

1, 2, 3 4 4 1, 2, 3

:
:
:
177 (125)
4 (, , , ,
) 2 (,), 1 ()
(<30 , 30 - 39, 40 - 49, 50 - 59, 60)
(<50 , 50)
:
: (mean \pm SD); 4.61 \pm 0.69, 3.96 \pm 0.60,
3.48 \pm 0.45, 3.61 \pm 0.50, 2.44 \pm 0.32, 2.44 \pm 0.37, 1.81 \pm 0.32, ; 4.29 \pm 0.57, 3.83 \pm 0.56,
3.37 \pm 0.56, 3.52 \pm 0.48, 2.32 \pm 0.37, 2.30 \pm 0.36, 1.76 \pm 0.34. 40
, 6 가 (4
) ()
(2.59 \pm 0.35 mm) (2.35 \pm 0.27 mm) (p value < 0.05),
(2.38 \pm 0.37 mm)가 (2.28 \pm 0.37 mm)
(p value: 0.14).
(, 2.63 \pm 0.43; , 2.39 \pm 0.35 mm) (, 2.34 \pm 0.29; , 2.21 \pm 0.34 mm)
:
, 가 40 가
,
가 2.59 \pm 0.35 mm,
가 2.38 \pm 0.37 mm , 가 2.63 \pm 0.43 mm, 가 2.39 \pm 0.35 mm

(2D DSA) , , ratio,)

(4 - 7).

가 가 , Abe (8)
(1 - 3), 2D DSA

2D DSA , 2D DSA 15.3 \pm 4.8, 23.1 \pm 7.5
(, , dome - to - neck ,

1.9 \pm 1.4, 7.5

1
2 \pm 4.8
3
4

2D DSA, , 가 (,), , 125 , 177 . 48 , 77 , 16 - 76 45 , 177 30 (14%) (stenting) 60 (11%) 30 (11%)가 (6). stenting (Table 1).

carotid endarterectomy (biplane (9, 10). , , DSA unit; Integris Allura biplane, Philips Medical Systems, Best, Netheland) stenting 가 (2D (11). , stent DSA), (4 - 5 ml/sec, 16 - 20 ml in total) , 55 %sec, 240 ° C - arm , 120 (). stenting (Integris 3D RA release 2; Silicon Graphics Inc., Mountain Hill, CA, U.S.A.) stenting 가 (Feldkamp's cone beam algorithm/volume rendering) 가 (12 - 14). "medium resolution" stenting 가 stent 가 가 stent / 1 1 (: 1 /6). stent 가 (15 - 17). , 7 (1. ; 2. , ; 3. , ; 4. ; 5. ; 6. ; 7. , A1), (Fig. 1). 가

5

195

2D DSA

(, ,), 1 cm

Table 1. Sex and Age Distribution of the Study Population

Age groups (years)	Male (%)	Female (%)
< 30	9 (14)	26 (23)
30 - 39	16 (25)	12 (11)
40 - 49	16 (25)	21 (19)
50 - 59	17 (26)	30 (27)
60	7 (11)	23 (21)
Total	65 (100)	112 (100)

가

가

가 30

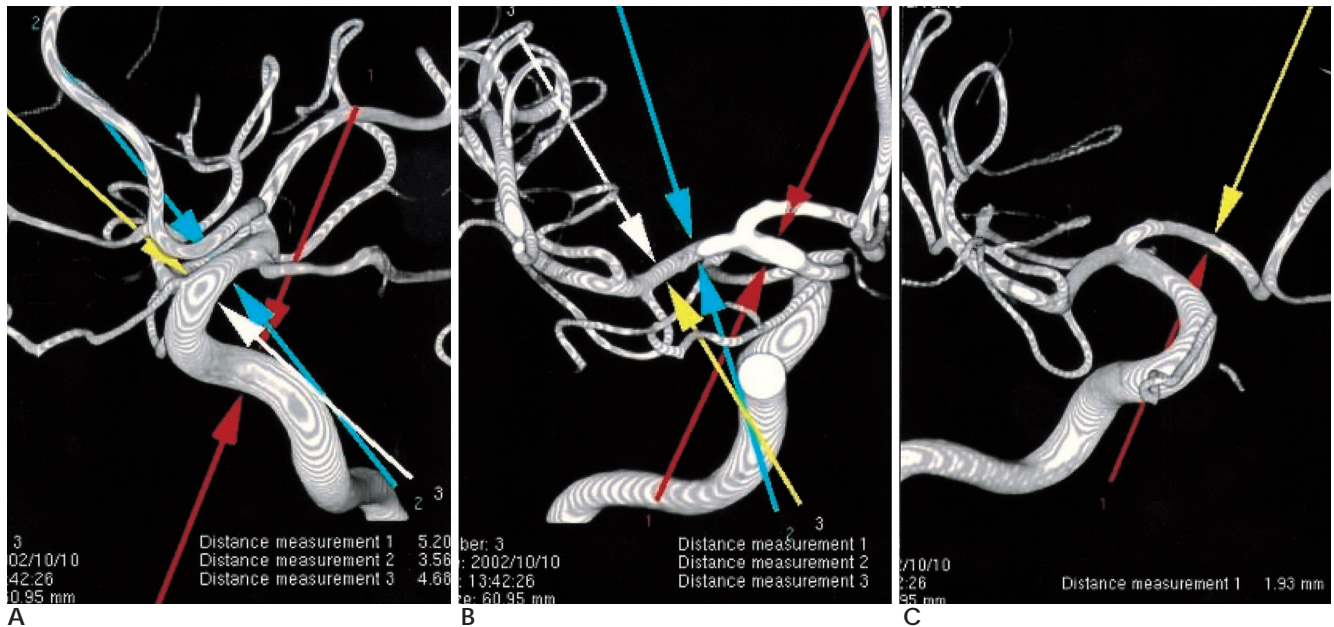


Fig. 1. Measurements at seven sites on three-dimensional arterial images, secondarily reconstructed with medium resolution, using user interface of 3D DSA workstation.

Each arrow indicates measuring diameter at three sites on internal carotid artery (A), two sites on middle cerebral artery and one site on internal carotid artery (B), and one site on anterior cerebral artery (C). Cranial angulation close to superior view, at which the artery is seen along entire length at a time and not overlapped with adjacent arteries, is usually made to measure middle cerebral artery diameter.

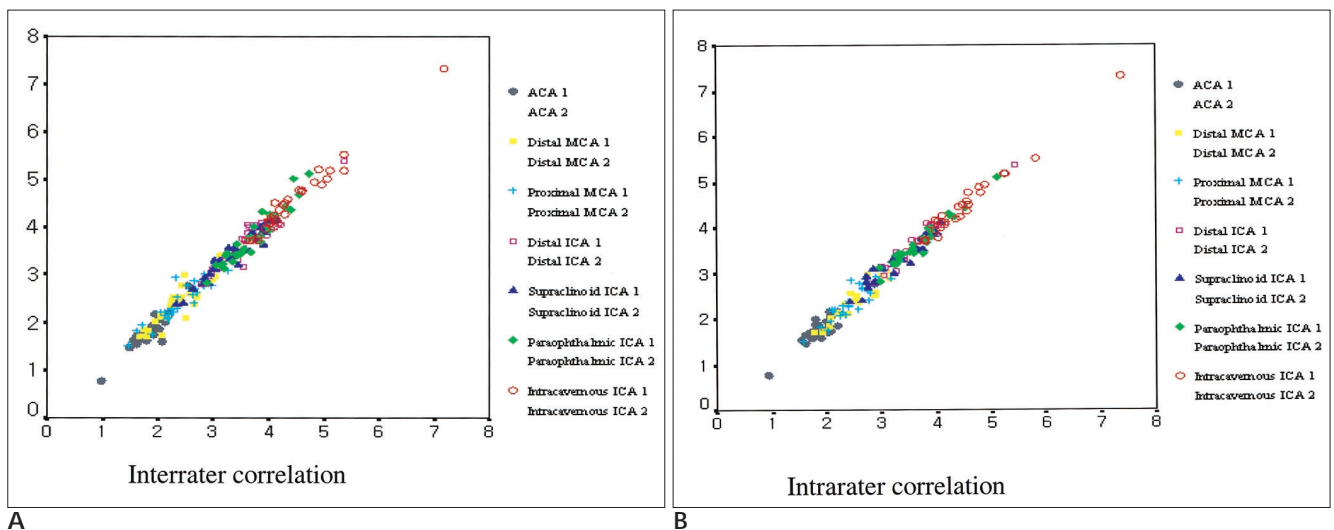


Fig. 2. Graphs showing very high intratester and intertester correlation for measured values at seven sites of the intracranial artery.

가 0.9 가 (Fig. 2).

(n=177), (Anova test), (50) (50) (independent samples test).
 30 7 (intrarater correlation) CT MR
 (interrater correlation) (Pearson correlation
 Shrout - Fleiss reliability test), 0.7 가 2D DSA
 가 SPSS
 11.0
 가 (4.14 - 4.81 mm), 3
 (3.19 - 4.12 mm),
 (, 2.15 - 2.68 mm;
 , 1.72 - 1.86 mm). 40
 , 30 50 3.49 (3.39 - 3.59) cm (16),
 3.63 (2.75 - 4.55) cm
 (Table 2). 3.64 (2.72 - 4.51) cm,
 50 (2.64 ± 2.51 (1.87 - 3.10) cm 2.55 (1.94 - 3.16) cm
 0.33 mm)가 30 (2.27 ± 0.32 mm) 30 (2.34 ± (17), 가
 0.21 mm) (2.59 ± 0.35 mm)
 (2.35 ± 0.27 mm) 가 가
 (p value < 0.05). 50
 (2.68 ± 0.41 mm)가 30 (2.21 ± 0.20 mm) 40
 50 (, 2.63 ± 0.43; 7 5
 2.39 ± 0.35 mm) (, 2.34 ± 0.29; , 2.21 ±
 0.34 mm) 가 , 40 가 가 가
 (2.38 ± 0.37 mm)가 가
 (2.28 ± 0.37 mm) 50 가 30
 (p value: 0.14). 30
 7 가

Table 2. Distribution of the Normal Intracranial Arterial Diameter According to Sex and Age

Age (years)	Sex	Intracavernous ICA	Paraophthalmic ICA	Supraclinoid ICA	Distal ICA	Proximal MCA [*]	Distal MCA [*]	ACA
30 >	M	4.57 ± 0.29	3.83 ± 0.42	3.27 ± 0.37	3.36 ± 0.26	2.27 ± 0.32 [*]	2.41 ± 0.34	1.82 ± 0.21
	F	4.46 ± 0.58	3.73 ± 0.58	3.35 ± 0.62	3.49 ± 0.46	2.33 ± 0.38	2.26 ± 0.35	1.72 ± 0.36
30 - 39	M	4.77 ± 0.54 [*]	4.00 ± 0.48	3.51 ± 0.44	3.42 ± 0.36	2.34 ± 0.21 [*]	2.21 ± 0.20 [*]	1.84 ± 0.24
	F	4.15 ± 0.46 [*]	3.80 ± 0.36	3.29 ± 0.32	3.56 ± 0.45	2.22 ± 0.38	2.15 ± 0.37	1.79 ± 0.31
40 - 49	M	4.61 ± 0.58 [*]	4.12 ± 0.78 [*]	3.53 ± 0.47 [*]	3.70 ± 0.57 [*]	2.41 ± 0.29	2.42 ± 0.31 [*]	1.75 ± 0.35
	F	4.14 ± 0.61 [*]	3.64 ± 0.60 [*]	3.19 ± 0.51 [*]	3.31 ± 0.53 [*]	2.23 ± 0.34	2.18 ± 0.32 [*]	1.76 ± 0.35
50 - 59	M	4.41 ± 0.73	3.86 ± 0.58	3.45 ± 0.50	3.73 ± 0.44	2.64 ± 0.33 ^{*,#}	2.68 ± 0.41 ^{*,#}	1.86 ± 0.40
	F	4.22 ± 0.35	3.96 ± 0.42	3.46 ± 0.53	3.52 ± 0.39	2.33 ± 0.30 [*]	2.38 ± 0.26 [*]	1.81 ± 0.30
60	M	4.81 ± 1.30	3.94 ± 0.65	3.63 ± 0.44	3.90 ± 0.78	2.47 ± 0.39	2.49 ± 0.48	1.73 ± 0.36
	F	4.42 ± 0.74	3.98 ± 0.70	3.46 ± 0.66	3.74 ± 0.49	2.44 ± 0.44	2.40 ± 0.45	1.74 ± 0.37

ICA: internal carotid artery, MCA: middle cerebral artery, ACA: anterior cerebral artery

*: p value less than 0.5 between different sex groups, #: p value less than 0.5 between different age groups

Numbers written are diameter ± SD mm.

가 , 40
가 50
가
가
가 (9 - 14).
(50)
 2.59 ± 0.35 mm, 2.38 ± 0.37 mm,
 2.63 ± 0.43 , 2.39 ± 0.35 mm ,
가
stenting 가
가
가
가
가
가 (: 0.9).
가
가
가 7
가 (: 0.9).
가
(18),
가
가
가
가
C - arm
가 40
가
가 2.59 ± 0.35 mm, 가 2.38 ± 0.37 mm
가 2.63 ± 0.43 mm, 가 2.39
 ± 0.35 mm .

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Measurement of Normal Intracranial Artery Diameter Using Three-dimensional Reconstruction Rotational Angiogram¹

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Purpose: To evaluate the distribution of normal intracranial artery diameter according to sex and age, using three-dimensional reconstruction rotational angiography.

Materials and Methods: One hundred and twenty-five adults with normal intracranial arteries who underwent 3D rotational angiography ($n=177$) were included in this study. The arterial diameter was measured at four sites of the internal carotid artery (cavernous, paraophthalmic, supraclinoid, and distal), that of the middle cerebral artery at two (proximal and distal), and that of the anterior cerebral artery at one (middle). For each sex and age group (< 30, 30 - 39, 40 - 49, 50 - 59, 60 years), the mean diameter of the artery at these seven sites was calculated, and differences analysed. In addition, the middle cerebral artery diameter was compared between a younger group (< 50 years) and an older group (≥ 50 years).

Results: The mean diameter at each site for each sex was as follows: male (mean \pm SD): 4.61 ± 0.69 , 3.96 ± 0.60 , 3.48 ± 0.45 , 3.61 ± 0.50 , 2.44 ± 0.32 , 2.44 ± 0.37 , 1.81 ± 0.32 ; female: 4.29 ± 0.57 , 3.83 ± 0.56 , 3.37 ± 0.56 , 3.52 ± 0.48 , 2.32 ± 0.37 , 2.30 ± 0.36 , 1.76 ± 0.34 . For those in their 40s, the diameter at five sites (all four sites of the internal cerebral artery and a distal middle cerebral artery) was significantly greater in males than in females. For other age groups, however, the difference between the sexes was absent, or was significant at only one (cavernous internal cerebral artery for those in their 30s) or two (proximal and distal middle cerebral artery for those in their 50s) of the seven sites. In the older age group, the diameter of the proximal middle cerebral artery was 2.59 ± 0.35 mm in males and 2.38 ± 0.37 mm in females. For the distal middle cerebral artery, the corresponding figures were 2.63 ± 0.43 and 2.39 ± 0.35 mm, respectively. For both sexes, the differences between the two age groups were significant.

Conclusion: For those in their 40s, the normal diameter of the intracranial artery at most arterial sites was significantly greater in males than in females. The normal diameter of the middle cerebral artery was significantly greater or tended to be greater among the older group than the younger group (for males and females, respectively, 2.59 ± 0.35 mm and 2.38 ± 0.37 mm at the proximal site, and 2.63 ± 0.43 mm and 2.39 ± 0.35 mm at the distal site).

Index words : Cerebral angiography
Cerebral blood vessels

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