

## Pure motor stroke as the most frequent lacunar syndrome: A clinical update

Adrià Arboix, María José Sánchez, Josep Lluís Martí-Vilalta

Adrià Arboix, Cerebrovascular Division, Department of Neurology, Hospital Universitari del Sagrat Cor, Universitat de Barcelona, E-08029 Barcelona, Catalonia, Spain

María José Sánchez, Medical Library, Hospital Universitari Sagrat Cor, E-08029 Barcelona, Catalonia, Spain

José Lluís Martí-Vilalta, Acute Stroke Unit, Department of Neurology, Hospital de la Santa Creu i Sant Pau, Universitat Autònoma de Barcelona, E-08026 Barcelona, Catalonia, Spain

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**Correspondence to:** Adrià Arboix, MD, PhD, Cerebrovascular Division, Department of Neurology, Hospital Universitari del Sagrat Cor, Universitat de Barcelona, Viladomat 288, E-08029 Barcelona, Catalonia, Spain. [aarboix@hscor.com](mailto:aarboix@hscor.com)  
Telephone: +34-934948940 Fax: +34-934948906

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**Core tip:** Pure motor stroke (PMS) is the most common of any lacunar form (between one half and two thirds of cases). The posterior limb of the internal capsule, corona radiata, and pons are the most frequent brain topographies. This present update is focused on the clinical evidence and mechanisms underlying the relationship between PMS and different stroke etiologies.

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### Abstract

Pure motor stroke (PMS), also known as pure motor hemiparesis, is the most common of any lacunar form (between one half and two thirds of cases, depending on the series). In an acute stroke registry, 733 patients presented a lacunar infarct and PMS accounted for 12.7% ( $n = 342$ ) of all first-ever stroke patients and for 48% of all lacunar syndromes. The posterior limb of the internal capsule, corona radiata, and pons are the most frequent brain topographies. Infarcts in the mesencephalus or medullary pyramid have been exceptionally reported. This present update is focused on the clinical evidence and mechanisms underlying the relationship between PMS and different stroke etiologies.

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### CLINICAL DEFINITION

Pure motor stroke (PMS), also known as pure motor hemiparesis, was first reported by Fisher and Curry in 1965 and it is considered the commonest lacunar syndrome in clinical practice, accounting for between one half and two thirds of cases, depending on the series. Lacunar infarction accounts for one fourth of all cerebral infarctions<sup>[1,2]</sup> and generally develops in patients with hypertension and/or diabetes mellitus.

Definition of known pre-stroke hypertension includes patients having systolic and diastolic blood pressure higher than 140/90 mmHg, respectively, measured at least twice by the general practitioner before stroke onset, or those with high blood pressure at the time of stroke onset with one or more of the following: hypertensive retinopathy, left ventricular hypertrophy diagnosed by electrocardiographic or echocardiographic criteria, or abnormal renal function (excluding diabetes or other alternative cause of nephropathy). In accordance with World Health Organization criteria, diabetes is diagnosed

**Table 1** Demographic characteristics and frequency of lacunar syndromes in the Sagrat Cor Hospital of Barcelona Stroke Registry

	<i>n</i> (%)
Total patients	733
Male	423 (57.7)
Age, yr, mean (SD)	74.1 (10.2)
Age ≥ 85 years old	110 (15.0)
Lacunar syndromes	
PMS	352 (48)
Pure sensory stroke	127 (17.4)
Sensorimotor stroke	83 (11.3)
Dysarthria-clumsy hand	59 (8)
Ataxic-hemiparesis	24 (3.3)
Atypical lacunar syndromes	88 (12)

PMS: Pure motor stroke.

**Table 3** Topographies in pure motor stroke

Internal capsule
Pons
Corona radiata/centrum semiovale
Basal ganglia
Mesencephalon
Medullary pyramid
Cerebral cortex <sup>1</sup>

<sup>1</sup>Cerebral topography related to PMS not due to lacunar infarct. PMS: Pure motor stroke.

when post-stroke repeated fasting plasma glucose levels exceeded 7.8 mmol/L (149 mg/dL). Serum determination of HbA1c is useful in doubtful cases to diagnose previous diabetes.

Pierre Marie in 1901 and Ferrand in 1902 had first stressed the link between isolated sudden hemiparesis and lacunes.

In the Sagrat Cor Hospital of Barcelona Stroke Registry, PMS accounted for 48% of all lacunar syndromes<sup>[3]</sup> (Table 1). It was the first lacunar syndrome recognized clinically, and its features have been the most thoroughly explored<sup>[1]</sup>. The clinical criteria of PMS include the presence of unilateral partial or complete paresis involving at least two of three areas (face, upper limb, or lower limb) of the body and no evidence of aphasia, apraxia, and agnosia, nor visual field defect, eye movement disturbance, ataxia, sensory loss or evidence of bilateral weakness<sup>[4-6]</sup>. Pure motor monoparesis is almost never due to lacunar infarct (Table 2). These restricted motor deficits are more likely to be of cortical origin<sup>[2,6]</sup>.

Although the main elements of the PMS syndromes are motor, other complaints are not rare, especially sensory disturbances, which occur initially in as many as 42% of cases<sup>[6]</sup>. These complaints usually present as numbness, heaviness, and loss of feeling. Only scan abnormalities are found on clinical examination. Improvement is seen in a high percentage of cases of PMS. Recovery is usually more rapid and more complete than that following cerebral surface infarction with a similar initial motor deficit<sup>[7]</sup>. The syndromes of partial hemiparesis show

**Table 2** Distribution of weakness related to pure motor stroke in 128 patients included in the Sagrat Cor Hospital of Barcelona Stroke Registry

Distribution of weakness	PMS ( <i>n</i> = 128) <i>n</i> (%)
Face, arm, leg	112 (76)
Face, arm	6 (4)
Arm, leg	16 (10)
Face <sup>1</sup>	6 (4)
Arm	4 (3)
Leg	4 (3)

<sup>1</sup>Patients with isolated pure facial central palsy with dysarthria have been included in the atypical lacunar syndrome in another study. Modified from Arboix *et al*<sup>[6]</sup>. PMS: Pure motor stroke.

the best prognosis, as do those with the smaller infarct size on computed tomography scan or brain magnetic resonance imaging, but cases of complete hemiplegia followed by almost full recovery have been encountered<sup>[5,8]</sup>.

Lacunar infarctions are not a benign vascular condition; in contrast, they present a high risk of recurrence and vascular dementia in the mid and long term<sup>[9-11]</sup>.

Recurrent lacunar ischemic stroke may be associated with a more severe clinical picture and it is one of the major factors involved in producing lacunar state and vascular subcortical dementia<sup>[7-12]</sup>. Recurrent strokes are more likely to be lacunar if the index event is lacunar<sup>[5]</sup>.

## CLINICO-ANATOMIC CORRELATIONS

PMS has been reported from autopsied cases as a focal small (< 20 mm in diameter), deep infarction (lacunar infarct subtype) involving the internal capsule, corona radiata, pons and medullary pyramid<sup>[1,2]</sup>. Other topographies are centrum semiovale, basal ganglia and mesencephalon (Table 3). The most common correlations have been with capsular locations. The greater number of lacunes has been reported in the posterior limb of internal capsule<sup>[5]</sup>.

These anatomical structures are supplied by the lentostriate branches and the long deep perforator medullary branches of the anterior and middle cerebral arteries, and the paramedian branches of the basilar artery<sup>[1]</sup>.

Small vessel diseases are mainly of atherosclerosis-degenerative type, such as lipohyalinosis or microatheromatosis of lacunar infarcts<sup>[11,2]</sup>.

## OTHER CAUSES OF PURE MOTOR SYNDROMES

The concept of lacunar hypothesis (the presence of a lacunar syndrome is usually due to a lacunar infarct) suggested by Miller Fisher is clinically valid and useful in PMS<sup>[13-15]</sup>. This lacunar syndrome is commonly due to lacunar infarct resulting from small vessel disease. In a clinical study<sup>[5]</sup> of 222 patients with PMS, lacunar infarcts were found in 189 (85%) patients, whereas ischemic lacunar syndromes not due to lacunar infarcts occurred in 23 (10.4%) (atherothrombotic stroke in 12, cardioembolic

**Table 4 Pure motor stroke not due to lacunar infarcts**

Non-lacunar ischemic stroke <sup>1</sup>
Cardioembolic stroke
Atherothrombotic infarct
Internal carotid artery occlusion in the neck
Ventromedial pontine infarction due to a propagating thrombosis of the basilar branch
Complex aortic atheroma plaques
Ischemic stroke of unusual etiology
Ischemia-edema after craniotomy for postoperative bleeding
Intracerebral hemorrhage
Subdural hematoma
Brain abscess of the motor cortex
Cerebral metastasis
Demyelinating disease

<sup>1</sup>Cerebral cortical surface infarction or large deep infarction (> 20 mm diameter).

stroke in 7, infarction of undetermined origin in 3 and infarction of unusual etiology in one) and hemorrhagic lacunar syndromes in 10 (4.5%). Other causes of PMS<sup>[14,16]</sup> are showed in Table 4. These rare causes can nowadays be easily detected by imaging techniques.

However, the lacunar syndromes do not predict lacunar infarcts when used in the first hours of stroke. Later, they have a reasonable predictive power if the classic definition is retained<sup>[17]</sup>.

## PURE MOTOR STROKE OF UNUSUAL ETIOLOGY

PMS and the other lacunar strokes may be caused in less than 5% of cases by other etiologies, mainly hematological diseases and infectious or inflammatory arteritis<sup>[4,5,18]</sup>.

Hematological disorders associated with lacunar stroke include polycythemia vera, essential thrombocythemia, and primary antiphospholipid antibody syndrome<sup>[18]</sup>.

Infectious arteritis due to neurosyphilis, neurocysticercosis, neuroborreliosis, and acquired immunodeficiency syndrome has been also associated with lacunar infarction. In patients with first ever stroke, chronic *Helicobacter pylori* infection detected by IgG antibodies is associated with risk of small artery occlusion<sup>[5]</sup>.

Moreover, inflammatory arteritis in systemic lupus erythematosus or granulomatous angiitis and polyarteritis nodosa have been related to lacunar infarctions, although in cases of polyarteritis nodosa, lacunar strokes are due to thrombotic microangiopathy, not vasculitis<sup>[18]</sup>.

Drug abuse, particularly of cocaine, and pseudoxanthoma elasticum may produce small, deep infarcts<sup>[5]</sup>.

Other uncommon etiologies include hereditary (cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy), mitochondrial (mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes), deposition of substances in the vessel wall (amyloid in sporadic and hereditary cerebral amyloid angiopathy or ceramide in Fabry's disease), or toxic cause. Other small vessel diseases are venous collageno-

sis, post-radiation angiopathy and non-amyloid microvessel degeneration in Alzheimer disease<sup>[5,18]</sup>.

## CONCLUSION

PMS is the most common lacunar syndrome. The lacunar hypothesis is clinically valid and useful in PMS; however in 10%-15% of the cases PMS may be associated with underlying non-lacunar ischemic mechanisms such as cardiac source of embolism, atherosclerosis, intracerebral hemorrhage or cerebral ischemia of unusual etiology that may influence management. Thus, it is mandatory to establish the etiological diagnosis of PMS to classify correctly the stroke subtype.

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