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Editor's Spotlight/Take 5: What are the Risk Factors for Cerebrovascular Accidents After Elective Orthopaedic Surgery?

Seth S. Leopold MD

A visiting professor once asked an audience of residents why patients come to the doctor's office.

"To get a diagnosis?" one answered. The professor shook his head.

Note from the Editor-In-Chief: In "Editor's Spotlight," one of our editors provides brief commentary on a paper we believe is especially important and worthy of general interest. Following the explanation of our choice, we present "Take Five," in which the editor goes behind the discovery with a one-on-one interview with an author of the article featured in "Editor's Spotlight."

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"To learn about treatment options?" offered another. Thumbs down again. More guesses, more noes.

"Patients come to physicians' offices because we can see the future," pronounced the visiting instructor.

That physician—whose opinions and contributions I continue to respect, though he has since retired—was a tumor surgeon. This fact no doubt colored his perspective; certainly patients with cancer are appropriately concerned about prognostic information. And certainly he offered his punch line at least in part for effect. Many factors cause patients to seek care, and all of the residents' suggestions were reasonable.

Although at the time I found his answer thought-provoking, I now am struck by how ineffective we actually are at seeing the future on behalf of our patients. While we can predict with some accuracy whether a patient undergoing elective orthopaedic surgery will experi-

ence a cardiac complication [5, 8], we have few other good tools of this sort. Yet so many complications and failures can occur after major surgery: Infection, nerve injury, cerebrovascular accident (CVA), pulmonary embolism, and simple (but important) dissatisfaction, to name a few. Groups continue to develop predictive models [4, 10], and risk calculators like those by Lee et al. [6, 7, 11] and the National Surgical Quality Improvement Program (NSQIP) [1, 2] are publicly available, but these calculators generally have not been validated by others, and where they have been, their performance has been imperfect [3].

If we were to create a ratio with fear plus harm in the numerator and our ability to predict it in the denominator, I imagine that few complications would score higher than CVA. Post-operative strokes can be devastating or fatal, yet we are so ineffective at predicting them. In fact, CVA does not even appear on the NSQIP's Surgical Risk Calculator [1, 2]. For this reason, we are fortunate to have the analysis in this month's *Clinical Orthopaedics and Related Research*® by Alpesh A. Patel's team at the Feinberg School of Medicine at Northwestern University.

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Dr. Patel's group evaluated the experiences of more than 42,000 patients recorded in the NSQIP database who underwent common orthopaedic procedures, including lower-extremity arthroplasty, various kinds of spine surgery, and total shoulder replacement. They found that surgical times longer than 3 hours, insulin-dependent diabetes, and a history of transient ischemic attack were the strongest predictors of stroke after surgery, all demonstrating odds ratios of > 2.75 . Other risk factors included hypertension, dyspnea, 75-years-of-age or older, and chronic obstructive pulmonary disease.

The bad news, of course, is that most of these factors are not modifiable in advance of elective surgery. The good news is that work like this can be used to develop and validate predictive tools that let our patients see the future, and perhaps to decide—based on what they see—whether indeed elective surgery is a good decision.

Join Dr. Patel in the Take 5 interview that follows for more about his team's fascinating discoveries, and for a deeper dive about how to put them to use in practice.

Take Five Interview with Alpesh A. Patel MD, senior author of “What are the Risk Factors for Cerebrovascular Accidents After Elective Orthopaedic Surgery?”

Seth S. Leopold MD: *Congratulations on this exciting and important work. Although CVA after elective orthopaedic surgery occurs rarely—13 per 10,000 patients in your study—it often is disabling to patients, and you found some important factors that are associated with increased risk. How have you put your findings into practice?*

Alpesh A. Patel MD: This work was, in part, inspired by the experience of one of my patients, who experienced a CVA after an otherwise successful elective posterior lumbar procedure for degenerative spondylolisthesis. This was a devastating event for my patient, his family, and for our spine team; however, given his age (80-years-old) and history of multiple transient ischemic events, it's one that should not have surprised us.

We now can use information, including the findings of this study, to identify high-risk patients prior to surgical intervention. In my practice, this includes a protocol-driven evaluation of all high-risk patients by a perioperative team of hospitalists and anesthesiologists prior to surgical treatment. Patients deemed to be very-high-risk are then reviewed collectively by the surgeon, anesthesia, and hospitalist team members. Specifically for CVA, patients with risk factors identified in this article are assessed for carotid atherosclerotic disease. Additionally, those with cardiac

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arrhythmias or atrial fibrillation are assessed for preexisting cardiac thrombi by echocardiography. Patients with correctable risk factors may have surgery delayed while others may move ahead, albeit with a clearer understanding of surgical risks.

Dr. Leopold: *The language physicians use to describe risk to patients can substantially influence patients' decisions. For example, telling a patient with diabetes that his risk for stroke after elective spine surgery is far less than 1%, and telling him that his risk may be three or four times more severe than the typical patient undergoing the surgery both may be correct based on your data. Yet the former seems reassuring, and the latter sounds*

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intimidating. How do you handle this when you discuss risk with your patients?

Dr. Patel: It is all about perspective. Rather than biasing my patients towards one interpretation or the other, I present both sides. I want them to understand what their absolute risk is, but also to understand how other aspects of their health can impact their relative risk of surgical complications. This brings their understanding of risks to a level at which true informed consent can be obtained, and also improves the patient-physician relationship. I think it also prepares a patient and his or her family for what could happen after surgery. Complications that are anticipated have a different effect on patients and families than complications that were unexpected or not disclosed ahead of time.

Dr. Leopold: *One risk factor believed to be important for CVA after orthopaedic surgery—cardiac arrhythmia [9]—was not available for analysis in your NSQIP dataset. How important a gap is this, and how might it be incorporated into any predictive models or tools that may be developed going forward?*

Dr. Patel: This is actually a critical limitation of our study. All studies of large administrative or quality databases are only as good as the information contained within those

datasets. I believe that if cardiac arrhythmias including atrial fibrillation could have been included, they would have been identified as a risk for CVA. In my practice, the presence of these diseases is considered a risk for peri-operative CVA and is managed as such with a presurgical cardiac evaluation.

However, creating a risk calculator for CVA is challenging, predominantly because of the small number of events that occur even in a large database such as NSQIP. While risk factors can be identified statistically across a large number of procedures, our knowledge loses granularity as it gets down to the level of the individual patient or procedure.

Dr. Leopold: *Apart from stroke, what other postoperative complications have received inadequate attention and what might be done to remedy that?*

Dr. Patel: There are a number of complications that have not been appropriately addressed. Some, such as dysphagia and dysphonia after anterior cervical procedures, while commonly reported, have been poorly defined and evaluated with nonvalidated scoring systems. This makes it difficult to assess our ability to minimize or prevent these complications. Our group is actively working to define dysphagia and dysphonia using validated patient-reported systems and then to investigate interventions to decrease or

eliminate these complications. Other complications in orthopaedic surgery, like CVA, that are rare, poorly understood, and devastating include vision loss, neurological injury, and vascular injury. These will require large, prospective collections of data to better define risk factors. It is a tall order but one that we have a responsibility to achieve.

Dr. Leopold: *What can we look forward to seeing from your group in the future? What are the next few big projects in the queue?*

Dr. Patel: I mentioned our group's work on the prospective assessment of patient-reported dysphagia and dysphonia after anterior cervical surgery. We have a number of projects using "big data" like the NSQIP dataset to better define a number of parameters in orthopaedic surgery. We look forward to presenting additional risk factors for surgical complications, as well as better defining the impact of these complications on patients and on the economics of surgical care. Perhaps the part of our program that I am the most excited about is our work with prospective patient-reported outcome measures, specifically the NIH-funded Patient Reported Outcomes Measurement Information System (PROMIS) in orthopaedic surgery. We currently are submitting our work in the validation of PROMIS outcome measures in adult spine surgery and comparing its

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historical/legacy outcome measures. If we, as well as others, can define the reliability, validity, and clinical applicability of PROMIS measures in orthopaedic patients, I believe that this could be a game-changer in our assessment of patient outcomes after orthopaedic surgical procedures. It could make real-time data acquisition feasible across all clinical practices while also obtaining better and more meaningful information about our procedures and our patients.

References

1. American College of Surgeons National Surgical Quality Improvement Program. Surgical risk calculator. Available at: www.riskcalculator.facs.org. Accessed December 3, 2015.
2. Bilimoria KY, Liu Y, Paruch JL, Zhou L, Kmieciak TE, Ko CY, Cohen ME. Development and evaluation of the universal ACS NSQIP surgical risk calculator: A decision aid and informed consent tool for patients and surgeons. *J Am Coll Surg*. 2013; 217:833–842.
3. Cologne KG, Keller DS, Liwanag L, Devaraj B, Senagore AJ. Use of the American College of Surgeons NSQIP surgical risk calculator for laparoscopic colectomy: How good is it and how can we improve it? *J Am Coll Surg*. 2015;220:281–286.
4. Courtney PM, Melnic CM, Gutsche J, Hume EL, Lee GC. Which patients need critical care intervention after total joint arthroplasty? A prospective study of factors associated with the need for intensive care following surgery. *Bone Joint J*. 2015;97-B:1512–1518.
5. Ford MK, Beattie WS, Wijeyesundera DN. Systematic review: prediction of perioperative cardiac complications and mortality by the revised cardiac risk index. *Ann Intern Med*. 2010; 152:26.
6. Lee MJ, Cizik AM, Hamilton D, Chapman JR. Predicting medical complications after spine surgery: A validated model using a prospective surgical registry. *Spine J*. 2014;14: 291–299.
7. Lee MJ, Cizik AM, Hamilton D, Chapman JR. Predicting surgical site infection after spine surgery: A validated model using a prospective surgical registry. *Spine J*. 2014;14:2112–2117.
8. Lee TH, Marcantonio ER, Mangione CM, Thomas EJ, Polanczyk CA, Cook EF, Sugarbaker DJ, Donaldson MC, Poss R, Ho KK, Ludwig LE, Pedan A, Goldman L. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation*. 1999;100:1043.
9. Mortazavi SM, Kakli H, Bican O, Moussouttas M, Parvizi J, Rothman RH. Perioperative stroke after total joint arthroplasty: Prevalence, predictors, and outcome. *J Bone Joint Surg Am*. 2010;92:2095–2101.
10. Ogura K, Yasunaga H, Horiguchi H, Fushimi K, Tanaka S, Kawano H. Nomogram predicting severe adverse events after musculoskeletal tumor surgery: Analysis of a national administrative database. *Ann Surg Oncol*. 2014;21:3564–3571.
11. SpineSage. About spinesage. Available at: www.spinesage.com. Accessed December 3, 2015.