Acute cerebral infarction complicated with gigantic uterine myoma: MR findings of brain and pelvis

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Aims and objectives

The majority of ischemic strokes are due to cardioembolism, large vessel atherothromboembolism, small vessel occlusive disease, or other unusual mechanisms.

Occasionally, stroke can also occur as the first sign of cancer, or lead to its detection. Several major mechanisms of stroke exist in cancer patients, which can be directly tumour related, because of coagulation disorders, infections, and therapy related.

By the similar mechanism, the patients with uterine myoma may occur cerebral infarction, too. Although cerebral infarction associated with uterine myoma has rarely been reported, myoma is not well recognized as a potential cause of stroke (1-3).

The purpose of this study was

• To demonstrate the clinical features and laboratory data
• To evaluate imaging findings in patients diagnosed with acute cerebral infarction complicated with gigantic uterine leiomyoma
• To investigate the pathogenesis of cerebral infarction in uterine leiomyoma patients
Methods and materials

Patient population:

Institutional review board approval was granted for this study.

- Between 2007 and 2014, this was a retrospective analysis of 6 patients with acute cerebral infarction complicated with gigantic uterine myoma measuring >10 cm in diameter.
- The patients were aged between 43-66 years (mean, 50.8 years).
- Five patients (83%) had cerebral infarction at the initial onset.
- In five patients (83%), uterine myoma was discovered after a diagnosis of cerebral infarction.
- Benign leiomyoma was either proven pathologically (n=4) or clinically diagnosed (n=2)

Imaging study:

- All patients underwent emergency stroke-unit MR protocol in the acute stage of the ischemic ictus, followed by pelvic MR or whole body CT in the acute or subacute stage.
- MR examinations were performed with a clinical whole-body imager operating at 1.5-tesla (MAGNETOM Avanto, Siemens) or 3.0-tesla (MAGNETOM Trio A Tim, Siemens).
- CT examinations were performed on a 16 or 128-slice multiple detector CT (MDCT) scanner.
Results

Table 1 shows summary of clinical features and laboratory data.

Cerebral infarction:

- All patients but one (83%) suffered acute cerebral infarction from occlusion or stenosis of the proximal portion M1 of the middle cerebral artery (MCA).
- In the remaining one patient with ovarian cancer, multiple small infarcts were simultaneously detected in more than three vascular territories.
- Five patients were classified as embolic type infarction and one was classified as thrombotic type.
- All patients, except one, did not have persistent or paroxysmal arterial fibrillation (Af). The patient with Af had no cardioembolic clot by cardiovascular CT.

Blood examination:

- Blood examination showed iron deficiency anaemia in five (83%).
- On hemocoagulation examination, coagulation disorder, defined as elevated plasma D-dimer or thrombin-antithrombin complex (TAT), was identified in five patients (83%).

Uterine myoma:

- In all patients, intratumoral degeneration was recognized on T2-weighted, T1-weighted and post-contrast T1-weighted MR images or by contrast enhanced CT.
- One patient had ovarian cancer in addition to large myoma.
- One patient had hydronephrosis by the compression of the uterine myoma.

Representative cases

Case 1: A young woman with a huge myoma (Figure 1)

A 46-year-old woman presented to our hospital with right hemiplegia and aphasia. She was diagnosed with acute embolic stroke based on cranial MRI findings. Magnetic resonance angiography (MRA) showed occlusion of the left middle cerebral artery (MCA). Whole body CT was performed to determine the source of the embolus, and a large pelvic mass was found. Pelvic MRI showed a uterine leiomyoma, for which hysterectomy was performed subsequently.

Case 2: An old woman with persistent arterial fibrillation (Figure 2)
A 66-year-old woman presented to our hospital with a chief complaint of paralysis of the left upper extremity. She was hospitalized and was evaluated to have heart failure due to atrial fibrillation. On the 4th day of hospitalization, left hemiplegia progressed and she was diagnosed with acute embolic stroke based on MRI findings. MRA showed occlusion of the right MCA. By blood test, anaemia was ruled out but hypercoagulation was noted (D-dimer = 11.33 µg/ ml). Whole body CT was performed to search for the source of the embolus; there was no intracardiac thrombus, but a large pelvic mass was found. On pelvic MRI, the preoperative diagnosis was leiomyosarcoma. Postoperatively, cellular leiomyoma was the pathologic diagnosis.

Case 3: A middle-aged woman with ovarian cancer (Figure 3)

A 56-year-old woman presented to our hospital with sensation of abdominal pressure and disturbance of consciousness. Pelvic and cranial MRI were performed on the first hospitalization day. She was diagnosed with multiple asynchronous infarcts based on cranial MRI findings. MRA showed stenosis of the bilateral internal carotid arteries. Pelvic MRI showed a large uterine leiomyoma and right ovarian tumour. Right hydronephrosis was noted complicated by the compression of the pelvic mass. Radical hysterectomy was performed; submucosal myoma and ovarian cancer were confirmed pathologically.

Case 4: Young woman with recurrent cerebral infarction and the increased myoma (Figure 4)

A 44-year-old woman presented to our hospital with severe left hemiplegia. She was diagnosed with acute embolic stroke from right MCA occlusion by cranial MRI findings. A submucosal leiomyoma measuring 16 cm was detected on pelvic MRI. She underwent arteria temporalis superficialis bypass operation for the MCA occlusion; the uterine myoma was not operated on. Five years later, cerebral infarction recurred and severe embolic stenosis of the proximal right internal carotid was detected on CT angiography. On pelvic MRI, the submucosal myoma enlarged to 20 cm.
Table 1

<table>
<thead>
<tr>
<th>Patient</th>
<th>Cerebral infarction</th>
<th>Blood examination</th>
<th>Uterine myoma</th>
<th>Intratumoral degeneration</th>
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</thead>
<tbody>
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<td>Complications</td>
<td>Type</td>
<td>Hb(g/dl)</td>
<td>D-dimer(µg/ml)</td>
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</tr>
</tbody>
</table>

ND · · · no data
*She had no cardioembolic clot by cardiovascular CT
Fig. 1: Case 1. (A) DWI showed hyperintense lesions, indicating an acute infarction in the left MCA. (B) FLAIR images showed no hyperintense lesions but intraarterial signal. (C) MRA showed M1 region of left MCA occluded. (D)(E) T2WI image in pelvic MRI showed hypointense lesion and hyperintense lesion were mixed, indicating a uterine fibroid with denaturation. (F) Contrast-enhanced T1WI image showed heterogeneous contrast enhancement in a huge uterine-derived mass.

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Fig. 2: Case 2. (A) (B) DWI and ADC map showed acute infarction in the right MCA. (C) MRA showed M1 region of right MCA occluded. (D) T2WI image in pelvic MRI showed hypointense lesion and hyperintense lesion were mixed, indicating a uterine fibroid with denaturation. (E) ADC map showed a diffusion decrease in tumor margins. (F) Contrast-enhanced T1WI image showed heterogeneous contrast enhancement in a huge uterine-derived. Lelomyosarcoma was suspected in the preoperative diagnosis.

Fig. 2

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Fig. 3

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Fig. 4

(A) DWI showed an acute infarction in the right MCA area. (B) MRA showed M1 region of right MCA occluded. (C) T2WI in pelvic MR showed submucosal leiomyoma with denaturation of the 16cm size. (D)(E)(F) Five years later, cerebral infarction recurred and severe embolic stenosis of the proximal right internal carotid and the myoma increased to a 20cm size.

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Conclusion

Discussion: Gigantic uterine myoma-related mechanism of stroke

1. Hypercoagulability

Perhaps the most important and underreported mechanism by which leiomyoma can cause stroke is abnormal coagulation cascade. Coagulation disorders, such as disseminated intravascular coagulation (DIC), are more likely to be seen in stroke patients with leiomyoma than patients without it. Some studies have investigated the link between benign disease, particularly leiomyoma, and DIC (4-10). Most of these cases with gigantic myoma were found to have elevated levels of D-dimer or TAT.

2. Myoma compression of the pelvic vein

Uterine leiomyoma is usually asymptomatic. However, as with increasing size, symptoms may be present due to compression of the surrounding anatomic structures; this may also result in significant increase in the incidence of thromboembolism (8, 9). Perhaps the most well recognized clinical presentation of hypercoagulability is deep venous thrombosis and/or pulmonary embolus. These venous clots may lead to stroke via direct venous-to-arterial shunting, sometimes referred to as ‘paradoxical’ emboli. There is debate on whether venous-to-arterial thromboembolization occurs via a patent foramen ovale (PFO). The likelihood of having a stroke is doubled in patients with PFO, suggesting that something about the shunt increases stroke risk (10). On the other hand, neither the size of the PFO or the degree of venous-to-arterial shunting correlated with risk of stroke recurrence (11). One interesting study found an increased rate of pelvic thrombosis in patients with cryptogenic stroke, some of whom had a PFO, suggesting this as a possible mechanism (12). Nevertheless, it seems reasonable that an increased risk for venous clot formation increases the risk for paradoxical embolization (13).

3. Iron deficiency anaemia

Physiological mechanisms that may play a role in the development of ischemic stroke in patients with Iron deficiency anaemia include thrombocytosis, hypercoagulable state and anaemic hypoxia. Low iron levels disinhibit megakaryocyte activity (14), resulting in secondary thrombocytosis and a hypercoagulable state (15). Microcytic red blood cells have altered deformability, increasing blood viscosity which, in turn, may increase the risk for venous thrombosis (16). The decreased oxygen-carrying capacity of the erythrocytes results in anaemic hypoxia; hence, anaemic patients need increased blood flow to the brain to compensate for the lack of oxygen in the blood. This increased blood flow can cause vascular endothelial damage, resulting in thrombus formation.
Conclusion

1. Gigantic uterine leiomyoma should be considered as one of important risk factors for cerebral infarction in young women.

2. The pathogenesis of thromboembolism complicated with gigantic leiomyoma is still uncertain; however, multiple complex factors may be involved.
References