are also then part of the subset that have most of the problems postoperatively. I think it will be 2-fold: looking at true incidence, and helping elaborate on modifiable or identify new risk factors.

Regarding anesthesia, that is really going to be an interesting area. TAVR has now moved into the second generation where now the majority of transfemoral procedures are going to be done percutaneously. There is also a movement afoot by our anesthesia colleagues in a

multicenter trial that we're participating in where sedation is going to be individualized to a given patient looking at monitoring brain function during the anesthetic procedure in an attempt to not overanesthetize some of our patients.

We are going to see better testing, better imaging, and I think more fine-tuning of our anesthesia, and it will be interesting to see the differences that play out here.

Dr Svensson. Thank you.

EDITORIAL COMMENTARY

Delirium after aortic replacement: A transvalvular approach is no panacea

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Postoperative delirium (PD) is an increasingly recognized complication of all surgical procedures, both minimally invasive and other. Surgery for aortic valve replacement is no exception, and Maniar and colleagues¹ provide the largest study to date of PD after transcatheter aortic valve replacement (TAVR). Despite the relatively less invasive nature of TAVR, compared with open surgical aortic valve replacement (SAVR), the overall incidence of PD in this retrospective study was essentially the same (30% for SAVR vs 29% for TAVR; $P = .40$). On the surface, this result may seem disappointing, ie, that a relatively "less invasive" procedure would not lower the incidence of this serious complication. However, the TAVR approaches varied considerably (including transfemoral, transapical, and transaortic), and in a subset analysis of the transfemoral approach, which is arguably the least invasive, the PD incidence was, in fact, lower than that with SAVR (18% vs 33%, respectively; $P = .025$).

However, the lack of difference in the primary comparison, even ignoring this subset analysis, may be due to the multifactorial nature of delirium. The etiology

and pathophysiology of PD is incredibly complex; it may depend as much on nonsurgical factors as on actual surgical trauma and its associated inflammatory response, which is commonly included in discussions of delirium pathophysiology. Similarly, this complexity may partially explain the lack of PD difference in the 2 groups. Inflammation from TAVR is thought to be lower, compared with SAVR,² but it is only one possible target for addressing delirium. Further, the importance of inflammation as an etiologic factor in PD has been questioned recently, given the failure of high-dose steroids to mitigate its occurrence.³

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Central Message

Delirium remains an important neurologic sequela of aortic valve replacement, despite use of a more minimally invasive transvalvular approach.

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Several questions remain as to what we should do with this information. Should it inform preoperative decisions as to how to proceed? When a patient develops PD after a TAVR, how will it affect their subsequent care? Essentially, no meaningful therapy is available for delirium. Most of the pharmacologic approaches (ie, antipsychotics) that have been used for in-hospital delirium, although they modestly decrease the overall severity of PD, do not have a meaningful impact on its overall incidence. In addition, evidence is unclear as to whether any of them affect long-term, patient-centered outcomes,⁴ such as 30-day disability-free survival.

Nevertheless, a clear finding is that the occurrence of PD does identify the patient as being at subsequent high risk for increased 1-year mortality; in the present study, as much as 3 times higher. Further, if a preoperative means were available to assess the PD risk in TAVR patients, this assessment could inform the decision regarding use of surgery, or even whether to do aortic valve replacement. At the very least, it would allow a more informed discussion with the patient and their family prior to the procedure.

Just as the full impact of inflammation on PD is unclear, considerable uncertainty remains as to other possible inciting factors. One of them is the influence of the anesthetic technique. Although the vast majority of TAVR procedures are still performed under general anesthesia, local anesthesia with sedation is being increasingly used. This increase may present an ideal opportunity to examine the influence of anesthetic techniques on PD in TAVR. Again, however, the existence of a single “magic bullet” that can reduce the incidence of PD is unlikely. If general anesthesia has an effect, I would argue that it would be relatively small. Results from a randomized controlled trial using sedation versus general anesthesia for TAVR are important to acquire; it should address both the impact of sedation level and drug types.

The study by Maniar and colleagues¹ has important limitations. Despite the propensity matching for SAVR and TAVR, the databases used likely did not capture

important factors for delirium. Frailty, for example, is a consistently implicated factor in PD,⁵ as is the presence of preoperative cognitive impairment,⁶ which may, in fact, have been deciding factors in choosing TAVR rather than SAVR. In other words, if the TAVR patients were frailer and more cognitively impaired, this might account for the lack of difference in PD between the groups.

Another limitation is that only PD that occurred in the intensive care unit was considered. The overall in-hospital incidence of delirium in SAVR and transfemoral TAVR may have been the same, although this possibility seems unlikely. This issue is important to consider in future studies.

The nearly certain continued expansion of TAVR (and other catheter-based valve procedures) is unlikely to eliminate the troublesome complication of PD. If we continue to use TAVR in a population of increasingly aged and frail patients, we need to adapt strategies to mitigate the occurrence of PD. Maniar and colleagues¹ provide a meaningful piece to the ever-expanding puzzle of PD. Their data point to the need for further investigation of the influence of surgical procedure type on occurrence of PD; we eagerly await continued investigation.

References

1. Maniar HS, Lindman BR, Escallier K, Avidan MS, Novak E, Melby SJ, et al. Delirium after surgical and transcatheter aortic valve replacement is associated with increased mortality. *J Thorac Cardiovasc Surg.* 2016;151:815-23.
2. Adrie C, Parlato M, Salmi L, Adib-Conquy M, Bical O, Deleuze P, et al. Bacterial translocation and plasma cytokines during transcatheter and open-heart aortic valve implantation. *Shock.* 2015;43:62-7.
3. Dieleman JM, Nierich AP, Rosseel PM, van der Maaten JM, Hofland J, Diephuis JC, et al. Intraoperative high-dose dexamethasone for cardiac surgery: a randomized controlled trial. *JAMA.* 2012;308:1761-7.
4. Myles PS. Perioperative outcomes: Are we asking the right questions? *Can J Anaesth.* August 19, 2015 [Epub ahead of print].
5. Leung JM, Tsai TL, Sands LP. Brief report: preoperative frailty in older surgical patients is associated with early postoperative delirium. *Anesth Analg.* 2011; 112:1199-201.
6. Fong TG, Hsieh TT, Wong B, Tommet D, Jones RN, Schmitt EM, et al. Neuropsychological profiles of an elderly cohort undergoing elective surgery and the relationship between cognitive performance and delirium. *J Am Geriatr Soc.* 2015;63:977-82.