INTRODUCTION
Mainstem bronchus rupture is a rare but frequently fatal injury in pediatric patients experiencing chest trauma. We report the case of a 13-year-old boy who presented to the operating room after being struck by a semi-truck as a pedestrian. A previously unidentified complete right mainstem bronchus rupture was identified intraoperatively. During his operative course, he developed severe refractory hypoxemia that required emergent ECMO support.

CASE DESCRIPTION
A previously healthy 13-year-old boy presented as a Level 1 Trauma after being struck by a semi-truck as a pedestrian. In addition to numerous contusions and hematomas, diagnostic studies identified an acute dissection of the right proximal subclavian artery, a right tension pneumothorax, a right upper lobe pulmonary laceration, a small left-sided pneumothorax, and numerous orthopedic trauma injuries, including a fractured right scapula, a dislocated right clavicle, and cervical and thoracic spinous process fractures. A right thoracotomy tube was placed in the emergency department, and the patient was admitted to the floor. He was maintained on 6 LPM nasal cannula overnight with plans to perform a flexible bronchoscopy and possible VATS the following morning. A pre-operative chest x-ray is shown in Figure 1. Following uneventful induction of anesthesia and placement of a single-lumen endotracheal tube, a fiberoptic bronchoscopy identified significant damage to the right mainstem bronchus and plans were made for an open thoracotomy. Upon positioning in the left lateral decubitus position, the patient experienced rapid desaturation with an oxygen saturation nadir in the 40s. The patient was immediately returned to the supine position. Despite endotracheal tube suctioning, albuterol, epinephrine, and manual ventilation on 100% FiO2, oxygen saturation remained in the 70s. Attempts were made to isolate the left lung by fiber-optic guided left mainstem intubation and bronchial blocker placement. These attempts were unsuccessful, and the patient was deemed too unstable for exchange to a double lumen endotracheal tube. An intraoperative chest x-ray was obtained, and is shown in Figure 2. A chest tube was placed on the left side with no improvement in ventilation.

Arterial blood gas demonstrated significant hypoxia and hypercarbia. The patient was transfused packed red blood cells to improve oxygen carrying capacity. The decision was made to place the patient on ECMO support. Following institution of Veno-Venous ECMO, a right thoracotomy was performed and a complete rupture of the right mainstem bronchus was identified. A right pneumothorax was performed and the bronchial rupture ligated. The patient was taken to the PICU on full ECMO support. The patient was successfully weaned from ECMO on post-operative day 6. The patient experienced a prolonged ICU course, requiring a total of 70 days in the ICU, complicated by pneumonias and ARDS. He returned to the operating room for tracheostomy, as well as repeat thoracotomy for bronchopleural fistula. He remained in the hospital for 72 days before being discharged to a skilled nursing facility. He subsequently had his tracheostomy decannulated and was discharged home from a skilled nursing facility 94 days after his accident only requiring supplemental nocturnal oxygen.

CASE DESCRIPTION, CONT.

Figure 1. Pre-operative AP supine chest radiograph showing a right sided tension pneumothorax.

Figure 2. Intraoperative AP supine chest radiograph with persistent right pneumothorax and significant opacification of the left lung.

DISCUSSION
We believe many factors lead to the delayed diagnosis of the ruptured bronchus. At first, the patients symptoms were nonspecific, and initial imaging did not show the full scope of the injury. We believe that for various reasons the magnitude of the injury did not present itself until he was positioned laterally. In the 24 hours after his injury, his left-sided pulmonary edema worsened, secondary to his pulmonary contusion. Those two occurrences, combined with placing that lung in the dependent position, increased the shunt in that lung. Once positive pressure ventilation was applied, the mainstem bronchus rupture declared itself, and with the preferential ventilation of the non-dependent lung, that ventilation was subsequently lost into the pleural cavity and exited via the newly placed chest tube. Thus, adequate ventilation in this setting became nearly impossible.

Mainstem bronchus rupture is a rare but frequently fatal injury in pediatric patients experiencing chest trauma. 1 In the adult literature, rupture of a mainstem bronchus secondary to trauma is associated with a mortality of as high as 67%. 2 Various strategies have been employed to best allow healing of the bronchopleural fistula while also allowing for adequate ventilation. 3-6 These cases in particular become a delicate balancing act, as ventilatory management of the bronchopleural fistula aims to keep airway pressures as low as possible so as to not continue to force air through the fistula. In this turn can lead to an increase in atletelic lung tissue and a potential decrease in adequate ventilation. Difficulties increase when the symptoms of ARDS are also present. 7 One potential option that has been utilized successfully in some of these patients is initiation of Veno-Venous extracorporeal membrane oxygenation (ECMO) to allow for ‘rest ventilation’ of the lung in order to allow for healing. 2,7

REFERENCES