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Retroperitoneal Hematoma With Abdominal Compartment Syndrome During Minimally Invasive Mitral Valve Replacement

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Abstract

Although retroperitoneal hematomas most often occur secondary to trauma, they are a reported complication of ruptured aneurysms, anticoagulation therapy, and femoral vascular access. In the cardiovascular literature, retroperitoneal hematomas have occurred after percutaneous coronary interventions; however, these hematomas rarely bleed to the extent that they cause abdominal compartment syndrome. The present report describes the case of an adult patient who had a retroperitoneal hematoma develop during minimally invasive mitral valve replacement with intraoperative abdominal compartment syndrome requiring emergent surgical decompression.

Although retroperitoneal hematomas have been documented to occur after femoral access in percutaneous coronary interventions, these hematomas rarely bleed to the extent that patients develop abdominal compartment syndrome. We describe a patient who had abdominal compartment syndrome develop secondary to a retroperitoneal hematoma during minimally invasive mitral valve surgery.

A 66-year-old man was referred to our institution for elective mitral valve repair. The patient's past medical history was notable for mitral regurgitation with worsening shortness of breath on exertion. Preoperative chemistry, hematology, and coagulation panels were within normal limits, and transthoracic echocardiogram was significant for an ejection fraction of 35% to 45% and severe mitral regurgitation.

The patient was scheduled for a minimally invasive mitral valve repair. After entering the chest through a 6-cm mini-thoracotomy, the pericardium was opened. After activated clotting time-guided heparinization, cannulation of the aorta and superior vena cava (direct), and left femoral vein (percutaneous, Seldinger technique, transesophageal echocardiography-guided) was carried out. The patient was placed on cardiopulmonary bypass with venous drainage from the SVC and femoral vein cannulae without incident. The valve was deemed unreparable due to a complex flail P2 and P3 with no viable chordae between the pathologic area and commissure, and a mitral valve replacement using a bovine pericardial bioprosthetic valve was performed. During the initial phases of the valve

replacement, the perfusion team reported a significant loss of volume. The abdomen at this point was slightly distended. Urine output and cardiac filling pressures were low. The presumptive diagnosis was retroperitoneal hematoma, and this was confirmed in time as the abdomen became more distended and tense. Given concerns about the possibility of an abdominal compartment syndrome and continued active bleeding, an intraoperative vascular surgery consult was requested. By this time, the intracardiac procedure had been finished, the heart was closed, and the aortic cross clamp was removed.

The left inguinal region was explored by the vascular team, and no injury to the femoral vein or artery was found. At this point, the abdomen was tensely distended, and attempts to wean the patient off cardiopulmonary bypass had been met with hemodynamic instability secondary to hypovolemia. A midline laparotomy was performed with immediate improvement in the patient's hemodynamics. An abdominal exploration revealed multiple loops of edematous small bowel, a large left-sided retroperitoneal hematoma that extended into the bowel mesentery, and no source of active intraperitoneal bleeding. The retroperitoneal hematoma itself was not opened. The retroperitoneum was packed, the abdomen was closed with Vicryl mesh (Ethicon, Somerville, NJ), the patient was weaned off bypass, and the thoracotomy was closed. The cardiopulmonary bypass time was 118 minutes and the cross-clamp time was 47 minutes. The patient received a total of 13 units of packed red blood cells during the surgery.

The following day, the patient was returned to the operating room for a planned abdominal re-exploration. The retroperitoneal hematoma had decreased in size, and no further hemorrhage was noted. The bowel was viable and less edematous. The abdomen was irrigated and definitively closed. The patient was ultimately discharged to rehabilitation in stable condition.

Comment

We present the case of a retroperitoneal hematoma (RPH) with resultant intraoperative abdominal compartment syndrome during a minimally invasive mitral valve replacement. Retroperitoneal hematoma most commonly occurs as a complication of pelvic trauma or femoral catheterization with a reported incidence of 0.15% to 0.5% in the setting of percutaneous coronary intervention [1]. There are no previous reports of RPH during a minimally invasive cardiac operation with resultant compartment syndrome requiring surgical decompression.

The early diagnosis of RPH is often difficult to establish and manifests only after a significant amount of blood loss has occurred with resultant hemodynamic compromise. After elective percutaneous coronary intervention, RPH may present with vague signs and symptoms, such as back pain or flank ecchymosis. During femoral access, RPH is most often caused by inadvertent puncture of the posterior wall of the femoral or iliac artery at the time of cannulation. Blood may then track through the posterior wall of the femoral sheath formed by the iliac fascia into the retroperitoneum [2]. In the setting of anticoagulation, bleeding may be significant. Previous studies have demonstrated female gender, body

surface area $< 1.73 \text{ m}^2$, and high femoral puncture site as independent risk factors for RPH [3].

Initial management of RPH is targeted at fluid resuscitation, blood transfusion, and reversal of coagulopathy. In most cases of spontaneous RPH, or RPH in a patient that is hemodynamically stable, conservative management alone is adequate. Continued hemodynamic instability is often an indication for more definitive intervention either through selective intra-arterial embolization, stent grafts, or abdominal exploration [4]. Although there is a growing trend toward the use of endovascular techniques as an alternative to open surgery, abdominal compartment syndrome requires immediate surgical decompression [5]. Abdominal compartment syndrome is defined as sustained intra-abdominal pressure greater than 20 mm Hg with end-organ dysfunction manifested as respiratory insufficiency, oliguria, and decreased venous return resulting in severe hypotension [6].

In the setting of cardiopulmonary bypass and general anesthesia, the usual signs of abdominal compartment syndrome may not manifest until significant hemorrhage has occurred. In our patient, RPH was initially suspected at least 30 minutes after femoral venous cannulation, when a significant decrease in blood volume was noted on the bypass circuit. Because moderate volume loss is not uncommon in patients undergoing cardiac surgery, the diagnosis of RPH was not certain until we noted clear and progressive distension of this very thin patient's abdomen. At this point, our goal was discontinuation of heparin, which required expeditious completion of the cardiac procedure and termination of cardiopulmonary bypass. Although we completed the valve replacement quickly (aortic cross-clamp time of 47 minutes), we could not wean the patient off bypass until the abdomen was opened and decompressed, restoring venous return. It should be noted that less severe cases of retroperitoneal hematoma might be difficult to detect by abdominal examination alone, especially in obese patients.

We assume that the venous bleeding began at the time of venous cannulation, and although the origin of the venous bleeding is unclear, systemic anticoagulation likely exacerbated a minor injury. Exploration of the groin revealed no evidence of anterior or posterior femoral arterial or venous injury, and after femoral vein needle access, the venous cannula had been passed over a wire (with transesophageal echocardiography visualization) into the right atrium without difficulty. It is possible that despite the use of a guidewire, the venous cannula caught and injured a branch of the venous system in the pelvis or abdomen. Less likely is the possibility of spontaneous venous (or arterial) retroperitoneal hemorrhage, as is sometimes seen in anticoagulated patients who have not undergone invasive procedures.

In conclusion, this report demonstrates that retroperitoneal hematoma and resultant abdominal compartment syndrome can occur in minimally invasive cardiac surgery involving peripheral venous cannulation. Given the significant volume of blood that can be contained within the retroperitoneum, a diagnosis can be challenging. Retroperitoneal hematoma should be considered in settings involving peripheral venous (or arterial) cannulation when there is a significant drop in the volume of the bypass circuit with no evidence of active hemorrhage in the chest.

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