



Borderline pneumothorax

Teodor Horvath¹, Petr Moravcik¹, Ladislav Mitas¹, Kristian Brat², Kamil Hudacek³, Vladimir Can¹, Martina Dia⁴, Dominika Ivanicka¹, Jaroslav Ivicic¹, Vaclav Kalis³, Alzbeta Kodytkova¹, Jitka Kratochvilova³, Adam Krenek¹, Lukas Majercak⁵, Zdenek Merta², Petra Penazová¹, Pavla Petr Dostalova⁶, Marek Plutinsky², Rudolf Rindos⁷, Michal Sochor¹, Pavel Vyslouzil¹, Zdenek Kala¹, Jindrich Vomela¹

¹Department of Surgery, ²Department of Lung Disease and Tuberculosis, ³Department of Anesthesiology, Resuscitation and Intensive Care Medicine, Faculty Hospital Brno and Faculty of Medicine Masaryk University, Brno, Czech Republic; ⁴Specialised Health Resort, Jevicko, Czech Republic; ⁵Department of Surgery, Nemocnice Ivančice, Ivančice, Czech Republic; ⁶Nemocnice Nove Mesto na Morave, Pulmonary Out Patient Centre, Nove Mesto na Morave, Czech Republic; ⁷Department of Thoracic Surgery, Ruzinov Hospital, Bratislava, Slovakia

Contributions: (I) Conception and design: T Horvath, P Moravcik, L Mitas, K Brat, K Hudacek; (II) Administrative support: K Brat, Z Kala; (III) Provision of study materials or patients: V Can, M Dia, P Petr Dostalova, J Ivicic, Z Merta, M Plutinsky, R Rindos, J Vomela; (IV) Collection and assembly of data: D Ivanicka, V Kalis, J Kratochvilova, A Kodytkova, A Krenek, L Majercak, P Penazova, M Sochor, P Vyslouzil; (V) Data analysis and interpretation: T Horvath, L Mitas, P Moravcik; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Dr. Teodor Horvath. Department of Surgery, Faculty Hospital Brno, Jihlavská 20, CZ-62500 Brno, Czech Republic.

Email: thahorvath@hotmail.com.

Abstract: Extraordinary demanding case requires creative solution within expenditure of intellectual energy supported by mature experience, and discerning intuition. This all with single rule: patients benefit. Previous and subsequent sharing and exchange yield full-blown versatility. Pneumothorax in breastfeeding mother, brachial plexus injury caused by lysis of apical adhesions, support of pulmonary plication by autologous fascia lata in advanced pulmonary emphysema, dorsal chest tube insertion through first intercostal space, stubborn pneumothorax in a musician of brass band, successful conservative treatment by chest tube as an alternative of thoracoplasty, talc slurry solution in elderly man with life threatening pneumothorax from advanced lung cancer decay cavity, and in young woman afflicted by lymphangiomyomatosis (LAM) are briefly reported.

Keywords: Pneumothorax; pulmonology; surgery

Received: 30 July 2019; Accepted: 14 August 2019; Published: 27 August 2019.

doi: 10.21037/vats.2019.08.02

View this article at: <http://dx.doi.org/10.21037/vats.2019.08.02>

Introduction

Routine treatment in patients with pulmonary pathology is performed by video-assisted thoracic surgery (VATS) (1,2). VATS's good reputation arising from a synthesis of tradition and healthy experimentation is further improved by improvements in non-intubated modifications (NIVATS) using epidural anesthesia (3), intercostal nerve blocks and vagal blockade even in anatomical resections (4) and the uniportal method (5). Nevertheless VATS has some limitations and certain risks as with any other method. Some questions remain unanswered and others require updated answers. Let us evaluate the following briefly:

(I) A breastfeeding mother;

- (II) Brachial plexus;
- (III) Massive postoperative subcutaneous emphysema;
- (IV) Apical occurrence;
- (V) Pleural porosity;
- (VI) Pulmonary tuberculosis;
- (VII) Advanced lung cancer;
- (VIII) System disease.

A breastfeeding mother

In the first case, a breastfeeding mother [40] of Balkan descent presented dyspnoea in the right side of the pneumothorax for approximately six months. This was

initially unsuccessfully treated with a thoracic tube primary underwater sealed, then supported by active suction. Next, a non-intubated video-assisted procedure was performed. Ruptured bullae in the apical segment of the upper lobe and the mediobasal segment of the lower lobe were found and resected. On the basis of physiological operative no pleural abrasion was performed. Incomplete reinflation of the lung with due to a mild air leak during the postoperative period required light active suction. Pulmonary parenchyma was completely ruled out on the eighth postoperative day. No air leak was recorded. The mother, in good spirits and with restored breathing function, was discharged from hospital on the tenth postoperative day. No interruption of breastfeeding was required. Two years after the operation, a follow-up physiological examination indicated normal postoperative pulmonary function and a normal CT scan.

Brachial plexus

Hundreds of papers have been written and published on postoperative dysesthesia and/or partial palsy of the upper arm after thoracic surgery. Any neurologist would say that C8Th1 radiculopathy can result from the lateral decubital position of the patient during the operation. There is no doubt about the potential for brachial plexus injury caused by lysis of apical pleural adhesions by electrocautery, resulting in a preganglionic partial lesion of the lower trunk. These two insidious results are unpleasantly linked. However, with careful and delicate preparation of this sensitive area, the marginal wedge resection of the adhered lung apex retained *in situ* onto the thoracic wall, can be a secure solution for any subsequent issues. This was shown in our case of a female patient, aged 32, with recurrent pneumothorax with large apical adhesions treated successfully by VATS.

Massive postoperative subcutaneous emphysema

A lobectomy of the right upper lung with squamous cell carcinoma using the Overholt procedure was performed in a heavy (6) smoker [61] with advanced pulmonary emphysema and limited pulmonary function. Lysis of numerous adhesions was needed. Over the next several hours after the operation, massive subcutaneous emphysema developed. Radical long subclavicular skin incisions were made. Although these incisions are usually sufficient in

solving subcutaneous emphysema, after several more hours, they proved inefficient, and respiratory insufficiency worsened. Despite intense active suction through both thoracic tubes, the residual pulmonary parenchyma partially collapsed. Surgical revision was indicated. Multiple pulmonary plications were performed, each one augmented with a free strip of autologous fascia lata, and a solution was achieved. Three weeks later the patient was discharged from the hospital. The patient ceased smoking, and after a short recovery period and his refusal to undergo adjuvant chemotherapy, he returned to his business as a general practitioner in the southeastern part of the country. Five years later he passed away by general spread of the cancer.

Apical occurrence

A suprascapular chest tube inserted vertically through the first intercostal space in the middle of the equilateral triangle created by the spinous processes of the vertebral column, the upper edge of the scapula, and the anterior margin of the trapezius muscle is not often used. However, this is a secure and effective way of performing apical pneumothorax treatment. In this case, a 66-year-old female smoker (1PPD 40 y) was given a VATS upper lobectomy due to lung cancer. Two chest tubes were inserted to deal with postoperative air leakage from the lung's parenchyma. Three days after the surgery, air leakage was still present and the pneumothorax worsened. On the tenth postoperative day a significant pneumothorax was still present. Considering that standard chest drainage in this patient had failed, we decided to remove the chest tubes entirely and to treat the pneumothorax with a new chest tube inserted in the suprascapular manner described above with an excellent anatomical, functional and aesthetic result. On the fourteenth postoperative day, the lungs remained completely re-inflated after removal of the newly inserted chest tube.

Pleural porosity

The particular mechanisms (anatomical, atmospheric, behavioural, mechanical, physiopathological, surgical) by which recurrent pneumothorax develops are still open to debate (7), an active musician [44] of a well-known brass band was treated for recurrent unilateral spontaneous pneumothorax with a tube thoracostomy. Then, VATS pleural abrasion was performed with electrocautery

ablation of small pleural blebs which were found during the operation. A short time after the VATS procedure pneumothorax occurred again supradiaphragmatically. We then followed the autologous blood pleurodesis procedure by Robinson (8), using a pointed thoracostomy tube, though this procedure was unsuccessful. Open surgery was ultimately considered. A parietal pleurectomy was performed and sufficient time for healing was given. The patient then returned to playing the trombone, and two years later he still does not experience any difficulties.

Pulmonary tuberculosis

We detected three spicular opacities in the right upper lobe with Quantiferon level within the grey zone, negative sputum examination, negative bronchoscopy and normal level of tumor markers in a former smoker [63] 1PPD 38 y with chronic obstructive pulmonary disease (COPD) IIIB, who was losing weight. A pulmonary resection was recommended. It became clear that a right upper lobectomy with wedge resection of the top of the sixth segment is needed, as, due to adherence to the apical posterior segment. A massive air leak occurred after the operation, though while the patient was still in the operating theatre. During the immediate revision, the destruction of the membranous portion of the medium bronchus was found and a middle lobectomy performed. The postoperative period was turbulent due a prolonged air leak and subcutaneous emphysema. Thoracic tubing was extracted on the eleventh postoperative day. Latent tuberculosis was verified histopathologically: granulomas with caseous nekrosis and BK positivity. Antituberculotics, particularly nidrazid, benemicin, pyrazinamid, and sural, were administered. After three weeks in the Department of Pulmonology and Tuberculosis, the patient was transferred to lung health resort. Five weeks later a massive localised subcutaneous emphysema appeared and the patient was referred back to surgery. Thoracoplasty was discussed, but not needed. Conservative treatment using a water-sealed thoracic tube was successful. A fifteen-month period of follow-up showed a stable state in the patient as the patient resumed his normal activities from prior to the operation.

Advanced lung cancer

An elderly man [67] with advanced lung cancer in the

right lower lobe with a decay cavity as a source of repeated pneumothorax was debated as a desperate case. A simple therapeutic strategy was used: Treating the pneumothorax involved a water-sealed Ch24 thoracic tube inserted through the second intercostal space. Full re-expansion of the pulmonary parenchyma was achieved with mild active suction. The next day, talc slurry—15 grams of talc in 50 milliliters of physiological solution—was administered and washed down with 30 milliliters of saline through the thoracic tube with no issues. The drain was clamped for fifty minutes. Active suction with 10 cm on the water column was applied for 24 hours. Then, the drain was extracted. An observation in the medical ward several days later found no signs of the recurrence of the pneumothorax and the patient was discharged. Within one year he had successfully resumed his normal social activities.

System disease

A young woman [25] with many years of anti-estrogen treatment of lymphangioliomyomatosis (LAM) was referred to surgery with breathing difficulties caused by left-sided pneumothorax. Routine pleural abrasion by VATS was performed in February 2015. Three months later she again reported recurrent left-sided pneumothorax and was somewhat disappointed in and distrustful of surgery. With psychological assistance, we obtained her informed consent for chemical pleurodesis and talc slurry. Chemical pleurodesis by tigecycline (International Nonproprietary Name i.e., INN) was unsuccessful. Next, the talc slurry procedure by thoracic tube was carried out repeatedly and successfully over the next ten days with an increasing dose of 5 and 15 grams. No side effects were observed. Approximately two years later she arrived again presenting dyspnoea and right-sided thoracic pain from right-sided pneumothorax. She refused pleural abrasion but accepted the talc slurry procedure. This was extremely painful and required relief by anodyne, and was accompanied by fever and shaking palsy, but was entirely successful. Over the next eighteen months, no relapse of the pneumothorax (PNO) was reported, despite several attacks of influenza.

Discussion

These cases represent a concentrated collection of examples of treatment possibilities. They only represent a possible

entry for management, without any claims as to efficacy. We always welcome further or alternative interpretations.

Improving the management of pneumothorax has, in our opinion, both global and specific implications. There is no doubt of the support for the idea of placing a thoracic drain more optimally (9-11) and to choose an appropriate VATS or open approach for pneumothorax treatment (12,13) which is generally correct or optimal. At the same time, there is a need to consider unique and subtle details for adequate treatment in individual patients. This collection of cases attempts to achieve this goal. Other examples are certainly available. Lastly, another demand emerges: to put a single issue into harmony with the whole without a prearranged opinion, completed system, outright principle, or closed planning. This means accepting unique surgical realities, utilizing the long-established global experience, while evaluating each case with an open mind to alternative treatments and possibilities.

Conclusions

No collective authority can remove from any individual surgeon *the personal responsibility* for the actual treatment given to the patient.

Acknowledgments

Sincere thanks to Mr. Jiri Kral, MD, Chairman Emeritus of Department of Thoracic Surgery of Masaryk Hospital Usti nad Labem.

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editors (Jin-Shing Chen, Ke-Cheng Chen and Mong-Wei Lin) for the series “VATS: Primary Spontaneous Pneumothorax” published in *Video-Assisted Thoracic Surgery*. The article has undergone external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/vats.2019.08.02>). The series “VATS: Primary Spontaneous Pneumothorax” was commissioned by the editorial office without any funding or sponsorship. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

References

1. Roviario G, Rebuffat C, Varoli F, et al. Major pulmonary resections: Pneumonectomies and lobectomies. *Ann Thorac Surg* 1993;56:779-83.
2. McKenna RJ Jr. Lobectomy by video-assisted thoracic surgery with mediastinal node sampling for lung cancer. *J Thorac Cardiovasc Surg* 1994;107:879-81; discussion 881-2.
3. Mineo TC. Epidural anesthesia in awake thoracic surgery. *Eur J Cardiothorac Surg* 2007;32:13-9.
4. Chen JS, Cheng YJ, Hung MH, et al. Nonintubated thoracoscopic lobectomy for lung cancer. *Ann Surg* 2011;254:1038-43.
5. Gonzalez-Rivas D, De La Torre M, Mosquera VX, et al. Single-port video-assisted thoracoscopic left upper lobectomy. *Interact Cardiovasc Thorac Surg* 2011;13:539-41.
6. Wilson D, Wakefield M, Owen N, et al. Characteristic of heavy smokers. *Prev Med* 1992;21:311-9.
7. Noppen M, Stratakos G, Verbanck S, et al. Fluorescein-enhanced autofluorescence thoracoscopy in primary spontaneous pneumothorax. *Am J Respir Crit Care Med* 2004;170:680-2.
8. Robinson CL. Autologous blood for pleurodesis in recurrent and chronic spontaneous pneumothorax. *Can J Surg* 1987;30:428-9.
9. Kartoun U. Improving the management of spontaneous pneumothorax. *Eur Respir J* 2018;52:1801857.
10. Porcel JM. Improving the management of spontaneous pneumothorax. *Eur Respir J* 2018;52:1801918.
11. Miller KS, Sahn SA. Chest Tubes Indications, Technique,

- Management and Complications Chest 1987;91:258-64.
12. Sakurai H. Videothoroscopic surgical approach for spontaneous pneumothorax: review of the pertinent literature. World J Emerg Surg 2008;3:23.
 13. Ruckley CV, McCormac RJM. The management of spontaneous pneumothorax. Thorax 1966;21:139-44.

doi: 10.21037/vats.2019.08.02

Cite this article as: Horvath T, Moravcik P, Mitas L, Brat K, Hudacek K, Can V, Dia M, Ivanecka D, Ivicic J, Kalis V, Kodytkova A, Kratochvilova J, Krenek A, Majercak L, Merta Z, Penazová P, Petr Dostalova P, Plutinsky M, Rindos R, Sochor M, Vyslouzil P, Kala Z, Vomela J. Borderline pneumothorax. Video-assist Thorac Surg 2019;4:19.