Fatal cerebral and cardiac infarction due to embolism of a mobile thrombus from aorta sinotubular junction atheroma in a 40-year-old female

V. Kavalercyk1, A. Hagendorff3, M. Kolesnyc1, M. Woehlke4, A. Staudt1, M. Kolosnik, M. Woehlke, A. Hagendorff

Strokes in young adults present a challenging problem in terms of care and social impact. Most of cases in this cohort are classified as strokes of uncertain etiology. Application of multimodality diagnostic approach could help in the estimation of risk factors and underlying mechanisms. Simultaneous acute cardio-cerebral infarction is a rare manifestation, especially in young individuals. Large artery atherosclerosis should be excluded as a potential cause. Transesophageal echocardiography plays an important role in the diagnostic algorithm.

The current article presents a clinical case of a fatal acute cardiac thrombosis in a 40-year-old female without previous cardiovascular diseases and negative family history. Transesophageal echocardiography identified a large mobile thrombus at the sinotubular junction of ascending aorta. Transthoracic echocardiography revealed regional akinisia of the inferior wall, despite normal electrocardiogram. The autopsy findings confirmed co-occurrence of thromboembolic stroke in the right middle cerebral artery area and left ventricular inferior myocardial infarction due to thrombosis of the right coronary artery. This case documents an exceedingly rare phenomenon in this cohort of a cardio-cerebral thromboembolism due to single atherosclerotic plaque destabilization.

Key words: sinotubular junction atheroma, mobile thrombus, cerebral infarction, myocardial infarction, young age.

Case report

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Case report
Strokes in young adults comprise 10–15 % of all cerebral infarctions [1]. Most of events are classified as strokes of undetermined etiology. Some studies demonstrated that large artery atherosclerosis is the cause in 4–21 % of patients in this cohort [2]. Nevertheless, it often remains underdiagnosed due to “silent” course of atherosclerotic vascular disease. Application of multimodality diagnostic techniques may result in fewer patients being classified as uncertain etiology. Here we present a clinical case of fatal stroke in a young female without previous cardiovascular history.

Clinical case

An unconscious 40-year-old female was admitted to the hospital with clinics of left-sided hemiparesis. She had not previous known cardiovascular diseases and her family history was negative as well. The preliminary diagnosis of “right middle cerebral artery stroke” was estimated and the patient was hospitalized to the stroke unit. The computer tomography confirmed a large thrombus formation in the proximal right middle cerebral artery (rMCA), which was partially removed by thrombectomy and thrombus aspiration (Fig. 1). Laboratory findings presented increased C-reactive protein and high sensitive troponin T. Tests for thrombophilia were negative. Electrocardiogram showed sinus tachycardia and complete right bundle branch block.

Transesophageal echocardiography illustrated mild reduced left ventricular function with regional akinesia of the inferior wall. No relevant valvular heart disease was present. Transthoracic echocardiography (TEE) found a large mobile thrombotic formation at the sinotubular junction (STJ) of the right aortic sinus (Fig. 2, 3, Supplementary video 1, 2 online). The echo contrast study revealed no intracardiac shunt, no signs of endocarditis and no thrombus in the left atrial appendage documented by TEE (Fig. 4). Additionally, bronchopneumonia was documented by clinical and radiological findings.

Decompressive craniotomy with duraplasty was performed due to refractory intracranial hypertension. Despite therapy, the patient died 6 days after admission. The pathological findings included a recent thromboembolic stroke in the area of rMCA sized 60 x 50 x 50 mm and residual 5-mm thrombus in the MCA. Significant leftwards displacement of the midline structures was observed with signs of severe cerebral edema (Fig. 5). Autopsy showed only mild sclerosis of the aorta and the supraaortal branches as well as mild coronary atherosclerosis. There was a distinct endothelial lesion in the middle of a circular 10-mm atheroma at the STJ of the right aortic sinus with a residual adhesive 3-mm thrombus (Fig. 6, 7). A 17-mm long adherent thrombus was found at the ostium of the right coronary artery with findings of a recent inferior myocardial infarction sized 70 x 50 mm (Fig. 8). In addition, a purulent absceding bronchopneumonia due to gram-positive cocci was documented.

Discussion

As many as 1 out of every 6 strokes occurs in a young adult [3]. Age below 45 is the mostly used criteria for young stroke. The vast majority of events in this cohort are classified as strokes of undetermined etiology. However, application of multimodality diagnostic approach could estimate the underlying cause in most of cases. The FUTURE study analyzed the risk factors of cerebral infarction in young individuals [4]. According to their findings, patients aged ≥35 years were more likely to have large artery atherosclerotic disease than patients below 35 years (11.6 % vs. 2.9 %, P < 0.05). TEE plays an important role in patients with stroke of uncertain etiology. It can reveal atherosclerotic plaques in the aortic arch, which often protrude into the lumen and have mobile components in a high percentage of cases. Aortic arch atheroma can be seen in some young adults but its incidence and severity increase with age. The SPARC study analyzed a random sample of 581 people over age of 44 years [5]. All participants had TEE, and atheroma was identified in 51.3 % of patients, been characterized as severe atheroma in 7.6 %. The vulnerable atherosclerotic plaque was defined as having thickness ≥ 4 mm, ulcerated, or with mobile component. Several autopsy series and retrospective studies of cases and controls have shown an association between aortic arch atheroma and arterial embolism, which was later confirmed by prospectively designed studies [6]. The presence of mobile thrombus at the STJ was identified as a cause of stroke in the current case. It’s worth mentioning, that STJ is a vulnerable hemodynamic area, where maximum blood flow rate is observed [7].

Another important feature of the current case is the myocardial involvement. Simultaneous acute cardio-cerebral infarction is a great management challenge for physicians. The incidence is currently unknown due to the rarity of this co-occurrence. There is no clinical trial or a consensus guideline for the management of such patients. The presence of myocardial infarction is a relative contraindication for use of recombinant tissue plasminogen activator in stroke patients, however, it is not evidence-based. The main concerns about giving thrombolytics to these patients are the potential myocardial wall rupture, postmyocardial infarction pericarditis that may become hemorrhagic, and embolization of possible left ventricular thrombi due to lysis [8]. Mechanical thrombectomy is an alternative technique which can be considered for these patients, as it was chosen in the current clinical case.

Conclusions

To sum up, the present clinical case documents an episode of fatal simultaneous cardio-cerebral embolism of a thrombus inserted at the sinotubular junction of aorta in a 40-year old apparently healthy female. The rupture of
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Fig. 1. Three-dimensional reconstruction of the cerebrovascular system by computer tomography showing the occlusion (↓) of the right middle cerebral artery.

Fig. 2. Three-dimensional transesophageal echocardiography demonstrates short-axis view of ascending aorta with mobile thrombotic formation (18 x 19 mm) attached to the sinotubular junction of the right aortic sinus. Watch additional supplementary video file 1 online (https://youtu.be/MTqoHkU5uKE).

Fig. 3. Three-dimensional transesophageal echocardiography demonstrates long-axis view of ascending aorta with mobile thrombotic formation (18 x 19 mm) attached to the sinotubular junction of the right aortic sinus. Watch additional supplementary video file 2 online (https://youtu.be/XCiJt5as7Ew).

Fig. 4. Transesophageal echocardiography contrast study with agitated saline (bubble study), showing an intact interatrial septum without any shunts.

Fig. 5. Autopsy findings of extended right-lobe median cerebral infarction with central displacement.

Fig. 6. Autopsy findings of ascending aorta with aortic valve. Thrombus (→) on atheroma (*) near the ostium of right coronary artery (→).

Fig. 7. Histological appearance of a residual thrombus (→) on atheroma (*) at the sinotubular junction of ascending aorta. Hematoxylin and eosin staining, original magnification x40.

Fig. 8. Autopsy findings of thrombus (→) on atheroma (*) and the right coronary artery (→) in longitudinal section.
a single atherosclerotic plaque led to dramatic course of disease in a young woman without risk factors and negative previous cardiovascular history.

**Conflicts of interest:** authors have no conflict of interest to declare.

**Disclosure:** No disclosure.

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