A new method for coping with lung parenchyma destruction in paediatric thoracic surgery

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Abstract

Lung resection for benign diseases in infants is an extremely difficult thoracic surgical decision. Paediatric patients with drainage resistant pneumothorax and/or pneumatocele due to destroyed lung pose an even more challenging task. We describe a parenchyma sparing method using a sealant—haemostatic complex foam (Tachosyl) developed originally for application in liver and kidney surgery. Both small patients with secondary pneumothorax were operated on successfully.

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1. Introduction

Airtight closure of the lung parenchyma is the Achilles heel of lung surgery. The long list of reinforcing manoeuvres applied for resection lines indicates, that the problem is far from being solved [1]. Glueing the surface is one of the most extensively researched aspects of this topic [2]. Optimising hospital stay by minimising drainage duration is a significantly different question from that scenario, where a troublesome lung parenchyma is unable to hold even the smallest and softest stitch. Destroyed lung due to inflammation poses this sort of situation [3]. In spite of the enormous healing potential of an infant, there are situations in thoracic empyema where lung resection is unavoidable [4]. The surgeon has to sail safely between Scylla of parenchyma sparing and Charybdis of removing all pathologies. We report a thoracic surgical application of a material, developed originally for local haemostatic control of bleeding abdominal organs. TachoSil® (Nycomed IM GmbH, Zürich, Switzerland) is a haemostatic biomatrix patch. It is enzymatically degradable and completely absorbable in less than 3 months following application. The honeycomb-like collagen sponge is coated with human coagulation factors and acts as tissue adhesive.

1.1. Case one

A 9-month-old boy suffering from cystic fibrosis of lung, kidney and liver was on artificial ventilation for two weeks for bilateral destroying bronchopneumonia. Due to the combined effect of the underlying parenchymal pathology, destructive Staphylococcus Aureus pneumonia and PEEP ventilation, a secondary tension pneumothorax developed on the left side. Several attempts at chest drainage provided only temporary pressure relief. Thoracotomy was decided after 10 days of slow deterioration in pulmonary status as a last resort solution as all laboratory data heralded a full blown sepsis.

A left sided axillary thoracotomy was performed and three fields of extensive damage of the lung parenchyma were identified. The lateral surface of the lingula, the posterior aspect of segment 6 and a small area in the apex of the lung gave the impression of a honeycomb with intensive air leakage. Lung resection was out of question and attempts at stitching failed as the tissue could not hold the sutures. Simple spraying of tissue adhesive also failed as the thin layer was immediately broken through by the high pressure of the ventilator. Then several patches were cut of the adhesive/foam complex (TachoSil®) and were pressed against the leaking areas one by one after drying their surroundings for at least 5 min. The chest cavity was closed leaving behind one chest drain on mild suction for 48 h. Pulmonary status of the patient normalised, however it was impossible to wean him from the ventilator for he suffered from generalised sepsis. Unfortunately the patient deceased due to rapid progression...
of the latter and multi-organ failure two weeks later. However no signs of recurrent pneumothorax were noted during the regular chest X-rays.

1.2. Case two

A 13-month-old girl, otherwise healthy, suffering from a bilateral bronchopneumonia was put on artificial ventilation for ARDS and sepsis. Microbiology revealed only scanty intracellular Gram positive cocci as previous aggressive antibiotic treatment made a more precise identification impossible. Multiple inflammatory foci had destroyed her left lung by developing secondary pneumatoceles and causing several attacks of tension pneumothorax. Repeated chest drains failed to control the situation. Twelve days following the onset of pneumothorax a thoracotomy was decided on the basis of the last CT images (Fig. 1) and quick deterioration of general condition and clinico-chemical measurements. At exploration there were definite holes in the apical and the axillary segments of the upper lobe and a perforating lung abscess occupied the segments 8 and 9. The intensively bubbling pleural leaks of the upper lobe were covered by Tachosyl patches according to the above detailed technique. Having completed the 2 × 5 min sealing procedure, the gangrenous part of the lower lobe was removed by means of an atypical wedge-like segment resection. The draining bronchus was directly sutured (3/0 Prolene), while parenchyma and vessels were covered by running stitch. The resected area was also covered by a TachoSil pad (Fig. 2). The patient made a quick and full recovery as the air escape stopped immediately and consequently her lung fully expanded. Five days later she was successfully weaned from the ventilator and was discharged from the hospital on the 10th post-operative day.

2. Comment

Using the sealing surface of a haemostatic foam pad originally designed and built to secure against dislodging may offer a solution in desperate situations where non-malignant disease otherwise would require extensive resection of the parenchyma of doubtful viability. Our method can be considered wherever a conservative resective technique may offer a reasonable solution. As these situations are not too infrequent and infective processes would presumably challenge the thoracic surgeon, topical antibiotic permeation of the foam seems to be a logical modification of the technique. As causative micro-organisms may vary case by case, no prefabricated infiltrated pads are advised, but rather letting them soaked up in situ with appropriately chosen antibiotics is perhaps a possible further development. In our experience the sealing-haemostatic foam complex offered a successful solution in a desperate situation.

References