Clinical Case Report

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Transverse rectus abdominis myocutaneous flap for postpneumonectomy bronchopleural fistula

A case report

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Abstract

Rationale: Numerous types of flap coverage have been reported to prevent or to repair bronchopleural fistulas. Most of the flaps were harvested from chest area. However, these pedicled flaps might not be optimal for the patient who has undergone previous radiotherapy on pulmonary parenchyma because the pedicle artery of the flap might have been injured by irradiation. Therefore, an alternative flap outside of the chest area is necessary.

Patient concerns: A 61-year-old male was diagnosed of squamous cell carcinoma in right upper lobe lung (cT3N2M0, stage IIIa). After completing the neoadjuvant chemoradiotherapy, he underwent video-assisted thoracoscopic surgery with right side intrapericardial pneumonectomy.

Diagnosis: Persistent air leak due to postpneumonectomy bronchopleural fistula.

Interventions: Pedicled transverse rectus abdominis myocutaneous (TRAM) flap was used to repair the bronchial stump.

Outcomes: The bronchial stump was repaired successfully, the bronchopleural fistula was obliterated, and the patient was free from air leak after following for 12 months.

Lessons: This case demonstrated that pedicled TRAM flap is a feasible alternative to repair bronchopleural fistula.

Abbreviation: TRAM = transverse rectus abdominis myocutaneous.

Keywords: bronchial stump coverage, bronchopleural fistula, myocutaneous flap, pedicled flap, pneumonectomy

1. Introduction

Postpneumonectomy bronchopleural fistula remains a challenge for thoracic surgeons. The reported incidence ranged from 0% to 20%.[1] Small bronchopleural fistulas could be managed by less invasive bronchoscopic procedure, but large bronchopleural fistulas demand a prompt surgical obliteration. Various local-regional flaps have been utilized for covering the bronchial stump, for example, intercostals muscle, latissimus dorsi, omental, serratus anterior muscle, and pericardial flaps. Among these flaps, only pedicled intercostal flap is examined by randomized trials.[2] However, the pedicled intercostal flap might not be optimal for the patient who has undergone previous radiotherapy on pulmonary parenchyma.[3] In this case, we demonstrated an alternative which applying pedicled transverse rectus abdominis myocutaneous (TRAM) flap to repair the bronchial stump.

2. Case report

A 61-year-old male patient had a history of chronic obstructive pulmonary disease under regular bronchodilator treatment. In 2014, he suffered from severe productive cough with mucus sputum for several months and unintentional body weight loss 6 x0200A;kg within 6 months. After sputum analysis and chest imaging examinations in May 2014, he was diagnosed of squamous cell carcinoma in right upper lobe lung (cT3N2M0, stage IIIa). Then he received neoadjuvant chemoradiotherapy (etoposide 70 mg [45 mg/m^2] + cisplatin 79 mg [50 mg/m^2]; 4500 cGY in 25 fractions) from June to July 2014. In October 2014, surgical intervention was arranged. Because the tumor was located at right hilum and invaded main bronchus and major vessels, video-assisted thoracoscopic surgery with right side intrapericardial pneumonectomy was performed. Postoperatively, pathological exams revealed squamous cell carcinoma, T3N0M0, stage IIB. The postoperative course was smooth but he suffered from severe cough and right chest pain one month later. Laboratory exams revealed leukocytosis (white blood cells = 21,860 μL) and elevated C-reactive protein to 23.94 mg/dL. Chest X-ray showed cavitary lesion and computed tomography showed pleural effusion and fluid collection with mottled gas appearance in the dependent portion of right hemithorax (Fig. 1A). According to the patient's history, results of laboratory exams, and imaging findings,

Editor: Oliver Schildgen.

The authors have no conflicts of interest to disclose

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Medicine (2017) 96:16(e6688)

Received: 14 November 2016 / Received in final form: 17 March 2017 / Accepted: 20 March 2017

http://dx.doi.org/10.1097/MD.0000000000006688

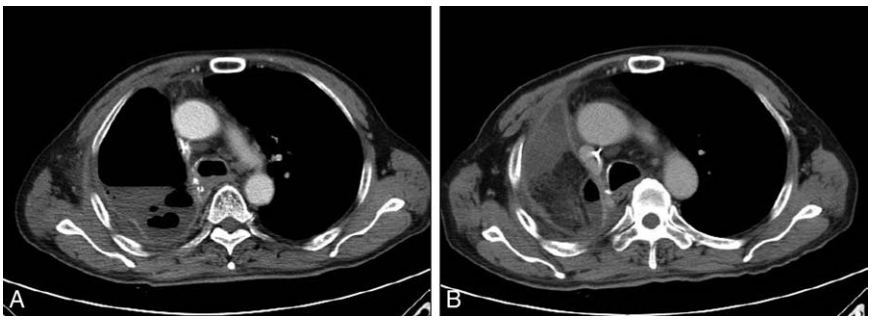

Figure 1. (A) The CT scan showed empyema in right hemithorax. (B) No air leak was noted 12 months after operation.

postpneumonectomy empyema was diagnosed and bronchopleural fistula was highly suspected. After admission, chest tube drainage was inserted and bronchoscopic tissue glue sealing was performed. However, persistent air leakage was presented and we decided to repair the bronchial stump with flap coverage. Because the patient just received neoadjuvant chemoradiotherapy a few months ago, the flaps harvested from chest area were not appropriate because the pedicle arteries might have been injured by irradiation. After discussing with the plastic surgeon, we decided to repair the bronchial stump by a TRAM flap.

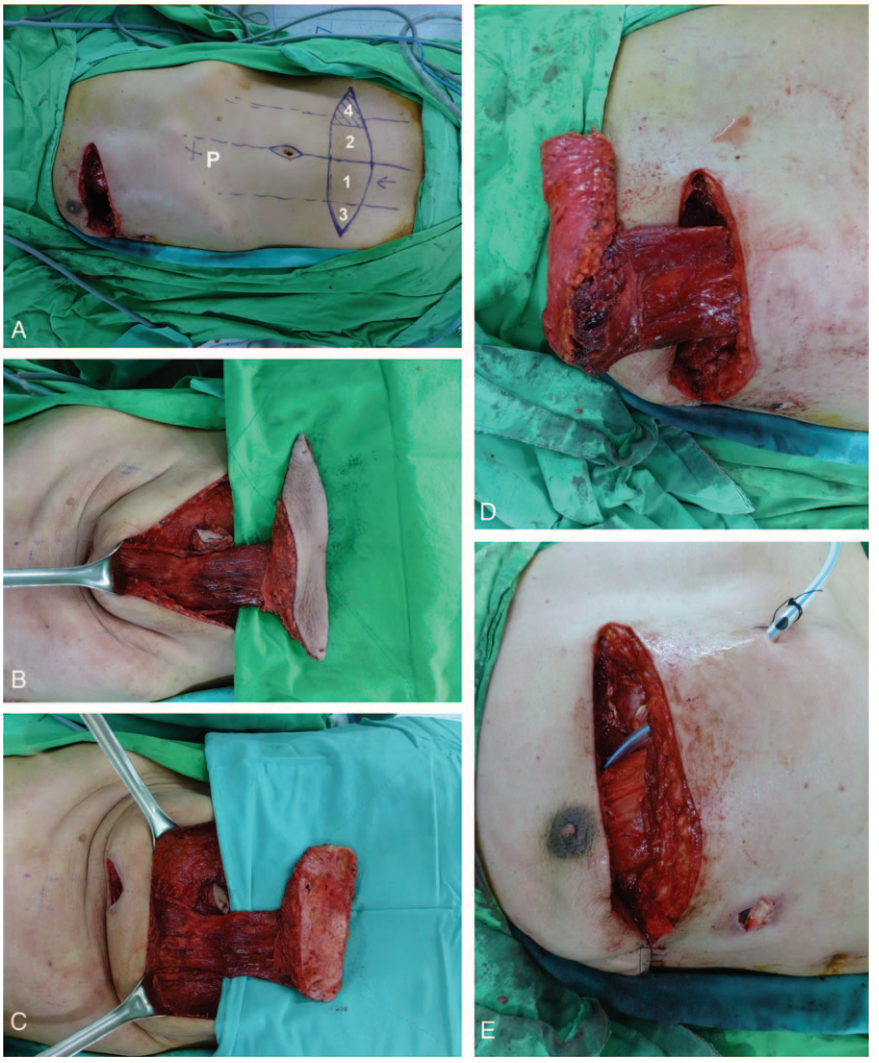

Figure 2. (A) The skin marking of the location of superior epigastric vascular artery (label P), right rectus abdominis muscle (arrow), and the transverse rectus abdominis myocutaneous flap with the Hartrampf zone system (zones 1–4); (B) the harvested transverse rectus abdominis myocutaneous flap; (C) the deepithelialized flap; (D) the transverse rectus abdominis myocutaneous flap was moved through a subcutaneous tunnel toward the right thoracic space; (E) the flap was fixed to posterior chest wall to cover the bronchial stump.

Intraoperatively, the patient was placed in supine. Right side exploratory thoracotomy was performed and the bronchial stump was located. The superior epigastric vascular artery and right rectus abdominis muscle was identified and the location of the TRAM flap was marked on the skin (Fig. 2A). Then the TRAM flap was harvested from right rectus abdominis (Fig. 2B) and was deepithelialized (Fig. 2C). Through a subcutaneous tunnel, the TRAM flap was moved toward the right thoracic space with no tension or kinking on the pedicle (Fig. 2D). Then the TRAM flap was fixed to posterior chest wall to cover the bronchial stump (Fig. 2E) and the tissue glue was also applied to the bronchial stump under bronchoscope. The donor site of flap was closed with mesh repair. The postoperative course was smooth and the air leak was diminished gradually. Then the patient was discharge under stable condition and was free from air leak after following for 12 months (Fig. 1B). The patient provided written informed consent for publication of this report and all accompanying images.

3. Discussion

Numerous types of flap coverage have been reported to prevent or to repair bronchopleural fistulas. Most of the flaps were harvested from chest, for example, intercostal flap, pericardial flap, pleural flap, thoracodorsal artery perforator flap, diaphragmatic flap, latissimus dorsi muscle flap, and serratus anterior flap. In a patient who has had previous neoadjuvant chemoradiotherapy, however, the pedicle artery of the flap might have been already injured.[3–5] The pathogenesis of irradiation-induced arterial injury has been described and involved several processes. Initially, endothelial injury and disruption of the internal elastic lamina were presented and followed by intimal fibrosis and plaque formation, occlusion of the vasa vasorum, fibrosis of the media and periarterial fibrosis.[3] Because the process can progress even 2 decades after irradiation, the currently patent pedicle artery might be gradually occlusive after years.[6] Therefore, an alternative flap outside of chest deserves further consideration.

According to the Hartrampf zone system, the TRAM flap is divided into 4 zones on the basis of blood supply to the overlying skin and subcutaneous tissue (Fig. 2A). Most complications, for example, skin or fat necrosis, mainly occurred in the contralateral distal area of the vascular pedicle (zone 4).[7] Therefore, we only kept zones 1 to 3 to repair the bronchial stump. The TRAM flap not only has rectus abdominis muscle (zone 1) but also the accompanying subcutaneous tissue (zone 2 and zone 3), which allow the TRAM flap to reach a farther area and to create a larger tissue volume (Fig. 2C).

Pedicled TRAM flap is one of the options for breast reconstruction. In this case, we used the same harvesting procedure to inset the flap into the right thoracic space to cover the bronchial stump. To compare with the other pedicled flaps for bronchopleural fistula, the TRAM flap has some advantages. Firstly, most flaps for repairing bronchial stump were harvested from chest and consequently the pedicle arteries might have been injured by previous radiotherapy. The pedicle artery of TRAM flap, superior epigastric vascular artery, is free from irradiation injury. Thus, the risk of flap failure could be lessened. Secondly, the wound of the donor site is also free from irradiation injury. If we harvested a flap from chest area to repair the bronchial stump, the wound of donor site might not heal well because the donor site has been exposed to previous irradiation. Thirdly, a large tissue volume is necessary to reduce the pleural dead space after pneumonectomy while repairing the bronchial stump. Obviously TRAM flap has greater tissue volume comparing with intercostal flap, pericardial flap, pleural flap, or diaphragmatic flap. Fourthly, TRAM flap had less postoperative impacts on activity or respiratory movement comparing with intercostal flap, latissimus dorsi muscle flap, or serratus anterior flap. Fifthly, the pedicle artery of TRAM flap, superior epigastric vascular artery, is longer than the pedicle arteries of the other flaps harvested from chest. The longer pedicle artery could allow the flap to reach the bronchial stump without tension and kinking, which is one of the keys of flap survival.

As lung cancer is one of the most prevalent cancers, all physicians may have a chance to take care the patients who underwent or will undergo pneumonectomy. Our case could help physicians to be aware of postpneumonectomy complications and help them to provide better care of these patients. Additionally, the principle which guided us to plan the TRAM flap is also the principle of planning any flap reconstruction. This case could help physicians to be familiar with these principles and to make appropriate decisions for the patients who have indications of flap reconstruction.

4. Conclusion

In this case, the patient's right main bronchus was looped and closed with autosuture stapling also applied with tissue glue. But these prophylactic managements did not prevent the occurrence of bronchopleural fistula. To the best of our knowledge, this is the first case to apply a pedicled TRAM flap to cover the bronchial stump. We demonstrated that pedicled TRAM flap is a feasible alternative to repair bronchopleural fistula. It deserved further investigation to explore the prophylactic effect of pedicled TRAM flap on reducing the incidence of postpneumonectomy bronchopleural fistula.

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