Management of bronchial dehiscence immediately following video-assisted thoracoscopic lobectomy

Mostafa Eladawy[a,b], Leena Pardeshi[b]

[a]Department of Anesthesia and ICU, Ain Shams University, Cairo, Egypt, [b]Department of Cardiothoracic Anesthesia, Newcastle Upon Tyne Hospital, Newcastle Upon Tyne, UK

Correspondence to Mostafa Eladawy, MD, DESA, Department of Cardiothoracic Anesthesia, Freeman Hospital, 52 Church Lane, Newcastle Upon Tyne, NE77DN, UK
Tel: 0447711293011;
e-mails: mostafaeladawy.an@yahoo.com

Received 30 October 2014
Accepted 24 December 2014

The Egyptian Journal of Cardiothoracic Anesthesia 2014, 8:108–111

Bronchial dehiscence is a rare complication following lung surgery. It might be life threatening if not diagnosed and treated immediately and appropriately. This case report high-lights an immediate presentation of bronchial dehiscence in a patient after video assisted thoracoscopic lobectomy. The complication was managed initially with an emergency insertion of single lumen tube which was swapped later on to double lumen tube for a better control of the ventilation.Ventilation improved when the single lumen tube was exchanged for a double lumen tube and the patient was taken back to the Operating theatre for repair and suturing of bronchial stump.In conclusion, leakage testing inside the operating room must be given full attention and should warrant a thorough revision and reassessment of all the stumps by the surgeons, but exclusion of the leak intraoperatively does not guarantee prevention of its occurence postoperatively. Dislodgement of staples can happen and leads to deleterious effects if not treated promptly. Respiratory distress, arterial hypoxia and chest drain bubbling immediately after lung surgery should be managed with fiberoptic bronchoscopy followed by immediate intubation with double lumen tube and exclusion of the operated lung.

Keywords:
bronchopleural, fistula, lobectomy, management, video-assisted thoracoscopic surgery

Egypt J Cardiothorac Anesth 8:108–111

1687-9090

Summary

Bronchial dehiscence is a rare complication following lung surgery. It might be life threatening if not diagnosed and treated immediately and appropriately.

This is a case report that highlights an acute presentation of bronchial dehiscence following video-assisted thoracoscopic right upper lobectomy for squamous cell carcinoma. Immediately after extubation, the patient developed bilateral surgical emphysema accompanied with a decrease in arterial oxygen saturation to 60%. Breathing was laboured and there was tachypnoea and chest crackles. Endotracheal reintubation and resumption of assisted mechanical ventilation were reinstated.

It was difficult to ventilate with single-lumen tube. Arterial saturation increased slightly to 75% following positive pressure ventilation and was accompanied with metabolic acidaemia. An excessive air leak was noticed with air bubbling in the chest drainage system.

Fiberoptic bronchoscopy revealed a large defect in the right upper main bronchial stem. Ventilation improved when the single-lumen tube was exchanged for a double-lumen tube. Repair of the bronchial stump was performed through open thoracotomy and followed by uneventful recovery.

Case presentation

A 76-year-old male patient was scheduled for video-assisted thoracoscopic right upper lobectomy for a squamous cell carcinoma (stage T_{1B} N_0 M_0). He had a history of left lower lobectomy 50 years ago for bronchiectasis. Before his admission, he was complaining of shortness of breath and chest pain on moderate exertion.

His comorbidities included hypertension, type 2 diabetes, chronic obstructive pulmonary disease, bronchiectasis and a diverticular disease. He was an exsmoker and he drinks alcohol occasionally. His regular medications included amlodipine, acetyl salicylate, metformin, ipratropium, simvastatin, budesonide and formoterol inhaler.

His preoperative arterial blood gases on room-air showed a pH of 7.43, pCO_2 of 5.6 kpa, pO_2 of 8.5 kpa, HCO_3 of 28 mmol/l, base excess of +3.2 and SpO_2 of 93%.

All preoperative laboratory investigations were within normal values for his age and are detailed as follows: sodium 135 mmol/dl (normal range: 133–146), potassium 4.0 mmol/dl (3.5–5.3), calcium 1.2 mmol/l (1.1–1.25), lactate 1.1 mmol/l (<1), haematocrit 43% (40–50), normal coagulation profile, kidney functions and blood count.

His ventilation perfusion lung scan showed a 33% perfusion of the left lung and 66% of the right lung. ECG and echocardiography were within normal limits for his age.

Cardiopulmonary exercise testing and pulmonary function tests have revealed the following results: VO_2 max of 16.3 ml/kg/min (67%), forced expiratory volume in 1 s of 1.4 l (56% of predicted value) and forced expiratory volume in 1 s/forced vital capacity of 42% (58% of predicted value).

Intraoperative monitoring included five-lead ECG, Invasive blood pressure, SpO_2, central venous pressure, core temperature, $EtCO_2$, ventilator alarm, inspired and expired gases including FiO_2 and vapour analyser and urine output. Induction of general anaesthesia was performed with midazolam, fentanyl, propofol and atracurium. A left double-lumen tube (bronchocath size 37) was inserted and its position checked with a flexible fiberoptic bronchoscope.

The left lung was ventilated with a drager primus anaesthesia machine in pressure mode ventilation with the following settings (Drager Primus, Drager, Lubeck, Germany): respiratory rate of 12/min, inspiratory pressure of 24 mbar and positive end-expiratory pressure (PEEP) of 5 mbar at an FiO_2 of 60%.

After the resection of the right upper lobe, it was difficult to extract the specimen through the thorcoscopic port. The surgical team finally managed to remove it successfully following vigorous manipulation. Immediately after the extraction, bleeding was noticed through the nonventilated tracheal lumen of the double-lumen endobronchial tube.

On reinstitution of ventilation of two lungs, an air leak was noticed, which reached up to 2 l at minute ventilation of 8 l/min. Fiberoptic bronchoscopy did not reveal any defects in the bronchial stump; the surgical team was notified but no true concern was raised at that time.

On insertion of chest drain, some air bubbling was noticed in the underwater seal. Surgical team was informed again who advised putting the chest drain on suction, hoping that the leak will improve after extubation and resuming spontaneous respiration.

Just before extubation, the patient was breathing spontaneously with minimal leak, good tidal volume and with arterial saturations up to 97%. The patient was extubated in the operating room and transferred to the postanaesthesia care unit. Immediately on arrival to the postanaesthesia care unit, he started to develop laboured breathing, and his SpO_2 decreased to 65%. He developed coarse crepitations and moderate surgical emphysema was noticed bilaterally especially on the right side.

His trachea was immediately reintubated with single-lumen tube and 5 mg of furosemide was given. Positive pressure ventilation started in pressure-controlled mode at peak inspiratory pressure of 25 mbar and PEEP of 5 mbar, but ventilation through the single-lumen tube was not satisfactory, and the leak reached a peak of 6 l and adequate tidal volumes of more than 6 ml/kg could not be achieved. His arterial blood gas showed a pH of 7.1, pCO_2 of 11.6 kpa and a pO_2 of 9.6 kpa on 100% inspired oxygen. Fiberoptic bronchoscopy showed a large defect at the right upper bronchial stump through which mediastinum could be seen.

The surgical team was informed and single-lumen tube was replaced by a double-lumen tube. Ventilation parameters remained at 25 mbar of peak inspiratory pressure and PEEP of 5 mbar; on isolation of the lungs, ventilation improved markedly, expiratory tidal volume increased to more than 6 ml/kg, and subsequently the patient was taken back to the operating theatre for repair and suturing of bronchial stump. An open thoracotomy was performed. Control of the dehiscent bronchial stump was achieved successfully.

The immediate postoperative course of the patient was uneventful, except for a prolonged need for a high flow nasal oxygen supply.

Discussion

Recently, a consensus was reached on some controversial points outlining the current accepted definition of video-assisted thoracoscopic surgery (VATS) lobectomy, its indications and contraindications, perioperative clinical management and recommendations for training and future research directions [1].

VATS has established itself well over the years in the field of thoracic surgery [2]. In our institute, the VATS procedures constitute about one-third of all thoracic surgical procedures and the surgeons have improved their safety profile considerably. The scope of thoracoscopic surgery now encompasses a wider range of procedures – for example, lobectomies, pneumonectomies, segmentectomies and even oesophagogastrectomy.

The rate of complications is relatively low, and commonly documented complications after VATS procedures are more or less the same as after thoracotomy procedures; air leakage, bleeding, infection, postoperative pain,

port-site recurrence and need for conversion to thoracotomy are among the anticipated postoperative complications. Shigemura *et al.* [3] demonstrated that patients undergoing lobectomy and lymph node dissection with VATS had less blood loss, faster recovery, shorter hospitalization and longer operating times than did patients undergoing lobectomy with the open approaches.

Tristan and his group confirmed these findings and showed that there were no significant statistical differences between VATS and open lobectomy in terms of postoperative prolonged air leak, arrhythmia and pneumonia mortality. VATS did not demonstrate any significant difference in locoregional recurrence, as compared with the open lobectomy arm, but the data suggested a reduced systemic recurrence rate (P = 0.03) and an improved 5-year mortality rate of VATS (P = 0.04) [4].

Although VATS lung surgeries especially lobectomies are shown to have significantly lower rate of complications compared with open lobectomies in general, they carry a higher incidence of prolonged air leak (>7 days). This results in longer use of chest drainage and even Heimlich valve at discharge [5].

The reoperation rates for major bleeding (>500 ml) and need for blood transfusion are not significantly different. Conversion rate from VATS to open has been shown to be 2–6% with bleeding accounting for only a minority of conversions. VATS lobectomy often requires an emergency conversion to thoracotomy, for example, in the event of massive bleeding. Most severe intraoperative complications were related to the injury of major pulmonary vessels (9/10), and most of these complications occurred during upper lobectomy (8/10) [5].

There have been reports of catastrophic intraoperative deaths. These cases included main pulmonary arterial and venous transection requiring reanastomosis, unplanned pneumonectomies, unplanned bilobectomy, tracheoesophageal fistula, membranous airway injury to the bronchus intermedius, complete staple line disruption of the inferior pulmonary vein, injury to the azygos/superior vena cava junction and splenectomy. Incidence of postoperative pain is much less, resulting in better functional outcome [6].

Multivariate analysis has shown squamous cell carcinoma, preoperative chemotherapy, lower lobectomy and middle and lower lobectomy as risk factors for bronchopleural fistula. It has been recommended that, in such cases, particular care must be exercised to maintain blood flow through the bronchial stump during surgery and to use reinforcement techniques such as stump coverage [7].

Our case has shown a rare, life-threatening complication of VATS lobectomy occurring during the immediate postoperative period. Limited surgical access, especially in upper lobectomies, may lead to inadequate check for air leak by the surgeon as demonstrated by this case. An anaesthetist should be more vigilant at the time of extubation and recovery period and should actively seek for evidence of air leak. To our knowledge, no consensus has been reached about the acceptable volume of air leak after this type of surgery; active and rapid management with isolation of lung and surgical exploration should be performed to prevent severe deterioration in respiratory complications. Our surgical team suspected slippage of surgical staples leading to a large defect in the right upper bronchial stump.

Sohasky and colleagues reported an acute life-threatening surgical complication of VATS, which was first suspected by inordinately increasing $EtCO_2$ (a five-fold increase) intraoperatively. In this instance, increase of $EtCO_2$ was due to an iatrogenic major airway injury during surgical dissection. They have stressed that successful outcome highlights the vigilance of the anaesthesia team, knowledge of the surgical procedure and close communication with the surgeons [8].

Flores and colleagues reported that catastrophic intraoperative complications of VATS lobectomy are uncommon. However, awareness of the possibility of such injuries is critical to avoid them, and development of specific management strategies is necessary to limit morbidity [9].

Conclusion

Leakage testing inside the operating room must be given full attention and should warrant a thorough revision and reassessment of all the stumps by the surgeons. An acceptable leak of less than 20% of the minute volume necessitates a close follow-up to detect any increase in the leak needing a revision with fiberoptic bronchoscopy. Vigorous manipulation and extraction of lobes through thoracoscopic ports can sometimes have deleterious effects and dislodgement of staples. Respiratory distress, arterial hypoxia and chest drain bubbling immediately after lung surgery should be managed with fiberoptic bronchoscopy followed by immediate intubation with double-lumen tube and exclusion of the operated lung.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

1 Yan TD, Cao C, D'Amico TA, Demmy TL, He J, Hansen H, *et al.* International VATS Lobectomy Consensus Group Video-assisted thoracoscopic surgery lobectomy at 20 years: a consensus statement., Eur J Cardiothorac Surg 2014; 45:633–639.

2 Solaini L, Prusciano F, Bagioni P, di Francesco F, Solaini L, Poddie DB. Video-assisted thoracic surgery (VATS) of the lung: analysis of intraoperative and postoperative complications over 15 years and review of the literature. Surg Endosc 2008; 22:298–310.

3 Shigemura N, Akashi A, Funaki S, Nakagiri T, Inoue M, Sawabata N, *et al.* Long-term outcomes after a variety of video-assisted thoracoscopic lobectomy approaches for clinical stage IA lung cancer: a multi-institutional study. J Thorac Cardiovasc Surg 2006; 132:507–512.

4 Yan TD, Black D, Bannon PG, McCaughan BC. Systematic review and meta-analysis of randomized and nonrandomized trials on safety and efficacy of video-assisted thoracic surgery lobectomy for early-stage non-small-cell lung cancer. J Clin Oncol 2009; 27:2553–2562.

5 Sawada S, Komori E, Yamashita M. Evaluation of video-assisted thoracoscopic surgery lobectomy requiring emergency conversion to thoracotomy. Eur J Cardiothorac Surg 2009; 36:487–490.

6 Ilonen IK, Räsänen JV, Knuuttila A, Salo JA, Sihvo EI. Anatomic thoracoscopic lung resection for non-small cell lung cancer in stage I is associated with less morbidity and shorter hospitalization than thoracotomy. Acta Oncol 2011; 50:1126–1132.

7 Nagahiro I, Aoe M, Sano Y, Date H, Andou A, Shimizu N. Bronchopleural fistula after lobectomy for lung cancer. Asian Cardiovasc Thorac Ann 2007; 15:45.

8 Sohasky J, Chimbira WT, Nafiu OO. Intraoperative bronchopleural fistula during thoracoscopic lobectomy: the role of end-tidal CO_2 monitoring. A&A Case Rep 2013; 1:52–53.

9 Flores RM, Ihekweazu U, Dycoco J, Rizk NP, Rusch VW, Bains MS, *et al.* Video-assisted thoracoscopic surgery (VATS) lobectomy: catastrophic intraoperative complications. J Thorac Cardiovasc Surg 2011; 142:1412–1417.