

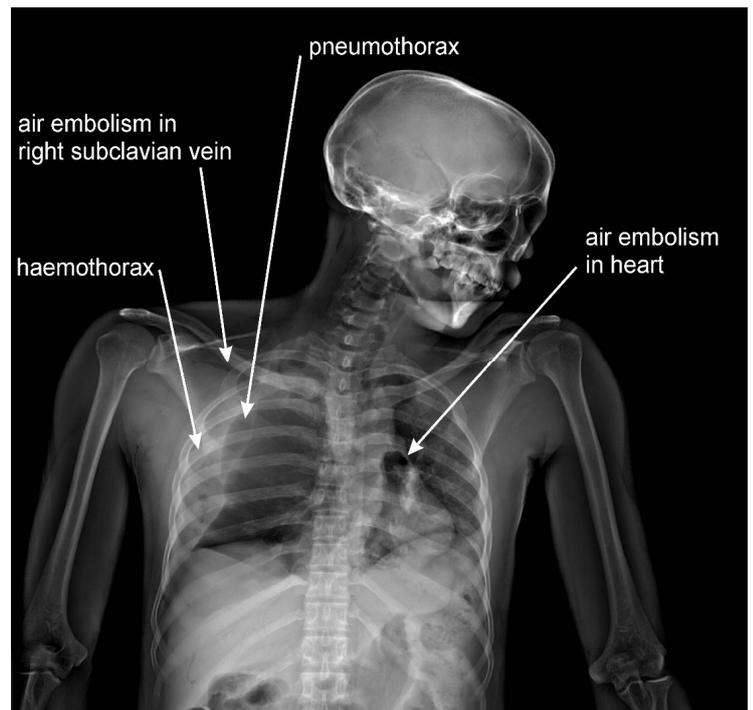
A Stab to the Neck Results in a Haemothorax, a Pneumothorax and an Air Embolism in the Heart

A case study from the Salt River Forensic Pathology Services Laboratory, Cape Town, South Africa.

Introduction

An air embolism is gas or air entrainment in the circulatory system, either in an artery (arterial embolism) or in a vein (venous embolism). This can occur when there is a breach in the cardiovascular system. In other words, it occurs when a ruptured artery or vein has been exposed to external gases. This could occur during surgery or during an injury. Another way is when gases that are normally in solution in the blood experience a higher internal pressure than the blood can provide to keep the gas in solution. This occurs as a result of rapid decompression when scuba diving, for example.

Small amounts of gas in the blood are generally absorbed by the body and pose only a limited risk. However, an air embolism produces an air lock, usually in an organ such as the lungs, the heart or the brain. This blockage prevents blood from flowing through the organ and can lead to rapid ischaemia of the organ, leading to respiratory failure, a cardiac infarction or a stroke, and hence death of the patient.



Case Presentation

An adult male victim received a stab wound to the neck. He collapsed and died on the scene.

Imaging and Diagnosis

An external examination revealed a single acute puncture wound to the right side of the neck. Autopsy showed the tract of the wound extending downwards and penetrating into the right subclavian vein, continuing into the pleural cavity.

A Lodox full-body image of the victim revealed a haemothorax and a pneumothorax on the right, and an air embolism in the heart, as well as air trapped in the subclavian vein.

Discussion

The tract of the stab wound passed through the subclavian vein. This exposed the vein to the external atmosphere and air entered the blood circulation. The venous system drains deoxygenated blood from the body back to the heart¹. The heart would be the first organ the blood would reach, depositing the air into the right chambers of the heart (right atrium followed by right ventricle), causing an air lock. Blood would thus not be pumped forward by the heart to the rest of the body, resulting in ischaemia.

The tract also continued into the chest cavity. Typically, the air pressure outside the body is greater than the air pressure in the lungs. Therefore, air also entered the chest cavity, causing a pneumothorax. The higher air pressure now surrounding the lung easily collapses the lung, rendering it unable to inflate and oxygenate the blood for the rest of the body. The stab wound also allowed blood to enter the chest cavity, causing a haemothorax, which further aided in collapsing the right lung.

A ruptured vein could also lead to excessive bleeding and possible exsanguination. However, this would have been a slower process. Death was rapid and primarily as a result of the air embolism in the heart, concomitant with the haemo- and pneumothorax².

Conclusions

An autopsy will reveal a collapsed lung. The ruptured subclavian vein would also lead a medical examiner to suspect a possible air embolism. If the entrapped air is to be detected in the heart, it is necessary to dissect the heart under water, thereby releasing the air bubble as confirmation of an air embolism. However, recording photographic evidence of this is difficult and time-consuming.

The Lodox full-body scan revealed the haemothorax, the pneumothorax, an air embolism in the subclavian vein, and the fatal air embolism in the heart. Thus, the radiology supported the findings of the autopsy, and also ruled out other trauma.

References

1. Hall-Craggs ECB. Anatomy as a Basis for Clinical Medicine, 3rd Edition; *Chapter 1, Introduction - The Cardiovascular and Lymphatic Systems*. Williams & Wilkins, Waverly Europe, 1995: 22-24
2. Saukko P & Knight B. Knight's Forensic Pathology, 3rd Edition; *Chapter 13, Complications of Injury*. Arnold, London, 2004: 339-351