

Simultaneous multiple organ emboli in a patient with solid organ malignancy: a case report

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Background

Thrombosis is a dangerous complication of cancer. At least 20% of cancer patients are diagnosed with a venous thrombotic event and 1% with an intra-arterial thrombotic event. Here, we present a patient that developed separate thrombi that occurred simultaneously in both the venous and arterial circulation.

Case summary

An 80-year-old woman with a history of recently diagnosed squamous cell lung cancer presented to our institution with an out of hospital cardiac arrest. On arrival, she was found to have an inferior ST-elevation myocardial infarction on electrocardiogram and on examination was found to have right-sided neurological deficits. Computed tomography head and aortogram showed an acute ischaemic stroke and bilateral segmental pulmonary emboli. Coronary angiogram showed thrombotic occlusion distal to the right coronary artery, and the patient underwent aspiration thrombectomy with thrombolysis in myocardial infarction 3 flow established at the end of the procedure. The patient was then transferred to interventional radiology where she had successful clot retrieval of the cerebral thrombus. The patient progressed well and had full neurological recovery 72 h post-presentation. Subsequent transoesophageal echocardiography showed no evidence of a patent foramen ovale or other intracardiac shunt. The patient was prescribed long-term anticoagulant with Clexane.

Discussion

There was suspicion for a deep vein thrombosis with subsequent embolization to the lungs and paradoxical embolization through an intracardiac shunt. However, no such defect was detected and it appears that the patient did develop thrombi in the arterial and venous system separately. This case highlights the prothrombotic state of malignancy, with the patient suffering from multiple separate life-threatening thrombi.

Keywords

Case report • Thrombosis in cancer • Arterial thrombus • Venous thrombus • Percutaneous coronary intervention • Stroke • Multiple interventional procedures

Learning points

- Thrombosis is a dangerous complication of cancer.
- Multiorgan thrombosis in both the arterial and venous circulation can occur simultaneously.
- Multiple consecutive invasive procedures (in this case coronary angiography with thrombus aspiration followed by cerebral angiogram with clot retrieval) can be performed safely and lead to successful outcome.

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Introduction

Thrombosis is a dangerous complication of cancer. At least 20% of cancer patients will be diagnosed with a venous thrombotic event and 1% of cancer patient with an intra-arterial thrombotic event.¹

The prothrombotic nature of cancer is a complex interplay of multiple factors. In keeping with Virchow's triad, there are alterations in blood flow, vascular endothelial injury, and hypercoagulability. This is caused by inflammation, cell necrosis, increased cytokine production and abnormal protein production, and metabolism from the tumour itself.²

Here, we present a patient that developed a thrombotic complication in both the venous and arterial circulations simultaneously.

Timeline

3 months prior to presentation	Diagnosed with squamous cell lung carcinoma. Chemotherapy (paclitaxel and carboplatin) initiated
Upon presentation to Emergency Department post out of hospital cardiac arrest	Patient found to be aphasic, with new right-sided weakness Inferior ST-elevation on electrocardiogram Computed tomography scans showed left middle cerebral artery (LMCA) stroke and bilateral pulmonary emboli Angioplasty performed with successful thrombo-aspiration Subsequent successful clot retrieval from LMCA
3 days post-admission	Had full neurological recovery Patient commenced on therapeutic Clexane
5 days post-admission	Transoesophageal echocardiography performed no inter-atrial shunt demonstrated
3 months post-discharge	Patient had no residual neurological deficits and no further thrombotic events. Chemotherapy had been ceased, and she was now on a checkpoint inhibitor Patient was switched from Clexane to lifelong Apixaban

Case presentation

An 80-year-old woman with a history of recently diagnosed Stage III squamous cell lung cancer presented to our institution with an out of hospital cardiac arrest. She had a witnessed collapse and was found to be in pulseless electrical activity. She regained circulation after two cycles of chest compressions (CPR).

The patient had a past medical history of ongoing cigarette smoking and chronic obstructive airways disease, for which she was on

tiotropium and seretide. Her lung cancer was discovered 3 months prior on a chest X-ray done as part of a work up for an episode of chest pain. She had completed 8 weeks of palliative chemoradiotherapy, with her last cycle of carboplatin and paclitaxel ending 2 days before presentation.

On arrival to Emergency, her observation was as follows: heart rate of 80 b.p.m., systolic blood pressure 110 mmHg, respiratory rate of 18 b.p.m., and oxygen saturations 99% on 2 L/min of supplemental oxygen. She was found to have an inferior ST-elevation myocardial infarction on electrocardiogram and was transferred emergently to the cardiac catheterization suite.

Examination done in the holding bay revealed slight right-sided weakness, facial droop, neglect, aphasia, and an upgoing planter reflex. Her calves were soft and non-tender. A computed tomography head and aortogram was organized.

Computed tomography head (*Figure 1*) showed a hyperdense left middle cerebral artery (LMCA) sign consistent with an acute ischaemic stroke due to proximal subtotal thromboembolic occlusion of the artery. The remaining intracerebral vessels as well as the internal carotid and vertebral arteries were unremarkable.

Computed tomography aortogram (*Figure 2*) showed bilateral segmental and subsegmental pulmonary emboli with an occluded right inferior pulmonary artery and no evidence of aortic dissection or anomalous drainage of the inferior vena cava.

Targeted transthoracic echocardiogram (TTE) showed an akinetic inferior wall with normal right ventricular size, function and pressures.

Coronary angiography (*Figure 3*) showed thrombotic occlusion of the distal right coronary artery.

The patient was loaded with 300 mg of aspirin, 180 mg of ticagrelor, and 7000 units of intravenous heparin. An aspiration thrombectomy was performed and revealed a large amount of thrombus. The artery was smooth walled and there was no evidence of a plaque rupture. Following this, there was resolution of the ST-elevation and thrombolysis in myocardial infarction 3 flow was re-established without the need for stent placement.

The patient was then transferred to the interventional radiology suite where she had successful LMCA clot retrieval. An inferior vena cava filter was also inserted to prevent further embolization from any potential deep venous thrombosis (DVT) of the pelvis or legs. The patient progressed well and had full neurological recovery 72 h post-presentation.

Subsequent transoesophageal echocardiography (TOE) showed no intra-cardiac thrombus. An agitated saline bubble study was also performed with TOE which showed no evidence of a patent foramen ovale (PFO) or other intracardiac shunt to explain a paradoxical embolism.

Thrombophilia screening and further scans for potential DVT were not done as it was felt it would not affect the patient's management. Based on current guidelines, the patient was prescribed long-term anticoagulation with enoxaparin, a low molecular weight heparin (LMWH), at a dose of 1 mg/kg b.i.d.^{1,3,4} Antiplatelet therapy was not continued as the source of the coronary thrombus was thought to be embolic.

On review, 3 months post-discharge, the patient had no further thrombotic events. Chemotherapy had been ceased and she was

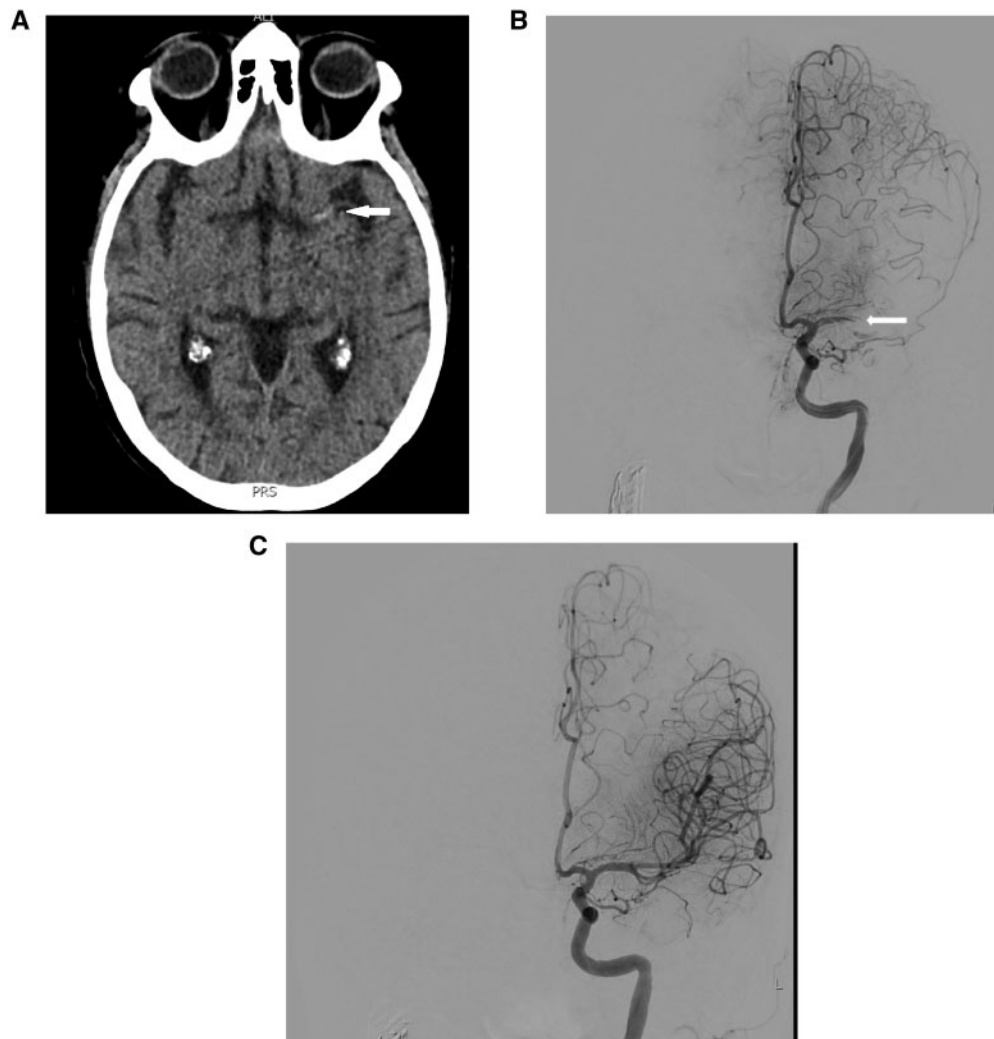


Figure 1 (A) Computed tomography brain demonstrating hyperdensity in left middle cerebral artery (see arrow), consistent with an acute thrombus. (B) Cerebral angiogram of the left cerebral artery prior to clot retrieval. (C) Cerebral angiogram of the left cerebral artery post clot retrieval.

commenced on a checkpoint inhibitor. As she had developed thrombus in three separate organs, it was decided that she should have life-long anticoagulation. It was felt that enoxaparin would be impractical thus she was switched to apixaban.

Discussion

Due to emboli being found simultaneously in multiple organs, there was a strong suspicion of a DVT with subsequent embolization to the lungs and paradoxical embolization via a defect such as an atrial septal defect or PFO.

However, no such defect was detected on TTE and TOE and it appears that the patient did develop thrombosis in the arterial and venous systems separately.

Intra-arterial thrombotic events are rare and occur mostly in metastatic cancers, or in patients receiving anthracyclines, taxane-, and platinum-based chemotherapies.⁵

Venous thrombosis is more common and is thought to be under-recognized in patients with cancer.⁶ Tumour cells appear to create a hypercoagulable state by interacting with all parts of the haemostatic system.

Proposed mechanisms include the ability of tumour cells to produce and secrete both procoagulant and antifibrinolytic substances or by a physical interaction between the tumour cells and blood or vascular cells.^{2,7} In addition, certain oncology treatments such as chemotherapy and hormonal therapy also contribute to increased risk of thrombosis by causing endothelial damage, or stimulation of tissue factor production and procoagulant factors by host cells.²

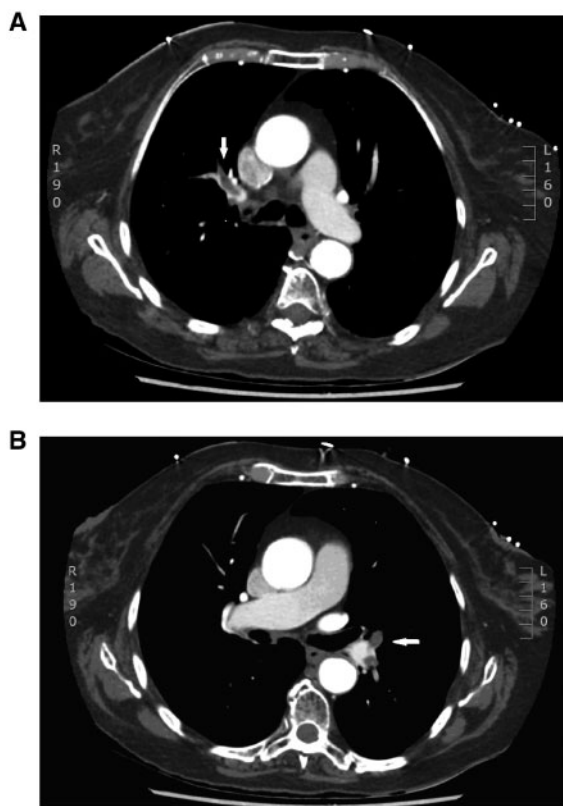


Figure 2 (A) Pulmonary embolus in right pulmonary arteries. (B) Pulmonary embolus in left pulmonary arteries.

Nonetheless, the mechanisms for the prothrombotic state of cancer are not entirely understood and thrombosis remains the second most frequent cause of death in cancer patients.⁸

Thrombosis in cancer is complicated not only by increase rates of recurrent thrombosis but also by a higher risk of bleeding with anticoagulation treatment.^{1,9} Therefore, the decision to anticoagulate a patient should take into account the bleeding risk of the patient and weigh it against the risk of recurrent thrombosis.

Low molecular weight heparin for at least 3–6 months is the current standard of care for the treatment of cancer associated thromboembolism. This recommendation was based on a meta-analysis which showed that LMWH was associated with a reduction in recurrent thrombosis without any difference in mortality and bleeding, when compared with warfarin.^{1,9}

While the use of direct oral anticoagulants (DOACs) in the treatment of thromboembolic disease is increasing, there is still limited data in their use in oncology patients.

Recently, two randomized clinical trials that compared DOACs with LMWH showed DOACs had a lower rate of recurrent thrombosis in the first 6 months of treatment but a higher rate of major bleeding.^{10,11}

Extending the duration of anticoagulation beyond 6 months should also be considered for patients still undergoing active treatment for their malignancy or if thrombosis recurs during anticoagulation.¹

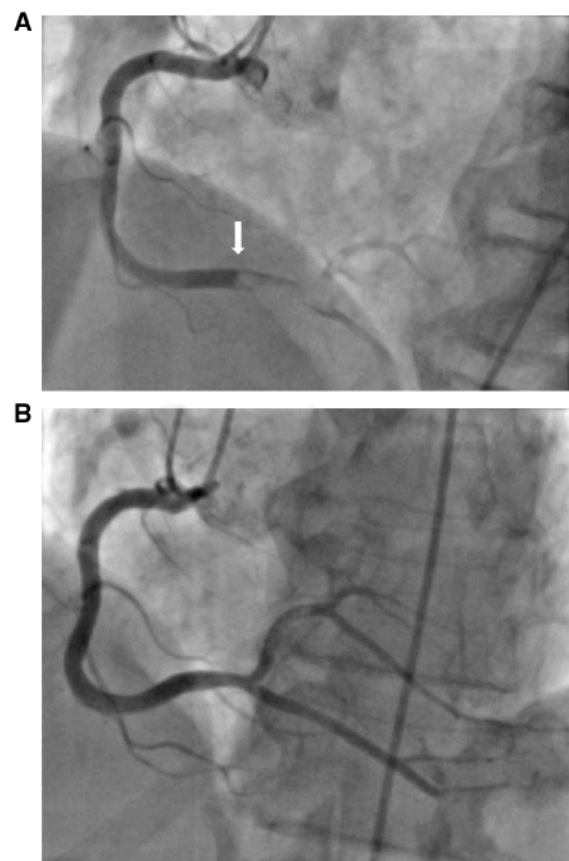
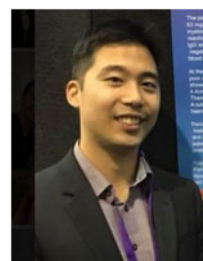


Figure 3 (A) Coronary angiography demonstrating thrombotic occlusion of distal right coronary artery. (B) Post-thrombectomy demonstrating thrombolysis in myocardial infarction 3 flow and no residual lesion.

This case highlights the prothrombotic state of malignancies with the patient suffering from multiple, separate, life-threatening thrombi.

Lead author biography



Christopher Wang graduated from the University of Melbourne with a MBBS. Upon completion of his Internal Medicine training, he is currently specializing as an Advanced Trainee in Cardiology at the Gold Coast University Hospital. He has particular interest in cardiac imaging, specifically in cardiac magnetic resonance imaging and is looking forward to further sub speciality training in this field.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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