

CASE REPORT

Major ischaemic stroke caused by an air embolism from a ruptured giant pulmonary bulla

Johanna F Gudmundsdottir,¹ Arnar Geirsson,¹ Petur Hannesson,² Tomas Gudbjartsson^{1,3}

¹Departments of Cardiothoracic Surgery, Landspítali University Hospital, Reykjavik, Iceland

²Department of Radiology, Landspítali University Hospital, Reykjavik, Iceland

³Faculty of Medicine, University of Iceland, Reykjavik, Iceland

Correspondence to

Professor Tomas Gudbjartsson, tomasgud@landspitali.is

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SUMMARY

We report an extremely rare complication of a major ischaemic cerebral event caused by an air embolism due to spontaneous rupture of a giant pulmonary bulla that occurred during an airline flight. Shortly after take-off, the patient experienced sudden right-sided hemiplegia and dyspnoea. Following an emergency landing in Reykjavik, a CT scan of the brain showed minute air bubbles consistent with air emboli within the left-sided intracerebral arteries, and MRI showed signs of acute ischaemic cerebral infarction in the left hemisphere. The patient later underwent a pulmonary lobectomy and survived this life-threatening complication with relatively mild neurological sequelae.

BACKGROUND

Giant pulmonary bullae (GPB) are air-filled spaces within the parenchyma of the lung that fill more than one-third of the hemithorax. GPBs can cause complications, such as pneumothorax, haemorrhage or lung infections. We report an extremely rare complication of GPB where major ischaemic stroke occurred during an airline flight caused by air embolism from a ruptured GPB.

CASE PRESENTATION

A 58-year-old non-smoking male, previously healthy, suddenly experienced aphasia and right hemiplegia during a trans-Atlantic flight, about 20 min after take-off. After emergency landing in Iceland, he was transported to our hospital in Reykjavik. On admission he reported left-sided chest pain with dyspnoea.

INVESTIGATIONS

A chest X-ray showed a large left-sided pneumothorax; a chest tube was inserted. Owing to incomplete lung expansion it was decided to perform a CT of the thorax, which revealed a 15×13 cm thin-walled GPB in the left upper lobe (figure 1). Urgent CT of the brain was also performed and showed several minute air bubbles, consistent with air emboli, within the left-sided intracerebral arteries (figure 2). Furthermore, a MRI of the brain showed signs of acute ischaemic cerebral infarction in the left hemisphere (figure 3). These findings were compatible with cerebral air embolism and thought to originate from the GPB in the left hemithorax.

TREATMENT

Our patient received conventional oxygen therapy and his symptoms improved. One month after

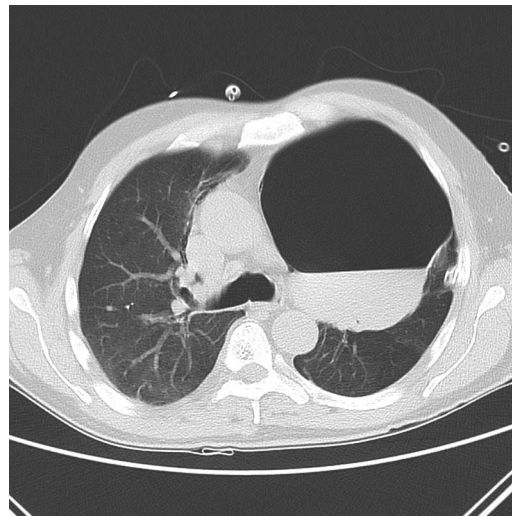


Figure 1 A chest CT scan 2 days after admission, which shows a giant bulla in the left lung and several smaller cysts.

admission the GPB was surgically removed with an upper left lobectomy (figure 4). Pathological examinations revealed a benign thick-walled bulla and emphysematous lung tissue.



Figure 2 A CT scan of the brain soon after admission, which shows filling defects in arterioles from the left a. cerebri media due to air emboli.



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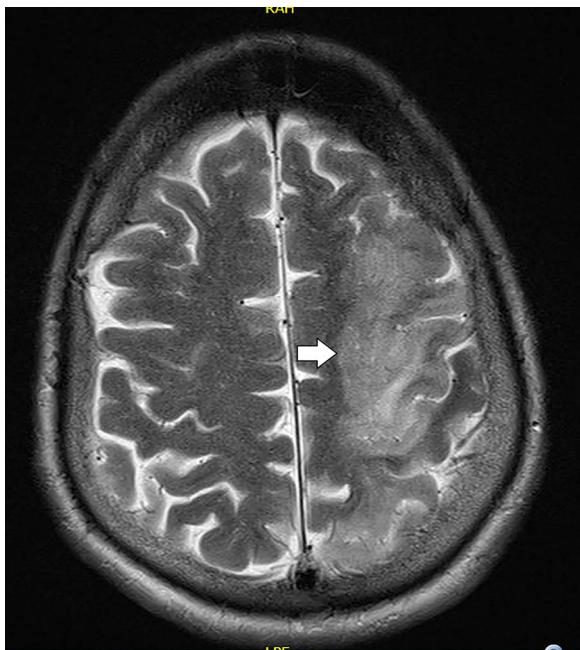


Figure 3 An MRI of the brain 2 days after admission, which shows ischaemia in the left hemisphere.

OUTCOME AND FOLLOW-UP

The patient tolerated the operation well and was discharged 2 weeks later. He was then transported back to England, where he is recovering from his stroke.

DISCUSSION

GPBs are rare, especially in non-smokers. They do not participate in ventilation or gas exchange and have the tendency to grow and compress the surrounding normal lung tissue, causing dyspnoea. Most GPBs, however, are diagnosed incidentally on chest X-ray in middle-aged heavy smokers.¹ When complications occur or the bullae occupy more than half of the hemithorax, surgical removal is usually recommended.¹



Figure 4 A picture of the resected left upper lobe. The giant bulla has been cut open.

Ischaemic stroke caused by air embolism due to a ruptured GPB during an aeroplane flight is extremely rare, with only two cases being previously reported.²⁻³ In both cases the patients suffered primary brain injury with sudden onset of unconsciousness shortly after take-off. The clinical presentation of cerebral gas embolism is determined by the quantity of gas and the areas of the brain that are affected, ranging from minor motor weakness and headache to convulsion, loss of consciousness and coma.⁴ Our patient never lost consciousness and had only mild cerebral oedema; in contrast, in the two other GPB cases, both patients lost consciousness, with extensive bilateral intraparenchymal air bubbles and cerebral oedema, one with lethal outcome.⁵

Air embolism in patients with pre-existing lung pathology during air flight is thought to be pulmonary barotrauma due to pressure change during ascent. The pressure drop causes an air-containing bulla to expand, which can cause tears of its wall and leakage into the circulation.⁵ The GPB in the present case most likely ruptured into the pulmonary veins, from where the air travelled to the left heart and embolised to the arterial cerebral circulation. The cerebral involvement is probably due to the sitting position of the patient.

Neurological deficit due to cerebral air embolism may be reversible. Treatment usually consists of administration of oxygen, which can counteract ischaemia and reduces the size of air bubbles by depleting intravascular nitrogen.⁴ Hyperbaric therapy has also been suggested in intracerebral air embolism, compressing the bubbles and reducing the extent of inflammation caused by their presence.⁴ However, to our knowledge, there are no cases reported where this treatment has been used in a case due to ruptured GPB.

Our patient received only conventional oxygen therapy and his symptoms improved. The outcome was favourable, mostly related to small areas of cortical involvement.

This case demonstrates how previously healthy patients can suddenly develop severe neurological deficits from ruptured GPB during air travel.

Learning points

- ▶ A pulmonary bulla is generally asymptomatic and the diagnosis is incidental. Complications are uncommon.
- ▶ Surgical resection of giant pulmonary bullae is indicated for patients who present with complications, such as rupture, pneumothorax, bleeding and infection.
- ▶ Changes in atmospheric pressure can lead to rupture of a previously asymptomatic pulmonary bulla and cause gas embolism into the circulation.
- ▶ Patients with cerebral gas embolism can benefit from hyperbaric oxygen treatment and resection of the pulmonary lesion to avoid further complications.
- ▶ Patients with known pulmonary bullae should be warned of the possibility of expansion of the bulla in situations of variations of atmospheric pressure, such as air travel and deep sea diving.

Contributors JFG contributed in the study design, collection and analysis of the data, and writing and revision of the manuscript. AG and PH contributed in the analysis and collection of data, and revision of the manuscript. TG is the guarantor, and was involved in the management of the case, study design, collection and interpretation of the data, writing and revision of the manuscript.

Competing interests None.

Patient consent Obtained.

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