Case Studies

Unusual Intracranial Arterial Calcification and Vitamin D Deficiency

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Although intracranial arterial calcifications (IACs) are encountered in approximately 85% of patients with acute ischemic stroke (IS), the significance of IAC in plaque instability is still controversial. Because most tissues including brain tissue have vitamin D receptors, vitamin D deficiency might play multiple roles in variable sites. Here, we report a novel presentation of IS with IAC including anterior cerebral artery involvement due to vitamin D deficiency.In conclusion, although the role of IAC in cerebral infarction is still controversial, we suggest that insufficient vitamin D should be examined and treated appropriately in all patients with IS. We believe that this article provides important implications for the treatment of vitamin D deficiency in patients with IS. **Key Words:** Calcification—cerebral infarction—hypovitaminosis D—stroke—ischemic stroke.
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Introduction

Vitamin D deficiency is frequent in approximately 50% of the general population. Because most tissues such as brain, breast, colon, as well as skeletal tissues have vitamin D receptors, vitamin D deficiency might play multiple roles in variable sites.[1,2] Furthermore, although intracranial arterial calcifications (IACs) are encountered in approximately 85% of patients with acute ischemic stroke (IS), the significance of IAC in plaque instability is still controversial.[1] Here, we report a novel presentation of IS with IAC including anterior cerebral artery (ACA) involvement due to vitamin D deficiency.

Case Report

A 55-year-old woman presented with sudden drowsiness and diplopia. The neurological examination revealed dysarthria and vertical gaze limitation of the right eye. Brain computed tomography showed severe arterial calcifications in multiple intracranial vessels, including the middle cerebral artery, the ACA, the vertebral artery, and the basilar artery, without calcifications in the cerebral parenchyma (Fig 1, A-C). Brain magnetic resonance imaging revealed multiple hyperintensities in both the thalami and the right midbrain on diffusion-weighted imaging and multiple microbleeds in both the basal ganglia and the thalami (Fig 1, D-F).

Laboratory results showed severe hypovitaminosis D (25-hydroxy-vitamin D, 6.3 ng/mL [normal value, 10.6-43.4] and 1,25-hydroxy-vitamin D, 73.5 pg/mL [25.1-66.1]) and secondary hyperparathyroidism (89.3 pg/mL).

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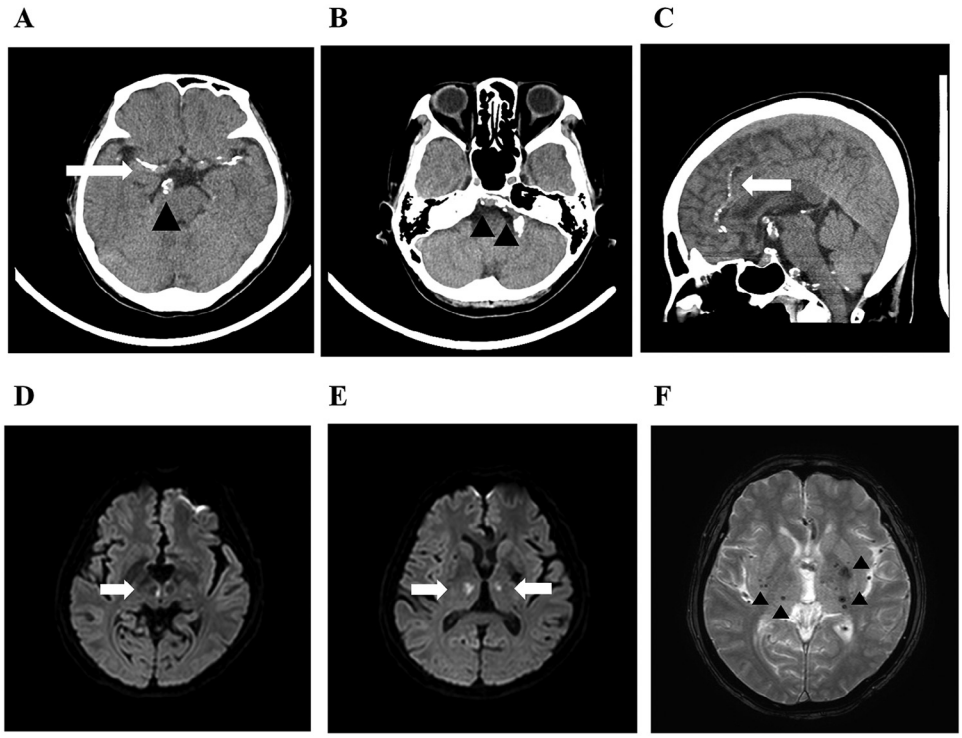

Figure 1. *Brain computed tomography imaging. (A) Intracranial arterial calcifications of both middle cerebral artery (arrow) and basilar artery (arrowhead). (B) Intracranial arterial calcifications of the tortuous left vertebra artery (arrowheads). (C) Intracranial arterial calcifications of anterior cerebral artery (arrow); brain magnetic resonance imaging. (D) hyperintensity of right midbrain on diffusion-weighted imaging (arrow). (E) Hyperintensities of both thalami on diffusion-weighted imaging (arrows). (F) Multifocal hypointensities of both basal ganglia and thalami on gradient echo imaging (arrowheads).*

The levels of serum calcium (8.6 mg/dL), ionized calcium (1.16 mmol/L), phosphorus (3.5 mg/dL), and homocysteine level (11.2 µmol/L) were normal. The patient did not have chronic kidney disease. Bone mineral density demonstrated osteoporosis in the lateral femoral condyle and the vertebrae (*T*-score, –3.9). On day 5, the patient was discharged with an antiplatelet and vitamin D supplements.

Discussion

Aging, male gender, hyperhomocysteinemia, conventional vascular risk factors, and chronic kidney disease were reported as predictors of IAC, although our patient did not have any risk factors but hypovitaminosis D.[3,4] Symptomatic IAC due to hypovitaminosis D without any other risk factors is unusual. Furthermore, distal parts to the circle of Willis such as the ACA and the posterior cerebral arteries were seldom affected in those rare IAC cases.[5] A significant inverse correlation has been reported between coronary artery calcifications and serum vitamin D levels.[6] However, to the best of our knowledge, the relationship between multifocal IAC including ACA and hypovitaminosis D has not been demonstrated.

Hypovitaminosis D is frequent in approximately 50% of the general population. Because the active form of serum vitamin D (1,25-hydroxy-vitamin D) does not correlate with clinical vitamin D status, serum 25-hydroxy-vitamin D concentrations should be measured. Because most tissues such as brain, breast, colon, as well as skeletal tissues have vitamin D receptors, vitamin D deficiency is an important factor affecting multiple organ failure.[2]

There is no optimal consensus in 25-hydroxy-vitamin D levels. When the level is under 30 ng/mL, intestinal calcium absorption will decrease. This enhances parathyroid hormone elevation, which activates osteoblasts. Transformed osteoclasts resolve the mineralized bone–collagen matrix, causing osteoporosis. Furthermore, because hypovitaminosis D activates the renin–angiotensin–aldosterone system and insulin resistance, vitamin D deficiency is associated with hypertension, diabetes, heart failure, and vascular inflammation.[2] The exact pathomechanism between IAC and microbleeds has not yet been determined. Based on previous reports, IAC may provoke hemodynamic fluctuations because of luminal stenosis and increased arterial wall stiffness.[4] Therefore, some pieces of evidence have demonstrated that IAC is associated with white matter changes and microbleeds, especially in deep cerebral microbleeds.[4]

Although IAC is a considerable biologic marker of atherosclerosis, it is not constantly associated with arterial plaque burden or IS.[1] However, we suggest that insufficient vitamin D should be examined and treated

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appropriately in all patients with IS. We believe that this article provides important implications for the treatment of vitamin D deficiency in patients with IS.

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