Pulmonary laceration and contusion in a young male patient due to a motorcycle accident

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ABSTRACT
Chest trauma injuries are one of the main causes of death in young people and include lung contusions, lacerations, pneumothorax, hemothorax, rib fractures and tracheobronchial injuries. Pulmonary contusions are the most common identified entities after trauma, and they result in alveolar hemorrhage without loss of the physiological structure of lung parenchyma. On the other hand, pulmonary lacerations, which are often associated with contusions, result in rupture of the alveoli causing formation of cavities. Patients present symptoms ranging from minimal to severe, including cough, chest pain, hemoptysis, dyspnea, tachypnea, and hypoxemia. Findings may not be apparent immediately after injury and chest CT is the most sensitive imaging technique for diagnosis. Contusions usually resolve with supportive care in 5–7 days. In this report, we present a case of lung contusion and laceration in a 19-year-old patient after a motorcycle accident.

INTRODUCTION
Chest trauma injuries are one of the main causes of death in young people and include lung contusions, lacerations, pneumothorax, hemothorax, rib fractures and tracheobronchial injuries1,2. Pulmonary contusion is the most common identified entity after trauma and usually results from blunt chest trauma (traffic accidents, falls from great heights), shock waves associated with penetrating chest injury, or explosion injuries3,4. Unlike contusion, pulmonary laceration results in disruption of the architecture of the lung and could potentially cause more serious damage. Pulmonary lacerations are commonly caused by penetrating trauma and result in formation of one or multiple cavities filled with air, blood, or both5. In this report, we present a case of lung contusion and laceration in a 19-year-old patient after a motorcycle accident.

CASE PRESENTATION
A 19-year-old patient, non-smoker, without previous medical history, presented to the emergency room due to fever and pain at the right periorbital area of the face after a motorcycle collision twenty-four hours ago. The patient was examined initially by general surgeons. He was febrile (38°C) and hemodynamically stable. His oxygen saturation was normal (SatO2: 98% breathing room air) and he had normal breath sounds in auscultation. From physical examination, he presented with bruise injuries in the right side of the face and a right periorbital hematoma. His laboratory examinations revealed normal hemoglobin (15.9 g/dL), elevated white blood cell count (14.90 K/μL with 78.7% neutrophils), elevated creatine kinase (956 U/L) and elevated C reactive protein (96.9 mg/L). After exclusion of SARS-Cov-2 infection, he underwent computed tomography (CT) of the head which showed fracture displacement...
of the right maxillary sinus and orbitally wall, air-fluid level within injured sinus and right periorbital hematoma (Figure 1). The patient was admitted to the Oral and Maxillofacial Surgery Department for further management with reconstructive surgery. Upon admission, a chest X-ray revealed a cavitary lesion in the right middle lung zone and a fracture displacement of the right clavicle (Figure 2). Chest CT confirmed a fracture displacement of the right clavicle without pneumothorax as well as three cavitary lesions with air-fluid level within the minor and major fissure of the right lung with maximum diameter of about 3.7 cm and adjacent ground glass opacities (Figure 3). Pulmonary preoperative evaluation was performed and the working diagnosis of pulmonary laceration with contusion post-acute chest trauma was made. Thorough evaluation for common and specific pathogens for lower respiratory tract infection proved insignificant. The patient received empirical antimicrobial treatment with ampicillin/sulbactam and azithromycin for superinfection, oxygen therapy with high fractions of inspired oxygen to increase the resolution rate of the cystic lesions and was systematically monitored. Multidisciplinary discussion between pulmonologists, the treating surgeons,
the anesthesiologists and the thoracic surgeons led to the decision to postpone imminent surgical management in order to minimize the risk of pneumothorax under positive pressure due to generalized anesthesia. Surgical reconstructive management was undertaken two weeks later without any complications after a new chest X-ray and CT revealed remission of the laceration and contusion lesions (Figures 4 and 5). The patient was discharged from hospital in a very good condition.

**DISCUSSION**

A pulmonary contusion is an injury to the lung parenchyma which usually occurs from blunt chest trauma and results in alveolar hemorrhage. As a pathology, it was first described in 1761 by an Italian anatomist, Morgagni, while the term pulmonary contusion was coined in the 19th century by Dupuytren, a French military surgeon. Widespread use
of explosives during the time of World War I and II led to increased recognition of contusion due to blast injuries4. The most common causes are traffic accidents, pedestrian injuries, falls from great heights, explosions and sports injuries5. The mechanism is the disruption of alveoli and capillaries due to rapid compression and decompression of the chest wall. Alveolar hemorrhage and few hours later interstitial oedema develop in the afflicted parenchyma6,8.

Patients can present with symptoms ranging from minimal to severe, including cough, chest pain, hemoptysis, dyspnea, tachypnea, and hypoxemia. Breath sounds may be decreased, while hematoma and subcutaneous emphysema may be present9. In chest X-rays, findings may not be apparent until 48 hours post-injury10, while chest CT is a more sensitive imaging technique11. Studies have also shown that chest ultrasonography could be useful for the diagnosis of contusion12,13. Ground glass opacities may be present in mild cases whereas widespread consolidations may indicate severe injury14. Specific treatment is often not required and supportive care with prevention of respiratory failure, pain control, management of airway drainage and adequate intravenous fluid replacement are the primary aims of therapy4. In severe cases with development of acute respiratory distress syndrome (ARDS) non-invasive positive pressure ventilation or invasive ventilation may be used3. Surgical stabilization may be required in the case of multiple rib fracture/flail chest2. Contusions usually resolve with supportive care in 5–7 days3, while findings in X-rays may disappear after 10 days8. Pulmonary lacerations are often associated with pulmonary contusions15. They are usually caused by penetrating chest trauma but can be seen after blunt trauma as well16,17. They were first described in

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Figure 5. Chest CT, 2 weeks later, which revealed remission of the laceration and contusion lesions
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1940 by Fallon. The mechanism is rupture to alveoli due to compressive forces applied to the lung parenchyma and the concomitant retraction of the surrounding elastic tissue resulting in the formation of small cavities that are filled with air or blood. These entities are mostly observed in patients aged <30 years, due to the greater compliance of pulmonary lacerations need to undergo any surgical procedure under general anesthesia, there is a greater risk of pulmonary lacerations, pneumothorax, hemothorax, rib fractures and death in young people and include lung contusions, pneumothorax, hemothorax, rib fractures and asphyxia. These entities are mostly observed in patients aged <30 years, due to the greater compliance of

CONCLUSION

Chest trauma injuries are one of the main causes of death in young people and include lung contusions, lacerations, pneumothorax, hemothorax, rib fractures and tracheobronchial injuries. Patients present symptoms ranging from minimal to severe, including cough, chest pain, hemoptysis, dyspnea, tachypnea, and hypoxemia. Findings may not be apparent immediately after injury and chest CT is the most sensitive imaging technique for diagnosis.

CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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DATA AVAILABILITY

The data supporting this research cannot be made available for privacy or other reasons.

REFERENCES

1. Injury Facts: The Source for Injury Stats. National Safety Council. Accessed February 7, 2021. https://www.nsc.org/home-safety/tools-resources/injury-facts#:~:text=Injury%20statistics%20examined%20by%20NSC

2. Ullman EA, Donley LP, Brady WJ. Pulmonary trauma emergency department evaluation and management. Emerg Med Clin North Am. 2003;21(2):291-313. doi:10.1016/s0733-8627(03)00016-6

3. Choudhary S, Pasrija D, Mendez MD. Pulmonary Contusion. StatPearls Publishing; 2021. Accessed February 7, 2021. https://www.ncbi.nlm.nih.gov/books/NBK558914/?report=reader#_NBK558914_pubdet_

4. Rendeki S, Molnár TF. Pulmonary contusion. J Thorac Dis. 2019;11(Suppl 2):S141-S151. doi:10.21037/jtd.2018.11.53

5. Collins J, Stern EJ. Chest radiology: The essentials. 2nd ed. Lippincott Williams & Wilkins; 2008:120.

6. Cohn SM. Pulmonary contusion: review of the clinical entity. J Trauma. 1997;42(5):973-979. doi:10.1097/00005373-199705000-00033
7. Karmy-Jones R, Jurkovich GJ. Blunt chest trauma. Curr Probl Surg. 2004;41(3):211-380. doi:10.1016/j.cpsurg.2003.12.004
8. Allen GS, Cox CS Jr. Pulmonary contusion in children: diagnosis and management. South Med J. 1998;91(12):1099-1106. doi:10.1097/00007611-199812000-00002
9. Miller DL, Mansour KA. Blunt traumatic lung injuries. Thorac Surg Clin. 2007;17(1):57-61. doi:10.1016/j.thorsurg.2007.03.017
10. Ganie FA, Lone H, Lone GN, et al. Lung Contusion: A Clinico-Pathological Entity with Unpredictable Clinical Course. Bull Emerg Trauma. 2013;1(1):7-16. Accessed February 7, 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4771236/pdf/bet-1-007.pdf
11. Schild HH, Strunk H, Weber W, et al. Pulmonary contusion: CT vs plain radiograms. J Comput Assist Tomogr. 1989;13(3):417-420.
12. Soldati G, Testa A, Silva FR, Carbone L, Portale G, Silveri NG. Chest ultrasonography in lung contusion. Chest. 2006;130(2):533-538. doi:10.1378/chest.130.2.533
13. Xiouchaki N, Georgopoulos D. The use of lung ultrasound: A brief review for critical care physicians and pneumonologists. Pneumon. 2007;20(2):134-141.
14. Miller LA. Chest wall, lung, and pleural space trauma. Radiol Clin North Am. 2006;44(2):213-224. doi:10.1016/j.rccl.2005.10.006
15. Gavelli G, Canini R, Bertaccini P, Battista G, Bnà C, Fattori R. Traumatic injuries: imaging of thoracic injuries. Eur Radiol. 2002;12(6):1273-1294. doi:10.1007/s00330-002-1439-6
16. Magret M. Lung trauma. Clin Pulm Med. 2010;17(2):75-81. doi:10.1097/CPM.0b013e3181d269aa
17. Papagiannis A, Gaziotis G, Anastasiadis K. Post-traumatic pulmonary pseudocyst: an unusual complication of blunt chest injury. Pneumon. 2005;18(2):228-232.
18. Fallon M. Lung injury in intact thorax with report of case. Br J Surg. 1940;28(109):39-49. doi:10.1002/bjs.18002810905
19. Tsitouridis I, Tsinoglou K, Tsandiridis C, Papastergiou C, Bintoudi A. Traumatic pulmonary pseudocysts: CT findings. J Thorac Imaging. 2007;22(3):247-251. doi:10.1097/RTI.0b013e3180413e2a
20. Sorsdahl OA, Powell JW. CAVITARY PULMONARY LESIONS FOLLOWING NONPENETRATING CHEST TRAUMA IN CHILDREN. Am J Roentgenol Radium Ther Nucl Med. 1965;95(1):118-124. doi:10.2214/ajr.95.1.118
21. Carroll K, Cheeseman SH, Fink MP, Umali CB, Cohen IT. Secondary Infection of Post-traumatic Pulmonary Cavitary Lesions in Adolescents and Young Adults: Role of Computed Tomography and Operative Debridement and Drainage. J Trauma. 1989;29(1):109-112. doi:10.1097/00005373-198901000-00024
22. Mavarez-Martinez A, Soghomonyan S, Sandhu G, Rankin D. Intraoperative Tension Pneumothorax in a Patient With Remote Trauma and Previous Tracheostomy. J Investig Med High Impact Case Rep. 2016;4(1). doi:10.1177/2324709616636397