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Host: Welcome to the Anesthesiology journal podcast, an audio interview of study authors and editorialists.

Dr. James P. Rathmell: Hello. I’m Jim Rathmell, Professor of Anesthesia at Harvard Medical School and Chair of the Department of Anesthesiology, Perioperative and Pain Medicine at Brigham and Women’s Hospital in Boston. I’m one of the Executive Editors for Anesthesiology and you’re listening to an Anesthesiology podcast that we’ve designed for physicians and scientists interested in the research that appears in the journal. Today we’re going to talk to the lead author of an original research article that appears in the April 2019 issue. With us today is Dr. Alparslan Turan. Dr. Turan is Professor of Anesthesiology and Vice Chairman of the Department of Outcomes Research in the Anesthesiology Institute at Cleveland Clinic in Cleveland, Ohio.

Dr. Turan is the lead author on an article that appears in the April 2019 issue of the journal titled “Incidence, Severity, and Detection of Blood Pressure Perturbations after Abdominal Surgery: A Prospective Blinded Observational Study.” Dr. Turan, thanks for joining us.

Dr. Alparslan Turan: Thank you for the invitation.

Dr. James P. Rathmell: Well, congratulations on the publication of your work. You’ve examined an important topic for anesthesiologists: intraoperative and postoperative hypotension.

Your article starts by emphasizing how common hypotension is during the intraoperative and postoperative periods and that these periods of low blood pressure have been associated with many different adverse outcomes, including myocardial injury and stroke. So, this is an important topic.

I want you to start by explaining why you set out to do this study. Give us some background and then tell us what your original hypothesis was.

Dr. Alparslan Turan: Well, basically as a group we have been working on hypotension, intraoperative hypotension, and different outcomes including kidney injury and myocardial injury. We have done a few studies on the topic and we found out that even a few minutes of hypotension, intraoperative hypotension, they are associated with kidney injury plus myocardial injury after surgery.

So, this drove a lot of attention and it was a very interesting result for us. But more importantly when you are in the intraoperative period, there is a few things that is very different than on a regular floor. First of all, there’s an anesthesiologist or a provider sitting in the room and constantly dealing and checking the patient which at that point have blood pressure measurements from one to five minutes and the intervention is very fast, pretty quick and fast. Even though if that’s fast and that quick, these people do have kidney injury and myocardial injury after anesthesia.

So, it drew our attention because there is also 30% decrease in the metabolic rate under anesthesia which basically decreases those kind of complications. However, when we look at the wards, the same events do happen; we do see a lot of hypertensions, hypertension in the regular floors and the majority of the time the nursing evaluates every four hours to eight hours. At the Cleveland Clinic, it’s every four hours the vital signs are assessed by the nursing.

So, there’s a gap of a lot of monitoring and information that’s done up on the floor and we know that intraoperative mortality rates have tremendously decreased with us basically being top of many other things. But on the floor that’s not the case; we do see quite a lot of patients who die in the first 30 days after surgery and the majority of them are related to things that can be preventable, if possible.

So, that has led us to design this study to see what is the incidence of hypotension and hypotension that is happening up on the floor. Plus, what is happening when the nurses are doing the monitoring every four hours compared to a more advanced technology where you can do a continuous measurement which is nowadays pretty easy to do.

Dr. James P. Rathmell: Well, this is an observational study, so I suppose your hypothesis was that there’s a lot of undetected episodes. The study evaluated the incidence and severity of postoperative hypotension and hypertension in adults that were recovering from abdominal surgery and the extent to which serious perturbations were missed by this routine vital sign assessment. So, tell us just exactly how you conducted the study.

Dr. Alparslan Turan: This was basically a sub-study of two underlying trials which one of them was FACTOR and the other one was EXPLANE where we required patients to have continuous monitoring on the regular floor.

The first study was evaluating the effect of intravenous acetaminophen in patients who were having abdominal surgery and the other one was comparing bilateral transversus abdominus plane block with liposomal bupivacaine versus continuous epidual analgesia.

And these patients were placed on continuous monitoring using ViSi Mobile system which is from the Sotera Wireless. This is an FDA-approved device for continuous measurement.

The patient was placed on the monitor as soon as they came out of anesthesia and stayed on the monitoring for at least two days and then the wireless continuously monitors the blood pressures.

And we went back and looked at the nursing evaluations which is done every four-hour intervals in the clinic. So, that’s how we designed the study.

Dr. James P. Rathmell: Alright. So, you took a step back from the consequences of hypotension to have a close look at how often hypotension actually occurs and then how severe and prolonged the episodes were and whether or not they were undetected by routine monitoring on the floors.

You measure blood pressure every minute for 48 hours in 312 patients recovering from abdominal surgery. Can you explain how these data were collected? Was there anything unique about the monitoring system you used?

Dr. Alparslan Turan: The ViSi Mobile system is a very tiny, small device that’s a wearable mobile technology which continuously captures multiple vital signs; this includes pulse rate, oxygen saturation, ECG recording, basic respiratory rates, skin temperature and it has a continuous noninvasive cuffless blood pressure.

Basically it’s a cuffless blood pressure that’s calculated from the ECG and pulse-oximetry signals utilizing pulse arrival time technology and compared to a previously captured formal oscillometric blood pressure measurement.

So basically this is a very easy-to-use device. It does not require a continuous oscillometric measurement which makes it very comfortable for the patient so it doesn’t bother them a lot and they don’t drop out of the study easily.

So, this is a very compact device and it wirelessly sends all the information, all the data to a server from where we can retrieve all the information.

Dr. James P. Rathmell: So, my vision of patients sitting on the floor having the blood pressure cuff go up every minute isn’t really what happened. It’s the use of the new technology that’s quite comfortable. So, what did you learn in this study?

Dr. Alparslan Turan: First of all, interestingly, we found that hypotension was pretty common and hypertension was pretty common in these patients as well. We designed the study for different cutoff points for hypotension and we found out 24% of our patients had at least one episode of hypotension which means a MAP of less than 70 mm Hg for 30 minutes or 16% of them had an episode that’s lasting more than 60 minutes which is pretty intense hypotension for a very long time.

And the same happened when we used the cutoff point of 65. We found out that 14% of the patients had at least 30 minutes of hypotension and they were – a majority of these were not recognized by the nursing.

When we look at the - to compare two groups, there were 57 patients out of 312 who had a MAP below 65 for continuous 15 minutes and out of this 57, 27 of them were missed by the routine vital sign evaluation of the nursing, which is approximately 50% of the patients. This is a lot.

We know that 65 mm of Hg is related to a bunch of bad outcomes including myocardial injury and acute kidney injury even for a few minutes under anesthesia, but at this point they were more than 50 minutes and 50% of them were missed by routine monitoring.

When you look at the hypertension, a similar trend was seen there as well. We had two cutoff points, but the first one was under 110 mm Hg and the other one was 130 mm Hg.

And we found out that 10% of the patients at least averaged 30 minutes per hour at below 110 and likewise 6% of the patients averaged at least five minutes per hour at below 130; 130 is quite a lot MAP I mean, if you think about 130, you need to have at least quite a significant amount of hypotensions.

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And when you look at how many of them were missed, that's even more interesting because there were 44 patients out of 315 who had a MAP of 110 and above and they missed around 44% of those patients as well.

Again, the continuous measurement showed 42% of those patients which is 132 of patients had 110 and above for 30 continuous measurements and 96 of them were missed which is 73% by the nursing. This is quite significant.

I mean, if you look — think about it, basically the continuous measurement takes quite a lot of patients who are having hypertension while the nursing — because of the time intervals is missing a majority of this hypertensive and hypotensive events after anesthesia.

Dr. James P. Rathmell: I want to restate some of your findings just so listeners can digest them a bit more. Nearly a quarter of patients experienced an episode of mean arterial pressure of less than 70 that lasted at least 30 minutes and 18% had an episode where the mean arterial pressure was less than 65 mm Hg lasting at least 15 minutes.

Nearly half the patients who had mean arterial pressure of less than 65 mm Hg for 15 minutes were undetected by routine vital sign assessments and the data for modest and severe hypertension are even more profound where those episodes are largely missed. Wow. Both hypotension and hypertension are surprising common, they’re surprisingly prolonged and most episodes go undetected by routine monitoring.

So, what do you conclude from your study and why are your observations potentially important? These are 312 patients who had routine abdominal surgery; it seems like the majority of them probably did pretty well despite all of these episodes.

Dr. Alparslan Turan: Well, it’s an interesting question. First of all, I think the technology needs to move into the direction of continuous monitoring. We have done a lot of things in anesthesia, a lot of things have changed; however, our ward monitoring has not changed at all. We have the spot checks which is between four to eight hours and we are, as you see, missing quite a significant amount of hypotensions and hypertensions.

I think as anesthesiologists we need to step down and figure out and maybe widespread use of continuous monitoring in the wards. At the same time, I think this information – there will be a lot of information. This information needs to gather together and maybe go through a small artificial intelligence and after a certain evaluation, they should give certain signs to the physicians and nursing so that these patients who are under risk for myocardial injury, kidney injury and stroke should be intervened before the things happen. I think that’s the future of anesthesia and future of the perioperative period.

I hope today’s discussion will lead many of you listening to read this new article that appears in the April 2019 issue of ANESTHESIOLOGY where you can learn more about the incidence, severity and detection of blood pressure perturbations after abdominal surgery.

Dr. Turan, thank you for joining me today and for the terrific explanations.

Dr. Alparslan Turan: Thank you for the invitation. Must appreciated.

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Host: You’ve been listening to the ANESTHESIOLOGY journal podcast, the official peer-reviewed journal of the American Society of Anesthesiologists. Check anesthesiology.org for an archive of this podcast and other related content.

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