

**Anesthetic Management of Patients Undergoing Spine Surgery**

**2016**

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Dr. Alan Jay Schwartz: Hello. This is Alan Jay Schwartz, Editor-in-Chief of the American Society of Anesthesiologists' 2016 *Refresher Courses in Anesthesiology*, the latest research and education information. The focus of the new online format of the *Refresher Courses in Anesthesiology*'s CME program, and the modules featured, is to educate learners on current developments in the science and clinical practice of the specialty of anesthesiology, critical care medicine and pain management. For the first time ever, we will be speaking directly with individual authors to learn about their expertise, perspective and insight regarding their featured module.

Today, we are pleased to present the following one-on-one conversation with fellow *Refresher Courses in Anesthesiology* Editor, Dr. Amanda Burden, and author Dr. Susan Black. They will be highlighting the module titled, "Anesthetic Management of Patients Undergoing Spine Surgery."

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Dr. Amanda Burden: Hi. I'm Amanda Burden, Associate Professor of Anesthesiology at Cooper Medical School of Rowan University, and I'm one of the Associate Editors of the American Society of Anesthesiologists' anesthesia refresher course lecture publication, which highlights and publishes select lectures from the Annual Meeting.

With us today is Dr. Susan Black, Professor, Department of Anesthesiology, University of Alabama School of Medicine. Dr. Black is here today to discuss her *Refresher Course* lecture titled, “Perioperative Management of Patients Undergoing Spine Surgery.”

In her lecture, Dr. Black helps us understand issues involving the anesthetic management of patients undergoing spine surgery. Her work discusses the preoperative, intraoperative and postoperative course for patients who undergo spine surgeries. She provides guidance about airway management, which is of particular concern, obviously, to all of us as anesthesiologists; and in patients who have cervical spine pathology. Her discussion of the intraoperative course for spine patients includes an overview of hemodynamic and neurologic monitoring, as well as transfusion management. When discussing postoperative concerns, Dr. Black includes a very helpful discussion of a variety of approaches to pain control. She also presents the current understanding of the very rare and very tragic complication of postoperative visual loss.

Dr. Black, welcome, and thank you for shedding light on this important and timely subject. We hope that you will highlight some of the critical educational points in this module for us.

Dr. Susan Black: Well, thank you very much for having me. As anesthesiologists, I think that we all have, as – one of our first concerns as we approach each patient is assessment of their airway management. And that concern is appropriately even greater in those patients who have cervical spine disease. One of the things that we know about patients with cervical spine disease is that not only are they at an increased risk for us encountering difficulty in securing their airway; there may be some risk to them that occurs as a consequence of our managing the airway. And I’ll tell you a little bit about what I mean about that.

When you look at patients who have cervical spine disease compared to a cohort of patients without cervical spine disease, those patients are somewhat more likely to present difficulty to us in visualizing the glottic opening when we go to secure their airway. So, they may be a little bit more difficult at the onset. The type of pathology influences that. The higher the disease, the greater the risk that the airway may be difficult. And any patient who's had any kind of stabilization procedures, either permanent internal fixation, or external fixation such as halos, will significantly increase the chance that we're going to encounter difficulty. And so, you have a group of patients that may be more difficult to intubate.

When you look at those patients, however, the best predictors of whether or not you're going to have difficulty securing the airway is our conventional airway assessment. So, it's one of those extra pieces of information you put in the back of your mind as you approach the patient. If their airway exam looks like it's going to be a straightforward airway to secure, then the fact that they have cervical spine disease is probably not going to change your management very much.

But if it's a patient in whom you have a little bit of concern that you may have some difficulty in securing their airway, you want to be a little bit quicker to pull in one of those ancillary devices, as opposed to that same patient, that same exam, when they don't have cervical spine disease combined with it.

On the other side of that equation is, do we pose a risk to the patient who has cervical spine pathology when we go to secure the airway? And I think that's one of the things that can cause the greatest degree of concern for anesthesiologists as we prepare to manage these patients; in particular, those patients who have either known or suspected cervical spine instability.

Now, of course, the most common reason our patient's cervical spine's going to be unstable, or potentially unstable, are patients who've been victims of trauma; but they're also patients who have degenerative disease, such as rheumatoid arthritis, that may result in instability.

There has been a large amount of work over the last 20 to 25 years, and probably before that as well, looking at techniques of securing the airway to try to understand the impact of using those different techniques on the chance that we're going to injure a patient; or, the other way to look at it: what do those techniques do to improve the safety of securing the airway in those patients? People have looked at things from stabilization strategies, manual in-line stabilization, hard cervical collars; and then they've also looked at all the different airway devices: blind intubation guides; fiber-optic; indirect scopes; direct scopes; intubating LMAs.

And when you pull all that data together, there are several things that are fairly consistent across those studies. Some are done in cadaver models. Some are done in normal patients, looking at cervical spine motion. And then we have large clinical series looking at the impact of managing the airway on patients who actually have cervical spine instability.

And when you take all that information together, we know when it comes to looking at techniques to stabilize the spine – so, when you're managing the airway in a patient who may have an unstable cervical spine, you want to secure the airway efficiently and you want to minimize the motion of the spine, because that motion is the thing that may be damaging to the patient's spinal cord.

We know that the stabilization technique of manual in-line stabilization is very effective consistently at, at least, limiting the motion that occurs with most intubation techniques in the presence of an unstable cervical spine. We also

know that use of manual in-line stabilization increases the difficulty in securing the airway a little bit. We don't get quite as good of a view of the glottis opening with manual in-line stabilization as we do without. Nonetheless, it remains the most common and accepted practice for limiting motion of the spine as you try to secure the airway.

Hard cervical collars, on the other hand, do a great job at protecting the patient outside of the circumstance of securing the airway, but don't limit motion of the spine when we go to secure the airway, and in fact just increase the difficulty that we're going to encounter in intubating those patients. So, as you approach that patient that comes to the operating room with a hard cervical collar on, the data clearly supports that it's safe and appropriate to remove at least the front of that collar, stabilize the neck with manual in-line stabilization, proceed to secure the airway, and then you can put the collar back on if it's appropriate.

When you look at intubation tools, pretty much all of them compare back to conventional direct laryngoscopy. And all of those tools—blind intubation guides; intubating LMA; fiber-optic scopes; indirect scopes—all have been shown to effectively secure the airway with less motion compared to conventional direct laryngoscopy. So, all of those techniques can be used to limit motion of the cervical spine in a patient who has known or potential cervical spine instability, and they're effective at securing the airway – limiting the motion, and securing the airway in a time-efficient and appropriate manner.

There – other information that is quite clear, is that there is no best technique. All the techniques, from manual in-line stabilization with conventional direct laryngoscopy, through indirect scopes, blind intubation guides, LMA, fiber-optic scopes, have all been used safely.

And I think what is to me the most important take-home message in approaching the patient who has potential cervical spine instability, is to

recognize the potential for instability; assess the patient and the clinical situation that you're facing; and assess your own experience with different techniques; and choose a technique that is best in your hands for that particular clinical scenario. Just because your partner is great with a fiber-optic scope, doesn't mean that's the right approach for you at that time. The best approach for the patient is what's appropriate based on your experience and your clinical evaluation of the patient, rather than a single best technique that everybody needs to follow. Because there is no best technique, and the evidence is very clear that there is no single best technique for airway management.

I think one of the other areas that is important to think about in managing these patients, has to do with transfusion management. Now, not every spine procedure is going to be associated with a large blood loss and the potential to need to transfuse the patient. And so, I think one of the first things that the anesthesiologist managing these patients needs to think about is to try to predict, based on the patient, their pathology, the procedure, and that surgeon's own history with that procedure, to try to identify those patients that may require transfusion intraoperatively, and then think about the strategies that can be utilized to minimize their requirement for banked blood.

In general, cervical spine procedures are not as bloody as the thoracic and lumbar spine procedures, and a simple to follow is that the more bone work that's going to occur, the more bleeding you're likely to have. So, it's influenced by how much work is going to be done at each level. Decompression is going to be bloodier than a discectomy. And it depends upon the number of levels that are going to be done.

And then again, it depends upon the surgeon's experience. And you'll see, when you're talking about decompressive procedures, that the predictive blood loss in the surgical literature will be anywhere between 100 mls a level and 500 mls a level, really showing a difference in the different surgical approaches and

experience. So, you have to have a little institutional knowledge of the history as well as understanding the planned procedure for this patient.

A lot of strategies have been used. One thing that I think is still practiced to some extent is the use of mild degrees of hypotension during multiple-level thoracic and lumbar spine procedures. And when you look at the data on that, it is equivocal as to whether or not mild degrees of induced hypotension cause a decrease in estimated blood loss. Some studies show that it's effective, and others show that it is not. But there is very consistent data that the use of induced hypotension does really nothing to change the risk that the patient will require a transfusion intraoperatively. So, using induced hypotension to decrease the potential for transfusion is probably not indicated.

That doesn't mean that mild degrees of induced hypotension have no potential advantages. There are a number of surgeons who feel like they have better exposure or better operating conditions with mild hypotension compared to normotension. And so, perhaps, if it facilitates the surgeon's visualization of the field and facilitates the process of the operation, if there's no risk to mild degrees of hypotension in that patient, perhaps it can be considered. But it isn't something that you can count on to limit your transfusion requirement, because the data is consistent that it's not going to do that effectively.

There are a number of techniques that have been shown to be effective in limiting blood loss in transfusion. The one with the most consistent evidence supporting its use is the use of the antifibrinolytic agents, Amicar and tranexamic acid. And those have been used pretty extensively in multi-level thoracic and lumbar procedures, and have been consistently shown to decrease blood loss, and most of the time to decrease transfusion requirements. And importantly, there's been no increased risk for thromboembolic complications in those patients who received antifibrinolytics. Intraoperative cell salvage, preoperative autologous donation, have also been utilized, and in some studies

have been shown to be effective in decreasing transfusion requirements; and other studies have not demonstrated efficacy.

As you think about the cost-effectiveness of using one of these modalities to limit the requirement for transfusion in patients undergoing spine procedures, you can kind of break down the patients into maybe three groups. Those in which the usual case has a blood loss that's less than 10% of the patient's estimated blood volume—none of these techniques is going to be cost-effective, or is not likely to be cost-effective. In those patients that you think they might lose up to 30% of their blood volume, choosing one technique will be beneficial.

But studies that have studied using a combination of techniques, such as intraoperative cell salvage as well as preoperative autologous donation—the combination of any two techniques is not advantageous compared to a single technique alone. And really, only those cases where you anticipate a large blood loss, greater than a third of the blood volume, would it be beneficial to utilize multiple techniques.

And so, I think that one of the things that's most important is to look at your patient population, your surgeon's history, the planned procedure, and target that group of patients that you expect may lose between 10 and 30% of their blood volume, and pick the management strategy—preoperative donation; intraoperative salvage; use of antifibrinolytics—that's most cost-effective in your patient population and within your practice.

And finally, I think a problem that is very common across patients undergoing spine procedures are issues with perioperative pain management. Many of these patients will come to us, having been on narcotics preoperatively to manage the pain associated with their spine disease. Some of them will have been on the narcotics relatively short-term, but many of them will be on long-term, chronic narcotic medication. And that, just like in any patient population,

is going to complicate our ability to provide optimal perioperative pain management for those patients. It is a procedure associated with a lot of bone work and a lot of muscle work and so, of course, it can be quite uncomfortable, added to the fact that the patient may have some opioid tolerance already.

Central neuraxial blockade is one mechanism that may be quite effective. Even single-shot techniques – a single dose of intrathecal narcotics has been shown to be very effective in short-term pain management.

There's been a good bit of interest in the last several years in using multimodal medication management strategies in patients undergoing spine surgeries, just as there have been with a number of other operative procedures. Those multimodal management strategies generally include some sort of combination of controlled-release narcotics, perioperative ketamine, preoperative pregabalin or gabapentin, scheduled acetaminophen or scheduled nonsteroidal anti-inflammatory agents, and most of those regimens will include two or three of those various different medications. All of those have been shown to be better than single agents in managing perioperative pain in this group of patients.

In comparing different regimens, there was really no difference in different combinations, as long as it was multimodal. The big difference came with, initiating that prior to the start of surgery, with some sort of preemptive analgesia, seems to greatly improve the ability to provide optimal pain management in the postoperative period while the patient's an inpatient, and there is at least one study that showed better patient perception of outcome in the early weeks after surgery, when preemptive analgesia was used as part of a multimodal regimen. So, that's something, I think, that's really important, not only in terms of in-hospital management and outcome, but improving long-term function for these patients and improving patient satisfaction in these patients as they come for these procedures. And I think that that's something that can be very beneficial to our patients, to consider that as we go forward.

One thing to think about: there is a little bit of evidence in the surgical literature that the use of the nonsteroidal anti-inflammatory agents may impair fusion success rate. So, it's just something to think about in those patients who undergo fusions, to help you determine what components of a multimodal regimen you want to utilize.

The last thing that I think – it's sort of an overarching comment that patients coming for spine procedures are a very diverse group. The 35-year-old with a herniated disk; the patient with rheumatoid arthritis; the elderly patient with longstanding degenerative disease, having multi-level decompression—they're very, very different patients, even though they're all undergoing spine procedures. And I think that the most important thing is to really think about, what are the unique intraoperative events they're going to face; what the unique perioperative complications that may come their way; and think about strategies that we can use as anesthesiologists to optimize the perioperative period for each of these procedures.

And there's going to be a very different strategy, depending upon the procedure and the patient. But I do think it's a group of patients in whom, if we pay attention to those details, that we have the opportunity to really optimize not only their outcome but optimize their overall satisfaction with the procedure and their time within our care.

Dr. Amanda Burden: Dr. Black, thank you so much for taking the time to discuss the challenges and the opportunities in spine surgery. As you've expressed, spine surgery really presents unique management challenges for anesthesiologists, and we really appreciate you taking the time to work with us, and discuss your work, and help us better understand how to approach these patients, both their spine disease and their other comorbidities, as well as critical aspects of the planned procedure. And now, Dr. Schwartz, back to you.

Dr. Alan Jay Schwartz: Thank you for joining us today, and participating in this insightful conversation with this month's featured author. Be sure to join us for next month's one-on-one author interview, presented in this new, exciting format.

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