

## EDITORIAL COMMENT

## When Uncontrolled, Air Can Give You a Hard Time\*



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In this issue of *JACC: Case Reports*, Green and Hering (1) refer to the case of an 84-year-old male patient with a history of a coronary artery bypass graft 24 years earlier. The patient was admitted for permanent pacemaker implantation; a cardiac resynchronization therapy–P system was implanted through direct left subclavian puncture. The procedure required multiple puncture attempts. After the procedure, routine chest x-ray showed a small predominantly basal left pneumothorax. On the following day, pneumopericardium and pneumomediastinum were noticed. The patient was conservatively treated and was discharged on post-procedural day 3.

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The investigators assumed that air progressed from the left pleura into the mediastinum and pericardium through microscopic fistulae. Pneumothorax is a well-known complication of subclavian vein puncture for pacemaker implantation, as described >40 years ago. To avoid any kind of puncture site complications or malposition of pacemaker leads, the surgeon should respect some aspects. The course of the subclavian vein is superficial. A too deep puncture should therefore always be suspect. The puncture should be parallel to the clavicle and target the junction between the first rib and the clavicle. This step should be done under fluoroscopy. In case of a difficult puncture, a contrast agent can be administered via a venous access to the arm to depict the target vessel accordingly. After successful puncture, the backflow

and the color of the blood should be checked carefully to distinguish between arterial and venous puncture. After implantation, fluoroscopy control and x-ray, as described in the case, are mandatory, regardless the type of implanted system. A characteristic finding of pneumopericardium is air surrounding the cardiac border that does not extend beyond the reflection of the aorta or the pulmonary artery, as shown in the figures in the paper (1). Pleural and lung complications might have been present in >5% of the implantations with different degrees of clinical impact (2), with a downward trending with experience. It is also clear that pacemaker implantation is safe, and the complication rate is usually low (3). In any case, underreporting cannot be excluded as well.

In the current case, the patient had coronary bypass surgery long before, and this might have been the cause of a partial pneumothorax because it is likely that the patient had pleural adhesions related to the initial operation, although no surgical report is available to the reader. In the presence of pleural adhesions, there is the likelihood of partial pneumothorax and air dissection into the mediastinum and pericardium with or without subcutaneous emphysema. This is also not a surprise.

Pneumomediastinum is the presence of free air within fascial planes of the mediastinum. Secondary pneumomediastinum can be caused by a specific injury, such as trauma, surgery, or intervention (4). This seems to be the cause in this case because there was a previous trauma in the form of multiple attempts to puncture the subclavian vein. The investigators did not disclose the number of attempts, but the word “multiple” is self-explanatory for experienced operators. There was also a high likelihood of an injury to the left lung, which resulted in pneumothorax and later pneumomediastinum and pneumopericardium. As per the Macklin effect as referenced by the investigators, the progression of air through the bronchoalveolar sheath may lead to

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pneumomediastinum and eventually pneumopericardium, resulting from entrapment of air in the pericardial space. This is the basis of such a complication that is seen after blunt chest trauma, intermittent-positive pressure ventilation, acute asthma, or respiratory distress syndrome. Air can dissect any vascular structure as well and reach the mediastinum and pericardium. This is, as confirmed by the investigators, an uncommon condition, but as stated, pneumopericardium and pneumomediastinum may be seen after different types of trauma as discussed in the current case. Both conditions have also been reported after colonoscopy (5).

In summary, the complication reported here is uncommon. The pathophysiological explanation has been well understood for decades because air always dissects under pressure toward the areas of less resistance, the peribronchial or perivascular space. It is an interesting case, not frequently seen, although it

might be somewhat presumptive to state that this is the first case of an acute pacing complication, considering that due to the structure of the publication, the investigators did not report their literature search methodology. From the learning perspective, this confirms that regardless of technology, basic medical knowledge must always be at the forefront of diagnosis. The clinical implication is that most patients without tension pneumothorax, pneumomediastinum, or pneumopericardium, can be conservatively treated. Initial good monitoring is important because hemodynamics can be compromised due to cardiac tamponade.

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