Air embolism

An air embolism, also called a gas embolism, occurs when one or more air bubbles enter a vein or artery and block it. When an air bubble enters a vein, it's called a venous air embolism.

Gas embolism is a rare but fatal clinical emergency. Hydrogen peroxide (H2O2) can cause gas embolism when improperly used in closed cavities or for deep and large wound irrigation.

Presentation of case: A 31-year-old woman was diagnosed with lumbar-3 tuberculosis and paravertebral abscess and underwent emergency spinal surgery in a prone position. After removing the tuberculous pus, 200 mL of H2O2 (3 % v/w) was used to repeatedly irrigate the abscess cavity. Immediately after irrigation, the patient suffered cardiac arrest. During cardiopulmonary resuscitation, transesophageal echocardiography revealed that the right cardiac cavity was filled with a diffuse “Snowflake-Like” gas embolus, and cranial computed tomography showed a multi-point pneumocephalus in the frontal lobes. The patient eventually suffered brain death despite the return of spontaneous circulation after active resuscitation.

Discussion: H2O2 can quickly release abundant oxygen and water upon contact with catalase. Oxygen bubbles enter the vascular lumen and cause mechanical obstruction of the right cardiac circulation. In addition, H2O2 and oxygen bubbles may migrate upwards and enter the intracranial tissue through the epidural space or subdural space, resulting in intracranial pneumatosis. Diagnosis and treatment of gas embolism are extremely difficult. Some suggestions are that H2O2 should not be used in closed cavities or on deep and large wounds due to the potential risk of fatal gas embolism.

Conclusion: The fatal complications of gas embolism and pneumocephalus rarely occur simultaneously in one patient, and we aim to highlight this potential risk of intraoperative H2O2 use in spinal surgery [1)]

Air embolism is a potentially fatal complication of any operation when an opening to air occurs in a non-collapsible vein (e.g. diploic vein or a dural sinus) when there is a negative pressure in the vein (e.g. when the head is elevated above the heart) [2)].

Arterial gas embolism following pulmonary barotrauma occurs in 13-24% of cases of diving deaths. The study aimed to evaluate the usefulness of a histomorphometric digital analysis in detecting air space over-distension due to pulmonary barotrauma. The study was performed on lung parenchyma specimens of 12 divers: six had died due to arterial gas embolism following pulmonary barotrauma (mean age at death of 54 years, range of 41-61 years), and six had drowned in saltwater without a diagnosis of pulmonary barotrauma (mean age at death of 54 years, range of 41-66 years) (positive controls). For negative controls, six cases of non-SCUBA divers (mean age of death of 42 years, range of 23-55 years) who died of intracerebral hemorrhage were evaluated. No significant differences were observed in the characteristics of the air spaces between control groups (positive and negative). However, differences were observed in the area occupied by air spaces and the percentage of air space area when we compared the case group to the controls ($p < 0.01$); and there was a slight difference in the maximum and minimum diameters of air space ($p < 0.05$). The mean area occupied

by air spaces and the mean percentage of air space was the most useful for discriminating pulmonary barotrauma from other causes of death (100% sensitivity and 91.7% specificity). Based on our study, the inclusion of an increased pattern of air spaces as a possible diagnostic criterion for pulmonary barotrauma would be helpful in discerning the cause of diving death [3].

1)
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2)
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3)
Casadesús JM, Nieto-Moragas J, Serrando MT, Boadas-Vaello P, Carrera A, Aguirre F, Tubbs RS, Reina F. Pulmonary barotrauma in SCUBA diving-related fatalities: a histological and histomorphometric analysis. Forensic Sci Med Pathol. 2023 Jan 27. doi: 10.1007/s12024-022-00567-1. Epub ahead of print. PMID: 36705884.