© Wydawnictwo UR 2018
ISSN 2544-1361 (online); ISSN 2544-2406
doi: 10.15584/ejcem.2018.2.13

http://www.ejcem.ur.edu.pl/en/
European Journal of Clinical and Experimental Medicine
Eur J Clin Exp Med 2018; 16 (2): 159–162

CASUISTIC PAPER

Krystian Ciechański [1(ABDFG)], Agnieszka Radzka [1(ABDFG)], Klaudia Brożyna [1(ABDFG)], Jędrzej Tkaczyk [1(ABDFG)], Aleksandra Kędziora [2(ABDFG)], Michał Tchórz [3(ABDFG)]

Investigation of focal necrotizing pneumonia after diesel fuel ingestion

[1] Student's Research Group at the Department of Toxicology, Medical University of Lublin, Lublin, Poland
[2] Student's Research Group at Chair and Departament of Epidemiology and Clinical Research Metodology Medical University of Lublin, Lublin, Poland
[3] Department of Toxicology, Medical University of Lublin, Lublin, Poland

ABSTRACT

Introduction. Diesel oil is a mixture of hydrocarbons. These compounds are widely used in everyday life. Oral exposures are most often accidental and affect mainly children, but they also happen in adults. Oral ingestion may lead to aspiration of pulmonary alveoli which may cause necrotizing pneumonia.

Aim. The aim of the study is to assess te severity of diesel oil intoxication on an example of a presented case.

Methods. The analysis of the clinical patient history and review of available literature.

Results. A 27 year old patient was admitted to the toxicology department due to accidental diesel poisoning. Patient drank a small amount diesel oil, then suffered nausea and vomiting, which resulted in aspiration of diesel to respiratory system. During hospitalization focal necrotizing pneumonia was diagnosed. Patient was treated with intensive specific pharmacotherapy. On the 11th day of stay, the patient was discharged with recommendation of control in the pulmonological and toxicological clinic and chest x-ray examination in order to diagnose the suspicious oval change discovered in the right lobe during hospitalization.

Conclusion. First toxicity symptoms are non-specific, so well collected anamnesis is crucial. Complications of hydrocarbon ingestion can be a threat to patient's life. Due to rarity of the problem, there are no clearly defined treatment guidelines.

Keywords. diesel fuel, intoxication, necrotizing pneumonia

Introduction

Diesel oil is a product of distillation of crude oil mainly consisting of a mixture of aliphatic hydrocarbons with a C9-C24 chain length.[1,2] These compounds are used in everyday life by almost every person. Frequent contact with diesel fuel is a potential source of exposure and poisoning. Oral poisoning with diesel is most often accidental and mainly affects children under 5 years. The frequency of this poisoning is about 1/3 of cases in the USA.[3-5] Among adults, oral diesel intoxication is most

Corresponding author: Krystian Ciechański, e-mail: Krystian54321@gmail.com

Participation of co-authors: A – Author of the concept and objectives of paper; B – collection of data; C – implementation of research; D – elaborate, analysis and interpretation of data; E – statistical analysis; F – preparation of a manuscript; G – working out the literature; H – obtaining funds

Received: 21.04.2018 | Accepted: 22.05.2018
Publication date: June 2018

Ciechański K, Radzka A, Brożyna K et al. *Investigation of focal necrotizing pneumonia after diesel fuel ingestion*. Eur J Clin Exp Med. 2018;16(2):159–162. doi: 10.15584/ejcem.2018.2.13

common in developing countries.[6] Oral poisoning with hydrocarbons may cause pneumonia, which in rare cases can even lead to death (less than 1% of cases).[7] It is rare to drink over 10 ml of hydrocarbons at once because of their unpleasant taste. However, pneumonia may be caused be the aspiration of small dose such as 2 ml to the bronchial tree.[7] The group most exposed to such cases are fire swallowers and workers of petrochemical industry. A common practice used mainly in developing countries is siphoning fuel from the vehicle's tank, which aspirated into oral cavity may contribute to poisoning.[8] Derivatives of crude oil may occur to injury of respiratory, digestive and cardiovascular systems or renal failure associated with multiorgan failure or rhabdomyolysis.[9]

Case report

A 27 year old patient was admitted to the hospital emergency department and then to the toxicology department due to accidental diesel poisoning. During anamnesis, the patient admitted to drinking small amount of diesel. He could not determine the exact volume of consumed toxic. In the pre-hospital conditions, patient suffered nausea and vomiting, which resulted in aspiration of diesel to respiratory system. On the day of admission to the toxicology department, patient was in middle condition. He was conscious, in verbal logical contact, cardiovascular and respiratory efficient. He reported stabbing chest pain in the heart area and increased dyspnea at rest. In the physical examination doctors detected weakened alveolar murmur and characteristic smell of diesel noticeable from the mouth. Laboratory tests showed: leucocytosis- 16400/ul; CRP- 22 mg/l, pCO_2- 53.1 mmHg, pO_2- 25.8 mmHg; saturation- 46.2%. In a performed x-ray of the chest, we observed massive densities on the right side near the heart and a small amount of liquid in the right diaphragm-rib angle (figure 1). To verify the examination computed tomography (CT) was performed. In the CT we observed: in segments 7-10 above diaphragm and in heart area merging densities with hypodens areas, in segments 8-10 parenchymal lesions (ground glass opacity) corresponding to symptoms of necrotizing pneumonia (figure 2).

During 11 days of hospitalization patient required intensive pharmacotherapy. We applied combination of antibiotics (clindamycin and ceftriaxone), steroid therapy and normalized electrolyte balance. Due to increased dyspnea, patient temporally required passive oxygen therapy. As a result of performed therapy, patient's condition improved, disappearance of reported complaints and regression of changes in imaging examinations were observed. Control x-ray of chest showed reduction of parenchymal lesions and rounded cyst of about 4cm. In case of improvement of clinical condition, patient was signed out with recommendation of control in the pulmonological and toxicological clinic and chest x-ray examination after 10 days in order to diagnose the suspicious oval cyst in the right lobe.

Fig. 1. Posteroanterior chest radiograph demonstrating alveolar infiltrates, more in the right lower zone

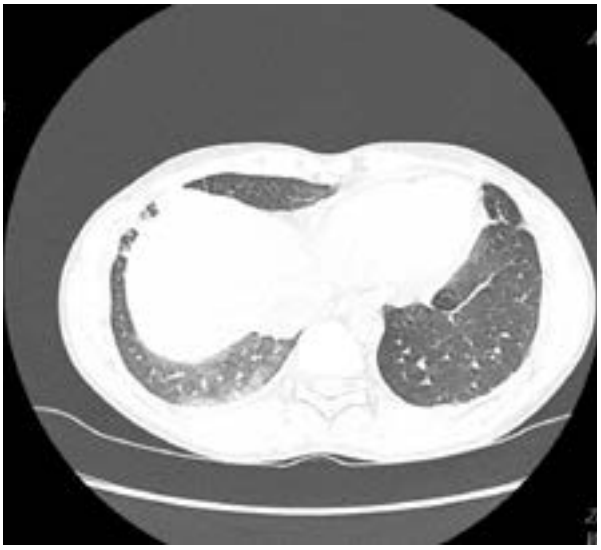

Fig. 2. Computed tomography scan demonstrating right lower lobe consolidation

Discussion

Aliphatic hydrocarbons are well absorbed through the gastrointestinal tract, skin and lungs. Absorption depends on its chemical structure. The longer is carbon chain, the lower is absorption of hydrocarbons.[9] Toxic effects of this substances also depends on their physical properties: viscosity, volatility, solubility and surface tension.[9] The main factor contributing to their aspiration is low viscosity, while the lower the viscosity, the higher risk of aspiration and its penetration to bron-

chial tree.[10] Aspirated oily hydrocarbons do not stimulate cough reflex, but they reach the pulmonary alveoli causing chemical damage to capillaries, interalveolar septum and epithelium. This results in local edema of alveoli and disruption of surfactant secretion.[11] Surfactant, as a compound reducing surface tension, does not fulfil its function. Pulmonary alveoli collapse. This causes disproportions of alveoli ventilation and secondary leads to hypoxia.[12] During the inflammatory reaction, macrophages are activated and inflammatory cytokines are released. This process contribute to the bronchial tree contraction and dysfunction of cilia located in airways.[13,14]

General symptoms of poisoning appear a few hours after aspiration (coughing, dyspnea, choking) and increase from 2 to 8 days.[12] Delayed symptoms result from the lipophilicity of hydrocarbons. These compounds easily penetrate into the fat tissue, where they are accumulated and released over time.[9] Additionally this ability simplify their passage through the cerebral and cellular barriers.[1] Complications of intoxication of diesel oil which worsen patient's prognosis are pleuritis, emphysema, chemical pneumonia, or bacterial infection.[12] A small group of patients may develop cysts, pulmonary abscess, pleural effusion or pulmonary fibrosis.[15] In the case of lung aspiration, the first radiological changes may occur within 2-6 hours after aspiration. In presented case we observed massive inflammatory changes in the right lobe with clinical symptoms of respiratory tract damage. In the control x-ray of chest oval shading (diameter about 4cm) was observed. The image of this change correlated with the picture of post inflammatory cyst of cavity. Mechanism of creating of cavity of cyst after hydrocarbons aspiration is unclear. It is believed that thickened inflammatory wall of alveoli may contribute to accumulation and entrapment of air on the principles of valve mechanism. This may cause creation of pneumatocele. Such phenomenon can also depend on mean time from aspiration to applied treatment, as well as the type and amount of aspirated hydrocarbons.[16]

Due to small number of reports in the literature concerning pneumonia caused by the aspiration of oil derivatives, there are no clearly defined rules of treatment.[17] The main treatment used is symptomatic, aimed at supporting respiratory functions and preventing complications. After hydrocarbon ingestion, giving medical charcoal or gastric emptying is not recommended due to increasing risk of aspiration.[20] When respiratory failure occurs, patients often require respiratory therapy or extracorporeal membrane oxygenation (ECMO) techniques. One of the indications fur using ECMO is severe respiratory failure due to chemical pneumonia.[18] The applied steroid therapy contributes to the reduction of inflammatory response and prevention of pulmonary fibrosis.[9]

Summary

The presented issue of chemical pneumonia does not exhaust the broad symptomatology and numbers of complications associated with crude oil derivatives poisoning. Acute and especially chronic exposure to aliphatic hydrocarbons may lead to multi organ dysfunction, severe condition and death.

Conclusions

- Crude oil derivatives poisoning is extremely dangerous, because even a slight aspiration of these compounds may result in the development of serve complications which may be a serious threat to patient's life.
- First symptoms of intoxication are non-specific. Therefore, it seems crucial to have a properly collected anamnesis and performed fast treatment in order to reduce the risk of developing complications.
- Due to rarity of the problem, there are no clearly defined treatment guidelines, what often complicates and lengthens the healing process of patient.

References

1. Seńczuk W. *Toksykologi*a. Warszawa: PZWL; 2002:596-599.
2. The origin and chemistry of petroleum. https://www.pacelabs.com/environmental-services/energy-services-forensics/forensics-101-a-primer/the-origin-and-chemistry-of-petroleum.html. Accessed May 10, 2018.
3. Mowry JB, Spyker DA, Cantilena Jr LR, Bailey JE, Ford M. 2012 Annual report of the American association of poison control centers' national poison data system (NPDS): 30th annual report. *Clinical toxicology.* 2013;1,51(10):949-1229.
4. Jolliff HA, Fletcher E, Roberts KJ, Baker SD, McKenzie LB. Pediatric hydrocarbon-related injuries in the United States: 2000–2009. *Pediatrics.* 2013;1,131(6):1139-47.
5. Sheikh S, Chang A, Kieszak S, et al. Characterizing risk factors for pediatric lamp oil product exposures. *Clinical toxicology.* 2013;1;51(9):871-878.
6. Venkatnarayan K, Madan K, Walia R, Kumar J, Jain D, Guleria R. "Diesel siphoner's lung": Exogenous lipoid pneumonia following hydrocarbon aspiration. *Lung India: official organ of Indian Chest Society*. 2014;31(1):63.
7. Siddiqui E, Razzak J, Naz F, Khan SJ. Factors associated with hydrocarbon ingestion in children. *Journal of the Pakistan Medical Association.* 2008;58(11):608.
8. Hadda V, Khilnani GC, Bhalla AS, Mathur S. Lipoid pneumonia presenting as non resolving community acquired pneumonia: a case report. *Cases journal*. 2009;2(1):9332.
9. Pach J. *Zarys toksykologii klinicznej*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego; 2009:538-543.
10. Osterhoudt KC, Burns Ewald M, Shannon M, Henvetig FM. *Toxicologie emergencies in Textbook of pediatric emergency medicine.* 5th ed Philadelphia PA; 2006: 951.

11. Franquet T, Gómez-Santos D, Giménez A, Torrubia S, Monill JM. Fire eater's pneumonia: radiographic and CT findings. *Journal of computer assisted tomography*. 2000;1,24(3):448-450.
12. Pham K, Sverchek J, McPheeters RA. Chemical pneumonitis from hydrocarbon aspiration. *Western Journal of Emergency Medicine*. 2008;9(3):165.
13. Grossi E, Crisanti E, Poletti G, Poletti V. Fire-eater's pneumonitis. *Monaldi Arch Chest Dis*. 2006;65(1):59-61.
14. Hadda V, Khilnani GC. Lipoid pneumonia: an overview. *Expert Rev Respir Med*. 2010;4(6):799-807.
15. Indumathi CK, Vikram KS, Paul P, Lewin S. Severe lipoid pneumonia followingaspiration of machine oil: successful treatment with steroids. *Indian J Chest DisAllied Sci*. 2012;54(3):197-199.
16. Yi MS, Kim KI, Jeong YJ, Park HK, Lee MK. CT findings in hydrocarbon pneumonitis after diesel fuel siphonage. *American Journal of Roentgenology*. 2009;193(4):1118-1121.
17. Zhang J, Mu J, Lin W, Dong H. Endogenous lipoid pneumonia in a cachectic patient after brain injury. *Int J Clin Exper Pathol*. 2015;8(4):4238.
18. Arendarczyk A, Wilimski R, Michniewicz M, Czub P, Hendzel P. Zasady kwalifikacji do ECMO u osób dorosłych. *Folia Cardiologica*. 2017;12(1):113-117.
19. American Thoracic Society. European Respiratory Society. Idiopathic pulmonary fibrosis: diagnosis and treatment: international consensus statement. *Am J Respir Crit Care Med*. 2000; 161:646-64.
20. Hydrocarbon Poisoning. The MSD Mannuals. https://www.msdmanuals.com/professional/injuries-poisoning/poisoning/hydrocarbon-poisoning/. Accessed May 19, 2018.