

Best Practices in the Pharmacologic Reversal of Neuromuscular Blockade



CMEO Podcast Transcript

J. Ross Renew, MD, FASA, FASE:

Hello. On behalf of CME Outfitters, I would like to thank you for joining us for part three of this podcast series focused on improving perioperative care entitled *Best Practices in the Pharmacologic Reversal of Neuromuscular Blockade*. Today's learning objective is to utilize appropriate best practices in the pharmacologic reversal of neuromuscular blockade. With me today is Dru Riddle and Ian Makey. Dru is a nurse anesthetist at Tech, in Texas. Welcome, Dru.

Dru Riddle, PhD, DNP, CRNA, FAAN:

Hey, thanks. I appreciate you inviting me to be here. It's good to be part of the panel.

J. Ross Renew:

Great. And with us today, also, is Ian Makey, a cardiothoracic surgeon that I get the opportunity to work with frequently at my institution. Welcome, Ian.

Ian Makey, MD:

Thank you very much. Glad to be here.

J. Ross Renew:

All right, to get us started today, I wanted to step back and kind of talk broadly and ask each of you to share your thoughts on the importance of multidisciplinary communication intraoperatively. I try to think about the bridging communication between our two specialties. And if we could start with you, Ian, how do you view the role and the importance of open lines of communication during the course of an operation?

Ian Makey:

Yeah, thanks, Ross. The anesthesiologist and the surgeon, although it seems like there's a barrier, there's the drape, but we're literally like a few feet apart from each other, so it's not like it's a hard thing. We're just talking back and forth, I would say, during the course of the operation. It's usually at the beginning and towards the end where it's most needed.

I would say for us, a majority of what I do is lung surgery, and so that comes up with lung isolation, and if it's not ideal, or patients have emphysema and the lung's not deflating well, and then those situations where you insufflate the chest and you can get hypotension, those are important times to have good communication regarding the neuromuscular blockade and having patients still during the operation. There's certain times when it's more important.

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A lot of lung resections nowadays are done minimally invasively, and so, we're particularly sensitive during those operations if the patients are moving. If the diaphragm's moving, that would almost be impossible to do the operation. For most of those cases, I don't think about it because you guys do a nice job, but they need to be completely paralyzed.

And even then, sometimes if we're dissecting very centrally near the hilum or sometimes dividing the vagus branches going to the lung, we can still see little movement, but I would say those are the most important times to have the good communication and to have that full paralysis.

J. Ross Renew:

Okay. Yeah, thanks for sharing that. Dru, how about you? From your end, from the other side of the drapes, how do you view multidisciplinary communication intraoperatively and the importance of it?

Dru Riddle:

Yeah, it's critical. I mean, there's plenty of studies, as I'm sure most of the listeners have had an opportunity to read about, when communication breaks down, and especially in the perioperative period, and even more specifically, intra-op, we can have outcomes that are less than desirable for our patients, and it may actually contribute to some safety concerns for our patients. I think about this kind of on a continuum of communication, where there's the intra-op logistics of what's going on right now. I'm struggling perhaps hemodynamically in managing the patient. The surgeon might be struggling with an aspect of the surgical procedure, but I back up just a little bit from that and think about the planning on the front end. And I think, admittedly, we all probably don't do as good a job as we would all like to do in having a "let's sit down" even if it's a minute or two on the front end and say, "Hey, what are you expecting in this case? Do you think there's going to be more blood loss, for example, than I would've normally anticipated?"

And most of it's on anesthesia. While we may have certain areas in which we focus, we are almost a jack of all trades where we do anesthesia for lots and lots of different kinds of surgical procedures. And especially if you haven't done something in a bit of time, it may be a really good opportunity to have a quick reminder here. Neuromuscular blockade, a great example. This is a case in which the patient needs to be deeply, deeply blocked, and I need to know that on the front end so I can plan my care and intra-op and post-op management.

So, all of that to say, it's critically important. We probably, in the hustle and bustle of day-to-day trying to take care of patients, don't do it as well as we should, but we certainly need to.

J. Ross Renew:

Yeah, I couldn't agree with you more, Dru, particularly that part of covering multiple different specialties and perhaps stepping into an environment that you don't normally practice anesthesia in. I think having those open lines of communication at the start, preoperative planning, and then continual discussion about where you're at in the case. For the times we are able to work with a surgical team maybe more frequently, it is neat to see the efficiencies and improvements in patient safeties that occur.

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I know my team works with Dr. Makey's team very frequently, and so you get to see a lot of the same familiar faces. And we've got a pretty good idea on when things are getting close to wrapping up. That's got a big impact on our reversal options. If we can time it and know that they're closing and no longer need the patient to be as paralyzed, we can let that patient spontaneously recover to a shallow level of blockade. In that case, we would have the option to use either neostigmine or sugammadex.

Certainly if the operation ends sooner and we haven't recovered to a shallow level, then this is an instance where we're going to have to use sugammadex to reverse. That's the only drug that's available to reverse moderate and deep levels of blockade consistently. The other thing that I think comes from working... a little bit of familiarity working with the same team over and over is, we can pick up on when that some of the nonverbal communication that happens too.

I know for instance, in Dr. Makey's room, when the music gets turned down, then that's turning into a more critical moment, and we're going to have to be a little more vigilant and pay attention to different things and some of the nonverbal communication that happens. And that just goes along with working with people consistently and pretty frequently.

Ian, I want to pick your brain about a case that you shared with me a couple weeks ago that you had. If I remember correctly, there was a tumor in the left side of the chest that was near the phrenic nerve. And while I was not covering that case, a colleague of mine was, and there were some interesting implications on neuromuscular blockade. Do you mind discussing that a little bit with us?

Ian Makey:

Yeah, absolutely. I'll keep it vague for patient privacy reasons, but the patient had an extremely large tumor at the apex of his left chest. And during the course of the dissection, it was difficult to tell if we had injured the phrenic nerve or not. And so, once we had finally gotten everything out, I wanted to know. Because if it was injured, I could do a diaphragm plication, but if it wasn't, then obviously we didn't need to. And it's always just a pain to go back later and do a diaphragm plication.

So, I asked the anesthesiologist to reverse the patient and lighten up on the sedation. And after about five minutes, we started seeing the left diaphragm moving. The patient was breathing spontaneously. It totally changed what we were able to do. It made me feel so much better, because as try as you might, we traced the phrenic nerve up very high, but we had taken the pleura, and it was very hard to see. And so in that situation, it was a great help to know that we had done it and had not injured the phrenic nerve.

That was actually the first time I had ever done that, but there are some times when that occurs with mediastinal masses and things like that, thymectomies. One example that was really useful. Yeah, I would just say, overall with reversal is, I remember in training, which is now over 10 years ago, that it's something I just forgot. We would always have to wait around for patients to wake up.

I remember waiting in the OR for 20 minutes for patients to wake up and start breathing spontaneously. Being able to reverse patients makes the turnover so much faster because of that. So, just one other example there.

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J. Ross Renew:

Well, thanks for that, Ian. Pretty neat story. I think that demonstrates some of the versatility that our pharmacologic agents have in being able to facilitate something like that. Dru, have you encountered anything like that where you've had to maybe reverse something abruptly or had to take into some special considerations neuromuscular blockade management as it relates to the impact of the course of the operation?

Dru Riddle:

Yeah. In my practice, we do a large amount of head and neck cancer surgery, some of these really big flaps and free flaps and neck dissections, often actually in combination with our thoracic surgery colleagues that are doing mediastinal work, etc. Not too terribly long ago, we had a patient deeply paralyzed. They were working in the thorax, but also in the neck, and the otolaryngologist recognized that there could have been a potential for some nerve damage based on some altered anatomy.

The patient had a bunch of radiation. And so, we had a patient in a fairly deep level of neuromuscular blockade. And really, to assess function to determine what the next steps were going to be for that surgery, rapid reversal of that was critical. And we did. We were able to use sugammadex, and as Ian said, within a very short amount of time, we were able to do some evaluation to determine that, indeed, the nerve was intact and what the surgeon thought was some nerve damage turned out to be, unfortunately, just some scar tissue, I think, from a longstanding radiation injury.

And it did change the outcome for that patient and allowed us to intraoperatively make the right decision. The other outcome is you either kind of guess, which is never good, or you hope for the best, and then patient could have potentially some airway, really serious airway concerns if that wasn't recognized intra-op. It's kind of rare. I think we probably all could think about times from the anesthesia side of things when we may have wanted to do that. Having been in practice for 20 something years, I remember times when I wish I could have done that intraoperatively.

But without the access to sugammadex, with neostigmine, it was impossible to do. And so, we start telling jokes in the OR to wait a little while and pass the time until the patient gets to a level of spontaneous recovery that is then reversible.

J. Ross Renew:

Sure. The other instance that I was thinking about while you were sharing your story, Dru, was in a lot of our head and neck cases, we'll have some kind of neuromonitoring. Even in our neurosurgery, we'll have neuromonitoring in which we're going to be monitoring – maybe it's the function of the diaphragm, maybe it's just using motor evoked potentials. I remember in training there was this dogma that you had to give that patient succinylcholine to intubate so that they would be able to monitor.

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Subsequently, in the mechanism of action, the neuromuscular blockade would wear off. About a number of patients, particularly the young healthy males, a muscular patient, when you talk with them about their past anesthetics, they say, "It was great, but I felt like I was beat up. I was sore all over." And I think we underappreciate the occurrence of succinylcholine-induced myalgias as it relates to quality of recovery. And outside of the rapid sequence indication, I see not a whole lot of use for succinylcholine these days.

We know that it has lots of side effects, has a lengthy side effect profile. And I think if we're trying to avoid some of the succinylcholine-induced myalgias, which can be upwards to 50% of patients, using a small intubating dose of roc [rocuronium] and then using an appropriate dose of neostigmine or sugammadex, depending on the level of blockade, can help you facilitate monitoring in these cases in which at least the old dogma was we're going to give succs [succinylcholine] at the beginning of this case and just stay away from any non-depolarizing agents.

Dru Riddle:

It's a really good point and a piece of practice that I've changed over the last several years. Exactly that. You know what's interesting with the myalgias, I have a really good friend of mine who had that happen just a few weeks ago, and he was literally limping around for a week. And until you see these patients, I think we do really underappreciate the myalgias that they can get.

J. Ross Renew:

Sure. Shifting gears, Dru, I wanted to ask you, how do you try to stay in tune with the surgical team as far as it relates to maintaining an appropriate level of blockade? Is it a familiarity thing, you kind of know what they're expecting, or is it an overt conversation?

Dru Riddle:

I think it's probably a bit of both. To your point earlier, when I'm working with a service line, or a particular surgeon, even, that I'm pretty familiar with and have worked with a lot, there is a lot of nonverbals and just expectations, that unless we talk about it and it's different than the status quo, we're going to assume its status quo.

But I have found in particular of late, and when I say of late, maybe in the last five or six years, and I've really begun to understand better the literature around neuromuscular blockade and neuromuscular blockade management, that I'm actually asking questions to the surgeon much more frequently. Is this patient appropriately paralyzed? Are you struggling because perhaps the patient's pushing or moving?

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And thinking about big laparoscopic robotic cases where we know we need to have them deeply paralyzed. I would assert that even with the most sensitive monitors possible, we still don't always recognize or see what the surgeons are seeing and perhaps struggling with as they're operating. And so, I've become a little bit more open about, from my side of things, it looks like this patient's deeply paralyzed. But you tell me, does this patient need additional neuromuscular blockade to facilitate whatever it is that you're trying to accomplish here? And I'll say that that has started to permeate, at least in my practice, across our department, where we really have much more of an open communication, quite frankly, because now I have the ability to keep a patient perhaps more deeply paralyzed because I don't need a 30 or 45 minute or up to an hour spontaneous recovery period if I'm choosing not to use neostigmine to antagonize their block.

J. Ross Renew:

All right, agree. That's definitely had an impact on practice, having new reversal agents. I don't even know if I'd call them new anymore, but having alternative reversal agents. Ian, you said something earlier that I wanted to circle back to, and it related to the diaphragm moving, and can you share with us the impact that that has on your ability to operate during thoracic surgery?

Ian Makey:

Sure. Yeah, I think there's some more critical portions of the operations that you have to be careful with and you don't want patient movement or diaphragm movement, particularly if you're near the pulmonary vessels, stapling is an important time, dissection along if you're near the phrenic nerve for whatever reason. So, all more critical times where you need the deeper paralysis.

Dru, I was going to see if you... With the patient positioning at the beginning of the case, I always thought the train of four was supposed to be up somewhere around the face or neck. And I learned from you guys that it's supposed to be on the hand, so I didn't know if you wanted to comment on that when you're doing the positioning and where the arm is and all that kind of stuff.

Dru Riddle:

Yeah, it seems like it would be such a simple thing. We take patients to the operating room all day, every day. We put them on the operating room bed, and we get them ready for surgery. Prepped and draped in the usual sterile fashion that is always dictated in every note in America, or probably around the world. But that prepped idea and putting them in the right position, I think... I mean, I'm sure we all have probably more than we want to admit times when you're like, "Oh gosh. No, you wanted the arms tucked or arms out or what have you?"

I mean, in an ideal world, we would have access to monitoring at the hand and we would need to be able to see and watch the thumb. That's not always possible. And depending on the piece of equipment you have doing the monitoring, there's going to be times when it's not useful. So the next best option, I don't want to say next best, but more feasible option might be on the face.

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But there are going to be times when that happens, if we're doing it correctly, where at the end of the procedure, once we're able to drape the patient and get access to the arm again, that we would move that monitor down to the arm and do a final assessment of where we are based on assessment at the thumb rather than what we're seeing at the face.

It's been interesting. We've been really pushing that in my practice and asking surgeons, is it critical that the arm is tucked, or it would be nice, but yet it's not going to really impact surgical exposure or whatnot, if we could at least leave one arm out. And interestingly, there's actually, at least what I've seen, and correct me if I'm wrong, but there's been a lot of times when tucking both arms is a matter of habit or history, but not necessarily a requisite for successfully operating on the patient.

Ian Makey:

Yeah, I would say most of it is habit. Obviously sometimes you need them tucked. But yeah, I think it's mostly habit.

J. Ross Renew:

All right, so when I'm working with somebody tomorrow and they want to tuck both arms, I'm going to say, "Ian Makey said you're probably doing this out of habit." But in all seriousness, I do want to refer our listeners back to one of the other podcasts in this series, a conversation I had with Deb Faulk on monitoring and the difference in monitoring at the hand versus monitoring at the face. And I think that perception that monitoring at the face is routine that, Ian, you mentioned is pretty widespread, but our ASA guidelines have defined the definition of recovery is at the hand.

It's because it's one of the last muscle groups to recover. So, we're trying to set the threshold as high as possible. So, if the hand's recovered, then some of the other muscles that we care about, the pharyngeal adductors, the diaphragm, have hopefully recovered at that instant. So, at our institution, we have acceleromyography available everywhere, and we have electromyography [EMG] available in rooms where arms are frequently tucked, like the robotic rooms. And so, we'll use EMG when the arms are tucked, and they have to be tucked. Because as a reminder to our listeners, the EMG works when the arms are tucked because you're measuring action potentials, whereas acceleromyography, or AMG, is measuring the actual acceleration of the thumb.

Dru, you're out of practice, correct me if I'm wrong, that you have predominantly peripheral nerve stimulators at this point and just a couple quantitative monitors available.

You'll have the peripheral nerve stimulator on the face during the case when the arms are tucked, and at the end, you're trying to get it back on the hand to confirm recovery. Is that current standard?

Dru Riddle:

Yeah, ideally. I would be lying if I said we did that every single time, probably airing our ways here, dirty laundry, but ideally, and that really is being pushed, that in the absence of some quantitative monitor where we can get a train of four ratio, yeah, we're moving it hopefully from the face to the hand.

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J. Ross Renew:

And then the other thing that I think pops up from something that you said, Ian, was needing a deep level of blockade for the diaphragm. And I know from trying different monitors and trying to get my department used to monitoring at the hand throughout the duration of the operation, it requires a deep level of blockade to paralyze the diaphragm. There is a high density of these nicotinic acetylcholine receptors at the diaphragm, so you need a lot of drug on board to keep that diaphragm paralyzed.

It's one of the first muscles that comes back. And so, if you're used to monitoring at the face and re-dosing your neuromuscular blockade every time the train of four count returns to let's say one, and now you're monitoring at the hand, you're going to be having to use a different pattern of neurostimulation. This is when we're going to use something like post-tetanic count to try to help guide and re-dose and maintain our level of blockade.

Because at the hand, you could have a train of four count of zero, but you look on your ventilator and you see the diaphragm moving. You can see it on the capnograph. And so, there's just that shift, that conversion that you have to make in your head when you're transitioning from monitoring at the face to monitoring at the hand.

Shifting gears, Ian, I wanted to ask you about... I know I've personally done a number of cases on patients with significant pulmonary disease, and they've got preexisting pulmonary disease and now they're coming for thoracic surgery, which to me, the alarms are going off that this patient is at risk for postoperative complications. Can you talk to me about how you approach this patient perioperatively and the things you might try to do to optimize them preoperatively so they have a good postoperative course?

Ian Makey:

The LVRS, lung volume reduction surgery, population is a very fragile population. They basically are lung transplant candidates, but we try to use not a transplant way to improve their breathing where we resect the most diseased portion of their lung. I mean, I encourage everybody to exercise and try to lose weight. Almost everybody. Anybody who's overweight to lose weight prior to surgery, for better or for worse. But these patients have several factors that increase their risk of complications afterwards.

One is they have severe... I mean, to be a LVRS candidate, you already have to have very severe emphysema usually with FEV1 and DLCO in the 20% range. And you're improving that function, but it's not like a transplant. You're improving it maybe 10% - 20%. So, they can retain carbon dioxide afterwards, and then, just because of maybe some narcotics, and then if they have any muscle weakness on top of that, then you're going to be at high risk of reintubation post-op. Other reasons for them to have difficulties is the air leaks. That's the major complication after that surgery.

And then the last is pain control. Even though we are doing most of them minimally invasively, if they're splinting, if they're having trouble taking deep breaths and tall sit up. If you can eliminate having the neuromuscular weakness from that, it's extremely important because on those patients, I do not want them getting reintubated. You're putting positive pressure back on those already fragile staple lines and air leaks. If they develop an air leak, it changes their post-op recovery from a day or two to weeks. It's pretty critical in those patients.

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J. Ross Renew:

Thanks for sharing that. Dru, if you had a patient that you were looking up maybe a thoracic surgery and you saw that they had a 40 pack year history, were on four liters of oxygen around the clock, how are you going to approach that patient?

Dru Riddle:

Unfortunately, we're seeing more and more of those folks, right? Life expectancy is going up, but maybe our life choices aren't keeping up with that. I think Ian brought up a really good point about those patients that are getting thoracic surgery in the face of severe lung disease, but we know folks with these really critical lung diseases are presenting for non-thoracic surgery as well. And so, I kind of approach this from a, what's the state of their lung disease preoperatively? Risk calculations and risk stratification is paramount.

But most of the time we're going to have to proceed with the surgery and ensuring that we've optimized the possibility of them having zero pulmonary implications from the anesthetic. We know they're going to be there regardless of what we do, but of course, limiting opiates, ensuring that these patients have nothing that's going to cause respiratory depression. And then probably most critical to that is appropriate intraoperative neuromuscular blockade management coupled with reversal, and then postoperative assessment of residual neuromuscular blockade.

And I think one of the things, we've highlighted this in this series of podcasts already, but I think it's important to reiterate, and that is residual postoperative neuromuscular blockade. Patients that have some degree of neuromuscular blockade don't always present in the same way. It can be quite subtle. And in the young, healthy 19 or 20-year-old college athlete, it may be clinically insignificant. But in the 40, 50, 70, 90-year-old with the 40 pack year history and preexisting pulmonary disease, my guess is a list of comorbidities associated with that as well.

It can be absolutely devastating for those patients. From a management perspective, I think we need to be even more heightened in our vigilance on intraoperative care for those folks and really making sure that they're well-antagonized at the end.

J. Ross Renew:

Just to echo those comments, Dru and Ian, this is a patient population that deserves the utmost vigilance, and we have to avoid leaving them with any degree of residual weakness. Because like you said, Dru, the young college athlete is probably going to be fine, and the chances of them having a complication related to residual weaknesses is very low. But this patient with significant pulmonary disease, we have to avoid what would, in my view, be an iatrogenic complication from inappropriate neuromuscular blockade management.

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So we have to make sure they're strong. My personal way to wake these patients up, I like to get them over to the stretchers, sit them up. We've done a number of multimodal pain relief things, and then making sure they're wide awake, and then ensuring their neuromuscular function has been adequately restored with an objective monitor. Another patient population that I think is kind of similar to this, the patient with myasthenia gravis.

And whether they're coming for a thymectomy, which I know Ian does a number of thymectomy patients and has a large myasthenic practice, or if it's just a patient who happens to have myasthenia coming for an unrelated surgery, I think this patient population warrants some similar considerations as well. And then Ian, while I've got you here, I wanted to pick your brain on same kind of question as the last one, how you approach the myasthenic patient. Are there differences with how you approach them versus let's say the patient with significant pulmonary disease?

Ian Makey:

Yeah, I think this patient population is interesting. Usually they're a little bit younger, so they're not as fragile as some of the lung patients, but what's interesting is that postoperatively, they can have a myasthenia crisis, which I'm not sure if it's exactly from the anesthesia or from the paralysis, but that crisis mimics neuromuscular weakness. I mean, that's what myasthenia is. It's just interesting that, again, in the postoperative period and the recovery area, if they're struggling, is this a myasthenia crisis which would require PLEX and IVIG, or is this just inadequate reversal?

So, if you're very confident that it's not inadequate reversal, then can more quickly put them in the ICU, watch them, or if they're struggling quite a lot, then initiate the PLEX. So I think it's an interesting decision point right there, which is going to be hard to distinguish clinically unless you're just quite confident with your reversal.

J. Ross Renew:

I want to ask Dru the same question. But before I toss him the baton, I want to point out to our listeners that that was the... We're 20 something minutes into the podcast and we've hit our first instance of the surge and blaming anesthesia for a complication. Our literature will say, "Oh, you can have a myasthenic crisis just from, I'll turn it around and say, the stress of surgery." So is it the stress of surgery or is it the anesthesia causing the myasthenic crisis? But regardless, I did want to pick your brain, Dru, on how you approach that.

Dru Riddle:

There are certainly complex patients. There's probably a series of board review questions in anesthesia and you know one of them is going to be something around management of the myasthenic patient. The other is difficult airway and malignant hypothermia, of course. But what we know about folks with myasthenia is that they are unpredictably sensitive to non-depolarizing agents. And what happened in the myasthenic you took care of last month may be completely different than the myasthenic you take care of this month based on the continuum of their disease, right?

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The recommendations tell us that to the extent possible, let's avoid altogether using neuromuscular blocking agents. It's not always feasible. And so, we know then we're going to have to alter our dose of non-depolarizing, potentially, in order to obtain reasonable amounts of neuromuscular blockade that are appropriate. But some of the literature is pointing to, and in fact there's been a study, I think, it was within the last month or so, earlier in 2023, that specifically called out if sugammadex is not available, then neuromuscular blockade in the myasthenic patient should be completely avoided.

That's a pretty profound statement, but it only takes one or two myasthenic patients that you take care of to understand why clinically that's such an important and maybe a bit provocative, but at the end of the day, lifesaving for these folks. And Ian, to your point on the what is the differential, right? I've taken care of this myasthenic patient. They have some what appears to be weakness in the recovery room.

If we've eliminated everything else like opiates and benzos and volatile anesthetic, for example, we do still have this decision point of is it drug-induced neuromuscular weakness that they haven't been reversed from, or is this a myasthenic crisis? And maybe it is both, but we know the treatment of those two things are radically different.

And if we don't treat them well and make the wrong decision, we actually potentially can make the patient worse, especially if you're in a practice where you're not like you guys, where you're seeing folks maybe for thymectomies or other myasthenic-related surgeries and you have a little more frequency. For those of us that aren't doing that as often and it's just the patient that happens to be scheduled to have their gallbladder out and oh, by the way, they have myasthenia, it really does make a significant difference in how we care for them.

Ian Makey:

I mean, I guess it's somewhat relevant with those patients is you obviously want them to be well-controlled going into the operation. We're talking about thymectomy because it helps with their post-op. I mean, it helps with their symptoms. And then often they can have some tumors, some thymomas. You don't want them in a crisis, obviously. You want them well-controlled. You want them to take their Mestinon (pyridostigmine) before the surgery and then continue that Mestinon afterwards. Those are some of the things to avoid the complications on those folks as well.

J. Ross Renew:

Sure. For our listeners that don't encounter this patient often, I wanted to just reinforce something that Dru said about sugammadex over neostigmine in this setting, and it relates to the mechanism of action. Remember, pyridostigmine and neostigmine are in the same class of medications, and so having a neuromuscular blockade antagonist reversal drug like sugammadex, whose mechanism of action is independent of acetylcholinesterase inhibition, is very, very helpful.

You can be fooled by these patients because even if they have a train of four, count of four, I'll remind the listeners that you can still have up to 75% of your nicotine and acetylcholine receptors blocked, and that safety window, the margin for error in this patient is much, much smaller. So really, vigilance is needed for this. Like all patients, recommend using objective monitoring and sugammadex specifically in this case.

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I want to close with one final discussion on something that I view as a nice overlap between our specialties as well, and that is enhanced recovery protocols, ERAS, enhanced recovery after surgery. And it's something that you see a lot in the literature. I think that it's clearly attractive to both providers, clinicians, as well as administrators. If we can get people out safer with better outcomes and save money as a consequence of that, it's something that's desirable to everybody.

Dru, I want to start with you, just asking about some of the considerations you might have when developing enhanced recovery protocols, ERAS protocols, specifically as it relates to neuromuscular blockade management.

Dru Riddle:

I guess in my mind, ERAS, just like you said about sugammadex, oh, it's new. "Oh gosh, ERAS is new," and clearly it's not. We've been doing ERAS-type things for probably well over a decade, maybe in some centers more in the U.S. at least. I think we underestimate how the protocol fits together in a very sort of eloquent way. And what I mean by that is, it doesn't take much to completely derail the patient from a really good recovery, a good recovery profile.

And the residual neuromuscular blockade will absolutely derail a patient from the ability to participate in what we would expect in the protocol. Thinking about things like early PO intake, early ambulation, appropriate pain control, etc., when a patient has some blurred vision, double vision, perceived difficulty swallowing, maybe a little bit of weakness when we try to stand them up the first time, that completely sets the patient back. And really regardless of the surgical specialty, some of those basic principles are going to apply almost universally with maybe some rare exceptions.

And so, I think it's incumbent upon us as anesthesia providers to realize a very small window of decision point intraoperatively can have days and/or weeks of catastrophic outcomes for the patient in the sense of what we would expect to be a really speedy, appropriate recovery. They lay in bed. They have the development of all the side effects that happen with not early ambulation, etc.

This is an area for me that I'm quite passionate about because I've seen it in the literature, but then seen in just everyday practice where that residual neuromuscular blockade, even if it's not fulminantly the classic presentation, will absolutely derail the patient and set them up for a really long recovery, much longer than we would've expected otherwise.

J. Ross Renew:

Yeah, I couldn't agree with you more about some of those tenets that you mentioned for this. And Ian, I wanted to pick your brain too while we've got you here about your approach to developing enhanced recovery protocols. Maybe it's surgical specific, or maybe it's just broadly how you approach these.

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Ian Makey:

With a lot of our lung resection cases, specifically lung lobectomies, we're trying to get those stays down to one night, two nights. There's a lot of factors that go into it, as with a lot of other surgeries, I'm sure, but air leaks is one. Pain control is a big one. But I think, as Dru was alluding to, some of the neuromuscular ones are interesting.

You had mentioned that urinary retention, for example, unless you are... If the patient developed urinary retention, have a Foley put in, we don't typically put Foleys in in our lobectomy patients, but they have that Foley the following morning, then you have to give them that six hours to void again. So many decisions are made in the morning that if you have one little setback, then that can automatically delay them to the next day, post-op day two.

The other thing, obviously, if they get reintubated in the recovery area, or maybe they're trying to have their first sip and they accidentally aspirate, then that's clearly going to knock things way back. And so it's just some of those not common, but things that raise the risk of some of those complications can certainly impact your earlier discharge date enhanced recovery.

J. Ross Renew:

I think that those things that you guys had mentioned makes a lot of sense. Certainly getting reintubated is going to set you back, but even some of the other stuff that we may not appreciate as anesthesia providers, because I don't know that they were necessarily... Once my patients get extubated, I don't know that I'm looking at everybody's chart really closely to see this postoperative course, so I appreciate that insight, Ian, that you have on following them perhaps a little more longer postoperatively.

I wanted to close by thanking our two guests today, Dr. Makey and Dr. Dru Riddle here to share with us their insight on neuromuscular blockade management as it relates to multidisciplinary approaches and development of ERAS and how we can improve outcomes. So, thank you all for joining me today.

Ian Makey:

Yeah, thanks for having us, I learned a lot.

Dru Riddle:

Yeah, likewise. Appreciate it.

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J. Ross Renew:

CMEO programs always include SMART goals to help you translate information into action. SMART stands for specific, measurable, attainable, relevant, and timely. Our SMART goals for this program is to utilize evidence-based neuromuscular blockade reversal strategies to optimize postoperative recovery, incorporate assessment for postoperative residual weakness into institutional ERAS protocols of appropriate reversal of neuromuscular blockade to avoid postoperative residual weakness and the resulting complications, and finally, to maintain an open line of communication between surgical and anesthesia teams to optimize surgical conditions and avoid postoperative residual weakness.

All three podcast episodes, plus a wide variety of other educational activities and resources, can be found online at the CME Outfitters Virtual Education Hub. To receive continuing education credit for this activity, participants must complete the post-test and evaluation online. Thank you to Dr. Dru Riddle and Dr. Ian Makey and all of our learners out there for joining us today. Be safe and take care.