Novel treatment (new drug/intervention; established drug/procedure in new situation)

Correction of postpneumonectomy syndrome using a custom implant

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Summary

The authors describe a patient who underwent a right pneumonectomy for removal of a bronchial carcinoid tumour. Over time she developed recurrent infections, dyspnoea and wheeze despite no evidence of tumour recurrence. A marked mediastinal shift caused severe narrowing of the left main-stem bronchus as it was draped over the vertebral column consistent with a diagnosis of postpneumonectomy syndrome. Mediastinal reorientation was accomplished with the placement of two breast implants. Failure of the superior implant resulted in a recurrence of symptoms 4 months postoperatively. A durable custom expander with wall thickness three times that of a standard expander was placed after rupture of one of the two initially placed saline implants. At 2-years follow-up the patient has complete resolution of symptoms, without any further postoperative complications.

BACKGROUND

Correction of postpneumonectomy syndrome involves mediastinal repositioning by filling the postpneumonectomy space with saline breast implants. The incidence of complications of this procedure is yet to be defined but implant failure often occurs. This case shows a novel

approach to the vexing clinical problem of implant failure in postpneumonectomy syndrome patients.

CASE PRESENTATION

A 41-year-old woman presented with a history of worsening dyspnoea, wheezing and recurring bronchitis

Figure 1 The initial CT scan of the thorax after the onset of symptoms of postpneumonectomy syndrome revealing a shift of mediastinal contents into the right hemithorax. The heart abuts the right lateral ribcage and the left mainstem bronchus is draped across the vertebral column with compression by the aorta and pulmonary vessels.

Figure 2 Postoperative CT scan of the thorax after the first operation. Two implants are placed in the right hemithorax resulting in reorientation of the mediastinum and resolution of symptoms.

following a right pneumonectomy in 1992 for a carcinoid neoplasm of the right main-stem bronchus. CT scan of the thorax revealed a shift of mediastinal contents into the right hemithorax (figure 1). The heart was abutting the right lateral ribcage and the aorta and pulmonary vessels compressed the left mainstem bronchus as it was draped across the vertebral column. Bronchoscopy confirmed dynamic severe narrowing of the proximal left main-stem bronchus.

TREATMENT

In the initial surgical procedure, two saline breast implants, measuring a total of 960 cc, were placed into the right hemithorax. This resulted in clockwise rotation and shift of the mediastinal contents into native orientation. A 16×4 cm AlloDerm (LifeCell, Branchburg, New Jersey, USA) sheet was laid over the posterior mediastinum to prevent erosion of the implant from the bronchial stump staple line. Intraoperative bronchoscopy revealed a patent left main-stem bronchus. CT scan on postoperative day 1 showed a return of the mediastinal contents to near midline, with patent left lung airways (figure 2). However, 4 months later she noticed a recurrence of all her preoperative symptoms. A CT scan revealed a deflation of the superior implant likely secondary to mechanical trauma from the bronchial staple line (figure 3). Our diagnosis was a rupture of the implant secondary to bronchial staple line erosion.

To obviate this problem a custom tissue expander (Specialty Surgical Products, Victor, Montana, USA) (figure 4) with a wall three times as thick as the normal implant was fashioned. Consent and legal release was obtained from the patient regarding the off-label use of the custom expander for both the manufacturer and surgeons. It was placed through a repeat thoracotomy to replace the superior implant. This was filled to 120 ml of saline with concomitant visualisation of the left bronchial lumen

to achieve adequate mediastinal mobilisation. In order to facilitate placement, a partial rib resection was performed.

OUTCOME AND FOLLOW-UP

The patient is currently asymptomatic; 2 years post the revision procedure, with complete resolution of her symptoms. Follow-up chest CT scan at 4-year intervals, in the absence of symptoms, will be completed to ensure implant integrity and safety.

DISCUSSION

Dyspnoea, cough, wheeze and recurrent bronchial infections in the setting of prior right pneumonectomy and imaging revealing an anatomic shift of mediastinal contents resulted in a diagnosis of postpneumonectomy syndrome. The excessive anatomic shift responsible for causing postpneumonectomy syndrome occurs only in certain patients and is believed to be a function of hyperinflation of the remaining lung, the size of the pneumonectomy space and the elasticity of the mediastinum.¹ With right pneumonectomy, mediastinal contents move toward the empty pleural space to settle in the right paravertebral gutter. There is counter clockwise rotation of the mediastinum along with hyperinflation of the left lung with herniation into the contra-lateral hemithorax. This results in stretching of the bronchus as well as compression anteriorly by the pulmonary artery and posteriorly by the aorta and vertebral column.

Surgical correction involves repositioning of the mediastinal contents into their native orientation by filling the postpneumonectomy space. Long-term data is available on the use of foreign materials in the thorax through plomage of the pleural space, a technique that was commonly used for treatment of tuberculosis in the 1930s and 1940s. Similar materials have been used to treat postpneumonectomy syndrome such as inert Lucite balls and even

Figure 3 CT scan revealed compromise of the superior implant. This correlated with a return of symptoms 4 months after the first operation.

Figure 4 Custom expander designed for durability (Specialty Surgical Products). The expander wall thickness is three times that of a conventional expander.

ping-pong balls.² Tissue expanders and saline filled breast implants are currently favoured for use rather than Lucite balls as they are felt to have less risk of migration, subsequent compression and possible erosion of the mediastinal contents such as the superior vena cava, oesophagus and bronchi.³ Saline filled breast implants and tissue expanders were not designed specifically for use in the postpneumonectomy space. It is generally felt that the silicone shell is well tolerated and has very little risk of compressing mediastinal contents provided total volume remains below 1

litre.⁴ Of note, a saline filled implant should be used while a silicone filled implant should be avoided in the postpneumonectomy space due to the risk of implant failure and extrusion of contents.

Implant migration and durability remain two concerns with expanders and saline breast implant filling of the postpneumonectomy space. Audry *et al*⁵ and Rasch *et al*⁶ reported tissue expander leakage requiring replacement. In a retrospective case series of 19 patients, Macaré van Maurik *et al*⁷ reported four incidents of tissue expander

leakage. They also reported implant migration behind the heart resulting in dysphagia and expander herniation into the contralateral hemithorax. Podevin *et al*² in 2001 in a series of eight patients reported both tissue expander and saline breast implant leakage and rupture with a single incident of saline breast implant migration.

Of particular concern is an exposed bronchial stump staple line that can be a source of trauma to the implants. The use of AlloDerm (LifeCell) prophylactically did not prevent the saline breast implants from trauma in the original procedure. The leak from the superior implant prompted us to design a custom expander with a wall three times as thick to ensure long-term implant integrity for the revision procedure. We are cautiously optimistic, as the prosthesis must remain intact for a prolonged period of time.¹

Learning points

- ▶ Saline breast implants are the current standard of care for mediastinal reorientation in postpneumonectomy syndrome.
- ▶ Saline breast implants are susceptible to failure in this off-label use as they may be subjected to trauma in the thoracic space that they were not designed to sustain over the long-term.
- ▶ The thicker wall of the custom expander promises to be more durable for use in reorienting mediastinal anatomy and preventing recurrence of postpneumonectomy syndrome.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. **Mehran RJ**, Deslauriers J. Late complications. Postpneumonectomy syndrome. *Chest Surg Clin N Am* 1999;**9**:655–73, x.
2. **Podevin G**, Larroquet M, Camby C, *et al*. Postpneumonectomy syndrome in children: advantages and long-term follow-up of expandable prosthesis. *J Pediatr Surg* 2001;**36**:1425–7.
3. **Horowitz MD**, Otero M, Thurer RJ, *et al*. Late complications of plombage. *Ann Thorac Surg* 1992;**53**:803–6.
4. **Bédard EL**, Uy K, Keshavjee S. Postpneumonectomy syndrome: a spectrum of clinical presentations. *Ann Thorac Surg* 2007;**83**:1185–8.
5. **Audry G**, Balquet P, Vazquez MP, *et al*. Expandable prosthesis in right postpneumonectomy syndrome in childhood and adolescence. *Ann Thorac Surg* 1993;**56**:323–7.
6. **Rasch DK**, Grover FL, Schnapf BM, *et al*. Right pneumonectomy syndrome in infancy treated with an expandable prosthesis. *Ann Thorac Surg* 1990;**50**:127–9.
7. **Macaré van Maurik AF**, Stubenitsky BM, van Swieten HA, *et al*. Use of tissue expanders in adult postpneumonectomy syndrome. *J Thorac Cardiovasc Surg* 2007;**134**:608–12.

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