Iatrogenic tracheobronchial injuries most often are tears that result from endotracheal intubation, diagnostic or operative endoscopies, long-term ventilatory support or barotraumas, or injury during procedures adjacent to the trachea (eg, mediastinoscopy or esophagectomy). Such tears usually are partial or complete disruptions that are immediately recognized, and thus effective surgical therapy provides excellent functional outcomes. We describe a delayed bronchial sleeve resection of an iatrogenic laceration of the membranous wall of the right bronchial tree with reanastomosis between the middle-lower lobe carina and main bronchus takeoff and reimplantation of the upper lobe bronchus into the distal, ventral, intrathoracic trachea.

Clinical summary. A 31-year-old woman presented with recurrent severe hemoptysis after having had coughing and bronchospastic attacks for 1.5 years. Her history revealed that a posttraumatic fracture of the T6 vertebral body had been stabilized 2.5 years previously by means of transpleural place-

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lateral thoracotomy was made, and the pleural space was entered through the fifth intercostal space. The entire dorsal segments of the upper and lower lobes were densely attached to the respective parietal pleura of the costovertebral groove, and the entire transverse apex of the azygos vein cross was covered by fibrotic tissue. Following an extrapleural plane, the azygos vein was ligated proximally and distally to the fibrotic area. Systematic dissection resulted in freeing the right bronchial tree from the lung parenchyma anteriorly and from the midesophagus posteriorly. The entire posterior or membranous wall of the right main bronchus to the middle-lower lobe carina, had been lacerated and invaginated by the head of the proximal screw and the connecting bar. Care was taken to preserve as much of the peribronchial blood supply as possible. The endobronchial system was then purposely entered by opening the junction of the cartilaginous and membranous bronchus at the origin of the intermedius bronchus. Endoluminal inspection showed a complete destruction of the pars membranacea, leaving no chance for a primary longitudinal repair.

Given that the takeoffs of the right upper, middle, and lower lobes were intact, the length of the intrathoracic trachea was short, and the bronchial tissues were supple, the decision was made to avoid a pneumonectomy and to undertake a bronchial sleeve resection with reconstruction of the right bronchial tree. The inferior pulmonary ligament was divided and ligated, followed by section of the right main bronchus 0.5 mm from its origin and the distal intermedius bronchus at the level of the middle-lower lobe carina. The proximal and distal screws and longitudinal bar were then uneventfully

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Fig 1. CT scan showing the invagination of the head of the longitudinal bar into the proximal right main bronchus.

Fig 2. Endoscopic view showing the head of the longitudinal bar invaginated into the membranous wall of the right main bronchus shortly after its origin.

Fig 3. Drawing showing the creation of the 1-cm² oval orifice into the distal trachea, which allowed the reimplantation of the right upper lobe bronchus. This was made after resection of the entire membranous wall of the right bronchial system, reimplantation of the middle-lower lobe carina into the origin of the remnants of the right main bronchus, resection of the upper lobe takeoff, and completion of the posterior part of the great fissure. The view is from a right posterolateral thoracotomy. RUL, Right upper lobe; RML, right middle lobe; RLL, right lower lobe; LMB, left main bronchus; S6, sixth segment of the RLL.

Fig 4. Three months of postoperative endoscopy control, showing patent and well vascularized anastomoses. RML, Right middle lobe; RLL, right lower lobe; LMB, left main bronchus; RUL, right upper lobe.
entire lacerated membranous wall. Reconstruction of the right bronchial airway was by an end-to-end anastomosis, according to the method described above, which is usually used for any tracheobronchial reconstruction. Adequate release of tissues to accomplish tension-free anastomoses was obtained by sectioning the pulmonary ligament and opening the entire pretracheal fascia. We extended the lessons that had been learned from bronchoplastic and carinal reconstruction by resecting the upper lobe takeoff along with the lacerated membranous wall and reimplanting the upper lobe bronchus into the ventral distal trachea. Care was taken to respect anatomic relations and the geometry of reconstruction. Indeed, the potential risks of this reimplantation were believed to be reasonable because the intrathoracic trachea was short enough to avoid anastomotic tension. Had this not been the case, tension on the anastomosis could alternatively have been avoided by using an infrahilar U-shaped pericardial release.

**Conclusion.** We have reported the first bronchial injury after reconstruction of spinal trauma and reimplantation of the right upper lobe bronchus into the distal trachea. The entire lacerated membranous wall of the right bronchial tree was removed through an extended bronchial sleeve resection, and a pneumonectomy was avoided by reanastomosing the middle-lower lobe carina to the main bronchus takeoff and the upper lobe bronchus to the distal intrathoracic trachea.

**Comments.** Isolated laceration of the right main bronchus by the spicula of vertebral body fragments has been described, but we have found no previous report of a complete laceration of the entire membranous wall of the right bronchial system after spine operations. In our patient it is reasonable to believe that the proximal screw was not firmly fixed and not fully transvertebral and that because of this, the head of the screw eroded progressively into the right main bronchus, carrying with it the longitudinal connecting bar. It seems most likely that the hemoptysis was the result of erosion of the peri-bronchial arteries, but we cannot exclude the possibility that the bleeding came from the azygos vein. The extent of the laceration made a simple repair impossible. Given the patients’ youth, every effort was made to avoid sacrifice of any lung parenchyma. This was possible by respecting the principles of airway reconstruction. The initial tracheobronchotomies at the proximal main right bronchus and at the distal bronchus intermedius allowed assessment of the lesion and resection of the entire lacerated membranous wall. Reconstruction of the right bronchial airway was by an end-to-end anastomosis, according to the method described above, which is usually used for any tracheobronchial reconstruction. Adequate release of tissues to accomplish tension-free anastomoses was obtained by sectioning the pulmonary ligament and opening the entire pretracheal fascia. We extended the lessons that had been learned from bronchoplastic and carinal reconstruction by resecting the upper lobe takeoff along with the lacerated membranous wall and reimplanting the upper lobe bronchus into the ventral distal trachea. Care was taken to respect anatomic relations and the geometry of reconstruction. Indeed, the potential risks of this reimplantation were believed to be reasonable because the intrathoracic trachea was short enough to avoid anastomotic tension. Had this not been the case, tension on the anastomosis could alternatively have been avoided by using an infrahilar U-shaped pericardial release.

**References**