

Paediatric ICU Local Infection Prevention & Control Risk Assessment Specific to Covid-19

8th July 2020 – SBAR

Purpose

- The purpose of this SBAR is to suggest appropriate risk-assessed infection control measures for PICU relating to the current Covid-19 pandemic.
- The proposed solution is based on 3 streams:-
 1. Patient testing and screening
 2. Risk based Patient cohorting pathways specific to Paediatric Intensive Care
 3. Risk based use of PPE specific to Paediatric Intensive Care
- It is accepted that this SBAR will be subject to change based on changing Covid-19 epidemiology and population background levels of risk.

Situation

- There is an ongoing worldwide Covid-19 pandemic.
- Following an initial pandemic peak in cases in Scotland in April / May 2020 cases have now fallen significantly.
- Current pandemic modelling in Scotland suggests a sustained ongoing decline in cases, although the risk of a second wave or ongoing community transmission is present.¹
- Universal infection prevention and control guidance pertaining to intensive care units during pandemic SARS CoV2/Covid-19 have been issued by the combined public health agencies of the UK. These have been updated regularly as dictated by changing epidemiology and PPE availability.²
- This guidance is currently deployed in PICU at the Royal Hospital for Children and has been used since early April 2020 due to the presence of sustained community transmission of SARS CoV2.
- Current infection control measures, combined with physical infrastructure, are impacting on PICU's ability to provide adequate isolation or cohort areas for patients requiring intensive care, the majority of whom do not have Covid-19 disease.
- Epidemiological data has emerged during the pandemic that suggests paediatric patients have a markedly reduced risk of significant SARS CoV2 infection compared to adults.
- Epidemiological data suggests that infection control risks may be different between adult and paediatric intensive care units.

Background

Risk of Covid-19 in PICU versus adult ICU

- During the current Covid-19 pandemic there has been a significant difference in Covid-19 epidemiology between adult and paediatric populations.
- The paediatric population has been significantly less affected than the adult population.
- There have been 2,488 confirmed and 4,161 confirmed and suspected deaths in adults in Scotland. There have been no deaths in children in Scotland < 15 years old – Scot Gov data 05/07/20
- There have been 18,287 confirmed infections in Scotland. In Scotland only 1:10,000 children and adolescents were diagnosed with COVID 19 compared to 1:300 of the adult population (June 2020). This has reflected international experience where few children have required hospitalisation for the direct effects of COVID 19 or the newly emergent multi-system inflammatory disorder temporally associated with SARS CoV2 (PIMS-TS).
- 1047 children were tested in Glasgow between 05/02/20 and 06/30/20. Only 12 children tested positive and the last positive case in a child occurred on 30/4/20. Approximately 2500 children have been tested in Lothian with only 15 testing positive,
- A total of 518 patients > 15 years of age have been admitted into adult ICU in Scotland between 01 March and 14th June 2020. The majority (90%) have occurred in those > 45 years old.³ In contrast in Glasgow PICU only 2 children have tested positive for SARS CoV2. Edinburgh PICU has also had only 2 children test positive. All children in PICU in Scotland made full recoveries.
- In the UK and Ireland 70 laboratory confirmed cases of SARS CoV2 have been reported to the Paediatric Intensive Care Audit Network as of 17th June 2020.⁴ In contrast adult data for ICU admission in England, Wales and Northern Ireland documents 12,539 adult admissions with confirmed COVID-19.⁵
- Contact tracing is now well established in Scotland. A total of 383,722 tests on 275,751 people have been performed in Scotland since the start of the pandemic (to date 5/7/20 – Scotgov data). Currently 3000-6000 people are being tested every day. The number of proven new infections nationally is now reliably < 20 per day. The contact tracing system is now tracing > 1800 contacts of positive patients per week.

Conclusion

- The risk of Covid-19 disease is falling.
- Infection Control risks relating to Covid-19 currently appear to be different between adult and paediatric intensive care.
- The risk of Covid-19 disease currently appears to be reduced in Paediatric ICUs versus Adult ICUs.
- Adult ICU infection control measures specific to Covid-19 based on adult ICU population risk profiles are therefore not directly transferable to Paediatric ICU.

Assessment

Paediatric ICU specific infection control risk analysis and testing

- Few children require PICU admission with primary COVID 19 or PIMS-TS but the majority of PICU admissions in winter will have respiratory symptoms and fulfil the putative case definition. The inability to reliably clinically identify COVID 19 and the paucity of knowledge regarding rates of asymptomatic infection in children will ensure that air-borne PPE requirements will be mandatory in the initial management of all who require aerosol generating procedures which are widespread in this environment until formal risk assessment and virology results are available.
- Managing the infection control requirements of a pandemic virus which only affects very small numbers of children but which could have serious effects on staff during an epidemic of a second and much more ubiquitous infectious respiratory virus (RSV) is very problematic. Minimising the potential for cross infection whilst not compromising patient care is a very difficult balance using estate which was not designed for this purpose.
- The key difference between ICU and Ward based Infection Control risk is the presence of Aerosol Generating Procedures (AGPs). The presence of AGPs currently requires full PPE including FFP3 mask, visor, long sleeved gown and gloves. The presence of AGPs makes cohorting patients challenging.
- The evidence behind AGP risk assessment is limited. The most recent assessment by WHO (2014) states that there is only consistent evidence that there is an increased risk of transmission for the following procedures: tracheal intubation, tracheotomy procedure, non-invasive ventilation, and manual ventilation before intubation as AGPs.⁷
- PICU differs from adult ICU in employing more non-invasive (NIV) respiratory support techniques which are currently classified as continuous AGPs. Current Glasgow PICU management utilises non-invasive ventilation (NIV) in 11.5% of patients and high flow oxygen in 35.5%.⁴ These techniques are very effective and often employed first line in e.g. RSV bronchiolitis. However the availability of only 1 negative pressure cubicle in PICU will almost certainly require a cohorting approach in 4 bedded bays. The presumptive cohorting of RSV positive and presumed COVID negative infants undergoing continuous AGPs represents an infection control risk requiring a detailed infection control risk assessment.
- The classification of high flow oxygen as an AGP is based on consensus rather than evidence and is currently under review.⁶ High flow oxygen flow rates in paediatric practice are typically significantly lower than in adult practice (typically 4-20L/min in paediatrics versus up to 60L/min in adults). It could reasonably be expected that lower flow rates may result in lower levels of any potential aerosol.
- Paediatric endotracheal tubes (ETT) in those receiving invasive ventilation are much smaller than adult ETTs. They are therefore more likely to obstruct with respiratory secretions which poses an immediate threat to life. In addition paediatric ICU patients have a lower respiratory functional residual capacity and higher metabolic rate compared to adult ICU patients making them more prone to rapid and severe desaturation events in the event of a partial or complete ETT blockage. In our experience current in-line ETT suction devices do not reliably perform well in small ETTs necessitating intermittent and at times emergent open ETT suctioning. Availability of in-line suction devices for smaller sizes of ETTs (below 4.5 ETT) is currently limited. Open ETT suctioning is classified by HPS/PHE as an AGP requiring

full PPE precautions. A WHO published systematic review of the evidence reached an alternative view that ETT suctioning was not aerosol generating although the evidence base is poor.⁷ The current requirement to don full PPE for open suction for all patients, irrespective of Covid risk, may risk inadvertent ETT blockage, delay lifesaving interventions and be difficult to justify given the current apparent low risk of SARS-CoV2 infection in PICU patients assessed as low risk of Covid-19.

- The current Infection Control requirement for isolation and full AGP PPE precautions at all times in patients receiving high flow oxygen and NIV and open ETT suction, irrespective of Covid risk or status, presents a risk to the effective safe management of patients within PICU as we enter winter planning. This is because:
 - The inability to cohort low risk patients with alternative diagnoses receiving high flow oxygen, NIV and other AGPs will significantly reduce bed availability and patient access to PICU
 - The requirement for nursing and medical staff to wear full AGP PPE at all times for close to 50% of patients, irrespective of individual patient risk, will place physical and psychological demands on staff for prolonged periods of time that are difficult to justify given the low overall risk of SARS-CoV2 infection in children, impacting on staff morale.
- Testing It is recognised that false negative rates of 2-29% occur with Covid-19 RT-PCR testing.⁸ Sensitivity may depend on sample site: BAL 93%, Sputum 72%, Nasal swabs 63%, Throat swabs 32%.² Asymptomatic paediatric patients undergoing elective cardiac surgery already undergo pre-operative viral screening for SARS CoV2. Edinburgh PICU currently screens its in-patients twice weekly for SARS-CoV2.

Conclusion

- PICU-specific Infection control risk assessment surrounding aerosol generating procedures, particularly high flow oxygen, NIV and open ETT suctioning, in patients assessed to be low risk, should be addressed.
- Viral testing of asymptomatic paediatric patients is already ongoing within the RHC, Glasgow as well as PICU, Edinburgh.
- Efficacy of viral testing is uncertain and should not be used as the sole determinant of risk stratification in paediatric patients.

Recommendation

1. Patient testing and screening

a. Screening of Patients requiring elective admission to PICU

It is recommended that all paediatric patients undergoing elective surgery requiring PICU admission undergo pre-operative SARS CoV2 screening (combined throat and nasal swab).

b. Screening of all patients in PICU

It is recommended that all patients being admitted to PICU, irrespective of reason for admission, be screened for SARS CoV2 via a combined viral throat and nasal swab on admission. An endotracheal aspirate will also be obtained if patient is intubated.

c. Ongoing PICU surveillance SARS CoV2

It is recommended that all patients in PICU will undergo routine weekly SARS CoV2 surveillance (combined throat and nose swab and endotracheal aspirate if ventilated). This will occur on a Tuesday or Wednesday to optimise laboratory pathways.

2. Risk based patient cohorting

PICU will be split into Red (known/suspected COVID or contact), Amber (Low risk/test results unavailable) and Green (low risk/test results available) areas depending on a formal clinical risk assessment. Patients will be able to move between areas as risk assessment and viral testing results develop.

Criteria for ICU placement as follows:

Red* Patients Known/Suspected COVID or contact	Amber* Patients Low risk or test results unavailable	Green* Patients Low risk / test results available
<ul style="list-style-type: none"> +ve COVID-19 test result 	<ul style="list-style-type: none"> COVID-19 test result unavailable 	<ul style="list-style-type: none"> COVID-19 test result negative
<ul style="list-style-type: none"> Known close contact of +ve COVID-19 patient 	<ul style="list-style-type: none"> No close contact with known or suspected cases 	<ul style="list-style-type: none"> No close contact with known or suspected cases
<ul style="list-style-type: none"> Unexplained fever >37.8C (Consultant decision) 	<ul style="list-style-type: none"> No unexplained fever >37.8C (Consultant decision) 	<ul style="list-style-type: none"> No unexplained fever >37.8C (Consultant decision)
<ul style="list-style-type: none"> Loss of senses of taste or smell 	<ul style="list-style-type: none"> No changes in sense of smell/taste 	<ul style="list-style-type: none"> No changes in sense of smell/taste
<ul style="list-style-type: none"> Respiratory symptoms 	<ul style="list-style-type: none"> No respiratory symptoms or clear alternative respiratory diagnosis 	<ul style="list-style-type: none"> No respiratory symptoms or clear alternative respiratory diagnosis

***If patient scores elements from more than one category on table they will be placed in higher risk category e.g. patient has elements of both Amber and Red – patient will be placed in Red pathway.**

Red Zone – Pod 1 (Pod 1 Cubicles + Bed Bay 1-4)

Bed space order: Cubicle 5 > 12, 6-7, thereafter 4 Bed bay 1-4 followed by 4 bed bay 8-11 if required. Thereafter Bed Bay 13-16 as last resort with potential movement of “Green” patients to Ward 1E.

Amber Zone – Pod 1 (Pod 1 Cubicles + Bed Bay 8-11)

To be used as a transitional area pending viral testing results.

Bed space order: Cubicle 6-7, followed by 4 bed bay 8-11 if not occupied by Red Zone patients. Thereafter Bed Bay 13-16 as last resort with potential movement of “Green” patients to Ward 1E.

Green Zone – Pod 2 (includes also Beds 8-11 until such point as required for Red/Amber Zone)

Special considerations

- **Haemonc / Immunosuppressed patients**
- Cubicles 17 & 18 (if no indication for Red or Amber Zone). Cubicle 12 if not available.

- **Overflow to Ward 1E**
- In event of PICU becoming full an attempt would be made to prioritise “Green” patients to Ward 1E in the first instance. If “Red” or “Amber” patients also require expansion into Ward 1E this would preferentially be to Cubicles with PPVL capacity.

Cleaning of PICU Cohort Areas

Cleaning of cohort areas will adhere to standard Infection Prevention and Control guidance.

3. Risk based use of PPE specific to PICU

Droplet Precautions - Personal Protective Equipment (PPE)

Fluid Resistant Surgical Mask (FRSM) plus or minus eye protection (based on risk assessment) must be worn **if within 2m of any patient at all times**. Single use plastic aprons and gloves should be used if providing direct patient care but these must be removed and hands decontaminated between patients or between tasks if gloves are contaminated with blood or body fluids.

FRSM and eye protection can be used sessionally or as single use:

- FRSM must cover both nose and mouth
- Must not be allowed to dangle around the neck after or between each use
- Must not be touched once put on
- Must be changed when moist or damaged
- Must be worn once and then discarded
- Hand hygiene must be performed after removal and disposal

Aerosol Generating Procedure – Personal Protective Equipment (PPE)

- FFP3 mask
- Face visor
- Long sleeved surgical gown
- Single gloves

FFP3 mask, visor and long sleeved surgical gown can be used sessionally or as single use.

If used sessionally –

- Single used plastic apron must be worn over gown and disposed of between patients
- Single use glove must be removed and hands decontaminated between patients or between tasks if gloves are contaminated with blood or body fluids.

PPE Risk Assessment and review mechanism

It is recommended that proposed levels of PPE be reviewed regularly. This will be achieved via monthly meetings of the Revisiting Covid Guidance Team.

Red* Pathway Known / Suspected COVID or contact	Amber* Pathway Low risk / test results unavailable	Green* Pathway Low risk/test results available
<ul style="list-style-type: none"> Minimise staff present 	<ul style="list-style-type: none"> Minimise staff present 	<ul style="list-style-type: none"> Minimise staff present
<ul style="list-style-type: none"> AGP Cohort – full AGP PPE 	<ul style="list-style-type: none"> AGP Cohort – full AGP PPE 	<ul style="list-style-type: none"> AGP Cohort – droplet precaution PPE + risk assess face visor use
<ul style="list-style-type: none"> Intubated in single room – full AGP PPE 	<ul style="list-style-type: none"> Intubated in single room – droplet precaution unless AGP (see below for AGP) 	<ul style="list-style-type: none"> Intubated in single room – droplet precaution PPE + risk assess face visor use
<ul style="list-style-type: none"> AGP in single room – full AGP PPE 	<ul style="list-style-type: none"> AGP in single room – full AGP PPE 	<ul style="list-style-type: none"> Open ETT suction – droplet precaution PPE + face visor – aim to minimise open suction with use of in-line suction.
<ul style="list-style-type: none"> Self-ventilating, no AGP, single room – droplet precaution PPE. <p>Surgical mask for patient if tolerated. Can deliver oxygen under surgical mask if required.</p>	<ul style="list-style-type: none"> Self-ventilating, no AGP, single room – droplet precaution PPE. <p>Surgical mask for patient if tolerated. Can deliver oxygen under surgical mask if required</p>	<ul style="list-style-type: none"> Planned intubation / extubation / bronchoscopy / upper GI endoscopy – droplet precaution PPE + face visor Unplanned extubation / circuit disconnection – droplet precaution PPE + face visor Planned ventilator / circuit change – droplet precaution PPE + face visor. Ventilator must be placed on standby prior to circuit change to minimise AGP.

*Staff have the option to employ full AGP PPE for any patient, irrespective of pathway, if they risk assess it is required for their personal safety.

List of AGPs

Procedures currently considered to be potentially infectious AGPs for COVID-19 are:

- Intubation, extubation and related procedures, for example, manual ventilation and open suctioning of the respiratory tract (including the upper respiratory tract).
- Tracheotomy or tracheostomy procedures (insertion or open suctioning or removal) bronchoscopy and upper ENT airway procedures that involve suctioning.
- Upper gastro-intestinal endoscopy where there is open suctioning of the upper respiratory tract.
- Surgery and post mortem procedures involving high-speed devices.
- Some dental procedures (for example, high-speed drilling).
- Non-invasive ventilation (NIV); Bi-level Positive Airway Pressure Ventilation (BiPAP) and Continuous Positive Airway Pressure Ventilation (CPAP).

- High Frequency Oscillatory Ventilation (HFOV).
- Induction of sputum.
- High Flow Nasal Oxygen (HFNO).

Evidence Base

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<https://www.gov.scot/binaries/content/documents/govscot/publications/research-and-analysis/2020/06/coronavirus-covid-19-modelling-epidemic-scotland-issue-no-5/documents/coronavirus-covid-19-modelling-epidemic-scotland-issue-no-5/coronavirus-covid-19-modelling-epidemic-scotland-issue-no-5/govscot%3Adocument/coronavirus-covid-19-modelling-epidemic-scotland-issue-no-5.pdf>
2. COVID-19: infection prevention and control guidance
Public Health England
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/893320/COVID-19_Infection_prevention_and_control_guidance_complete.pdf
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6. Aerosol Generating Procedures Version 1.3 June 2020. HPS / NHS Scotland.
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