Pulmonary Embolism after IVC Filter

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Case presentation

The patient was a 64-year-old moderately overweight (170 cm, 95 kg, body mass index 33) man with kyphosis scheduled for a revision posterior spine fusion. His past medical history was significant for hypertension, hypercholesterolemia, and multiple previous spine procedures for postoperative infection and pseudoarthrosis. Two years before this procedure, the patient underwent a sequential anterior–posterior thoraco-lumbar fusion, which was complicated by a postoperative pulmonary embolism (PE) requiring placement of an inferior vena cava (IVC) filter.

The current procedure consisted of a posterior re-instrumentation (T7 to the ileum), revision decompression (L3–S1), a posterior lumbar interbody fusion (L4–L5), and a pedicle subtraction osteotomy (L3). The 12-h procedure was associated with an estimated blood loss of 5,500 ml that required three units of packed red blood cells, 6 l of lactated Ringer solution, 1 l of 5% albumin, and 1,500 ml of cell scavenged blood cells. The patient was hemodynamical throughout the procedure and intra-operative somatosensory evoked potential monitored, and a wake-up test at the end of the procedure documented the absence of adverse neurologic sequelae. The patient was mechanically ventilated for the first postoperative night and was clinically stable.

At 9 AM on the morning of postoperative day 1, the patient was extubated, an arterial blood gas 30 min post-extubation (FI02~30%) was 7.34/42/119. Throughout the remainder of the morning, the patient was alert, interactive, and physiologically stable. At 2:15 PM on the first postoperative day, the patient complained of nausea and immediately suffered a sudden cardio-respiratory arrest. Resuscitative

measures were initiated immediately lasting 30 min and included cardiopulmonary resuscitation, electrical defibrillation, and intravenous epinephrine and vasopressin. A rhythm was restored initially requiring hemodynamic support with norepinephrine. A bedside echo performed after the successful restoration of a circulation revealed a small, normally contracting left ventricle and a dilated right ventricle. A spiral computed tomography (CT) performed 1 h later confirmed a diagnosis of a massive PE with occlusive thrombus in the right middle lobe, right lower lobe, anterior left upper lobe, and the base of the left lower lobe. The patient was re-extubated several days later, but had suffered global cerebral ischemia with severe cognitive impairment.

Discussion

Thromboembolic complications remain one of the leading causes of morbidity and mortality after orthopedic surgery. Considerable progress has been made in risk assessment and prophylaxis for deep venous thrombosis (DVT) and PE after arthroplasty and trauma surgery [1]. Although a review of the literature indicates that such thromboembolic phenomenon may complicate spine surgery, there is limited information regarding the risks and possible prevention [2–4]. The case presented is of interest in a number of respects, specifically the magnitude of the pulmonary embolism, its early (post-op day 1) occurrence, and its occurrence at all given the previously implanted IVC filter.

The reported incidence of thromboembolic complications after spinal surgery is 0.5 to 15%. Risk factors that have been associated with PE/DVT include length of the operative procedure, prone positioning, anterior approach to the spine, duration of postoperative immobilization, and motor neurological deficits in the lower extremity.

The insertion of an IVC filter in this patient 2 years before the present surgery may have been reassuring to some; however, pulmonary embolism has been well documented in post-filter insertion [6, 7]. The only randomized trial comparing IVC filter use with no filter in patients with documented DVT is the Prevention du Risque d'Embolie Pulmonaire par Interruption Cave trial [8]. The use of IVC filter was found to be beneficial at 12 days with a statistically

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significant difference in PE in those with and without filter (1.1 vs. 4.8%, $P=0.03$). However, no statistically significant difference in PE was found 2 years later, although the rate of DVT was higher in the filter group compared to the no filter group (21 vs. 12%, $P=0.02$) raising the possibility that the presence of an IVC filter could increase the rate of DVT. These same patients were followed up to 8 years later where the incidence of PE was 6.2 vs. 15% in the filter and no filter group ($P=0.008$). The higher incidence of DVT persisted however in the filter group (35.7 vs. 27.5%, $P=0.042$). Therefore, although an IVC filter does protect against PE, it does not eliminate it and may lead to a higher rate of DVT [9].

Other complications seen with an IVC filter include migration or tilting, which decreases clot trapping ability. Vena caval thrombosis may occur in up to 14.6% of cases leading to the development of collateral circulation with the possibility for an alternative pathway for clots to travel to the lung [10]. Consequently, CT scanning has been recommended both in the short- and long-term evaluation of IVC filter [11]. This patient did not have such testing done preoperatively. It might be prudent to do so preoperatively in any patient with a history of IVC filter insertion after a documented PE/DVT.

According to Brambilla et al., this patient would be considered high risk for thromboembolism given his age (>40), history of PE, obesity, and planned complex surgery of significant duration [12]. The question arises as to whether this patient should have had a second, retrievable or a temporary filter placed perioperatively in view of his significant risk factors and the theoretical problems associated with an existing filter. The temporary filter is often used when the risk of PE has a limited time frame. It differs from a retrievable filter, as it lacks wall anchorage and is attached to the end of a venous catheter that enables easy withdrawal [13]. Most temporary filters must be removed within 2–6 weeks, but some can be left for longer periods [14]. However, there is a risk of epithelization after 10 days necessitating repositioning of the filter. Retrievable filters, on the other hand, can be removed up to 14 days if not repositioned or may be left in permanently.

In conclusion, any patient at risk for PE/DVT in the perioperative period and who has had IVC filter insertion in

the past should have their filter assessed before surgery. An abdominal CT to rule out malpositioning or thrombosis should be performed. Duplex ultrasound of the lower extremities may be helpful as well because of the higher risk of DVT from an IVC filter. A retrievable or temporary filter should be considered if these studies are abnormal and the risks of thromboembolism are high.

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