Ventilator Associated Pneumonia in Pediatric Severe Traumatic Brain Injury - Pediatric Grand Rounds-6-5-2026-Meeting Recording

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36m 46s

Calderon, Delia started transcription

Ranch, Daniel 0:03

I can do a quick intro, and then I'll let you introduce Franz. But good morning, everybody, and thank you for joining UT Health San Antonio Pediatric Grand Rounds. Another special guest today, one of our very own, Dr. Franz Puglio, who will be speaking.

Wu, Theodore 0:08

Okay, sounds good.

Ranch, Daniel 0:24

As a reminder, as you long, please don't forget to mute your devices. Also, the CME code will be placed in the chat, so you can check there for the code. I'm going to let Dr. Wu take over and introduce Dr. Buil.

Wu, Theodore 0:38

Hey, good morning. I'm Ted Wu, one of the pediatric intensivists here.

LS

Leigh Shapleigh 0:41

I'm not working on it. Calm down.

Wu, Theodore 0:45

Um...

Ted Wu, one of the pediatric intensivists, and I have the pleasure this morning to introduce one of our graduating fellows, Dr. Franz Puil. He's here at UT Health San Antonio. Dr. Puil, a little bit about him. He earned his medical degree from Texas Tech University.

in El Paso and completed his pediatric residency here in San Antonio and continue on in our fellowship where he's continued to kind of distinguish himself in both clinical care and education. He's board certified in pediatrics and going to be board eligible in pediatric critical care. He's received multiple
honors, recognizing his dedication to teaching and service, including earning a Best Teacher Award to medical students, and then also awarded A Texas Medical Education of Champion of Health as well. His academic interests focus on critical care outcomes, as well as quality improvement initiatives.
including development of a fading protocol for infants on high flow nasal cana, who we worked with our pediatric hospitals with. Today he's going to be presenting on a lot of our ventilator associated pneumonias in our pediatric traumatic brain injury population.
He is deeply committed to medical education and teaching, and he has accepted a position with our Division of Pediatric Critical Care. So please join me in welcoming Dr. Puell.

Puyol, Franz 2:29

Thank you, Dr. Wu, for that intro. As he said, I'm Dr. Franz Puil, one of the graduating pediatric critical care medicine fellows here at UT Health San Antonio. And today I'm going to be presenting on ventilator-associated pneumonia in pediatric severe traumatic brain injury. A lot of intensive care sounding wards there, but
I promise there will be some tie back to general pediatrics as the presentation goes on.
I have no disclosures.
So severe traumatic brain injury is defined as having a GCS of less than 9, and this affects 37,000 children from the ages of 0 to 14 years of age every year in the United States.
The leading causes vary by age. However, falls, motor vehicle collisions, and abusive head trauma are generally the top three culprits that contribute to severe traumatic brain injury.
And this is something that carries a pretty high mortality, about a 20% mortality risk, and over 50% of survivors have some form of unfavorable outcomes after six months, including lower educational attainment, psychiatric conditions, and disability, usually neurological disability.
And as time has gone on, there is an increased recognition of TBI in general, both in

adults and children as a chronic medical condition, given the degree of associated comorbidities that we see in this population.
So one thing that I was interested in is how this affects the immune system and how the downstream effects of that, generally the intensive care setting, but also further along the line in these patients' course. So immune system impairment has been described in multiple studies with animal and in vitro studies following a TBI.
with inappropriate elevations of anti-inflammatory cytokines such as IL-10 that rise as early as the 1st 12 hours since the injury. Now initially you get this very, very strong inflammatory response, as you can see from the diagram here. But as time goes on and as soon as you know the first day or so of injury, there is an immunosuppression
done by the immune system, whether or not it's inappropriate or appropriate, given that there's also severe brain inflammation, there is a compensatory anti-inflammatory response to the degree that can cause some degree of immunosuppression.
So while the immune system in general is inappropriately shifted to an anti-inflammatory state, specifically alveolar macrophages specifically become less able to secrete chemokines for neutrophil recruitment. And this diagram kind of shows how a CNS injury can affect the lungs in some way. So essentially alveolar macrophages are not able to migrate
recruit or migrate neutrophils to the lungs. There's also a decreased T-cell function as well.
And then hyperosmolar therapy, which is something we use very, very frequently for intracranial pressure management, such as using 3% saline or mannitol. These also diminish neutrophil adhesion, but specifically we're talking about 3% saline, which is what we more commonly use in the pediatric population.
So given the impairment on the immune system, patients with severe TBI are at risk for nosocomial infection, with one study describing nearly one-third of these infections being ventilator-associated pneumonia or VAP, as I'll be referring to it from here on out.
In one adult study, nearly 50% of TBI patients developed VAP, with risk increasing about 7% with each day of endotracheal intubation.
Pediatric data is sparse, but the two cohort studies that we do have with STBI reported incidents of about 25 to 41 percent.
So this is a generally busy slide, but I will simplify it here in a minute. But VAP is

essentially defined by the CDC as a new pneumonia where the patient is on mechanical ventilation for greater than two consecutive calendar days since the day of the event. And the date of the event meaning when the VAP happened, two days from when the patient was intubated. And
For the sake of our population, we're going to ignore this box on the right that says immunocompromised.
Now, I know I already said that these patients already have immunosuppression from the injury itself, but these are specifically referring to patients who have had chronic immunosuppression or are on immunosuppression medications. But what these two boxes essentially boil down to is that there's two ways to diagnose the pneumonia for this population, either
You have clinical findings, and there are age-based clinical findings and x-ray findings. Now, sometimes there aren't as many obvious clinical findings, but if there's an isolated pathogen with x-ray findings, that can also qualify as being defined as a VAP. So there's two big diagnosis.
ways to diagnose a VAP. And they essentially involve both needing an x-ray and clinical findings, or you can have an isolated pathogen with a few less clinical findings or clinical findings that are more subtle.
So what we know about VAP in the pediatric STBI population is not a lot, but in the absence of TBI at least, we know that the incidence of pediatric VAP is significantly lower, it's about 5 to 10%, with most isolated organisms being gram-negative, specifically pseudomonas.
So the first study that looked at this population by Hamill, and I hope I'm saying that name correctly, this was back in the mid-2010s, looked at TBI and ICP lowering management practices, essentially the standard things that we do in the intensive care unit to lower ICP and how, and if they have any increased risk of developing VAP.
And what they found was that neuromuscular blockade infusion, barbiturate comas, and cooling blankets, which we use often to get them to normothermia, were found to be independently associated with the development of VAP. Now, granted, these are generally more second-tier therapies. Neuromuscular blockade and barbiturate comas are not usually the first things we jump to with these patients, unless we are really, really struggling with intracranial pressure management.
What they did also find is that any antibiotic use and nutrition route were not found to be protective or associated with VAP.

And then also they noted that that was associated with increased time on mechanical ventilation as well as increased ICU and hospital length of stay.
And there was a second study published about three years ago by Gagan. Again, I hope I'm saying that name correctly, but they studied the risk factors that led to the development of early VAP, and they defined early VAP as within seven days in the same population of STBI pediatric patients, and they had a cohort of 90 patients. One thing that was interesting about their study is that they had
two criteria to define it. They had both the CDC criteria, which I kind of already outlined, and also they had like a presumptive diagnosis that the patient had been treated with antibiotics for at least seven days. They presumed that patient had a VAP if there was no other source of infection that was actively being treated. I am assuming they did this because it was a retrospective review.
The study did find that abusive head trauma was associated with the development of VAP. And then they also found that cumulative days of exposure are 3% nebulized saline, not to be confused with hypertonic boluses that we give to lower ICP, 3% nebulized saline is to break up secretions in the airway, was associated with decreased incidence of VAP for
both the criteria that they had.
And then contrary to the prior study, they did not show an association between the development of VAP and the use of neuromuscular blockade or targeted temperature management. They also did not find barbiturin infusion to be associated with the development of VAP. However, they lumped barbiturin infusion and benzodiazepine infusions as one variable. They referred to them as sedatives.
So these were not independently analyzed as one as separate variables.
And also contrary to the prior study, they did not have any difference in their bat population having increased length of intubation, hospital length of stay, or ICU length of stay.
I think the most significant thing to take away from this study is that functional status scales at times of discharge were higher in the VAT patients, indicating that there was some increased functional impairment at the time of discharge for this population in this study.
They also report both these studies reported that MSSA or methicillin sensitive Staph aureus and H flu were the most commonly isolated organisms in their in their vap cohort, which is different than the pseudomonas that is usually isolated from pediatric patients. However, I will have a

Big caveat is that in VAP both in studies and also in personal clinical experience. that microbiomes seem to be all over the place, and it's very difficult to nail down one specific organism.
So my specific research project and fellowship was looking at very, very similar things in the prior studies. Essentially, it was the risk factors and outcomes with ventilator-associated pneumonia and pediatric STBI. And these are my fellow faculty mentors, Dr. Nicholson, Dr. Brigman, who are part of our trauma faculty. And I presented this data in slightly different ways at both the American College of Surgeons Clinical Congress back in October, and then at the Society of Critical Care Medicine Congress back in March.
But our study was also a retrospective cohort study at our academic institution, and we included patients under the age of 18 with STBI who were intubated for at least 48 hours between 2020 and 2024. That was chosen specifically because that's when we had Epic rollout in mid-2020 and getting data prior to that was extremely difficult.
Patients were excluded if they progressed to brain death, transferred to another facility, or if they were already on immunosuppression therapy prior to their TBI.
And then the way we defined VAP, we only used one criteria, at least the CDC criteria, and they had to meet either the pneumonia one, which is the clinical and x-ray finding diagnosis, or the clinical and x-ray plus a pathogen finding. So as long as they met one of those CDC criteria, they qualified as having a VAP.
And then the variables, which I'll get into what variables we collected, were initially compared between VAP and non-VAP patients using a univariable analysis. And those that approach statistical significance using a p-value of less than 0.1 were then included in a multi-variable survival analysis. And then for the multi-variable survival analysis, statistical significance was the standard.
Less than 0.05.
So as you can see, there is a lot of variables to be collected, but we collected demographic.
demographic data, trauma characteristics. The ISS stands for Injury Severity Score, which is often used to somewhat triage the degree of injury. However, evidence in pediatrics is a little iffy, especially the younger the age. Another notable trauma characteristic we collected was evidence of aspiration when they were intubated. which we defined, because we had to define that ourselves, was if on the radiology reports immediately following intubation or before the two-day mark required to

meet that criteria, if there was any consolidation concerning for aspiration per the radiology reports, or if during the intubation note, because this is a chart review, if anywhere on the intubation note there was any description of
concern for aspiration.
other infections and variables, because there's a possibility that these patients had other possible sources of infection. We also looked at that and also they had a positive viral panel, which I'll get in some results in a bit, but I was very surprised with the lack of the amount of patients who had a positive viral panel. And then our standard or very common ICU interventions are up here on the left.
including surgical prophylaxis, which we defined as essentially narrow spectrum antibiotics, usually a second or third generation cephalosporin, and then more broad spectrum antibiotics, which is either a fourth generation cephalosporin, peptazo, or vancomycin therapy, or anything even more broad than a second or third generation cephalosporin that we considered more broad spectrum.
And then also airway clearance therapy, back suctioning, albuterol treatments, nebulizer treatments, which are standard things we typically do for airway clearance for our ICU patients. Also, whether or not they got hypertonic saline, either as boluses or as a continuous infusion, whether they were fed or not via enteral feeds, use of SUP, which stands for stress ulcer prophylaxis, which is either a
Proton pump inhibitor or an H2 blocker.
and then the use of neuromuscular blockade either as an infusion and then the cumulative amount of neuromuscular blockade they got. And then we did separate benzodiazepine and barbiturates because we do frequently use benzodiazepines in these populations to some degree. However, barbiturate use is much less common and we usually use it as a second tier therapy. And then we also looked if there was any surgical
interventions done, like if there was an ICP monitor placed, or if they had an NDVD, an extraventricular drain, or if they had a craniectomy for severe ICP issues. And then for the outcomes, we looked at mortality, duration of intubation, whether or not they had a tracheostomy placed, and then latent stay for both the ICU and the hospital. Unfortunately, the biggest outcome that we were not able to collect because we did not have the data for it was functional severity score, which is one of the things I was the most interested in. And for that would have to have been a prospective study.
So overall, there was 940 TBIs in that four year period. However, as you can see, a vast majority of those were excluded for not meeting the severe TBI criteria. And

then another solid chunk of those were not included given that they were not intubated for at least two days. Those another patient excluded due to already being on immunosuppressive therapy.
And then there was another patient who was transferred to another facility, so we cannot complete the data for chart review. And then there was a further 32 that progressed to brain death. So overall, we had an NF 75 with 30 of those patients meeting VAP criteria and 45 of those being in the non-VAP category.
And this is a vanilla survival analysis, Kaplan-Meier curve. And what it's just looking at is the time it took to develop VAP. So 60% of these patients did not develop VAP. So that's why the line just kind of flat lines after about at about 10 days. But the range for developing VAP for our population is between 3:00 to 10 days, with the average being at around 5:00 to 6:00 days.
And the reason the three, the reason that there's a flat line at the beginning is because in order for you to meet that criteria, you have to be in have to have been in speed for at least two days. So the earliest you can technically be was three days.
So this is our final multivariable survival analysis. And what we did see is that in our population at least, males were more likely to have had developed VAP. And then evidence of aspiration during intubation, which in hindsight is not too surprising, but that is also a significant risk factor for developing VAP.
Enteral feeding, however, and cumulative exposure to albuterol was almost protective against VAP. And there was a slight increase in hospital length of stay as well. And this is the survival analysis and plot formation for all of us that are more visual like me. But you can kind of see the effect size of it. The evidence of aspiration is pretty
has a pretty significant effect on whether or not they developed that, at least in the study. And then hospital in the state, just to go along with what I was saying, even though the value is statistically significant, it was not, it doesn't strike you as that impressive on visual form.
And then just to hammer home the same kind of results, these are the variables, and of all the variables we collected, these are the only ones that ended up becoming statistically significant in this multivariable analysis. I apologize for those of you who cannot see color very well, but essentially I'm highlighting here is that the ones in the red,
are the ones that were seen as increased, having increased risk of VAP or hospital length of state, in that case, having a longer length of state. And then the green

variables are almost seen as protective against VAP.
Similar to what I was saying is that essentially male gender and evidence of aspiration were associated with increased risk of VAP in pediatric patients with STBI, increased albuterol exposure and enteral feeding may be protective against VAP. And of note, the enteral feedings were not distinguished in terms of whether they were gastric or jejunal. And that analysis was not really able to be done given that there was just
too small of a number to actually compare those two things once I did get these results. But enteral feeding, regardless of route, seemed to be protective against VAP.
But one of the most notable findings is that many, essentially almost all of the first and second tier elevated ICP interventions, including ICP monitors, EVDs, craniectomies, hypertonic saline, benzodiazepine and neuromuscular blockade exposures were not associated with or protected against VAP in this cohort.
And then antibiotic exposure, regardless of how broad it was, was not found to be protective against that. And also of note, after speaking with some of our trauma faculty as well, it is very likely that EMS was administering some one shot of ceftriaxone, IM.
out in the field for TBI. And this is based on an adult study that was published a couple of years ago in the Lancet. So it is possible they have had may have had even more antibiotic exposure that we were not accounted for or was not documented.
And then VAP was also associated with a longer length of stay, but there was no increased IC length of stay. There was not a higher risk of having a tracheostomy placement, no higher risk of longer intubation, and there was no increased mortality risk.
So how this adds to the literature with the asterisk being that this is not technically a published study yet, however, we will be looking to publish our findings. This is the first study with this population demonstrating the following. So male gender with the increased risk of developing VAP,
This is also the first study looking at aspiration and its relationship with contribution to VAP. However, with the big asterisk is that a major caveat to defining is that defining aspiration, pneumonia, and VAP is difficult. The only thing that really separates it is the timing of development of symptoms. For example, a patient who had a clear X-ray for two days and then on day three,
has a consolidation now. While it does meet VAP criteria, it is difficult to say, oh, it was because they aspirated or not. However, the findings do kind of go in line that if

they did aspirate, they are more at risk of developing a VAP.
This is also the first study looking at enteral feeding as a protective factor against VAP, and that VAP was not associated with increased risk of having a tracheostomy placed, which one could argue is somewhat of a functional outcome.
And then also antibiotics, regardless of how broad, were not shown to be protective against VAP either.
And also importantly, this also supports the current Brain Trauma Foundation recommendations for management of STBI in that they recommend starting enteral nutrition within 72 hours. So in a way, this also supports early enteral feeding.
So this big table is me comparing our findings and the findings from the other two studies to each other. You can see the ends on the top. The other two studies were slightly larger, but had relatively similar incidences of VAP. The other two studies did show that older age was more likely to develop VAP. For us, it was not a statistically significant variable. However, on UD variable analysis, it was
close. It did, it was, I think, I believe the P value was 0.09, so it was relatively close. And then it was eliminated because it was not significant once you put it in the multi-variable analysis.
Our study and the most recent study from 2023 did not show any racial differences. However, the first study did show that non-white patients were less likely to develop that.
Ours was the only one that showed males more likely to develop VAP. And I will mention that injury severity score was not higher in the male patients, which is something that I'm sure came to a few people's heads as like, well, they're more likely to have more risky behaviors, which is probably true. But there was no increased risk or there's no higher injury severity score between male and female.
patients. We also looked at site of intubation, meaning whether they were done in the field or whether they were done in the hospital or our hospital. And there was not a significantly increased associated risk of where they were intubated. And of note, one thing that was consistent over all three of the studies is that there was not an increased injury severity score.
for was not increased, the score was not related to the development of VAP. And then same as the other two studies, MSSA was the most commonly isolated organism in our study as well.
Aemophilus influenzae was isolated in some patients, but the number, the reason I don't have a #2 is because our #2 was all over the place. We got a lot of

combinations of H flu, Klebsiella organisms, and a lot of multi or polymicrobial samples.
And then hospital length of stay has been demonstrated in the past. However, ICU length of stay was not re-demonstrated in our study. It was only seen in that first study. Ours is the only one that used tracheostomy placement as an outcome, and it did not look like there was an increased risk of having a trach placed if you had a VAP.
And then, as I said, probably the outcome I was most interested in, unfortunately, was not able to collect because we did not have that information. But functional status scale, only the one study did show it did show that there was increased impairment. And then probably one thing that all the intensivists really, really care about is mortality. And there does not appear to be an increased risk of mortality in this population.
And this is more looking at the actual therapies. Ours did show that it was a decreased risk of VAP with cumulative albuterol exposure. The prior study showed the same thing on their univariable analysis, but on their multivariable analysis, that was not found to be significant, but it has been demonstrated to some degree before.
We were not able to replicate the nebulized 3% saline finding of it being protective. We did not find benzodiazepine used to be protective or a risk factor. And then all these other risk factors of that first study did show being having increased risk of that. We did not redemonstrate and the prior study did not seem to redemonstrate either.
But the big takeaway here also is well that enteral feeds appear to be protective against FAP in this population. At least our study was the first one to show that.
So to summarize, essentially, the similar findings to the other two cohorts show that increased or the injury severity does not seem to correlate with the development of VAP. MSSA seems to be the most frequently isolated organism. And while VAP may not have increased mortality, it may lead to increased hospital length of stay and ICU length of stay in that prior study. However, again,
difficult to tease out because every hospital and unit is different. You know, some units have different policies in terms of what needs to be in the ICU and what doesn't.
And then cumulative albuto exposure may be protective. And this is possibly due to aiding in airway clearance to some degree, which is my hypothesis as to why this

finding has been somewhat demonstrated in a couple of studies.
So what does this mean? But more importantly, does it matter? Yeah, short answer is we don't know. We don't know if VAP is something that we simply just treat and we don't know what are the overall long-term outcomes for these patients. In intensive care, you know, we generally only see them while they're very critically ill.
or in the phase of getting towards going down to a step down unit or even to home.
So we don't know the long-term effects of it.
So that second study that was published in 2023 did show worsening functional impairment in their VAT population. And long-term follow-up studies in older adults show that patients with CNS syndrome are more likely to develop community-acquired pneumonia, which is a common cause for mortality in that specific population.
So it's unclear how this translates to pediatrics as there is no literature.
There's no literature that shows us, shows whether or not this relationship exists.
And so, but what would likely need to happen is some kind of a prospect of likely multi-center study with long-term functional infectious outcomes would be an ideal way to analyze this question.
And then what does this mean for the general pediatrician? And again.
The short answer is we don't know.
However, a severe TBI should be thought of and treated as a chronic disease, even if neurological impairments are not obvious. Specifically, what you're generally looking for is new problems in school and new psychiatric disorders, which have been documented in the TBI population.
And then the question is, you know, if the patient had a VAP, they may be more at risk of having more worsening functional outcomes at time of discharge. Whether or not that translates to long-term outcomes is still unclear.
So to conclude, there's a lot of unknowns as to the significance of VAP in the severe traumatic brain injury population in pediatrics. At least what we found is that aspiration at the time of intubation for STBI is associated with VAP. However, this could be extrapolated as an overlap with aspiration pneumonia and is unclear.
where the aspiration pneumonia begins and where the vap ends and where the vap ends or vice versa.
Injury severity, antibiotics, first and second tier therapies for STBIs for ICP managements do not seem to correlate with VAP risk, which is I think one of the more significant findings as well. And then supportive care measures such as

albuterol as an adjunct for airway clearance and enteral feeding may be protective. And then finally, there is some evidence that that may affect functional outcomes. While I did not get that in my specific cohort, there is a study with evidence showing that, and the question will be in the future is whether or not this affects long-term functional outcomes in a population that's already at risk for having long-term Disability.

So I just want to acknowledge my project mentors, Dr. Brigman and Dr. Nicholson. My faculty mentors, Dr. Meyer and Dr. Wu. Dr. Cook, who I don't know if he's on the call or not, but he helped me a lot with the statistics for this specific project and my other fellowship project as well.

And then list of a lot of my references. And then thank you. I will take any questions at this time.

Wu, Theodore 29:47

That's great. Thank you, Dr. Buell, for, you know, leading this discussion and, you know, presenting some of your research here. So, yeah, like you said, open to questions. Looks like Dr. Weimer.

Dr. Weimer, did you have a question?

Seidner, Steven R 30:25

I think you're muted, Dr. Worman.

Wu, Theodore 30:35

Ohh.

If Dr. Weimer had a question, you know, we'll kind of chime in a little bit.

Any other questions for Doctor Poole?

You know, this patient population is already a very difficult, you know, population to treat. A lot of morbidities associated, you know, we've, as a critical care community, has worked really hard in kind of identifying things that don't worsen the prognosis. And this is ventilator-assisted pneumonias is just one of them.

And it's been hard to kind of quantify or even have describe what that, you know, what the risk factors are and whether or not the things that we do try and protect from it, you know, even has an effect. So this is kind of one of the first things that we've able to describe what we do here in our unit to see, you know, if it has any effect, you know, so.

Yeah.
Doctor Seidner.

Seidner, Steven R 31:38
Wonderful presentation, Franz. One question is, you know, enteral feedings are protective, which isn't surprising because they tend to be good for just about everything, but aspiration is bad, and you might think that there'd be more aspiration with enteral feedings. So any comments on the
kind of the conflict of those two.

Puyol, Franz 32:01
Yeah, and then, you know, the question we often get during rounds is, you know, or we discuss, you know, does it need to be postpyloric? And the answer is, we're not sure. We generally, especially in the smaller patients, we aim for these feedings to be postpyloric because of the theoretical risk.
However, given the, again, I was surprised by the low amount of postpyloric feeding tubes that have been placed, so it wasn't really something we could necessarily compare. But that being said, one thing I did not analyze was had patients developed aspiration after starting enteral feeds? And the question, and the answer to that is we honestly don't know.
That would need to be a separate outcome that we look at.

Wu, Theodore 32:45
But in your evidence here, does it show that starting interval feeds worsen?
Their disease, at least the pneumonia, increases risk.

Puyol, Franz 32:56
No, it seemed to be protective at least.

Wu, Theodore 32:59
Yeah, so at least, right? So I think that's where it's very interesting because there's been, you know, culture change because, you know, like even using high flow and your other QI project, you know, whether or not those kids are going to have more pneumonias while they're being fed, whether it be post-pyloric or NG tube.

Puyol, Franz 33:02
Yeah.

Wu, Theodore 33:19
Right, will they will they have more aspiration pneumonia, you know, so, so if it's showing that it's protective, at least we're not causing more harm while doing so.

Puyol, Franz 33:30
Yeah, and to piggyback off that, sorry, to piggyback off that as well, you know, like the, I know the question might be that, okay, well, you only looked at the first incidence of VAP, which is true, but you also have to look at the ones that did not end up developing VAP. The end point for the study was, you know, whether or not they developed VAP, that's whenever their time

Wu, Theodore 33:30
Doctor.
Yeah.

Puyol, Franz 33:50
to be in the study ended or once they were once it was two days after extubation. So at least from that standpoint, it didn't seem like there was an increased risk of aspiration from that standpoint, if that makes sense.

Wu, Theodore 34:06
Doctor Perlman.
He had a question.

Perlman, Jeremy S 34:09
I get great talk, friends. And I just had a question. So the decision whether to feed, do early enteral feeds, was that kind of like a protocol thing or was it judged by patient by patient? Because I'm just wondering if maybe the sicker patients weren't fed early and maybe it's an association isn't like.
Protection, but really just not the causality doesn't really go in that direction necessarily, like, but, but um, if it's something you kind of...

Yeah, just explain like how the unit decided whether to start the early intro feeds or not. And sorry, I missed a couple minutes at the beginning. So if you explain that, I'm sorry.

Puyol, Franz 34:42

Yeah.

No worries. I mean, it was retrospective, so it's not like it wasn't like some, it wasn't like a prospective study where you included patients in a protocol. It's usually individualized. And if the patient, usually the, our general rule of thumb is that if the patient is stable, not going for surgical procedures, and even if they are, we can pause feeds. It's usually not an issue.

whenever they're intubated or if...

or if they're not on significant amount of vasopressures, then we start feeds. I did not include this data, but generally patients were started on feeds within three days. The vast majority of them were started within three days.

Perlman, Jeremy S 35:20

Thanks.

Wu, Theodore 35:25

We have a question on the chat from Dr. Weimer. Have you used inhaled antibiotics when there is need for antibiotics? Ketones showing brain function help in animals. Ketones increase by giving MCT MCT oil.

Puyol, Franz 35:42

We do not. I don't think we generally have done inhaled antibiotics for this case. I think the only inhaled antibiotics we really do use, and it's not in this population, is tobramycin.

Wu, Theodore 36:04

Alright, any other questions?

All right, well with that, a reminder for everyone to sign in for their CME credit. Otherwise, thank you, Dr. Puyo, and everyone have a great weekend. Stay dry.

Puyol, Franz 36:32

All right, thank you all for having me.

Wu, Theodore 36:32

And go, Spurs, go!

Alright, bye.

Puyol, Franz 36:35

Mhm.

◉ **Calderon, Delia** stopped transcription