
A Method for the Measurement of the Intracranial Artery Stenosis

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Background: To measure the degree of stenosis, a diameter of maximum stenotic point and that of the presumably normal portion of the diseased artery (D_{normal}) should be determined. However, largely due to a lack of consensus on the definition of the D_{normal} , a standard method of measuring intracranial artery stenosis has been lacking. This study was aimed to determine D_{normal} for the development of a reliable method to measure the intracranial arterial stenosis. **Methods:** Using jeweller's eyepiece, arterial diameters from 20 cases with a normal cerebral angiogram, were measured by two neurologists at the proximal portions of C2, C4, C6, and C7 segments of the bilateral internal carotid arteries (ICA). The proximal, middle, and distal portions were measured in the M1 segment of the bilateral middle cerebral arteries (MCA), the basilar artery (BA), and the intracranial segments of the bilateral vertebral arteries (VA). After determination of interobserver and intra-observer agreements, to establish the representative site of the D_{normal} , measured diameters from the portions within the arterial segment and that of a corresponding portion of the contralateral artery were compared. **Results:** In the MCA, BA, and VA, agreements of measurements were all acceptable and high in the order of the middle, distal, proximal, and the contralateral corresponding portions. However, in the ICA, correlation rates of each segment were moderate, and the proximal portion of the BA demonstrated low interobserver agreement. **Conclusions:** From these findings, the middle portion of the diseased artery may be used for the representative point to determine the D_{normal} . When the middle portion is diseased, the distal, proximal, and the contralateral corresponding artery, in the order, can be chosen. This method could be validated in part by demonstrating a very high interobserver agreement when the degree of stenosis was measured in 20 angiograms with a MCA stenosis.

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Key Words: Intracranial cerebral artery, Stenosis, Cerebral angiography

..... 6 ~ 29%

: 134 [1-4]. 가

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[5-11].

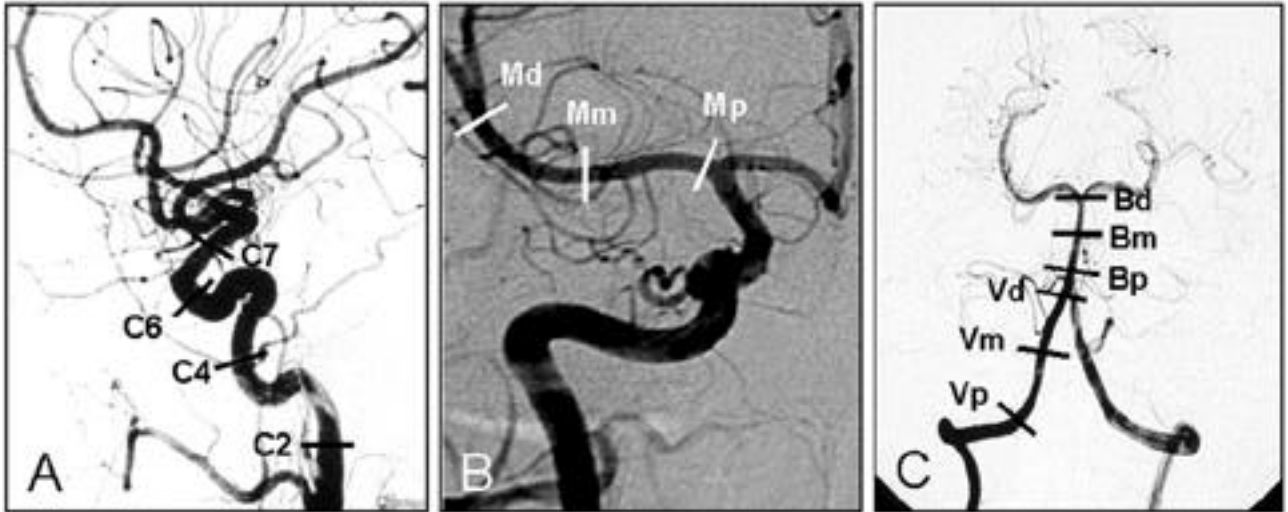


Figure 1. Angiograms showing portions of the intracranial arteries, which were used for measurements. **A)** internal carotid artery, **B)** middle cerebral artery, and **C)** vertebrobasilar artery. C2, C4, C6, and C7 represent the petrous portion, the cavernous portion, the ophthalmic artery origin, the anterior choroidal artery origin, respectively.

Mp, Mm, and Md represent the proximal, middle, distal of the middle cerebral artery, respectively. Bp, Bm, and Bd represent the proximal, middle, distal of the basilar artery, respectively. Vp, Vm, and Vd represent the proximal, middle, distal of the vertebral artery, respectively.

Measurement Site	Study	Sample Size (n)
Internal Carotid Artery (ICA) - C2, C4, C6, C7	Samuels [12].	1999 1
	[13-17].	2002 2
Middle Cerebral Artery (MCA) - Md, Mm, Mp	Yonsei Stroke Registry [18]	20
	Bouthillier [19]	20
Vertebrobasilar Artery (VBA) - Vp, Vm, Vd, Bp, Bm, Bd	1.	20
	(carotid bulb) [12].	0.1 mm
Other Measurements	4	10
	(Fig. 1).	M1

Table 1. Intra-observer and interobserver agreements of measurements.

Artery	Portion	Observer 1	Observer 2	Interobserver
ICA	C2	0.86	0.76	0.43
	C4	0.66	0.91	0.64
	C6	0.77	0.83	0.7
	C7	0.83	0.56	0.41
MCA	Proximal	0.6	0.78	0.66
	Middle	0.6	0.89	0.76
	Distal	0.84	0.84	0.81
BA	Proximal	0.7	0.61	0.27
	Middle	0.72	0.93	0.47
	Distal	0.74	0.89	0.68
VA	Proximal	0.76	0.87	0.69
	Middle	0.83	0.77	0.75
	Distal	0.78	0.6	0.5

BA, basilar artery; ICA, internal carotid artery; MCA, middle cerebral artery; VA, vertebral artery. C2, C4, C6, and C7 represent the petrous portion, the cavernous portion, the ophthalmic artery origin, the anterior choroidal artery origin, respectively.

(Fig. 1).

Pearson correlation

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SPSS

가 0.4

0.4 ~ 0.7

(lateral view)

(AP view)

1.

(Table 1).

2.

2.

20

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(%) = [(

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, 1.

3.

Table 2. Correlation rates of measurements in the intracranial arteries.

Internal carotid artery

	C2	C4	C6	C7	contralateral
C2	1	0.514	0.549	0.37	0.571
C4	0.514	1	0.556	0.436	0.561
C6	0.549	0.556	1	0.448	0.448
C7	0.37	0.476	0.488	1	0.252

Middle cerebral artery

	Proximal	Middle	Distal	contralateral
Proximal	1	0.7	0.661	0.554
Middle	0.7	1	0.764	0.587
Distal	0.661	0.764	1	0.576

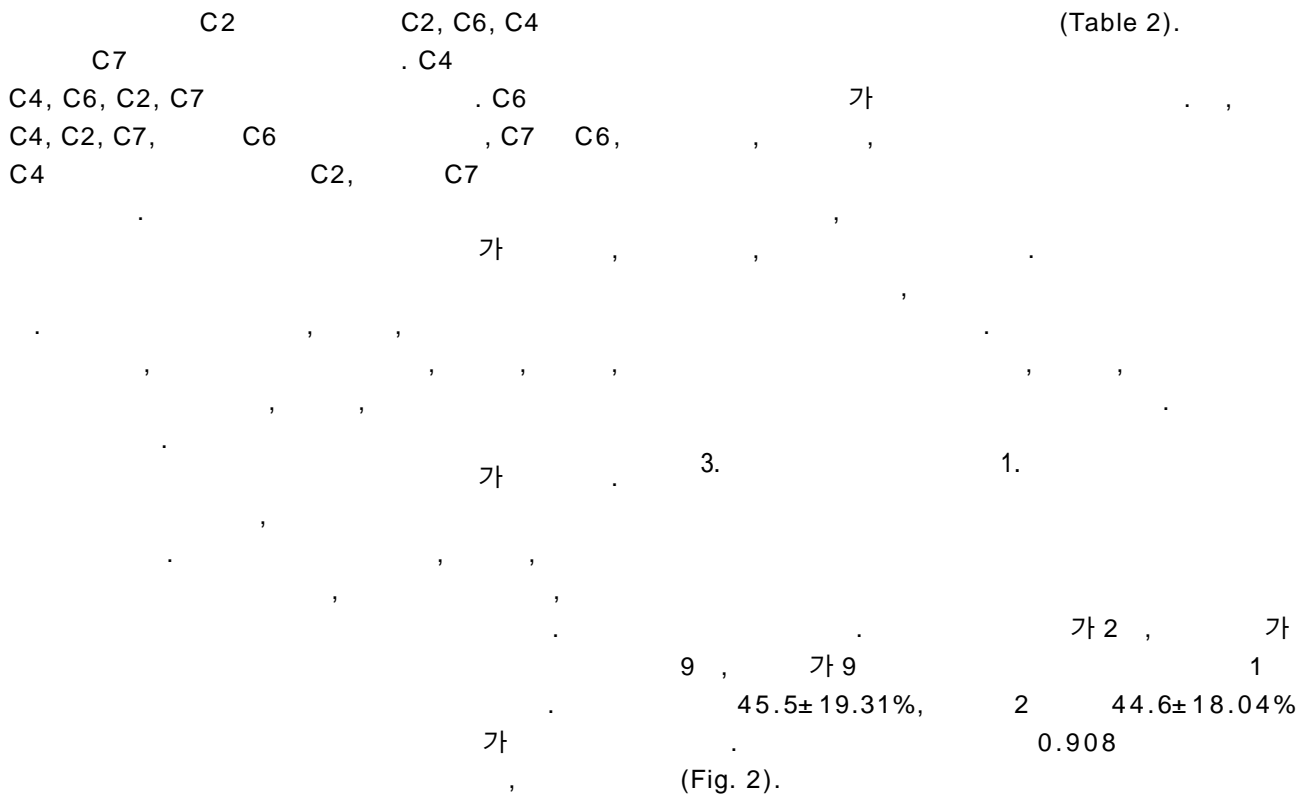
Basilar artery

	Proximal	Middle	Distal
Proximal	1	0.674	0.635
Middle	0.674	1	0.851
Distal	0.635	0.851	1

Vertebral artery

	Proximal	Middle	Distal	contralateral
Proximal	1	0.778	0.592	0.299
Middle	0.778	1	0.724	0.41
Distal	0.64	0.723	1	0.197

C2, C4, C6, and C7 represent the petrous portion, the cavernous portion, the ophthalmic artery origin, the anterior choroidal artery origin, respectively.



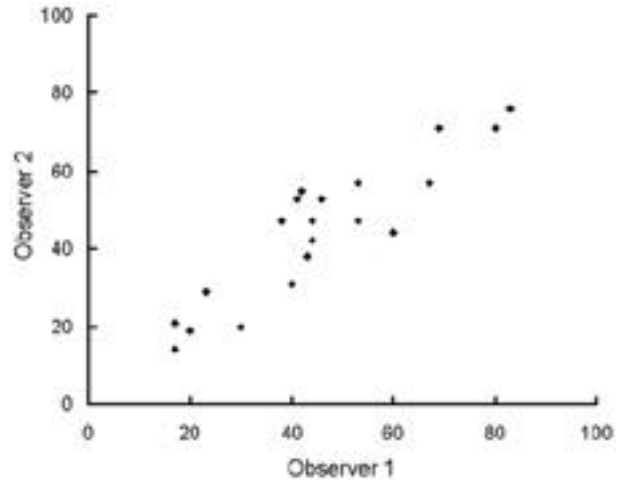


Figure 2. Interobserver agreements of the stenotic degree which were measured in the diseased middle cerebral artery. Numbers in the axes represent the percent degree of stenosis.

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가 ,

[16-17].

가 ,

가 [12].

가

(hypoplasia)

가

가

가

(segment)

가

4 [20].

가

가

. Samuels

(precavernous and postcavernous portion)

가 (petrous portion)

[12].

0.43

가

[21],

가

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