Pulmonary embolism following pneumonectomy in blunt thoracic trauma

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Case report

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A 31-year-old male sustained a severe crush injury to his chest after being caught between a truck and loader. His admission injuries included: multiple left sided rib fractures with a left flail chest, pulmonary contusions, left main stem bronchus injury, left pulmonary artery dissection, traumatic aortic disruption, left humerus and radius fractures and thoracic vertebral spinous process fractures (Fig. 1). After stabilisation and insertion of a left thoracostomy tube, he underwent successful placement of an aortic endovascular stent graft. On admission bronchoscopy he was found to have a laceration to the membranous portion of his left main stem bronchus without an obvious air leak. This was initially managed non-operatively. On post-admission day 2 he developed progressive hypoxaemia, and bronchoscopy confirmed complete occlusion of his left main stem bronchus. The bronchial injury and resultant obstruction was not amenable to endobronchial stenting. Chest radiograph showed opacification of his left lung (Fig. 2). At thoracotomy extensive tissue destruction involving greater than 90% of his left main stem bronchus was found, and was not repairable. A left pneumonectomy was performed.

Ten days following pneumonectomy the patient developed acute respiratory failure and hypotension. Computed tomography (CT) identified a massive PE occluding the right main pulmonary artery (Fig. 3). An emergent multidisciplinary conference reviewed the available options which included: sternotomy with cardiopulmonary bypass and pulmonary thrombectomy, peripheral extra corporeal membrane oxygenation for haemodynamic support and intravenous heparin and lastly catheter directed thrombolysis and placement of an inferior vena cava (IVC) filter. Given the marked haemodynamic instability of the patient, thrombolysis and filter placement was chosen. Following thrombolysis the patient experienced immediate and marked haemodynamic improvement. Systemic anticoagulation was initiated. Ultimately his orthopaedic extremity injuries were corrected and he survived to independent ambulatory discharge from the hospital.

2. Discussion

2.1. Pulmonary embolism in major blunt trauma and prophylactic inferior vena cava filters

Severely injured patients are at high risk for both deep venous thrombosis (DVT) and subsequent PE with current estimates of DVT incidence in trauma patients approximating 13% with prophylaxis and 38% without. Estimated incidence of PE approaches 1.4%, with a concurrent fatal PE rate of 0.3%. In addition to the routine use of mechanical and pharmacologic prophylaxis, guidelines regarding the role of prophylactic placement of IVC filters in high risk trauma patients have been published by the Eastern Association for the Surgery of Trauma (EAST). Despite his extensive injuries this patient would not have satisfied EAST criteria for a prophylactic IVC filter. Recently a number of centres have reviewed their experience with prophylactic IVC filters in trauma. In general the majority of IVC filters are inserted on post-admission day 6, by interventional radiologists, with a very low complication rate (<1%). Complications including thrombosis, migration and fracture occur at a rate of 1–5%.

Retrieval rates are low, ranging from 22% to 58%. The incidence of PE despite having an IVC filter in place ranges from 0% to 1.6%. The efficacy of prophylactic IVC filters in preventing PE has not been evaluated in a randomised control trial in trauma patients.

2.2. Pulmonary embolism following lung resection

The incidence of thromboembolic events following elective lung resection is high. In a series of 77 patients undergoing elective pulmonary resections without routine pharmacologic DVT prophylaxis, the rates of postoperative DVT and PE were 14% and 5%, respectively. Further, PE following lung resection is a frequent cause of cardiorespiratory failure and in-hospital death. In a large review of 1735 pulmonary resections, of the 20 patients who underwent autopsy following in-hospital cardiorespiratory arrest, 90% died of PE. Of the proven postoperative PE cases in this series, 74% occurred despite DVT prophylaxis with subcutaneous unfrac-
In more modern series, authors describe a variety of potentially successful management options for acute PE including systemic anticoagulation with heparinoids, systemic thrombolytic treatment, catheter directed thrombolysis and pulmonary thrombectomy with cardiopulmonary bypass. Although the impact of PE following lung resection for cancer is substantial, it is unclear how to interpret and extrapolate these results to trauma patients undergoing lung resection. Due to the multi-system trauma, combined with pneumonectomy, the predicted risk of PE was high in our patient. As a result, we believe consideration should be given to prophylactic IVC filter placement in all trauma patients undergoing some form of lung resection, especially pneumonectomy.

2.3. Thrombolysis in trauma

Although the use of thrombolysis in the management of stroke and myocardial ischemia has become widespread, there is little published experience with its use in trauma. Current publications are largely restricted to traumatic carotid dissection and the evacuation of haemothoraces.5 Thrombolytics are generally contraindicated in the setting of suspected intracranial injury, recent surgery or trauma. Traditional management of significant acute PE has been sternotomy and pulmonary thrombectomy with the aid of cardiopulmonary bypass. This treatment carries a high mortality, and still requires the use of systemic anticoagulation. More recent descriptions of the off-label use of thrombolytic therapy for management of acute PE are provocative, and have been life-saving on occasion. Unfortunately the risk of bleeding remains, with episodes of fatal haemorrhage following thrombolysis being well described.4 In this patient’s case, the use of emergent catheter-directed thrombolytic therapy was a difficult decision that was made with consultation between the trauma surgeon, critical care specialist, thoracic surgeon, cardiac surgeon and interventional radiologist. Although the therapy was complicated by extensive soft tissue bruising, as well as oral mucosal bleeding, it was also life-saving. Thrombolytic therapy for management of acute life-threatening PE cannot be recommended based on this case, but should be considered as a possible treatment option. This patient represents the first described case of a large PE following pneumonectomy for trauma.

References