

COVID-19 and the NICU Balancing Safety and Care

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I dedicate this column to the late Dr. Andrew (Andy) Shennan, the founder of the perinatal program at Women's College Hospital (now at Sunnybrook Health Sciences Centre). To my teacher, my mentor and the man I owe my career as it is to, thank you. You have earned your place where there are no hospitals and no NICUs, where all the babies do is laugh and giggle and sleep.

One cannot watch television or pick up a newspaper without being bombarded with COVID-19 stories and information. In our lifetimes, we haven't seen anything like this; while the adult world is the focus of this pandemic, we in the NICU must contend with the risks associated with parental involvement in the care of their babies.

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There is no evidence of vertical transmission of novel coronavirus between mother and baby at this time. Infants born to COVID-19 infected mothers have not tested positive for the disease, nor has novel coronavirus been found in amniotic fluid or breast milk. (1,2) While this is ostensibly good news, it must be tempered with the fact that this is a hitherto unknown pathogen and that while our knowledge base is growing daily, there is still much we don't know. It is my opinion that one cannot be too cautious dealing with COVID-19; better to modify the policy as evidence becomes available than to wait for evidence to form policy. Unfortunately, the latter approach has been most common and has likely led to the explosion in cases outside the Wuhan epicentre.

Many hospitals have prohibited visitors during this crisis. This approach is certainly prudent given the increasing evidence of asymptomatic transmission but may not be in the best interests of the neonatal population. Regardless, in Toronto, there are discrepancies between institutions. (A copy of Toronto's guideline is attached. NOTE: this is an example and not intended as medical advice or protocol). (17) A previous column (December 2019) discussed the relationship between respiratory care and neuro-developmental outcome, including the benefits of direct parental involvement and kangaroo care. The clear benefits of parental contact must be weighed against the risks to the baby and those who care for it. The unit in which I am employed has limited visitation to one parent at a time. Overnight stays are permitted, parents are forbidden to leave the NICU area until leaving the hospital, and face masks must be worn at all times.

The major concern when breastfeeding an infant of a COVID-19 infected mother or symptomatic parent under investigation is twofold: prevention of transmission to the infant and protection of those charged with the infant's care. It is not breastmilk that is of concern, rather the potential infection of others via droplet. The safest approach here is to have parents wear masks to reduce the chance of droplet exposure during breastfeeding; however, the utility of regular surgical masks in preventing transmission of COVID-19 is questionable. (3) The same applies to kangaroo care since exposure is identical. During skin to skin contact, consideration may be given to having the involved parent thoroughly clean the area of contact in addition to routine hygiene. (4) Ideally those entering the room of a COVID-19 infected patient should wear a properly fitted N-95 mask, (5) but the international breakdown of our supply chain has resulted in an acute shortage of PPE; thus surgical masks are being used as a substitute. There is much debate over the utility of these masks to protect caregivers but increasing evidence in their ability to reduce transmission. (6)

The best way to contain an outbreak like this is to test and isolate. (7) China and South Korea have amply demonstrated the efficacy of this approach. However, a combination of reagent supply shortage and a concurrent shortage of swabs (ironically mostly manufactured in Italy) have made this impossible as the pandemic spread to the rest of the world, and the fact that the number of infections outside the epicentre now greatly outnumber those within is a testament to the necessity of testing. Given the possibility of asymptomatic transmission, it would behoove us to assume infection in all until proven otherwise and act accordingly. This is a case of what we don't know can indeed hurt us.

The risks associated with aerosol-generating medical procedures are well known, particularly in the adult population. It stands to reason that a premature infant generates less aerosol than an adult; however current guidelines call for the infant of a confirmed or suspected parent to be treated in the same manner as an adult patient. (8) Compounding this is the unusually high viral titre with COVID-19 infection, potentially making droplets more likely to lead to infection. (9)

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In the adult population, when mechanical ventilation is required, lower tidal volumes (3-6mls/kg) and higher PEEP has been rec-

ommended, although recent anecdotal reports from the front lines are less clear. (These anecdotal reports are coming from Twitter® posts from ER physicians on the front line and as such do not constitute evidence). A letter to the editor of The American Journal of Respiratory and Critical Care Medicine, March 2020, suggests a different approach. One that is echoed by other anecdotal reports and describes an atypical ARDS picture associated with COVID-19. In this case, it is not a lack of recruitment that is the problem but rather uneven ventilation/perfusion matching. (10) HFO is potentially more prone to aerosol generation, and if used, airborne precautions are advised. (11) (This is an excellent reference for the management of all COVID-19 patients.) A filter on the expiratory limb of any ventilated patient may be considered provided it does not interfere with the normal operation of the machine and are changed in accordance with the manufacturer's recommendations.

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It is perhaps fortunate we have little data regarding neonatal infection with COVID-19. It seems that mechanical ventilation for symptomatic positive infants may only be required for other reasons (i.e., extreme prematurity as the limited number of cases seen thus far have not required intubation) and that neonates exhibit the same relatively mild symptoms of older children.(12) Recent reports of 2 infants succumbing to COVID-19 in the U.S. may be a harbinger of things to come.(13) It is my sincere hope this is not the case.

Perhaps the most significant risk NICU staff face for infection are each other. Given the increasing rate of community-acquired infection and asymptomatic transmission, we are at the same or greater risk than the general population. Fomites are a known source of transmission (particularly plastic and stainless steel). (14) We are all potentially exposed this way, particularly when using public transit as grab bars, and handles are all made of plastic and stainless steel. The importance of meticulous, regular hand

hygiene, and avoidance of touching the face cannot be emphasised enough.

The concept of social distancing is difficult to achieve in the NICU environment due to the necessity of close contact during procedures and the proximity of workstations. Staff are well-advised to wear face masks at all times as a matter of policy to mitigate the risk of infection. Patient assignments should be such that staff can be stationed as far away from each other as is practically possible. COVID-19 doesn't discriminate based on credentials!

This pandemic will affect all of us one way or another. As NICU caregivers, we may be at reduced risk relative to our adult colleagues; however, as the crisis worsens, some of us may be seconded to adult areas. Now would be a good time for those assigned exclusively to the NICU to brush up on adult ventilation protocols. The Toronto Centre for Excellence in Mechanical Ventilation provides an excellent resource.(15)

As evidence is gathered, the guidelines and recommendations we practice under are subject to change. Given limited numbers (although still increasing exponentially), the fact that there is presently no evidence to suggest vertical transmission or risks associated with breastmilk, for example, doesn't necessarily mean risks do not exist. Healthy, younger patients are dying from COVID-19. While the mean age of infection is 45 years, the mortality rate for those <60 is approximately 0.32% compared to 6.4% in those >60 and 13.4% in those >80. (16) 0.32% seems pretty small, but this represents a 3-fold increase over that of seasonal flu in the general population.(17) We're all playing Russian roulette; the only difference is the number of bullets in the gun. I, for one, prefer not to play.

Finally, while high-frequency jet ventilation (HFJV) is commonly used in the NICU setting, there is currently no commercially available adult jet ventilator in North America. There are a few machines available in Toronto cobbled together in labs at the University of Toronto years ago. These have been used as a last-ditch effort when other modes have failed. The Oscillate study of conventional (CV) vs. high-frequency oscillation (HFO) ventilation in adult respiratory distress syndrome (ARDS) found HFO detrimental, but similar research on HFJV has not been performed.(18) The benefits of HFJV in the neonatal population may well apply to the adult population; the high mortality rate from ARDS surely should provide an incentive to its study in this population. Now seems to be a good time.

I have been asked to explore the possibility of using the LifePulse HFJV machine in larger patients. I shall keep readers apprised of any progress in that regard.

We are facing the challenge of our careers and, indeed, our lives. The world is counting on us. Please, everyone, take care of yourselves and each other. While always important, it is now more so than ever.

References:

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4 <https://ilca.org/covid-19/>

5 <http://www.cidrap.umn.edu/news-perspective/2020/02/unmasked-experts-explain-necessary-respiratory-protection-covid-19>

6 [https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370\(20\)30073-0/fulltext#seccesectitle0012](https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(20)30073-0/fulltext#seccesectitle0012)

7 <https://www.aljazeera.com/news/2020/03/testing-tracing-backbone-coronavirus-response-200318191010542.html>

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9 Dr. David Graham, Johns Hopkins All Children's Hospital, personal communication

10 <https://www.atsjournals.org/doi/pdf/10.1164/rccm.202003-0817LE>

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17 <https://www.nytimes.com/article/coronavirus-vs-flu.html>

18 <https://www.nejm.org/doi/full/10.1056/NEJMoa1215554>

19 https://www.obgyn.utoronto.ca/sites/default/files/toronto_region_covid_19_management_of_pregnant_women_and_neonates_with_suspected_or_confirmed_covid_march_17_2020.pdf. This is an updated version of the above link.

for teaching and training users of the LifePulse HFJV in Canada. He is not involved in sales or marketing of the device nor does he receive more than per diem compensation. Also, while the author practices within Sunnybrook H.S.C. this paper should not be construed as Sunnybrook policy per se. This article contains elements considered "off label" as well as maneuvers, which may sometimes be very effective but come with inherent risks. As with any therapy, the risk-benefit ratio must be carefully considered before they are initiated.

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Disclosures: The author receives compensation from Bunnell Inc

