Air embolism after insertion of a percutaneous endoscopic gastrostomy – case report

Zračna embolija po vstavitvi perkutane endoskopske gastrostome – prikaz primera

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ABSTRACT

Percutaneous endoscopic gastrostomy is the method of choice in patients with long-term restriction of oral nutrition. Complications during percutaneous endoscopic gastrostomy insertion or immediately after the procedure include bleeding, perforation, peritonitis and damage of other internal organs. A very rare complication of endoscopic procedures is also air embolism. In the article, we present a case of cerebral air embolism in a 66-year-old patient after insertion of a percutaneous endoscopic gastrostomy.

IZVLEČEK

Perkutana endoskopska gastrostoma je metoda izbora pri bolnikih z dolgotrajno omejitvijo oralne prehrane. Zapleti med vstavitvijo perkutane endoskospske gastrostome ali takoj po posegu vključujejo krvavitev, perforacijo, peritonitis ter poškodbo drugih notranjih organov. Zelo redek zaplet endoskopskih posegov pa je tudi zračna embolija. V članku prikažemo primer možganske zračne embolije pri 66-letnem bolniku po vstavitvi perkutane endoskopske gastrostome.

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INTRODUCTION

Percutaneous endoscopic gastrostomy (PEG) was first described as a method to establish a nutritional route by Gauderer and colleagues in 1980 (1). Research shows that enteral nutrition has many advantages over parenteral nutrition. The decision to undergo the procedure must be considered on an individual level, as the benefits and risks must be analyzed in detail and the concerns of the patient and his relatives thoroughly assessed (2).

Complications during PEG insertion or immediately after the procedure are rare and include bleeding, perforation, peritonitis, damage to other internal organs. Attention should also be paid to complications due to the application of drugs used as part of sedation and analgesia during the procedure. Late complications are mostly related to care – local inflammation with infection, leakage, clogging of the tube, mucosal overgrowth over the stomach lining and aspiration of food (3, 4). Air embolism is a less frequently seen or described complication of endoscopic examinations (5).

CASE REPORT

We report a case of a 66 year old male patient without associated diseases or regular therapy and a medical history of the right lower lobe lung adenocarcinoma (T1bN2M0), after radical chemo- and radiotherapy until December 2020, with progression of the disease to the subcarineal lymph nodes in September 2022 (with a clinical picture of dysphagia) and repeated radiotherapy until December 2022 with a complete response. Since February 2023, he was treated several times in various medical facilities for outbreaks of infection. Most likely, due to the passage of food through a defect in the wall of the esophagus, which was never proven by radiological examinations.

In April 2023, he was treated at the Emergency Department of the University Clinical Center Ljubljana, due to fever over 38°C with chills and vomiting of blood. During hospitalization, a gastroscopy was performed, where fresh blood was present in the esophagus, and a shallow wall defect was visible at 30 cm. Transparency was poor, free perforation in the mediastinum or fistula with air bubbles was not recognized. The wall seemed very thin and soft, due to the risk of the wall puncture, hemostasis measures were not performed.

As the hemoglobin continued to drop, an urgent council of pulmonologist, thoracic surgeon and interventional radiologist decided to insert a stent graft into the aorta. The procedure was performed under general anesthesia. The thoracic aorta, just below the left subclavian artery, was covered with two stent grafts, approximately 20 cm long, and dilated with a balloon. After the procedure, patient was transferred to the Oncology Institute Ljubljana for further antibiotic therapy, parenteral nutrition and agreement regarding the insertion of a gastrostomy.

Approximately a week later, we performed a gastroscopy with the placement of a PEG with gastropexy. During the examination, mild bleeding was still visible at the site of the defect. There were no signs of complications during the procedure. Upon returning to the ward, the patient developed a mild disturbance of consciousness and a left-sided hemiparesis, as well as involuntary movements of the right limbs.

A head computed tomography (CT) with CT angiography of the aorto-cervical and cerebral arteries was performed, where there were no signs of a fresh infarction, but several very small hypodense air inclusions were visible in the right frontal and parietal lobes. 100% oxygen was administered via an OHIO mask, and he received benzodiazepines due to the clinical picture of an epileptic attack. The following day, the disturbance of consciousness deepened, he suffered a focal epileptic seizure again. He was transferred to the intensive care unit, where he was anglosedated and intubated. Control head CT showed resorption of gas bubbles in the right hemisphere, with the formation of edema. An ultrasound of the heart was also performed, which did not show air bubbles in the cardiovascular circulation or a possible open foramen ovale. Treatment in a hyperbaric chamber

was considered, but was not realized, due to the inability of the patient to cooperate and questionable effectiveness in the absence of bubbles on the control head CT.

During the treatment, epileptiform activity was ruled out with an EEG, no demarcated ischemia, herniation, bleeding or air inclusions were found on control imaging of the head, and the edema subsided. Antibiotic therapy was reintroduced due to the onset of the infection, patient also required vasoactive support and supplemental oxygen in inhaled air. Anticoagulant treatment was initiated in the presence of thrombosis of the right axillary vein. After 16 days, the patient was extubated. From the neurological deficits a left hand paresis remained, but it also gradually resolved. 12 days after transfer from the intensive care unit, patient had an episode of hematemesis and melena. Despite symptomatic supportive therapy, he died the same night.

DISCUSSION

An air embolism is a sudden clogging of a vessel with air, due to communication between the air source and the vessel and a pressure gradient that allows the passage of air into the bloodstream. It can occur with or without direct damage to the vessel (6, 7). It is a very rare complication of endoscopic examinations, the first description in the literature is from 1988 (8). Most commonly it is associated with endoscopic retrograde cholangiopancreatography (ERCP), but can result from any endoscopic procedure, including gastroscopy, enteroscopy, colonoscopy, and endoscopic ultrasound. Only one description of air embolism after PEG insertion is available in the literature, from 2013, where a 65-year-old male was diagnosed with portal vein air embolism 8 days after the procedure (9).

Air embolism is especially uncommon in upper gastrointestinal endoscopic procedures, because of the unique hepatic venous drainage. It may be limited to the portal venous system or develop into a systemic air embolism if the liver is bypassed (e.g. portosystemic bypasses, biliary-venous fistula, air flow directly into the hepatic veins or inferior vena cava). Arterial air embolism is even rarer and occurs in certain circumstances, such as the presence of an intracardiac bypass (most often an open foramen ovale), intrapulmonary right-left shunt, retrograde flow into the cerebral veins via the superior vena cava, or passage of air into the left atrium via pulmonary veins. These structural anomalies are usually not previously known, and often remain unrecognized even during diagnostics (in the event of a complication) (10, 11).

Risk factors for air embolism are inflammatory mucosal changes (e.g. inflammatory bowel disease, mesenteric ischemia), ulcer, tumor, postoperative gastrointestinal fistula, previous procedures or operations of the biliary system, transhepatic portosystemic shunt, special interventional techniques such as cholangioscopy, biliary sphincterotomy, placement of a metal stent, high-pressure air insufflation, increased volume and/or rate of air infusion (12).

The consequences of an air embolism depend on the speed and volume of air introduced into the bloodstream. Many cases are subclinical, but the clinical picture can be dramatic with cardiopulmonary instability and neurological symptoms. It may overlap with cardiopulmonary symptoms associated with sedation or neurological symptoms due to an ischemic or hemorrhagic event in the central nervous system (10). The diagnosis of air embolism is often difficult, because air can be absorbed from the circulation while the diagnosis is still ongoing. The presence of bubbles in the right atrium or pulmonary vein can be detected with cardiac ultrasound (preferably transesophageal). Potential structural anomalies of the heart, such as an open foramen ovale, can also be assessed. CT is the method of choice for detecting air inclusions in the portal system, lungs or brain parenchyma (11, 12).

The goal of treatment is to prevent further embolization and ischemia. Insufflation of the gastrointestinal tract should be stopped as soon as possible and excess gas should be aspirated. Application of 100% FiO2 is indicated. Patient can be tilted upside down by 30°

or placed in the left lateral position, thereby trying to prevent the further passage of air into the left heart and head. A possible therapeutic intervention is the insertion of a catheter into the central vein or pulmonary artery to aspire gas from the right ventricle. Treatment in a hyperbaric chamber is indicated, as the size of air bubbles can be reduced, nitrogen reabsorption is accelerated and the oxygen content of arterial blood is increased, which potentially reduces ischemia (13).

CONCLUSION

Air embolism is a rare endoscopic complication with a high mortality rate, presenting as cardiopulmonary instability and neurological symptoms. Diagnosis can be difficult.

We have presented a case of air embolism after gastroscopy with PEG insertion. It is not entirely clear whether the cause of the air embolism was the PEG insertion itself or insufflation in the presence of a defect in the esophageal wall.

Awareness, quick recognition and appropriate action by all who carry out such investigations and interventions in essential.

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