

Things to keep in mind after cardiopulmonary resuscitation: bilateral severe and widespread subcutaneous emphysema together with unilateral pneumothorax

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ABSTRACT

Cardiopulmonary resuscitation (CPR) can cause severe complications such as rib and sternal fracture, pneumothorax or hemothorax. In this article, we report a case of widespread and severe bilateral subcutaneous emphysema and unilateral iatrogenic pneumothorax that does not correlate with the severity of the emphysema that occurred after active CPR.

Keywords: Cardiopulmonary resuscitation, pneumothorax, emphysema

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Cardiopulmonary resuscitation (CPR) is a life-saving maneuver but it can also damage the chest wall and cause severe complications. The incidence of rib fractures during CPR varies between 13-97%. In addition, it is known that the incidence of sternal fracture changes between 1 and 43% during CPR [1]. Pneumothorax, which is a known complication of rib fractures, has also been reported among the complications of CPR [1, 2].

In this article, we report a case of widespread and severe bilateral subcutaneous emphysema and unilateral iatrogenic pneumothorax that does not correlate with the severity of the emphysema that occurred after active CPR.

CASE PRESENTATION

A 79-year-old female patient has presented to a medical center with the complaint of palpitation.

During initial physical examination, she has developed cardiopulmonary arrest. Active CPR has been performed for 20 minutes and the patient responded to CPR. She has been re-examined during the post-CPR period and referred to our hospital with the finding of extensive subcutaneous emphysema. The patient developed cardiopulmonary arrest again in our emergency department and active CPR was applied for 10 minutes. The patient responded to the second CPR as well and was consulted to our clinics. On the physical examination, the patient was unconscious and her pupils were dilated. She had widespread subcutaneous emphysema on the eyelids, around the neck, frontal wall of the chest and abdomen. Her lung auscultation revealed diminished respiratory sounds on the right lung. Postero-anterior chest X-ray and chest computed tomography (CT) revealed minimal pleural effusion bilaterally, fractures of the 2nd, 3rd and 4th ribs on the right, 2nd and 3rd ribs on the left, bilateral common subcutaneous emphysema with



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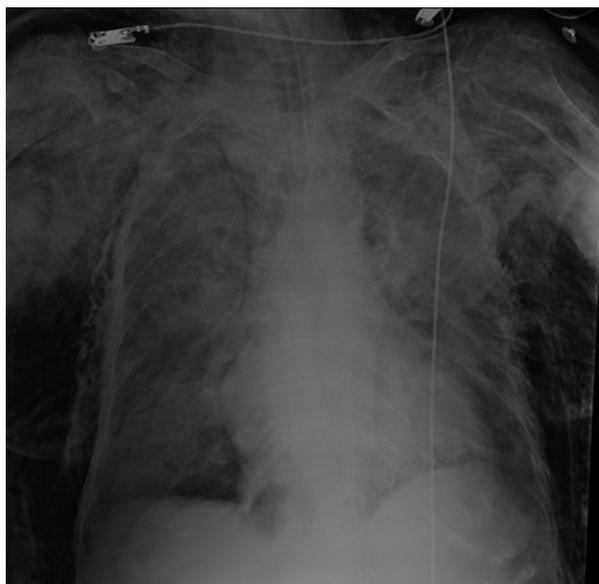


Figure 1. Chest X-ray showing bilateral multiple ribs fractures and widespread subcutaneous emphysema.

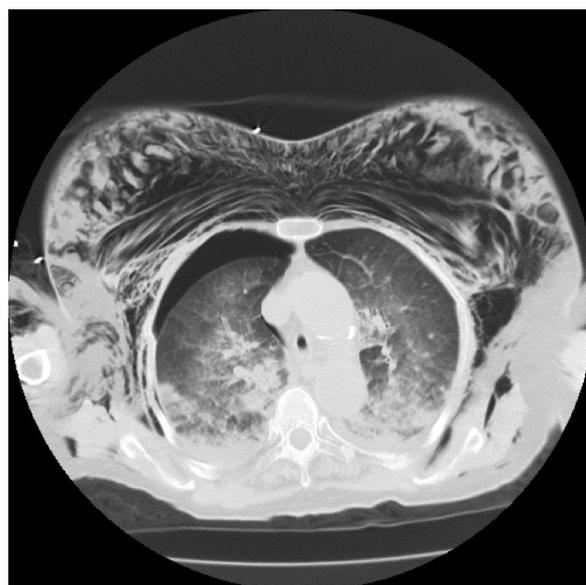


Figure 2. Computed tomography scan showing bilateral widespread subcutaneous emphysema with pneumothorax of the right lung and bilateral ribs fractures with bilateral pleural effusion

pneumothorax of the right lung (Figures 1 and 2). The patient underwent urgent tube thoracostomy through the intersection of second intercostal space and mid-clavicular line on the right with 28 Fr drain. There was plenty of air and 100 cc sero-hemorrhagic drainage. After the procedure, the patient who was planned to be hospitalized in the intensive care unit (ICU) was referred to another center by ambulance due to lack of unoccupied ICU rooms.

DISCUSSION

It is argued that in order for an active CPR to be effective, approximately 5-6 cm of chest compression should be applied and 100-120 compressions should be performed per minute [3]. Thus, patients who had CPR are exposed to intense forces on the chest and are severely traumatized. For this reason, physicians should not overlook the possibility that complications of chest trauma such as rib fractures and hemo-pneumothorax can also be seen after active CPR. There are also publications supporting this argument [3, 4]. It is also reported that especially elderly and women are more susceptible to CPR-related injuries [5]. Our case is compatible with these publications in terms of age and the development of unilateral multiple rib fractures.

Although there are not many publications about the development of pneumothorax after CPR, this condition has been reported as a complication of CPR [6, 7]. This complication can be developed with or without rib fractures. Pneumothorax, without rib fractures, may develop due to chest compressions or barotrauma resulting from mechanical ventilation during or after endotracheal intubation. Similarly, pneumothorax secondary to CPR may be accompanied by subcutaneous emphysema [8]. However, in our case, bilateral subcutaneous emphysema was quite widespread and severe compared to the pneumothorax that was detected on the right. When the scientific literature is reviewed, only one case with severe subcutaneous emphysema incompatible with pneumothorax secondary to CPR was found [9]. If the developmental mechanism is examined, displacement of fractured rib fragments causes visceral pleura and pulmonary parenchymal laceration. Thus, some of the air that escapes to the pleura with the developing pneumothorax passes through the intercostal muscle lacerations caused by displaced ribs and finally reach subcutaneous space. The air that enters the subcutaneous space due to high frequency active chest compressions and positive pressure mechanical ventilation are trapped because of the fact that the ruptured intercostal muscles operate as a one-way valve system during the passive

decompression period. We think that bilateral severe subcutaneous emphysema incompatible with the volume of pneumothorax developed with this mechanism in our case.

CONCLUSION

As a result, it should never be forgotten that CPR is a serious cause of chest trauma. Patients responding to CPR should be investigated as soon as possible for chest trauma and its complications that are a potential source of morbidity and mortality.

Informed consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of interest

The authors declared that there are no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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REFERENCES

- [1] Hoke R S, Chamberlain D. Skeletal chest injuries secondary to cardiopulmonary resuscitation. *Resuscitation* 2004;63:327-38.
- [2] Sirmali M, Türüt H, Topçu S, Gülhan E, Yazici U, Kaya S, et al. A comprehensive analysis of traumatic rib fractures: morbidity, mortality and management. *Eur J Cardiothorac Surg* 2003;24:133-8.
- [3] Kim MJ, Park YS, Kim SW, Yoon YS, Lee KR, Lim TH, et al. Chest injury following cardiopulmonary resuscitation: A prospective computed tomography evaluation. *Resuscitation* 2013;84:361-4.
- [4] Karmy-Jones R, Jurkovich GJ. Blunt chest trauma. *Curr Probl Surg* 2004;41:211-380.
- [5] Beom JH, You JS, Kim MJ, Seung MK, Park YS, Chung HS, et al. Investigation of complications secondary to chest compressions before and after the 2010 cardiopulmonary resuscitation guideline changes by using multi-detector computed tomography: a retrospective study. *Scand J Trauma Resusc Emerg Med* 2017;25:8.
- [6] Krischer JP, Fine EG, Davis JH, Nagel EL. Complications of cardiac resuscitation. *Chest* 1987;92:287-91.
- [7] Oschatz E, Wunderbaldinger P, Sterz F, Holzer M, Kofler J, Slatin H, et al. Cardiopulmonary resuscitation performed by bystanders does not increase adverse effects as assessed by chest radiography. *Anesth Analg* 2001;93:128-33.
- [8] Vinay B, Venkataramaiah S, Sriganesh K, Rao M. Pneumothorax with subcutaneous emphysema following cardio-pulmonary resuscitation. *Minerva Anesthesiol* 2013;79:824-5.
- [9] Bekeredjian R, Meyer FJ, Frey N, Radeleff B. Massive tissue emphysema after cardiopulmonary resuscitation. *Am J Emerg Med* 2007;25:101-2.



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