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Case Study

Awake Thoracic Surgery with Extracorporeal Membrane Oxygenation

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ABSTRACT

A 75-year old patient with a right sided secondary pneumothorax and prolonged air leak showed upper lobe predominant bullous emphysema. Due to the patients extremely reduced general condition neither an open approach nor a thoracoscopic approach seemed possible. Hence, we performed an awake lung volume reduction surgery with perioperative single site veno-venous extracorporeal membrane oxygenation. No heparin was administered. The extracorporeal membrane oxygenation (ECMO) could be weaned up to the second postoperative day. The further postoperative course was uneventful. This current case suggests that combining awake surgery with extracorporeal membrane oxygenation could be a future concept in extremely compromised patients.

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Introduction

The use of awake (AW) thoracic surgery may be beneficial, especially due to the abandonment of muscle relaxants; a faster postoperative recovery and a reduction of stress hormones have been described [1]. Nevertheless, the impact especially on severely compromised patients remains unclear [1]. We report on an extended indication for AW thoracic surgery to ECMO-augmented-AW thoracic surgery due to severest respiratory compromise of the patient.

Case Report

A 75-old male (176cm/ 60kg) presented with acute dyspnea due to secondary pneumothorax with partially collapsed right lung. Initial treatment was a thoracic drain. The medical history of the patient showed COPD GOLD IV Group D with home oxygen therapy of 3.5 l/min at rest. A prolonged air leak and inability to remove the drain resulted and was caused by severe upper lobe predominant bullous emphysema. Despite initial conservative management, no reduction of the air leak was noticed. Due to this we indicated an operative therapy. On the other hand, due to the patient's overall condition (O₂ requirement by severe emphysema; bedridden due to dyspnea; lung function not feasible) an open thoracic approach was ruled out. A thoracoscopic approach with

single lung ventilation or a sole non-intubated approach seemed not possible due to the severe emphysema with need for O₂ at rest. Preoperative blood gas values were SO₂ 88% and pO₂ 48 mmHg.

We decided to perform an awake lung volume reduction surgery (LVRS) on the right side with perioperative v-v ECMO support. Under local anesthesia and beginning sedation (intravenous Dexmedetomidine) a 27 Fr double lumen cannula (Maquet) was inserted via the right jugular vein (echocardiographic and fluoroscopic guidance). For analgesia we used intravenous remifentanyl and a plexus block. No heparin was administered. Neither an intubation nor noninvasive ventilation was performed. The ECMO (Maquet Cardio Help with an HLS advanced 7.0 Oxygenator) was operated with a blood flow of 3l/min and a FIO₂ of 50%. The patient remained cardiopulmonary stable and responsive. The level of sedation was increased, and the patient was placed in a left lateral decubitus position. After collapsing the right lung via a standard three port thoracoscopic approach the patient still remained stable (no catecholaminergic support; respiratory balanced at a respiratory rate of 5/min). A ruptured bulla was found intraoperatively. We proceeded with an uneventful thoracoscopic LVRS on the right upper lobe (Figure 2). An additional talc pleurodesis was performed. Two standard thoracic drainages were placed and put on suction after an operative time of 49

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minutes. No relevant air leak was detectable. With wound closure, sedation was already reduced and tapered.



Figure 1: Photography showing the non-intubated patient direct preoperative and the intraoperative thoracoscopic aspect with the mostly resected part of the right upper lobe.



Figure 2: Photography of the non-intubated patient with the v-v-ECMO directly postoperative.

Already during repositioning, the patient was fully awake and without pain. ECMO support was continued unchanged and the patient admitted to the ICU for further monitoring and respiratory exercises. ECMO therapy was weaned and successfully removed on the morning of the second postoperative day. No anticoagulation was administered during ECMO therapy instead only routine coagulation measurements. After removal of the ECMO heparin was administered prophylactically, the patient returned to the normal ward the fourth postoperative day. The postoperative blood gas analysis showed a SO_2 97% and pO_2 76 mmHg at $4L O_2/min$. 20 days postoperatively (complication of clostridium difficile infection) the patient was discharged home with the same oxygen therapy as before the event. An interview the 10th day after discharge revealed the patient well and that the whole procedure was not perceived as unpleasant. After 6 month the patient was still in a stable condition like before the pneumothorax.

Comment

It is well known that an intubation in COPD patients leads to further morbidity especially in an exacerbated situation. Postoperative pulmonary complication rates in COPD patients range from 2-19% in

non-cardiac surgery whereas for lung resections this rate increases to 4-41% [2, 3]. This relationship led to the concept of an extracorporeal gas exchange to avoid intubation and mechanical ventilation in these patients [4]. AW thoracic surgery may have beneficial effects in an overall population but the impact especially on severely compromised patients remains unclear [1]. Perioperative ECMO support in thoracic surgery is well established especially for airway management. Nevertheless, rates of up to 20 % for bleeding complications caused by the proposed need for anticoagulation limit its liberal use [5]. Due to positive experience in v-v- ECMO patients without systemic anticoagulation (heparin coated systems in short- to midterm use) we did not use systemic heparinization in this case. Until now, to our knowledge, ECMO was used only in conventional thoracic surgery and not in AW thoracic surgery. In this case we successfully combined these two approaches with the aim of further minimizing deleterious side effects of mechanical ventilation in a severely compromised patient.

Conclusion

Combining AW thoracic surgery and perioperative ECMO is feasible. This may be a future concept to allow operative therapy in respiratory extremely compromised patients in far more cases than the described LVRS. To abandon systemic heparinization might be suggested in similar cases.

Conflicts of Interest

None.

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