

1.	(ICA)	(ECA)
	Internal carotid artery	External carotid artery
Size	Larger	Smaller
Location	Posterolateral	Anteromedial
Branches	None	Yes
Waveform	Low resistance	High resistance
Temporal tap	Negative	Positive

1. Duplex (Carotid Duplex Ultrasonography)

, B - mode
Doppler sample volume
가 가 ,
angle of insonation 가 (1).
TCD
가 . Duplex
가 가 duplex
, , (innominate artery)
가 (aortic arch)
European(ECST), North American
(NASCET) Asymptomatic Carotid Atheros-
clerosis studies(ACAS)

, 가
, 가 ,
(acoustic shadowing)
duplex
가 .
duplex
, ,
Doppler
, ,
B - mode
(plaque) , color flow
power Doppler가

. , 1
duplex
가 가
가 .
가 (velocity spectral bandwidth), (envelope
margin) 가 ,

2. (criteria)		pulsed - wave			가 (collateral flow)		
Diameter	Peak	Peak	End	End	(overestimation)		
Stenosis (%)	Systolic Frequency (KHz)	Systolic Velocity (cm/s)	Diastolic Frequency (kHz)	Diasolic Velocity (cm/s)	volume flow rate 가 가		
40~60	> 4.0	> 120	> 1.3	< 40			
61~80	> 4.0	> 120	> 1.3	> 40			
81~90	> 4.0	> 120	> 3.3	> 100			

가 .

가 가 , Doppler

가 (disturbed, high pulsatility, low turbulent)가 , broad- end - diastolic velocity, high Vs:Vd(systolic/ dias- ening, jagged, sawtooth margin acoustic envelope, tolic) ratio high peripheral vascular resistance , low pul- satility, high end - diastolic velocity, low Vs:Vd (systolic/diastolic) ratio (turbulence)

North American Symptomatic Carotid Endarte- rectomy Tria(NASCET) 70~99%

Asymtomatic Carotid Atherosclerosis Study(ACAS) 60~99%

low distal peripheral resis- tance . Delayed systolic acceleration

95~99% (subtotal)

가 가 , color flow power Do- ppler subtotal total trickle flow

90% (3, 4). string flow

International consensus meeting . B - mode

2 2 mm

volume flow rate

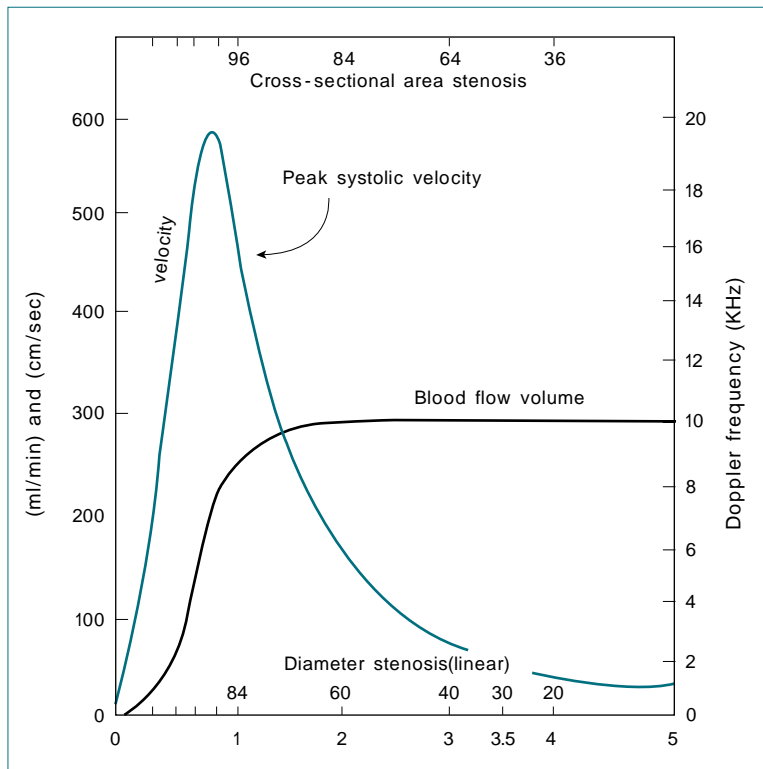
가 가 (5)(1).

B - mode

(lumen) , 1986 Pignoli (6)

(high - resistance Doppler) Wong (7)

B - mode



1. flow volume
1.5 ~ 2.0 mm (60 ~ 80%
가 가 flow volume
flow volume

media thickness) (medi-
an) 0.5 ~ 1 mm
, 5% 2 mm
. IMT bifurcation(BIF)
가 , (CCA)
가 , (ICA)
. IMT CCA(carotid
bulb proximal 1 - cm
segment) BIF(flow
divider proximal 1 - cm
segment), ICA(flow divider
distal 1 - cm segment)
, 가
IMT sampling protocols

가 4%

B - mode far wall (11). 55 7,983
echogenic line lumen - (intima) 27 Rotterdam (12)
, line (media) -
(adventitia) . line 가 가 가
가 intima - media thickness(IMT)가 1.41 , 1.43 가 .
(IMT)

7.5 ~ 10 MHz 0.15 ~ 0.2 mm .
(8), 10% Howard Atherosclerosis Risk in Communities
(9). (mean intima - (ARIC) 가 가 ,

(13). , (13). 가 가 (13). . Salonen LDL echogenic (fibrous component) 가 . (14), Blankenhorn (15) Crouse (16) 가 hyperechoic , LDL HDL 가 acoustic shadowing(echoes) . (smooth, irregular, crater/ulcer), echodensity(anechoic, hypoechoic, echogenic, hyperechoic, echodense), (shadowing), texture(homogeneous, heterogeneous/mixed,) (radial longitudinal) . radial longitudinal , (thromboembolism) 가 . heterogeneous , ulcerated (amaurosis fugax), (retinal ischemia) 가 (18). 가 BIF ICA (posterolateral wall) (posterolateral longitudinal view) 가 , (lateral view) 가 . B - mode (ultrasound beam) 가

echos homogeneous, mixed heterogeneous echolucent anechoic . Homogeneous (fibrous component) 가 . hyperechoic , acoustic shadowing(echoes) (smooth, irregular, crater/ulcer), echodensity(anechoic, hypoechoic, echogenic, hyperechoic, echodense), (shadowing), texture(homogeneous, heterogeneous/mixed,) (radial longitudinal) . radial longitudinal , (thromboembolism) 가 . heterogeneous , ulcerated (amaurosis fugax), (retinal ischemia) 가 (18). 가 BIF ICA (posterolateral wall) (posterolateral longitudinal view) 가 , (lateral view) 가 . B - mode (ultrasound beam) 가

Asymptomatic Carotid Artery Progression Study (ACAPS)(17), Cholesterol - Lowering Atherosclerosis Study(CLAS)(15) Pravastatin, Lipids and Atherosclerosis in the Carotids(16) LDL lovastatin, pravastatin, colestipol niacin B - mode , B - mode 가 . B - mode low - intensity echoes(echolucent, hypoechoic, anechoic), median - level echoes(echogenic), high - level or intense echoes(hyperechoic) . B - mode bright , echogenicity

(transducer) (blood pressure cuff)
 (angulation), B - mode image beam steering reactive/ischemic hyperemia
 가 , color (mild, latent steal pheno-
 flow (transverse view) menon) , ,
 . (true in-
 tracranial steal)

2. Duplex

(Vertebral Duplex Ultrasonography)

(VA)
 (subclavian artery)
 (innominate artery)

, VA
 (collateral flow)
 duplex du-
 plex

VA 가 1982 Aaslid 2 -
 (tranducer) (posteroinferior) MHz pulsed wave
 (transverse process) 가
 acoustic shadow VA , (vasospasm)
 C4 - 5 level . 가 가 ,
 B - mode
 (right, 3.81 mm : left,
 3.88 mm). VA (low - resis-
 tance spectral pattern) ,

duplex
 , ,
 , VA
 .
 (subcalvian steal syndrome)
 VA
 spectral waveform,

(Transcranial Doppler Sonography)

(Transcranial Doppler Sonogra-
 phy) circle of Willis

가 1982 Aaslid 2 -
 MHz pulsed wave
 가
 (vasospasm)
 가 가 ,
 .

1.

(Examination Technique and Vessel Identification)

(window), ,
 sample volume , ,
 (tracing) ,
 (ICA, MCA, ACA),
 (MCA > ACA > PCA),
 . TCD 가

MFV 20~55 cm/sec 50 mm

가 .

가 , (2) (Internal Carotid Artery, ICA) Siphon

10~20% , 10~ 60~70 mm

20% 가 C4 가 , C2

가 MFV 30~65 cm/sec

C4

2) (Transorbital approach) 70 mm

siphon 가

power가 12 .

W/cm² .

가 sample volume 3) (Suboccipital approach)

scale 가

power가 가 .

가 . 가

가 가 (1) (Vertebral Artery, VA)

가 , 55~70 mm

가 가 .

가 MFV 20~50 cm/sec 가

(1) (Ophthalmic Artery) .

40~60 mm , (hypoplasia) 가

MFV 10~30 cm/sec, PI 1.0 (retromastoid

가 가 approach)

가 40~60 mm

가 .

(2) (Basilar Artery, BA)

가 80~110 mm MFV 20~

siphon 60 cm .

4) (Transcervical approach)
(man-
dible angle)
가 가
가 Sample volume
power
duplex

2. TCD

1) Screening and Evaluation of Intracranial Major Vessels

MR angiography(MRA)가
MRA 가
(artifact) (siphon
,
가 가
TCD
MRA
가 PCA 가
가 MRA
TCD가 A1
(VA) 가 (hypoplastic)
MRA TCD

2) Early Detection and Follow - up of Vasospasm TCD (vasospasm)

가
TCD
가
TCD MCA
(hemispheric index)
ICA
()
(SAH)
3~4 () TCD

3) Emboli Detection

TCD
(0.5)
가 (high - intensity transient
signals, HITs). ()
HITs
가 가 가 가
(false - positive, false - negative)
PFO(patent foramen ovale)
(paradoxical emboli)가

4) Subclavian Steal

. TCD () , rior communicating artery) 가
siphon(ICA) 가 .
TCD . TCD
/

. TCD
4~6 MHz pulsed wave Doppler .
duplex , 4 MHz continuous wave ACA가 2.0~1.75 mm
Doppler .
(90%)
가 가 , 가 (PI)
가 (breath holding)
1~2 TCD TCD MCA
(vasomotor reactivity)
가 가 : ⑤

5)
가
(extracranial ICA)
(1) ACA A - com(anterior communi-
cating artery) ACA MCA
(2) (ophthalmic artery)
ECA 가 siphon ,
(3) (internal maxillary artery)
가 siphon ,
(4) p - com(poste-

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