LNP 298
Toxicology Expert Witnessing: More than Numbers
Dr. Allison Muller

Kelly: Hi, it's Kelly Campbell. Welcome back to the Legal Nurse Podcast. Today we have Dr. Allison Muller. She's a board-certified toxicologist and registered pharmacist with over 20 years' experience in the field of clinical toxicology. After a nearly 20-year career leading the poison control center at the Children's Hospital of Philadelphia, which included consulting on toxicology cases from 21 counties in Pennsylvania and Delaware, Dr. Muller is presently an independent consultant specializing in providing expert witness testimony on cases involving medications, alcohol, chemicals and environmental toxins.

She is also an adjunct faculty at the University of Pennsylvania School of Veterinary Medicine and a founding section editor for *The Journal of Emergency Nursing*.

Welcome and thanks for joining us today.

Allison: Thank you so much for having me on the podcast. I'm excited to talk with you.

Kelly: I have lots of questions. And you know before I ended up going to perfusion school, I was at University of Arizona for pharmacology and toxicology.

Allison: Oh wow.

Kelly: Yeah, so it's pretty fascinating to me. What made you go into the field of toxicology?

Allison: My undergraduate and my graduate degrees are both in pharmacy. And when I graduated from my undergrad program, I was working at the poison control center here in Philadelphia. It's at the Children's Hospital Philadelphia, and I really enjoyed toxicology, so I really committed my career to toxicology rather than pharmacy. And I did also a Doctor of Pharmacy degree and then I did some post-op work in toxicology and eventually became director of the poison control

center. I was the director there for 10 years. I was on staff as one of the poison specialists for 10 years.

Toxicology really is a natural fit for pharmacists and for nurses who have an interest in drugs and chemicals and understanding the things, the bad things, that can happen to the body with these substances. And most importantly, understanding how we can treat and affect patients that might be poisoned. So, I'm very passionate about toxicology. I did still keep my pharmacist license, but I haven't filled a prescription in a couple decades. I'm definitely committed to doing toxicology consulting exclusively.

Kelly: It's so impressive.

Allison: Well, thank you.

Kelly: What types of cases do you work on as an expert witness?

Allison: The typical cases would be, let's say, from an attorney who's working on a medical malpractice case. And to me, it really does not make a bit of difference if it's a plaintiff's case or a defense case. For me, it's just a matter of how I can best explain the science of the case to an attorney and then ultimately to a jury. So, a medical type of case may be somebody, let's say they were in the hospital, who may or may not have had an adverse effect from a drug—either because there were drug interactions that weren't picked up, or the dose was incorrect, or maybe the wrong patient just got the wrong drug. There are a whole host of reasons why there could be medication misadventures for either an inpatient or an outpatient.

I also get cases from criminal defense attorneys. Unfortunately, the kinds of cases that are coming up are way too frequent in my area of expertise, and that has to do with the opioid epidemic. Many of these criminal defense cases are death due to drug delivery. Typically, my job is trying to really drill down as to whether that was the sole cause of death or were other drugs on board also responsible.

Other criminal defense cases tend to be things like this: There's a homicide, but the person has these drugs in their system or takes these prescription medications. What could be their role in the change and behavior that led to the homicide? I also get a lot of personal injury

cases. So, they may involve drugs, alcohol, or both where somebody either has a simple DUI with alcohol.

I typically don't take those cases because they're frankly not that exciting for me, but I do take those alcohol-related cases that might be with also drugs involved and saying, "What's the role of these drugs in the person?" It's either driving impairment or impairment at the worksite or cases known as dram shop cases where a patron is at a bar, and they are potentially being over-served even with the visible signs of intoxication. I need to drill down what the lab results show and what the other patrons have to say about the behavior, and the bartender.

So, those are the three types of cases: personal injury, medical malpractice, and criminal defense.

Kelly: Ok. Do you mind if we break each one down and dissect each one? For personal injury, how would you go about trying (to analyze it) or from start to finish?

Personal injury, you would receive a case, whether it's defense or plaintiff. How would you look at the records or what would be some of the things that you would look at to determine: the records, the medical examiner, or an autopsy, and how would you look at it as an expert? I mean, obviously as a pharmacist, you would do that. How do we look at that?

Allison: That's a great question, and I do the same thing for every case. So, some of this might be repetitive, but I'll start from the top.

Whenever I get a call from an attorney about a case, first, I want to make sure that I don't have a conflict. I need to know who the parties are that are involved, and all the attorneys involved in the case, to make sure that I have not been contacted by the other side in any way shape or form. And I'm not familiar with the case at all, that's the first thing.

The second thing is, I also want a very high-level overview of what the case is. I'm not going to get into a half-hour conversation about the case because we're working in the dark. If I don't have any records in front of me, I'm not going to give opinions on something based on

what the attorney or some other expert has gleaned from the record. So, that's the second thing.

The third thing is, I will ask the attorneys where they are in the process of getting all the materials in discovery for the case. I have cases that are in my office now that are in all different stages. Some cases I might not get all the discovery materials for months; therefore, my opinion is not going to be ready for months. And so, I also want to know what they have and what they're waiting for, and then I may make recommendations to get additional materials.

The big one in personal injury cases for me is: I will ask the attorneys if they have historical medical records. So, if it's a personal injury case, and the patient was hospitalized, of course, the attorney is going to have those hospitalization records, but what they don't have sometimes is historical records. So, I want to really get a lay of the land as to what this person's medical history is. I want the medical records from their primary care doctor or from their neurologist or any other specialist that they've seen.

And then being a pharmacist, of course, I want the pharmacy records. Also. states have something called "Prescription Drug Monitoring Systems." I also want that data, and these are things that attorneys may not have. The pharmacy records and the prescription drug monitoring data typically are not ready readily available to me, so they'll say, "Okay, we'll put that on the list for discovery." So, those are all helpful.

Once I get all the materials that they have—and it might not be just records—it might also be videos or recordings or text messages. I mean, everything should come to me because it's not up to the attorney to determine what the toxicologist needs and doesn't need.

A lot of times it's not just the medical piece of it, especially as you had mentioned about death cases. Especially with death cases, I need really to understand the circumstances surrounding the death and getting crime scene investigation data. I also want any statements from bystanders, police reports, like everything. So, I have attorneys send me everything, and then I go through all the records.

Now, everybody has a preference. I used to have the preference of having paper records, but then it becomes voluminous. I have boxes and boxes and boxes of paper records and then I must get them professionally destroyed and all that, so now I go through electronic records.

And so, legal nurse consultants should keep in mind everything that they are noting is discoverable and needs to be shared with the attorney. When I'm deposed on cases, I have sometimes sheets of note paper that I've taken notes on cases as I'm going through the records. I'll be like, "Page 55, column one, I've found this." I never want to write directly on the records because I might have to get those back.

Kelly: Right.

Allison: So, they'll get handwritten pages. Be mindful what you're writing down because you need to be giving all of that to the attorney and then that ultimately will be shared during deposition, that is, as a product that you need to produce for them.

And so, these are some of the things I was looking for personal injury cases. I don't go straight to the lab, the toxicology lab for the post-mortem data, the toxicology labs that are done at autopsy. Those are interesting, and I will certainly look at them, but that doesn't make my opinion one way or the other yet.

One of the things I stress to attorneys when I'm teaching them also about these types of cases is if all you have is a drug level, all you have is a drug level. You should not be making any hardened fact conclusions just based on the drug level. You need more than that because oftentimes the drug levels are showing you, hey, at some point in time this person used this drug, but is it telling you the dose? Is it telling you when? Is it telling you if they were impaired or not? You need more data.

So, the summary, I would say, for personal injury cases, and really all cases, is make sure you have everything you need. Make sure the attorney is sharing everything that they have with you regardless of whether they think it's helpful or not. Because really, they don't have your expertise, so they don't know what you really can find helpful.

Kelly: Right. That's so valuable. No matter what expert you are, they don't have your expertise. So true.

Allison: And I have a professional services agreement that includes a HIPAA agreement and other separate topics, but I won't get too far into that. But within the professional services agreement that is signed by the attorney prior to me doing anything with the record, doing any sort of review, it does have in there that they would be required to supply me with everything that they have obtained during discovery.

Kelly: That's very wise. I do the same thing. That's so wise. Okay, regarding the autopsies, you had mentioned about the drug levels with autopsies. Can you delve a little bit deeper into that?

Allison: I do a one-hour talk for attorneys about these postmortem cases because there are a lot of misconceptions about postmortem toxicology, and not only in the layperson community but also in the healthcare provider arena. And things like when you're looking at autopsy reports, and the medical examiner is stating what the cause of death is, the medical examiner doesn't necessarily have anything but autopsy reports. I don't mean to minimize it because autopsy results are huge, and the toxicology results are very key, but oftentimes the medical examiner doesn't have everything that you have.

The medical examiner doesn't have the hospitalization records or the past medical history or bystander reports or police reports sometimes. So, when they're putting the cause of death, you can't take that at face value. For example, if I get a case and it says the cause of death is heroin overdose, an unintentional accidental heroin overdose, I don't say, "Oh well, the medical examiner said it was accidental heroin overdose so it must be."

No, let's see what we found at the scene. Let's see other data that we can come up with. "What other drugs were in their system?" "Oh, but they had a host of other drugs." They may have had, let's say, a benzodiazepine on board. They may have had other street drugs on board. I mean, they may have had fentanyl.

So, there are other things that can come into play, or maybe the bystanders gave totally different reports in terms of how the person was acting or what their drug use habits were, etcetera. First thing is

not to take that at face value. The medical examiner will give the best answer that he or she can based on what they have. Again, it's not fair to say that their answer is the end all be all because they don't have everything that you have.

And the second thing is back to interpreting drug levels. So interpreting drug levels and post-mortem cases is tricky because people really want to extrapolate retrospectively what a drug level was prior to death. Between my undergraduate program and my graduate program, I took three semesters of pharmacokinetics.

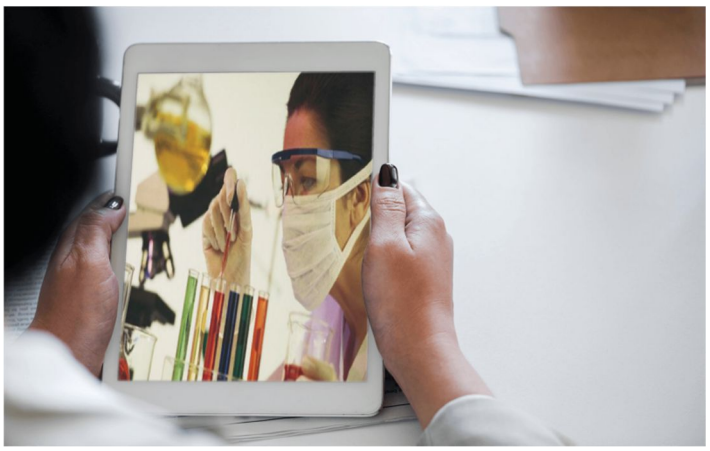
Pharmacokinetics is the science behind what the body is doing to a drug once it enters the system. You can't apply the formula or the formulate or any of those principles to patients who are no longer living. I can't take those calculations and figure out what was the dose that they took based on this level. I've seen opposing experts do that, and they clearly have no idea what post-mortem toxicology is about if they're using pharmacokinetic calculations for drug levels from dead patients.

So that's the first thing, you can't use pharmacokinetics principles and figure these things out for post-mortem levels. The second thing is sometimes levels look unexpectedly and falsely elevated because there are all these changes in the body after death. Attorneys are very familiar with this too. I refer to something called "Post-Mortem Redistribution, which is PMR, and so what that means is things don't stay put after death, and some drugs degrade more than others, many of the opioids are famous for this like fentanyl, for example.

If I see a sky-high fentanyl level, I'm like "Well, it's high. Was it really this high before death or was it because of the post-mortem redistribution and things are just shifting around coming from tissues into the blood?" And depending where they drew the sample from, the post-mortem standpoint makes a difference as well. So, I don’t get too excited about what the levels looked like in terms of how high they are. If it's a trauma case, what type of trauma case is it? If it's something where maybe contents of the gastric cavity could have spilled out into the blood or such, that's a problem with really interpreting levels.

I like vitreous humor because vitreous humor is a protected space in terms of getting levels. The problem is that we don't always have references that tell us what the difference between humor levels mean. The other thing is, and I mentioned this when I spoke at the annual meeting for the legal nurse consultants, that there's a textbook by a gentleman named Basalt and you know it's a very, very voluminous amount of material in there in terms of how to interpret levels.

With ante-mortem and post-mortem, you'll see that there are ranges. It might say, "So, that's been reported for such-and-such drug from 5 ng per milliliter to 5,000. I'm being a little exaggerating here but not by much. So, for someone to say, "Well, they had a level of 75 and it's in that range. Boom, that's the cause of death" is incorrect. You know there's also all these different charts that'll try and correlate drug levels with a fatality versus therapeutic post-mortem drug levels or non-toxic post-mortem drug levels. Those are only a starting point. Those are not meant to be, "Okay, that's the end of the story. We go to these charts." So, use them very carefully and don't use them in isolation.



This is Pat Iyer.

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the code Listened in the coupon box to get a 25% discount. Now let's return to the show.

Kelly: Another book that is coming out by AALNC is in the eBook series on the opioid crisis by Sharon Kelly, and I happen to be the peer review for that. And, I think that's a very valuable book too.

Allison: Well, you must tell me a little bit about that. In the book, do they talk about things related to the toxicology of the opioids?

Kelly: Yes, and just a little bit touches on it, but it's more the various cases in the opioid crisis in the form of kinetics just a little bit, not near as in-depth as what you're providing. I think people are going to end up listening to this podcast quite a bit because you're touching on things that the legal nurse consultant needs to be aware of. In fact, what are some of the other pitfalls that we need to look for in addition to higher levels or redistribution?

Allison: The other piece is (and this goes for really all cases and not just post-mortem, but it came to my mind because of a discussion I had with an attorney, and I caught this error) make sure the units are consistent. Like if you're looking at drug levels in the autopsy report to the toxicology analysis, note the levels. If there's any place else that you have documentation of levels, make sure it's the same unit. And if it's not the same unit, you need to do a conversion. I've seen that error before where there's a confusion with the units. I can see how that could happen, but it's a very dangerous mistake to make, so make sure that you're paying attention to units.

Kelly: Something so little, but so big.

Allison: It could be a hundred-fold difference you know. We must make sure that we're paying attention to the units.

Kelly: Right, right. Okay, do you have any other tidbits?

Allison: I would also say for post-mortem cases, to make sure that you are clear on what all the results mean in terms of, okay, there are metabolites and then there are parent drugs. So, I'll give an example with morphine. If you have morphine in a post-mortem toxicology analysis, you may or may not be able to figure out what was going on.

In other words, morphine is the parent drug so, "Did the person use morphine at the get-go, or did they use heroin?"

And morphine is one of the two major metabolites of heroin. It's the one that sticks around longer. The other one is the 6-monoacetylmorphine, the 6-MAM. And that doesn't stick around quite as well, and can you tell the difference? And it's hard to figure that out if that's all you have is a morphine level, and I've seen that.

I had this one case where the medical examiner ironically enough this time had more information than I did, at least in the beginning. Sometimes you don't know what you don't have until you say, "Wait a second, what did he have exactly, or she have?" So, in this case, the person had morphine post-mortem, and the cause of death was listed as you know heroin toxicity.

And I saw the attorney, and I said, "I don't know how the medical examiner thinks that this is a heroin overdose because there's morphine. How does the medical examiner know one way or the other if the morphine came from heroin or if the morphine came from morphine?"

And he said, "I don't know." I said, "Well, I don't know either because I can't say that this is a heroin overdose. I mean, it's definitely an opioid because the way the person was found and the timing. It was clearly an opioid, but I don't know if it's heroin or morphine." So, then I got information that the medical examiner had that I didn't, and I got the scene investigation report.

There were all these packets at the scene like on the floor, on the table, in the trash, these glassine packets with this little stamp on it. And street drugs, particularly heroin, they have brands to let users know like, "Okay, I get this brand. I know what kind of dose or what kind of high I'm going to get. I know it's from this dealer," and it was one of those ones. You can even google it. I forget what it was. It was like a Mickey Mouse one. I'm making that up, but something to that effect. And it says like a Mickey Mouse heroin packet or whatever, and then that was it. So, the medical examiner knew about that at the scene and I didn't know. So, I thought, "Oh, yeah, now that makes sense."

Kelly: How about that? So, you do just have to pay attention then. Well, can you distinguish for us the difference between like hair samples, a blood sample, the different techniques of those type of samples and what that means?

Allison: Sure. I'll go back to the cases involving living patients. There are pluses and minuses for all those types of samples. We'll start with urine samples for toxicology testing. The nice thing about urine samples is that you're going to have a longer detection time for drugs and their metabolites when you're testing urine. So, things stay in the bloodstream only so long, but they'll stay in the urine longer. So, you'll get a longer detection time. So that's the nice thing about urine toxicology testing.

The bad thing is that there are numerous ways to try and adulterate, switch and do something to throw the result off of urine toxicology testing. And those are things like (I mean, actually an attorney told about this one) you can buy synthetic urine off the Internet.

Kelly: Oh, my goodness.

Allison: Yeah, I was thinking, "Just when I think I heard it all." I know it's hard to get somebody else's urine because they're going to test the temperature. It's going to be different if it's from somebody else unless they gave the sample like right there on the spot literally. So, you know it's hard for people to come in with someone else's urine and keep it at the right temperature and that sort of thing. And you know, people try to add all different things with a low success rate, but still there's the chance that the urine could be adulterated. So, that's the one problem with urine.

Blood is the most accurate. It's obviously the most invasive, but it's the most accurate. But again, the issue is, things don't hang around the blood as well as they hang out in urine.

I get a lot of questions about the hair testing. I don't do a lot with hair testing for my purposes. I mean, it's one thing if you're monitoring people for new and upcoming drug use because the drug is going to stay in the hair follicles, and they can't wash it out. So, let's say they're in some sort of program where they're being monitored for drug use,

okay, they can get hair samples and as the follicle is growing, they could see if there's any drug in there.

But, the issue for me is that I don't get any data from that other than, okay, they've used the drug at some point in time and they're not clean now because they had nothing in their hair, and now they do. But there's not data out there that really connect the dots between levels in hair samples and the amount of use or time of use. So, it's not helpful for me.

And then of course there are breath samples, and you know we're all familiar with the breathalyzer technology that's used for alcohol. I don't know how close they are, but there are a couple of companies that are developing, and I know ones out in California. They were talking about it at a toxicology meeting last month, a breathalyzer for marijuana.

Kelly: Yes.

Allison: Yeah, that's key because it's not like alcohol where you blow a level, or even if a blood level, and that's a whole other topic too about marijuana metabolites that say, "This person was impaired based on this level." We have those data for alcohol. We don't have those types of data for marijuana metabolites. But what it's supposed to do is say, "Okay, if it's picking up this level of metabolite, we at least know that it's within like the past hour or two" and then they are connecting that to say, "All right, this particular metabolite is being picked up on this breathalyzer. That means it was a recent exposure." And then they're taking it a step further to say, "recent exposure, meaning they were intoxicated in the past whatever the time frame is." So, there's still a lot of the data that has not been released about that, so stay tuned on that.

Kelly: Now this is a disclaimer of personal opinion. I mean with so many people getting it prescribed for medicinal reasons, you still have those side effects whether you're driving or not with the prescription.

Allison: And the issue becomes, like here in Pennsylvania, the level is like incredibly low. It might as well just be zero, but if you're caught with really any trace essentially of marijuana metabolites in your system, you're considered impaired. So, you know maybe you're using

medicinal marijuana, but still you shouldn't be driving if it's a certain level. But we don't know what that certain level is and that's the problem.

So that's why Pennsylvania has this very low level of essentially zero (I think it's actually 0.1) to say, "If you're about this level, you're impaired," not because there's science to say you're impaired. It's just because they're saying, "You know what, we don't know what the level is, and we're going to say if any, you're not supposed to be driving." There needs to be some more refinement to that, but there's just not the data that we need to say what that level is. It's very tricky.

Kelly: It is, it is and I'm glad there's science coming behind and again that's personal opinion based on a friend of mine whose daughter was killed by someone driving while under the influence of pot specifically.

Allison: My goodness.

Kelly: I know.

Allison: It's so difficult to hold people accountable for this when we don't have data. So, we're saying like, "We're giving this out as medicinal marijuana, but, by the way, we don't know how much it is a problem for you to drive." So, you're trying to hold people accountable for something, but you're not giving them information because the information isn't there. So, you know how much is safe? Is any safe? I don't know and to hear stories like that is just so disheartening.

Kelly: I know, and I have to say this was someone that was not using it medicinally. I don't want to start a controversy, but I have my own opinions. I do have another question for you before we go. I know we were starting to make this podcast longer than what it's supposed to be.

Now I've been starting to read that meth is on the rise versus heroin and opioids. Have you started to see or get requests on meth?

Allison: I haven't had a lot of methamphetamine-only cases. I've had cases, whether they be criminal cases or others, like post-mortem cases, with methamphetamine being detected along with other drugs. And it's interesting because I just read, and I think it was in the *Wall Street Journal*, about some statistics about how you know methamphetamine

is on the rise, and opioids are somewhat down in certain areas of the country.

You know methamphetamine is one of those drugs where it's not something that comes to mind like heroin or other opioids where there's this high likelihood of death with overdose. Overdose of methamphetamine is not benign, don't get me wrong, but typically, if you must put it side-by-side with an opioid, the latter is a lot more likely to cause a fatality than methamphetamine. Again, both are dangerous, bad, toxic, but opioids are certainly more toxic in terms of risk for fatality.

Kelly: Okay. I was just curious. You know every drug seems to be cyclical with decades or like the 70s then cocaine was popular. Was the 70s cocaine? I was born in the 70s, but cocaine had its heyday, and then it was heroin, and I was just wondering if meth is starting to be the trend because Adderall and with the millennials if that's like a socioeconomic difference of Adderall and meth. I was just curious if there was a connection there.

Allison: Yeah and I must jump through hoops to get the pseudoephedrine for my stuffy nose because the phenylephrine just doesn't do it and has more side effects. But even though I must sign my life away to get pseudoephedrine, it doesn't seem like the methamphetamine labs are being shut down.

So, I don't know what impact that made, but it's interesting what you said about trends. Like I'll give one kind of example and I talk about this in an hour-long talk, so I'll just make this one statement that you know PCP was big in the 70s, right. So, I cannot tell you the last time, if ever, I've seen a drug screen with PCP on it that wasn't a false positive. Like PCP is one of those always false positive. I mean, almost always. I mean if you want to know, you must do confirmatory tests. But that's one of those things on a drug screen like PCP is not all that common, but it sure is common as a false positive.

Kelly: Interesting. Well, it has been fascinating. The time flew for me. Maybe it's because of my University of Arizona and pharmacology toxicology days, but I can just continue talking to you all day. But tell our listeners how we can stay in touch or reach out to you when we have some questions or reach out to you as an expert?

Allison: So, I have a web page, and instead of like giving you the whole long web address the easiest way to find me is just to Google "Allison Muller Toxicologist" and I'll light up like a Christmas tree, my LinkedIn page, my web page. You know any of my blog posts that are on my web page. A lot of these talks that I've mentioned that I do for attorneys have been video recorded and are on my web page. My blog is in the "Of Interest Section" and the name of my company is "Acri Muller Consulting." That's harder to remember versus just Googling Alison Mueller Toxicologist. You'll find me, and I consult with attorneys all over the country. So, it's not like "Oh well, I'm not anywhere near Philadelphia." That's fine. I travel. There's a phone. That's fine."

Kelly: Okay great. Well, thanks for your time and listeners don't forget to tune in next week. Thanks for joining us.

Allison: Thank you so much for having me. This was so fun.

Kelly: It was, thank you. I learned so much.

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