

좌전하행지 재개통술 후 재협착 진단에 있어 경흉부 도플러 심초음파로 측정한 관동맥 혈류 예비력의 유용성

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Clinical Usefulness of Noninvasive Measurement of Coronary Flow Velocity Reserve with Transthoracic Doppler Echocardiography for Detection of Restenosis after Revascularization of Left Anterior Descending Coronary Artery

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ABSTRACT

Background and Objectives : The measurement of the coronary flow velocity reserve (CFR) using transthoracic Doppler echocardiography (TTDE) has been reported to be useful for assessing the physiological significance of left anterior descending coronary artery (LAD) stenosis. This study was performed to evaluate the usefulness of CFR by TTDE for diagnosis of restenosis following revascularization procedures. **Subjects and Methods :** Patients who were scheduled for follow-up coronary angiography following percutaneous intervention, or coronary bypass, surgery for a LAD lesion were enrolled. Prior to the follow-up coronary angiography, flow velocities in the distal LAD were measured by TTDE, both at rest and during the intravenous infusion of adenosine. CFR was defined as the ratio of the hyperemic to the basal peak diastolic velocities. Angiographic restenosis was defined as a diameter stenosis of more than 50% of the normal value by a quantitative coronary angiography. Of 142 consecutive patients, measurement of the CFR was possible in 95% (n = 135), with 39 patients having a myocardial infarction in the LAD territory. The remaining 96 patients were used as the subjects of this study. **Results :** The diameter stenosis was $41 \pm 26\%$, with angiographic restenosis found in 33 patients (34%). The mean CFR by TTDE was 2.5 ± 1.1 . CFR < 2.0 was used to diagnose restenosis, with a sensitivity and specificity of 79% (26/33) and 89% (56/63), respectively. **Conclusion :** The noninvasive measurement of the CFR with TTDE is highly feasible, and can be a useful diagnostic modality for restenosis of a LAD following a revascularization procedure. (*Korean Circulation J 2002;32 (10):856-863*)

KEY WORDS : Coronary disease ; Blood flow velocity ; Echocardiography, doppler .

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서 론

가

가

Thallium SPECT가

(1-3)

(coronary flow reserve, CFR)

가

CFR

guide wire

(4)

(5-8)

가

CFR

(left anterior descending coronary artery, LAD)

가

CFR

(10-14)

가

(15-17)

CFR

(18-20)

가

(21-23)

대상 및 방법

대 상

2001 4 1 2001 12 31

, nitrate)

경흉부 도플러 심초음파

가(E.S.W, J.K.S.)가

Acuson Sequoia 512 digital ultrasound system(Acuson, California)

(5 MHz)

range 12~24 cm/s

Filtering artifact

4

5

flow mapping 가

LAD 가

5 MHz

flow 가

LAD 가

sample volume

5 MHz pulsed wave

beam LAD

color signal 가

0.5

super VHS

경흉부 도플러 심초음파를 이용한 CFR의 측정

2 (0.14 mg/kg/min)

spectral

cycle LAD

spectral

가

가 CFR 가

관상동맥조영술

(가

on-line quantitative coronary angio-
graphic system(Ancor 2.0, Siemens, Erlangen, Ge-
rmany)

calibration

foreshortening 가
, proximal shoulder dis-
tal shoulder 50%

통계분석

SPSS 9.0

±

Student's t-test

CFR

Pearson's correlation

p<0.05

결 과

142

135 (95%)

39

96

환자들의 임상적 특징

59±9.7

가 70

(80%) . 5

, 2

. 89

가

, 7

가

. 89

71

, 4

, 14

25(26%), 52(54%),

25(26%)

가 67(75%)

가 22(25%)

11.3±7.1 mm

41±26% . 50%

33 (34%)

TTDE로 측정된 관동맥혈류예비력

8.3±5.3

TTDE

26.9±14.0, 46.8±27.3 cm/sec

69.5±41.0, 109

±61.0 cm/sec

2.5±1.1

Fig. 1

Fig. 2

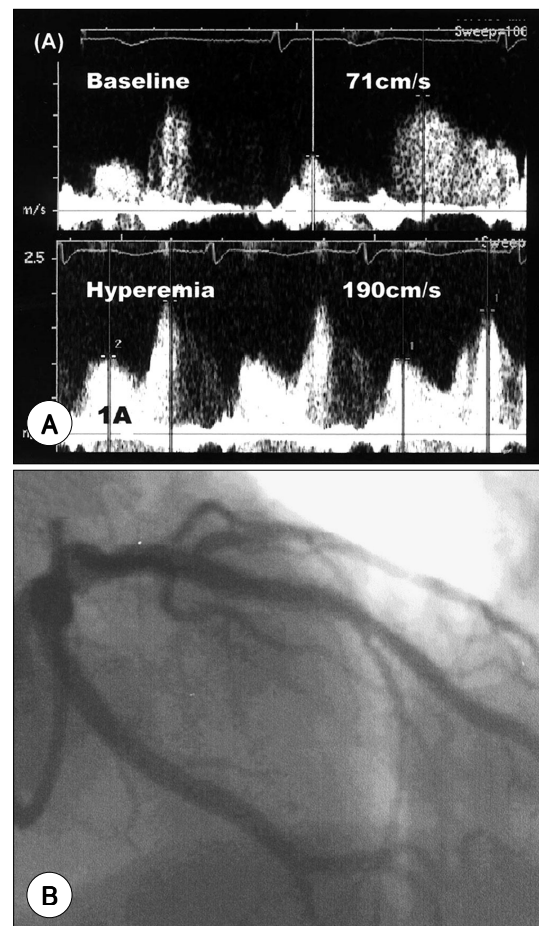


Fig. 1. Transthoracic Doppler result (A) and coronary angiogram (B) in a patient who had underwent stenting at left anterior descending artery. Coronary flow reserve was 2.7 (190/71). Diameter stenosis was 18% by quantitative coronary angiographic analysis.

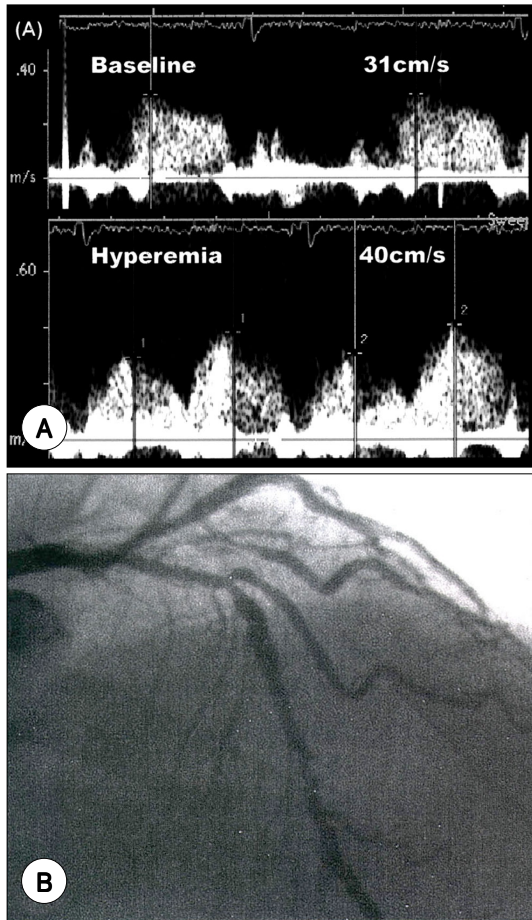


Fig. 2. Transthoracic Doppler result (A) and coronary angiogram (B) in another patient who had underwent stenting at left anterior descending artery. Coronary flow reserve was 1.3 (40/31). Diameter stenosis was 53% by quantitative coronary angiographic analysis.

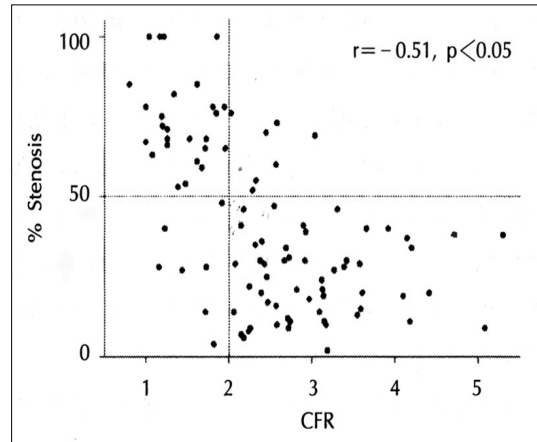


Fig. 3. Relation between % diameter stenosis and coronary flow reserve.

, CFR AUA(area under curve) AUA 0.77, 0.74, 0.88 CFR 가 (Fig. 4).

관동맥혈류예비력과 Thallium SPECT 및 답자운동 심전도와의 비교

36

58%(7/12, 14/24) . Thallium SPECT 18 , Thallium SPECT 67%(8/12), 33% (2/6) .

고 찰

CFR (r = - 0.26, p<0.05), CFR (r = 0.49, p<0.05). CFR (r = - 0.51, p<0.05, Fig. 3).

(Table 1). 2 79% (26/33), 89%(56/63) , 가 79% (26/33), 89% (56/63) (Table 2).

가

4)

guide wire 5-8)

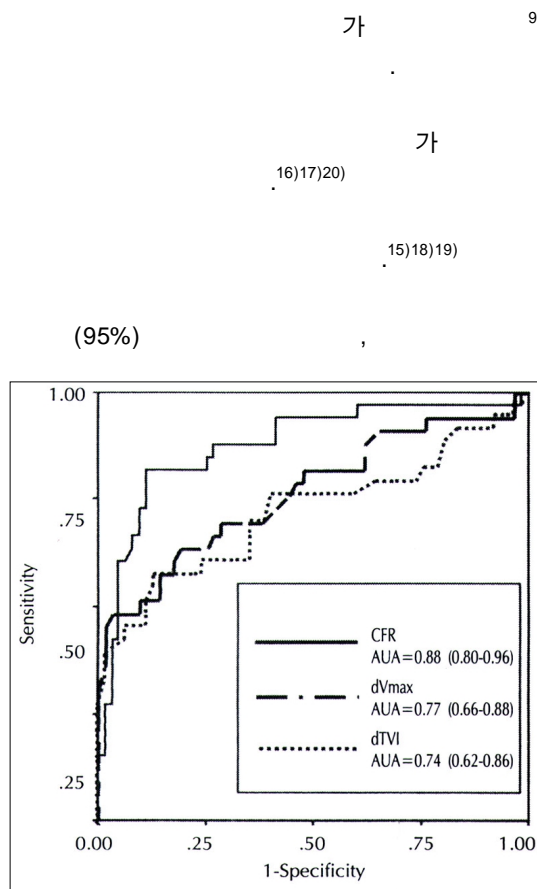


Fig. 4. ROC curve comparing sensitivity and specificity of coronary flow reserve (CFR), hyperemic diastolic Vmax (dVmax), and hyperemic mean diastolic velocity (dTVI).

Table 1. Transthoracic Doppler parameter and coronary flow reserve in total patients, groups with restenosis and without restenosis

	Total (N = 96)	Restenosis (+) (N = 33)	Restenosis (-) (N = 63)
Baseline data			
Heart rate (/min)	64.8 ± 10.9	66.3 ± 10.9	64.0 ± 11.0
Systolic peak velocity	26.8 ± 14.0	28.8 ± 19.1	25.9 ± 11.0
Diastolic peak velocity	46.8 ± 27.3	47.2 ± 31.9	46.6 ± 24.9
Systolic mean velocity	5.8 ± 3.9	6.3 ± 4.7	5.6 ± 3.5
Diastolic mean velocity	17.6 ± 9.7	17.0 ± 11.1	17.9 ± 8.9
Hyperemia data			
Heart rate (/min)	78.1 ± 12.9	78.1 ± 14.4	78.1 ± 12.8
Systolic peak velocity	69.5 ± 41.0	65.1 ± 51.5	71.4 ± 35.7
Diastolic peak velocity*	109.1 ± 61.0	79.2 ± 58.7	124.7 ± 56.5
Systolic mean velocity	15.6 ± 9.9	16.0 ± 13.3	15.4 ± 8.0
Diastolic mean velocity	36.4 ± 21.7	27.0 ± 20.1	41.3 ± 20.7
CFR*	2.5 ± 1.1	1.7 ± 0.9	2.9 ± 1.0

Values are mean ± SD. * : p<0.05 vs group with restenosis and without restenosis, CFR : coronary flow reserve

가 9) 가 . (mi-
nimal cross-sectional area)가 CFR
24) CFR 2.6
± 1.2, CFR 2.5 ± 1.1 , p=0.74
CFR
가
가
2.0 7 ,
27 ± 15% , CFR 1.6 ± 0.3
10.4 ± 4.8 mm
(3), (4),
(1), (1), (1)

Table 2. Sensitivity and specificity of coronary flow reserve (CFR) in predicting restenosis

CFR	Restenosis (+)	Restenosis (-)
<2.0	26	7
2.0	7	56
	33	63

Sensitivity = 26/33 = 79%, specificity = 56/63 = 89%
positive predictive value = 26/33 = 79%
negative predictive value = 56/63 = 89%

8)

CFR

가

가

(SPECT)

가 63~82%, 가 77~84%

1-3) 28)29)

가

79%, 88%

가

가

Doppler guide wire

(adenosine)

가

SPECT 20) Doppler guide wire

가

TTDE

가

가 25)

flow acceleration 100%

flow acceleration 56%

81%, 43%

flow acceleration

TTDE

가

가

임상적 의의

가 46.8 ± 27.3 cm/s Pizzuto 26) $28 \pm$

9 31 ± 7 cm/s, Hozumi 16) 22.9 ± 6.6

23.6 ± 10.3 cm/s, Caiatti 19) 32 ± 11

34 ± 12 cm/s

가

가

가

가

가 37 ± 23

cm/s 27) 50 ± 17 cm/s 14)

가

가

79%, 88% ,
 6 79%, 88% .
 31)
 TTDE CFR
 6 TTDE CFR 2
 가
 6 TTDE

결 론 :

CFR

중심 단어 :

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요 약

배경 및 목적 :

(coronary flow reserve, CFR)

가

CFR

가

방 법 :

142

가 135

96 (80 , 59 ± 9.7)

. CFR

CFR

50%

결 과 :

41 ±

26% , 33 (34%)

46.8 ± 27.3 cm/s

109

± 61 cm/s CFR 2.5 ± 1.1

CFR 2.0

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