A huge ovarian tumor: Perioperative ventilation challenges

Wan Fadzlina Wan Muhd Shukeri, Wan Mohd Nazaruddin Wan Hassan

ABSTRACT

Introduction: Huge ovarian tumors can compromise respiratory functions in various ways leading to a challenging ventilation management.

Case Report: We report a case of a young lady with a huge ovarian tumor (17 kg) posted for tumor resection, which was initially intubated and required high ventilator setting using airway pressure release ventilation (APRV) mode in the intensive care unit (ICU) for respiratory failure secondary to concomitant splinting of diaphragm, pleural effusion and pneumonia. Herein, we described our successful use of APRV extended into the intraoperative period of the tumor resection in order to maintain an adequate oxygenation and ventilation. As the operating room (OR) ventilator is not equipped with APRV as a mode of ventilation, there were several practical challenges we faced. Firstly, we had to transport the ICU ventilator to the OR with the patient. Due to the inability to deliver inhaled anesthetic while the patient was connected to the ICU ventilator, and also to accommodate the need of spontaneous breathing with the use of APRV, we had to modify our usual anesthetic technique. We used total intravenous anesthesia in the form of propofol-remifentanyl target-controlled infusion for maintenance of anesthesia and avoided the use of neuromuscular blocking agent. Her oxygenation markedly improved after the tumor was removed, and she was successfully extubated five days after the surgery.

Conclusion: In the case of a huge ovarian tumor with severe respiratory failure that requires APRV mode of ventilation preoperatively, the surgery for tumor resection can be proceeded successfully with the continuation of APRV into the intraoperative period. Based on our experience, we believe that this approach can also be applied in other types of huge intra-abdominal tumors which present with similar respiratory complications.

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CASE REPORT

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Keywords: Airway pressure release ventilation, Huge ovarian tumor, Total intravenous anesthesia

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INTRODUCTION

Patients with a huge ovarian tumor may have compromised respiratory functions for various reasons

which can lead to many challenges in their ventilation management [1–4]. Before the tumor is removed, respiratory failure can be induced by splinting of the diaphragm by the tumor. Patients can also have pleural effusion, and following removal of the tumor, re-expansion pulmonary edema may occur. Here we report our challenging perioperative ventilation management in a patient with a huge ovarian tumor (17 kg) who was initially ventilated for respiratory failure and subsequently scheduled for tumor resection surgery. This was a case of a late presentation of ovarian tumor which was mistaken as a pregnancy by the patient who had been trying to conceive for several years.

CASE REPORT

A 36-year-old woman, with no previous comorbidities, presented to the emergency department (ED) with worsening shortness of breath and cough productive of yellowish sputum for three days prior to admission. However, she denied any history of fever. She also complained of progressive abdominal distension for the past eight months. She had actually been trying to conceive in the last six years and believed that the abdominal distension was due to pregnancy. Even though the results of several urine pregnancy tests done earlier at her family clinic were negatives, she insisted that she was pregnant and decided to default the follow-up. Her menses was previously normal until a year ago when she started to have amenorrhea.

At the ED, she was conscious but tachypneic with a respiratory rate of 22 breaths per minute. Her hemodynamics was stable. Chest examinations revealed reduced air entry at the base of the lungs bilaterally with coarse crepitations in the left lung. Her abdomen was grossly distended and markedly tense. There were no signs of peritonitis. Ultrasound scan of abdomen demonstrated a huge and well-encapsulated mass occupying the pelvic cavity extending to the upper abdomen. Chest radiography showed left-sided pleural effusion with air-space opacities at the left mid zone of the lungs. The impression at this point was that the patient had a huge ovarian tumor with pleural effusion causing the shortness of breath.

The patient was subsequently admitted to the gynecological ward for further treatment and investigations including computed tomography (CT) scan of the thorax, abdomen and pelvis. The CT scan revealed a huge pelvic mass which was likely to originate from the right ovary and the possibility of malignancy cannot be ruled out. She was consequently planned for tumor resection surgery in the next ten days after optimization of her condition. However, in the ward, she became progressively tachypneic with worsening productive cough. She was then treated with antibiotics for hospital-acquired pneumonia (HAP). On the day of the scheduled surgery, she developed type I respiratory failure and was referred to the anesthesia team for intubation. We

intubated the patient and admitted her to the intensive care unit (ICU) for ventilatory support and optimization before surgery.

In the ICU, she initially required high ventilatory support with inspired oxygen concentration (FiO₂) of 0.9 and positive end-expiratory pressure (PEEP) of 12 cmH₂O using synchronized intermittent mandatory ventilation (SIMV) mode. This could only achieve arterial partial pressure of oxygen (PaO₂) of 97 mmHg. Her total white cell count also increased and the diagnosis of severe sepsis secondary to HAP was made. On the third day in ICU, she further desaturated and the FiO₂ was increased to 1.0. Ventilation mode had to be changed to airway pressure release ventilation (APRV), an advance mode of mechanical ventilation, in view of severe hypoxemia. The gynecological team was keen to proceed with surgery but we faced the dilemma of deciding the right time to allow the surgery to be performed in view of the severity of her current lungs condition.

After being commenced on APRV, the patient gradually improved. We managed to wean the FiO₂ to 0.5 after five days but the other parameters of APRV setting remained relatively high. In view of the potential of further improvement of oxygenation and ventilation by earlier removal of the abdominal mass, we decided at this point to allow the surgery to be proceeded. In order to minimize the interruption of current management of ventilation, we decided to maintain the APRV mode during transportation and surgery. Therefore, we had to transport the ICU ventilator (Nelcor Puritan Bennett 840 Ventilator System, Minneapolis, United States) to the operating room (OR) with the patient (Figure 1).

With regards to accommodating the need of spontaneous breathing with APRV mode and at the same time our inability to deliver inhaled anesthetic while the patient is connected to the ICU ventilator, we had to use total intravenous anesthesia (TIVA) technique in maintaining anesthesia throughout the surgery in the form of propofol-remifentanyl target-controlled infusion (TCI). No neuromuscular blocking agent (NMBA) was given to allow spontaneous breathing during the high pressure level ('P-high') of APRV. Ventilation was maintained with APRV mode of the same setting used in the ICU but with a higher FiO₂ of 0.8. After the tumor was removed, as we expected, her lung compliance as well as oxygenation significantly improved. Therefore we decided to change the ICU ventilator to the OR ventilator using SIMV mode and anesthesia maintenance was also changed to sevoflurane. She was also subsequently paralyzed with rocuronium to facilitate the remaining surgery. However, after removal of the tumor, her blood pressure started to drop until she required fluid resuscitation, transfusion of three pints packed cell and noradrenaline infusion. Estimated blood loss was about 1200 ml. Total duration of surgery lasted about four hours. Huge ovarian tumor, weighing about 17 kg, multiloculated with mixed cystic and solid content was removed (Figure 2). At the end of

surgery, she was returned to the ICU for continuation of supportive management and weaning.

Five days postoperatively, she was extubated well after a period of slow weaning from ventilator and vasopressor supports. She was subsequently discharged to the gynecological ward the next day. She was well and comfortable without requiring oxygen support during our follow-up visit in the ward five days after she was discharged from ICU. The histopathological report available later showed that the ovarian tumor was an atypical proliferative mucinous tumor with the omentum showing no evidence of malignancy.

DISCUSSION

Huge ovarian tumors for surgical resection can potentially pose significant anesthetic challenges particularly on respiratory as well as on cardiovascular systems. Our patient presented with respiratory failure secondary to tumor compression, which was worsened by compounding pleural effusion and HAP. Combination of these three pathologies caused the difficulty in maintaining her oxygenation which consequently required high ventilator setting. One of our main goals of management was to achieve good oxygenation on low ventilator setting so that surgery could be performed safely. However, the improvement in her oxygenation was persistently poor. Therefore, we decided to put her on APRV in our attempt to improve her severe hypoxemia.

The APRV is an advance mode of mechanical ventilation that had gained popularity recently as an effective rescue therapy for patients who are difficult-to-oxygenate [5]. It applies continuous positive airway pressure, or the 'P-high', for certain duration of time known as the 'T-high' to maintain adequate lung volume and alveolar recruitment. The 'P-high' will be intermittently released to a lower set of pressure, or the 'P-low,' for a shorter period of time known as the 'T-low' where most of carbon dioxide (CO₂) removal occurs. In APRV, minute ventilation and CO₂ removal relies heavily on the patient's spontaneous breathing effort during the 'P-high'. It has been shown in multiple studies to provide better oxygenation as compared to conventional mechanical ventilation in patients with reduced functional residual capacity and lung compliance, which is the case of our patient [6–9].

After being commenced on APRV for several days, the patient's oxygenation gradually improved. Weighing the risks and benefits of the surgery at this point, we decided to allow the surgery to proceed. To counteract the risk of worsening hypoxemia, we planned to extent the use of APRV into the transportation and intraoperative period bearing in mind of the three-fold practical implications it posed. Firstly, the APRV mode of ventilation was not available on the OR ventilator. Therefore, we had to move the ICU ventilator together with the patient during transportation to the OR and applied it intra-

Figure 1: The patient, being connected to the ICU ventilator (Nellcor Puritan Bennett 840 Ventilator System, Minneapolis, United States), which was moved to the OR to ensure minimal deterioration of respiratory physiology during transportation and surgery. It can also be seen that anaesthesia maintenance was achieved with administration of TIVA using TCI propofol-remifentanyl.

Figure 2: Huge ovarian tumor, weighing about 17 kg, multilobulated with mixed cystic and solid content was removed.

operatively during the tumor resection. Secondly, as the ICU ventilator is not equipped with inhaled anesthetic delivery system, we adopted the TIVA technique as an alternative mean for maintenance of anesthesia. Thirdly, as APRV is a mode of ventilation that relies heavily on patient's spontaneous breathing, we had to avoid the use of NMBA during surgery. This was facilitated with the use of TIVA in the form of TCI propofol-remifentanyl which can avoid sudden movement without the use of NMBA [10].

Our case is different from the previously reported cases on anesthetic management of huge ovarian tumors [1–4]. In all of the case reports, the tumors were benign and cystic in nature, which allowed slow aspiration of the fluid before tumor resection to prevent ventilatory compromise. In our case, malignancy was suspected and as such aspiration cannot be undertaken due to the risk of disseminating malignant cells. However, the histopathological report available later showed no evidence of malignancy. Furthermore, their patients did not present in respiratory failure as our patient did. To the best of our knowledge, we are the first to report the successful use of APRV in the OR setting. Most of the available literature described its use in the postoperative period in the ICU [5, 7, 8]. We believe that we could manage the ventilation challenges in this huge ovarian tumor case successfully due to combination of preoperative optimization, timely decision to proceed with surgery, minimizing deterioration in respiratory physiology during transportation and intraoperatively with the use of APRV, and gradual weaning from ventilator post-operatively.

CONCLUSION

In the case of a huge ovarian tumor with severe respiratory failure that requires airway pressure release ventilation (APRV) mode of ventilation pre-operatively, the surgery for tumor resection can be successfully proceeded with the continuation of APRV into the intraoperative period. Based on our experience, we believe that this approach can also be applied in other types of huge intraabdominal tumors which present with similar respiratory complications.

Author Contributions

Wan Fadzlina Wan Muhd Shukeri – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Wan Mohd Nazaruddin Wan Hassan – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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