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Case report

Spontaneous intracardiac microcavitations in a patient with a colonic carcinoma

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SUMMARY

Intracardiac microcavitations consist of airy microbubbles. They are typically found in patients with an intravascular line or device, mechanical heart valves or in decompression sickness. We report a case of a patient in mid-70s who was admitted due to weakness in both legs, left-thoracic pain and fever. Despite the lack of any of the risk factors mentioned above, spontaneous microcavitations were detected in the right sided cardiac cavities. After the detection of liver lesions suspicious for a metastatic disease, a colonoscopy was performed. An ulcerated colonic carcinoma at the ileocecal valve was diagnosed and highly suspicious for being the entry port of the microcavitations. This unusual presentation of microcavitations together with a colonic neoplasia leads to hypotheses about the journey of the microbubbles from the ascending colon into the right heart.

Gastrointestinal tumours are described as being the causes of microbubbles. Translocation of microbubbles through hepatopulmonary shunting are described in the context of locally applied particles of similar size during radioembolisation. A thorough aetiological workup is of importance since the underlying cause is potentially dangerous due to its own nature of disease and due the complications of the microcavitations such as paradoxical emboli or pulmonary sequelae.

BACKGROUND

Spontaneous intracardiac echo contrast is often described in the left atrium. It has a characteristic,

smoke like look, caused by increased ultrasound scatter due to stasis of cellular components.^{1,2} Patients usually suffer of a cardiac abnormality such as atrial fibrillation (AF), prosthetic mitral valves, enlarged left atrium and right atrial enlargement with elevated ventricular pressure and tricuspid regurgitation.^{3,4}

Microcavitations, however, are a different and distinct echocardiographic phenomenon. Since they consist of microbubbles, they mainly occur in patients with extracorporeal, transcutaneous lines and devices (eg, cardiopulmonary bypass or dialysis machines) in place which serve as port of entry. They have also been described in patients with a mechanical heart valve where they result from the rapid pressure drop during valve closure.⁵

In this present case, however, the search for the source of the microbubbles was less straight forward.

CASE PRESENTATION

A man in mid-70s was admitted to our emergency department because of an acute weakness in both legs which had led to a fall. He also reported chest pain, combined with a feeling of tachycardia after his fall. He had not noted any dyspnoea. He felt well in the last few days except for chronic pain of the left leg. His medical history is remarkable for mitral regurgitation and hypertensive heart disease (HFpEF), chronic renal failure KDIGO II, normochromic normocytic anaemia and AF. Cardiovascular risk factors were arterial hypertension, dyslipidaemia and a former nicotine abuse. Current medication was phenprocoumon, bezafibrate, candesartan, bisoprolol and chondroitin sulfate.

At presentation, the patient had a temperature of (39.8°C) with normal blood pressure, heartrate and oxygen saturation. The clinical examination was unremarkable except for a systolic murmur. There was no more weakness in the legs. The ECG showed AF with T-negativities in III. Laboratory tests showed a haemoglobin of 88 g/L, leucocytes of $15.9 \times 10^9/L$, CRP of 60 mg/L (ref.: <10 mg/L), creatinine of 198 $\mu\text{mol/l}$ (ref.: <104 $\mu\text{mol/l}$). Blood cultures were negative. The X-Ray of the thorax only showed signs of venous congestion.

We admitted the patient to the normal ward with a telemetric monitoring. The next day, there was no fever, the laboratory values were unchanged. The clinical examination still gave no

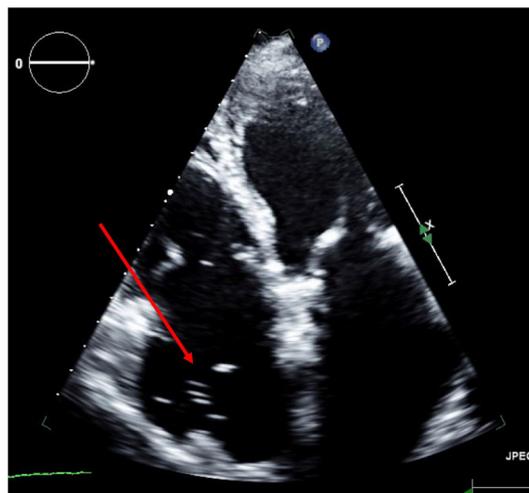


Figure 1 Echocardiographic view (4-chamber axis) with microcavitation in the right ventricle.



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Figure 2 CT scan of the thorax, with air in the right ventricle (arrows) and also the suspicious lesions in the liver.

hints of an acute infection. The diagnosis of an infection of unknown origin was maintained and the search for the source was started with an echocardiography due to the pre-existing mitral regurgitation. Surprisingly, the examination revealed continuous spontaneous microcavitations in the right atrium, right ventricle, right ventricular outflow tract and truncus pulmonalis (figure 1). No right-to-left shunt could be detected. A CT scan of the chest confirmed the findings (figure 2). A second surprising finding were several hypodense hepatic lesions, which lead to the suspicion of a metastatic disease. A colonoscopy was additionally performed, where an ulcerated colonic carcinoma at the ileocecal valve was detected (figure 3). Unfortunately, the patient refused any further examinations or treatment and left the hospital before the workup could be completed. He died 4 months thereafter.

OUTCOME AND FOLLOW-UP

Unfortunately, the patient refused any further examinations or treatment, and left the hospital before the workup could be completed. He died 4 months thereafter.

DISCUSSION

The port entry, therefore, must be detected. In our case, it seemed to be the colonic adenoma. Scarce literature underlines the plausibility for our theory and is sequentially presented here to explain the bubbles' journey from the port of entry to the cardiac cavities.

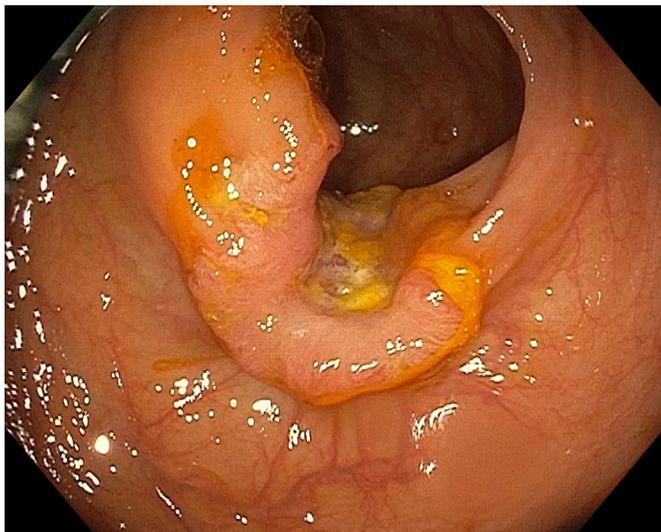


Figure 3 Colonoscopy of the ileocaecum with the suspected carcinogens of the colon.

Learning points

- ▶ Microcavitations are a rare form of spontaneous intracardiac echo contrast due to microbubbles.
- ▶ The search for port of entry is obligatory. Gastrointestinal tumours can be a potential source of microcavitations.
- ▶ Their deleterious potential of the microbubbles depends on the size and amount of air in the circulatory system.

The first stage is the way to the portal venous system, the venous drainage of the colonic cancer described. Hepatic portal venous gas, is a rare finding, but is described in a variety of intestinal pathologies such as infections, ulcers or ileus.⁶ Li *et al* describe hepatic portal gas in a patient with colonic cancer,⁷ suggesting that neoplastic pathologies can also serve as a port of entry.

The transition of the bubbles from the portal venous system to the cardiac cavities must have been facilitated by the metastases: air usually can be cleared from all organs within minutes to hours, as shown in a study after cardiac surgery.⁸ The liver also seems to effectively clear hepatic portal gas.⁹

However, portosystemic and hepatopulmonary shunting is known to occur during radioembolisation of hepatic metastases with particles of 20–60 μm diameters. The shunt fraction of the microparticles varies between 1% and 10%, depending on the angiogenetic characteristics within the neoplasia.^{8 10 11} These particles are about the same size as the microbubbles described.¹²

Neoplastic angiogenesis can lead to malformations, making portosystemic shunting possible. In an assessment of angiogenesis in colonic cancer, the vessels were irregular, widely branched and of highly variable calibre,¹³ assuming that the angiogenesis of the metastases are the same, portacaval and therefore porto-cardiac shunting is highly possible.

For our patient, we could not find any other source of the microbubbles but the colonic neoplasia.

Unfortunately, visualisation of air in the colonic wall as pneumatosis intestinalis or in the portal system as a proof for our hypothesis is lacking, also due to the patient's unwillingness to undergo further investigations. Nonetheless, we believe that the combination of the pathophysiological mechanisms described above is a valid explanation for our findings.

Microcavitations should always lead to an extended search for a plausible port of entry. Although the translocation of microbubbles through the portal system into the cardiopulmonary circulation is rare, an intestinal neoplasia can still be a plausible source. Elimination of the port of entry offers also the cure for this potentially deleterious disease.

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REFERENCES

- Black IW. Spontaneous echo contrast: where there's smoke there's fire. *Echocardiography* 2000;17:373–82.
- Yasuoka Y, Naito J, Hirooka K, *et al.* Right atrial spontaneous echo contrast indicates a high incidence of perfusion defects in pulmonary scintigraphy in patients with atrial fibrillation. *Heart Vessels* 2009;24:32–6.
- Castello R, Pearson AC, Labovitz AJ. Prevalence and clinical implications of atrial spontaneous contrast in patients undergoing transesophageal echocardiography. *Am J Cardiol* 1990;65:1149–53.
- DeGeorgia MA, Chimowitz MI, Hepner A, *et al.* Right atrial spontaneous contrast: echocardiographic and clinical features. *Int J Card Imaging* 1994;10:227–32.
- Patel H, Boateng S, Singh G, *et al.* Spontaneous right-sided microcavitations in a healthy adult. *Echo Res Pract* 2015;2:K33–6.
- Nelson AL, Millington TM, Sahani D, *et al.* Hepatic portal venous gas: the ABCs of management. *Arch Surg* 2009;144:575–81. discussion 581.
- Li Z, Su Y, Wang X, *et al.* Hepatic portal venous gas associated with colon cancer: a case report and literature review. *Medicine* 2017;96:e9352.
- Chung EM, Banahan C, Patel N, *et al.* Size distribution of air bubbles entering the brain during cardiac surgery. *PLoS One* 2015;10:e0122166.
- Inokuchi R, Fukuda T, Yahagi N, *et al.* Severe hepatic portal venous gas that spontaneously resolved within a day. *Intensive Care Med* 2014;40:1369.
- Hennigan TW, Earlam S, Allen-Mersh TG. Is liver to lung shunting in colorectal liver metastasis the cause of toxicity following treatment with cytotoxic microsphere aggregates? *Br J Cancer* 1992;66:1169–70.
- Narsinh KH, Van Buskirk M, Kennedy AS, *et al.* Hepatopulmonary shunting: a prognostic indicator of survival in patients with metastatic colorectal adenocarcinoma treated with ⁹⁰Y Radioembolization. *Radiology* 2017;282:281–8.
- Barak M, Katz Y. Microbubbles: pathophysiology and clinical implications. *Chest* 2005;128:2918–32.
- De Palma GD, Maione F, Esposito D, *et al.* In vivo assessment of tumour angiogenesis in colorectal cancer: the role of confocal laser endomicroscopy. *Colorectal Dis* 2016;18:O66–73.

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