

# 85| Neuropsych Bite: Clinical Case 5 – With Dr. Beth Slomine

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**Speakers:** Beth Slomine, Ryan Van Patten, John Bellone



**Intro Music** 00:00



**Ryan Van Patten** 00:17

Welcome, everyone, to Navigating Neuropsychology: A voyage into the depths of the brain and behavior, brought to you by INS. I'm Ryan Van Patten...



**John Bellone** 00:25

...and I'm John Bellone. Today we have Clinical Case #5, which is a conversation with Dr. Beth Slomine. Beth is a board certified pediatric neuropsychologist at

Kennedy Krieger Institute and a professor at Johns Hopkins University School of Medicine. You can listen to our full length episode with Beth on therapeutic hypothermia for pediatric cardiac arrest at [navneuro.com/49](http://navneuro.com/49).

**Ryan Van Patten** 00:52



There are some caveats that come with these clinical case presentations, but rather than repeat them each time we will just refer you to the introductions for episodes 77 and 79 where we lay them out. One note for this episode: we're intentionally vague with some details related to the case such as the child's specific country of origin. We did this on purpose to maintain the highest level of anonymity and confidentiality. We recognize that this information is important in real world cases.

And, with that, we give you today's clinical case presentation.



**Transition Music** 01:28



**Ryan Van Patten** 01:37

Thank you, Beth, again. You've been so generous with the full episode and being on the board and doing this. We really appreciate it.



**John Bellone** 01:44

Yeah, we only have six more things that we're going to ask you to do after this.



**Ryan Van Patten** 01:47

[laughs]



**Beth Slomine** 01:47

[laughs] Well, you know, I love doing it. I love telling everybody to listen to you guys. I tell all my fellows to listen and that listening to your podcast is the best way to study for the board exam.



**Ryan Van Patten** 01:59

Thank you.



**John Bellone** 02:00

It's really nice of you.



**Ryan Van Patten** 02:01

Yeah, appreciate it.



**Beth Slomine** 02:02

So, the first case is a young girl, we'll call her Sue. She's 7, and she came to us after experiencing a hypoxic ischemic injury due to cardiac arrest. This occurred while she was hospitalized acutely for atypical hemolytic uremic syndrome, which is a disorder that causes difficulties with blood platelets as well as kidney failure and, in some cases, can result in cardiomyopathy basically. In her case, that resulted in this cardiac arrest that occurred within days of her initial hospitalization. So after the cardiac arrest, her heart stopped, so her brain stopped getting blood. That's why she sustained this hypoxic ischemic injury, which resulted in a significant change in functioning. Then she was admitted to our rehab hospital for a stay to help her improve her functioning. So this neuropsychological evaluation was done in the context of her rehab stay before she was discharged to go home. Would you like me to tell you a little bit about her background? Is that helpful?



**Ryan Van Patten** 03:32

Yeah, that'd be great.



**Beth Slomine** 03:33

So she lives with her parents and has only lived in the United States for the last couple of years. The family had moved here from another country in Asia so English was her second language. She had completed kindergarten the year before this event so she had some exposure to English because she was going to an English speaking school, but her parents required an interpreter for our interactions. So she had English but [we're] not sure how great her English was. So that was certainly a concern. Otherwise, she was healthy and didn't have any significant physical or mental health concerns prior to this acute event. No concerns with birth or early development. Do you want me to move on from the background at this point?



**Ryan Van Patten** 04:32

I've got a couple follow up questions based on what you just said. If there's any more background information, I think that'd be great to hear. And then before we move into the testing, I've got a couple follow ups and John may as well. Is there anything else from her background that you think we should know?

**Beth Slomine** 04:48



I don't think so. She has a couple siblings at home, including a very young infant sibling, which made it really challenging for her parents to be with her in the hospital. The other thing that was really challenging was this was somebody who was seen during the pandemic. We had restrictions on the number of visitors - only one parent was able to visit for a period of time for up to two weeks. So families needed to make a choice in terms of who was going to be in the hospital, which limited our ability to really provide feedback and information to families. Not just about her neuropsychological findings, but also about all of her rehab needs and medical needs more broadly.

**John Bellone** 05:35



Can you tell us a little bit about the cardiopulmonary arrest and the efforts to resuscitate her?

**Beth Slomine** 05:41



Yes, yes. So she was hospitalized and diagnosed with hemolytic uremic syndrome and over the next couple of days, she deteriorated. She needed to be on dialysis for kidney failure. Then about a week into her hospitalization she became tachycardic, had a seizure-like event, and then sustained this cardiac arrest. The records aren't entirely clear, but they attempted for 60 minutes to resuscitate her. And then she was placed on ECMO to help make sure that her organs were being adequately perfused. One of the things that's important is that she had this cardiac arrest while in the hospital so the people that were providing CPR and trying to resuscitate her were experts, medical experts, who were easily able to get to her and provide that care immediately. So even though 60 minutes of attempted CPR is a long time, her blood is moving during that time, which is important when we think about the outcome.

**Ryan Van Patten** 06:55



Right. She has expert medical professionals doing the CPR, which is keeping her blood flowing. There's a big difference between out-of-hospital and in-hospital cardiac arrest and CPR because of the high level of training that those professionals have.

**Beth Slomine** 07:10



Exactly. This is a great example of a child who had an arrest in the hospital and got that high level of support and the outcome was much better than it would have been if this was a cardiac arrest that occurred in the community where there's

bystander CPR or people are waiting for CPR until the EMS comes, which obviously could be a devastating outcome in that case. So after the cardiac arrest, she had an EEG with some abnormal generalized slowing suggestive of severe diffuse cerebral disturbance, which is not uncommon after cardiac arrest because it really affects the brain diffusely. And MRI showed mild global cerebral parenchymal volume loss and abnormalities in the basal ganglia and in the cerebellar hemispheres. She also had an injury to the thalamus. Basal ganglia and thalamus, just like the hippocampus, have high metabolic demand and so they're the first areas that might be impacted after an injury like this. They're the areas that are most vulnerable, but there's also diffuse injury after something like a cardiac arrest. She also had a particular microhemorrhage in the left frontal lobe as well.



**John Bellone** 08:42

When did she regain consciousness? And what did she look like behaviorally?

**Beth Slomine** 08:48

She was pretty quickly responsive to light touch and had some motor responses. She came to us about 22 days after the cardiac arrest, which was about 30 days after she was hospitalized. At that time, she was responsive but nonverbal. She needed a wheelchair to move around because of significant motor impairment. She also was not able to eat by mouth and was being fed with a feeding tube. Over the course of her time - so what we do in our rehab center is we do an initial evaluation when children are first admitted, usually within the first five days or so often over a couple of sessions, maybe three sessions over that time, to look at not only general neurobehavioral functioning but also trajectory of recovery, which helps us predict outcome and be able to provide more information to the family as we think about how long they're going to be in the hospital.



In those first couple of days, she was awake, alert, unresponsive. She was following one-step commands, but there was delay - she was very slow. Kind of a blunted affect. She was primarily communicating with gestures, but starting to voice some short phrases. Her speech was very low volume initially. She had a lot of balance difficulties and weakness and poor coordination. She had some observed dysmetria and a mild tremor when reaching. She had very impaired attention, orientation, and memory, and difficulty with executive functioning. Initially, because English wasn't her first language and she wasn't talking, it was hard to sort out how much of it is language versus how much is this new injury. And her parents weren't readily available to get good background information.

So I just told you about all this background information, but at the moment, when she first comes to the hospital, we're collecting all of that at one time. It's not uncommon for kids early after any kind of brain injury to be nonverbal when they first come to rehab. But, in her case, knowing that English was not her first language and that her parents were not fluent in English, we did wonder how much of this was language based. We were able to eventually get school records and talk with parents with an interpreter. And then also she became much more verbal over time. So those questions were answered as she continued to evolve over time.

**Ryan Van Patten** 11:41



It's interesting how you're piecing it together over time. In an outpatient setting, when the patient is stable, we often focus on the background on the front end and try to get that sorted out and then do testing. In this case, this child is medically unstable, things are happening quickly. So you go back after the fact and piece together some of the background as she becomes more verbal.

**Beth Slomine** 12:03



Yeah, and it's really all happening at the same time. As soon as she comes in, we have an educator on our team who gets a consent from parents - or we would get the consent for her because that educator might not have been in the hospital at that moment that the parent is there - and we try to contact the school and get that information. So all of that is happening at the same time that we're doing an interview with a family and we're working with a child. We're collecting all of this information simultaneously.

**Ryan Van Patten** 12:34



Right. So listeners should know that, Beth, we already have a full episode with you on pediatric cardiac arrest and hypoxia. They can reference that for more detail, but I'm wondering if you could give us a brief review of the mechanisms underlying pediatric cardiac arrest, hypoxia, and then brain dysfunction and cognitive behavioral dysfunction.

**Beth Slomine** 12:57



Yeah, there's a lot of different reasons why children have a cardiac arrest. Often outside of the hospital a child might have an undiagnosed cardiac condition and have sudden cardiac arrest. That's rare, but it occurs. Or a child has a blocked respiratory tract for some reason - whether they have asthma and they have trouble breathing, or they choke on something and it gets stuck in their airway and then that lack of respiratory ability results in a cardiac arrest. When that happens out of

the hospital, if you don't have immediate and quick resuscitation, CPR, then it can be very devastating. Children who arrest in the hospital often are sick because they're in the hospital, and then have an arrest. This case is an example of that. Often those kids have developmental delays prior to their cardiac arrest. They might have long-standing medical issues. For example, children with Down Syndrome often have cardiac issues. If you have a child like that, who's in the hospital dealing with some kind of medical issue and then has an arrest, they might get great CPR care and the impact of the cardiac arrest on outcome may be less significant. But, you still have to keep in mind the long-standing pre-existing neurodevelopmental difficulties that that child might have been experiencing. In this case, this child was typically functioning prior to this cardiac arrest. So what we're left with is the impact of the cardiac arrest but also, in her case, she had this hemolytic uremic syndrome, which has some of its own risk factors associated with it that we need to keep in mind. So whenever you're thinking about a cardiac arrest, you have to think about the arrest as well as the etiology of the arrest and if the etiology of the arrest was something else, even if it's asthma, that might have long-standing impacts. You have to think about the neurologic effects as well as the overall medical effects.

**Ryan Van Patten** 15:14



Right. With atypical hemolytic uremic syndrome, generally speaking, that means low circulating red blood cells, right? There can be related issues like acute kidney failure, thrombocytopenia, and other related issues. So that has its own mechanisms that can negatively impact brain functioning. But then, obviously, the cardiac arrest was a big deal, too.

**Beth Slomine** 15:38



Yeah. I actually just went back and took a look at the most recent follow up for this child with the cardiologist and her cardiac issues have since cleared up. Her heart is healthy at this point. So even though she had cardiac issues from probably the clogging of those small vessels in her heart, that has since improved with medication. So, hopefully, she'll have few ongoing medical issues. But she's still getting infusions to manage the effects of the atypical hemolytic uremic syndrome. I'm not an expert on that by any means, so that's about the most I can tell you about that. [laughs]

**Ryan Van Patten** 16:27



[laughs] Yeah, that's fair.



**John Bellone** 16:28

It was a great overview, though. So she gets to your unit about 22 days after the cardiac arrest and then my understanding is you did testing over the course of many sessions. Can you talk to us about the testing process and the results? Very high level.



**Beth Slomine** 16:45

Yeah, so we do this initial evaluation. Then depending on how long the child is in the hospital, we might even step back and start doing some cognitive rehab, psychoeducation, and try to hold off on testing until we get closer to discharge. Kids are actively changing during rehab and we don't want to waste our standardized tests. Then the child is different from how they were on the test and the test is meaningless. And you can't use it again, because you just gave the CVLT. So I think of myself as very stingy with testing. I wait until I feel like somebody is stable and ready to move forward. So you'll see that there was, I think in the report I said 11 sessions of testing, but that was really over a shorter period of time because we're fitting our time in with PT, OT, and speech. It's not like outpatient testing where we have a whole day with somebody. We might have a half hour or hour session interspersed between other therapies. So that's one of the reasons why it needs to happen over multiple days.

Do you want me to talk about the test results at this point?



**John Bellone** 17:55

Yeah, the testing process and the results. Again, very high level.



**Beth Slomine** 17:59

Yeah. So, in this case, we did a typical battery of standardized tests as you would in an outpatient setting, including measures of IQ, attention, language, visual perceptual, memory functioning, executive functioning. Overall, she did average on things that were visually-based generally, including measures of visual reasoning as well as visual memory. But she really struggled with some of the verbal reasoning tasks. Had some difficulties with verbal memory, as well as attention and executive functioning. Qualitatively, we saw those difficulties with attention and executive functioning as well. So, again, we came back to "Well, how much of this verbal difficulty is language and English being second language?" I think at that point, it was really hard to answer. I don't know how much because we have a little bit of baseline. We knew she did well in kindergarten, but we didn't really have a great grasp on her pre-injury language functioning. Certainly the executive and

attentional difficulties were new and something not reported previously. She also had weakness. She was able to progress from the wheelchair to being able to walk around independently, but she still had very significant fine motor issues. So for example, on the Grooved Pegs on her right hand, which was her dominant hand, she was three standard deviations below the mean. But on her left hand, we weren't even able to do it, we had to discontinue it. I mentioned before some kind of left-sided injury but you have to keep in mind she had a really diffuse injury. So her motor pathways are impacted bilaterally. I think that's probably a good overview of her test results.



**John Bellone** 20:12

You mentioned the basal ganglia and cerebellum were both involved. So we would expect some degree of motor difficulties.



**Beth Slomine** 20:18

Exactly. Yep. She has a lot of different areas of impairment, but that said, you know, we talked in the full episode about how sometimes kids with cardiac arrest remain unresponsive or minimally responsive. This is a child who made really nice gains after having a prolonged cardiac arrest that took 60 minutes for return of circulation.



**John Bellone** 20:47

Right. Like you said, the good outcomes are likely attributed to the very high quality resuscitation measures and CPR that she was getting.



**Beth Slomine** 20:56

Exactly.



**Ryan Van Patten** 20:57

What about behavioral observations? Her behavior and emotional functioning that you observed in the rehab unit during testing and outside of testing. What was that like? Was there a change in that over time?



**Beth Slomine** 21:11

Yeah. My recollection is she was very distractible, she was somewhat impulsive.

There was a period, when she was talking, where she would first sit and she would just say "no", but then could be redirected back to doing things. You take a little child, you put them in a strange environment, at the time everybody's wearing masks and face shields, it's hard to know how much of that is behavior due to just

her parents aren't there and there's scary people with masks versus how much is new due to the cardiac arrest and associated injury that that she sustained. But that was a very significant issue that got better over time. I mean, before she left, she participated fully in testing. She did not say "no", she did not refuse anything. Trying to get even something like a whole WISC in a child like this, again, two weeks before would have been impossible. So over the course that she was with us, which I think was about two months, she made really nice changes.



**John Bellone** 22:25

Can I ask, on your rehab unit, is it typical for you to give that comprehensive of a battery? It seems like a pretty lengthy battery.



**Beth Slomine** 22:35

No, it isn't. And I always struggle with that. This was a family that lived further from our academic medical center. They had one car. The father worked, the mother was home with all of these other children, including one infant and didn't speak English. There was no school happening because of the pandemic. There was no way I anticipated her to get any kind of testing or check in through school. I didn't expect the family to be able to come back to us anytime soon, in a realistic way. So we went ahead and did that testing. Also I felt like she got to a good place and she was relatively qualitatively close to baseline so it was time to be able to really see quantitatively how close she was to what we expected her baseline to be. So that was some of the reasoning that went into why we went ahead and I decided to do a full evaluation at that time before she left.



**Ryan Van Patten** 23:41

Right. You've mentioned English as her second language several times. Of course, something else we're aware of are cultural factors, which could be related to her behavior in this setting and her cognitive test performance. I wanted to mention that. I'm also interested in recommendations for her.



**Beth Slomine** 24:02

Yeah, and I can tell you - recommendations last year during COVID were really challenging for any recommendations for school. So, with children, we always think about school as the place where they can continue to get intervention and rehabilitation and where they have a structured program to move forward. If this had been a different time, I would have recommended returning to school with an IEP or maybe even only a 504. Maybe some modifications, but with English as Second Language to continue on a regular basis. I would have wanted OT to check

on her because of that fine motor difficulty. She's going into 1st grade and I was really concerned about how developing writing was going to work, and drawing and cutting and all those things you do when you're in elementary school. What we ended up doing, in the feedback with mom with an interpreter over the telephone, was talk to her about how comfortable she felt with virtual school with her other kids. Because she doesn't speak English, they can't even really call the school and ask for help because they can't log on. It sounded like at least that was going okay with her typically developing other children. So we capitalized that and tried to work out a plan for this child to also participate in virtual schooling and try to move forward with some recommendations for occupational therapy. Through the school, it was unclear how that was going to play out that year. We did recommend outpatient physical therapy services. We spent some time talking through not only us in neuropsychology, but our team and thinking about the logistics of that with the one car, one parent having to work, where the physical therapist was, how she was going to get there. The other thing that was key was this child needed ongoing infusions due to the hemolytic uremic syndrome, like every month or month and a half or so. But that required mobilizing and getting to an academic medical center. One of the things I think a lot about with families is not overloading them with recommendations. Trying to think about recommendations that fit into their family, and how to help progress a child forward without overloading a family with unrealistic expectations or things that they just might not be able to mobilize to do.



**John Bellone** 26:50

Can you talk a little bit about the prognosis of recovery and development over the next few months or years even?



**Beth Slomine** 26:56

Yeah, I would expect it - there's several processes happening, right? One is that she's still in an active state of recovery. This is only two and a half months after cardiac arrest. We see very significant recovery in the first six months, but continued recovery past that time. But she's also developing, right? You expect her to also develop new skills, but she's also behind her peers now. So we expect that as she develops and recovers that gap between her and her peers, I'm really worried that that's going to increase over time. As the demands increase for paying attention more or organizing more, over time, she's going to struggle even more relative to her peers. She's certainly somebody who's at risk and should be followed.

One of the things that we have at our institution is we have a brain injury follow up clinic where we recommend that all of the kids that are able to come in for a follow up. Come in maybe eight weeks after discharge, maybe three months later, six months after that - kind of an ongoing check in on their rehab needs, their neuropsychology needs, educational needs, general mental health needs, physical therapy needs. It's kind of a one stop shop. They come in and all these different professionals check in on them and people put their heads together and update someone's rehab plan. We recommended this for this family. That was an example of something that they have not yet followed up on. I think it's hard. It's not a realistic recommendation in some ways for this family. Ideally, I would think a child like this should have a neuropsych follow up about two years after this. If they had come to our follow up clinic, there's a neuropsychologist there that could check in and help with the exact timing of that. But I am worried about the follow up in this case, because the only one following her at this point seems to be the cardiologist who's not going to notice this. When you have a family where English is the second language, I'm not sure how much they're going to be able to appreciate and identify concerns. I am hopeful, on the other hand, now that she's hopefully back in school this school year, that there'll be more monitoring and the school will be able to identify concerns and help her get the services she needs. But she's really at risk.



**Ryan Van Patten** 29:37

Definitely a complex case, but this review has been instructive. So, thank you.



**Transition Music** 29:45



**Ryan Van Patten** 29:45

Well, that does it for today's conversation. We have upcoming episodes on intellectual disability, culturally informed neuropsychological assessment, cannabis and driving, working memory, and autism, among others. As always, thanks so much for listening, and join us next time as we continue to navigate the brain and behavior.



**Exit Music** 30:08



**John Bellone 30:31**

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**Ryan Van Patten 30:43**

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