

Pathogenic Heterogeneity of Distal Single Small Subcortical Lenticulostriate Infarctions Based on Lesion Size

Yuan Gao, MD,*¹ Bo Song, MD,*¹ Quan Yong, MD,*¹ Lu Zhao, MD,* Yan Ji, MD,*
Yi Dong, MD,† David Z. Wang, DO, FAHA, FAAN,‡ and Yuming Xu, MD, PhD*

Background: Single small subcortical infarctions (SSSIs) in the lenticulostriate artery territory can be classified as proximal single small subcortical infarction (pSSSI) or distal single small subcortical infarction (dSSSI) lesions depending on the involvement of the lowest part of the basal ganglia. It was reported that pSSSI lesions have more characteristics of large artery atherosclerosis, whereas dSSSI lesions are more characteristic of small vessel disease. Because infarction of small vessels is more likely to be distal and may result in small lesions, we hypothesized that the clinical features of dSSSI lesions might be heterogeneous and classified based on lesion size. *Methods:* Lenticulostriate SSSI patients admitted within 72 hours of stroke onset were included from a prospectively registered hospital-based stroke database. We determined the location (lowest slice [LS] involved) and size (total number of slices [TNS] involved) of SSSIs on magnetic resonance imagings. Based on lesion location, SSSIs were divided into pSSSI (LS ≤ 2) and dSSSI (LS > 2); the latter were further subdivided into distal and small SSSI (ds-SSSI, TNS ≤ 2) or distal and large SSSI (dl-SSSI, TNS > 2). The clinical characteristics were compared between different groups. *Results:* A total of 204 patients were included out of 1158 patients registered in the database. We found that ds-SSSI was most often associated with severe white matter hyperintensities. However, patients with dl-SSSI most often had a higher rate of additional concurrent atherosclerotic disease as coronary heart disease, compared to patients with ds-SSSI. *Conclusions:* The pathogenesis of dSSSI may be heterogeneous depending on lesion size. **Key Words:** Single small subcortical infarction—lesion pattern—parent artery disease—small vessel disease—atherosclerosis.

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From the *Department of Neurology, the First Affiliated Hospital of Zhengzhou University, Zhengzhou, Henan, China; †Department of Neurology, Huashan Hospital, State Key Laboratory of Neurobiology, Fudan University, Shanghai, China; and ‡INI Stroke Network, OSF Healthcare System, Department of Neurology, University of Illinois College of Medicine, Peoria, Illinois.

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Address correspondence to Yuming Xu, MD, PhD, Department of Neurology, the First Affiliated Hospital of Zhengzhou University, 1 Jian-she East Road, Zhengzhou, 450052, Henan, China. E-mail: xuyuming@zzu.edu.cn; 13903711125@126.com.

¹ These authors contributed equally to this article.

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Introduction

Single small subcortical infarction (SSSI) is defined as a single small deep infarction in the territory of a perforating artery with a maximum diameter of 20 mm or less.¹ They have been classified into 3 distinct pathological subtypes by Fisher² and Caplan³: fibrinoid or lipohyalinosis degeneration (located at the distal portion of the perforating arteries), microatheroma formation, and atherosclerotic lesion of parent artery disease (PAD) (located at the proximal portion of perforating arteries). A parent artery is the artery from which a perforating artery originates. Approximately 16.9%-35% of SSSIs are accompanied by PAD.¹ PAD may cause SSSI by occluding the proximal portion of the perforating arteries, which results in a proximal single small subcortical infarction (pSSSI) extending to the lowest portion of the basal ganglia where the perforator artery branches from the middle cerebral artery (MCA) in the territory of the lenticulostriate artery (LSA) (Fig 1, A). Fibrinoid or lipohyalinotic degeneration

primarily affects the distal portion of perforating arteries, resulting in a distal single small subcortical infarction (dSSSI) (Fig 1, B,C), usually a small lacunar infarction.⁴⁻⁶ Some studies have shown that pSSSIs are most often associated with large artery atherosclerosis, while dSSSIs are more often associated with white matter hyperintensities (WMHs) or microbleeds.^{1,4-6} The location of an SSSI (proximal or distal) has been used to differentiate an SSSI of atherosclerotic origin from an SSSI of lipohyalinotic origin. Some dSSSI lesions are located distally in the territory of the LSA and are of small size (Fig 1, C). Others are relatively larger in size (Fig 1, B). Lesion size (thickness or axial diameter) has been reported to be associated with PAD,^{1,4} which is a definite evidence of atherosclerosis. Therefore, larger lesion size might be associated with atherosclerotic disease; however, to our knowledge, no previous studies have investigated whether different dSSSI lesion patterns are homogeneous. Because it has been proven that SSSI with and without PAD cannot be differentiated based on the

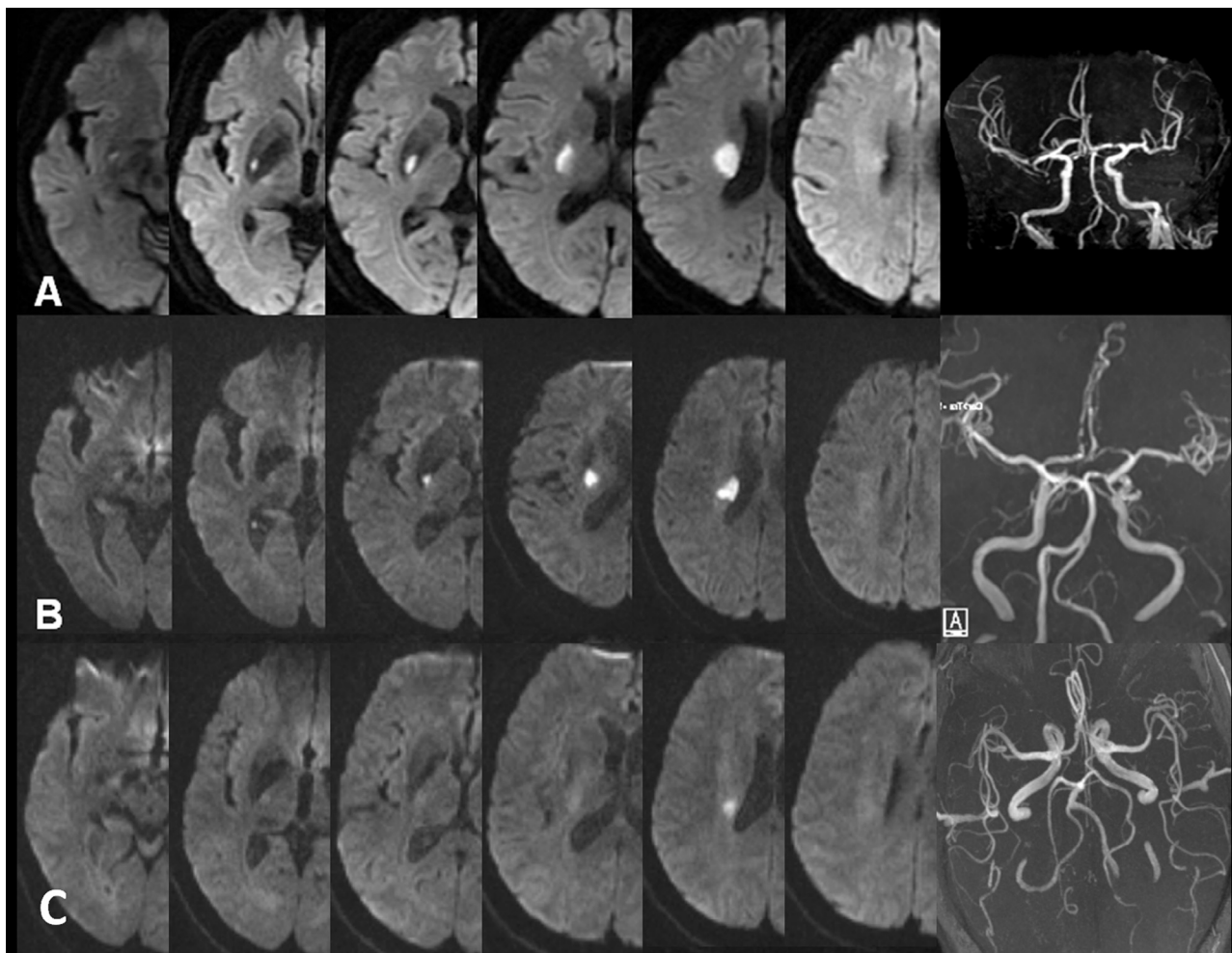


Figure 1. (A) In pSSSI with PAD, the lesion extends to the lowest portion of basal ganglia. (B) In dSSSI without PAD, the lesion is visible on 3 slices without involvement of the lowest 2 slices. (C) In dSSSI without PAD, the lesion is visible within the distal 1 slice. Abbreviations: dSSSI, distal single small subcortical infarction; PAD, parent artery disease; pSSSI, proximal single small subcortical infarction.

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