

1

:
 :
 15 () 22 ()
 ,
 ,
 (0 - 24%), (25 - 49%), (50 - 69%), (70 -
 99%)
 : 74 52 (44 8),
 10 , 8 , 4 .
 가 (p value < 0.05).
 가 .
 :

,
 가 가
 가
 ,
 (1 - 4).
 (screening method)
 (5).
 2003 1 2004 5
 (Magnetic Resonance
 Angiography: MRA)
 15 (, :
 =4:11, 31 - 71 , 58)
 가 (6, 7).
 MRA
 22 (: =11:11, 40 - 76 , 53)
 . MRA 3 - 20
 가 2006 9 21 가 2008 1 8
 .

(8.2) , 1 - 15 (6.6) 6 - 7 mL (Omnipaque 300, Nycomed, Norway) 1,024 × 1,024 matrix

1.5T (Gyrosan NT Intera, Philips Medical Systems) 가

3 (3D Time of Flight: TOF) MRA (contrast enhanced: CE) MRA 가

Gibo (8) (petrous segment), (cavernous segment), (supraclinoid segment)

(Acuson 128 unit(Acouson, Mountain view, Calif. U.S.A.) 7MHz , picture archiving and communi - cating system: PACS) (Raypax, Seoul, Korea)

45 - 60 3 - 5 (peak systolic velocity: PSV) 가 (end diastolic velocity: EDV), PSV 가

2 2 - 3 cm 가 (9).

(bulb) 1 - 2 cm Percentage of stenosis (%) = (1 - Diameter of the most stenotic segment/Diameter of the normal segment) × 100

index, RI, 1 - EDV/PSV (Resistive (0 - 24%), (25 - 49%), (50 - 69%), (70 - 99%)

CCA, PSV)

74

(Integris, Philips, Best, 가 Jonckheere - Netherlands) Terpstra (SPSS 11.5, Chicago, IL).

Table 1. Results of 15 Patients with Stenosis of the Intracranial ICA

Patient	Right ICA			Left ICA		
	Location of Stenosis	Stenosis (%)	Stenosis in Branches	Location of Stenosis	Stenosis (%)	Stenosis in Branches
1	supraclinoid	75				
2				cavernous	33	M1 100%
3			M1 50%	supraclinoid	53	M1 90%
4	cavernous	77		cavernous	52	
5	supraclinoid	40		supraclinoid	39	
6	supraclinoid	70		supraclinoid	56	
7	supraclinoid	33		supraclinoid	63	
8	supraclinoid	65				
9				supraclinoid	52	
10	petrous	72				
11			M1 55%	supraclinoid	43	
12	cavernous	54		cavernous	46	
13				cavernous	42	
14	supraclinoid	32		supraclinoid	55	
15	supraclinoid	37		supraclinoid	32	

Note. ICA = internal carotid artery, M1 = first segment of middle cerebral artery

PSV

(p value < 0.05).

15 30 8 4 , 가 .
 10 , 8 ,
 . 8 , 7
 Fig. 2
 PSV
 EDV가 .
 (supraclinoid) 15 , (cavernous)
 6 , (petrous) 1 .
 4 50% 1
 (Table 1).
 74 (52%,
 48%) (21%) (79%)
 PSV EDV, PSV, PSV ,
 (Table 2)
 RI (4).
 (Fig. 1). Jonckheere - (39%),
 Terpstra PSV EDV, (10%).

Table 2. Results of Carotid Doppler Ultrasound (Mean Values \pm standard deviation) According to Grade of Intracranial ICA Stenosis

Parameter	Normal (n = 52)	Mild Stenosis (n = 10)	Moderate Stenosis (n = 8)	Severe Stenosis (n = 4)	p-value*
ICA PSV (m/s)	0.51 \pm 0.11	0.49 \pm 0.16	0.43 \pm 0.10	0.36 \pm 0.09	0.004
ICA EDV (m/s)	0.21 \pm 0.07	0.19 \pm 0.07	0.18 \pm 0.06	0.15 \pm 0.03	0.003
CCA PSV (m/s)	0.75 \pm 0.20	0.72 \pm 0.24	0.70 \pm 0.25	0.57 \pm 0.06	0.016
PSV Ratio	0.73 \pm 0.23	0.70 \pm 0.18	0.65 \pm 0.18	0.62 \pm 0.12	0.175
RI	0.58 \pm 0.06	0.59 \pm 0.08	0.59 \pm 0.10	0.55 \pm 0.03	0.286

Note. ICA = internal carotid artery, CCA = common carotid artery, PSV = peak systolic velocity, EDV = end diastolic velocity, RI = resistive index

* p-values were obtained by Jonckheere-Terpstra test.

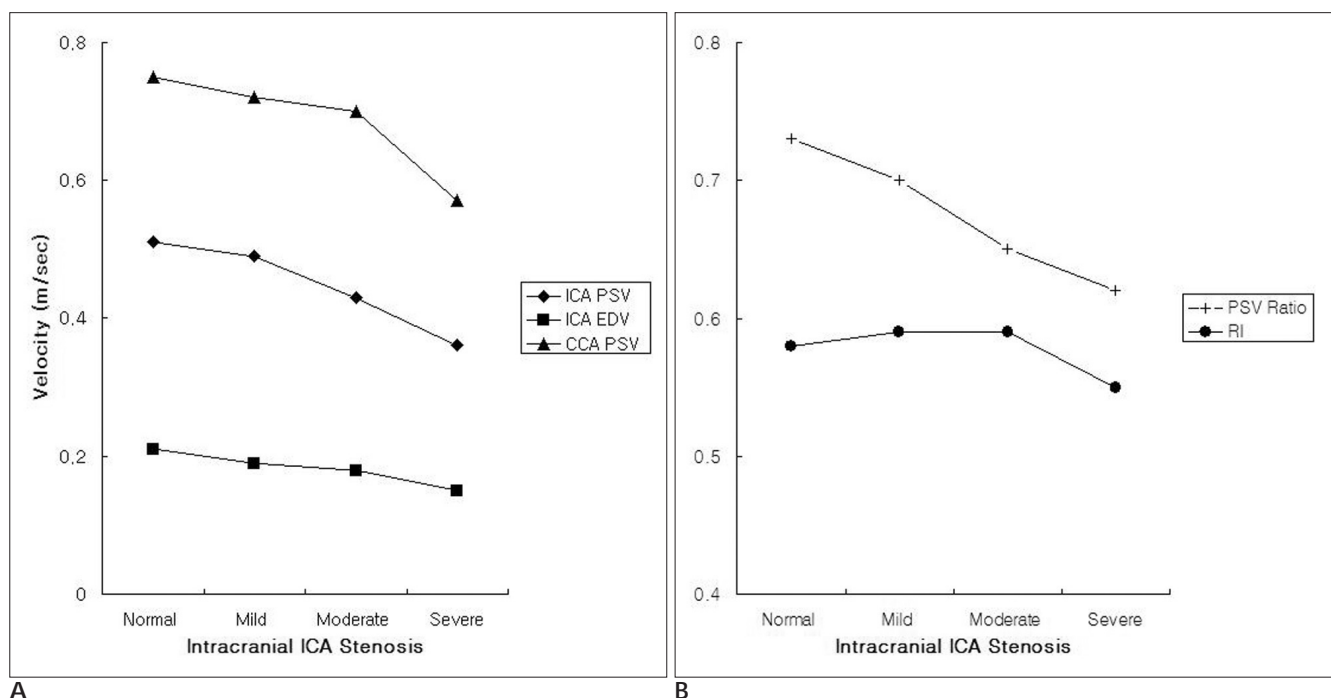


Fig. 1 A, B. Mean values of Doppler parameter in the carotid ultrasound. As the grade of stenosis increases, PSV and EDV in ICA, PSV in CCA and PSV ratio decrease, but this pattern is not noted at RI.

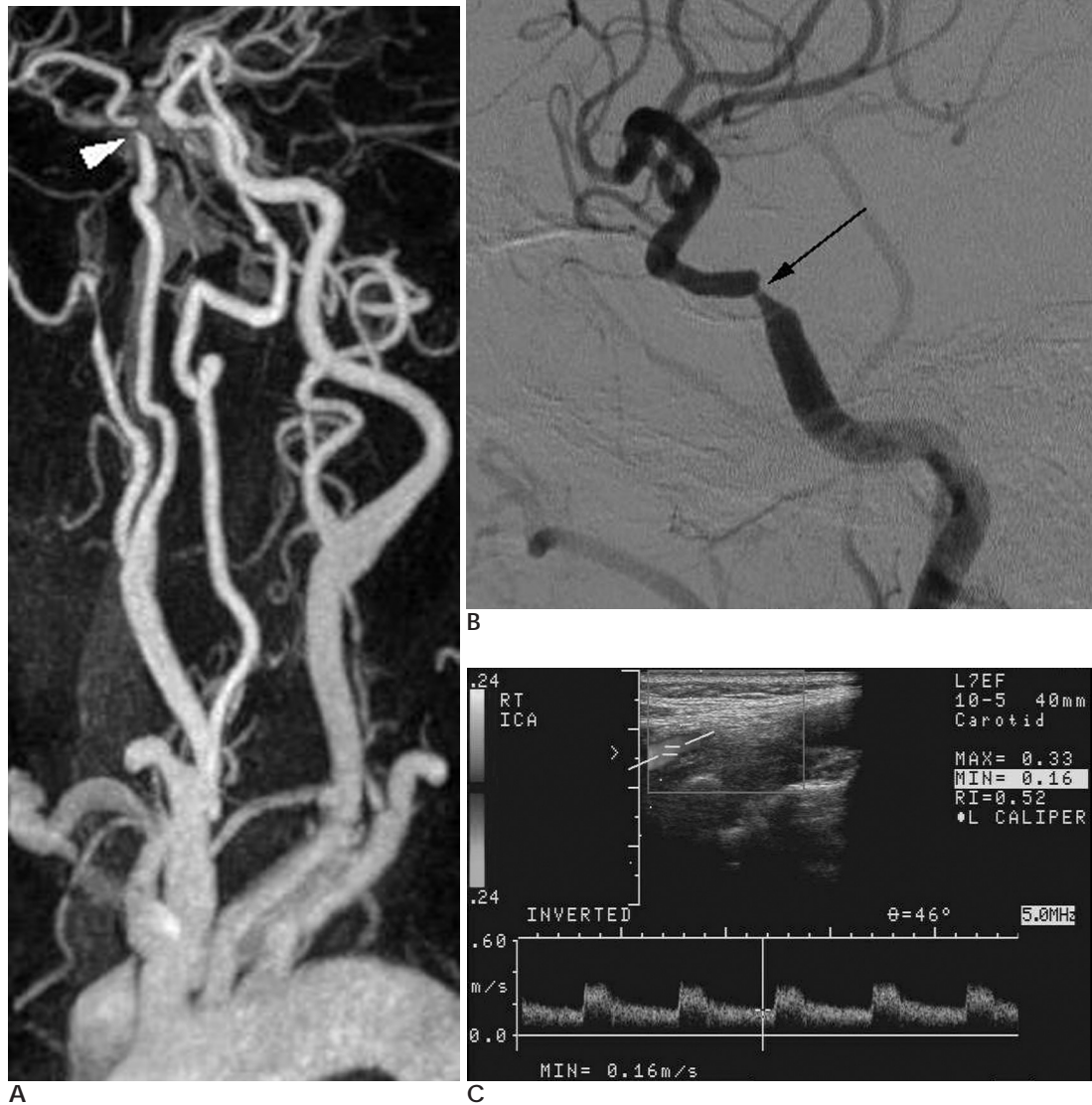


Fig. 2. A 66 year old woman with old infarction in the basal ganglia (Number 4 case).

A. Contrast enhanced MRA does not show any stenosis in both the common carotid artery and extracranial segments of the internal carotid artery. But, there is focal signal void in the cavernous segment of right internal carotid artery (arrowhead).

B. Lateral projection of the right internal carotid angiogram shows severe stenosis at the cavernous segment of right internal carotid artery (arrow).

C. Carotid Doppler ultrasound shows 0.33 m/sec of peak systolic velocity and 0.16 m/sec of end diastolic velocity in the right internal carotid artery.

가 (superficial temporal artery - middle cerebral artery bypass surgery) (11, 12). 가 (13). 50% 가 (14).

, (PSV RI 가 (6).
 ,) PSV RI 가 (7).
 가 (15, 16).
 가
 (Transcranial Doppler: TCD), PSV EDV, PSV
 (CT Angiography: CTA)가 가
 TCD , , 가 가 . PSV 가
 , , (17). 가
 RI 가 RI가
 가 가
 가 (18).
 MRA 3D Time of Flight(TOF) RI
 가 PSV 가
 가 CTA 가 가 PSV
 가 (19). PSV가 가
 (CE MRA) TOF 가 TOF (Table 2). EDV, PSV
 가 (20, 21).
 (CT)가
 (22). CTA 가
 가
 (5, 23 - 25). 가 가 가
 PSV가 가 가
 PSV 50% < 125 cm/sec,
 50% - 69% 125 - 230 cm/sec, 70%
 > 230 cm/sec 가 2, 3, 11
 (26). PSV EDV
 가 , 가
 , 가 가
 가
 (5).
 (27). PSV EDV, PSV가
 가
 가
 가 가
 가 (28).

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Carotid Doppler Ultrasound in Patients with Stenosis of the Intracranial Internal Carotid Artery¹

Yeon Soo Lim, M.D., Won Jong Yoo, M.D., Hyun Wook Lim, M.D.

¹Department of Radiology, Holy Family Hospital, The Catholic University of Korea

Purpose: To investigate the Doppler ultrasonographic parameters of a carotid ultrasound (CUS) for the stenosis of the intracranial internal carotid artery (IICA).

Materials and Methods: The authors evaluated 15 patients with normal extracranial ICA, the common carotid artery (CCA), and stenosis of IICA (patient group). The control group consisted of 22 patients with normal findings on a magnetic resonance angiography (control group). All subjects were subjected to a CUS, whereas subjects from the patient group underwent a cerebral angiography. The following parameters were investigated: peak systolic velocity (PSV) and end diastolic velocity (EDV) in ICA, PSV in CCA, resistive index (RI) in ICA, and PSV ratio. Stenosis was measured following an angiography and was graded as follows: normal (0 - 24%), mild (25 - 49%), moderate (50 - 69%), and severe (70 - 99%). Next, the CUS findings, which reflected the IICA stenosis, were investigated.

Results: Of the 74 ICAs, 52 were normal (44 ICAs in the normal group and 8 ICAs in the patient group), 10 had mild stenosis, 8 had moderate stenosis, and severe 4 had severe stenosis. As the stenosis grade increased, PSV and EDV in ICA as well as PSV in CCA, decreased (p value < 0.05); however, the PSV ratio and RI remained unchanged.

Conclusion: As stenosis of IICA increases, PSV and EDV of ICA and PSV of CCA decreases following a CUS.

Index words : Carotid stenosis
Carotid artery, internal
Ultrasonography, Doppler
Atherosclerosis

Address reprint requests to : Won Jong Yoo, M.D., Department of Radiology, Holy Family Hospital,
82, 2-Sosa dong, Wonmi-gu, Bucheon, Gyunggi-do 420-717, Korea
Tel. 82-32-340-7082 Fax. 82-32-340-2187 E-mail: wjyu@catholic.ac.kr