

Bronchiolitis – An evidence based approach to clinical practice - Pediatric Grand Rounds-20260925_073014-Meeting Recording

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● **Calderon, Delia** started transcription



Calderon, Delia 0:07

There you go.



Kamat, Deepak M 0:07

Yes, she has started. Good morning and welcome to Pediatric Grand Rounds. Just a quick reminder that the CME code is in the chat box and is working. And also, please complete the evaluations at the end of the presentation, which

those help us give provide feedback to the Grand Round speaker. It's my great

pleasure to introduce this morning's Grand Round speaker, Dr. Nirupama

Kannikeswaran, who I know for almost 25 years now. She is a professor of pediatrics at Central Michigan University.

an attending physician in the Division of Pediatric Emergency Medicine at Children's Hospital of Michigan, where she has practiced for more than 20 years. She's a clinical clinician educator and researcher, currently serving as research director for Pediatric Emergency Medicine Division and the abstract chair for AAP Section.

on emergency medicine. She serves as a champion for the faculty development for university pediatricians. Her scholarly work spans bronchiolitis, procedural sedation, pediatric trauma, and health disparities with several peer-reviewed publications. A dedicated mentor, she has guided several medical students



Leigh Shapleigh 1:11

It.



Kamat, Deepak M 1:28

residents, fellows, to many publications. And I was fortunate enough actually to co-

edit a book with her. We should be out soon. So, Dr. Kandi Kannikeswaran, thank you very much for accepting our invitation and the floor is yours.

RK **Roopa Kannikeswaran** 1:47

Thank you, Dr. Kamat, for the kind introduction, and thank you for the opportunity and the invitation for the Grand Rounds. Today, we are going to be talking on bronchiolitis, how to apply evidence-based practice to our day-to-day clinical practice.

This.

Our learning objectives are to look at the current evidence-based guidelines for bronchiolitis. And we will be specifically focusing on the use of high flow nasal cannula, which I am sure you guys use abundantly at your institution, just like at my institution. And we are going to demystify high flow nasal cannula and say why it is not as useful. And we are going to review evidence on feeding while on high flow support. And we are going to look at a risk stratification tool to quickly identify children with bronchiolitis who would require escalation of support.

As you all know, bronchiolitis is the most common cause of hospitalization among infants and accounts for actually almost one-fifth of hospitalization in infants, especially in the winter months. And the proportion of bronchiolitis hospitalizations to the total hospitalizations among infants keeps increasing. And that is why it's very important to apply evidence for the management of this condition.

These are the current guidelines, and I put it up here because, as you all know, the diagnosis of bronchiolitis is clinical. There is absolutely no specific test that tells you that this child has bronchiolitis. All of the societies, whether it's in the Americas or the Canadian or Australasian,

They recommend supportive therapy along with hydration, whether it is oral hydration or NG or IV hydration. There is no role for any diagnostic testing or use of bronchodilators, epinephrine, corticosteroids. And as regards to antibiotics, The American Academy of Pediatrics Febrile Infant Guidelines actually state that bronchiolitis is a low risk criteria for serious bacterial or invasive infections, and therefore diagnostic testing is not indicated other than checking for urinary tract infection. Now, let's look at high flow really closely. High flow recommendation, the AAP does not have any specific recommendation on when to use high flow. And in

fact, they just recently came out with the Delphi guidelines, which I will talk about a little later. And all other societies

say that high flow should not be our first standard of care, but it actually should be a rescue therapy when there is hypoxemia or low flow oxygen therapy fails. But this does not what happened in real time practice.

This is a study by Peltier et al, and they looked at the FIS database of all the 47 children's hospitals. And as you can see, the ICU admissions for bronchiolitis has doubled. And if you can see here, there's a steep increase in the use of high flow. The dip is only during the COVID era, and it's gone up by more than 130%. Along with the use of high flow, the use of non-invasive ventilation for bronchiolitis has also increased, while the use of low flow or no oxygen has gone down.

What this has led to is that it has led to an increase in the ICU admissions without increase in severity of bronchiolitis. And as you will see in the next few slides, it has not changed any outcomes for infants with bronchiolitis.

So a little bit about why high flow helps. And I want to confess that some of these sites are AI generated, although it's my own material, but AI just made it pictographically better. So we know that it provides humidified oxygen and therefore improves mucociliary.

clearance. It also most importantly flushes out the anatomic dead space and washes out the CO₂ from the upper air passages and therefore prevents rebreathing and improves alveolar ventilation. And it also prevents the airway collapse because it provides positive pressure. So the net effect is it prevents hypoxemia, it improves the work of breathing, and also gives better tolerance of breathing. These are the proposed mechanisms of high flow.

Now, the first study that led to the widespread use of high flow nasal cannula was the PADIS-1 trial, which was a multi-center randomized trial, which was conducted across 17 hospitals in Australia and New Zealand. They randomized children one-to-one to high flow oxygen and they used

2 liters per kg per minute versus low flow oxygen, which they defined as 2 liters per minute. And they enrolled infants less than 12 months of bronchiolitis and who required supplemental oxygen. But as you can see, they actually started supplemental oxygen on

kids with even SPO₂ of, sorry, 92 to 94%, whereas all the societies say that hypoxemia is less than 90%. And their primary outcome, they looked at escalation of

care or treatment failure.

And in treatment failure, they did not use objective criteria, but they said that if you met three of the four criteria, like you have persistent tachycardia, persistent tachypnea, increased oxygen requirement, and they had an early warning trigger in their

electronic health record. If the infant met those criteria, that was considered as escalation of care and treatment failure.

And they also did a couple of things which is not usually done in randomized control trial, which is 1, they said that patients in the standard nasal cannula oxygen can be switched over to high flow nasal cannula oxygen because of ethical reasons you cannot avoid giving.

an infant in distress, high flow support, but it meant that there was dilution of the groups. And also they said that irrespective of this objective criteria, if the clinician taking care of the patient felt that the child needed escalation of care, they could escalate.

Care.

So this is their demographics, and they had a large cohort of kids. They had around 1,700 kids, and majority of them were older children, greater than six months of age.

And they also included people with

a comorbid disease, right, like chronic lung disease and congenital heart, which normally we do not include in kids with bronchiolitis studies.

And here is their main outcome. As you can see, this is a Kaplan-Meier curve. And on the y-axis, you have the proportion of infants who remain free from treatment failure. And this is the day since randomization on the X curve.

So pretty quickly, you can see there is a separation among the high flow oxygen and standard oxygen therapy group. And that happens within the first 24 to 48 hours.

And we all know most of the infants with bronchiolitis who have high flow nasal cannula failure,

fail within the first 12 hours. So this is not something new. And they found that those kids who were on high flow failed significantly less. It was 23% versus 12%.

And as regards to the escalation of care, there was also a significant difference that standard oxygen therapy kits, 16% failed versus 7%. And they said that the number needed to treat to prevent one treatment failure was 9. So this is all

Very good, right? It's a very impressive outcome. And if you look at it, you are like, wow, high flow really helps and we should be using high flow in all these kits. But

remember, the treatment failure was that the child had improvement, persistent tachycardia, persistent tachypnea or hypoxemia. But did they make any difference in the real-time outcomes which we care, which is what they looked at secondary outcomes, which is like there was no significant difference between these two groups when it came to hospital length of stay, the oxygen duration, the percentage of kids that went to the ICU, the intubation rates, or adverse events. So none of the outcomes that we as clinicians care about was shown to be true between the high flow nasal cannula group versus the low flow nasal cannula group.

We already discussed some of the study limitation, which was that the outcome, the primary outcome itself was not an objective measure. Most importantly, 30% of infants were escalated to therapy on clinician gestalt alone.

which meant that if I as a clinician looked at this infant and felt that there was respiratory distress and I did not like the way that the child was breathing, I could change into high flow. The other important thing is even those infants who were on standard oxygen therapy who were risk with high flow nasal cannula did really, really well. And the problem, other problem with this study, as we talked about, was their oxygen saturation at which they started supplemental oxygen was at the higher end. Most of the time, we would not start these kids on oxygen at the time.

that level and there was huge site variation.

And since that time, we've had about three other randomized control trials which have enrolled greater than 2,000 patients. So while all studies of high flow versus low flow oxygen have found an improvement in the respiratory rate, in the physiologic parameters, such as work of breathing, none of them have found improvement in length of stay, oxygen duration, intubation rates, return rates, or readmission rate at all. In fact, what is worse is now, because we have all these high flow settings,

the ICU admissions have increased A whopping 300%. And this is not good because we all know that there is shortage of PICU beds elsewhere. And what is worst is we have increased our healthcare costs without meaningfully changing outcomes in children with bronchiolitis.

So why should we de-implement high flow nasal cannula? One is that most of our randomized control trials have clearly shown that most of the kids with moderate

bronchiolitis and even some severe bronchiolitis will do very well on standard oxygen therapy.

GF **Gary Francis** 14:51
Mm.

RK **Roopa Kannikeswaran** 14:56

And we can always use high flow as a rescue therapy rather than jump immediately onto high flow as the first line of therapy, which is what all major guidelines say, which however, we do not do in practice. So how can you be implement high flow. So there are several strategies and there are several QI studies that have come up. So the main two main strategies are you can pause that initiation and also wean aggressively. Those are the two.

two main categories by which we can be implement.

So instead of clinician just stalled, we now have pathways, bronchiolitis pathways, where there are objective criteria as to when you should be starting high flow nasal cannula. This was the first big study that came out of the American Academy of Pediatrics. It is value in patient QI collaborative. They used both these methodologies. They used the pause as well as the holiday arm. What the pause means is rather than jumping immediately to high flow nasal cannula,

you pause, put a bronchiolitis scoring, and if the infant meets severe criteria, then you start the high flow. So with this QI initiative, they were able to decrease the high flow initiation to down by 32%. And in the holiday,

they would give them time off, like scheduled time off the high flow nasal cannula, and thereby decrease the high flow nasal cannula duration support by 28%. And what is the best thing about the QI initiative? It showed that these can be achieved. without any change in length of stay or, you know, adverse events like increase in the positive pressure ventilation. There are other studies that have now come out as well. And the first one is from Cincinnati Hospital, the other one from Inova Hospital. And All of these have shown that if you use standardized criteria, if you do group huddles, if you give real-time feedback to clinician using the electronic health record, and if you talk to the families as to how they can accept a little bit of tachypnea and retractions,

all have shown that you can safely decrease the use of high flow nasal cannula. You

can even half it to 50% of the original use without changing any adverse events such as ICU admissions or the positive pressure ventilation needs.

And how do you wean? So there are three other strategies that have been looked at for weaning. One is the, again, the VIP collaborator where they gave like a scheduled time off high flow for a few hours. And if the infant did well, then you change. decrease it to 50% and then turn it off in the next hour.

And this is the this study, the Soydon study, is actually done by nurses. Rather than a clinician doing the weaning, the nursing at bedside looked at work of breathing and the respiratory oxygen index, which we will talk about in a little bit, which is a proxy for severity of bronchiolitis.

Not only were the infant started to be weaned earlier, but it also reduced the high flow nasal cannula duration. It reduced the ICU stay by one day. It reduced the hospital stay by one day, and there were no differences in the safety measures, which were the rates of intubations, readmission, or non-invasive ventilation use.

At our own hospital, at Children's Hospital, what we do now is that once we know that an infant is stable for three to four hours on whatever high flow setting they were started, we place a communication order for beaning. The infant is turn down to 50% or to 1 liter per kg and we reassess within the hour. And if there is no change in the work of breathing or, and we have set parameters, which you can see in the last column here, if there is no increase in the heart rate, if there is no hypoxemia,

then we wean them in the next hour.

And this was our results. We implemented an updated bronchiolitis pathway. We made three changes. First, we only put them on high flow nasal cannula for severe bronchiolitis. Second, we started feeding kids on high flow nasal cannula. And Third, we started aggressively weaning them. And as you can see, it made a significant difference for the duration of high flow as well as in the hospital length of stay. That is a pretty big difference in the hospital length of stay. And as you can see here, our safety measures, the PI.

CU admissions, the need for positive pressure ventilation, the ED return visits or hospital admissions were unchanged with the updated bronchiolitis pathway.

So in summary, what can we do? We should be starting most of the kids with standard and low flow oxygen. In fact, in 2026, we have the first time an expert panel guidelines that was published in Hospital Pediatrics just recently.

They recommend initiation of high flow for only impending respiratory failure or for

significant hypoxemia and not for work of breathing chest wall retractions, which is why commonly we put them on high flow.

If we put the kids on high flow, we should be beaming them deliberately and aggressively.

Now, let's switch gears and talk about a little bit on feeding on high flow nasal cannula. At our institution, when we first started high flow nasal cannula support, we almost 100% kept the kids NPO. And that was because we were worried whether there would be an incoordination between the suck and swallow reflex in these young infants who are on high respiratory support leading to aspiration. Then we looked at some ICU, the critically ill kids are still fed through an NG tube and they all seem to do well.

And so we thought, why not we apply the same rationale to these kids on high flow nasal cannula?

So we performed a study to look at whether feeding the infants in the emergency department who are hospitalized for high flow nasal cannula for bronchiolitis was associated with a shorter hospital length of stay without increase in return ED visits or hospital readmissions.

So we enrolled children less than 24 months of age with bronchiolitis. They had to be hospitalized on high flow. And as I already briefly mentioned, we updated our protocol, bronchiolitis protocol, to feed the kids and beam aggressively. We excluded kids who had other comorbidities. And so these were healthy kids with bronchiolitis, but we did include premature kids.

So our primary outcome was the hospital length of stay and our primary exposure of interest was feeding. And we hypothesized that the fed group would have decreased length of stay. And we also secondary outcomes, we looked at whether they were started on IV fluids.

adverse events related to nutrition such as aspiration, choking, gagging, and ICU admissions and written ED visits. I'm sorry, this is a busy table. I just put this in to show that we had a lot of younger infants, about 50% of our infants were less than 12 months of age. And we had a good amount of kids who were premature, who was like 21 months of age. And these were kids with moderate bronchiolitis, as shown by the ROX index.

And what did we find? And these infants were on high flow nasal cannula support up to a maximum of 1.5 liters per kg. And our hospital length of stay decreased significantly in the fed group, 39 hours versus 56 hours.

Of course, our biggest limitation was, as you can see, because this was a retrospective chart review, we had a lot of kids whose feeding status was unknown. So we did a lot of sensitivity analysis, thinking that, you know, the unknown was all non-fed.

And still, our length of scale did not change.

Then what we did was we looked at our median length of stay, which was 45 hours.

And then we said we will do a logistic regression analysis, controlling for other variables such as age, prematurity, viral testing, severity of

bronchiolitis. And even when we adjusted for all of these, the length of stay for the fed infants was less. The odds were 1.88 times higher that the infant who was fed would be discharged home sooner. And why does this happen?

Because if you have a young infant who's not fed, they are hangry. They are crying.

And crying leads to increased work of breathing and retractions. You see, you as the clinician think crying equates to respiratory distress.

and therefore they go up on the high flow support. So feeding is really good for kids on high flow nasal cannula to wean them.

We did not see any adverse events at all. And at the time we published our study, there was another group, Gray et al. They looked at patients where they initiated enteral nutrition in the wards. But most of their infants were on lower oxygen support of 1 liter per kg per minute.

and only 11 patients experienced an adverse events. And of these, four were choking, which is really not any big deal. And when they say possible aspiration, they were concerned about aspiration. There were no kids with aspiration pneumonia.

And around 5 kids had worsening respiratory distress with feeding, but none of these kids ended up needing escalation of support. So in compared to Gray's study, for our study, our age was even lower. Like we were able to feed even



Lynch, Jane L 27:16

I.



Roopa Kannikeswaran 27:21

infants as young as two months of age or even less than a month of age. And remember when I showed you around 21% of our patients had a history of prematurity. We began oral nutrition in the emergency department and our maximum high flow rate



Lynch, Jane L 27:22

Yeah.



Roopa Kannikeswaran 27:41

on these kids that were fed was 2 liters per kg. And so we fed kids across all severity and they did really, really well.

Of course, our study had limitations that we talked about. You saw that there was a large proportion of unknown, but we did sensitivity analysis. And all our sensitivity analysis showed the same findings that those infants who were fed had.

significant decrease in the hospital length of stay. Our findings, of course, cannot be extended to the people with comorbid medical conditions and those requiring immediate ICU care or positive pressure ventilation.

So what do we do now? I can tell you that the proportion of patients that fed has increased close to 90% because the rest of the 10% are getting directly admitted to the ICU. Those we do not feed. The proportion of people that are requiring IV hydration has significantly decreased.



Lynch, Jane L 28:46

No.



Roopa Kannikeswaran 28:53

So we do not start most of our kids with bronchiolitis on IV fluids at all if we are able to watch them feed in the emergency department. So I want to leave with one summary that oral nutrition is safe. And if you feel that

the infant is not able to feed orally. You can even use an NG tube to feed. But in our experience, most of the kids do very well with oral nutrition. And we also looked at solids versus liquids, because the thing is, do

feeding them solids cause more harm and it has not been shown to be true as well.

So feed your babies on high flow. They will thank you and you would be able to wean them quicker and you would be able to discharge them sooner.

The last thing I want to talk about is risk stratification in bronchiolitis. If you are working as a senior resident in the winter months and fall months, you can see that all kids with bronchiolitis look the same.

right? And so amongst the cohort of kids who you admit, there should be a way to

quickly identify which infants need escalation of care. So high flow failure rate occurs in about 20 to 30 percent of infants with bronchiolitis. When I say failure rate, What we mean is these kids go on to need positive pressure ventilation. So we all know that historically what we looked at is if a kid has a comorbid medical condition like Down syndrome, congenital heart disease, pulmonary hypertension, chronic lung disease, they are at increased risk for escalation of care. But the truth is, majority of infants with bronchiolitis do not have these risk factors. And so far, how we have looked at bronchiolitis risk stratification is by using the bronchiolitis score. I don't know about you guys, but remembering these scores is very, very cumbersome. And performing these scores, like, you know, tachypnea of 60 gets you a score of 1, as opposed to 80 that gets a score of 2, is very, very hard. And plus, the way I.

look at work of breathing, is not same as somebody else. This is work of breathing scoring. So these scores have not been validated at all. And in fact, when there was a prospective comparison of the most commonly used bronchiolitis scoring, these scores performed really poorly in predicting outcomes. So what we need in bronchiolitis is a simple tool that we can use, that we can perform at bedside, which is very objective and whereby we can use early risk stratification and identify those kids that are at high risk of needing positive pressure ventilation.

This is the new score, which is called as respiratory oxygenation index, and it's calculated as oxygen saturation over the FIO₂, and it's a ratio to the respiratory rate. All of this you can do at

bedside without any problems. This was actually first described in adult patients with pneumonia with acute hypoxemic respiratory failure. And subsequently, they have validated the score in hypoxemic respiratory failure, both in pneumonia and COVID-19. And in adults, the lower the ROX score, greater than, less than 4.8, shows that your odds of getting onto mechanical ventilation are higher.

So what we did at our hospital, we conducted A prospective study on 373 children who had a, who had clinical diagnosis of bronchiolitis and were admitted to the hospital. Our need for positive pressure ventilation was 13.1. We defined high flow failure as need for positive pressure ventilation.

As you can see here, those kids that required positive pressure ventilation were more likely to have lower oxygen saturation, more hypoxemic, and had greater length of stay, which all makes sense. There was a significant difference in the ROX.

between those kids that required positive pressure ventilation versus those kids that did not require positive pressure ventilation.

But what is neat is we divided the ROX scores amongst our cohort into quartiles. And as you can see, the kids in the lowest quartile whose ROX was less than 5.3 had three times higher odds of requiring

positive pressure ventilation. And we adjusted this model for age, gender, apnea, prematurity, and still the ROX, the kids with the lowest ROX had three times higher odds. And when we looked at it, there was like a stepwise progression.

And also the kids, the risk of positive pressure ventilation doubled for those kids with the lowest ROX, whereas it stayed steady for the first three quartiles of ROX.

Unfortunately, however, the sensitivity and specificity were around 70%.

percent respectively. And this is because we know in addition to hypoxemia as being the cause of respiratory failure in bronchiolitis, there is also an obstructive component and work of breathing that the ROX does not account for.

Now, obviously, this was a single center study, and we enrolled only a convenient sample of patients. And there was a very small proportion of patients who required positive pressure ventilations, and we did not do serial measurements. So these are the limitations.

But despite these limitations, there is a signal that the ROX can be used at bedside to predict risk of care escalation in bronchiolitis. So

Then what we did was we applied the ROX to 900 patients with bronchiolitis during the next couple of seasons of bronchiolitis. And as you can see here, there is a stepwise progression

of the risk for need for positive pressure ventilation as the ROX scored lowest. And the cutoff seems to be 5.5. So the lower the ROX, the higher the need for positive pressure ventilation.

Going on, so we thought, so we, for the first two studies, we put ROX on those kids after the high flow nasal cannula was initiated. So then we thought, what if we applied the ROX to kids that are presenting at triage?

before high flow is even initiated? And can we predict which kids will require care escalation? And we did a multicenter study. This was a planned secondary analysis at three big pediatric emergency departments. And we looked at ROX respiratory rate as well as ROX heart rate.

But as you can see here, we looked at the first is the triage ROX and the pre-high flow ROX. Unfortunately, it did not do well. There was no difference in the kids who

required escalation of

care amongst with the pretty high flow or the first. They did not predict well. There was a signal with the ROX HR, but it was still not significant.

And you can see here the area under the curve is less than 0.5, which means it's equivocal and it's not good as a distinguishing point. So what we know is the pretty high flow ROX and the triage ROX is not good enough.

tool for care escalation. But one of this study's limitation was that we calculated the ROX pre-high flow, and which meant that we used an FIO₂ of 0.21 for the calculation of ROX.

In that study, around 40% of kids subsequently went on to have oxygen requirement, and therefore the pre-high flow may not be the best way to say whether ROX was useful or not useful.

There have been studies in the ICU as well, use looking at ROX. The Melissa study is from France, where they looked at infants with less than six months of age, and these were kids with severe bronchiolitis. And they looked at our zero as well as the first hour after high flow initiation, and they did not find any significant differences in ROX. And however, they defined high flow failure as by work of breathing, which might be a limitation. The second study was by Nasi Mento. And they looked at 102 infants and two PICUs. And here, the ROX was significantly lower amongst the kids that had high flow nasal cannula failure. But the hour that the ROX was significant was 12 and 24 hours.

and not at initiation. So.

To summarize, is ROX ready to use? Probably not yet. As I said, most kids will have hypoxic failure, but some of the kids will also have obstructive failure with mucus plugging and ROX does not.

include the work of breathing. And ROX so far has shown mixed results, and we do not have consistent studies where serial measurements were done for ROX to show that it is really useful. I do think that there is a

value for it in the wards around the 6 to 12 to 24 hour mark, which is when most of the high flow nasal cannula failure appears. And I also feel there is a role for it in the ED disposition to say if you have a kid with a lower ROX,

You should be thinking of admitting the kid to the ICU rather than to the floor.

So what are the future directions? We do need multi-center studies. We do need serial ROX measurements. And now we are actually looking at whether ROX combined with some clinical factors such as work of breathing,

and serially monitoring the ROX will give us some better answers and better sensitivity to predict care escalation. And we are also thinking whether ROX will be a useful tool to guide clinicians for high flow.

initiation rather than escalation triggers. So to summarize the grand rounds today, I want to say that use high flow sparingly, become more comfortable with Getting used to seeing kids in respiratory distress, and...

showing the evidence to the parents and educating your team that high flow is not the solution and it does not change outcomes. Feed your kids liberally while on high flow nasal cannula and look at ROX for risk stratification.

With that, I thank you for your attention and I will be happy to answer any questions.



Lynch, Jane L 43:04

No.



Kamat, Deepak M 43:09

Thank you, Dr. Kannikeswaran for that wonderful presentation on bronchiolitis. I see a question in the chat box from Dr. Wood. Did you look at breastfeeding on infants who are on high flow breastfeeding?



Roopa Kannikeswaran 43:23

Yes, yes. So they were both breastfed and bottle fed infants. And contrary, we had expected breastfeeding would be harder on high flow and it was not. So as I said that our infants were even the less than two months two to five months did really well. And so any sort of feeding did not make any difference. So.



Kamat, Deepak M 43:52

Okay, then another question by Dr. Lipsitt. Taking your reasoning one step further, are we admitting too many infants with bronchiolitis? Could more parents monitor their kids at home?



Roopa Kannikeswaran 44:05

Yes, that's been shown to be very true. We are not only admitting many kids, we are admitting many kids to the ICU because of the high flow situation. So what you can do at the bedside prior to admission, you can suction the kid, make the kid

feed, have the parent get comfortable with a little bit of retractions. And most of the mild bronchiolitis should go home. And some of the moderate ones, if they are able to feed without difficulty in your emergency department, even though they have retractions, they are kids and they're obviously not hypoxic. They should be able to be discharged home without admitting to the hospital.



Lynch, Jane L 44:52

Do you have, I'm not seeing the sign out in here, or maybe it's just the title's not changed.
I was gonna...



Kamat, Deepak M 45:01

Sorry, I think there is another question by Dr. Courand. For those infants on low flow oxygen or high flow oxygen, do we have an upper limit respiratory rate to move to NG phase?



Roopa Kannikeswaran 45:15

There is no upper limit of respiratory rate to move to NG feeds. And in fact, when talking to parents, they feel that NG tube is very invasive. And so at our hospital, we do NG feeds only for those kids that end up in the ICU on high clonal cannula support. The rest of them we have been using just oral feeds. So low flow, really there should be no question that everybody should be on just oral feeds. High flow, if you have a kid at the maximum settings, and if you're worried that the kid might end up needing a transfer to the ICU, maybe. talk to parents about NG hydration, but we've not had success because parents feel that NG tube is more invasive and they prefer feeding them orally rather than NG tube.



Kamat, Deepak M 46:13

Thank you, Dr. Kannikeswaran. The question by Dr. Pearson should need for frequent suction to maintain adequate feeding be an admission criteria for those kids who don't have hypoxia.

RK **Roopa Kannikeswaran** 46:26

Not frequent suction, but I would say that in the younger infants, especially like less than two to three months of age, the kids that blow the raspberry bubbles, that is an adult version of, I am not able to maintain my oral secretions. Those kid needs to be watched.

If you're just suctioning the nose, but they're able to have an open mouth and if they're able to feed, they should still be able to go home.

 **Kamat, Deepak M** 46:56

This question by Dr. Perlman, ROX will perform much better if you combine it with protocol to win FIO₂ whenever SAO₂ is above 96%. For example, if baby is on 50% oxygen and setting at 100%.

She might be able to be on 25% oxygen and do just as well with our weeks half as high.

RK **Roopa Kannikeswaran** 47:24

Yes. So for the weaning, you don't even need to use the ROX, right? Because if your kid is on a FIO₂ of 100%, the ROX might be higher, I mean lower. So in those cases, you're just seeing the work of breathing. And if the infant has been stable on the current setting for two to three hours, half it, and then half it every hour, and then see if they do well. So.

 **Kamat, Deepak M** 47:56

This is a question by Doctor Bonilla: Since ROX is dependent on FiO₂ as one of the criteria, what SPO₂ of the patient do you normally start meaning FiO₂?

RK **Roopa Kannikeswaran** 48:10

We accept anything below 90%, and in some kids, like even 89, 88%, we start winning the FIO₂.

 **Kamat, Deepak M** 48:22

Doctor Sanders, does feeding or high flow show more improvement on hospital length of stay? I suspect we are more inclined to feed if worker breathing is less.

RK **Roopa Kannikeswaran** 48:38

Any feeding actually improves length of stay. And as I said, the infants who are kept NPO are very angry and hungry, and that actually leads them to cry more and you falsely attribute it to increased length of stay. And definitely all the studies have shown that

there is like decreased length of stay. So you do not have to worry about aspiration even unless the kid has severe distress that you are thinking that the kid will end up going to the ICU. Most of the kids on the floor on high flow nasal cannula support can be safely fed. We have fed kids.

Kids up to two liters per kg, irrespective of the FIO₂, so...

 **Kamat, Deepak M** 49:24

There's a question by Dr. Svatek. Additionally, to be clear, you no longer use respiratory score, just ROX for your bronchiolitis patients.

RK **Roopa Kannikeswaran** 49:34

Not yet. So as I said, that the ROX is very new data, and therefore we have used it only for our research purposes until now, until we know that this works well at the inpatient settings. And all the studies that I have presented on ROX have been done in the ED setting or the PICU setting.

We don't have anything yet on the hospital setting, which is what we are working on right now. And as I said, the limitation of ROX is we don't have the work of breathing incorporated in it. And I feel that there should be some. So I'm looking at ROX plus the work of breathing as my next study now.

Soap.

 **Kamat, Deepak M** 50:20

Okay, next question. Would you recommend that parents who take their children home to monitor get a pulse oximeter to use?

RK **Roopa Kannikeswaran** 50:29

No, it's been clearly shown. There was a large study actually in bronchiolitis at the hospital setting where parents, where physicians responded to continuous pulse oximetry rather than the patient. And that study clearly showed that we should not

be monitoring continuous pulse oximetry in infants with bronchiolitis. So answer is no.
whether at home settings or hospital settings.



Kamat, Deepak M 50:57

Next one, with RSV vaccines, have you noticed any change in admission rates?



Roopa Kannikeswaran 51:03

Yes, significant. In fact, I had it as one of my slides, extra slides, and I didn't put it in. It's not only shown to decrease by 75% the admission rate, and also the severity of bronchiolitis has been shown to gone down.

And now we have very good data from throughout the world, Spain, France, US, which all show it. And interestingly, because this is not a vaccine, the acceptance by families has been really high. Because as you can imagine, the post-COVID era, our regular immunizations have come down, but RSV for some reason, the acceptance by parents has been really good. And so because it is pictured as not a vaccine, but it's a monoclonal antibody and the maternal vaccine rates, it's still For that, for protection of RSV, we do not have robust data yet, but the data signals that the severity is actually going down as well.



Kamat, Deepak M 52:16

Thank you, Dr. Kannikeswaran. Any other questions, comments for Dr. Kannikeswaran?

I don't see any, so we have plenty of time to go. Yeah, sure, sure.



Roopa Kannikeswaran 52:33

Dr. Kamat, can I say one thing? If anybody is interested, I know Dr. Sutter told me that you guys don't feed kids about 1 liter per kg. And if anybody wants us to share our protocol for the feeding or high flow nasal cannula support initiation, I would be more than happy.

To do that as well, so.



Kamat, Deepak M 52:58

Thank you, thank you.



Roopa Kannikeswaran 53:16

Thank you, Dr. Kamat, for the opportunity.



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