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# **ABOUT COVER**

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CASE REPORT

# Thrombolysis and embolectomy in treatment of acute stroke as a bridge to open-heart resection of giant cardiac myxoma: A case report

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Author contributions: Chang WS and Zhang HQ were the patient's neurologists; Chang WS, Zhang HQ, Li N, and Liu H reviewed the literature; Chang WS, Zhang HQ, Li N, Liu H, and Yin JJ contributed to manuscript drafting; Chang WS, Zhang HQ, and Yin JJ were responsible for the revision of the manuscript for important intellectual content; all authors issued final approval for the version to be submitted.

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# Abstract

# BACKGROUND

Cardiac embolism is a common cause of ischemic stroke in young adults. Neurological complications associated with atrial myxoma most frequently include cerebral infarct due to embolus. Early complete resection of giant cardiac myxoma is the key to its treatment and prevention of stroke recurrence.

# CASE SUMMARY

A 42-year-old, previously healthy woman was admitted to the hospital with sudden-onset inability to speak and right-sided hemiplegia. While sweeping the floor 2 h prior to hospital admission, the patient developed sudden inability to express herself or understand what others were saying, accompanied by dyskinesia of the right limb, inability to walk or hold objects, and involuntary choreiform movements of the left upper limb. The patient was diagnosed with cerebral embolism and cardiac myxoma, complicated by left middle cerebral artery occlusion. The acute stroke was treated with intravenous thrombolytic therapy and arterial embolectomy as a bridging therapy to open resection of left atrial cardiac myxoma. The patient condition improved remarkably following initial thrombolysis and embolectomy and subsequently underwent emergency open resection of the atrial cardiac myxoma. She had no recurrence during 1-year follow-up.

# **CONCLUSION**

Strong consideration should be given to urgent intravenous thrombolysis (rt-PA, alteplase) in young adult stroke patients at the time of hospital admission. The present case demonstrated a highly successful outcome that combined thrombolysis and arterial embolus retrieval as a bridge to early complete resection of a



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giant cardiac myxoma for both stroke treatment and recurrence prevention.

Key Words: Stroke; Young women; Cardiac myxoma; Bridging; Open-heart resection; Stroke recurrence; Case report

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**Core Tip:** The incidence of ischemic stroke caused by cardiac mucinous tumors has been reported both nationally and internationally. Still, it is rarely reported that intravenous thrombolytic bridging artery retrieval with same-day open thoracotomy for left atrial mucinous tumors is performed in the early stage of stroke. We treated a case with cerebral embolic stroke associated with cardiac myxoma, the embolus was successfully removed, and the cardiac tumor was extirpated surgically on the day of presentation.

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# INTRODUCTION

Ischemic stroke in young adults is defined as an acute ischemic cerebrovascular disease that occurs in patients aged 18-45 years[1]. Approximately 10%-14% of ischemic strokes occur in young adults[2]. Cardiac embolism is a common cause of ischemic stroke in young adults, accounting for approximately 20% to one-third of all strokes<sup>[3]</sup>. Cardiac valve and endocardial lesions are the most common, in addition to congenital heart disease, recent myocardial infarction, and cardiac tumors. Atrial myxoma represents the most common type of primary cardiac tumor in adults, accounting for as many as 83% of all primary tumors of the heart. Most cardiac myxomas (CMs) are located in the left atrium, attached to the interatrial septum. Neurological complications associated with atrial myxoma most frequently include cerebral infarct due to embolus.

# CASE PRESENTATION

# Chief complaints

A 42-year-old, previously healthy woman was admitted to the hospital with suddenonset inability to speak and right-sided hemiplegia.

# History of present illness

The patient suddenly was unable to express herself or understand what others were saying, accompanied by dyskinesia of the right limb, inability to walk or hold objects, and involuntary choreiform movement of the left upper limb, while sweeping the floor, 2 h prior to hospital admission. She denied nausea and vomiting, limb convulsions, incontinence, or loss of consciousness.

# History of past illness

The patient had a free previous medical history.

# Personal and family history

The patient had no history of trauma or preceding infection.

# Physical examination

The patient's admission vital signs included that temperature was 36.9 °C, heart rate was 72 beats per minute, respiratory rate was 18 breaths per minute, blood pressure



was 134/115 mmHg, and oxygen saturation in room air was 99%. The clinical neurological examination revealed mental clarity, depression, complete mixed aphasia, both eyes stared to the left, pupils that bilaterally were of equal size and shape, with a diameter of 3 mm, and normal light reflex. The nasolabial fold on the right side was shallow, and the tongue uncooperative. The drop test of the right limb was positive and there was no response to stimulation; the left upper arm demonstrated involuntary choreiform movement, and the left lower leg stimulated sensitive flexion. Both Chaddock's sign and Babinski's sign were positive on the right. The heart rhythm was regular, and heart sounds were hyperdynamic with a grade 3/6 systolic murmur at the apex, and rumble-like murmur.

## Laboratory examinations

Blood analysis revealed: Neutrophils 79.5% (nL, 50%-70%), platelets  $344 \times 10^{\circ}/L$  (nL, 100-300 10°/L); hemoglobin 103g/L (nL, 110-150 g/L); mean hemoglobin concentration 295 g/L (nL, 320-360 g/L). The mean erythrocyte volume was 67.7 fL (nL, 82-95 fL); CRP was 78.61 mg/L (nL, 0-10 mg/L); and leukocytes, erythrocytes, coagulation, D-dimer, renal function, electrolytes as well as urine analysis were normal. Fingertip blood glucose was 7.4 mmol/L. Chest X-ray and arterial blood gas were also normal. A 12-lead electrocardiogram was normal with sinus rhythm.

### Imaging examinations

A noncontrast computed tomography (CT) scan of the brain showed no abnormality (Figure 1A). The NIHSS score was 18 points (level of consciousness question 2, level of consciousness instruction 2, gaze 2, facial paralysis 1, right upper limb 4, right lower leg 4, and aphasia 3). The patient fulfilled criteria for intravenous thrombolysis and she was successfully treated with intravenous thrombolysis using alteplase (0.9 mg/kg, 10% of the total dose was administered intravenously as a bolus, followed by an infusion of the remaining dose over 60 min) without signs of bleeding, and alteplase was initiated within 140 min of symptom onset. Cerebral angiography was conducted immediately and showed focal cerebral ischemia resulting from a distal middle cerebral artery occlusion (Figure 1B). A Solitaire FR stent and microcatheter were pulled back simultaneously during blood aspiration with a 50 cc syringe in the guiding catheter to minimize the risk of distal emboli. A red jelly-like thrombus was withdrawn out of the stent (Figure 1C) and sent for the rapid pathological examination which was suggestive of atrial myxoma (Figure 2A). A tentative diagnosis was made of cerebral arterial occlusion due to embolism from a cardiac tumor. Re-examination showed that the left middle cerebral and left anterior cerebral arteries were both patent. Successful 100% recanalization was achieved (Figure 2B). Subsequent echocardiography showed the following: A mild increase in left atrial dimension (38 mm) and an abnormal hypoechoic mass measuring 6.5 cm × 3.5 cm, with a regular shape and homogeneous internal echo, which moved with the cardiac cycle. The neoplasm remained in the mitral orifice during diastole and prolapsed into the left atrium during systole (Figure 2C).

# MULTIDISCIPLINARY EXPERT CONSULTATION

The patient should undergo surgical treatment of the left atrial myxoma through a median sternotomy under cardiopulmonary bypass. Due to the large tumor size, the patient was at risk of cardiac arrest due to the re-shedding of mucous tissue or fragments. A preoperative conference included neurologic and cardiac anesthesiologists, a cardiac surgeon, and a neurosurgeon. There was no personal or family history. Specifically, there was no history of coronary heart disease, atrial fibrillation, or arrhythmia.

# **FINAL DIAGNOSIS**

The patient's final diagnosis was acute stroke, left middle cerebral artery occlusion, and CM.

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Figure 1 Head computed tomography before operation, intraoperative angiography, and stent embolectomy. A: Head computed tomography showed no abnormalities; B: Cerebral angiography showed that the left middle cerebral artery was occluded (orange arrow); C: Thrombus removed with a stent (Solitaire FR 4.0 mm × 20 mm).



Figure 2 Arterial thrombosis pathology, angiography, and echocardiography. A: Histopathological image showing scattered mucinous tumor cells and streaked polygonal eosinophil stromal cells in a mucinous-like matrix (hematoxylin-eosin staining, magnification, 10 × 10); B: Cerebral angiography showing that the left middle cerebral artery was patent (orange arrow); C: Pre-operative transthoracic echocardiogram showing that the internal diameter of the left atrium and left ventricle were abnormal but an irregular, space-occupying mass was visible in the left atrium, with a pedicle in the atrial-septal space with marked motion.

# TREATMENT

After discussion, the patient and her husband consented to surgical resection of the left atrial myxoma through a median sternotomy under cardio-pulmonary bypass. The procedure was completed without complications and pathological examination (Figure 3A) confirmed the diagnosis of myxoma (Figure 3B). Although straddling the mitral valve, the mass remained in the left atria throughout the cardiac cycle. On the second postoperative day, repeat neurological examinations showed that the patient had regained mental clarity and fluent speech, the right nasolabial sulcus was shallow, the muscle strength of the right limbs was 4/5, and there were no sensory abnormalities. Chaddock's sign and Babinski's signs had reverted to negative on the right. The NIHSS score at 24 h after stroke onset was 3 points (facial paralysis 1, right upper extremity 1, and right lower extremity 1). Blood analysis revealed: Hemoglobin 102 g/L (nL, 110-150 g/L) and normal neutrophils, platelets, leukocytes, erythrocytes, coagulation, D-dimer, renal function, and electrolytes. CRP restored to the normal range (7.25 mg/L; elevated CRP levels were more likely to be associated with stress from acute stroke). Brain magnetic resonance imaging at 4 d showed an area of hyperintensity in the left insular lobe, frontal lobe, parietal lobe, and occipital lobe, indicating acute cerebral infarction (Figure 4A), consistent with her weakness in the right upper extremity. Review of head CT at 14 d showed patchy area of low density within the lesion in the left basal ganglia region (Figure 4B). Computed tomographic angiography imaging showed excellent patency of the involved left middle cerebral artery (Figure 4C). The NIHSS score had dropped to 2, and the modified Rankin scale (MRS) score was 2 at discharge.

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Chang WS et al. Open-heart resection of cardiac myxoma



Figure 3 Appearance and microscopic display of the myxoma. A: Gross pathology. The excised myxoma measured 6.5 cm × 6.0 cm × 5.0 cm. On macroscopic examination, the excised tumor was reddish brown jelly-like with an irregular surface and mucus; B: Histological examination of the surgically removed cardiac mass showing [hematoxylin-eosin staining (HE), scale bar: × 200] mucinous tumor cells that were scattered, shuttle-shaped or stellate, with medium amounts of cytoplasm, eosinophilic, oval nuclei, and no nuclear divisions seen in the mucinous-like matrix (HE, magnification 10 × 40).



Figure 4 Magnetic resonance imaging, computed tomography, and computed tomographic angiography of the head. A: Diffusion-weighted imaging showed an area of hyperintensity in the left insular lobe, frontal lobe, parietal lobe, and occipital lobe consistent with acute infarction (orange arrow); B: A small left basal ganglia infarction and no signs of intracranial bleeding were found on further computed tomographic scan (orange arrow); C: Computed tomographic angiography imaging showed left middle cerebral artery patency and no stenosis (orange arrow).

# **OUTCOME AND FOLLOW-UP**

The NIHSS score was 1, and the MRS score was 0 at the 90-d follow-up. There was no recurrence of symptoms and the patient had recovered very well without any sequelae at the 1-year follow-up. During this period, warfarin was taken orally for anticoagulation, and INR indexes were monitored.

# DISCUSSION

CM account for only 0.5% of acute cerebral infarctions[4], and atrial myxoma is the most common primary cardiac tumor. Neurological complications associated with atrial myxoma most frequently include cerebral infarct due to embolus<sup>[5]</sup>. The mechanism of stroke in CM is believed to be emboli that originate from two sources: Thrombus on the surface of tumor tissue, and actual detachment of tumor tissue[6]. These frequently lead to embolic cerebral infarct, most typically in young women, with a female predominance between the third and sixth decades of life[7]. The main distribution of the infarctions is in the internal carotid artery system, although they may involve multiple vascular systems. The incidence of stroke is also associated with the position of the myxoma, and small-size myxomas cannot be ignored for the risk of



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stroke[8]. The young female patient had no commonly recognized high-risk factors (for example, hypertention and diabetes) predisposing to stroke, and without typical high-risk factors for cardiovascular disease and no concerning family history. The cardiac murmur detected on cardiac auscultation at the time of her hospital admission might have been a clue to cardiogenic embolism. The patient was promptly treated by thrombolysis and bridging embolectomy. Pathologically, the embolus had the form of clear mucus jelly, suggesting the presence of CM. The age and sex of the patient were consistent with those of previously reported series, with a female predominance between the third and sixth decades of life. Irrespective of the successful outcome of this patient, cerebral infarction caused by CM is a serious problem. For large vascular occlusion caused by CM, even with timely treatment utilizing rt-PA intravenous thrombolysis, success rates are still very low at approximately 10%, bleeding conversion rate is about 10.23% [5], and the curative effect is not satisfactory [9]. Mechanical arterial embolectomy can quickly open occluded blood vessels in up to 53%, but cerebral infarction due to CM has been shown to be recurrent[7]. To prevent recurrent embolic events and potentially sudden death, CM should be operated on as soon as diagnosed and safe to proceed. The longer the time interval between ischemic events and CM resection, the higher the risk of recurrent cerebral embolism[10]. Sethi [11] performed emergency peripheral vascular and cardiac surgery on a patient with acute massive cerebral infarction due to CM, and the patient performed well. Delayed surgical resection was associated with an increased risk of complications from the myxoma<sup>[4]</sup>. Shah et al<sup>[12]</sup> reported 10-, 20-, and 30-year survival rates of 77.0%, 51.8%, and 33.6% in CM. The prognosis of CM after surgical resection is good, and the recurrence rate is about 1%-4% in scattered cases[13]. Although the recurrence rate is low, warfarin anticoagulation was used for 1 year to prevent recurrence in the case.

# CONCLUSION

In this case, the occurrence of a large cerebral infarct was successfully avoided after intravenous thrombolytic bridging arterial thrombectomy, and the left atrial myxoma resection was performed on the day of admission so as to reduce the risk of recurrent ischemic stroke.

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