Catastrophes in the Cardiac Catheterisation Lab

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The cardiac catheterisation lab is no longer a diagnostic angiography suite. Interventional cardiologists today have broadened their therapeutic role; they are implanting percutaneous valves and ventricular assist devices (VAD’s), placing septal closure devices and great vessel stents, performing high risk percutaneous coronary intervention (PCI), radiofrequency ablation procedures, resynchronization therapy and insertion of automatic defibrillators in patients who are often hemodynamically unstable or precarious. The presence of a cardiac anesthesiologist in the cardiac catheterisation/electrophysiology lab greatly benefits the care of these patients. The anesthesiologist can provide analgesia, amnesia and comfort to the patient while also maintaining hemodynamic stability and airway control. The cardiologist can focus their attention on the procedure and achieve the best outcome. The patient and the cardiologist both benefit from the anesthesiologists’ expertise.

The provision of anesthesia outside the familiar confines of the operating room is the first challenge to the anesthesiologist. The cardiac cath lab is designed to meet the needs of the interventional cardiologist and the setup often provides the first challenge. It is very important that the anesthesiologist become familiar with the environment in advance of an elective or emergency procedure. The monitors, airway equipment, anesthesia machine, drugs, suction, defibrillator, gas outlets, etc are often different and unfamiliar. If called upon to resuscitate and anesthetise a patient in this foreign environment during an emergency, it would be advantageous that an anesthesia cart stocked with usual anesthesia equipment be readily available within the cardiac cath lab. This cart should include emergency airway equipment including difficult airway adjuncts and extra length intravenous tubing, anesthesia circuit extensions and extra pressure tubing for invasive monitoring as the patient is often at some distance from the anesthesiologist. The access to the patient is often limited by the C-arm. The ideal situation has been realized with the building of hybrid or multipurpose operating rooms to meet the combined needs of cardiologists, radiologists, anesthesiologists, cardiac and vascular surgeons providing complex care to high-risk patients.

One of the key principles of a successful cardiac cath lab procedure is good communication between the cardiologist and the anesthesiologist. Pre-procedural anesthesia consultation is imperative, especially as the majorities of these patients have significant comorbidities and are undergoing high-risk interventions. In many instances the patients are deemed “too sick” for conventional cardiac or vascular surgery and hence are undergoing a less invasive intervention. Concomitant severe pulmonary, renal or hepatic disease is often present in addition to a poorly functioning left or right ventricle. This has implications for the type of anesthesia used and monitors used. The anesthesiologist must also know the interventional
plan and anticipated patient requirements in advance e.g. lack of movement, ability to cooperate, and potential for blood loss and complications. As part of the planning process a backup or rescue scenario should also be discussed so that all members of the team can be prepared for all and any emergencies. Many of the procedural complications such as cardiac perforation, major vessel rupture, cardiac arrest, or cardiogenic shock require the use of emergency cardiopulmonary bypass or temporary VAD support as rescue therapy. A perfusionist must be immediately available and a cardiac surgeon on standby in the event that emergency open heart surgery is required. The potential for major blood loss must be anticipated and transfusion components available if required. A good knowledge of the common major complications or “catastrophes” in the cardiac cath lab is essential for the cardiac anesthesiologist.

Catastrophes or life-threatening complications can occur during cath lab procedures. Patients undergoing diagnostic angiography or PCI can develop dissection or perforation of the aorta or a coronary artery resulting in tamponade, acute myocardial infarction, cardiogenic shock or cardiac arrest. Embolic events, either air, atheroma or thrombus are uncommon but potentially lethal complications. Most cardiac interventionalists are skilled at stenting dissected vessels, performing pericardiocentesis or providing temporary cardiac support with an IABP or VAD. They are not skilled in airway management and cannot simultaneously resuscitate the patient and perform the rescue procedure. Therefore the anesthesiologist may be emergently needed to provide airway and hemodynamic support for acute CHF/cardiogenic shock or cardiac arrest. Rarely the patient may require emergency open-heart surgery for salvage. Great vessel stenting (e.g. aortic coarctation, pulmonary artery), percutaneous valve implantation (aortic, pulmonary), septal device closure, and balloon valvuloplasty can have common complications of embolisation (device/stent-valve/air/calcium), cardiac perforation with tamponade, aortic dissection, or great vessel rupture with massive hemorrhage. Rupture of the pulmonary artery may result in life-threatening hemoptysis and hemothorax necessitating insertion of a double lumen tube. All of these interventional procedures are usually performed with a cardiac anesthesiologist present. Awareness of the potential for these complications and being prepared to manage them is part of careful peri-procedural planning.

Serious complications also occur in the electrophysiology lab. Life-threatening arrhythmias (AF, SVT, VT, VF, AVB), cardiac arrest, hemothorax, pneumothorax or cardiac tamponade are not infrequent complications. Fortunately atrio-esophageal fistula, air emboli and pulmonary vein thrombosis are infrequent occurrences.
References

Shook DG and RM Savage. Anesthesia in the Cardiac Catheterisation Laboratory and Electrophysiology Laboratory. Anesthesiology Clinics 2009;27:47-56

