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

Dr. BobbieJean Sweitzer: Hello. I am BobbieJean Sweitzer, an Associate Editor for *ANESTHESIOLOGY* and you are listening to an *ANESTHESIOLOGY* podcast designed for physicians and scientists interested in the research that appears in our journal.

Today we are speaking with two authors of publications that are published in the December 2021 issue of the journal. With us is Dr. Charles H. Brown IV. Dr. Brown is the first author of an article titled, "Spinal Anesthesia with Targeted Sedation Based on Bispectral Index Values Compared with General Anesthesia with Masked Bispectral Index Values to Reduce Delirium: The SHARP Randomized Controlled Trial."

Dr. Brown is Professor in the Department of Anesthesiology and Critical Care at Johns Hopkins University School of Medicine in Baltimore, Maryland. Welcome, Dr. Brown.

Dr. Charles H. Brown IV: Thanks for having me, Dr. Sweitzer. I really appreciate the opportunity to talk about this work both with you and the audience.

Dr. BobbieJean Sweitzer: And joining Dr. Brown is Dr. Pratik Pandharipande. Dr. Pandharipande wrote an accompanying editorial, "Baseline Vulnerabilities May Play a Larger Role than Depth of Anesthesia or Sedation in Postoperative Delirium." Dr. Pandharipande is Professor, Department of Anesthesiology at Vanderbilt University Medical Center in Nashville, Tennessee. Welcome, Dr. Pandharipande.

Dr. Pratik Pandharipande: Thank you. Really glad to be here on this podcast and with this group to have a good discussion.

Dr. BobbieJean Sweitzer: So, Dr. Brown, let's start with you. That was a cute title, "The SHARP Trial," especially about spinal anesthetics seeing that naming of studies is actually one of the most important aspects nowadays. So can you tell us a little bit of that acronym: what it stands for and how long did it take you guys all to come up with that?

Dr. Charles H. Brown IV: Yes, thanks for that question. So the acronym stands for Shaping Anesthetic Techniques to Reduce Postoperative Delirium. And I've really found that having a nice acronym helps with study communication both internally and externally and sometimes it's a challenge to find the right acronym that has a positive tone and communicates the study.

So, I thought this one was nice; as you said, SHARP has connotations of the spinal needle as well as sharpness in mind is the positive tone for the acronym. It takes a while sometimes to come up with a good acronym but it's one of the things that can be done in the car driving or another down time.

Dr. BobbieJean Sweitzer: So it's actually doing double duty; I get that now. Yes, I think that it is important to have a good name. I think it helps people remember the study and remember the results, so kudos on that.

So maybe you can tell us what your primary and if there are any secondary aims were with this study.

Dr. Charles H. Brown IV: Sure. So the genesis of this study really was to examine the question of whether depth of anesthesia is a modifiable risk factor for delirium and specifically whether reducing depth of anesthesia could reduce the instance of delirium.

And so, the primary aim of the study was to determine whether a bundled approach to reduce anesthetic exposure and reduce depth of anesthesia would, in turn, reduce the instance of both delirium and delirium severity after lumbar spine fusion surgery.

There were some secondary aims to look at reductions or changes in post-hospital discharge cognition, function, health-related quality of life and pain as well. And then finally we had a few specified subgroup analyses to look at to see if the effect of the intervention was different in different subgroups of patients.

Dr. BobbieJean Sweitzer: So, I know when I first saw the title of this study I thought it was going to be about lower extremity joint replacements or some surgery like that and I was quite surprised and I wonder if some of our listeners will be as well at the type of surgery that these patients had in your study given that you were comparing spinal anesthetics versus general anesthetics.

Can you tell us why you chose this type of surgery and is this routine to be done under spinal anesthesia in your institution?

Dr. Charles H. Brown IV: So to answer that question I'll give some further background. So at the time of this study design most studies or several studies had suggested that there was a reduction in delirium with strategies to reduce depth of anesthesia. There were, in particular, two studies in general anesthesia and in each of those I would say the comparison was a deep anesthesia versus an even deeper anesthesia since everyone was under general anesthesia.

There was also a study from my colleague Fred[erick] Sieber in hip fracture surgery where they had randomized patients all undergoing spinal anesthesia to different depths all with propofol sedation. And there were some weaknesses in looking at the whole of the literature that I wanted to address and in particular the hip fracture patient population as we know is very cognitively vulnerable and so may not be generalizable to the vast majority of older adults undergoing surgery.

And so, I really wanted to look at the question of whether reducing depth of anesthesia beyond general anesthesia, so even lighter, could be a strategy to reduce delirium in a population of older adults that's generalizable and that is not cognitively impaired.

And so we really needed a patient population which general or a spinal or regional approach was appropriate and, importantly, we needed a population in which there was a reasonable instance of delirium. I had done a prior study here at Johns Hopkins suggesting that there was a reasonable instance of delirium after spine surgery.

Concomitantly another colleague and many others have looked into elective joint replacement and the instance of delirium can actually be fairly low, so not a great population for this kind of interventional study.

So at the time of designing this study I got to know colleagues at Mercy Medical Center and there's a great group of surgeons and anesthesiologists and they had been using spinal anesthesia in their practice. And what was interesting is that some anesthesiologists were using spinal anesthesia for patients undergoing spine surgery who they thought were too sick for general anesthesia and others would use it in the exact opposite population in patients who were very healthy and they wanted to fast track through the procedure.

So it really created an nice equipoise as it was unclear who the best population was, what the benefits were, but it was also clear that the group had experience in using spinal anesthesia for patients undergoing spine surgery and both the anesthesiologists and surgeons were comfortable with this.

So, it was a nice population to explore that let us answer the goals of the study in a safe manner and produced results which we think are highly applicable and can be generalizable.

At our institution, we do a lot of surgeries that are multilevel and take longer than what was used in this study. And so this study was actually done at a collaborating institution, Mercy Medical Center.

Dr. BobbieJean Sweitzer: It seems like you put more work into that than you did coming up with that name. But that was an excellent explanation as to how you really paid so much attention to your design so that you had the best hope of answering the questions that you wanted to answer.

So, Dr. Pandharipande, you began your editorial, I think, discussing the impactful studies in mechanically ventilated ICU patients and what we have

learned from those patients and sedation levels. Can you tell us a bit more about that?

Dr. Pratik Pandharipande: Yes. So, there have been a number of studies that have looked at the impact of sedation on ICU outcomes especially since the advent of continuous infusion pumps and the transition away from (sounds like: intermittent) medications that we used to use in the past. And many of these well-conducted and impactful studies in critically ill patients have shown that deep sedation is associated with worse outcomes including mortality and that sedative medications and particularly the benzodiazepines are associated with a greater probability of delirium.

Now, follow-up studies have shown that delirium is a worse harbinger for dementia after critical illness so that provides the sedation modification as a potential area to target to try and improve outcomes. Now there have been now implementation studies that have taken the literature that we have based on the fact that deep sedation is associated with worse outcomes and have targeted daily or weekly trials adding light sedation paradigms into practice trying to avoid benzodiazepines, trying to mobilize patients and those have shown improvements in delirium rates, time in the hospital, as well as improvement in mortality.

So, these have all been studies that have been conducted in ICU patient populations which provide us a framework to try and understand some of the benefits that might occur if such approaches are even taken in the perioperative setting.

Dr. BobbieJean Sweitzer: So, Dr. Brown, a key aspect of your trial was the use of Bispectral Index values in both of your groups, both the general anesthetic and the spinal groups, but I think you used them a bit differently. Can you tell us how you used this and why?

Dr. Charles H. Brown IV: Yes. So, a key aspect of this study design was to separate punitive depth of anesthesia in each arm. We had preliminary data prior to beginning the study, observational data, that suggested that the average BIS values were lower in patients who had general anesthesia as compared to patients who were undergoing spinal anesthesia and this data was collected prior to the start of the study.

For the study design, based on that data, we decided to mask the Bispectral Index values for patients and providers in the general anesthesia group and we were fairly certain that these values would be on the low side. For the spinal anesthesia group, we tried to target BIS values greater than approximately 60 to 70 and we thought that that was achievable based on our pilot data.

We were not able to use other measures of depth of anesthesia such as a sedation scale given that this was spine surgery and generally the clinicians were uncomfortable rousing patients and moving them around during some of the spine fusion surgery.

So as opposed to other studies which have used the sedation scale, we primarily targeted the anesthetic agent administration and the depth of aesthesia using BIS values. And so, in some sense this study, in a lot of senses, has a lot of pragmatic elements because we were nesting this within really the clinical care of a spine anesthesia and surgery practice.

Dr. BobbieJean Sweitzer: Dr. Pandharipande, do we know anything about what BIS values mean in nongeneral anesthesia patients?

Dr. Pratik Pandharipande: The BIS has been used in critically ill patients to ensure amnesia when chemical paralysis is required for management of, say, severe (inaudible). So that is where most practicing intensivists would use the BIS.

Now, the correlation between BIS and sedation depth in ICU patients has not been consistent. So, we do use the BIS values in the ICU associated with amnesia which has been extrapolated mainly from studies in anesthetized patients and not necessarily from critically ill patients in the ICU. So, where exactly one should target BIS with regards to sedation depth in critically ill patients is not known; we just know the threshold for amnesia based on the studies in anesthetized subjects.

What we do know is that short periods of both oppressions, so the extreme values in BIS in critically ill patients is associated with worse outcomes including death but where in the middle zone of BIS values correlates with outcomes is really not known.

Dr. BobbieJean Sweitzer: Dr. Brown, other than controlling for the targeted BIS values in the spinal group and hiding the BIS values from providers in the general anesthetic groups, did you control for anything else; for example, the drugs that they were allowed to give patients?

Dr. Charles H. Brown IV: The bundle that we used for the intervention group was spinal anesthesia with targeted BIS values and then propofol for sedation. In the general anesthesia group obviously there was a volatile anesthetic with paralysis and reversal.

We conducted the study in the Mercy Medical Center and really tried to have a lot of the study protocols be within the bounds of usual care. So, we did not specifically prescribe all the pain control in the postoperative period, other nonpharmacological interventions. Everything was within the confines of usual care but their usual care has a lot of structured protocols. So, we really tried to balance the pragmatism of the trial with controlling multiple factors.

Dr. BobbieJean Sweitzer: And how and when did you assess patients for delirium?

Dr. Charles H. Brown IV: We assessed patients on each of the first three days after surgery that they were in the hospital, we used the Confusion Assessment Method that was administered by an experienced research nurse and as part of this method there's a formal test of cognition that are administered each day including the Mini-Mental Status Exam, months of the year backwards, other small tests of cognition as well as informal conversation with patients, nurses, any family members.

And based on all of that input, the research nurse makes a judgment according to the CAM or the Confusion Assessment Method criteria was to whether the patient meets criteria for delirium, so that includes an acute and fluctuating change in cognition, inattention and either changes in thinking or changes in level of consciousness.

And our group has a lot of experience in administering the CAM and I think it's really important to understand which instrument was used and in which context because when you compare the instance of delirium across different surgical populations or different instruments, you can get really a variety of results and so understanding both the instrument used and the methodology is important.

Dr. BobbieJean Sweitzer: Dr. Pandharipande, going back to those ICU studies, can we extrapolate what we've learned about the risk of delirium and risk factors for delirium and all the prevention techniques that I think are even being utilized today in the ICUs to the perioperative setting? Or are these two different situations?

Dr. Pratik Pandharipande: No, I think we can definitely extrapolate some data from these ICU studies. It's important to realize that many of the ICU studies do enroll patients that are admitted into the ICU after major surgical procedures. So I think there is definitely lessons learned from that.

We know that baseline vulnerabilities and these happen in the perioperative period as well whether it's advanced age, frailty, dementia, perhaps sepsis, I mean, these are patients that come to our perioperative settings and for surgical procedures and these baseline vulnerabilities do increase the risk of delirium. So, we know that part and we can learn from that.

We also know that some of the precipitating factors that happen in the ICU may happen in the perioperative period and this includes heavy use of benzodiazepine medications or prolonged deep sedation. So these precipitating factors on top of baseline vulnerabilities I think are lessons that we can take from the ICU into the perioperative setting.

Dr. BobbieJean Sweitzer: So, Dr. Brown, what did you find in this study of yours?

Dr. Charles H. Brown IV: So, I can summarize five to seven years' worth of work in a sentence or two. We found that there is no difference in the instance of delirium in the spinal anesthesia group, 25% versus the

general anesthesia group, 19%; we also saw no difference in delirium on any particular postoperative day and finally for these primary outcomes we saw no difference in the maximum delirium severity score either through the hospital day or on any particular postoperative day, and the delirium severity score as weighted towards hyperactive delirium but gives a more continuous measure of delirium severity.

Dr. BobbieJean Sweitzer: After seven years of work, if you want to expound on that a little more, go right ahead.

Dr. Charles H. Brown IV: Trials such as this take a long time to do and they are important to answer questions such as this. So, it's really important to, as an investigator, be able to have the training, the funding, and the important question to ask and then also to be able to diversify and be able to look at multiple research questions concomitantly since as you can see this trial took a long time to do. But I'm very grateful for support of funders such as the IRS, and the NIH and institutional support as well as collaborators both at Mercy and at Johns Hopkins and the patients who participated that allow this kind of research to occur.

Dr. BobbieJean Sweitzer: Yes, I guess it takes a village, right? I do appreciate, I think, and I think our listeners do appreciate the value that we get and all the hard work that the researchers put in to trying to help us answer these important questions.

So, I think you found some differences in delirium based on findings on the Mini-Mental Status Examination even if you didn't find overall. So, first maybe can you tell us how that exam is done, what it indicates and then about the results of this in your study?

Dr. Charles H. Brown IV: So, the Mini-Mental Status Exam I'm sure is familiar to many people in the audience and tries to assess cognition globally on a scale of 0 to 30 and there are correlations of certain cutoffs with different levels of cognition including mild cognitive impairment or dementia although really it can be used primarily as a screening tool.

I think it's important in the context of surgeries to assess cognition and the Mini-Mental Status Exam is one brief way to do that. I'd say there's two findings of note from this study: the first is that baseline Mini-Mental Status Exam score was strongly correlated with delirium both in unadjusted and adjusted models. And I think this is very consistent with the literature and my read of the literature is that age and decreased cognition are really dominant factors for postoperative delirium across many studies in many surgical populations. So it's nice to see that consistent finding in our study.

Secondly, we conducted several subgroup analyses to examine if the intervention was different or had different effects based on different subgroups of patients. And so we looked at subgroups according to age, according to Charlson Comorbidity Index and according to baseline cognition. And for age and comorbidity index, we did not find any difference in the effect of the intervention based on either of those subgroups.

However, for cognition we found something different. So, we divided patients into two subgroups according to a Mini-Mental Status score of 27. What we found is that for patients under 27—so these are patients who are more cognitively impaired—that spinal anesthesia was better than general anesthesia for reducing delirium. However, in patients who had a baseline Mini-Mental Status score of 27 to 30, we found that general anesthesia was better.

So, I think these results are intriguing and you certainly have to think about the fact that patients with baseline lower cognition are at higher risk for delirium and these are the patients that we really need to develop good interventions for.

But I would also say that this is a subgroup analysis; it was pretty specified, but I think really is hypothesis-generating and sets the stage for further studies which albeit can be hard to find and screen for some patients with some cognitive impairment but I think it sets the stage for important areas of future research.

Dr. BobbieJean Sweitzer: Yes. I think that they say all good studies often ask more questions as well as answering some questions.

So, Dr. Pandharipande, were you surprised by the findings of this study?

Dr. Pratik Pandharipande: I was definitely surprised at first glance considering the ICU data that I referred to. But then I think if you go back and look at the patient population, you realize that there are meaningful differences in the study population with regards to severity of illness, depth of sedation and duration of deep sedation which are quite different in the ICU patients as compared to during the short anesthetics and that leads to much lower cumulative (sounds like: drug burden) in a way.

So, I think it's important to realize that and acknowledge that the SHARP Study and the effort that went into the conduct of the study over the last many years that it has helped shape and understand our thoughts on how sedation might be impactful in lower severity among those patients and that perhaps when your patients don't have a high vulnerability then a short duration of sedation modification may not have that much of an impact.

But as Dr. Brown said and you reiterated, I think it opens up new questions and perhaps new patient populations where we may be able to sharpen our study design to say that the higher vulnerable patients may be the ones that we need to really focus our attention on when it comes to looking at the precipitating factors or the potentially modifiable factors that we can control

So I think I was surprised but then when you delve in deeper into the study you realize it has helped us answer one important question but then brought up these news questions in these new patient populations that we perhaps should now focus on to take it to the next level.

Dr. BobbieJean Sweitzer: I think you just coined the name of Dr. Brown's next study: The SHARPEN Study.

Dr. Pratik Pandharipande: I think he just has to figure out a way to add the E and N and what that stands for.

Dr. Charles H. Brown IV: I like the study acronym name and I will give you credit for that, Dr. Pandharipande.

Dr. BobbieJean Sweitzer: And on your drive home you can figure out what that E and that N are going to stand for. So, Dr. Brown, as I recall, the BIS values in the spinal group were actually fairly low. I know you had originally said in this interview that you were targeting them to be, I think, about 70 to 80? But I thought they were a bit lower than that. Can you discuss that and do you think this had any impact on the findings?

Dr. Charles H. Brown IV: Yes, we targeted the BIS values to be above 60 to 70 and on average the BIS separation was significant; it was 45 on average in the general anesthesia group and 62 in the spinal anesthesia group.

Ideally we would have achieved a larger separation and certainly that could be one explanation for the findings and certain it could be a limitation. I will say that beyond average BIS we also looked at the extremes of the BIS values and there are certainly differences there.

So, when we looked at BIS less than 40 there was substantially more minutes of BIS less than 40; it was 68 versus 3 in the general for spinal anesthesia group and the other end for BIS greater than 55 there was more minutes of that in the spinal anesthesia versus general anesthesia group. But I think average BIS is one way to look at it. We also looked at number of minutes of BIS at these extremes.

Ideally we would use purely spinal anesthesia with no sedation; however, in the context of the study design and the surgical population and the surgeons and the anesthesiologists, this was not feasible or pragmatic. We did not pilot this kind of study with patients but I would also imagine that that kind of study may be a barrier to recruitment for patients, older adults to be awake and have no anesthetic medication on board.

So, in designing these studies there's always a balance of the scientific question, the control that you can put in as the investigator, and the pragmatism of conducting the study.

Dr. BobbieJean Sweitzer: Did you find any other differences and outcomes between the two groups?

Dr. Charles H. Brown IV: So in terms of anesthetic management, we saw several. So patients who had general anesthesia had increased

administration of opioid while patients in the spinal anesthesia group had slightly more intravenous fluid administered and these are really anesthetic intraoperative variables.

In terms of patient outcomes, there was slightly less pain at PACU discharge in the spinal anesthesia group but no differences in pain scores on postoperative day one and no changes or differences in length of stay between the two groups either.

Dr. BobbieJean Sweitzer: And Dr. Pandharipande, I believe some patients in both groups received intrathecal morphine and other intravenous opioids and I think about a third in each group received midazolam. What do we know about the impact of these medications on delirium?

Dr. Pratik Pandharipande: Certainly, the data on benzodiazepines is almost uniform with regards to their association with delirium in vulnerable populations and it's not really one benzodiazepine over the other as we have data on lorazepam, midazolam, diazepam, all associated with delirium in vulnerable populations. So that part seems to be relatively clear.

With regards to opiates, it's not as clear cut. There have been studies which have shown that pain itself is a risk factor for delirium but then we also know that overzealous use of opiates is also deliriogenic. So getting that right balance of controlling pain but at the same time not giving too many opioids is important.

And so thinking of multimodal techniques and thus limiting dependency on opiates through use of regional anesthetic techniques, et cetera, may be the right approach, but these medications do have their own impact on delirium that has to be taken into account.

Dr. BobbieJean Sweitzer: So, Dr. Brown, did you find any apparent effects of the different medications or were you able to look at that in subanalysis such as the intrathecal morphine or the midazolam?

Dr. Charles H. Brown IV: Midazolam will be easier to discuss. There were no differences in delirium incidence according to whether or not patients receive midazolam and there were a reasonable number of patients in the study—approximately a third—who did receive midazolam although the doses were low, so a median of 2 mg.

And I think it speaks to what Dr. Pandharipande was pointing out that the difference in cumulative exposure in the OR and the ICU since a small amount of midazolam was administered in the study, which is very, very different than the cumulative doses that have been considered in some ICU studies. So, in our study we did not find any association of midazolam at low doses with postoperative delirium.

For intrathecal morphine, this was a medication that we allowed in the study protocol and I think in retrospect the results would have been cleaner and easier to interpret if the administration of intrathecal morphine was standardized.

What we found is that in unadjusted analyses, not considering the effect of the intervention, intrathecal morphine in unadjusted analyses was not a risk factor for postoperative delirium; however in an adjusted analysis it was a risk factor for postoperative delirium.

And I make this point because I think it's always important to consider both sets of analyses in case various modeling strategies can allow one particular factor to be overfit to the model and not truly show this association. This is an important point because in other studies the exact opposite has been shown. So I think it's exploratory needs to be look at in other studies.

As far as the modifying effect of intrathecal morphine, what we found is that for patients who did not receive intrathecal morphine there was a beneficial effect of spinal anesthesia compared to general anesthesia for reduction of delirium while for patients who did receive intrathecal morphine the benefit was greater in the general anesthesia group.

And so this was not a prespecified subgroup analysis; we looked at it as a post hoc analysis. And so, again, I think the limitations need to be clear that this is, again, exploratory, it was one of several subgroup analyses, and the results need to be considered in that context.

Dr. BobbieJean Sweitzer: So, I know you spoke to this to some degree about the challenges of getting patients to agree, perhaps, to surgery without sedation. But I know that there's always a specter of like is it the stress of surgery, is it the hospital's impact on delirium development? What role does actually anesthesia or a particular drug play?

And I think increasingly perhaps is the message gets out there about the harm of various compounds be those opioids or can – in patients who do come in and have certain procedures done with minimal or no sedation, they go to dialysis, for example, they come in and have long MRIs and don't get drugs, do you think we can't actually – if we explain to patients the potential harm or the need to figure out what's harmful, we can't convince somebody to just have a spinal or a local with no sedation?

Dr. Charles H. Brown IV: I think that's a good question and ideally that would be a study design that would be very interesting. The issue will be finding a population that has a sufficient number of procedures with a sufficiently high incidence of an outcome that is interesting to look at and patients would be amenable to that.

So I think there are potential avenues for that and I have been contacted by surgical and anesthesia colleagues in whose practice they have done lumbar fusions or laminectomies with neuraxial techniques without sedation and so it can be done and we're considering options, but it's harder.

Dr. BobbieJean Sweitzer: Well, you've got some start on the SHARPEN trial.

Dr. Charles H. Brown IV: That's right.

Dr. BobbieJean Sweitzer: Dr. Pandharipande, have other studies shown that the use of BIS can impact delirium in the perioperative setting we're talking about, not in ICU, or even I guess in the ICU does the BIS help impact that outcome? And if so, do we know what BIS target is important?

Dr. Pratik Pandharipande: I don't think we have a consistent message over here. I mean, there have been studies that have looked at this and really not found that targeting a particular number is consistent in reducing delirium and that has played out even in the ICU studies where it's not clear as to what BIS value should be utilized as a good surrogate for sedation depth.

What we do know is that deep sedation with regards to BIS in the BIS burst suppressed levels is associated with outcome including delirium. And so really that's what is clear is that you don't want people to be burst suppressed because that is not associated with the good outcomes. Beyond that it's really not clear where that threshold is that we should be targeting.

And so I think a question that still remains is whether BIS is truly a good surrogate for sedation depth targeting beyond amnesia which it was initially utilized for and it's still being used for but I think we're trying to extrapolate it for a depth of sedation marker and perhaps it's just not the right depth of sedation marker to be utilized.

Dr. BobbieJean Sweitzer: So, Dr. Brown, if a patient is anticipating surgery and anesthesia and they ask you personally what you think can be done to lower their risk of delirium, what would you advise them?

Dr. Charles H. Brown IV: A couple things would come to mind for a patient undergoing surgery in terms of delirium. I think that the baseline risk matters a lot and so by baseline risk, age and in particular cognition are very important as well as comorbidities, functional status, some other markers. But baseline risk matters.

I think the type of surgery and the recovery matters and so I think there are differences depending on if patients are undergoing cardiac surgery, highly invasive with a long recovery versus other shorter recovery surgeries.

And then I do think that avoiding complications matters. So avoiding extended stays in the ICU, multiorgan dysfunction, all of things are very important.

When deciding that what are the things that can be done and are modifiable, I'd have a couple answers. I'd say in the preoperative period

try and optimize things that can be optimized. So, fitness, strength, sleep regiments, optimizing medication usage. Most patients will do reasonably well and some of the recommendations that I will talk about are active areas of study that we're not quite sure if they're efficacious or not. But from my read of the literature and what can be done, these are things that I would consider.

In the intraoperative period, judicious use of medications. Dr. Pandharipande talked about the balance of pain and opioids and it's important to consider both of those as potential deliriogenic factors, avoiding excessive benzodiazepines, and then regional approaches as able.

And in the postoperative period I'd say we have the largest literature both in the ICU and then in more ward-based populations both medical and postoperative all in the importance of nonpharmacologic approaches to prevent delirium and things that are really capsulated in the HELP Program from Dr. Sharon Inouye. And principles of this are make sure that patients are mobile after surgery, judicious use of medications, have family members present, encourage communication, give patients back their hearing aids and eye glasses.

There are a number of these nonpharmacologic approaches that in individual items may have a small contribution but as bundle have been shown to be highly effective and I think it goes back to the notion that in care of older adults and reducing delirium these small steps add up in the total care of the patient.

Dr. BobbieJean Sweitzer: I hope today's discussion will interest many of our listeners and lead you to read these important articles to learn more. Thank you, Drs. Brown and Pandharipande, for discussing your work with us today. I wish you well as you continue your efforts to enhance the practice of anesthesiology and strive to improve the care of our patients.

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.