



Case report

Pulmonary contusion after bumper car collision: Case report and review of the literature

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A B S T R A C T

Thoracic trauma is a major source of morbi-mortality in injured children. Their pliable chest wall makes pulmonary contusion the most common chest injury. It is most often secondary to blunt trauma caused by traffic accidents. We report a case of severe chest trauma caused by a bumper car collision in an 8-years old girl. She sustained right lung contusion that led to complete atelectasis. After a week of supportive therapy, bronchoscopy removed a mucous plug from the main bronchus, resulting in significant clinical improvement. We aim to raise awareness of the risk of severe chest injuries during bumper car collisions.

1. Introduction

Trauma is the greatest cause of morbidity and mortality in pediatric populations worldwide. Roughly one in four children require medical care due to unintentional trauma every year [1]. Chest trauma represents less than 10% of trauma affecting children. Blunt forces account for 90% of these injuries, with motor vehicle crashes, pedestrian accidents and falls the most frequent mechanisms [2]. Only 0.2% of chest trauma occur in amusement parks according to the French surveillance network of home and leisure injuries EPAC (“Enquête permanente sur les accidents de la vie courante”) [3]. The same report states that 20% of amusement park injuries occur on bumper cars. It was therefore of little surprise that we found no mention of a case of chest trauma caused by a bumper car accident.

Herein, we report a case of severe pulmonary contusion and atelectasis caused by a bumper car collision.

2. Narrative

An 8-year-old girl presented to the emergency department 72 hours after sustaining blunt trauma to the chest during a bumper car rear-end collision when she was thrown forward into her seatbelt. She complained of chest pain and worsening shortness of breath. She had a history of asthma for which she had never been admitted to the hospital and was not taking any medications. Her vital signs and oxygen saturation were stable upon admission. Pulmonary auscultation revealed diminished breath sounds in the lower half of the right lung. The

patient's chest radiography showed atelectasis of the lower half of the right lung (Fig. 1). A CT scan revealed complete obstructive atelectasis of the right middle and lower lobes and ground-glass opacity in the right upper lobe (Fig. 2). There was no abdominal lesion. The history of trauma, clinical presentation and radiological findings led to a diagnosis of a pulmonary contusion following blunt trauma and complicated by obstructive atelectasis. Few hours after admission, patient's respiratory state deteriorated with polypneic breathing, chest retractions and hypoxemia (pulsed oximetry 80%). She was transferred to the pediatric intensive care unit where nasal high-flow oxygen therapy (oxygen flow rate of 15 L/min, fraction of inspired oxygen up to 0.3) was administered for 48 hours. Although stabilized, dyspnea persisted and required nasal oxygen (3–4 L/min) for a week. Chest physiotherapy did not result in marked expectoration. Chest radiography and CT scan on day 7 showed no improvement. A bronchoscopy was performed on day 8 and revealed a large mucous plug occluding the right main bronchus. There were no underlying endobronchial lesions, nor foreign bodies. The right lung fully expanded after the plug was removed. The patient's breathing also improved substantially. Haemophilus influenzae was found in sputum culture at a concentration of 10⁵ colony-forming units per mL and treated with amoxicillin/clavulanic acid. As the patient presented recurring coughing during exercise, inhaled corticosteroids were also prescribed, alongside with inhaled short-acting beta 2-agonists as needed.

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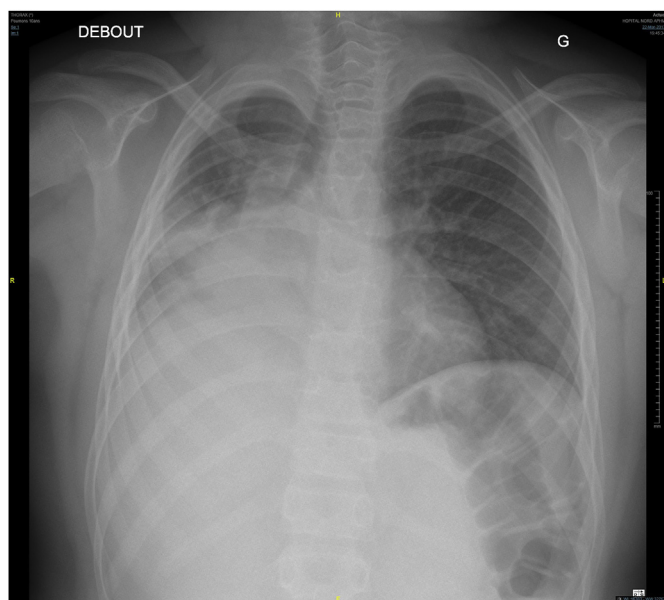


Fig. 1. Admission chest radiography showing atelectasis of the lower half of the right lung in an 8-years old girl after bumper car collision.

3. Discussion

From an epidemiological point of view, chest trauma represents 7% of all amusement parks injuries in the EPAC 2015 report [3]. This is consistent with data provided by the American National Electronic Injury Surveillance System (NEISS) network stating that 10.9% of amusement ride injuries are chest injuries [4]. They are mostly benign and only rarely require to be hospitalized (8% of chest injuries and 4% of bumper car injuries) [3]. Very few bumper cars related injuries have been reported and none involved the chest area. Notably, Preble et al. [6] reported 62 cases of corneal foreign bodies from bumper car collisions in 1974. In both the EPAC and the NEISS reports [3,4], girls were more likely to sustain injuries in amusement parks than boys (respective sex ratio 0.71 in EPAC and 0.8 in NEISS). Injuries were most frequent in the 10–14 years old age group in the EPAC report whereas median age was 8.6 years old in the NEISS report. Our patient, an 8-year-old girl, fits these statistics perfectly.

From a mechanical standpoint, the average maximal speed of a bumper car is 8 km/h (5 mph). Although high speed is correlated with more severe injuries, there is no absolute speed for a driver to experience injury [7]. Severe trauma can occur even with low speed vehicles such as bumper cars. Also, our patient was wearing a seat belt. Common lap and shoulder seat belt related injuries include contusion of the chest wall and spinal, abdominal and pelvic injuries [8]. Our patient's seat belt was a single loose horizontal strap at the base of the chest. It may have contributed to her chest trauma.

Pulmonary contusion is the most common chest injury in children, occurring in more than half of all blunt chest traumas [5]. This is due to the child compliant chest wall that allows parenchyma injury without bony injury. Consequently, nearly half of children with pulmonary injury do not present sign of external chest wall trauma [9]. Neither did our patient. Transmission of energy to the underlying parenchyma causes injury to the alveolar capillaries resulting in alveolar hemorrhage and interstitial edema. The excess fluid interferes with gas exchange leading to ventilation/perfusion mismatch, intrapulmonary shunting and loss of compliance, which results in hypoventilation and hypoxemia [9]. The pain associated with chest trauma can also lead to splinting, which may restrict ventilation and further promote atelectasis, as seen in our patient.

Clinical manifestations of pulmonary contusion include polypnea,

chest pain and hemoptysis [10]. As seen in our patient, the delayed respiratory distress usually peaks at around 72 hours [10].

However, diagnosis is difficult by physical examination alone. Chest X-ray can be used to diagnose pulmonary contusion but this injury can be missed if radiography is performed too early (sensitivity 47% at admission vs 92% after 24 hours) [10]. CT scan is generally superior for accurate assessment of pulmonary contusion, with excellent sensitivity of 100% and specificity of 60% [10]. But some suggest that tomography is overused in blunt pediatric chest trauma, often improving diagnosis without impacting treatment [11]. In 2016, Golden et al. stated that chest tomography should be limited to the identification of intrathoracic vascular injuries when confronted to an abnormal mediastinal silhouette on chest X-ray [12].

The treatment of pulmonary contusion is generally supportive, including adequate analgesia, oxygen support if hypoxemia exists and chest physical therapy. There usually is no need for mechanical ventilation [13]. But we could raise the question whether or not non-invasive ventilation could have been helpful in treating obstructive atelectasis in our patient.

Most pulmonary contusions will resolve without scarring within 7 days [5]. Some will develop acute respiratory distress syndrome, atelectasis (such as our patient) or infections. Prognosis is also impacted by associated injuries, which exist in 50% of children with blunt chest trauma [9] and comorbidities, such as asthma in our patient's case.

Severe amusement ride injuries are widely covered in the media. But medical reports of such injuries remain few and mostly related to neurologic injuries occurring on roller coaster rides [4,14]. Bumper car collisions have rarely been documented as a cause for serious trauma. We find they can be responsible for injuries as severe as seen in road traffic accidents which account for most chest trauma in children. With this case, we aim to raise awareness of the risk of severe chest injuries caused by bumper car collisions.

Funding source

No funding was secured for this study.

Financial disclosure

Authors have no financial relationships relevant to this article to disclose.

Conflicts of interest

Authors have no conflicts of interest to disclose.

Abbreviations

None.

Table of contents summary

Bumper car collisions can be responsible for severe chest trauma.

Contributors' statements

Mahé Berland: Dr. Berland drafted the initial manuscript and approved the final manuscript as submitted.

Marjolaine Oger: Dr Oger contributed to data acquisition concerning the patient's hospitalization in the ICU, revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

Emi Cauchois: Dr. Cauchois contributed to data acquisition concerning the patient's hospitalization in the ICU, revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

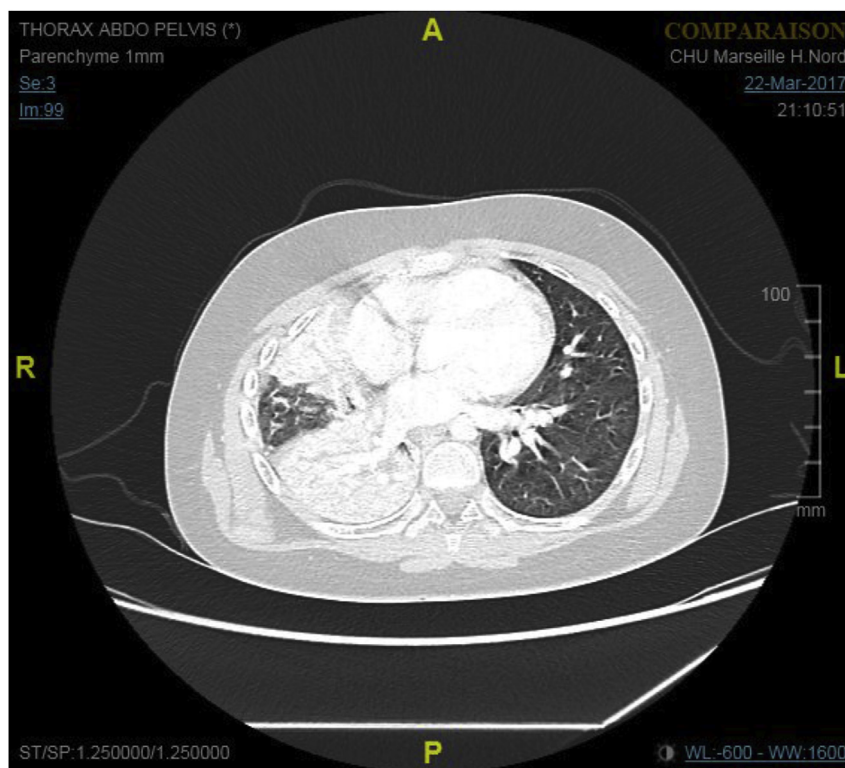


Fig. 2. Admission CT-scan showing complete obstructive atelectasis of the right middle and lower lobes and ground-glass opacity in the right upper lobe consistent with a pulmonary contusion in an 8-years old girl after bumper car collision.

Karine Retornaz: Dr. Retornaz contributed to data acquisition concerning the patient's follow-up, revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

Valerie Arnoux: Dr. Arnoux contributed to data acquisition concerning the patient's initial ER consultation, revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

Jean-Christophe Dubus: Pr Dubus suggested the case be published, contributed to interpretation of all data, revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rmcr.2018.10.006>.

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