Tracheal fistula repair with stent placement after failure of reconstruction with muscle tissue. A lung cancer surgery complication

Paul Zarogoulidis a, b, *, Stavros Tryfon c, Maria Saroglou c, Dimitris Matthaios d, Kosmas Tsakiridis e, Haidong Huang f, Chong Bai f, Wolfgang Hohenforst-Schmidt g, Dimitris Hatzibougias h, Evaggelia Athanasiou h, Electra Michalopoulou-Manoloutsiou h, Ioannis Mpoukovinas i, Aris Ioannidis j, Christoforos Kosmidis k

a Pulmonary Department, "Bioclinic" Private Hospital, Thessaloniki, Greece
b 3rd University General Hospital, "AHEPA" University Hospital, Thessaloniki, Greece
c Pulmonary Department, "G. Papanikolaou" General Hospital, Aristotle University of Thessaloniki, Greece
d Oncology Department, General Hospital of Rhodos, Rhodes, Greece
e Thoracic Surgery Department, "Interbalkan" European Medical Center, Thessaloniki, Greece
f Department of Respiratory & Critical Care Medicine, Changhai Hospital, The Second Military Medical University, Shanghai, China
g Sana Clinic Group Franken, Department of Cardiology / Pulmonology / Intensive Care / Nephrology, "Hof" Clinics, University of Erlangen, Hof, Germany
h Microdiagnostics® Private Pathology Lab, Thessaloniki, Greece
i Oncology Department, "Bioclinic" Private Hospital, Thessaloniki, Greece
j Surgery Department, "Genesis" Private Clinic, Thessaloniki, Greece

ARTICLE INFO

Keywords:
Lung cancer
Stent
Bronchoscopy
Rigid bronchoscope
EBUS-TBNA
Fistula

ABSTRACT

A report a case of a 63 year old male diagnosed with lung cancer adenocarcinoma. The patient had a right paratracheal mass diagnosed with EBUS-TBNA 22G. The patient had surgery, however 7 days after the billau catheter was removed pneumothorax was diagnosed which did not resolved. Bronchoscopy reveled two minor fistulas in the interior wall of the trachea. An additional surgery was performed in order to add muscle patches on the exterior part of the trachea. Unfortunately additional stent placement was placed after a silicon stent since the muscle patches failed. We chose a metallic auto expandable stent since after three months of follow up a small metastastic lesion was observed in the liver. Stent placement is an option for these patients and the right stent has to be placed for each case.

1. Introduction

Surgery is the best option for early stage lung cancer patients [1]. Therefore screening is essential for high risk patients [2]. Video assisted surgery (VATS) is commonly used in most tertiary hospitals [3]. Another method is the use of robotic assistance, however; the cost is much higher than VATS [3]. Lung cancer staging is performed with positron emission tomography (PET-CT) and endobronchial ultrasound-convex probe (EBUS-TBNA) [4]. Currently with VATS complications are limited, however; there are cases where local interventions are necessary to resolve the problem. Lately endobronchial valves have been used to resolve air-leaks from small fistulas [5]. Thoracic surgeons have been using extrathoracic pedicled muscle flaps in order to cover non-malignant tracheal or bronchial fistulas for several years [6].

Tracheal stents can be used to block air-leaks, small or large. The issue is usually to choose the right material, silicon or metallic (covered) [7–9]. We have also stents that are covered with drug eluting agents in order to induce locally cancer apoptosis or block fibrinus tissue formation [10–12]. The procedure of stent placement is easy and currently companies and experts in the field are focusing in 3D customized stents [13].

2. Case presentation

We report the case of a 63 year old male diagnosed with lung cancer adenocarcinoma with EBUS-TBNA 22G needle. The patient had a right paratracheal mass diagnosed with EBUS-TBNA 22G (Figs. 1 and 2.). The patient had surgery a right pneumonetctomy, however after 7 days when the billau catheter was removed pneumothorax was diagnosed

* Corresponding author. 3rd University General Hospital, "AHEPA" University Hospital, Thessaloniki, Greece.
E-mail address: pzarog@hotmail.com (P. Zarogoulidis).
which did not resolved. Bronchoscopy reveled two minor fistulas in the interior wall of the trachea (Fig. 3.). An additional surgery was performed in order to add a muscle flap patch on the exterior part of the trachea (Fig. 4.). Unfortunately additional stent placement was placed after a silicon stent since the muscle patches failed (Fig. 5.). We chose finally a metallic auto expandable stent since after three months of follow up a small metastatic lesion was observed in the liver (Figs. 6 and 7.). Stent placement is an option for these patients and the right stent has to be placed for each case. After one year of follow up small granulomas have been observed in parts of the stents, however without local cancer recurrence. The patient had a biopsy of the initial metastatic liver lesion and with PD-L1 expression 90% is under immunotherapy with pembrolisumab for 9 months with complete disease control (see Fig. 8).

3. Discussion

Lung cancer screening is were nowadays focus for patients with smoking habit, ≥ 50 years of age and chronic obstructive pulmonary disease (COPD) [2]. We have novel diagnostic tools such the Radial Endobronchial ultrasound, endobronchial ultrasound-convex probe,
electromagnetic navigation and cone beam ct [14–21]. Pet-ct and endobronchial ultrasound convex probe is currently used for lung cancer staging [4,22]. Video assisted thoracic surgery is the most methodology for lung cancer practice. Regarding patients with disease relapse especially in non-small cell lung cancer adenocarcinoma -we have to acquire biopsy in order investigate epidermal growth factor receptor (EGFR), anaplastic lymphoma kinase (ALK), proto-oncogene B-Raf (BRAF), proto-oncogene-1 (ROS-1), RET proto-oncogene (RET) and programmed death-ligand 1 (PD-L1) [23,24]. Our patient had only a liver lesion as disease relapse and he was only positive for PD-L1 90%, and therefore we initiated pembrolisumab 200mg every 20 days as treatment. We have performed again PET-CT evaluation for re-staging as we did initially and the lesion is not currently active, however; we will continue immunotherapy treatment and follow-up. Patients with this profile of complete disease response have been evaluated in clinical trials and they can receive immunotherapy for at least two years. Then it is up to the

Fig. 3. Blue arrows indicate the fistulas. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Fig. 4. Schematic demonstration for the muscle flap placement.
oncology council if the patient has still disease complete response to stop the treatment and be under close follow-up [25]. Regarding the proper stent, we chose a silicon stent as an initial material since we did not have a disease relapse, however; afterwards we inserted a metallic stent since this is the proper material when we have disease relapse and malignancy [26]. The metallic stent is more difficult to remove, as it has to be destroyed. Regarding this patient we could leave the silicon stent, since we have complete disease control [27,28].

**Declaration of competing interest**

The authors declare no conflicts of interest.
References

[1] R.U. Osarogiagbon, R. Rami-Porta, M.S. Tsao, et al., The international association for the study of lung cancer (IASLC) molecular database project: objectives, challenges and opportunities, J. Thorac. Oncol. (2021) official publication of the International Association for the Study of Lung Cancer.

[2] G. Tringali, G. Milanese, R.E. Ledda, U. Pastorino, N. Sverzellati, M. Silva, Lung cancer screening: evidence, risks, and opportunities for implementation, Röfo : Fortschritte dem Geb. Rontgenstrahlen Nucl. (2021).

[3] R. Gullo, C.M. Gagliardo, M. Palazzolo, et al., Postoperative outcomes, lymph node dissection and effects on costs among thoracotomy, video-assisted and robotic-assisted lobectomy for clinical stage I non-small cell lung cancer, Minerva surgery 76 (1) (2021) 80–89.

[4] A. Al-Ibraheem, N. Hirmas, S. Fanti, et al., Impact of (18)F-FDG PET/CT, CT and EBUS/TBNA on preoperative mediastinal nodal staging of NSCLC, BMC Med. Imag. 21 (1) (2021) 49.

[5] A. Fiorelli, A. D’Andrilli, R. Cancone, et al., Unidirectional endobronchial valves for management of persistent air-leaks: results of a multicenter study, J. Thorac. Dis. 10 (11) (2018) 6158–6167.

[6] P. Ronkopfova, J.Y. Perentes, M. Schafer, et al., Repair of challenging non-malignant tracheo- or broncho-oesophageal fistulas by extrathoracic muscle flaps, Eur. J. Cardio. Thorac. Surg.: official journal of the European Association for Cardio-thoracic Surgery 51 (5) (2017) 844-853.

[7] P. Zarogoulidis, K. Sapalidis, C. Kosmidis, et al., Stents for small airways: current practice, Expet Rev. Respir. Med. 14 (10) (2020) 969–972.

[8] W. Hohenforst-Schmidt, B. Linsmeier, P. Zarogoulidis, et al., Transtracheal single-point stent fixation in postracheostomy tracheomalacia under cone-beam computer tomography guidance by transmural suturing with the Berci needle - a perspective on a new tool to avoid stent migration of Dumon stents, Therapeut. Clin. Risk Manag. 11 (2015) 837–850.

[9] W. Hohenforst-Schmidt, P. Zarogoulidis, G. Pitsiou, et al., Drug eluting stents for malignant airway obstruction: a critical review of the literature, J. Canc. 7 (4) (2016) 377–390.

[10] P. Zarogoulidis, K. Darwiche, R. Walter, et al., Research spotlight: sirolimus-coated stents for airway tracheal stenosis: a future 3D model concept with today’s knowledge, Ther. Deliv. 4 (9) (2013) 1093–1097.

[11] P. Zarogoulidis, K. Darwiche, K. Tsakiridis, et al., Learning from the cardiologists and developing eluting stents targeting the mtor pathway for pulmonary application; A future concept for tracheal stenosis, J. Mol. Genet. Med. : Int. J. Biosmed. Res. 7 (2013) 65.

[12] R.F. Walter, P. Zarogoulidis, F.D. Mairinger, et al., Cell viability of fibroblasts to pifenidone and sirolimus: a future concept for drug eluting stents, Int. J. Pharm. 466 (1–2) (2014) 38–43.

[13] S.E. Shai, Y.L. Lai, Y.W. Hung, et al., De novo cartilage growth after implantation of a 3-D-printed tracheal graft in a porcine model, Am. J. Tourism Res. 12 (7) (2020) 3728–3740.

[14] P. Zarogoulidis, H. Huang, C. Bai, et al., Endobronchial ultrasound convex probe for lymphoma, sarcoidosis, lung cancer and other thoracic entities. A case series, Respiratory medicine case reports 22 (2017) 187–196.

[15] B. Zaric, V. Stojsic, T. Sarcev, et al., Advanced bronchoscopic techniques in diagnosis and staging of lung cancer, J. Thorac. Dis. 5 (Suppl 4) (2013) S359–S370.
[16] W. Hohenforst-Schmidt, P. Zarogoulidis, T. Vogl, et al., Cone beam computer tomography (CBCT) in interventional chest medicine - high feasibility for endobronchial realtime navigation, J. Canc. 5 (3) (2014) 231–241.

[17] W. Hohenforst-Schmidt, R. Banckwitz, P. Zarogoulidis, et al., Radiation exposure of patients by cone beam ct during endobronchial navigation - a phantom study, J. Canc. 5 (3) (2014) 192–202.

[18] Z. Huang, H. Huang, Y. Ning, et al., Radial probe endobronchial ultrasound assisted conventional transbronchial needle aspiration in the diagnosis of solitary peribronchial pulmonary lesion located in the segmental bronchi, J. Canc. 10 (3) (2019) 634–642.

[19] B. Zaric, V. Stojic, V. Carapic, et al., Radial endobronchial ultrasound (EBUS) guided suction catheter-biopsy in histological diagnosis of peripheral pulmonary lesions, J. Canc. 7 (1) (2016) 7–13.

[20] H. Haidong, N. Yunye, Z. Wei, et al., Multiple guided technologies based on radial probe endobronchial ultrasound for the diagnosis of solitary peripheral pulmonary lesions: a single-center study, J. Canc. 8 (17) (2017) 3514–3521.

[21] K. Sapalidis, K. Romanidis, P. Oikonomou, et al., Convex endobronchial ultrasound: same coin, two faces. Challenging biopsy and staging for non-small-cell lung cancer, Lung cancer management 8 (4) (2020) LMT20.

[22] K. Zarogoulidis, D. Latsios, K. Porpodis, et al., New dilemmas in small-cell lung cancer TNM clinical staging, OncoTargets Ther. 6 (2013) 539–547.

[23] N. Tsoulos, E. Papadogoulou, V. Metaxa-Mariatou, et al., Tumor molecular profiling of NSCLC patients using next generation sequencing, Oncol. Rep. 38 (6) (2017) 3419–3429.

[24] K. Zarogoulidis, P. Zarogoulidis, K. Darwiche, et al., Treatment of non-small cell lung cancer (NSCLC), J. Thorac. Dis. 5 (Suppl 4) (2013) S389–S396.

[25] M. Perna, V. Scotti, P. Ciammella, et al., The NIPRO Study: an Observational, Retrospective, Multicenter Study on the Safety of the Radiotherapy and Immunotherapy Combination for Advanced-Stage NSCLC, Clinical lung cancer, 2021.

[26] D. Himeji, G.I. Tanaka, C. Fukuyama, et al., Severe tracheal stenosis after first administration of pembrolizumab rescued by Dumon Y-stent in a lung cancer patient, Respiratory medicine case reports 28 (2019) 100923.

[27] D. Himeji, G.I. Tanaka, C. Fukuyama, et al., Endobronchial metastasis of ovarian cancer rescued by tumor ablation and a self-expanding hybrid stent: a case report and review of the literature, Respiratory medicine case reports 30 (2020) 101132.

[28] S. Ho, S.K. Goh, A.W. Ng, et al., Long-term tolerance of a fractured self-expanding metal stent in a patient with adenoid cystic carcinoma, Respiratory medicine case reports 28 (2019) 100960.