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TRANSCRIPT - GR 11 04 22 "Updates in Post-Arrest Care and Targeted Temperature Management" Benjamin Abella, MD, from the University of Pennsylvania

Medicine Grand Rounds

- 00:20:26 All right, everyone. We're gonna hook up and go ahead and get started here. Welcome to Medicine Grand Rounds today. It's uh my distinct honor to introduce Dr. Benjamin Abella from the University of Pennsylvania, who'll be speaking with us today. Dr. Abella completed his medical training at the Johns Hopkins School of Medicine, followed by his Internal Medicine Residency at the University of Chicago,
- 00:20:47 part entering his life and Medicine. Uh, Dr. Abella also received a masters in philosophy from the University of Cambridge, which is a true marriage of the humanism and science that's reflected in our specialty. Uh, he decided that one Residency was not enough. So, after completing his residency and internal medicine, he then decided to do a second Residency, this time in emergency medicine, and he went on to do a fellowship in resuscitation, both at the University of Chicago as well.
- 00:21:14 In his post training life. He became an assistant professor of emergency medicine at the University of Chicago, but shortly thereafter found his way to the University of Pennsylvania, where he rose to the ranks of academic Medicine is now the William G. Backs, Professor of Emergency Medicine. There
- 00:21:29 Dr. Abella has a passion for academic and clinical excellence uh specifically in the field of resuscitation medicine, and as such as a director for the center of Resuscitation Science, the Vice Chair for Research in the Department of Medicine at Penn, and the Medical Director of the Penn Acute research collaboration.
- 00:21:45 Um, He will be talking specifically today about post cardiac arrests care uh with respect to target temperature management uh a subject on which he's truly a nationally and internationally recognized expert. Please give a warm welcome to Dr. Abella.

Benjamin Abella

00:21:59 Well, well, thanks very much. I really appreciate that lovely welcome. And I'm sorry we can't all be together in person. I'm sure you guys are getting as tired of zoom conferences as I am. I miss the in-person connection. But here we are. We'll do the best we can. I'm going to go ahead. And share my slides. Let's see um.

Unknown Speaker

00:22:19 This will work one second.

Unknown Speaker

00:22:28 Okay. And I'm going to start the slide show.

Benjamin Abella

00:22:31Okay,

- 00:22:44all right. So uh as described, I'm at University of Pennsylvania, where I have folks. My career largely on cardiac arrest and post cardiac rest care.
- 00:22:55The goal of my talk today is going to be to share some updates. Oh, is there some technical or audio problem.
- 00:23:03We're all good. We're okay, Sorry about that. Okay, No worries at all. Um, to share with you some updates on where we stand with host or us care, and specifically with a therapy known as targeted temperature management or Ttm. Many of you may know that Ttm has been one of the cornerstones of care for patients fall on cardiac arrest.
- 00:23:23But there has been some controversy around target temperature management in the last
- 00:23:27ten years or so, shall we say? And one of my goals will be to help explain, contextualize, and hopefully give you a path forward for what you can do with targeted gempshire management, post-rest care more generally.
- 00:23:40So let's begin a little bit first uh my disclosures uh just to share. You show you where I get my funding from. I have no equity or stock, and anything related to post-rest care so hopefully. Uh, my talk will be unbiased today.
- 00:23:56Now I always like to start and end with a patience scenario, a patient story to keep us focused on what really matters, which is the patients in front of us. And so here is an anecdote of a cardiacrest patient that I think
- 00:24:09very much illustrates what we're talking about, and what what is a classic, critic or scenario? So In this case we have a fifty seven year old male. They're in cardiac. Arrest
- 00:24:18the N. That one is called to Ems arrives, and there it's found that the wife witnessed the arrest, and she's also doing bystander. Cpr. And this makes all the difference in the world for those of you who follow um social media. You may have heard of the famous social media, Doc Glo Comb Fleckin. He actually had a cardiac arrest last year, and his wife witnessed the arrest and did Bystander Cpr. And he's alive today to entertain us. So it really makes a difference by center. Cpr. Is one of the key interventions.

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00:24:45No, it turns out Ems was unable to resuscitate this patient from ventricular fibrillation, and so they brought to the emergency department

Benjamin Abella

00:24:53in the er they're still found to be in V fibs, and now they've had a prolonged downtime uh acs is in a continued, and eventually the patient gets a pulls back. They get what's called our Osc. Or return of spontaneous circulation, which is getting your pulse back. But now the patient is comatose,

- 00:25:11and this is presumably because of the ischemic time, and hit to the brain. It may also, of course, be related to medications if given during the intubation. Um, sometimes yes, sometimes no. But in any case, this is now a patient who is not waking up after arrest. You know two things are done in this scenario which are fairly typical clinical assessments, and we recommend that this be part of any post-rest care protocol, that within the first
- 00:25:35half an hour to an hour everybody gets a head ct. And this is to look for trauma. It's not to neuro prognosticate. The initial Nct. Is mostly to make sure there's no blood in the head, because, after all the patient collapsed at home. Did they fall down the stairs to they hit their head. You'd hate to miss the sub dural or other interrenal hemorrhage

- 00:25:51also to get an Ecg. And they do that. And there's no stemming. Okay. So Ecg: negative head Ct: negative, and the patient is off to medical icu. So This
- 00:26:00mit ctl and story, I think, very much encapsulates a lot of the features of what is typical for cardiac quest and post-rest care. And the question now is, how do we get this patient better? How do we improve their outcome so that they can walk out of the hospital one hundred and fifty.
- 00:26:14Well, one of the key things that we have done for about twenty years now clinically to do this, to to improve outcomes is to use something called targeted temperature management and look something like this: Nice you temperature over time patients are cooled, kept cool, and then rewarmed. And this is a process that takes place over the first few days from the Ed to the Icu, and decades of laboratory studies have shown that this is an effective therapy. It lowers a brain of scheme it affects. Glutamate toxicity, does never
- 00:26:44things that are good for the brain, and you know in a forty-five minute grand rounds. I can't share with you all the animal data, although just I'll have one slide on that later on today. Suffice it to say, this came from a very strong mechanistic place in the laboratory, and then it was tested in the clinical environment, and several clinical studies were done in now about twenty years ago, or the Foundational studies, the heck of Study, by Stephen Bernard and colleagues in the third study by Adrissi, and these three studies randomized patients
- 00:27:14after recession from Cardiac rest to either cooling to a target of thirty-three Celsius. That's by the way, what is the typical or was the typical target temperature thirty three. Celsius
- 00:27:26versus no cooling to look at outcomes, and this is what it looked like an actual clinical practice. This is from the heck of trial, and you can see there's cooling. There's maintenance and rewarming, and there's two lines here. When looking at the bladder temperature over time, one is the experimental
- 00:27:41group, but that is the group that you see where it dips down and comes back up, and the other is the control group, where no one is cooled at all, and normal thermody is entertained. No.
- 00:27:51When you look at the outcomes in these three trials, and, by the way, all three studies only considered it a good outcome. If there's neurologic recovery. None of us go into this business uh considering in the success. If someone leaves the Icu and their comatose, and they're going to an L tack, and they're traits in Peg. That is not a success. And so the authors wisely chose neurologic recovery. They use the scale. Cpc. Cerebral performance. Category. It's a very crude scale, neurologic recovery. But if I said to say a Cpc. One or two is good recovery, and that's what they
- 00:28:20and you can see, looking at the red percentages, a very big improvement, a big effect size, with cooling to improve cardiac rest outcomes. And in the heck of study they look six months later, and they found this was a durable benefits, this wasn't transient. Six months later all but one piece. We're alive, and indeed at pen, and we have a large alumni club of cardiac, rest patients and survivors, I should say.
- 00:28:43And uh, we followed some ten, twelve, fifteen years, and they're doing very well. So the message I leave you with really here is that if someone can walk out of the hospital they can do very well from cardiac arrest. So that is a a a note of optimism, a cautious note of optimism.
- 00:29:02No, those studies look at shockable rhythms of arrest. So the question then remained in the field for quite some time. What about non-shockable rhythms? As you know, many patients have pee a or asist dollar cardiac arrest and that those are bad rhythms to have. Uh, because, unlike the fib, there's no direct electrical treatment for them. And so uh, it took some time for this study to be done, which was a first randomized trial of cooling for non-shockable rhythms, and this was done in France, and two thousand and five

Unknown Speaker

00:29:31French Icu, and they cooled patients to either thirty three or kept them normal thermic,

Benjamin Abella

00:29:37and and the patients they enrolled were all pretty darn sick. Most of the patients had as a stolic arrest, and some of it, pa and, as you might imagine, survival is much, much lower for a sisterly uh. But these authors reasoned. Well, yes, lower survival,

- 00:29:52but, on the other hand, potentially more room for benefit, and that is to say, uh, the injury. Severity is such that they might see a a benefit from something that's brain protective. And indeed, that's what they found. They found a statistically significant improvement in survival
- 00:30:07with the use of a cooling with use of hypothermia or target temperature management, and they uh also found interestingly, that overall mortality was the same. What happened with Cpc. One or two survival is greater. And this is actually a really exciting finding, because again, we don't want people going to L tax straight and peg. That's not a success. And so what in their hands, what hypothermia seem to be doing is not saving patients lives, but saving patients brains. So if you're going to survive, you'd survive.
- 00:30:37It's better with hyperference. That was very exciting, and that basically made the guidelines a very straightforward process. And these are the American Heart Association guidelines. I show you from two thousand and fifteen and twenty one,
- 00:30:47where fundamentally they recommend Ttm for most patients from cardiac arrest. Now there are certainly some exceptions, but there is a strong recommendation, regardless of initial rhythm to use target and temperature management. Now,
- 00:31:02here's where it gets a little bit more complicated If you look at the these words on the on the screen. They do include the option for higher temperatures, so I'll just read it to you in case you can't see so well. We recommend selecting and maintaining a constant temperature between thirty, two and thirty-six, and you might go Well, thirty-six. I thought you were just talking about all the studies having thirty-three is the goal. Temperature.
- 00:31:23Now Theyj is not saying left the temperature, you know, wildly go back and forth between These goals they say, pick a temperature and stick with it. But you can pick some things low. Thirty-two and size thirty-six. Now, where did that come from?
- 00:31:35That came from the next studies that I'm. Going to share with you. And this is known as the Ttm. Study at very originally. Now it's known as the Ttm. One study, because there was a Ttm, too, and in Ttm. One a study done by Nicholas Nielsen and colleagues in Scandinavia largely
- 00:31:52is they ask the following question: Do We really need to cool patients to thirty-three? Or can we cool them ever so slightly, or really honestly maintain them at thirty-six? Now, Why, thirty six
- 00:32:05they originally actually proposed thirty-seven. But there, we didn't like it, because there was no strong evidence for thirty-three. So they said, Well, let's do a do this effect. Let's compare two different doses of hypothermia. Now, why would you do this well? For on the one hand you do this because
- 00:32:19there are some side effects of thirty-three. It turns out they're very modest, and i'll get to them a little bit later, but they said, Well, if thirty-six works maybe it's a lower dose. This is a classic dis effects sort of philosophy here like. Do you need the whole thing, or can you use half the dose with the same benefit.
- 00:32:33The other reason why they thought this might still be useful is fever is very common. After cardiac arrest extremely common up to forty of patients mount some neurogenic fever from brain stem to function after cardiac rest. And so they. And, by the way, evidence is overwhelming that these fevers are bad fevers bad for the injured brain. And so the question then was, Well,
- 00:32:55maybe if we avoid fever, that's sufficient. Maybe you don't actually need to cool. Maybe we can just do for your avoidance and get the same bang for the buck

- 00:33:02and uh, these are the patients they enrolled in their two arms, and I want to highlight something that will return to a little bit later that it's a very unusual group. What I mean by that Um. The shockable rhythm. Arrest is high. The by center Cpr. Rate is very high, so seventy three percent by cent of Cpr rate.
- 00:33:21The stemmy rate is insanely high. Forty percent stemming.
- 00:33:24Um! That is nothing like poster as patient populations in the United States. Um, and the shock frequency of shocks is very low. Um! When You see, patients post-rest. My suspicion is, you see, about thirty to forty percent of patients with overt shock um we see? That? As well, so fifteen percent shock rate is pretty low. So basically the feeling here is um um that that these patients uh have a low uh injury severity.
- 00:33:53Um. And and one of the reasons why this might be. The case
- 00:33:56is because, uh in Europe you may not know. This. Ems is what's called a stay in play philosophy rather than scoop and run, so they will not transport many of these systems. They will not transport patients to a hospital unless they get rask. Now, patients who get Rosk in the field versus patients who get rosk in the ed tend to be phenotypically very different,
- 00:34:16all right. So what did they find? They found that survival was the same
- 00:34:21in both groups. So a thirty-three or thirty-six same outcome So this was a big deal in the field, because all these prior studies it said thirty-three was the best, and now thirty-six is an acceptable option um, cause a lot of confusion. So they're ensued for about five years, and massive to be about, Do we do thirty-three to thirty-six. Well, to add fuel to the
- 00:34:39by uh, actually i'm going to skip these next slides, it's not worth it to add fuel to the fire. Um! The authors did the next study, now known as Ttm to and in Ttm to what the author is they said all right. If thirty-six is acceptable,
- 00:34:58maybe we can just do normal. Therm, Maybe we don't even need to cool them a little bit. Maybe we can just avoid fever aggressively using Ttm technologies. You know, there are these cooling blank If there's catheters. And so, using the same technologies to avoid fever, Maybe we can keep people under thirty-seven-eight and get the same benefit. And what they found again was it was the same whether you did Normothermia or you cooled. The thirty-three survival at six months was the same now
- 00:35:24again very skewed, patient population, which is the big warning sign here Now it's an eighty by center. Cpr: Can you imagine that four and five patients in the study got by centers? Cpr. Again, the Pci rate which they reported as opposed to stemming? That is, who got a who got a balloon and a stent
- 00:35:40thirty-eight. I don't know what you're you see at Uva, but i'll tell you at penn our our rate of Pci post arrest. That is, they go to the lab, and they see a lesion, and they feel it needs fixing. It's about ten to fifteen, so it's much lower. So this is just a very different patient, proper than anything we see, and I suspect anything. You see.
- 00:36:00Now, what are the side effects of Ttm, because the issue also is that the side effects are pretty minimal. So one of the big questions some of us have raised in the field is okay. Why are we even doing all these big studies? The danger of thirty-three is so small that it seems like we're splitting hairs here. Um, you know, if thirty-three had a real side effect that was dangerous, you might really wonder about thirty-six or thirty-seven, but it doesn't. The most common side effect of cooling is braidacardia, but it's generally of no clinical consequence.
- 00:36:28Um! It happens, we see it. It's. It generally does not require treatment. There's a slight increased risk of bleeding, but it's much, much less than Tp. For stroke for
- 00:36:38um that is, it's showing that less than five of patients, one that you should two, one shared for less than five percent of patients actually have any clinically relevant bleeding after cardiac arrest when you use a Ttm. And, by the way, these are studies that included patients on Kuma and Heperin, they were pre the no accura, but the point being the bleeding risk is small.

Unknown Speaker

00:36:58 So so really the risks of thirty-three are very minimal.

Benjamin Abella

00:37:02 And just to walk you through this a little bit. Um Braincardia. Very common weapons. See, heart rates in the thirtys fortys fiftys,

- 00:37:10 but you know as as good a critical care. Folks, you know. You think. Well, Um, let's not treat a number. What's the matter of pressure with your now? But with the cardiac output, so do we do not recommend reaching for the atropine in these situations. In most cases no treatment is required.

Unknown Speaker

00:37:25 So

Benjamin Abella

00:37:26 the the issue that we think about for this practically about bleeding, for example, because that's the one issue that we do worry about a little bit

- 00:37:34 we do not find, and this has been borne out by a number of studies that just because of patients on a noaker cumin, and just because they're on the heper and drip, just because they have history of jav lead et cetera,
- 00:37:44 we can still cool with thirty-three. That's not a problem. The folks that we would avoid thirty-three of folks who do have a bleed in their head or an active J. I bleed, and for them we would do normal. Thermy, we would avoid fever, and this has not been tested in ourct, but growing from a number of observational studies. This is a growing consensus in the field of how to decide who gets what temperature. So you can see by this the majority of people. We do not think the bleeding is a major risk for a small number when we do.
- 00:38:13 No,
- 00:38:14 I want to switch to gears a little bit and try to now make the argument that
- 00:38:19 we only thirty-three should still be the default temperature for many of the patients we see in the United States, and we should be very, very cautious about throwing out a therapy. That is such strong evidence based on two trials with a very skewed, non generalizable population. And I'm going to make this argument in sort of four bullet points, if you will, over the next few slides. Um, the animal literature uh
- 00:38:42 an overarching point about Rcts a real-world experience, and then some newer studies that I think, show the way forward.
- 00:38:50 Now, first of all, I had alluded earlier to the fact that the mechanistic laboratory did are quite strong, and indeed it is for several decades, hundreds of papers. I only showed you three examples here. Um, some from our lab, and a most model, others in in pig models. But but basically for for several decades a number of studies shown a dose of fact where the deeper you cool the better, and the longer you cool the better. So this is not some, uh, you know, unfounded concept here, so strong mechanistic biology to suspect that this would work
- 00:39:19 um studies that you really couldn't easily do in humans.
- 00:39:22 And I think a really important overarching point can be made that these two ourcts that came out teaching one and two. We're null studies. There were neutral studies, no harm, no benefit. So there's

a fundamental tenant that is often a spouse in medicine that we should not change our standard of care based on negative studies. And yet many hospitals are doing just that. There's this sort of rush to de implement. Because Ttm does require work. It requires effort, but there's been never any proven harm. And so, in a very large sort of picture view of this

Unknown Speaker

00:39:51there are three rcts that show a benefit from Ttm.

Benjamin Abella

00:39:55No. Rcts that show a harm from Ttm

- 00:39:58and two studies that are neutral for Ttm: so three to zero to two so, and then think, when a patient comes in who is mortally ill? Who's a high chance of significant brain injury or mortality. Family saying, Please do everything, Doctor Um. And you have three studies showing a benefit to studies and not neutral, and no study showing harm to me. It's really hard ethically to deny the patient that therapy that sometimes shows benefit. Think about this, for example, any of you butting oncologists, if they are residents in the room.
- 00:40:27Um. Patients come into oncology clinics all the time, and are put on therapies that there are phase two studies that shows some benefit. But nothing's really established definitively, and yet they are given those therapies without hesitation, because if there's no harm but potential benefit from a life threat, we tend to try to do that,
- 00:40:46anyway. The other food for that. But I think the more important newer evidence um is from the real world, from real world experiences with Ttm. And so here's an example of several published studies where a hospital decided to just switch based on ttm one. They went from thirty-three, to thirty-six, and what do they find? Their survival
- 00:41:05worsened? So there's cfpc One to survival fell, and they had more brain injured patients after the switch to thirty-six. They switched back to thirty-three by the way.
- 00:41:16Another example, this one out of the Us. Nick Johnson and colleagues, Nick Johnson, is at Harvard View, in Seattle, and they also switch to thirty-six, based on the Tdm. One study and their survival also fell. They had a twenty-five percent relative drop in neurologically good outcomes that's terrible, and they switch back to thirty-three as well. Now, what's going on here?
- 00:41:35They're not randomized trials, So the data are harder to interpret. But if I say that in the real world people have found that when you switch you worse now comes. So if you're going to consider cooling at managing temperature at thirty-six. It is absolutely incumbent upon you to be actually measuring outcomes into looking at survival. Because if you don't, you may miss the fact that you're actually hurting your patients.
- 00:41:59So what do I think is going on here? Well, I think it's important to think broadly and take a big picture view of medical progress and science. So this chart is sort of a tongue in cheek graph of what happens in a typical cycle of medical research, and this happens in oncology, happens in critical care. Look at the vitamin C story, for example. Um, we're some. Look at hydroxychloroquine for Covid, although I don't think that one ever reached the thing, though at the end that was a bunk therapy. But,
- 00:42:27um! You often have an initial study that looks really promising. Everyone says, Oh, my goodness, this is great in our case. Ttm works for everybody. Oh, my God! Isn't that wonderful!
- 00:42:36And then some studies come out saying, Not so fast. This might not work so well, and then you fall into this valley of despair. We go, you know. Gosh, we were wrong all along. How could we be so foolish in our case? Ttm Doesn't work, and that's sort of, I I think, where we've been for the last couple of

years. But just recently, in the last few years, some large studies have come out, saying, Wait a minute, Not so fast. The world is more complicated. And then you sort of reach this equilibrium where you say, you know, medicine is hard and complicated, and therapies don't work for everyone or no one.

- 00:43:05 They work depending on patient selection, and this goes for so many therapies. I'll do a very, very bread and butter, an internal medicine, example,
- 00:43:15 antibiotics for a cough
- 00:43:18 for an upper respiratory infection. Now, um, if you so it did a study where you selected for people who have known bacterial infection. Uh Uri. Let's say vegetable bronchitis. Antibiotics would be great, and you do it if you took, then a large population of people were very well who have a mix of viral and bacterial, mostly viral. As we know, antibiotics would be useless, and you'd say, never give antibiotics. But what's the reality? There's probably a subset of patients who benefit from antibiotics with Uri symptoms. For example,
- 00:43:48 as we know, folks with Cpd. We often put them in a products because there's good established evidence that lowers recidivism. There are Lower return to physician care. And so this is a very common theme across medical research that it's not so simple,
- 00:44:04 But the problem with not so simple is we like simple
- 00:44:07 in our in so many aspects of our lives, people like the simple path, but, in fact, uh a Ttm, I think, is going to be one of these examples, where maybe a big chunk of patients have no benefit from cooling, but a a not small chunk of patients absolutely would benefit from it. And if we deny them that therapy, we're harming them
- 00:44:27 now, why do I? What can I do to back up this this outrageous claim I'm making. Well, there have been several studies that have come out just in the last few years to really suggest. This might be, uh the way to bring everything together. The grand unifying theory, if you will, of ourct. So
- 00:44:43 simple way of looking at this from like an outcomes razor. Simplicity standpoint is, Let's start with the assumption that all the randomized trials are correct,
- 00:44:50 how to reconcile How can one and two be correct, and the three prior one would be to correct. They had different patients, different patient populations,
- 00:44:58 and in this study I think, really hammers this home. This was a cohort study, done at University of Pittsburgh, where um they have twenty plus hospitals in their system, and they have physicians who believe in thirty-three who believe in thirty-six. And so there was an a natural experiment that occurred where patients got different temperatures. Well,
- 00:45:16 they then uh looked at this by injury, severity, and they use something called the Pittsburgh cardiacgress category. It's. It's a very crude scale to look at injury after cardiacrest the bottom line that they found
- 00:45:28 the patients who are more injured did better at thirty-three. The patients who were less injured did slightly better at thirty six,
- 00:45:36 so that really, I think, is the whole ball game that it depends on the injury severity. Now,
- 00:45:42 unfortunately, injury severity is not so easy and postcardier crest patients, but nonetheless. Um. This is, I think, my fundamental beef with Ttm. One, and I I think they're well done studies. But everyone got by Center Cpr. And had to witness to rest. That's a very different set of patients than what I see in Philadelphia a high degree of unwitness to rest with. No by center. Cpr:
- 00:46:03 If you need another example of a study suggesting this harmonization, this is out of Japan, and they also looked at injury severity. They use something called our cast score. It's something that nobody uses, but they used um, and they found a sweet spot.
- 00:46:16 We're patients with a very low injury, severity low our test score. It didn't matter whether you did three hundred and thirty-six patients with a very high Our test score It didn't matter three or three. But patients in the middle. It mattered a lot. So some patients definitely benefited from thirty-three.

- 00:46:32 Yeah. Another example is just come out this was out of the Netherlands, and they've used eeg. Which I think is kind of cool, because eeg. Is actually a physiologic, direct measure of brain as opposed to a Cpac score or a our cast score. They actually looked at brain physiology, and they found that patients who had a mild and cephalop whose brains were okay post to us, didn't matter. Do what you want.
- 00:46:54 Patients with moderate encephalopathy actually benefited a lot from cooling the thirty, three verses thirty, six.
- 00:47:00 So now we have three large covert studies suggesting injury severity.
- 00:47:05 Well,
- 00:47:06 you know, this is a complex topic, and and I think the debate will raise on what is clear or increasingly clear is that it's going to be very hard to establish, whether in the hospital recipient's benefit from ttm to thirty-three. And this is a recent study suggesting a a null result, and again, I'm. Not convinced. It's null. What I am convinced is that it's a very hedgehogenous population in household rest, and very difficult to show a benefit.
- 00:47:31 Okay. So now let's turn gears a little bit to some other aspects of post-rest care hopefully I've convinced you that thirty-three may be right for some patients, and that we should not be hasty to throw out thirty Ttm. In in general, based on the Tt. One and two studies, and, in fact, the panel we default to thirty-three so most patients who come parad, or, as we call it, thirty-three, but in select cases we do thirty-six based on individual criteria, for example, a witness to rest with by-standard Cpr. Because they fit the ttm one criteria we will

Unknown Speaker

00:48:00 them at thirty-six or manage them at thirty six.

Benjamin Abella

00:48:03 Okay. But to switch gears an important question that comes up all the time for you as medicine providers and me as an emerging medicine provider is. Do we have to start this therapy in the er,

- 00:48:15 Or can I wait till they get up? Search the Icu and I'm sure you've been on either side of this debate, where you know you've seen what the er says ears off and say, Oh, no, no, no! Get it started because we're waiting hours and hours and hours for a bed Classic er I see you tension line. Well, unfortunately, the er loses out on this one, because a large study has shown that you really got to start this therapy within the first few hours, and this was a very large cohort of patients where they looked.
- 00:48:44 I'm just experientially at time to Ttm initiation. So on the left you see a histogram of time to initiation, and this is just the real world. Some people get ttm started right away, but some take two, three, four hours to get it started,
- 00:48:57 and this, of course, depends on all sorts of things. Patient stability, I see, but availability. The works
- 00:49:03 well. They found that if cooling is started within the first two hours, you get much more bang for the buck, you better survival. And this is particularly relevant, Of course, in our current situation, with terrible bed holding times and patients are waiting around the year for hours and hours and hours. So the fundamental point here.
- 00:49:20 If someone's not getting a nice you bed right away, you really got to start cooling in the year.
- 00:49:26 Another really important point to make, especially for folks who work in Icu's neural prognostication. How do we decide when patients will wake up. Well, this is a study we did some time ago where we asked the simple question, Phone cardi request.

- 00:49:38 Do people wake up? And what we found was, It takes days, three, four, five days for people to actually recover brain function and wake up. So it is um incorrect scientifically, and this is backed up by the ah guidelines that i'll show you in a second to make in your prognostication decisions based on arousal or awakening in the first two days.

Unknown Speaker

00:49:58 Now it goes further than that. It's been very well shown

Benjamin Abella

00:50:01 now that blown down loaded pupils in the first cities of arrest means nothing. Many patients have um abnormal brain stem reflexes for several days as well. Not just a question of waking up and following commands appropriately, So do not ner a partnership based on clinical exam within the first few days, and this is shown by the Jk. Guidelines. It's been, I show you two thousand and fifteen, but same in two thousand and twenty. You have to wait at least seventy-two hours to make your prognostication decisions and probably even longer if you're using Ttm again.

- 00:50:31 So I get calls all the time from residents, saying, Oh, Bloomberg and pupils, we're going to withdraw, and I see you can't do that blown to other people's. Do not mean this patient will not recover. Of course we'd rather have patients with reacting people, but it just isn't always the case.
- 00:50:47 Now another issue that comes up all the time and post-rest. Here is the role of the cat. Lap um. When do we, Cap? People? Should we cap people from curtis, or why would this even be a question? Well, it's a question because, and I'll just show you this briefly. A large studies have shown that coronary disease is very common
- 00:51:07 in patients after cardiac, that is to say, when patients get their pulse back, they go to lab. A lot of them have corner disease. That is a not surprising result. But it's striking how common it is, and but it makes sense. So you have to have a cardiac question something very often, not always, but very often it's recorded disease. So it's sort of relevant to. Now. Gosh! How do we figure out who should go to the Catholic?
- 00:51:30 Well, we studied this some time ago and looked at predictors of of needing the Catholic. That is to say, what simple factors could we identify in the er that could help us determine whether a patient need to go to the Catholic or not to put to find a point on it. Help us convince the cardiologists to take people to the Catholic,
- 00:51:49 and what we found was um! What we found, was it? It's actually pretty hard. So if they had a shockable rhythm, initial arrest. The odds ratio was three, so they were more likely to have a corner deleion on subsequent cap. That's somewhat helpful, but it means many patients with chocolate rhythm, still will have negative cats, which makes cardiologists angry,
- 00:52:09 or many patients peer sistily. If we actually by some dumb lock, convince them to go to the Catalan We'll have significant, so it's not perfect. Each was not good at all, so older means nothing.
- 00:52:20 Um. The strongest predictor was a history of coroner disease, which is completely unsurprising. If people of corn disease, they have coroner disease. So that's like a positive control. Finding actually uh. So, I would say that if someone comes in post to wrestling they have no significant history of corn, disease, cabbage, prior standing. You really got to think about the cat.
- 00:52:38 Um.
- 00:52:39 But I'll to whoops before I show you this. But i'll just tell you that several randomized trials have come out now looking at early versus late Kath following cardiac rest, and found no benefit of immediate gap. So I'm not saying you got a Catherine right way, but you should at least think about it now a fun story

to tell you. One of these trials came out and showed that early versus late Kath or equivalent, but they didn't take into account any clinical factors, and I got the the privilege writing the newly journal editorial on this, and I said, Gosh

- 00:53:08mit ctl! And you know, we really should think about other risk ratification for corn disease, for example, with the patient having chest, pain or shortness of breath before they collapsed. Maybe that's a clue, Maybe that tells us something one hundred and fifty.
- 00:53:18Well, the really fun thing about clinical research sometimes is you get to pose a question, and then you get to test it, you get to answer it. And so I said, You know what? Instead of just putting it out there as an editorial flapping my gums, I actually wanted to test this hypothesis. That is to say, could we use Ems information
- 00:53:37of what the spouse said or what they witnessed? Was the patient having chest pain. Could we use that to help build a predictive model? And, in fact, this we just published,
- 00:53:45we found we could.
- 00:53:46The history of corner disease was still the strongest predictor, but the second strongest particular, more than actually Ecg abnormalities, was, was the patient having chest discomfort before they collapsed. Now often we don't get this information from Ems or from the family.
- 00:54:01But if you're lucky enough to get a patient post to rest, and the family is in the waiting room, and you talk to them or you.
- 00:54:07Ems talks to them, and records that the patient was having just paying for a few hours, and then they collapsed. That patient probably needs the lab. Now that's a small that's not all the patients. That's the prime minority, but it's some, and we have often found this to be useful, that if the Ecg. Shows changes and the patient was, I mean chest pain, they really should go to the lab sooner rather than the later,
- 00:54:25so much more to learn. But just to show you sort of the pleasure of taking a question running with it and getting an answer,
- 00:54:34and with that I want to stop um with. And but I want to tell one more patient story. Um. So so you see, uh, down here on the far left. There is a gentleman um to our tolls, guy with corduroy pants. Well, he is a cardiac rest survivor,
- 00:54:50and I want to tell you a story in a few minutes. So he was in his thirties, and he was bicycling in Philadelphia, and thankfully he stopped for a second because he felt unwell in a way. Didn't didn't know we now know he'd be tack, and he was um feeling politicians and just breathless, and he collapsed dead of cardiac arrest. Well, he went to our hospital. We cooled him. We kept him, he now as an lcd. Because he had clean corner disease, and he's made a full recovery, and if you're interested in his name, I can share It's not hipaa violation, because he's been public there,
- 00:55:20that Conrad Um Zach um, and I did a story on Npr. Which is really cool to listen to. Sorry I don't mean to, too, my horn, but it's a good story to hear in his own words and his wife's words what the experience was like. So if you Google, Zach, Conrad Ice, cooling cardiac, or something like that, and it was on Why? Which is our local and pr affiliate It's a really nice radio show in any case. Why do I tell you this story, both because I like to remind everyone that this is about the patience I start with a clinical V yet, and end with one,
- 00:55:49but also to say the following:
- 00:55:51So if you get cardiac, arrest patients to recover, I strongly recommend that you bring them back to meet their rescuers to meet people in the lcu to get involved in Cpa training efforts one hundred and fifty.
- 00:56:02This does many things one it does a lot for them. They want to give back. They want to uh improve outcomes. And I've actually been working with Glaucom Fleck and his wife to help advocate for better Uh Cpr. Training and communities, because this all of a sudden very much matters to them.

- 00:56:19 Not only is it good for them, but it's good for all of us, because, you know, we many of us get very nihilistic about party at. We say, Oh, everyone's going to die. This is pointless. There's nothing like meeting some survivors, and hearing their story say, Gosh! You know I shouldn't be so quick to write these patients off
- 00:56:34 um, and we actually can do a lot of good, and so I strongly urge you to follow Cardio. Press patients, bring them back and have them tell their stories. Okay, With that I will stop sharing my screen. I want to leave a healthy ten, fifteen minutes for conversation. So Um, that's it. Thanks very much, guys. And what questions do you have?

DOM Noon Conference

00:56:54 Thank you, Dr. Bell. That was a phenomenal talk, and I think, um! The power of seeing survivors of cardiac arrest, as you mentioned, can be, can be quite inspiring. I certainly had a case or two of those during Residency. Um, I was just curious. Are you aware of any uh ongoing work research into more non-invasive methods of uh cooling. I know that the um

Benjamin Abella

00:57:15 there's obviously cooling blankets but uh cooling catheters um are obviously an invasive procedures there any research looking at other methods. Yeah. So we actually use the surface cooling device at our hospital. We don't use the catheters. Um, but certainly one can. And uh, you know, this is a nice statement to make, because I'm trying to stay unbiased. And the good news is, the science um lends itself to that there's no studies showing that the catheters or the blankets are better or worse than each other, so it's local preference. So we use the Arctic some

- 00:57:44 a blanket device at Pen. I had. No, I've recused myself from that decision process. So uh, you know, but that's what they picked, and I said, that's great as long as we're doing. Ttm. I'm fine with that um. And so you know the choice of invasive versus surfaces up to. You know individual hospitals and providers. Uh well, I should say hospitals, because the providers get what they get when the hospital purchases them.
- 00:58:06 But the point being that it is perfectly fine. Use not invasive methods now, as far as other methods that are being investigated. Yes, there are several groups that are working on other approaches to cooling. For example, there is an attempt to use cold air and do this through ventilatory mechanism. I I think that's going to be a little bit challenging.
- 00:58:24 Ah, certainly! There's a lot of research going on in other aspects of improving outcomes following cardiac arrest. But currently, the standard methods of cooling blankets or catheters seem to seem to roll the day one hundred and fifty.

Unknown Speaker

00:58:38 So other questions, folks, what questions do you have?

Benjamin Abella

00:58:42 I know you have questions. Everyone that's correct this therapy. I was there. It's a lot of questions. It's. I know the zoom things a little weird, can, can they? And zoom uh access the chat loop for questions in the chat.

DOM Noon Conference

00:58:52 Yeah, we've got chat up. Um, Thank you so much. Dr. Bella really appreciate your time today. Um. So you talked a lot about kind of thinking uh, Dr. Bell, We can unmute you in just one second. Sorry, um. But you talked about choosing your patients for cooling

- 00:59:11 um you mentioned potentially using. Eeg: How? What do you think the next step is in terms of how we differentiate, and what patients are most appropriate um for more aggressive cooling measures.

Benjamin Abella

00:59:31 Well, um, I think he he's going to play a big role in many hospitals Use Continue C Eg: Phone cardiac. Of course that's a big lift. It's not easy to do It's resource intensive. It' be nice to have other methods.

- 00:59:43 There's been attempts to use biomarkers blood serologic biomarkers like your fulfillment like chain glue, fibro, acidic protein.

Unknown Speaker

00:59:51 The problem there is Um,

Benjamin Abella

00:59:54 Well, there's several problems, one they often early on or so predictive. They're more predictive several days out, which doesn't help us too much. Um. Also, they're not. None of them are predictive enough, because what you really want is a biomarker. That's one hundred percent um uh specific that you don't want false positives. You don't want a high good February acidic protein and say, Oh, this patient is going to die with draw care, but the reality is they would have recovered. That's what we don't want, and and those blood by markers, have not achieved those goals yet.

- 01:00:23 So eg, maybe um. I think. Also, we just need to validate some of these clinical composite scores, and and there's three or four of them out there. But uh, they need a lot more work to validate them. Basically But I think one day we'll probably see some clinical score that will be baked into the emr like the herd score for chest pain that'll help us decide how injured patients are, and I'll probably be some come positive was by some superior given. Uh, you know. Uh, what's the lack date uh which is a good core lot of downtime. Those are both in the our cast score, so the our test score may be the best

Unknown Speaker

01:00:52 we've had, but they need to be validated.

Taison Bell

01:00:58 I don't know If Dr. Bell had a question I see tease on Belt says I can't tell you. I'm here. Thanks. Everyone uh nice, nice presentation. Thanks for coming question and a comment because one of the things that we've been discussing in Icu is which form of cooling to use. We have catheters now, but

- 01:01:16it was cool, and so I was wondering you mentioned time to the Ttm. Has uh one of the potential factors that can try uh for their outcome. So have you seen any data that suggest that uh the barrier to cap the replacement versus uh, the uh. What else of ease of use using surfing coolant?

Benjamin Abella

01:01:34That's a terrific question. Um, to to make sure everyone understands. So the issue is with Catheter. Is they cool a little bit faster, to be sure. But you need someone to put in the darn thing, and there's often delays given how overworked we all are to getting a dock at the bedside to put the darn thing in

- 01:01:53the blankets. On the other hand, cool little bit more slowly. Um, no, their reps would claim they don't. But you know, whatever they may. Um in some cases the problem that the benefit, though, is, it's nursing Driven So in our I use the nurses to slap on the path and go with it. So that's no one, to my knowledge, has looked at that Um, practically, that is to say, they have not actually measured times for either. Um, my hunch is, it's sort of a wash, and it's more about training of the local teams and what to do.
- 01:02:22But certainly I'll see this at Penn or our nurse is really like the fact that they can just put on the Arctic sun pads. They just need a doctors. Okay, to say, Yep, this is the right therapy, and then they just do it. The catheter, you know It's more of a thing. Um, but certainly many households use. The Kathryn's are very happy with them. Um, I don't want to get a too deep on this, because it'll sound like I'm selling on something, and I really try to avoid selling um, especially to say that both work works work fine, and I do think that there are, even though the Catherine works better. There are indeed delays to

Unknown Speaker

01:02:51getting it in for sure.

Taison Bell

01:02:53Okay, fair point. And then the second thing I want to talk again about um. You said earlier that there's no evidence that cooling causes harm.

- 01:03:02I disagree with you on that point. I'm from the Ttm. To trial, which I think is one of the better trials done in this arena. You just show that there is a higher incidence of rythmia type of, you know, Paralytics use longer length of time on the kind of ventilation, et cetera. So I do think that there has been some evident at least, you know, in this study, showing that it is, it can cause some hydrogenesis. Yeah, that that's totally a fair point. And I should clarify when I'm in harm, I'm in clinical outcome. So the survival of the same neurologic outcome was the same in both groups.

Benjamin Abella

01:03:32So the much has been made about this a rhythmia. It it's a little bit challenging to interpret it, and I'll give you a couple of reasons why. First, it didn't affect clinical outcomes. So you know you've all in the Ic seen post app or Sepsis related a fifth that doesn't affect outcomes in the end. Was that a major problem? Uh, sure, you'd rather not have it with me. But if it doesn't affect survival or brain function, which is the ho, which is the big uh prize.

- 01:03:56 Maybe it's less important, but it is real. I don't mean to completely diminish it. But the other issue about the rhythmic rate is that finding has not been seen in any other study of Ttm,
- 01:04:08 not a single one. The rhythm may rate in many of the other studies like five. So why they have this massive A with me a rate, and it's never been shown before by twenty years of research in this topic makes many of us think it's a definition issue, and the team group has been asked about this, and they've been kg about it,
- 01:04:27 you know. There's data collection at each site.
- 01:04:31 It's all about the boots on the ground, and how they interpret the rhythm. So, for example, or some corners putting in breed of Cardio as new rhythm, and because most patients who get breed of cardiac. Now the team group says, No, they data cleaned for that. But many of us just want. All I know is i'm scratching my head going. I don't know why they're with me, or so much higher than any other published study. It makes me think there's something a little weird going on there. But
- 01:04:53 to to agree with you in part. It is true that Ttm has its effects, and longer Icu state is need one of them, and that has real costs and system issues. And so this is not a trivial point. Um, but survival Patient outcomes definitely are not harmed by Ttm:

Taison Bell

01:05:12 Thank you,

Kyle Enfield (he | him)

01:05:14 hey? This is Kyle infield. Uh thanks for this talk. I think we've all appreciated it. I I wondered if you might spend some time expounding a little bit more on sort of the more personalized approach where we actually target patients who, in achieve more benefit for lower temperatures uh, and then maintaining normal Thermia for the patients who are less likely to benefit, because I think that's an important caveat. I mean you. You point out the differences between the Scandinavian and resuscitation systems and the patients they transport. And I I think we need to think a little bit harder about that in the Us. As well.

Benjamin Abella

01:05:44 Yeah, absolutely so. So you know, and I think for the residents in the room. This is one of the key teaching points that this field offers you, which is

- 01:05:53 anytime. You look at our Ct. I think one of the most important things to do is, look at the patient cohort. Look at It's typically table one. So I metaphorically always call it table one. It's not literally always table one, but their table. One will have their patient cohort, and you have to ask yourself, does this patient cohort
- 01:06:07 seem like it's my patient cohort, or, more importantly, for the given patient in front of me today, does this cohort adequately mirror the N equals one that I'm treating today in the Icu um, and that's a key issue that comes up in any rct in any subfield of medicine. And so I think this is highly relevant here. Now. Patient selection. It's tough, because this is sort of where we're at in two thousand and two. We I wish I had the full answer for you. I do not, I suspect, in five years there will be an answer.
- 01:06:37 Um. So what do I recommend? I think you have to ask yourself, Is the patient in front of me look like a Ttm to patient, or do they not so? Who are the Ttm. Two patients no shock or very low incidents of shock uh high rated by some Cp. And hurry to witness to rest. So it would be very reasonable if you have a

patient come to the Av. Who had a witness to rest the media by centers. Cpr: No events of shock, you know

- 01:07:00no requirement for pressers. It lactate clearances coming along beautifully, and maybe they're first likely it was only five or six. That patient probably does not need cooling. That patient fits the ttm to criteria, and you can just do aggressive Normothermia, and that doesn't mean you need thirty-three.
- 01:07:18On the other hand, if you get a patient post to rest who did not get by center. Cpr. His initial acting is fifteen and is on, you know. Some noor app, you say, for initially low maps. Uh that's not the patient that was well described in the ttm to Cohort and my fear is that they need ttm to thirty-three and by not doing so, you manager them. I I can't say that for sure. But that that's my hunch, based on the data I shared with you by injury. Severity,

Unknown Speaker

01:07:46a a deeper problem. Here

Benjamin Abella

01:07:48is, we don't have a brain probe in common use. They exist. I see P. Bolts, micro dialysis. But we're not doing that on these post-rest patients, and i'm not sure we should, or there's evidence to support it, but it it's sort of like. We need to see what's going on in the brain, because that's the fundamental issue.

- 01:08:05I believe that the presence of a lack of best and Cpr. Is probably a pretty good surrogate for brain injury, but it's probably not perfect. It probably is incorrect in many times, and so you might get by soon. Cpr. That's poorly performed. Say, and have significant brain swelling or other uh physiologic arrangements of neurologic tissue. Or you could have someone who is no by center. Cpr. Who's just you know, tough and no icp elevations in a healthy looking brain. So I think we need to move towards brain direct brain assessment in some fashion,

Kyle Enfield (he|him)

01:08:35and I guess a follow up. How do you handle your in hospital Cardiac arrest right now, because that population traditionally does poorly, regardless of what we do for them.

Benjamin Abella

01:08:44Yeah, we mostly within hospitals, do. Normally, we do a fever avoidance. Um, because the data are just so murky and also an in-house for rescue of the additional feature that these are generally very complicated patients, and I see with a lot going on, and you know, a a ten of critical period, Don't. Add new variables uh to very sick patients, and so we think fever. Avoid this, for many lcu cardiacs in the hospital is is appropriate.

Kyle Enfield (he|him)

01:09:16Thanks, sure.

Unknown Speaker

01:09:24 Who else has questions? Those are some great questions and good discussion.

Benjamin Abella

01:09:27 And, by the way, I thank Dr. Bell so for some disagreement. I love healthy disagreement. That's what makes medicine great, right? We uh, when the facts are not known, we have to disagree sometimes and like, think through the data and think through the importance of it. If something is so firmly established that it's obvious, then it's not fun. There's no disagreement. We just do the therapy right.

DOM Noon Conference

01:09:49 Hey, Dr. Bella, This is Brian Nolan comment, calling in from the conference room. Here I'll give you a little bit of a kind of related, unrelated question to this field. Uh, just with the New England Journal article last week uh, as we've been talking about out of hospital arrest, and some of the racial and ethnic differences in in this field that we've been talking about here with. Again. I think I see as a generalist and not an ICU doc, some kind of variation of practice. Are you aware of much in the literature in terms of

- 01:10:19 disparities, You know race or ethnicity in terms of application of

Benjamin Abella

01:10:24 temperature management. Is that anything out there in the literature or untapped it? It's a fascinating question. What is out in the literature is that there's huge variation from hospital hospital and the use of Ttm. And applications post-rest care modalities more generally a huge variation. We publish on this other groups are published on that. Now the interesting question is, does that have anything to do with socioeconomics of the communities of the hospitals or race at the individual level than hospitals That has not been a well established or studied at all. To my.

- 01:10:55 I think I've seen something on that last year, too. But it might be wrong. Don't quote me on that. What is clear?
- 01:11:01 Um! As alluded to. Some of you may not have seen this paper, I strongly recommend you check it out from Paul Chan and colleagues. Um! They did a major national evaluation of Cpr. Delivery and found huge racial disparities. Now, this is not news. Um. There have been a number of publications we published on this other on this, in smaller settings, showing huge racial disparities in the delivery of Cpr. That are just really a tragedy. And uh, and it's there, There's much to um dig into this. There's much to under
- 01:11:31 and study. Yeah, for example, it's really a community level problem, because by center Cpr. Is everything. And so it's not that
- 01:11:39 it's to a certain extent, probably the mechanism of racism, and to a certain extent community training. If communities are trained in poor communities generally have poor access to Cpr. Training because it relates to employment It relates to all sorts of things. Anyway, it's a very important paper and an important conversation to have that conversation has not yet really started around post-rest care.
- 01:12:02 So thank you. Somebody put the link to that paper in the in the conference. Thank you for doing that. Um! It's really a paper worth reading. And, by the way, there's been a number of papers. So if you're interested in in racial and socioeconomic disparities uh the world of out of hospital. Cardiac arrest has got a as chuck full with these studies, and actually gender disparities. To I might add, I'm. I'm very proud

of my mentee, I had a Phd student who showed that women get by center. Cpr. And you in the Us. And public at a lower rate,

- 01:12:32survive credit across at a lower rate than men, and one of the proposed mechanisms there is that people uh train to do Cpr. On Mannequins. So all of a sudden when faced with a woman who has breasts, they just don't over with their hands. They're nervous, they don't want to touch, and and so they get less. Cpr. And that's also a tragedy.
- 01:12:51So thank you for that prompt on that.

Chris Rembold

01:12:56So this is Chris ramble. I have a question.

- 01:12:59It. Have you ever been able to look, and I may have missed it in your presentation. But have you been able to look in terms of this possible cause of whether it's cardiac Arrest versus pulmonary arrest. Do we know anything about that?

Benjamin Abella

01:13:13Yeah, I didn't talk about that? And that's a great question. So So you know one of the things that's in a way you're bringing up the elephant in the room, which is, why did somebody have a cardiac arrest? Gee! Wouldn't that be nice to know? And indeed we it would be nice to know. But we often just sort of like lost that over, because, you know, you want to treat the underlying cause it is. That's a general tenant of many aspects of medicine. For example, if they had their arrest from a stemming, they need the Gap lab. They had the rest from a pe. Maybe they need Tpa

- 01:13:42and um. We are really bad at getting at the ideology, and So a lot of studies have sort of said presumed cardiac cause, and that's a terrible sloppy term, right presumed, cause well, they based in a very uh gestal criteria, but it's not great. Um.
- 01:13:58My personal belief, based on just anecdote and some smaller studies is that there's a significant minority of credit across patients who have pe is the cost that go completely undiagnosed and untreated. And it seems to me, knowing if someone at a pe that cause their rest early on would be really helpful. So we don't to answer your question simply. We don't know um. No one's done an evaluation to say how many cardiacs are from pe versus cardiac,
- 01:14:25is. There's this series of patients out of Oregon a sudden unexplained death syndrome or study Um, but it's different. Um. It it's an electrophysiology study of patients of electrophysiologic disease. So it's not all commerce. It's not. It's not quite perfect for this question, but getting at ideology. I think is a really important and under appreciated area.

Chris Rembold

01:14:47Thank you. I I remember this because when I did, cardiology consults over a long time, I've been on the faculty for a long time. One of the things I found is this is: if you went to the non-cardiology floors they would call a cardiology console if someone had a cardiology or a

- 01:15:04and if you went back and look through the notes frequently, you found that they got like really hypoxic right before it happened, and

Benjamin Abella

01:15:12I just so. I always was like It's different when you're on a cardiology for it. It'd be great to know this. Thank you for your answer. I think you're That's right. There are many causes of cardiac rest that do not have to do with the hurt. Uh, you know a little fun thing to end on. Perhaps this is common. By the way, this is a common point of confusion in the public.

- 01:15:33A check out the next time you see it, some story in the media about cardiac rest, they confuse heart, attack, and cardiac arrest as terms all the time all the time, and of course, heart attack. My cardiac arrests are not the same entity. They're very distinct entities,
- 01:15:46and it is fair to say that in the Us the majority of cardiac arrests are not from my cardiac arrests are from other causes. Sadly, of course, one of the big causes now is opioids and sort of primary respiratory arrest that leads to cardiac arrest. But pe
- 01:16:01uh electrolyte abnormality and dialysis patients uh heck just hypoxia from some massive lung infection. Um! There are many reasons why people men have cardiac arrest, and it cardiac is scheme is only one of them
- 01:16:18great. Well, thank you very much, Dr. Abella. Thank you for a phenomenal presentation and some very healthy discussion. I appreciate all the all the questions and comments.
- 01:16:27All right. Well, that concludes grand rounds. Thank you. Everyone alright, have a good day. Guys enjoy.