

Spontaneous hemothorax during general anesthesia

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Abstract

We report a case of spontaneous hemothorax in a healthy 27-year-old man undergoing elective reconstruction of the right anterior cruciate ligament (ACL) under general anesthesia. In the postanesthesia care unit (PACU), the patient became hypotensive and tachycardic with mid-sternal chest discomfort. A chest roentgenogram revealed an almost complete opacification of the right hemithorax. A diagnostic thoracentesis was positive for frank blood, confirming a right hemothorax. The patient was emergently taken back to the operating room. A chest tube was inserted, and 3.3 l of dark blood was drained. Once the patient improved hemodynamically, we proceeded with a right video-assisted thoracoscopic surgery (VATS). A bleeding vessel incorporated in a bleb was identified at the apex of the right lung. The bleeding vessel was clipped. A wedge resection of the apical bleb was performed and the associated torn vascular adhesion was stapled. The patient was found to have bullous disease at the apical region of the right lung. These bullae can undergo neovascularization and form vascularized bullae. Rupture of these vascularized bullae can cause a spontaneous hemopneumothorax. In our patient it is possible that an apical vascularized bulla ruptured causing a massive intrapleural bleed.

Key words Spontaneous hemothorax · Barotrauma · VATS · Peak pressure

Introduction

Hemothorax, a collection of blood in the pleural cavity, occurs often after trauma. In the absence of trauma it is usually associated with malignancy. Other causes include coagulopathy, pulmonary infarct, hemangiomas, uncontrolled hypertension, and iatrogenic complications [1]. Spontaneous hemothorax is a rare entity. Spontaneous hemothorax during general anesthesia is

even more uncommon. To our knowledge there is only one reported case of spontaneous hemothorax during general anesthesia. We report a case of spontaneous hemothorax in a healthy 27-year-old man undergoing elective reconstruction of the right anterior cruciate ligament (ACL) under general anesthesia.

Case report

A 27-year-old man (height, 1.73 m; weight, 78 kg) underwent elective reconstruction of his right ACL. His medical history revealed trauma, a stabbing, 10 years earlier, which had caused a right-sided hemothorax requiring a chest tube for drainage. He had been hospitalized for 3 days and then released as the hemothorax resolved. He admitted to smoking about a pack of cigarettes a day for the past 10 years. His surgical history was limited to an uneventful right inguinal hernia repair under spinal anesthesia 7 years previously. He was not taking any medications at home and had no known drug allergies. No preoperative laboratory tests or imaging studies were obtained. His preoperative vital signs were all within normal limits. His airway evaluation included a Mallampatti grade 2 airway. His intravenous access was a peripheral 20-gauge catheter. Anesthesia was induced with propofol, fentanyl, and rocuronium. The patient was orotracheally intubated with a 7.0 cuffed endotracheal (ET) tube using a Macintosh 3 blade. This sequence was uneventful. The patient was mechanically ventilated using volume control mode with a tidal volume of 560 ml at a rate of 10 breaths·min⁻¹. Peak pressures were not recorded. Anesthesia was maintained with desflurane, 6%–9%, oxygen, and intermittent doses of rocuronium. The duration of the procedure was 4 h and 30 min and the patient remained hemodynamically stable throughout. At the conclusion of the operation, the patient was felt to have an adequate train-of-four response and no reversal agents were

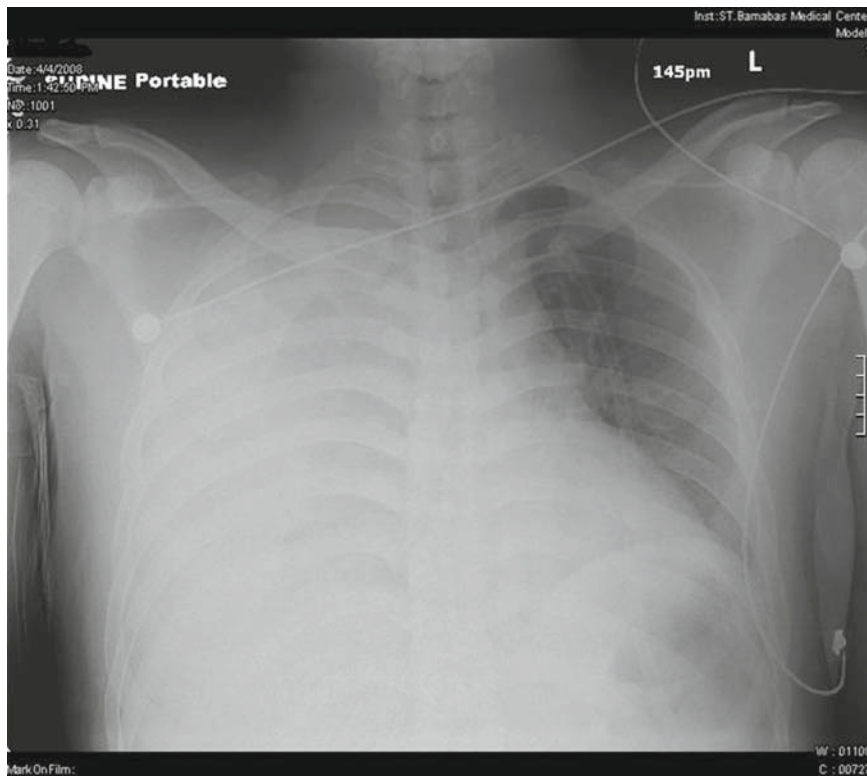


Fig. 1. Chest roentgenogram after anterior cruciate ligament (ACL) repair, taken when the patient was in the postanesthesia care unit (PACU)

given. The trachea was extubated uneventfully and the patient was transported to the postanesthesia care unit (PACU). There was minimal blood loss during the operation and 2 l of crystalloid was administered.

Upon arrival at the PACU the patient complained of mild mid-sternal chest pain and difficulty in taking a deep breath. The patient was hypotensive (85/45 mmHg) and tachycardic (135 bpm); he was given neostigmine and glycopyrrolate. The patient continued to experience difficulty breathing and had mild chest discomfort despite adequate oxygenation. He remained hypotensive and tachycardic. After 2 l of crystalloid fluid boluses and repeated doses of phenylephrine were administered, there was no improvement. Breath sounds could not be appreciated on the right side. A supine chest roentgenogram revealed an almost complete opacification of the right hemithorax (Fig. 1). Blood samples were drawn and revealed a hemoglobin of $7.7 \text{ g}\cdot\text{dl}^{-1}$. A left femoral triple-lumen catheter was placed while the patient was in the PACU. The patient remained hypotensive, requiring a phenylephrine infusion ($100 \mu\text{g}\cdot\text{min}^{-1}$). A diagnostic thoracentesis was positive for frank blood, confirming a right hemothorax. The decision was made to return to the operating room (OR) immediately.

In the OR, a 20-gauge left radial arterial line was placed prior to induction. Anesthesia was induced with ketamine, fentanyl, and cisatracurium. The trachea was intubated with a 7.0 cuffed ET tube. An 18-gauge

peripheral intravenous line was inserted. With the patient supine, a 31-French right chest tube was inserted, and 3.3 l of dark blood was drained, with simultaneous transfusion of packed red blood cells and crystalloid. The patient's hemodynamic status improved and he no longer required vasopressors to support his blood pressure. He was re-intubated with a 39-French left double-lumen tube to facilitate a video-assisted thoracoscopic surgery (VATS) for examination of the right hemithorax. One-lung ventilation was maintained with the patient in the left lateral decubitus position, with 100% oxygen and 3% desflurane. During exploration of the right thoracic cavity a bleeding vessel incorporated in a bleb was identified at the apex of the right lung. This bleeding vessel was clipped. A wedge resection of the apical bleb was performed and the associated torn vascular adhesion was stapled. An additional 2.7 l of blood was drained that was not initially drained by the chest tube. A total of 6 units of packed red blood cells, 10 units of platelets, and 2 units of fresh frozen plasma were transfused. Five liters of crystalloid was infused throughout the operation. At the end of the operation the hemoglobin was $9.5 \text{ g}\cdot\text{dl}^{-1}$ (I-Stat; Abbott Laboratories, East Windsor, NJ, USA). Once the patient was hemodynamically stable he was transferred to the PACU with the ET tube in situ. A chest roentgenogram revealed improvement of the right-sided opacification. The next day the trachea was extubated uneventfully. The following day the chest tube was removed and the

patient was transferred to a stepdown unit. He was discharged home on postoperative day 3.

Discussion

Spontaneous hemothorax is a rare but serious entity. The condition can be life-threatening because of progressively massive blood loss into the pleural cavity, leading to hypovolemic shock [2]. Spontaneous hemothorax during general anesthesia is even more uncommon. To our knowledge there is only one reported case of spontaneous hemothorax during general anesthesia. This occurred in a 72-year-old woman who underwent emergency repair of a damaged ascending colon. The etiology of the hemothorax could not be determined [3].

Our patient also had a spontaneous hemothorax during general anesthesia. It is not known if a history of a traumatic hemothorax predisposes one to a future hemothorax. Our patient's prior stab wounds had occurred in the inferior chest wall and so, logically, the bases of the right lung were explored first. However, the pleura was found to be smooth along the posterior-lateral aspect, with no corresponding bleeding or pathology on the visceral pleura of the lower lobe. The apex was then explored and many blebs were seen.

Blebs, also known as bullae, are air-filled lung cysts within or contiguous to the visceral pleura. Amjadi and colleagues [4] found the prevalence of blebs or bullae in young healthy males with no underlying pulmonary disease to be 6%. The strategy for ventilator management in a patient with known bullous disease is to avoid barotrauma. This can be accomplished by avoiding positive-pressure ventilation. If this is not possible then peak pressures should be limited in order to avoid rupture of bullae [5]. Also, the size of the ET, which represents the internal diameter in millimeters, will affect peak pressures. The smaller the internal diameter, the greater the peak pressures at any given tidal volume. In our middle-sized male patient we used a size 7 ET tube, which can be considered too small. For most middle-size adult males, a size 8 tube is appropriate [6]. Although peak pressures were not recorded, it is probable that the use of the size 7 ET tube contributed to high peak pressures and subsequent barotrauma.

Blebs can undergo neovascularization and form vascularized bullae. Rupture of these vascularized bullae

can cause a spontaneous hemopneumothorax (SHP) [7]. SHP is a rare event occurring in young patients with a male predominance [8]. Bullae can rupture during positive-pressure ventilation secondary to barotraumas [9]. In our patient it is possible that an apical vascularized bulla ruptured causing a massive bleed. However, only a hemothorax (and not a hemopneumothorax) was appreciated on chest roentgenogram. This might be explained by the large amount of intrapleural blood and subsequent clot formation which may have formed a cap on the ruptured bulla, stabilizing the pneumothorax. Also, if a pneumothorax was present it may not have been apparent from the portable roentgenogram, because a supine roentgenogram is inadequate for the detection of pneumothoraces [10].

Spontaneous hemothorax is a rare but serious complication. The rupture of vascular bullae causing an intrapleural bleed is well documented but has never been reported during general anesthesia. In a patient with bullous disease, appropriate ventilator management is crucial in limiting the chance of barotrauma and possible hemopneumothorax.

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