2020 [Annexe 3].
[13] Haut Conseil de la Santé Publique. Réduction du risque de transmission par la ventilation et gestion des effluents 17 mars 2020; 2020 [consulté le 07/04/2020] http://www.hcsp.fr/Explore/egi/avis/rapport_d/level7/783.
[14] Société française d’hypothèse hospitalière SF2H. Avis relatif aux mesures d’hypothermie pour la prise en charge d’un patient considéré comme cas suspect, possible ou confirmé d’infection à 2019-nCoV; 2020 [Accessible sur : https://www.sf2h.net/generat-sf2h-2019-nCoV-publication-de-28-01-2020 (consulté le 07/04/2020)].
[15] Haut Conseil de la Santé Publique. Gestion des déchets d’activités de soins (DAS) produits au cours de l’épidémie de COVID-19, en particulier en milieu diffus 19 mars 2020; 2020 [consulté le 19 mars 2020; 2020 (consulté le 07/04/2020)].
[16] Institut national de recherche et de sécurité pour la prévention des accidents du travail et des maladies professionnelles (INRS). Risques biologiques; 2020 [Accessible sur : http://www.inrs.fr/riscus/biologiques/fq-fq-masque-protection-respiratoire.html (consulté le 11/04/2020)].
[17] Mowbray N, Ansell J, Warren N, Wall P, Torkington J. Is surgical smoke harmful to theatre staff? A systematic review. Surg Endosc 2013; 27: 3100–7.

[18] Pierce JS, Lacey SE, Lippert JF, Lopez R, Franke JE. Laser-generated air contaminants from medical laser applications: a state-of-the-science review of exposure characterisation, health effects, and control. J Occup Environ Hyg 2011; 8: 447–66.

[19] Société française d’anesthésie et réanimation. COVID-19 : principes de gestion des voies aériennes; 2020 [Accessible sur : https://sfar.org/principes-de-gestion-des-voies-aerien#es]. (consulté le 07/04/2020).

[20] Patel ZM, Hwang PH, Nayak JV, Fernandez-Miranda J, Dodd R, Sajjadi H, et al. Precautions for endoscopic transnasal skull base surgery during the COVID-19 pandemic. Neurosurgery 2020. http://dx.doi.org/10.1093/neuros/nyaa125 [pii: nyaa125].

[21] Pitkäranta A, Jero J, Arruda E, Virolainen A, Hayden FG. Polymerase chain reaction-based detection of rhinovirus, respiratory syncytial virus, and coronavirus in otitis media with effusion. J Pediatr 1998; 133: 390–4.

[22] Pitkäranta A, Virolainen A, Jero J, Arruda E, Hayden FG. Detection of rhinovirus, respiratory syncytial virus, and coronavirus infections in acute otitis media by reverse transcriptase polymerase chain reaction. Pediatrics 1998; 102: 291–5.

[23] Sidman JD, Fry TL. Exacerbation of sickle cell disease by obstructive sleep apnea. Arch Otolaryngol Head Neck Surg. 1988; 114: 916–7.

[24] Friedman M, Ibrahim H, Bass L. Clinical staging for sleep–disordered breathing. Otolaryngol Head Neck Surg. 2002; 127: 13–21.

[25] Association française du sommeil en ORL (AFSORL), Société française d’ORL (SFORL). Conseils de bonne pratique de l’Association française du Sommeil en ORL (AFSORL) et de la Société française d’ORL (SFORL). Utilisation de la ventilation par pression positive continue (PPC) durant l’épidémie du COVID-19; 2020. https://www.sforl.org/wp-content/uploads/2020/04/AFSORL-SFORL-COVID-19-2ième-article.pdf.