

Arrhythmia and Vascular Procedures

Evaluating risk factors and outcomes of new-onset cardiac arrhythmias in open and endovascular procedures such as abdominal aortic aneurysm repair.

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In recent years, several large randomized trials have been completed comparing endovascular repair of abdominal aortic aneurysms (EVAR) with open surgery.¹⁻⁴ Each of these trials has shown a reduced 30-day mortality rate in patients treated with EVAR but no difference in all-cause mortality at long-term follow-up. However, it is still unclear what causes this “catch-up effect.”

One possibility is that patients who are treated with EVAR could have a common denominator that does not yield a perioperatively increased risk but does worsen the long-term prognosis. Such a denominator has yet to be found, but research is underway to attempt to answer this question. Transient perioperative cardiac arrhythmias have been shown to be an independent risk factor for mortality in noncardiac surgery.^{5,6} The vast majority of arrhythmias are asymptomatic in the perioperative setting;⁷ therefore, an undervaluing might be present in diagnosing them. A difference in incidence of cardiac arrhythmias in endovascular treatment compared to open surgery might explain part of the previously mentioned catch-up effect. This article presents an overview of published literature on this topic and discusses possibilities for future research.

LITERATURE REVIEW

The relationship between cardiac arrhythmias and surgery was described in the 1950s. More recently, Polanczyk et al investigated a group of 4,181 patients undergoing major, elective, noncardiac surgery, of which 876 were vascular patients.⁸ The investigators observed an incidence of supraventricular arrhythmia of 7.6%. It was related to male sex, an age of 70 years or older, valvular disease, a history of supraventricular arrhythmia, congestive heart failure (left ventricular ejection fraction < 40%), and premature complexes at the preoperative electrocardiography (ECG). Abdominal aortic aneurysm (AAA) repair

had an odds ratio of 2.5 (confidence interval [CI], 1.7–3.6), and with vascular surgery, they found an odds ratio of 1.6 (CI, 1.1–2.4). Furthermore, they found an association between supraventricular arrhythmia and an increase in length of hospital stay of 33% ($P < .001$). Brathwaite et al described a similar heterogeneous group of patients admitted to the intensive care unit after they underwent a variety of vascular, abdominal, and orthopedic operations in which it was seen that patients with new-onset atrial fibrillation (AF) had a greater rate of mortality (23.4% of patients with new-onset arrhythmia) and longer stay in the intensive care unit.⁹ The incidence of new-onset atrial arrhythmias was 10.2%. Thirty-one out of 47 patients had AF or atrial flutter, 15 had paroxysmal supraventricular tachycardia, and one had multifocal atrial tachycardia.

Several articles specifically assess new-onset arrhythmias in the context of vascular surgery. Feringa et al investigated the incidences of arrhythmias in patients treated with EVAR versus open AAA repair.¹⁰ One hundred twenty-six patients who underwent open AAA repair and 49 patients who underwent EVAR received a Holter recording 1 day before surgery for a total of 72 hours. New-onset AF, nonsustained ventricular tachycardia, sustained ventricular tachycardia, and ventricular fibrillation occurred in 5%, 17%, 2%, and 1% of patients, respectively. Cardiac arrhythmias had a higher prevalence in the open AAA repair group as compared to the EVAR group (29% vs 14%; $P = .04$), which might be related to the higher stress of surgery. Sustained ventricular tachycardia and ventricular fibrillation were not observed in patients treated with EVAR but occurred in four (3%) and two patients (2%), respectively, who were treated with open surgical AAA repair. Patients with perioperative cardiac arrhythmias were more likely to have perioperative ischemia and troponin T release than patients without arrhythmias.

There are conflicting reports as to whether or not patients who develop perioperative cardiac arrhythmias have worse cardiac outcomes. Valentine et al showed that 22 out of 211 patients (10%) suffered new-onset AF.¹¹ The investigators concluded that AF was regularly seen after surgery and that this was not associated with increased morbidity, mortality, or length of hospital stay. Perzanowski described a similar incidence for AF after open AAA repair.¹² Winkel et al investigated 317 patients who were scheduled for major vascular surgery without a history of AF.⁶ They found an incidence of 4.7% of new-onset AF and showed that there was an association with perioperative and late cardiovascular events (hazard ratio [HR], 6; 95% CI, 2.4–15; and HR, 4.2; 95% CI, 2.1–8.8, respectively). A different study included 513 patients who were scheduled for major vascular surgery.¹³ They received a Holter recording from 1 day before surgery to 2 days after surgery. New-onset cardiac arrhythmias were found in 55 patients (11%). AF, sustained ventricular tachycardia, supraventricular tachycardia, and ventricular fibrillation occurred in 3.7%, 6.6%, 1.2%, and 0.2%, respectively. New-onset cardiac arrhythmias were associated with a higher risk of cardiac death at a mean follow-up of 2 years (38% vs 17% in patients who did not have perioperative arrhythmias). This risk was higher in patients with new-onset supraventricular arrhythmias compared to those with ventricular arrhythmias (HR, 3; 95% CI, 1.5–6.2; and HR, 1.7; 95% CI, 0.9–3.6, respectively).

These studies mainly focus on AF after a variety of vascular surgical procedures. To assess the incidence and clinical relevance of all new-onset arrhythmias in patients undergoing EVAR, further studies are needed. Recently, Scirica et al described that short runs of nonsustained ventricular tachycardia (fewer than four beats), still seen 48 hours after non–ST-elevation acute coronary syndrome, had a higher risk of sudden cardiac death at long-term follow-up.¹⁴ As mentioned previously, Feringa et al described that in patients undergoing major vascular surgery, ventricular tachycardia is very common. Taking this into account, prolonged monitoring using an implantable loop recorder might be promising in identifying the true risk of EVAR patients associated with new-onset cardiac arrhythmias and could bring us a step closer in our endeavors for an explanation of the catch-up effect.

ONGOING STUDY

It is possible that increased diagnosis of patients who are at risk for developing new-onset arrhythmia will improve long-term outcomes for both surgical and endovascular procedures, a hypothesis we were interested in exploring in clinical studies. In our initial experience, we observed a population of more than 500 patients to explore the incidence of arrhythmia and any possible

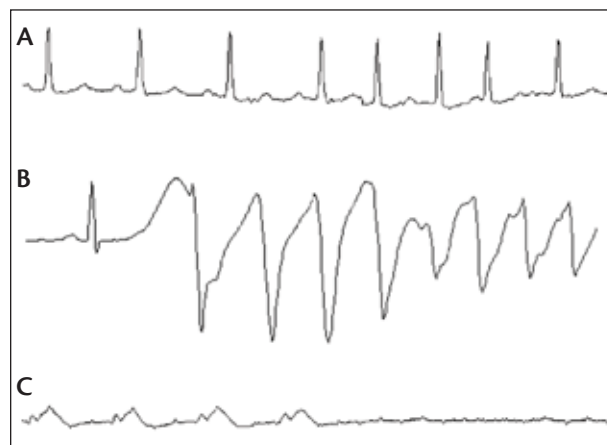


Figure 1. Atrial fibrillation (A), ventricular tachycardia (B), and asystole (C), as detected by the Reveal XT 9529 device (Medtronic, Inc., Minneapolis, MN).

impact on patient outcomes. Because the vast majority of perioperative arrhythmias are asymptomatic, we used Holter recordings to determine whether a patient was experiencing an arrhythmia. We defined an arrhythmia as new-onset when a patient had no history of arrhythmia and it was not seen in the preoperative period of the Holter recording. In this initial study period, we observed that 13% had new-onset cardiac arrhythmias, a number much higher than we had anticipated. Importantly, the patients who had cardiac arrhythmias had worse outcomes than those who did not. However, there were limitations to our previous study, including that the Holter recorders used could only be applied for a limited period of time—a maximum of 48 hours postprocedure. Many arrhythmias could develop outside the time span of the Holter ECG window. Because our ultimate goal was to determine whether arrhythmias are associated with increased mortality rates, we realized that we may have been missing an opportunity to better understand the new onset of arrhythmias and the plight of patients experiencing them.

PRISM-2

With this in mind, the PRISM-2 study was initiated. PRISM-2 is an observational study in which patients who are scheduled for elective major vascular surgery (open or endovascular AAA repair) and do not have a history of cardiac arrhythmias receive an implantable loop recorder (Reveal XT 9529) to capture arrhythmic episodes in the perioperative setting (Figure 1).

The Reveal device, which is implanted in a subcutaneous pocket under local anesthesia, can record ECGs over an extended period of time. In the PRISM-2 study, the Reveal device was implanted 1 month before surgery

to assess whether a detected perioperative arrhythmia is truly new-onset in nature, and initially, follow-up was scheduled for 1 month postprocedure to also evaluate the incidence of arrhythmias in this phase. However, it was later noted that some patients' arrhythmias were still in evolution at the follow-up visit, and it was decided to extend the monitoring window to 1 year postprocedure for these patients and all those who were newly enrolled.

CONCLUSION

It is important to recognize that the majority of patients with perioperative arrhythmia are completely asymptomatic; this could lead to an underestimation of its relevance for therapy management and risk stratification. A continuous cardiac monitor should help to bridge the gap between this condition and its symptoms, as has been demonstrated in some pathological conditions,¹⁵ and assist clinicians in understanding the entirety of cardiac and vascular disease a particular patient is experiencing before, during, and after a major procedure. Preliminary data from continuous, long-term monitoring in PRISM-2 are focusing on ventricular tachycardia and AF as the primary concerns. The study may determine whether there is a differentiation in evolution and severity of arrhythmias, with AF likely related to the stress of surgery, and ventricular tachycardia linked to the possible presence of ischemia (acute or transient). Data are still being collected and evaluated, with publication of the specific details, results, and conclusions of the trial anticipated in the coming months. ■

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