The Anesthesiologist's Perspective: Optimizing Anesthesia and Sedation

A review of the patient factors, techniques, and current recommendations in the literature for anesthesia selection based on the individual patient.

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Endovascular procedures have seen a great deal of advancement over the last several years. Along with this advancement has been the increasing acuity and age of the patient population who undergo these indicated procedures. These two factors have caused a greater involvement by the anesthesia care provider for vascular procedures and interactions with endovascular specialists. More sophisticated anesthesia techniques are necessary to care for this particular patient population. The purpose of this article is to provide insight into the anesthesiologist's approach to patients with peripheral vascular disease. Specifically, risk stratification concerns, comparison of anesthesia techniques, and an examination of procedural outcomes are described. An overview of some of the various anesthetic considerations for common vascular procedures are provided in Table 1.

PATIENT CONSIDERATIONS

One of the most important considerations when managing vascular patients is their preoperative disposition. In 1984, Hertzer et al published an article in *Annals of Surgery* that has been foundational in understanding vascular patients.[1] In this study, coronary angiography was performed in 1,000 patients being considered for elective vascular reconstruction. The patients included those who were being evaluated for various vascular procedures including carotid endarterectomy, peripheral vascular procedures, and abdominal aortic aneurysm repair. Severe correctable coronary artery disease (CAD) was identified in 25% of the entire patient population. Surgically correctable CAD was documented in 34% of patients suspected to have CAD by clinical criteria. The most interesting group was the 14% of the patients who had surgically correctable CAD but no previous indication of CAD by either electrocardiographic findings or symptomatology. This study revealed that vascular patients, regardless of preoperative findings of CAD, can have a significant risk for ischemia and myocardial infarction if conditions during the procedure create undue stress.

This study and many like it are at the forefront of most anesthesia care providers' minds when caring for endovascular patients. This information immediately designates vascular disease patients as American Society of Anesthesiologists physical status classification III/IV and almost never classification I/II. Anesthetizing patients with this background necessitates that anesthesia care providers approach endovascular patients differently than many other groups. These underlying physiologic conditions also promote the need for more conservative anesthesia techniques and, in certain circumstances, additional hemodynamic monitoring. Frequently, anesthesia care providers delay or request further preoperative workup for endovascular patients because of this background of unrecognized coronary ischemic risk.

Many elderly patients undergo endovascular procedures and, due to their advanced age, have some specific physiological limitations.[2] Anesthesia care providers seek to monitor the depth of anesthesia more closely in the elderly population to avoid delayed awakening and promote early recovery of cognitive function. Anesthetic techniques are used that have the lowest tendency toward postoperative nausea and vomiting in this population to improve their ability to become mobile and return to their functional baseline. Delirium in the elderly in the postoperative period is common. The cause for delirium can be inadequate pain control, anticholinergic drugs, or other agents that cross the blood–brain barrier. It has been shown that this occurs equally in patients who undergo regional or general anesthesia techniques.

CHOOSING AN ANESTHESIA TECHNIQUE

The complexity of endovascular patients has led many interventionalists to pursue local (monitored anesthesia

TABLE 1. ANESTHETIC CONSIDERATIONS FOR COMMON VASCULAR PROCEDURES

Procedures	Anesthetic Type	Postprocedure Recovery	Central Venous Access Required	Arterial Line Required	TEE Usage	Type and Screen	Antibiotics 30 Minutes Prior
Endovascular carotid stent	MAC or general	PACU	Rarely	Usually	Almost never	Rarely	Rarely
Carotid endarterectomy	General	PACU	Rarely	Usually	Almost never	Rarely	Always
Percutaneous intracranial intervention	General	NCC	Rarely	Usually	Almost never	Rarely	Rarely
Endovascular peripheral intervention	MAC, regional, or general	PACU	Rarely	Usually	Almost never	Rarely	Rarely
Aortobifemoral bypass	General and epidural	SICU	Usually	Always	Rarely	Always	Always
Axillofemoral bypass	General	PACU	Rarely	Usually	Rarely	Always	Always
Lower extremity bypass	Regional or general	PACU	Rarely	Usually	Rarely	Always	Always
Common femoral endarterectomy with vein patch	Regional or general	PACU	Rarely	Rarely	Almost never	Always	Always
Open abdominal aortic aneurysm	General and epidural	SICU	Usually	Always	Usually	Always	Always
Endovascular aortic stent: percutaneous	Regional or general	SICU	Rarely	Usually	Rarely	Always	Usually
Endovascular aortic stent: cutdown	Regional or general	SICU	Rarely	Usually	Rarely	Always	Always

Abbreviations: MAC, monitored anesthesia care; NCC, neurocritical care; PACU, postanesthesia care unit; SICU, surgical intensive care unit; TEE, transesophageal echocardiography.

care) or regional anesthesia techniques over general anesthetics to reduce postoperative morbidity and mortality.[3] Unfortunately, this line of thought has not been well supported by the medical literature. Several small studies have shown contradictory results when choosing a specific anesthesia technique. In the past, providers have assumed that general anesthesia created an increased risk compared to local or regional techniques. Although no large randomized trial has been performed to compare each technique, the available studies and anecdotal discussions are not supportive of this belief.

Many think the reason that regional techniques (spinal and epidural) have not shown an improved outcome is due to decreased peripheral vascular resistance, resulting in lower coronary perfusion pressure and the resultant coronary ischemia and potential myocardial infarction they may cause. Other reasons for the discrepancy can be explained by the unsecured airway and periods of prolonged hypoxia and/or hypercarbia with resultant acidosis. General anesthesia ensures airway protection and prevention of aspiration and adequate oxygenation and ventilation. Frequently, controversies can ensue regarding recovery time from local or regional techniques compared to general anesthesia. There has been suggestion in one study that a patient's length of hospital stay may be shortened if local or regional anesthesia is used compared to general anesthesia.[3] However, the overall effect on outcome appears to be negligible.

EVIDENCE FROM THE LITERATURE

Noh et al compared general anesthesia to local anesthesia in patients undergoing elective endovascular aortic aneurysm repair for infrarenal aortic aneurysm.[4] They compared the technical feasibility, occurrence of endoleaks, length of hospital stay, and 30-day clinical outcomes in the two groups of patients (those undergoing general anesthesia vs local anesthesia). There were no anesthetic conversions from local anesthesia to general anesthesia during the study. No difference was found in the number of endoleaks based on the type of anesthesia technique selected. There were also no significant differences in hospital length of stay, morbidity, mortality, nor the rates of secondary therapeutic procedures between the two groups during the 30-day follow-up period. This study concluded that either anesthetic technique was equally

safe, and the decision was more a matter of preference among the patient and the physician group.

Another study by Hajibandeh et al compared local versus general anesthesia for carotid endarterectomy.[5] The outcome endpoints that were examined to determine the difference in the two techniques were stroke, transient ischemic attack, mortality, and myocardial infarction. The design of the study was a comparative meta-analysis of randomized and nonrandomized trials to evaluate the comparative efficacy of local versus general anesthesia for carotid endarterectomy. Their findings demonstrated that observational studies showed improvement in outcome with local anesthesia compared to general anesthesia in terms of the rates of stroke, transient ischemic attack, mortality, and myocardial infarction. However, an analysis of randomized controlled trials did not show significant differences among the outcome endpoints. Therefore, this study continues to provide evidence that local anesthesia for various vascular procedures does not offer a safer management technique in terms of improved outcome, and only observational studies and anecdotal evidence show that a local anesthetic is safer.

The medical literature includes studies that show a tendency toward improved mortality rates with endovascular procedures compared to open surgical management. Although this fact is widely accepted, there are studies that question the comprehensive opinion of endovascular versus open techniques. Luebke and Brunkwall performed a risk-adjusted meta-analysis looking at 30-day mortality rates in endovascular versus open repair of ruptured abdominal aortic aneurysms.[6] The study population consisted of 81,681 patients. When preoperative hemodynamic instability was left uncorrected in comparing the two groups, the endovascular technique had a significantly lower 30-day mortality rate compared to open procedures. When the hemodynamic condition was corrected, the 30-day mortality rate was not significantly different between the two groups. This suggests that hemodynamically unstable patients who cannot tolerate CT imaging for preoperative diagnosis tend to go to the operating room and incur the resulting higher mortality rates because they are likely in a less stable condition, and this fact skews the outcome rates. The authors describe this as the "fit" patients being stable enough to undergo the endovascular procedure compared to the "unfit" patient who went to the operating room and ended up with a resultant worse mortality rate.

Another study by Liang et al compared in-hospital versus postdischarge major adverse events within 30 days following lower extremity revascularization.[7] Their goal was to examine outcomes at the time of hospital discharge compared to 30 days after discharge and the resultant effects of lower extremity bypass surgery versus percutaneous vascular intervention. They found that the total 30-day mortality rate was similar between the two groups. They also showed that major adverse cardiac events occurred in 2.9% of the percutaneous cases and 4.6% of the surgical cases. The investigators concluded that most major adverse events occur less frequently after percutaneous vascular intervention compared to lower extremity bypass surgery. They also concluded that peripheral vascular interventions utilizing percutaneous vascular techniques resulted in quicker patient recovery periods and shorter hospital length of stay. Their overall recommendation was that, in studying vascular patients, it is important to look at the 30-day outcome endpoints and not just hospital discharge records.

CONCLUSION

We have reviewed several of the documented risk factors that must be considered when selecting an anesthetic for a patient with peripheral vascular disease. We have further discussed the advantages and disadvantages of employing local, regional, or general anesthesia in an effort to assist the interventionalist who is attempting to perform these very difficult cases. These patients present a significant challenge to the anesthesia provider due to the presence of multisystem organ disease and a significant risk of coronary artery insufficiency, resulting in ischemia, infarction, or even death. Advanced age continues to be a challenge for the interventionalist and for the anesthesia care provider, as more and more complex techniques are being offered to the geriatric population. The breadth of literature comparing various anesthetic techniques is very limited, and further studies that are randomized and have statistical significance will be helpful as these techniques are offered to larger population groups. Ideally, interventionalists and anesthesia care providers can work together to provide safe and effective conditions to accomplish highly technical procedures and a resultant positive patient experience with limited mortality and morbidity. ■

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