Western Trauma Association critical decisions in trauma: Lung injury

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ABSTRACT: This is the Western Trauma Association's recommended algorithm for the management of a traumatic lung injury. The current algorithm and recommendations are based on available published randomized trials, observational studies, systematic reviews, and the expert opinion of the Western Trauma Association members. The algorithm and accompanying text represent a safe and reasonable approach to this common problem. We recognize that there may be variability in decision-making, local resources, institutional consensus, and patient-specific factors that may require deviations from the presented algorithm. This annotated algorithm is meant to serve as a basis from which protocols at individual institutions can be developed or serve as a quick bedside reference for clinicians.

LEVEL OF EVIDENCE. Consensus algorithm from the Western Trauma Association, Level V. (*J Trauma Acute Care Surg*. 2026;101: 187–198. Copyright c 2026 Wolters Kluwer Health, LLC. All rights reserved.)

KEY WORDS: Algorithm, injured lung, lung injury.

Traumatic injury accounts for ~300,000 deaths and 5.3 million years of potential life lost annually in the United States.[1] Thoracic trauma is common, affecting nearly one-third of injured patients.[2] Among severely injured polytrauma patients with thoracic involvement, pulmonary contusions are present in 16%,[3] and traumatic pneumothorax occurs in ~11% of the patients.[4]

Traumatic lung injuries may occur following both blunt and penetrating trauma and encompass a wide range of pathology, including pulmonary contusions, pulmonary lacerations, pneumothorax, hemothorax, and persistent air leaks. Blunt mechanisms, such as motor

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vehicle collisions and falls, commonly result in pulmonary contusions due to rapid compression and deceleration forces, whereas penetrating mechanisms, including gunshot and stab wounds, may directly disrupt pulmonary parenchyma and surrounding structures. These injuries can impair gas exchange, decrease pulmonary compliance, and contribute to respiratory failure, particularly in patients with severe polytrauma. Early recognition and appropriate management are essential, as delays in diagnosis or inadequate treatment may result in worsening hypoxemia, ongoing hemorrhage, or progression to tension physiology. Despite the frequency and clinical significance of traumatic lung injuries, substantial variability remains in their evaluation and management across institutions and providers.

Herein, we provide a systematic approach to the initial management of patients who may have sustained a lung injury (Fig. 1). The algorithms created by the Western Trauma Association (WTA) Algorithms Committee rely on existing data, and in instances where data are scarce, they incorporate expert opinions. The process involves thorough revisions by committee members and is presented electronically, in addition to being presented at the annual WTA meeting, for feedback from other members and attendees. Clinical decision algorithms ought to be viewed as suggestions to be supplemented by clinical judgment and adapted to the specific circumstances of the patient or institution when necessary.

ALGORITHM

Thoracic Trauma With Suspected Lung Injury

Traumatic lung injuries present with a spectrum of clinical and radiographic findings that should raise suspicion for underlying parenchymal or airway disruption. Patients may exhibit dyspnea, tachypnea, diminished breath sounds, hypoxemia, or shock. A persistent air leak (present for > 3–5 d) or a large pneumothorax that fails to resolve after tube thoracostomy is particularly concerning for significant pulmonary or bronchial injury. A persistent air leak may also be indicative of a tracheal injury, which is outside the scope of this lung injury guideline. Findings such as flail chest[5] and subcutaneous emphysema may further support the diagnosis.[6,7] Radiographic findings commonly include pneumothorax, pneumomediastinum, pneumopericardium, subcutaneous emphysema, and hemothorax, particularly when vascular injury coexists.[6,7]

Traumatic lung injury evaluation and management differ between blunt and penetrating mechanisms. Blunt trauma most commonly produces pulmonary contusion, intraparenchymal hemorrhage, and associated pneumothorax or hemothorax, with management focused on airway assessment, oxygen support,[8,9] tube thoracostomy,[10] pulmonary toilet, and adequate pain control. Ten percent or less will need operative intervention.[10] Conversely, penetrating trauma more often causes direct parenchymal disruption, pulmonary laceration, hemopneumothorax, persistent air leak, or injury to the tracheobronchial tree or pulmonary vasculature. These patients require early assessment for ongoing hemorrhage, massive air leak, bronchial injury, and need for tube thoracostomy, bronchoscopy, video-assisted thoracoscopic surgery (VATS), thoracotomy, or advanced respiratory support.

Primary Survey

The primary survey is critical during the initial assessment of the injured patient, ensuring rapid identification and treatment of immediately life-threatening conditions. The committee acknowledges that some patients may arrive in extremis and meet criteria for a resuscitative thoracotomy[11–16]; however, such patients are often undifferentiated, whereas this algorithm is specifically designed for patients with suspected lung injury. Advanced Trauma Life Support® has begun emphasizing an exsanguinating–airway–breathing–circulation framework,[17] within this context, the approach outlined here focuses on clinical decision-making in patients with potential pulmonary injury.

A) Airway and Breathing Including Intubation

Patients with hypoxia or respiratory distress should receive supplemental oxygen. Indications for endotracheal intubation in those with suspected lung injury include persistent respiratory failure despite adequate oxygen supplementation and significant chest wall injury or dysfunction resulting in respiratory compromise. Although additional indications for intubation exist, a comprehensive discussion is beyond the scope of this article.

Intubation should be avoided in two lung-injured patient populations. (1) In patients with obstructive shock due to tension pneumothorax, decompression must precede intubation. This diagnosis should be suspected in the presence of severe respiratory distress, hypotension, unilateral decreased or absent breath sounds, hyperresonance to percussion, jugular venous distension (which may be absent in hypovolemic patients), and tracheal deviation as a late finding. (2) In patients with exsanguinating hemorrhage, such as from a massive hemothorax. Both patients are preload dependent, and initiation of positive-pressure ventilation can further reduce venous return, precipitating cardiovascular collapse if the pneumothorax or exsanguinating hemorrhage is not mitigated first.

A trauma patient who deteriorates immediately after intubation has unrecognized hemorrhagic shock until proven otherwise, including from a massive hemothorax. When there is thoracic trauma with suspected lung injury, in addition to a thoracic source of bleeding and pericardial tamponade, the following diagnoses should be considered: (1) tension pneumothorax and (2) air embolism from a hilar bronchial injury.

1. The initiation of positive pressure ventilation can result in tension physiology due to a pneumothorax expanding, the presence of a bronchial or tracheobronchial injury, or a large bronchopleural fistula due to a pulmonary laceration.
2. Penetrating bronchial injuries near the hilum may

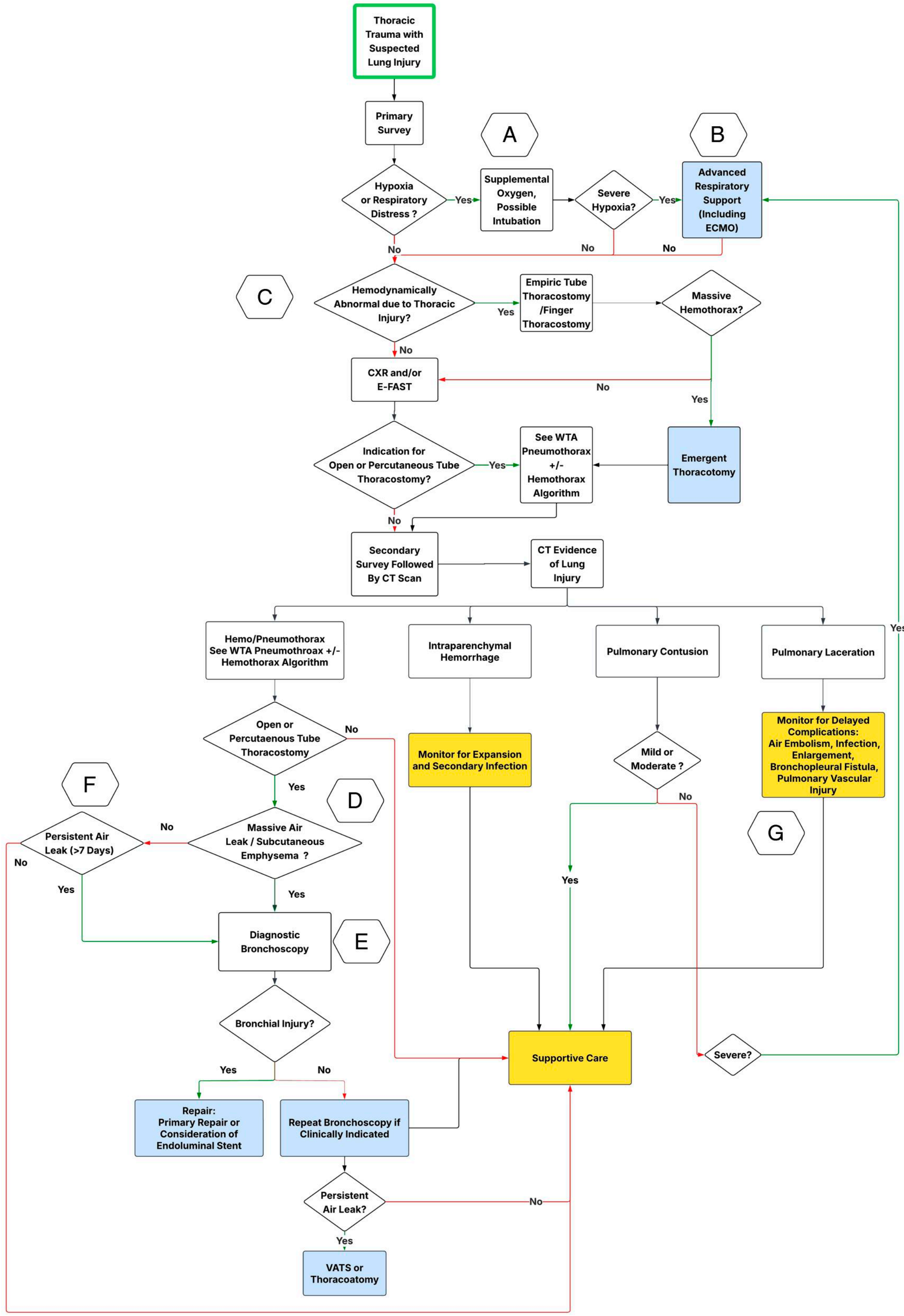

Figure 1. Lung injury algorithm.

result in systemic air embolism when there is communication to the pulmonary veins or left atrium, which should be suspected when a patient acutely decompensates following the initiation of positive-pressure ventilation. This scenario represents a surgical emergency. Immediate thoracotomy with clamping of the affected pulmonary hilum is indicated to prevent further air entrainment, followed by attempts to evacuate air from the heart and coronary circulation.

B) Advanced Respiratory Support Including Extracorporeal Membrane Oxygenation

If hypoxemia persists despite conventional mechanical ventilation, escalation to advanced respiratory support should be considered. Oftentimes, these interventions may occur after tube thoracostomy or bilateral tube thoracostomies, chest radiograph and ultrasound are considered. Adjunctive therapies may include lung isolation with single lung ventilation (advancing the endotracheal tube to the unaffected bronchial airway or using bronchial blockers), inhaled pulmonary vasodilators, such as epoprostenol sodium or nitric oxide, as well as venovenous extracorporeal membrane oxygenation (VV ECMO). The Extracorporeal Life Support Organization (ELSO) recommends VV ECMO for: "(1) Hypoxemic respiratory failure ($PaO_2/FiO_2 < 80$ mm Hg), after optimal medical management, including, in the absence of contraindications, a trial of prone positioning and (2) hypercapnic respiratory failure (pH < 7.25), despite optimal conventional mechanical ventilation (respiratory rate 35 bpm and plateau pressure [P_{plat}] ≤30 cm H_2O)."[18] However, in the setting of acute thoracic trauma with ongoing instability, prone positioning is impractical in the early resuscitative algorithm. In addition, when multiple injuries are being simultaneously addressed, use of ECMO may be impractical and will be unavailable in most centers.

C) Hemodynamically Abnormal Due to Thoracic Injury

Once airway and ventilation have been addressed, attention must turn to hemodynamic stability. Hemodynamic instability is commonly defined by a systolic blood pressure ranging from <70 to <100 mm Hg,[19–26] most frequently <90 mm Hg,[20–26] a heart rate >100 to 130 beats per minute,[19,26] or a shock index of ≥1.[25] These definitions may also incorporate inadequate physiologic response to resuscitation, such as persistent hypotension after 1 to 2 L of crystalloid or the need for 2 to 6 units of packed red blood cells within 24 hours.[21,22,26] Although we acknowledge that one should limit a crystalloid resuscitation and maintain a high blood product ratio resuscitation.[27–31]

In the hemodynamically unstable blunt or penetrating trauma patient with suspected thoracic injuries, immediate tube thoracostomy or finger thoracostomy is indicated to evaluate for a massive air leak or ongoing hemorrhage from a massive hemothorax. Bilateral tube thoracostomy or finger thoracostomy may be necessary depending on the underlying trajectory. Emergent thoracotomy for hemorrhage source control may be indicated, especially when thoracotomy reveals massive hemothorax or active hemorrhage.

Definition of Massive Hemothorax

A massive hemothorax is defined as ≥1,500 mL of blood evacuated immediately upon chest tube placement, while persistent bleeding is defined as 200 mL per hour for 2 to 4 hours.[32] Patients meeting these criteria should undergo urgent anterolateral thoracotomy. Although these thresholds remain widely utilized, they are derived primarily from historical experience and expert consensus rather than prospective investigation. Furthermore, fixed volume thresholds do not account for differences in patient size, baseline physiologic reserve, or total circulating blood volume. Consequently, a degree of blood loss that may be tolerated by one patient could be life-threatening in another.

Clinical physiology remains equally important when determining the need for operative management.[33–35] Persistent hemodynamic instability despite pleural decompression and appropriate resuscitation should raise concern for ongoing hemorrhage requiring definitive control. Manifestations such as refractory hypotension, progressive shock, increasing transfusion requirements, or evidence of inadequate end-organ perfusion may indicate that nonoperative measures are insufficient. In these situations, the patient's physiologic status should be prioritized over absolute drainage volumes when making operative decisions.

When physiologic exhaustion is present—manifested by acidemia, hypothermia, and coagulopathy—a damage control thoracotomy[36] is warranted. This approach may include rapid parenchymal packing with laparotomy pads, placement of thoracostomy tubes for pleural drainage, and temporary chest closure. To facilitate safe re-exploration, a plastic drape may be placed over the lung to prevent parenchymal adherence to the surgical pads and to minimize lung injury during unpacking. Closure techniques previously reported in the literature include skin-only,[37] adhesive dressing use,[30,31] negative-pressure wound therapy devices (NPWT),[38,39] and the Abthera Advance Open Abdomen Dressing system.[36,38,40] In cases where the pericardium has been opened or violated, high-suction NPWT is discouraged due to the risk of cardiac herniation and iatrogenic tamponade. If NPWT is employed in this setting, tissue coverage or a nonadherent protective barrier should be interposed between the cardiac structures and the wound sponge before application.

Adjuncts to Primary Survey

In hemodynamically stable patients, evaluation may proceed with primary survey adjuncts, including a chest radiograph and an Extended Focused Assessment with Sonography for Trauma (eFAST) examination. These modalities enable rapid detection of pneumothorax, hemothorax, and other thoracic injuries that may not be clinically evident. Ultrasound has a sensitivity of ~88% and specificity of 99% for the diagnosis of pneumothorax, compared with a sensitivity of 52% and specificity of 100% for chest radiography.[41] Importantly, anterior pneumothoraces may be missed on a supine chest radiograph due to the anterior distribution of intrapleural air. Indications for open or percutaneous tube thoracostomy are discussed in detail in the *Hemothorax/Pneumothorax* subsection later in this manuscript.

Secondary Survey

Computed tomography (CT) of the chest with intravenous contrast as needed is obtained as an adjunct to the secondary survey.[32] In hemodynamically normal patients with penetrating thoracic trauma, CT demonstrates a negative predictive value of 99% for clinically significant injury, making it a reliable modality for triage and management decisions.[42] Thoracic CT can delineate injuries requiring further evaluation and intervention, including hemothorax or pneumothorax, intraparenchymal hemorrhage, pulmonary contusion, and pulmonary laceration, each of which is discussed in the sections that follow. A summary of injury severity based on the American Association for the Surgery of Trauma Organ Injury Scale for Lung Injury is provided in Table 1.[43]

TABLE 1. Lung Injury Scale

Grade*	Injury Type	Description of Injury
I	Contusion	Unilateral, < 1 lobe
II	Contusion	Unilateral, single lobe
	Laceration	Simple pneumothorax
III	Contusion	Unilateral, > 1 lobe
	Laceration	Persistent (> 72 h) air leak from the distal airway
	Hematoma	Nonexpanding intraparenchymal
IV	Laceration	Major (segmental or lobar) air leak
	Hematoma	Expanding intraparenchymal
	Vascular	Primary branch intrapulmonary vessel disruption
V	Vascular	Hilar vessel disruption
VI	Vascular	Total uncontained transection of the pulmonary hilum

*Advance one grade for bilateral injuries up to grade III. Hemothorax is scored under the thoracic vascular injury scale.

Hemothorax/Pneumothorax

The WTA provides established algorithms for the management of hemothorax and pneumothorax.[44,45] CT may identify small pneumothoraces or hemothoraces that are not visible on chest radiography and are termed "occult."

Indications for tube thoracostomy in pneumothorax are largely based on the size of the pneumothorax. On chest radiograph, a pneumothorax occupying ≥ 20% of the hemithorax warrants drainage.[45] This threshold correlates with approximately a 2-cm rim of air between the lung edge and chest wall at the level of the hilum. Pneumothorax volume may also be estimated using the Collins method, calculated as: pneumothorax (%) = 4.2 + 4.7 (A + B + C), where A represents the intrapleural distances measured at the apex, B represents the hilum, and C represents the lower half of the collapsed lung, respectively.[46] On CT imaging, pneumothorax size can be assessed by drawing a radial line perpendicular to the chest wall at the largest air pocket. A measurement of > 35 mm supports chest tube placement.[47,48] For hemothorax, pleural drainage is generally recommended when the estimated volume is ≥ 300 to 500 mL.[44,49–51] Volume may be estimated using Mergo's formula: volume = distance^2 × length, where distance represents the maximum anteroposterior depth and length the craniocaudal extent of the effusion.[52]

Both the pneumothorax[45] and hemothorax[44] pathways include options for observation, tube thoracostomy, or percutaneous catheter drainage[53–62] based on patient stability and injury characteristics. In cases of hemothorax, thoracic cavity irrigation should also be considered if the patient is hemodynamically normal.[63–68] The hemothorax algorithm[44] delineates indications for operative thoracotomy, VATS,[62,69,70] and intrapleural thrombolytic therapy.[71–73]

D) Massive Air Leak Definition

After chest drainage with a thoracostomy tube, one should evaluate for a massive air leak. A massive air leak is defined as a continuous air leak involving more than two chambers within the water seal section,[74] failure of lung re-expansion despite ongoing air leak, or a continuous air leak accompanied by extensive subcutaneous emphysema. In mechanically ventilated patients, large air leaks of nearly 100% of inspiratory tidal volume have been described,[75] although the authors agree that smaller air leaks on the order of 30% to 50% of the inspiratory tidal volume may have oxygenation and ventilation ramifications. In patients without underlying lung disease, this is an injury to the proximal tracheobronchial tree unless proven otherwise. A nuanced discussion of thoracostomy tube management (number of thoracostomy tubes, placement to suction) is essential, given the theoretical risk of drawing air from the uninjured lung. In addition, if a patient is intubated, positive pressure will direct airflow through the pathway of least resistance, which is through the massive air leak, and temporary lung isolation may be needed before and during definitive repair.

E) When to Perform Bronchoscopy (Air Leak/ Pneumomediastinum)

If open or percutaneous tube thoracostomy is accompanied by a massive air leak, bronchoscopy should be performed to localize the site of airway injury. Additional indications for bronchoscopy include a large pneumomediastinum or a persistent air leak despite a properly positioned and functioning chest tube for more than 7 days.[74] In the presence of a massive air leak or extensive pneumomediastinum, bronchoscopy after or within 72 hours may be appropriate rather than waiting for prolonged chest drainage, particularly if the patient is otherwise adequately ventilating and oxygenating. If gas exchange is compromised, bronchoscopy should be performed urgently. An important exception is the undifferentiated patient, in whom pneumomediastinum may reflect an underlying esophageal injury, a condition that generally warrants emergent evaluation and management.[76] Upper endoscopy or an esophagram may be needed to rule out a clinically significant esophageal injury. Conversely, a small, isolated pneumomediastinum in the absence of mediastinal fluid, concerning mechanism, clinical findings, or additional imaging abnormalities may be managed expectantly.[76] In the *"Small Air Leak for Greater Than 7 Days"* subsection, we will discuss the timing of a bronchoscopy for small air leaks.

Bronchial Injury

If a bronchial injury is identified on bronchoscopy, management options include operative, endobronchial, or selective nonoperative strategies. Operative repair involves adequate debridement of devitalized tissue, followed by a primary end-to-end anastomosis of the clean edges of the bronchi, ensuring a tension-free repair. To minimize complications such as stricture formation and granuloma development, sutures are typically monofilament, absorbable and tied extraluminally using an interrupted technique, particularly on the cartilaginous side. Size mismatch may be mitigated using telescoping or beveling techniques. Buttressing of the suture line with vascularized tissue may further reduce the risk of dehiscence. In select patients, endoluminal stenting or placement of endobronchial valves may be considered, typically after multidisciplinary discussion.[77,78] Nonoperative management has also been described but should be reserved for selected cases, such as injuries <4 cm in length with well-approximated wound edges and no evidence of devitalized tissue.[78] Concomitant injuries requiring operative repair, such as arterial or esophageal injuries, are contraindications to nonoperative management.

Repeat Bronchoscopy

If no injury is identified on initial bronchoscopy, clinicians should maintain a low threshold for repeat endoscopic evaluation, as bronchial injuries may be missed early or their severity underestimated. Clinical deterioration, worsening subcutaneous emphysema, or failure of lung re-expansion should prompt reconsideration for repeat bronchoscopy or further imaging.

F) Small Air Leak for Greater Than 7 Days

For most nonmassive air leaks, tube thoracostomy with adequate lung re-expansion is sufficient treatment.[74] However, when an air leak persists beyond seven days despite appropriate tube thoracostomy, a bronchoscopy should be performed to localize the air leak.[74,79] Ultimately, VATS or thoracotomy should be considered to reduce the risk of complications such as empyema or bronchopleural fistula.[80] Some studies in patients with spontaneous pneumothorax suggest that up to 79% of persistent air leaks may resolve by 14 days,[81] which may support continued observation in selected patients. Minimizing suction, transitioning to water seal, or utilizing digital drainage systems can promote resolution of prolonged air leaks.[82–86]

Before proceeding to VATS or thoracotomy, additional management options include placement of one-way endobronchial valves.[80,87] Concomitant with or after VATS or thoracotomy, one may also consider pleurodesis[88,89] and chemical pleurodesis.[90] These interventions may require multidisciplinary consultation, such as cardiothoracic surgery or interventional pulmonology. When operative management is indicated, it most commonly involves wedge resection of the affected lung segment, with or without adjunctive parietal pleurectomy or pleurodesis, depending on intraoperative findings.

Intraparenchymal Hemorrhage

A pulmonary hematoma represents the accumulation of blood within the injured alveolar and interstitial spaces, most commonly following a pulmonary laceration. Because the pulmonary circulation is a low-pressure system, initial management is usually conservative. Thoracostomy drainage, lung re-expansion, and correction of coagulopathy[91] may provide adequate tamponade of hemorrhage and help determine the need for operative intervention. Immediate surgery in this setting may disrupt the tamponade and exacerbate bleeding. Massive hemoptysis is discussed within the *Pulmonary Lacerations* section of the manuscript.

Most pulmonary hematomas resolve spontaneously over several weeks, although complete radiographic resolution may take more than a year in some cases.[92] Close clinical and imaging follow-up is essential to identify complications such as hematoma expansion, secondary infection, or abscess formation. Surgical intervention, including VATS, is reserved for patients with substantial parenchymal destruction, ongoing hemorrhage from a major vessel, or development of a bronchovascular fistula.

Pulmonary Contusions

Pulmonary contusions can be clinically and radiographically absent during the initial 4 to 6 hours after injury, then blossom thereafter, leading to worsening hypoxemia for 4 to 5 days.[93] Radiographically, they appear as patchy infiltrates that cross segmental boundaries, reflecting alveolar hemorrhage and interstitial edema. Management is primarily supportive. Key components include multimodal analgesia (oral, intravenous, or epidural) to optimize ventilation; balanced volume resuscitation to avoid exacerbating pulmonary edema; and aggressive pulmonary hygiene, including incentive spirometry, chest physiotherapy, bronchodilators, and early mobilization.

TABLE 2. Surgical Approach by Hemodynamic Status and Injury Burden

Surgical Incision	Hemodynamic Status*	Injury Access
Left anterolateral thoracotomy (+/−clamshell)	Hemodynamically unstable patients, including pulseless patients	Access to the main pulmonary artery, the left pulmonary artery, the left upper lobe, the left lower lobe, and the left hilum
Right anterolateral thoracotomy	Hemodynamically unstable patient	Right pulmonary artery, right upper lobe, right middle lobe, right lower lobe, right hilum
Median sternotomy	Hemodynamically unstable patient	If concern for concomitant great vessel injury, right upper lobe, right middle lobe, right lower lobe, left upper lobe, left lower lobe
Left posterolateral thoracotomy*	Hemodynamically stable patient	Isolated hemithorax cavity that provides access to the left lung bronchi or parenchymal laceration
Right posterolateral thoracotomy*	Hemodynamically stable patient	Isolated hemithorax cavity that provides access to the right lung bronchi or parenchymal laceration

*Provided that there is no need to enter the abdomen, given the proven trajectory of penetrating trauma.

Supplemental oxygen is appropriate for mild contusions with hypoxia, while moderate injuries may require ventilatory support with lung-protective strategies[94] consistent with ARDSNet protocols.[95–97] Advanced respiratory care strategies parallel those used in acute respiratory distress syndrome. In addition to ARDSNet ventilation strategies, inhaled pulmonary vasodilators such as inhaled epoprostenol sodium or nitric oxide may be indicated.[98–101] Prone positioning should also be considered when the PaO_2/FiO_2 ratio is < 150.[102–104] In select cases of persistent hypoxemia despite maximal supportive care, ECMO[105] may be considered.[106]

G) Pulmonary Lacerations

Pulmonary lacerations most commonly result from penetrating trauma but may also occur after high-energy blunt injury. Four principal mechanisms have been described: compression rupture, compression shear, rib penetration tear, and adhesion tear.[107] Management of associated air leaks is discussed in the "*Hemothorax/Pneumothorax*" subsection of this manuscript. Lacerations may subsequently fill with air (pneumatocele), blood (hematocele), or both (hematopneumatocele).

If a patient presents with massive hemoptysis, angiographic evaluation with possible embolization of bronchial arterial branches may be pursued in hemodynamically stable patients. In unstable patients, operative exploration is required. Placement of a bronchial blocker under bronchoscopic guidance can isolate the affected lung, prevent life-threatening respiratory compromise, and serve as a temporizing maneuver.

Patients require close clinical and radiographic surveillance for complications, including abscess or empyema formation, bronchopleural fistula with persistent air leak, progressive enlargement from a ball-valve effect, air embolism, and pulmonary vascular injuries such as arteriovenous fistula or pseudoaneurysm. Management strategies range from conservative observation with serial imaging to endovascular embolization or pulmonary resection.

Preoperative Preparation

Endotracheal intubation with a double-lumen tube is preferred for thoracotomy and is mandatory for VATS, as it provides deflation of the injured lung. Alternatively, a bronchial blocker may be used. For urgent thoracotomy, a single-lumen tube is the optimal initial airway as it can be advanced into either mainstem bronchus to isolate the ipsilateral lung or used with a bronchial blocker. In truly emergent situations, however, attempts at lung isolation may delay life-saving intervention. In these cases, ventilation should proceed with low tidal volumes and higher respiratory rates until definitive control of the injury is achieved.

Pleural Exposure

In patients who remain hemodynamically unstable, an emergent anterolateral thoracotomy—with or without extension to the contralateral side (clamshell incision) should be performed. This approach provides the most rapid access to the thoracic cavity in the setting of ongoing hemodynamic compromise.

In stable patients, the operative approach is dictated by the suspected injury pattern, missile trajectory, hemodynamics, and side of the largest hemothorax. When the trajectory is confined to a hemithorax, VATS or robotic approaches may be possible, but a posterolateral thoracotomy is generally appropriate. A right posterolateral thoracotomy allows optimal exposure of the right and proximal left mainstem bronchus, right lung parenchyma, intrathoracic trachea, upper esophagus, superior vena cava, and azygous vein. On the other hand, a left posterolateral thoracotomy provides access to the distal left bronchial tree, left-sided parenchymal injuries, descending thoracic aorta, and distal esophagus. For suspected great vessel or cardiac injuries, median sternotomy offers superior exposure, except for a patient in extremis.[13,108] If access to both hemithoraces, the heart, or the descending thoracic aorta is required, a clamshell thoracotomy is appropriate (Table 2).

Tissue-sparing procedures—such as suture pneumonorrhaphy, pulmonary tractotomy, and nonanatomic wedge resection—that prioritize preservation of viable lung parenchyma are preferred whenever technically feasible. In contrast, resectional operations, including formal lobectomy and pneumonectomy, require the removal of substantial lung tissue and are associated with significant morbidity and mortality.[109,110] Accordingly, lung-preserving techniques should be employed whenever possible. The choice of procedure is influenced in part by the mechanism of injury. In penetrating trauma, tractotomy and wedge resection are commonly performed, as these approaches allow targeted control of hemorrhage and air leaks along the missile tract while conserving the surrounding lung tissue. In blunt trauma, however, more extensive parenchymal destruction may necessitate anatomic lobectomy or, rarely, pneumonectomy when resection cannot be avoided.

SUMMARY

The management of lung and or bronchial injured patients, both hemodynamically normal and hemodynamically abnormal, requires rapid and sound clinical decision-making. This work provides an up-to-date and evidence-based approach to their management and treatment.

AUTHORSHIP

A.M.H., J.P.K., R.C., M.A.B, K.L.B., C.A.C., N.K., A.J.K., T.R.K., R.K., M.L., K.I., G.A.G., A.R.P., S.A.S., M.A.S., K.M.S., R.B.T., E.M.W., J.L.H., and D.M.S. contributed in the study design. A.M.H. contributed to searching the literature. A.M.H. and J.P.K. drafted the article, which all authors critically revised and approved.

DISCLOSURE

Conflicts of Interest: All JTACS Disclosure forms have been supplied and are provided as Supplemental Digital Content, http://links.lww.com/TA/F601.

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