Symptom Surveillance After Hemispheric Surgery
Hydrocephalus Working Group Meeting
June 5, 2024
2:00 PM PST

Attendees: N. McNamara (initiative co-lead lead), A. Fallah (hydrocephalus working group lead), M. Jones (patient advocate lead)
Unavailable: S. Wang, S. Lam, C. Dorfer, J. Hauptman, S. Lew
Full video recording of meeting (unlisted)

Notes

- M. Jones reviewed the purpose and goal of the initiative
    - The problem we want to solve: Parents, caregivers, and clinicians do not have a roadmap to navigate medical symptoms and functional outcomes after hemispheric surgery.
    - The solution: develop recommendations for post-operative symptom surveillance and screening
    - Our goal:
        - Minimize surprises in chronic postoperative care
        - Prepare clinicians and caregivers for what may happen
        - Provide scaffolding for caregivers to manage medical and functional outcomes through adulthood.
- Systematic review has been completed and draft statements prepared
    - List of all literature with corresponding domains
    - List of all proposed statements w/ corresponding literature
    - Folder of hydrocephalus literature
- M. Jones discussed the desire to model the structure of these recommendations after the paper titled "Recommendations for Screening Pediatric Psoriasis Co-Morbidities for Primary Care Providers." She highlighted that this paper is well-organized, with each section having its own table and summary of recommendations, followed by specific recommendations supported by literature and a concluding paragraph.
- The group discussed the following preliminary statements resulting from systematic review of hydrocephalus after hemispherectomy literature
    - Statement 1: Educate all patients about hydrocephalus following hemispherectomy.
        - Discussion: The group agreed on the importance of broad education on hydrocephalus, including the meaning, symptoms, and potential risks post-surgery.
        - Status: Consensus of attendees reached (Green).
    - Statement 2: Evaluate all patients routinely for hydrocephalus following hemispherectomy.

        - Discussion: The need for routine surveillance was agreed upon, but there was variability in opinions on the duration and frequency of such surveillance.
            - Aria Fallah typically performs one MRI immediately after surgery and another one year later. Nancy McNamara mentioned their practice involves yearly follow-ups indefinitely, depending on the center's resources and patient availability.
            - Further input from all working group members needed on whether to extend routine surveillance beyond one year and how frequently imaging should be conducted (e.g., every 6 months or annually).
        - Status: Requires further discussion and input (Yellow).
    - Statement 3: Percentage of patients likely to develop hydrocephalus at various time points.
        - Discussion: Existing studies, such as Sean Lew's paper, estimate that 20-30% of patients may develop hydrocephalus, with a significant portion occurring within the first year post-surgery.
            - Aria Fallah raised concerns about potential overestimation in older studies and emphasized the need for updated, accurate data.
            - Monika Jones highlighted PESA's Global Pediatric Epilepsy Surgery Registry data showing a 24% occurrence rate, influenced by a higher percentage (40%) in patients with hemimegalencephaly (HME).
            - The group acknowledged the importance of considering etiology-specific data (e.g., HME vs. other causes) and agreed that input from the broader group is necessary to establish accurate percentages and refine recommendations.
        - Status: Requires further input and alignment (Yellow).
    - Statement 4: The following variables appear to predict hydrocephalus following surgery: (e.g., surgical technique, etiology, age at surgery, duration of disease, hemisphere, etc.)
        - Discussion: The group recognized the need to factor in different etiologies when making recommendations, as certain conditions like HME have higher risks of developing hydrocephalus. This statement will be discussed in more detail in future meetings to develop specific guidelines based on underlying conditions.
        - Status: Deferred for later discussion (Red).
- Key Discussion Points:
    - Surveillance Duration and Frequency: There is variability in current practices regarding the duration and frequency of post-operative surveillance for hydrocephalus. A minimum surveillance period of one year was suggested, but further discussion is needed to determine if this should be extended and how frequently imaging should be performed.

- Symptoms and Education: Importance of educating families on both classic and subtle symptoms of hydrocephalus (e.g., headache, nausea, vomiting, gait disturbances, changes in personality or school performance).
- Ensuring that caregivers and clinicians understand that symptoms can be varied and may develop years after surgery.
- Global Pediatric Epilepsy Surgery Registry data and bias: Acknowledgment of potential inclusion bias in registry data, as those who respond may represent more extreme cases. Emphasis on the need for accurate and comprehensive data collection to inform guidelines.
- Hydrocephalus Risk Factors: Discussion on factors contributing to hydrocephalus, such as surgical technique, duration, blood loss, and underlying conditions. Agreement to further explore these factors to provide more targeted recommendations.

Action Items:

- Summary and Input: Prepare a summary of the discussion and collect asynchronous input from the broader working group to finalize recommendation, particularly on minimum surveillance duration, frequency, and method; refine statements based on additional input.surveillance duration and method.
- Survey Development: Develop a survey to gather broader input from the group on specific recommendations.
- Future Presentations: Plan to present findings and gather further feedback at the upcoming research meeting in Boston, August 1 (A. Fallah).

	Hydrocephalus
Hc1	Educate all patients about hydrocephalus following hemispheric surgery.
Hc2	Original Statement: Evaluate all patients routinely for hydrocephalus following hemispheric surgery. Modified Statement: Surveil all patients routinely for hydrocephalus for a minimum of one year with CT or MRI.
Hc3	Original Statement: Approximately X percentage of patients can anticipate developing hydrocephalus following surgery at the following time points:
Hc4	The following variables appear to predict hydrocephalus following surgery: (e.g., surgical technique, etiology, age at surgery, duration of disease, hemisphere, etc.)
	[TABLE OF SIGNS AND SYMPTOMS OF HYDROCEPHALUS AFTER HEMISPHERECTOMY]. Suggestion to categorize as classic symptoms (e.g. vomiting) v. uncommon (gait disturbance), sometimes without change in ventricle size

AUDIO TRANSCRIPT

Monika Jones: So just briefly, we'll get started. This is the first meeting of the Hydrocephalus Working Group on symptom surveillance after hemisphere epilepsy surgery. This is a scientific initiative of the Pediatric Epilepsy Surgery Alliance to develop recommendations for symptom surveillance and screening after all the hemispheric procedures. Can the two of you briefly introduce yourselves?

Fallah, Aria: Go ahead, Nancy!

Nancy McNamara: Nancy McNamara, one of the pediatric epileptologists at the University of Michigan.

Fallah, Aria: I'm Aria Fallah, a pediatric surgeon at UCLA.

Monika Jones: Great. Let me just make sure someone hasn't emailed me saying, I can't get into the meeting. No, okay. So the problem we want to solve is that parents, caregivers, and clinicians—by clinicians we might mean some neurosurgeons, but we might also mean emergency room doctors, pediatricians—don't have a roadmap of care to navigate medical symptoms and functional outcomes after surgery. I pulled this slide, which is totally out of order. Sorry about that. So the solution of what we will do is actually develop these recommendations for symptom surveillance. Our goal is to minimize surprises in chronic post-operative care, prepare clinicians and caregivers for what may happen, and importantly, provide scaffolding for caregivers to manage medical and functional outcomes through adulthood. We have prepared the proposed statements for this working group already. You are free to accept them, reject them, amend them, or refine them. We've already finished the systematic review, and each group should consider each of the statements along with quality of care, burden of care, access to care, coordination, and transition to adulthood. For example, we wouldn't want to recommend something that a family in a very remote part of Montana might not ever be able to access. We really like these recommendations for screening off of pediatric psoriasis comorbidities that are for the primary care provider. We like how it's organized. Each section has its own table and summary of recommendations and then each specific recommendation. So you can see here overweight and obesity have just this statement: refer to the appropriate specialists as needed, etc., and children with BMI greater than 95th percentile. The literature that supports it, and then one paragraph that supports the conclusion. So if we could organize, just have our eye towards thinking about, maybe this is how we organize the final paper. It looks really good. It looks really clean, and it would be something that would be very impactful when it's finally published. Going back to the proposed statements: These are the four proposed statements that we have come up with. They're pretty straightforward and simple. The Neuropsychology Working Group has a much hairier list to deal with. So we would open it up for discussion now around statement number one: educate all patients about hydrocephalus following hemispheric surgery. So, in other words, post-operatively, the patient through parent proxy should be educated about what hydrocephalus is.

Fallah, Aria: Yeah, I agree.

Nancy McNamara: And I would say one thing I would refine would be acute versus early onset versus late onset.

Monika Jones: Early versus, okay. So hold on a second. Wanted to, I'm gonna do what we did in the Neuropsychology Group, Nancy, where we just labeled them green when we agreed. So we would agree to that, but we're saying that acute about hydrocephalus. Okay, so what you just said is technically in statement number 3 approximately, X percentage of patients can anticipate developing hydrocephalus following surgery at the following time points. Do you want this statement to be expanded to say something like including acute and chronic onset, acute or chronic, or delayed onset?

Nancy McNamara: I think this just gets at the thing that you always speak to, which is what you've mentioned at the beginning, which is sometimes people don't realize that it could be a risk five years out, ten years out.

Fallah, Aria: Right. But yeah, I see what you're saying. My only concern is the acute versus delayed is sort of, I mean, it doesn't have a, it's not a clinically helpful distinction. And it's not something that we, you know, we don't say we're diagnosing with delayed. I mean, I understand what you're saying. Maybe, you know, educate all patients about hydrocephalus following hemisphere surgery. And somehow indicating that you're sort of, you're never fully, I mean, you all, you basically have. I feel like the first statement is just all-encompassing. We can see what the group feels about, you know, and what if there's patients that are sort of, they present somewhere in between. They're sort of like a month out or two months out. But acute, does it not? I'm not sure if it's beneficial. I think that sentence 3 can capture more of, you know, percentage at what time points we can talk about the most common time points, I guess, the acute phase versus a delayed. But I'd like to keep that first statement broad. I think it's more helpful just for everyone to know that this is a risk. I'd say.

Monika Jones: Right. So just keep the first statement clean. Educate all patients about hydrocephalus following hemispheric surgery. So this paper would then have a paragraph of what does that mean? What does hydrocephalus mean, right? So that would be the education part that we would then hope that the neurosurgeon and or the family practitioner or somebody would go over with the patient. This is what hydrocephalus is. And here's a table of what the symptoms are. Well, that was easy. Done. Evaluate our, this is the trickier one. Evaluate all patients routinely for hydrocephalus following hemispherectomy. So this is a question that definitely comes up all the time is, should the kids be having routine MRIs or do you wait for the onset of symptoms? And then what symptoms are you looking for?

Fallah, Aria: Right. I would say if you value, so you're definitely doing surveillance. But you would evaluate symptoms with an extra set of images. Right? So evaluate all patients routinely for.

Monika Jones: Would it be surveil all patients routinely.

Fallah, Aria: Surveil is where we want to, and then we're going to have disagreement on duration. I'm sure within the group. I typically would, you know, surveil for about a year. And if there's no symptoms, you kind of, but I think this is going to be highly variable. And I don't think we have, you know, I mean, some of these patients have very delayed onset. We've talked about it, you know, five, ten years out. I don't think it makes sense to do routine imaging on all of them up until they should know about the risk of it down the road and obviously be educated to come and get a repeat imaging, even if it happens that far out. But I don't think, I don't think most of us are doing routine surveillance that far out. More than one year. I do a year, but I suspect there's variability. So maybe we can wait and see what sort of, we'll have the group comment on. So basically, the question is for a non-symptomatic child, how far out should we be imaging?

Nancy McNamara: Well, and I think even within that year, how it's done is incredibly variable. Right? So when the first imaging occurs, and then the second one, or do you just do one, and then a follow-up visit of the year. So I would love to hear the discussion, because we've completely changed how we do things. And we actually do yearly follow-up MRIs.

Fallah, Aria: Really, for indefinitely?

Nancy McNamara: As long as they let us. But we have a, I think lots of places have shunt protocol MRIs, so you don't have to sedate kids for.

Fallah, Aria: Yeah, we also, I mean, depends on your center too. But we, with a lot of kids from out of town, so we, you know, most of the time, especially when they're seizure-free. And they're, you know, it's hard to sort of continue following up or bringing them back. But yeah, it depends on the center as well. But I think, let's see if we can align on a period of time that we all think should be the minimum. I think that would be helpful.

Monika Jones: I think that statistic is at least 25% develop it. Oh, 25% of those who develop it, develop it in that first three-year period. When you look at Sean Lew's paper, it plateaus through the eighth year, but it never goes away. And then our data is showing 60 months out is the furthest. So, yeah, I mean, if that's the data point, because if it's that frequent, then it makes sense to surveil for that for five years.

Fallah, Aria: Do you have his Kaplan Meyer curve?

Monika Jones: See, I don't think I can share my Adobe. Hold on! Let me try it again. I hate Zoom. I still don't know how to use that. Where do I share my screen? Oh, where it says, share screen. Okay, here it is. So here's Sean's paper. So 27% were treated. Sorry, wrong stat. 27% were treated more than 90 days. Data was reversed.

Fallah, Aria: Do you have the Kaplan Meyer curve? If you can go to the figure.

Monika Jones: Okay. So yeah, this is hydro. Okay, so 100 months. I mean, that's a lot, right?

Nancy McNamara: Yeah, do you have how long they followed these kids?

Fallah, Aria: That's 8 years. I just had somebody develop it at seven years.

Monika Jones: Yeah. So the paper says, eight. Anecdotally, the furthest out I have seen is 25 years.

Fallah, Aria: So there's a lot of missing data here. I mean, you can see how many censored. Basically no more follow-up for that individual. So they're only contributing data to that time point. So the biggest drop is within those first few months. You can see, because you go from 1.0 to somewhere around 0.75 at about, I'd say, I don't know, a year out.

Nancy McNamara: Yeah, do you have a, how long they followed these kids?

Monika Jones: There's nothing.

Fallah, Aria: And then, if you go further, you're gonna so that's sort of, so 25% of kids have developed hydrocephalus by then, and then another five will be sort of much more delayed fashion. I think if we can get the group to at least align on minimum of one year, that'll be adequate. Because at some point, there's going to be a trade-off. How many kids are we, should we be routinely staying? Now, this is going to be very different if the child has symptoms. So this is basically a child who's otherwise doing great.

Monika Jones: So that would be then surveil all patients, routinely surveil all patients, including non-symptomatic. Well, you're not, do you ever surveil a symptomatic patient?

Fallah, Aria: Nope, I mean, I wouldn't call it surveillance. You're, you're evaluating that.

Monika Jones: You're evaluating. Okay. Evaluate all patients, including non-symptomatic, routinely for hydrocephalus, following for at least...

Fallah, Aria: For a minimum of one year.

Monika Jones: For a minimum of one year. And what does that mean? Does that mean an MRI every six months, or?

Fallah, Aria: Yeah, I think we're gonna get even less alignment on that. I think if we're gonna get too granular, it'll be tougher to agree. I mean, I typically do one right after surgery, and then I'll do one at a year out. But there may be some that will do it six months, one, six months later. I don't think there's any evidence to guide us when we are not. This is even in the general broader hydrocephalus literature. There's no guidelines for surveillance, the timing of

surveillance scans. And I wouldn't make it so granular, but I think the duration of time, like the one year minimum, should hopefully, I think we'll get more alignment on that.

Monika Jones: Okay. So that would be a question for them. I will flag this in the transcript.

Fallah, Aria: And I think it could be CT or MRI. We leave that up to the practitioner.

Monika Jones: Okay. We're still seeing the Sean Lew paper. I don't know if you're on that screen or you've moved on, but. Oh, I'm sorry. Have to share again. So here I'm gonna flag this yellow for we need input for Hc3. I feel like Sean's paper has the best data.

Fallah, Aria: Yeah, yes and no. It's the study most dedicated to hydrocephalus. But I think the numbers are grossly overstating the likelihood of hydrocephalus. And again, a lot of that data, I think we talked about, is based on that UCLA data. And when you speak to Dr. Peacock, he was routinely putting in shunts after the Hemi. So it's sort of much higher than what we're seeing today. Because this paper estimates at 20 to 30% risk. Which, talking to colleagues, I mean, I'm very curious to see what the group thinks. There's some that basically say we rarely ever see it anymore, or maybe low single digits to maybe as high as 10-15%.

Monika Jones: So our registry says, and I pulled the data today, we have 183 respondents in with hemispheric surgery, 24. So that number dropped one since December when we pulled it for the AES meeting, 24% instead of 25%. All surgeries. If the underlying etiology is hemimegalencephaly, that number is 40%. 28% of the registry is HME, so that 24% number has got a weight of the HME kids that have a higher percentage.

Fallah, Aria: Which will have more.

Monika Jones: That might be something also to consider in the paper is etiology-specific.

Nancy McNamara: As I say, etiology and probably method. If it was anatomical versus functional.

Nancy McNamara: Yeah. And then multiple surgeries, too. Right?

Fallah, Aria: Yeah. I mean, it's hard to separate it out, because the youngest kids have hemimegalencephaly. They're most likely to have needed anatomic. They're most likely to have a repeat surgery. Which one is it? You know what? What is the key? Right? And I think we get into this in a little bit. But they're all sort of highly correlated variables.

Fallah, Aria: Monika, I think there's definitely an inclusion bias of the families that are filling out the survey. You know, just like with everything, you're gonna see more of the extremes on both sides. The ones that really struggle with hydrocephalus a lot, and some that don't. But in the more recent paper, especially when we're looking at series out of each center, numbers are not as high as what's classically reported. And also that's the general sort of feeling amongst

pediatric neurosurgeons. We certainly may not be picking up all. And this is part of, you know, we're trying to address this or making sure we surveil, and we don't miss kids who have it.

Fallah, Aria: Yeah, I think we need the group's input on sort of what that percentage may be. And one way of doing this, I wonder if we can maybe ask each person to give us what they think is a current estimate and see if we're aligning on some range, you know, so like 5 to 10, or 10 to 15, or maybe higher.

Fallah, Aria: And this would be all comers. So from all patients undergoing hemispheric surgery, regardless of initial technique and what the underlying etiology is. So I think we should align on the larger, more broader statements, and then we can do a deep dive, maybe at a later date on HME, or anatomic versus vertical versus, you know, all that.

Monika Jones: Right. So we will leave this Hc4 for later.

Monika Jones: What I just worry about from a patient advocacy standpoint is, I'm concerned that a lot of the facilities that your data is inaccurate because those parents are not coming to your facility for diagnosis. They're going to a local ER or a local doctor, or the symptoms are so subtle that the child has hydrocephalus. I mean, there was already even a thread in this working group of, you know, the kid had hydrocephalus for two years, and we thought it was an orthopedic issue because it was just a gait disturbance, or something like that. Does that just worry me about the hospital-specific data is, how do you know that a lot of your patient, not you, you Aria, but a lot of patients haven't gone somewhere, you know, and have it, but haven't been diagnosed.

Fallah, Aria: I think we'll address that more in the symptomatic groups. So if your child is symptomatic after high, that's very different. Right? Because then you're saying, if you have symptoms, you must do X, Y, and Z. And we'll capture that. Actually, Sean Lew's study is also very interesting because of that large portion that gets censored, kind of tells you that we, exactly what you're saying. So many families are local. They're not seeing that specialized center anymore after, probably even after the first couple weeks. So there's definitely a lot actually, yeah, if you go up, yeah, all that. So all that red is censored. So if you look at that initial drop. So sort of where it goes. If I can annotate. But basically, I'm guessing shortly after surgery, till about 60, 70 months. The vast majority of these patients are sort of just not, you know, they're presuming, you know, maybe seizure-free or whatnot, but there's very little follow-up. And then the way I interpret this, and then going forward, there's some, I guess maybe the initial center becomes aware that some of these kids have hydrocephalus or not. But then it turns blue again.

Fallah, Aria: The other thing, Monika, I think that would be very important whenever we're doing this exercise. This reminds me of the grade recommendations that Gordon Guyatt developed out of McMaster, which is basically when you're doing recommendations. It's not just what you recommend, but the strength of that recommendation. For example, the first statement, everyone should be educated on hydrocephalus. That's not only that we agree, we unanimously

will probably agree on that, right? Versus our next statement, which was sort of one year, that should be, you know, that's sort of gonna be a weaker recommendation, cannot be that confident. So I think we need some sort of, also capture how unanimous that recommendation was.

Monika Jones: Okay.

Fallah, Aria: I think that'll be helpful for maybe all these working groups, especially here too.

Monika Jones: When we're looking at the table of symptoms, Sean's paper has this nice table. The ones that I find really important when we're talking to our families with, you know, they'll say, I went to the ER and they said, well, your child's not throwing up. Therefore, they can't have hydrocephalus. I mean, we have countless stories of parents getting turned away from the emergency room because the kid is not vomiting, and that's a classic symptom. So here his paper showed less than 50% had emesis. And then our registry data has just a little over half vomiting when they were first diagnosed, so kind of similar. Many of the children did not have the hallmark symptoms that we think of when we're thinking of hydrocephalus.

Fallah, Aria: Now, the kids in this registry are more likely the ones that are in the chronic development. So it's not the acute.

Monika Jones: I don't know the answer to that off the top of my head. They're anyone under age 17 who responded the registry, 17 and under who was responded. They're kind of all over the map, Aria. Why do you ask? Are you concerned about.

Aria Fallah: Yeah, because you know, Sean knows that, you know, failure to wean the EVD, that's basically saying that the patients leaking CSF for the pressure. So, I mean, we have to think about sort of what? How do we want to position this both for acute post-operative phase as well as chronic or focus on the chronic. I think this list that you have that also Sean Lew study has, and many of the other studies, is exactly what we see in kind of hydrocephalus, right? If there's the more common things, which is the headache, nausea, vomiting, of course, you know, a child has to be old enough to describe a headache. I'm sure the little ones probably have a headache, but can't really describe it. The kids are non-verbal. But we can have, if you look at Chiaris, for example, some of the other, we have a list of symptoms that could be hydrocephalus. I wonder if it's helpful to categorize them as sort of the more classic symptoms and sort of the less common. And the reason why I think that's important is because where we struggle with as clinicians is when we start seeing some of the, I saw something on your list, there was maybe a subtle neuro psych change, for example, right? And it's hard to sort of pinpoint and say, that's because of hydrocephalus that, you know, that loss of that particular function. So yeah, I mean, I also wanna make sure that this doesn't get misused in the way that, you know, my child has here. What did you have here? You know, decline in school, change in personality, for example. I would say again, I wanna see what the broader, you know, the whole group says, or Nancy what you think. But I don't want it to be used as like this one isolated symptom, it must be hydrocephalus. We could say a combination of these symptoms that are, in

my mind, they should be progressively getting worse. One way, you kind of know if it's just like, if it's a static issue, maybe not hydrocephalus. But if it's progressively getting worse, that's one. And then ideally compatible imaging, right? That's showing you a change in the ventricular size. Now, if you're not seeing a change in the ventricular size and you're seeing maybe one of the, you know, like, I don't know, one of these less common symptoms, then what do you do? That's more of a gray area. But, but I think for the purposes of this working group, we align on sort of the major presentations. But leave room for, you know, some of those less common presentations. So maybe we can have more softer language saying, you know, always consider an MRI or a ventricle that doesn't change in size in a child who's progressively symptomatic that there may be a component of hydrocephalus that needs to be further evaluated. I think something like that maybe.

Monika Jones: That would be very helpful just that alone, very helpful rather than kind of the black and white ventricles “look good. This kid is fine.”

Fallah, Aria: Correct. Yeah, I like that.

Monika Jones: Well, that was easy. Look, we're done. So I think we do need the input of the rest of the working group members. So what I can do is just prepare the summary, this recording, and then get their input. And then I'll send out a survey for the next meeting. And then Aria, you would present this at the research meeting in Boston. We can work on the slides together, but very few are actually making it live to the research meeting. Most will be via Zoom.

Fallah, Aria: Okay. And this will be to our cohort, the other doctors, right?

Monika Jones: The other doctors. Yeah, because, right, so kind of like the PCORI meeting where then the others provided their input or at least know about it.

Fallah, Aria: Yeah, I think so. It's good. Can do that.

Monika Jones: Great. Nancy, anything.

Nancy McNamara: No, this is really helpful. It's helpful to know that there's no guidelines. We want some guidelines. And I think, you know, the more I think about this, this is just education for clinicians, because who, you know, gait disturbance, you know, as a presenting symptom of chronic hydrocephalus, a lot of people don't know that.

Monika Jones: Yeah.

Nancy McNamara: Let me see it once.

Monika Jones: I remain shocked that this has never been done before. I really do. It's, I'm glad we're doing it. But at the same time, my husband and I were just laughing that Dr. Mathern literally went “Here you go. Here's your baby.”

Fallah, Aria: Yeah.

Monika Jones: Oh my God! Now, what do we do? You know, nothing but well-intentioned, obviously. And I get it. I get why that happens. But really, we need at least an infographic or something that the parents can look at. But I think we're on our way.

Fallah, Aria: Yeah, that would be great. Yeah. And Monica, I think, yeah. At a later date, I think maybe we speak to Jay Hauptman, or I don't know if anyone else is involved with it. You're in. But I think, yeah, down the road, something to think about, because they've been able to really put together some really high quality data on this. And I, and unfortunately, I think in the hemispherectomy world, because these are such rare surgeries. We're gonna move the needle so slowly here. I mean, we're trying. But, as you know, very slow.

Monika Jones: It is. It'd be nice if Christian Dorffer could also have a session at one of his international meetings, too. At least talk about this.

Fallah, Aria: Christian. So his group is just very focused on technical neuro. They actually to the point where they say, we don't even want to present patient data, and so on. It's, I mean, a little bit of it is okay. But the sessions is very technical sort of, this is how you do an RNS or a hemispherectomy. So. But yeah, we can, we can ask them, and see if there's interest.

Monika Jones: But what about a session, or even a few minutes on Oh, by the way, this technique you're likely going to reduce the chance of developing hydrocephalus versus this technique, or there's something we're doing in this technique that's causing more hydrocephalus. What is it about an anatomical that causes higher rate of hydrocephalus? Is it the amount of time you guys are in there, or?

Fallah, Aria: Yeah, we don't know. I mean, we're suspecting blood loss, surgical time. If you talk to Christian and the data we got through HOPs, the vertical had a very low, low rate. I don't know if we, I don't think we connected that as part of HOPs, but just anecdotally, I mean, Christian will weigh in as well when he hears this. But I'm hearing from some groups that it's sort of super rare to develop hydro. And we're seeing it. You know, we started doing the core plexus cauterization. Up until recently, I could have told you we had no one. I mean, recently we had someone. But it's just much, much lower than what's reported in those original studies. So I don't know if it's just more care, less blood loss, or just, you know, maybe pediatric-trained neurosurgeons are doing this as opposed to folks that haven't done training in pediatrics in the past. It was just, you know, mostly done by someone who just is interested in epilepsy. Right? So maybe some of those factors, but very hard to tease them apart.

Monika Jones: Even the embolic hemispherectomy. I know of two kids that developed it post-op.

Fallah, Aria: Right.

Monika Jones: Yeah.

Fallah, Aria: Yeah, that's interesting. Cause we don't know. You know, if they get a subdural hemorrhage or bleed, that can maybe increase it.

Monika Jones: Yeah, why, but I do know that. Well, I, what you got 11 minutes early. Both. Take care!