

Postoperative phrenic nerve palsy, a cause of prolonged mechanical ventilation in trans-sternal thymectomy

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Abstract

Post trans-sternal thymectomy, the patient may develop respiratory failure, usually due to myasthenic crisis or cholinergic crisis. These crises may prolong mechanical ventilation and impede on-table extubation. We report a case of respiratory failure due to unilateral phrenic nerve palsy in a case of myasthenia gravis.

A 35 year old female, known case of myasthenia gravis was posted for trans-sternal thymectomy. Anaesthesia was induced with Propofol, Fentanyl and low dose of Atracurium. Thymoma was incasing right subclavian vein and was adherent with the pericardium, Masaoka Grade III. Blood loss was approximately 200ml. Immediate post operative period showed low tidal volume, tachypnea and tachycardia in spite of train of four ratio >0.9 . Patient was kept intubated with suspicion of myasthenic crisis and the dose of Pyridostigmine was increased, but this lead to increased cholinergic symptoms. Pain was addressed with thoracic epidural analgesia. Chest radiograph done later in the evening showed elevated right hemi diaphragm, thereby, confirming the diagnosis of phrenic nerve palsy.

Difficult dissection in this case has resulted in right phrenic nerve palsy. Phrenic nerve palsy has to be considered as a cause of respiratory failure post sternotomy thymectomy, especially in case of Masaoka grade III and IV.

Key words: Myasthenia gravis, Phrenic nerve palsy, Respiratory failure.

INTRODUCTION

Thymoma is a challenge to anaesthesiologists due to the neuromuscular junction involvement and its effect as an anterior mediastinal mass. Post operatively, patient may develop respiratory failure, usually due to myasthenic crisis or cholinergic crisis. These crises may prolong mechanical ventilation and increase ventilator dependant days. The patients, even if adequately controlled on anticholinesterases and immune suppressants, with no preoperative respiratory distress may develop post-operative respiratory failure for reasons other than myasthenic or cholinergic crisis. In this case report we would like to present a case of 35 year female who underwent trans-sternal thymectomy for myasthenia gravis (Osserman IIb)¹ developed postoperative failure requiring mechanical ventilation due to unilateral phrenic nerve palsy.

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CASE REPORT

A 35 year old housewife, weighing 65 kilograms, diagnosed with myasthenia gravis (Osserman IIb) was posted for trans-sternal thymectomy. She had a typical history of progressive limb weakness and difficulty in deglutition worsening progressively for six months. There was no history of respiratory failure. Her symptoms improved with Pyridostigmine 60mg four times daily and Prednisolone 20 mg once daily. She was Acetylcholine antibody positive. Her pulmonary function test showed mild restrictive disease [Forced Expiratory Volume 1 (FEV1): 1.6 L, Forced Vital Capacity (FVC): 1.9 L. FEV1/ FVC: 78%]. Computed Tomography chest showed a hypodense lobulated mass lesion 6.5X4.4cm in anterior mediastinum. The mass was in close relation to ascending aorta, superior vena cava deforming contour of left atrium, likely Thymoma (Figure 1). The mass was incasing right subclavian vein and adherent with the pericardium, Masaoka Grade III². There was no compression of tracheobronchial tree.

In the morning of surgery, Prednisolone was continued, but Pyridostigmine was avoided. In the operating room,

patient was monitored with ECG, noninvasive blood pressure cuff, oxygen saturation probe. Pre-induction, a thoracic epidural line was inserted at T6-T7 level. Anaesthesia was conducted with Fentanyl 2mcg/kg, titrated dose of Propofol, and Atracurium based on TOF (train of four) count. The TOF count was two before administration of Atracurium, and after Atracurium 5mg, TOF count was zero. Endotracheal intubation was done, right internal jugular vein was cannulated, right radial artery was cannulated for invasive blood pressure monitoring. Anaesthesia was maintained with Isoflurane, oxygen and air, with a minimal alveolar concentration of 1. Ventilation was maintained by Intermittent positive pressure ventilation. Epidural analgesia was started with infusion of 0.125% Bupivacaine with 2 mcg/ml of Fentanyl at the rate of 5 ml/hour. Surgery was uneventful, but surgeons complained of difficult dissection due to infiltration of tumour to the pericardium and mediastinal pleura and it was incising right subclavian vein. Atracurium was repeated when TOF= 2. Duration of surgery was two hours. Blood loss was approximately 200ml. After completion of surgery, after TOF ratio was 0.7, Neostigmine 50 mcg/kg and Glycopyrolate 10 mcg/kg was given. Patient had low tidal volume (less than 2ml/kg), tachypnea (Respiratory rate more than 40/min), heart rate more than 140 beats per minute in spite of TOF>0.9. Patient was kept intubated and suspecting myasthenic crisis, we increased the dose of Pyridostigmine but this lead to increased cholinergic symptoms. Pain was addressed with thoracic epidural analgesia. Chest radiograph done later in the evening showed elevated right hemi diaphragm (Figure 2), therefore confirming the diagnosis of phrenic nerve palsy. The difficult dissection due to higher invasion

Masaoka grade might have lead to inadvertent phrenic nerve injury. Patient had tachypnea and shallow breathing with tachycardia, hence was kept on synchronized intermittent mandatory ventilation with pressure support. Tracheostomy was done on day five. After tracheostomy, minimal sedation was required. The patient was given spontaneous breathing trials (SBT) by T-piece every day. We were gradually able to decrease the pressure support to maintain minute ventilation. Frequency of SBT was increased and also the duration in the following days. Continuous positive airway pressure (CPAP) was used when patient was off SBT. Regular chest physiotherapy was given. On 15th day patient was totally off the ventilator. Patient was shifted out from ICU on 18th day and discharged from the hospital on 22nd day of admission with tracheostomy tube in situ.

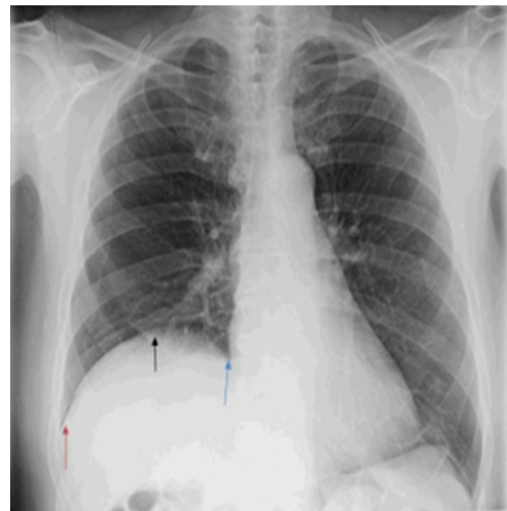


Figure 2: Chest X-ray showing elevated right hemidiaphragm (arrows).

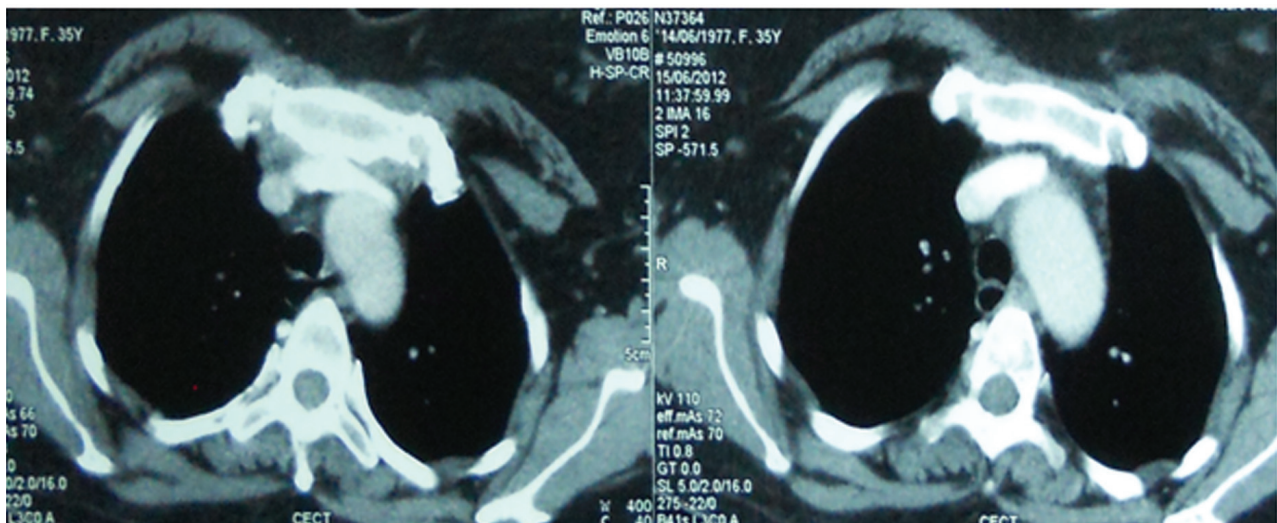


Figure 1: Contrast enhanced computed tomography showing thymoma

DISCUSSION

The myasthenic crisis is an exacerbation of myasthenia gravis, which can be caused by several different factors including respiratory infections, emotional stress and surgery. Cholinergic crisis occurs when the patient is overdosed with cholinesterase inhibitors and may show symptoms such as excessive salivation, sweating, abdominal cramps, urinary urgency, bradycardia, muscle fasciculations or muscle weakness³. Phrenic nerves run from cervical segments C3, C4 and C5 along anterior scalene muscle passing in close proximity to subclavian vein and pericardium. Phrenic nerve is vulnerable during surgery for Thymoma and its damage can lead to diaphragmatic weakness. Although incidence of phrenic nerve injury post thymectomy is rare⁴, incidence of 2% has been reported by Bulkley et al⁵ in 202 patients undergoing trans-sternal thymectomy. These patients had thymomas invading the phrenic nerve bundle. A study reported transient paralysis of the left hemidiaphragm in two patients, as a result of extended thymectomy⁶.

Prediction of need for post operative ventilation has been done by many authors. Co-existing lung disease, Pyridostigmine doses >750 mg/day, a pre-operative forced vital capacity <2.9 L⁷, severe bulbar symptoms and severe myasthenia gravis with previous respiratory crisis and cardiorespiratory disease⁸, a preoperative serum level of anti-acetylcholine receptor antibody >100 nmol/l and intraoperative blood loss >1000 ml were risk factors for postoperative mechanical ventilation^{9,10}. Our patient had mild restrictive pulmonary function, a bulbar involvement. Therefore we treated the patient in line of myasthenic crisis.

Preoperative continuation of Pyridostigmine, has been a matter of debate. The advantage of discontinuation is quicker onset of action of non-depolarizing neuromuscular blocking agent (NMBA) thus requiring a smaller dose. Different studies have used several NMBA, but there is no clear view whether to continue Pyridostigmine or not¹¹⁻¹⁴.

Some authors avoid muscle relaxants and use inhalation agents Sevoflurane or Desflurane or total intravenous anaesthesia implying early extubation. In

these cases, authors have continued Pyridostigmine perioperatively^{15,16}.

In this case we discontinued Pyridostigmine, and used Atracurium with neuromuscular monitoring. Both types of anaesthetic technique have been described without any effect on postoperative respiratory failure¹⁵.

Diaphragm plays an important role in respiration. Diaphragmatic paralysis may present as asymptomatic, symptomatic only with exercise, or respiratory insufficiency and death. Symptoms depend on the pre existing cardiorespiratory status, the extent of paralysis, unilateral or bilateral and on the nature of the paralysis, acute or chronic¹⁷. Acute onset paralysis, may lead to acute respiratory distress, severe orthopnea and fatigue leading to difficulty in weaning from mechanical ventilation.

In our patient, we had difficulty in weaning the patient from the ventilator due to unilateral phrenic nerve palsy. Patient had a restrictive lung disease, which might have contributed to the respiratory distress. In unilateral paralysis, lung function reveals mild restriction. Baseline upright vital capacity is mildly reduced (up to 80% of predicted). With bilateral disease, vital capacity may fall to 50% of predicted¹⁸. Maximal inspiratory pressures fall to 80% and 30% of predicted, with unilateral and bilateral paralysis, respectively¹⁹.

Symptoms usually diminish due to either desensitization, adaptation of accessory muscles of respiration or due to full or partial recovery of the phrenic nerve itself. No specific treatment is required for unilateral phrenic nerve palsy. Improvement has been described during follow up of months to years in various clinical settings²⁰. Although left sided phrenic nerve palsy is more common⁴, our patient had right sided palsy due to the tumour incasing right subclavian vein.

CONCLUSION

Patients of myasthenia can develop postoperative respiratory failure due to inadvertent phrenic nerve injury post trans-sternal thymectomy. This might lead to difficulty in weaning and add on to morbidity of the patient. High index of suspicion is required specially while operating on higher Masoaka grade thymoma.

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