INTRODUCTION

Minimally invasive techniques are becoming common, particularly in vascular surgery. These techniques tend to avoid large incisions and fluid shifts, as well as minimizing blood loss. Nonetheless, these procedures can sometimes be associated with marked, unexpected hemodynamic changes. Arterial pressure-based cardiac output monitoring with stroke volume variation assessment can be particularly valuable in these frail patients, particularly when surgical complications occur.

Clinical Events

Location: UCSD Medical Center, San Diego, CA
Patient details: 78-year-old man with hypertensive/atherosclerotic heart disease undergoing endovascular abdominal aortic aneurysm repair

CASE NOTES

The patient was a 78-year-old man with a 6 cm abdominal aortic aneurysm (AAA), presenting for endovascular repair (stent placement). His medical history was remarkable for chronic hypertension and atherosclerotic heart disease. Our plan was to provide general anesthesia with endotracheal intubation, intra-arterial pressure monitoring (radial artery) and minimally invasive cardiac output monitoring (Edwards FloTrac sensor, Edwards Lifesciences LLC, Irvine, CA). After a stable anesthetic induction, blood pressure was 136/78 and heart rate 64 BPM. Cardiac output (CO) was 4.5 L/min, and stroke volume variation (SVV) was 7%. The patient's oxygen saturation by pulse oximeter was 99% on 50% oxygen and hematocrit was 38%. The surgeons made a small incision in the right groin area, exposing the right femoral artery. They placed a catheter sheath into the artery under direct vision, with the goal of placing a catheter with stent into the abdominal aorta under fluoroscopic guidance.
One hour into what appeared to be an uncomplicated procedure, the patient’s CO dropped to 3.1 L/min, and his SVV increased to 35% (Figure 1). His heart rate had increased to 76 BPM, and his blood pressure was 110/60. Based on this information we made the diagnosis of acute hypovolemia, fearing accidental surgical disruption of the aorta. The surgeons performed a dye study showing that the aorta was actually still intact with no leakage. They suggested we search for another diagnosis. Nonetheless, we began aggressive volume resuscitation with colloid (5% albumin) and crystalloid solutions. Covert blood loss was identified from the surgical site beneath sterile drapes with saturated bed linens (estimated blood loss about 750 ml). After the administration of three units of packed red blood cells, 500 ml albumin, and 500 ml crystalloid solutions, the patient’s heart rate, blood pressure, CO, and SVV returned to baseline values. The remainder of the surgery and hospital course were uneventful; the patient was discharged to home the following day.

**DISCUSSION**

Minimally invasive vascular surgery is associated with decreased patient morbidity and resource utilization as compared with conventional “open” surgery. The procedures, however, are typically performed on elderly patients with coexisting cardiovascular disease. Thus, careful hemodynamic monitoring with aggressive, early treatment of abnormalities is essential. In this case, the sudden drop in CO, together with the rise in SVV “tipped us off” to the rapid development of hypovolemia. In particular, the rise in SVV indicating a probable decrease in circulating blood volume. The moderate rise in heart rate and mild drop in blood pressure might themselves have given us a hint, but these findings can be nonspecific during general anesthesia, as anesthesia itself can cause such conditions. We were concerned about possible disruption of the aorta, and were pleased to learn the problem was much easier to fix: leakage around the catheterization site at the femoral artery. Nonetheless, the situation was potentially life-threatening, and use of minimally invasive CO assessment with SVV allowed rapid diagnosis and carefully titrated fluid resuscitation.

Submitted by:
Gerard R. Manecke, Jr., M.D.
Chief, Cardiac Anesthesia
UCSD Medical Center
200 West Arbor Drive
San Diego, CA 92103