

도플러 유도 철선을 이용한 관상동맥 혈류예비력 평가에 있어 니코란딜과 아데노신의 비교

가

정해억 · 승기배 · 김범준 · 임상현 · 강동현
윤호중 · 채장성 · 김재형 · 홍순조 · 최규보

Comparison between Nicorandil and Adenosine in the Measurement of Coronary Flow Reserve Using a Doppler Guide Wire

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ABSTRACT

Background and Objectives : Coronary flow reserve (CFR) is the capability of coronary arteriolar bed to dilate in response to increased cardiac metabolic demand. Nicorandil, a hybrid of ATP-sensitive K^+ channel opener and nitrates, causes coronary vasodilation of both epicardial and resistance vessels. We investigated the feasibility and safety of nicorandil as compared to adenosine in the measurement of CFR using a Doppler guide wire. **Subjects and Methods :** We measured CFR in 26 consecutive patients (mean age 52 ± 19 years, M : F = 16 : 10) during coronary intervention with a 0.014-inch Doppler guide wire. We recorded the baseline average peak velocity (APV) and the hyperemic APV induced by intracoronary adenosine or nicorandil. The heart rate, mean aortic pressure and the time interval from maximal APV to baseline APV were also recorded. **Results :** There were no significant differences between APV, diastole/systole velocity ratio and CFR induced by adenosine and those induced by nicorandil (44.4 ± 17.3 vs 45.5 ± 17.6 , $p = 0.78$, 1.59 ± 0.51 vs 1.57 ± 0.52 , $p = 0.78$, 2.22 ± 0.89 vs 2.27 ± 0.94 , $p = 0.36$). The CFR and diastole/systole velocity ratio induced by nicorandil showed a strong positive linear correlation with those by adenosine ($r^2 = 0.77$, $p = 0.0001$, $r^2 = 0.83$, $p = 0.0001$). Adenosine significantly decreased the heart rate as compared to nicorandil (-25.5 ± 9.7 vs -8.7 ± 4.9 bpm, $p = 0.001$). There were no differences in the changes of mean aortic pressure between adenosine and nicorandil (-7 ± 9 vs -2 ± 3 mmHg, $p = 0.17$). Nicorandil prolonged the time interval from maximal APV to baseline APV compared to adenosine (194 ± 62 vs 37 ± 12 sec, $p = 0.001$). **Conclusion :** Nicorandil is feasible and safe for use in measuring CFR using a Doppler guide wire and may replace adenosine. (Korean Circulation J 2002;32(5):391-397)

KEY WORDS : Coronary flow reserve ; Nicorandil ; Adenosine ; Ultrasonography, Doppler ; Blood flow velocity.

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서 론

(coronary flow reserve) 가
가 ,
4 6 가
.¹⁾ (Doppler guide wire)
(ultrasound transducer)가
 ,
 .
(average peak velocity)
(adenosine) 가
 .
 , , , steal
phenomenon
.²⁾ (nicorandil) ATP
(ATP-sensitive potassium chan -
nel)
(nitrate)
가 .³⁾

대상 및 방법

대 상
2000 6 2001 6 가
가
가
 ,
10 g/dL ,

방 법

0.014 inch 12 MHz
가 FloWire (Cardiometrics,
Endosonic, CA, USA)
(adenosine, ,)
(nicorandil, ,)
20 µg,
2.0 mg , 15 µg,
1.5 mg .
가
.³⁾

측정절차

1) 6 Fr 7 Fr
(spectral wave)가
 .
2) ,
(100 150 µg)
3)
(average peak velocity) / (di -
astole systole velocity ratio)
4) /
5) 가 /

6) , 가 ,

통 계
가
/ , paired t - test
simple regression analysis
p 0.05

결 과

임상적 특성

26 (: =16 : 10) 52±
19
10 , 4 , 3
9 , 6
가
X

Table 1. Clinical characteristics

Age (yr)	52 ± 19
Sex (M / F)	16 : 10
Diagnosis (%)	
MI	10 (38.5)
Unstable angina	3 (11.5)
Variant angina	4 (15.4)
Stable angina	3 (11.5)
Syndrome X	6 (23.1)
Risk factors (%)	
Diabetes mellitus	6 (23.1)
Hypertension	5 (19.2)
Smoking	7 (26.9)
Hypercholesterolemia	3 (11.5)
Location (%)	
LAD	12 (46.1)
RCA	8 (30.8)
LCX	6 (23.1)
Number of disease vessel (%)	
One	5 (19.2)
Two	12 (46.1)
Three	9 (34.7)

MI : myocardial infarction, LAD : left anterior descending coronary artery, RCA : right coronary artery, LCX : left circumflex coronary artery

6 , 5
가 7
12 , 8
6 2
12 , 3 9 (Table 1).

아데노신과 니코란딜에 의해 유도된 측정치들의 비교와 상관관계

22.1 ± 9.9 1.18 ± 1.1 ,
/ , /
가 (Table 2).

Table 2. Comparisons of values measured by Doppler guide wire according to the drugs

	Adenosine	Nicorandil	p
Baseline values			
APV	22.1 ± 9.8		
DSVR	1.18 ± 1.1		
Hyperemic values			
APV	44.4 ± 17.3	45.5 ± 17.6	0.78
DSVR	1.59 ± 0.51	1.57 ± 0.52	0.78
CFR	2.22 ± 0.89	2.27 ± 0.94	0.36

APV : average peak velocity, DSVR : diastole systole velocity ratio, CFR : coronary flow reserve

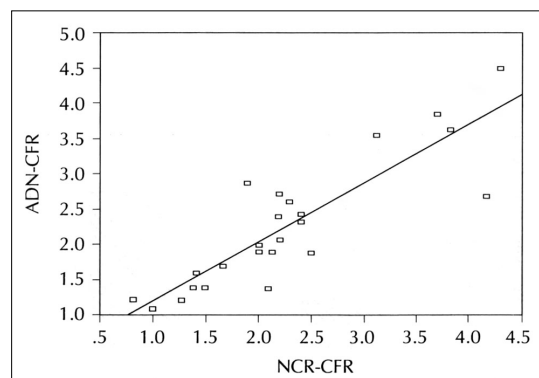


Fig. 1. Linear correlation between CFR-ADN and CFR-NCR. $y=0.836 + 0.357(r^2=0.77, p=0.0001)$. ADN-CFR : coronary flow reserve using adenosine, NCR-CFR : coronary flow reserve using nicorandil.

$r^2 = 0.77$
($p=0.0001$)(Fig. 1).

83
(Fig. 2).

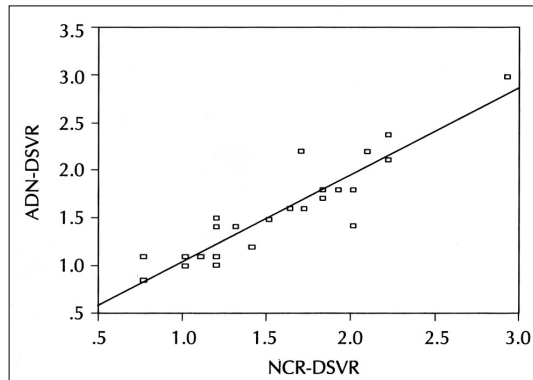


Fig. 2. Linear correlation between DSVR-ADN and DSVR-NCR. $y=0.914 + 0.147x$ ($r^2=0.832$, $p=0.0001$). ADN-DSVR : coronary flow reserve using adenosine, NCR-DSVR : coronary flow reserve using nicorandil.

Table 3. Comparisons of the change of hemodynamic parameters before and after injection of drugs

	Adenosine	Nicorandil	p
Hemodynamic parameters			
HR (bpm)	-25.5 ± 9.7	-8.7 ± 4.9	0.001
mean BP (mmHg)	-7 ± 9	-2 ± 3	0.17
Recovery time (seconds)	37 ± 12	194 ± 62	0.001

HR : changes of heart rate, BP : changes of aortic blood pressure

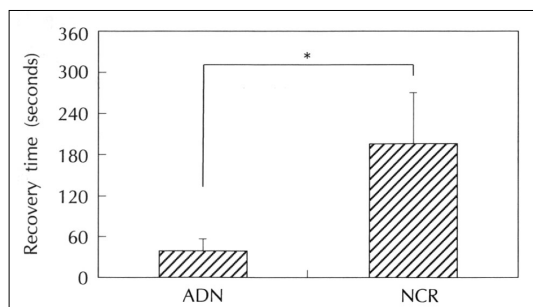


Fig. 3. Comparison of the recovery time between two drugs. The time interval from peak hyperemia to return to basal level is significantly shorter after nicorandil than after adenosine. * : 37 ± 12 vs 194 ± 62 sec, $p=0.001$, ADN = adenosine, NCR=nicorandil.

혈류역동학적인 변화의 비교

25.5 ± 9.7

8.7 ± 4.9

($p=0.001$).

7 ± 9 mmHg가

2 ± 3

mmHg가

가

($p=0.17$).

37 ± 12

194 ± 62

($p=0.001$)(Table 3)(Fig. 3).

고 찰

(coronary flow reserve)

가

가

4

6

가

¹⁾

(epicardial coronary artery)

(microvasculature)

(proximal compartment)

(distal com -

partment)

(pre -

arteriole)

(arteriole)

100 μ g

가

100 μ g

⁴⁾

2.7 ± 0.6

⁵⁾ X 3 mg T ST
가 가 가 ³⁾⁸⁾
가
⁶⁾ 가
⁷⁾
thermodilution, digital
subtraction, positron image, xenon washout
⁸⁾ Cole Hartley
가 가
가
⁹⁾¹⁰⁾ MRI, ¹¹⁾¹²⁾ 가
(papav - ³⁾⁸⁾
erine), ⁵⁾ (dypiridamole)
QT ⁸⁾
가 26
¹³⁾ 가
steal phenomenon
²⁾
가
(nitrate)
cGMP 가
ATP 가
(ATP - sensitive potassium - channel)
가 가
(hyperpolarization)
³⁾¹⁴⁾¹⁵⁾
요 약
가 배경 및 목적 :
¹⁶⁾¹⁷⁾ 2 mg

결 론 :

가 .

방 법 :

2000 6 2001 6 가

가

26 (52 ± 19 , : =

16 : 10)

0.014 inch FloWire

/ (15 20

μg) (1.5 2.0 mg)

/

결 과 :

22.

1 ± 9.9 1.18 ± 1.1 .

44.4 ± 17.3 $45.5 \pm$

17.6 , / 1.59 ± 0.51 1.57

± 0.52 2.22 ± 0.89

2.27 ± 0.94 가 ($p=0.78$,

$p=0.78$, $p=0.36$).

($r^2=0.77$, $p=$

0.0001), /

($r^2=0.83$, $p=0.0001$).

가 25.5 ± 9.7

8.7 ± 4.9

($p=0.001$),

-7.3 ± 9.2 mmHg -2.9 ± 3.7 mmHg

가 ($p=0.17$).

194 ± 62

37 ± 12 ($p=0.001$).

결 론 :

가

중심 단어 : ; ; ; ;

가

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