Anesthetic management of robot-assisted thoracoscopic thymectomy

Anil Karlekar, Devesh Dutta, Ravindra Saxena, Krishna Kant Sharma

Department of Anaesthesiology and Intensive Care, Fortis Escorts Heart Institute, New Delhi, India

Abstract

Myasthenia gravis (MG) is a rare disorder involving neuromuscular junction. In conjunction with medical therapy, thymectomy is a known modality of treatment of MG and has shown to increase the probability of remission and overall symptomatic improvement. For minimally invasive thymectomy, video-assisted thoracoscopic surgery has been the preferred surgical approach till recently. The robotic surgical procedure must necessarily bring new challenges to the anesthesiologists to effectively meet the specific requirements of the technique. At present, there is a paucity of literature regarding the anesthetic concerns of robotic assisted thymectomy, patient in question specifically posed a challenge since different maneuvers and techniques had to be tried to obtain optimum surgical conditions with stable ventilatory and hemodynamic parameters. Concerns of patient positioning and hemodynamic monitoring have also been discussed.

Key words: Minimally invasive, myasthenia gravis, robotic, thymectomy

Introduction

Myasthenia gravis (MG) is an autoimmune disease that affects neuromuscular transmission and results in chronic weakness and varying levels of fatigue in striated muscles. Since 1941, when Blalock first reported results of transsternal thymectomy in patients affected by MG, thymectomy has played a significant role constituting a widely accepted therapeutic option in the integrated management of MG.[1] Although various surgical approaches have been described for thymic resection, minimally invasive techniques have become increasingly popular as they offer low overall postoperative morbidity, faster recovery, shorter hospital stay and better cosmetic results when compared to conventional open techniques.

Address for correspondence: Dr. Devesh Dutta,
Department of Anaesthesiology and Intensive Care, Fortis Escorts Heart Institute, New Delhi, India.
E-mail: drdeveshdutta@yahoo.co.uk

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Case Report

A 17-year-old female, weighing 90 kg, with a diagnosis of MG was posted for robot-assisted thoracoscopic thymectomy (RATT). At admission, motor power of the limb muscles and pulmonary function tests were normal. The resting heart rate was 99/min and blood pressure was 130/90 mm Hg. Oral prednisolone 5 mg, pyridostigmine 60 mg and azathioprine 150 mg were administered on the morning of surgery. In the operating room, a 16 G venous cannula was secured in the right upper limb. 20 G cannula in left radial artery and 7 Fr double lumen catheter was inserted in right internal jugular vein under local anesthesia. An epidural catheter was also placed in left T4-T5 paravertebral space. After induction of anesthesia, trachea was intubated with a 37 Fr left sided double lumen tube (DLT) (Portex blueline endobronchial tube, smiths design Smith Medical Company, Hythe, U.K.) and lungs were ventilated with a tidal volume of 7 ml/kg and respiratory rate of 15/min. Airway pressure was 33 cm H_2O when both lungs were being ventilated. Position of DLT was confirmed with the help of fiberoptic bronchoscope. On the commencement of one lung ventilation (OLV) the airway pressure reached beyond acceptable level (up to 45-50 cm of water). Bronchial lumen was unclamped, and suction of both lumens was done and position of DLT was reconfirmed by fiberoptic bronchoscope. All these measures did not help much to decrease the airway pressure. Then it was decided to change mode of ventilation from volume control to pressure controlled ventilation-volume guaranteed (VCV to PCV), decrease the tidal volume to 5 ml/kg, and increase the respiratory rate to 17/min. These changes brought down the airway pressure up to 35 cm of water. Before the insertion of robotic arms, epidural infusion of bupivacaine (0.25% at a rate of 5 ml/h) was started. Patient was placed in a supine position with a 30° tilt to the right. There was a decrease in systolic blood pressure to 70 mm Hg after insufflation of CO_2 (15 mm of Hg) in thoracic cavity, which responded to volume infusion and reduction of CO_2 insufflation pressure (12 mm of Hg). Robotic docking took 35 min, and dissection and removal of the thymus took 55 min. Neuromuscular blockage was reversed with neostigmine 2.5 mg and glycopyrrolate 0.4 mg and trachea was extubated after adequate muscle strength observed on peripheral nerve stimulator (train-of-four ratio 0.9). Urine output during surgery was 300 ml over 120 min and blood loss was about 200 ml. After extubation, patient was shifted to the recovery room. Rest of the postoperative period was unremarkable. Bupivacaine (0.25%) infusion in thoracic epidural catheter was continued for next 8 h and pain score on visual analogue scale was satisfactory in the postoperative period. Oral prednisolone, pyridostigmine and azathioprine were started immediately on resumption of oral intake, and she was discharged next evening after surgery.

Discussion

Thymectomy for thymoma has traditionally been performed through a transsternal approach because of the excellent exposure and easy access. Over the past decade, because of growing interest in minimally invasive surgical techniques, video-assisted thoracic surgery has led to less frequent use of the classic transsternal approach. The RATT is the most recent innovation in minimally invasive thymectomy, and first RATT for the treatment of a small thymoma was performed in 2001.[2]

Robot-assisted thoracoscopic thymectomy has brought new challenges to the anesthesiologists, especially OLV with raised intrathoracic pressure and patient positioning. Preoperative preparation includes pulmonary function testing, its inference and appropriate management. Transsternal thymectomy may compromise ventilatory mechanism and this is where robotic technique has an advantage as the sternum is not disturbed and minimal bleeding occurs.

Patient positioning is a great concern, RATT requires position of the patient in such a way to allow docking of the robot, the optimal alignment and free movement of its arms. For left-sided procedures patient usually placed at the left edge of the operating table in semirecumbent position with the left side up using sand bags. The left upper limb remains in abducted, extended and externally rotated to accommodate the robotic arms. However, this position can lead to neurovascular compression and nerve injury of the left upper limb. Pandey and colleague in their case series of 17 patients undergoing RATT, suggested oximetry and arterial blood pressure monitoring in the abducted arm ipsilateral to the surgical approach. They observed that radial artery cannulaion ipsilateral to the surgical site gave a clue of vascular compression by robotic arms by showing decreased amplitude of the arterial waveform. However, authors suggest that it is not a confirmatory method for assessing the same and other more relievable monitoring like somatosensory evoked potential can be used to identify neurovascular compromise and thereby prevent injuries. The authors also suggest that ipsilateral upper limb can be kept adducted and supported along with patient in the beanbag or with the using of arm sling.[3]

One lung ventilation is special concern in robotic thymectomy and can present a challenge. Based on the critical care literature, there does not appear to be a peak airway pressure or plateau pressure level that is truly safe. A retrospective study of 197 patients undergoing pneumonectomies did, however, show that peak ventilation pressures above 40 cm H_2O were associated with the development of post pneumonectomy pulmonary edema.[4] Similarly, patients exposed to a plateau pressure of 29 cm H_2O were at significantly higher risk of developing acute lung injury after lung resection surgery than those who had a plateau pressure of 14 cm H_2O.[5] Regarding the mode of ventilation it has been suggested that use of PCV reduce peak airway pressure (Ppeak) and intrapulmonary shunt, thereby limiting the risk of barotrauma and improving oxygenation, respectively.[6,7] On the other hand, Rozé *et al.* in their study challenge the common clinical perception that PCV offers an advantage over VCV during OLV by reducing bronchial Ppeak. The authors concluded that during PCV for OLV, the decrease in Ppeak is observed mainly in the respiratory circuit and is probably not clinically relevant in the bronchus of the dependent lung.[8] However, in the present case changing the mode of ventilation from volume control to pressure control helped to achieve the decrease in airway pressure. It is a good idea to keep the peak airway pressure levels <35-40 cm H_2O and plateau pressures <25 cm H_2O to prevent intraoperative lung injury.

Postoperative analgesia is an important aspect for such patients to allow full freedom of chest movements to enable maximum respiratory dynamics and patient compliance. Others have used local infiltration of bupivacaine (0.25%), supplemented with intravenous tramadol (100 mg 8 h) and diclofenac (75 mg) in the postoperative period and such patients were found to have an acceptable visual analog scale score. Although neuraxial analgesia minimizes pain and improves postoperative ventilation, the minimally invasive nature of the procedure, local infiltration with bupivacaine combined with other analgesics may suffice to give a satisfactory pain score.

Capnomediastinum increases the central venous pressure so urine output should be considered as a good criterion for adequacy of fluid status and it is suggested that a transesophageal echo to be used under such circumstances.[9] Transient episodes of hypotension or arrhythmias may also occur during surgical dissection due to direct compression of the heart or major vessels by robotic instruments, capnomediastinum or by stretching of the pericardium. These episodes generally resolve by relieving the compression and did not require any pharmacological intervention.[3]

Conclusion

The procedure specific concerns during anesthetic management of Robot-Assisted Thymectomy are limited to airway management and patient positioning. Continuous vigilance, monitoring of airway pressure and end tidal carbon dioxide can help avoid dislodgement of the endotracheal tube as robotic arms are manipulated. Special attention should be paid to positioning of the patient after induction of anesthesia, to not only secure airway but also to protect vulnerable pressure points to avoid injury to nerves.

References

1. Blalock A, McGehee HA, Ford FR. The treatment of myasthenia gravis by removal of the thymus gland. J Am Med Assoc 1941;117:1529.
2. Jaretzki A 3rd. Thymectomy for myasthenia gravis: Analysis of controversies — Patient management. Neurologist 2003;9:77-92.
3. Pandey R, Garg R, Chandralekha, Darlong V, Punj J, Sinha R, *et al.* Robot-assisted thoracoscopic thymectomy: Perianaesthetic concerns. Eur J Anaesthesiol 2010;27:473-7.
4. van der Werff YD, van der Houwen HK, Heijmans PJ, Duurkens VA, Leusink HA, van Heesewijk HP, *et al.* Postpneumonectomy pulmonary edema. A retrospective analysis of incidence and possible risk factors. Chest 1997;111:1278-84.
5. Licker M, de Perrot M, Spiliopoulos A, Robert J, Diaper J, Chevalley C, *et al.* Risk factors for acute lung injury after thoracic surgery for lung cancer. Anesth Analg 2003;97:1558-65.
6. Tugrul M, Camci E, Karadeniz H, Sentürk M, Pembeci K, Akpir K. Comparison of volume controlled with pressure controlled ventilation during one-lung anaesthesia. Br J Anaesth 1997;79:306-10.
7. Heimberg C, Winterhalter M, Strüber M, Piepenbrock S, Bund M. Pressure-controlled versus volume-controlled one-lung ventilation for MIDCAB. Thorac Cardiovasc Surg 2006;54:516-20.
8. Rozé H, Lafargue M, Batoz H, Picat MQ, Perez P, Ouattara A, *et al.* Pressure-controlled ventilation and intrabronchial pressure during one-lung ventilation. Br J Anaesth 2010;105:377-81.
9. Chauhan S, Sukesan S. Anesthesia for robotic cardiac surgery: An amalgam of technology and skill. Ann Card Anaesth 2010;13:169-75.

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