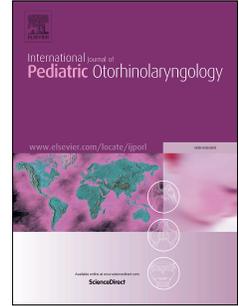


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Practical insights for paediatric otolaryngology surgical cases and performing microlaryngobronchoscopy during the COVID-19 pandemic

Authors

Claire Frauenfelder¹, Colin Butler^{1,2}, Ben Hartley¹, Lesley Cochrane¹, Chris Jephson¹, Robert Nash¹, Richard Hewitt¹, David Albert¹, Michelle Wyatt¹, Andrew Hall¹

¹ Great Ormond Street Hospital for Children

² UCL Institute of Child Health, London, UK

Corresponding Author

Mr Andrew Christopher Hall

Great Ormond Street Hospital

Great Ormond Street

Holborn

London

WC1N 3JH

020704059200

andrew.hall@gosh.nhs.uk

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Introduction

The current COVID-19 pandemic requires paediatric otolaryngologists to carefully select operative procedures undertaken during this time. However, the nature of many conditions treated by this group means that urgent operative evaluation and intervention in the airway, oral, and nasal cavities is still required. This paper produced by the Otolaryngology team at Great Ormond Street Hospital, London, UK aims to provide guidance for operative modifications to these necessary paediatric procedures at the time of the COVID-19 pandemic. Additionally, we share our experience performing microlaryngobronchoscopy in COVID-19 positive patients. It is recommended this paper be read in conjunction with supporting guidance from local otolaryngological societies and further literature as it becomes available.

Patient assessment for risk of COVID-19

Children have been infected from the early stages of the current pandemic, and those that are symptomatic have had a less-severe clinical illness than most adults admitted for treatment. Current data suggests that 15% paediatric COVID positive cases are asymptomatic and 25% present with features of an upper respiratory tract infection.[1] There are also concerns regarding the high viral load of asymptomatic paediatric patients.[2] A disproportionately high number of health care workers (otolaryngologists in particular) have been infected during the course of their recent clinical work.[3–5] The current risk of

transmission from asymptomatic patients with COVID-19 to clinicians is difficult to gage based on clinical patient assessment.

Patient COVID-19 status is being formally confirmed via testing, however not all patients requiring urgent surgical treatment of the oral cavity and respiratory tract will have been tested.

A key difficulty in paediatric otolaryngology practice is examining and operating in anatomical locations with high possibility of aerosol generation within a potentially asymptomatic population affected by COVID-19.[2] Asymptomatic patients are at risk of viral shedding during examination and procedural work involving these areas should also recognize the risk of transmission across adjacent surfaces.[6] Our current recommendation is all paediatric patients undergoing urgent otolaryngology procedures should be treated as suspected COVID-19 cases until proven otherwise due to the higher proportion of asymptomatic children carrying COVID-19. This is in keeping with guidance emerging from surgical societies and professional organisations.[7] While universal screening of patients prior to surgery would be ideal, few institutions around the world are currently equipped to do so due to restricted availability of testing resources. False negative test results remain an area of concern. As such, specific recommendations about which patients to test is currently evolving day by day and is beyond the scope of our discussion.

Personal Protective Equipment (PPE)

Appropriate PPE must be utilized to protect staff and local guidelines should reflect the increased risk of aerosol generating procedures (AGP), as described by the World Health Organization.[8] The following are the current guidelines published by ENT-UK:

Minimum PPE for urgent ENT procedures[9]

- FFP3 or Powered Air Purifying Respirator (PAPR) if fit test not achievable
- Long sleeved gowns
- Gloves
- Disposable eye protection

General Principles of paediatric patient treatment during COVID-19 pandemic

- Protection of staff, patient and future patients
- Only most urgent procedures should be performed
- Appropriate use of Personal Protective Equipment (PPE) at all times
- Where no appropriate PPE available, no oral cavity and invasive respiratory tract examination or procedure should be undertaken

Specific Airway & Procedural Principles

Intubation of the airway is widely recognized as a high-risk intervention for respiratory virus transmission to healthcare workers.[10] Procedural work undertaken in oral cavity and respiratory tract is also recognized to generate high volume of viral-laden aerosols.[11]

Only the most urgent procedures should be performed. Management of the airway during urgent paediatric otolaryngology procedures should aim to keep aerosol generation and gas escape from the airway to a minimum. Airway circuits should be closed for as long as possible and minimal airway or mucosal instrumentation should be performed.[12]

Procedures should be restricted to urgent components only and any suitable modifications or abbreviations to usual procedure should be employed, with the goal of limiting staff exposure to operating time and aerosol generation. No powered instrumentation should be used for soft tissue (e.g. microdebrider or laser). Minimal power should be used where drills or burrs are required for bone, however this work should be deferred wherever possible. Allow significantly more time for the procedure than it would usually take, especially while teams are adjusting to the operating conditions.

COVID-19 positive Microlaryngobronchoscopy: Practical Insights

Within our institution we have performed urgent microlaryngobronchoscopies in a COVID-19 positive paediatric patient in order to secure and evaluate a known difficult airway. We share our experience to assist other providers prepare to operate in this situation. Many of the general considerations for care of patients with COVID-19 have been explored in early literature, however there are a number of specific operative insights that may be useful.

MLB and rigid bronchoscopy should be considered very high-risk in terms of exposure to staff for the entirety of the procedure due to a combination of aerosol-generation and prolonged gas flow. The requirement for an open circuit delivery of gas/oxygen via the

nasopharynx or oropharynx combined with the manipulation of mucosa distributes a very high aerosol volume. Every effort should be made to shorten the procedure time before, during and after the case to minimize the exposure to viral aerosol by staff.[11,13]

As these procedures routinely involve oxygenating the patient via a nasopharyngeal or oropharyngeal airway, without any containment of aerosols, the follow advice applies:

- Only urgent cases should be performed
- All patients should be treated as infective
- Procedural time should be kept to a bare minimum with an expert provider performing the case
- Consider minimal 2 person operators given additional challenges of operating in additional PPE

a) Pre-operative considerations

- Time

All cases performed under these conditions are taking significantly longer time and patience with all team members during preparation is important. Especially with the addition of staff upskilling with donning and doffing of PPE, allow for up to double the usual time required for a case from brief to transfer of the patient back to intensive care or their ward environment. This should be taken into account in discussion with relatives and ward staff.

- Team preparation

Pre-operative briefing prior to patient arriving in theatre allows for targeted planning and optimized equipment preparation. A modified WHO checklist was utilized to adequately

prepare all staff as to their roles and responsibilities. Where time permits and while teams are learning about how to operate under these conditions, we found that short rehearsal of the procedure with the team beneficial. Our overnight theatre teams have begun their shift with a quick simulation to familiarize themselves with who will be performing what role and checking PPE stocking in the relevant theatres to ensure things are ready for an emergent case involving a COVID patient.

The role of simulation and its principles in preparation for scenarios such as this has also been recommended by the Royal College of Anaesthetists in the UK with supporting documents available to assist with local planning prior to an emergency event. This include activities such as rehearsal of donning and doffing in PPE or use of physical action cards to talk/walk through likely scenarios and how this may be planned for.[14] Any opportunities to practice 'in situ' as a team were felt to be invaluable at our subsequent debriefs.

- Team members

While the principle of keeping the number of team members within the theatre is important, overall the team may need to be larger and we have increased allocation of nursing staff, operating department practitioners for a COVID case, and changed our on-call theatre staff arrangements and numbers. We have also included the security team in briefing for the patient as they are key for safe transfer of the patient to and from the operating theatre, keeping contamination of doors, lifts etc. to a minimum as they walk with the clinical team while moving a COVID positive patient around the hospital.

During the case an additional nurse remained clean but with PPE donned in the preparation area with supply of anticipated extra equipment and disposables after different possible

outcomes of the procedure was discussed. This minimized delays while waiting for equipment. Also, a second operating department practitioner (ODP) was in the anesthetic room performing the same role: remaining clean but able to liaise with a runner allocated outside of the theatre for communication and to facilitate access to additional medication or equipment without contaminating other parts of the operating suite.

- Communication within the team is challenging

PPE required by involved staff can affect intra-operative communication owing to loss of visual cues and sound attenuation. As such particular attention should be given to minimize background noise and precise closed loop communication. Communication between team members in the theatre is more challenging and requires patience at a time of already-increased stress. Good briefing prior to the case helps with this as team members have an idea of what should be happening at each step. Speaker phones or walkie-talkies can be challenging due to PPE, however additional staff members and satellite members of the team with appropriate PPE donned were very helpful.

- Theatre Environment

Within our institution no negative pressure theatre environment is available and as such a normal pressure room with closed doors was used yet if present would be preferable.[12] Currently a group of nominated theatres for COVID cases have been allocated and stock/equipment within them has been modified.

- Transfer to theatre

The patient should be sent for once the team is ready with all equipment. PPE needs to be donned and checked prior to receiving the patient and time should be allocated even in emergent cases.

b) Anesthesia and airway management during MLB

Anesthetic rooms should not be used and induction of anesthesia should be in the operating theatre itself. Where the patient is being transferred from intensive care, minimal manipulation of airway adjuncts or suctioning should be minimized until all staff and equipment for the procedure is ready to begin immediately.

Insertion of an LMA at induction of anesthesia and prior to commencement of MLB/rigid bronchoscopy should also be considered. This decreases distribution of aerosols compared to open airway.[10,11] It allows a short but additional time period for preparation of equipment, clinician positioning, WHO surgical safety checklist etc while minimizing time with an open airway. Caution should be employed though as the LMA does not provide protection from spread of viral spread so should be used for the shortest possible period of time. There are many other guidelines being published by our anesthetic colleagues and these are beyond the scope of this discussion.

c) Intra-operative

- Equipment

Familiarity with the procedure and equipment is important and team members should be selected accordingly. Reassurance of anxious team members that in fact these procedures are well executed by your team on a regular basis is helpful. A brief but detailed discussion of how the procedure is expected to 'play-out' is important and allows nursing staff to

prepare a stockpile of equipment for all eventualities in close proximity to the theatre without contaminating other areas or risking staff by rushed doffing of PPE to leave the room. As mentioned, a PPE-protected clean member of nursing staff allocated to this equipment stockpile streamlined the time taken for the case. All equipment including light-leads, cameras, suction should all be set up and checked prior to arrival of patient in the room.

- Anticipate and verbalize potential difficulties

Attention should be paid to possible anatomical abnormalities or patient factors that will affect equipment selection (e.g. cleft palates with sumps of thick secretions, ex-premature infants with small airways that have been previously intubated with possible stenoses).

Suction attachments and laryngoscope blades set up should reflect these to streamline time and aerosol generation while manipulating the airway.

d) Post-operative

- Pause at the end of the case for safety

Doffing of PPE is high risk for transmission of aerosolized material and poor technique has been associated with increased COVID infection rates in healthcare workers.[10,11] Where the temptation is to remove PPE quickly at the end of the case, additional time should be allocated for this. As team members doff, team members need to supervise each other as they doff (especially while staff are new to PPE) to prompt the steps of doffing with proper hand hygiene to be performed between steps. Laminated guides on the wall in these areas are also helpful. This is especially important given the high level of contamination of the theatre and onto staff's PPE during MLB. Aerosol settling time of 20 minutes is allocated at

our institution between the patient leaving at the end of the case prior to any cleaning by nursing staff.

- Debrief

A short team debrief at the end of the case, especially during early experience of COVID cases being performed in the operating suite, allows for identification of steps to streamline, any system or equipment issues that should be addressed and to allow peripheral team members to learn from those involved in the case.

Other procedures

Flexible bronchoscopy via airway-adjunct or ETT

Flexible bronchoscopy should continue to be performed via an LMA or ETT with minimal opening or disconnection of the ventilatory circuit to prevent spread of aerosol.

Paediatric Tracheostomy

Tracheostomy is a high-risk procedure because of aerosol-generation and any elective paediatric tracheostomy should be delayed until active COVID-19 disease has passed in keeping with current guidance.[15] Any essential paediatric tracheostomy should proceed with PPE as for an AGP in suspected COVID-19 patients:

- Non-fenestrated cuffed tracheostomy should be used to minimise aerosol

- Initial advancement of the endotracheal tube should be performed prior to tracheostomy being made
- Ventilation to cease prior to tracheostomy tube insertion where possible and ensure swift and accurate placement of tracheostomy tube with prompt inflation of the cuff
- Ensure there is no leak from the cuff and the tube is secured in position
- Post-operative tube changes should only be limited to the initial tube change. Tube exchange should be deferred until the patient has ceased being contagious where possible

Humidification via tracheostomy tube following new paediatric tracheostomy should continue to be utilised to avoid crusting within the tube differing from adult guidance.[16] Careful clinical judgment is required when selecting the appropriate method of humidification and a heat moisture exchanger (HME) represents an alternative to wet circuit and may decrease aerosol generation. Nebulisers should be avoided and spacers with a metered dose inhaler provide an alternative method of medication delivery to the airway. Caution should be used as unlike adult patients, paediatric tracheostomy tubes classically have no inner cannula for removal and without humidification, are more likely to occlude. An occluded tube would necessitate disruption of the circuit in as an emergency, increasing likelihood of aerosol spread.

Paediatric Tracheostomy Tube Changes

Tracheostomy changes by staff should be minimized during the current COVID pandemic. Where possible the time to the next tracheostomy tube change should be extended or

avoided until no active COVID disease present, or negative status is confirmed. If essential, any tracheostomy change should proceed with PPE as for an AGP.

Paediatric Nasal and sinus surgery & Peri-orbital cellulitis

Non-urgent nasal or sinus surgery should not be undertaken during the COVID-19 pandemic. In peri-orbital cellulitis, the British Association of Paediatric Otolaryngology have recommended only considering operating on patients whose infection threatens vision or has developed an intracranial complication.[17] An external approach should be used where possible. Throat packs should be used with caution as insertion risks aerosol generation, however debris and secretions in the pharynx are likely to stimulate coughing on emergence from anaesthesia.

Paediatric nasal bone fracture reduction is not recommended at the present time unless there is a presence of a nasal septal haematoma. [17]

Other procedures

- Other urgent paediatric ENT procedures should be performed with a cuffed or micro-cuff ETT where possible
- Tube-selection should be targeted to minimising a leak around the tube
- Operating time should be kept to a minimum

Optimal management in the era of COVID-19 necessitates careful consideration of staff safety while continuing to ensure best possible care of the paediatric otolaryngology patient. As further evidence develops as to COVID-19 the recommendations of this paper may be subject to change. In addition, we recognise the availability of PPE worldwide remains variable and resource restriction may result in necessary variance.[8]

References:

- [1] X. Lu, L. Zhang, H. Du, J. Zhang, Y.Y. Li, J. Qu, W. Zhang, Y. Wang, S. Bao, Y. Li, C. Wu, H. Liu, D. Liu, J. Shao, X. Peng, Y. Yang, Z. Liu, Y. Xiang, F. Zhang, R.M. Silva, K.E. Pinkerton, K. Shen, H. Xiao, S. Xu, G.W.K. Wong, C.P.N.C.S. Team, SARS-CoV-2 Infection in Children., *New England Journal of Medicine*. (2020). doi:10.1056/nejmc2005073.
- [2] K.-Q. Kam, C.F. Yung, L. Cui, R.L.T. Pin, T.M. Mak, M. Maiwald, J. Li, C.Y. Chong, K. Nadua, N.W.H. Tan, K.C. Thoon, A Well Infant with Coronavirus Disease 2019 (COVID-19) with High Viral Load., *Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America*. 361 (2020) 1701. doi:10.1093/cid/ciaa201.
- [3] P.Z. PH, N. JV, Fernandez, M. JD, S. H, J. RK, Statement From: Stanford University School of Medicine Departments of Otolaryngology-H&N Surgery and Neurosurgery, Neurosurgery. (2020).
- [4] D. Lu, H. Wang, R. Yu, H. Yang, Y. Zhao, Integrated infection control strategy to minimize nosocomial infection of coronavirus disease 2019 among ENT healthcare workers, *Journal of Hospital Infection*. (2020). doi:10.1016/j.jhin.2020.02.018.
- [5] D. Wang, B. Hu, C. Hu, F. Zhu, X. Liu, J. Zhang, B. Wang, H. Xiang, Z. Cheng, Y. Xiong, Y. Zhao, Y. Li, X. Wang, Z. Peng, Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China., *JAMA*. 323 (2020) 1061. doi:10.1001/jama.2020.1585.
- [6] N.V. Doremalen, T. Bushmaker, D.H. Morris, Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1, (n.d.).
- [7] Magennis P, Kumar N, British Association of Oral & Maxillofacial Surgeons & ENT-UK: Guidance PPE for patients with emergency oropharyngeal and nasopharyngeal conditions whose COVID Status is unknown, (2020).
- [8] World Health Organisation, Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19), (2020).

[9] ENT-UK, Guidance for ENT during the COVID-19 pandemic, (24 March 2020)

<https://www.gov.uk/government/publications/wuhan-novel-coronavirus-initial-investigation-of-possible-cases/investigation-and-initial-clinical-management-of-possible-cases-of-wuhan-novel-coronavirus-wn-cov-infection#criteria>

[10] K. Tran, K. Cimon, M. Severn, C.L. Pessoa-Silva, J. Conly, Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review., PloS One. 7 (2012) e35797. doi:10.1371/journal.pone.0035797.

[11] J.C.-H. Cheung, L.T. Ho, J.V. Cheng, E.Y.K. Cham, K.N. Lam, Staff safety during emergency airway management for COVID-19 in Hong Kong, Lancet Respir Medicine. (2020). doi:10.1016/s2213-2600(20)30084-9.

[12] Safe Airway Society, Consensus statement: Safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group, Medical Journal of Australia. (n.d.).

[13] Public Health England, When to use a surgical face mask or FFP3 respirator, (2020).

[14] Faculty of Intensive Care Medicine, 'Think SIM' for your COVID Preparations. Accessed March 24. <https://icmanaesthesiacovid-19.org/covid-19-airway-management-principles>

[15] ENT-UK, ENT-UK Guidelines: Framework for open tracheostomy in COVID-19 patients, (2020).

[16] Royal College of Anaesthetists. UK, COVID-19 airway management principles. (March 2020)

[17] Kuo M. Otolaryngology, British Association of Paediatric Otolaryngology. BAPO statement on SARS Cov2 and Paediatric Otolaryngology Provision, (2020).