

풍선확장술 직후 시간경과에 따른 혈관의 변화 - Intravascular Ultrasound Balloon Catheter -

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= Abstract =

Time-Sequencing Morphometric Changes of Target Vessel Immediately after Percutaneous Coronary Balloon Angioplasty - Intravascular Ultrasound Balloon Catheter -

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Background : Plaque compression (and/or redistribution) and vessel expansion are important mechanisms of percutaneous coronary balloon angioplasty. We investigated the mechanisms of balloon angioplasty according to plaque characteristics by intravascular ultrasound and assessed the time-sequencing morphometric changes of target vessels after balloon dilation without catheter change using intravascular ultrasound balloon catheter.

Methods : We studied balloon angioplasty in 10 patients (eight male, average age of 55.3 years). Quantitative coronary angiography and intravascular ultrasound images were attained at baseline and at timed intervals of 0sec, 60sec and 180sec post-balloon angioplasty. The following categories were attained : reference diameter, minimal lumen diameter, cross sectional area (CSA) of lumen (L), external elastic membrane (EEM), and plaque + media (P + M). We also assessed the plaque morphology of target lesions and classified them into two groups according to intravascular ultrasound imaging : a soft plaque group versus a group characterized by fibrous and/or mildly calcified plaque.

Results : The proportion of plaque compression in the total luminal gain was 80% in the soft plaque group and 70% in the other ; the absolute amount of plaque compression was 26.9% in soft plaque and 24.0% in the other group. The time sequencing changes of target lesion EEM CSA of both groups were $14.4 \pm 2.9 \text{mm}^2$, $14.3 \pm 3.8 \text{mm}^2$ (baseline), $15.1 \pm 2.5 \text{mm}^2$, $15.4 \pm 3.7 \text{mm}^2$ (immediate), $15.0 \pm 2.8 \text{mm}^2$, $14.5 \pm 3.9 \text{mm}^2$ (180sec), those of P+M CSA (target lesion) were $10.4 \pm 3.3 \text{mm}^2$, $10.7 \pm 2.4 \text{mm}^2$ (baseline), $7.6 \pm 2.7 \text{mm}^2$, $8.1 \pm 2.4 \text{mm}^2$ (immediate), $7.9 \pm 2.9 \text{mm}^2$, $8.5 \pm 3.4 \text{mm}^2$ (180sec). Target lesion lumen CSA were $4.0 \pm 1.1 \text{mm}^2$, $3.6 \pm 2.0 \text{mm}^2$ (baseline) $7.5 \pm 1.1 \text{mm}^2$, $7.3 \pm 3.2 \text{mm}^2$ (immediate) $7.1 \pm 1.3 \text{mm}^2$, $6.0 \pm 1.7 \text{mm}^2$ (180sec) respectively.

Conclusions : Plaque compression (and/or redistribution) is the predominant mechanism of luminal

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gain in both groups. The absolute amounts of P+M CSA changes and time sequencing increments of target lesions were similar in both groups. In the non-soft group, the immediate increment and time sequencing reduction of EEM CSA in target lesions were greater than those of the soft plaque group.

KEY WORDS : Percutaneous coronary balloon angioplasty · Intravascular ultrasound balloon catheter · Plaque morphology.

서 론

1970년대 초에 도입된 관동맥 중재성 혈관성형술(percutaneous transluminal coronary angioplasty, PTCA)은 혈관 내 플라크를 압박하고/또는 재분포시켜 혈관 확장(compression and/or redistribution vessel expansion)을 유도하여 관동맥 협착을 치료하는 방법이다.

관동맥 중재성 혈관성형술은 관동맥 협착을 치료하는 데에 효과적이며, 최근에는 실시간 영상(real-time)을 제공하는 초음파를 이용한 관동맥 중재성 혈관성형술(intravascular ultrasound balloon catheter, Oracle Mega Sonic, Endosonics comp. USA)이 개발되어 사용되고 있다.

관동맥 중재성 혈관성형술은 관동맥 협착을 치료하는 데에 효과적이며, 최근에는 실시간 영상(real-time)을 제공하는 초음파를 이용한 관동맥 중재성 혈관성형술(intravascular ultrasound balloon catheter, Oracle Mega Sonic, Endosonics comp. USA)이 개발되어 사용되고 있다.

관동맥 중재성 혈관성형술은 관동맥 협착을 치료하는 데에 효과적이며, 최근에는 실시간 영상(real-time)을 제공하는 초음파를 이용한 관동맥 중재성 혈관성형술(intravascular ultrasound balloon catheter, Oracle Mega Sonic, Endosonics comp. USA)이 개발되어 사용되고 있다.

연구대상 및 방법

1. 연구대상
1997년 5월 1일부터 1997년 8월 31일까지

10 (8 , 2) intravascular ultrasound balloon catheter(IVUS balloon catheter)을 사용하여 ACC/AHA type C (osteal lesion), (>90 ° of arc) .

2. 방 법

1) 관동맥 조영술
Seldinger sheath, 5 French Judkins (Integris 3000, Philips, Netherland) .

8 Fr 7 Fr
가 가 (projection)
1 , 3 NTG 200ug
Philips, Netherland) (reference diameter, RD) (minimal luminal diameter, MLD) (% diameter stenosis, % DS)

2) Balloon angioplasty & intravascular ultrasound protocols(IVUS balloon catheter)

IVUS balloon catheter 20 MHz - 3.5 Fr over-the wire (Oracle Mega Sonics, Endosonics, USA) 0.014inch 가 1.0 가 IVUS balloon catheter NTG 200ug

automatic pullback device(Endosonics, USA)
0.5mm/sec

가 . 가 IVUS balloon catheter
nominal pressure(8) 3 가
. , 1 , 3

NTG
S - VHS

R 가
가
4).

(1)

(concentric form)
(eccentric)

(superficial) Ca⁺⁺, (deep) Ca⁺⁺
(echogenicity)

calcific plaque 가
(acoustic shadow) , soft plaque

가 (adventitia)
가 fibrous plaque soft plaque
가 cellularity가
(microcalcium)

plaque 가 mixed
(dissection) (media)
0.3mm 가
5,6)

(2)

10mm
40%
(reference diameter, RD)
external elastic membrane
(EEM CSA), (lumen CSA)
(media)
plaque + media CSA(P+M area, EEM CSA - Luman
CSA) , , 60 , 180

EEM diameter target lesion,

(CSA) , 60 , 180

3) 통계분석

±
SPSS Windows PC
non - parametric test(Kruskal - Wallis test)
p 0.05

결 과

1. 대상환자의 임상상 및 시술 전후의 혈관 조영술 소견

10 (8 , 2)
55.3 3 ,
5 , 2

Table 1

. American College of Cardiology/
American Heart Association

Table 2

2. 혈관내 초음파 결과

1) 180 가

Table 1. Clinical characteristics of patients

	Soft plaque group(5)	Others group(5)
Age(yrs)	53.0	57.6
Sex(M/F)	4/1	4/1
Clinical Dx.		
Stable AP	2	0
Unstable AP	3	3
Acute MI	0	2
T.chol(mg/dl)	173.5	189.4
T.glyceride(mg/dl)	228.5	149.8
HDL-chol(mg/dl)	32.8	34.8
Lp(a)(mg/dl)	20.6	24.7
Diabetes(n)	2	1
Smoking(n)	3	6
Hypertension(n)	1	2

plaque compression and/or redistribution
vessel expansion soft plaque
80% vs 20%, 180 81% vs 19%
others 70% vs 30%, 88% vs 12%
palque compression and/or redistribution
26.9%, 24.0%
180 24.3%, 20.8
(Table 3, 6).

2) EEM dia-
meters 가 (Table 4).

lumen CSA, EEM CSA, P+M CSA
P+M CSA
soft others

Table 2. Lesion characteristics & balloon angioplasty protocols

	Soft group (5)	Othr group (5)
Lesion sites		
LAD	3	1
LCx	1	2
RCA	1	2
Lesion type (ACC/AHA)		
A	2	1
B1	2	3
B2	1	1
Balloon/Artery ratio	0.98	1.02
Inflation Pr (atm)	7.6	7.4
Inflation dr (sec)	174	179
Ref. diameter (mm)	2.94 ± 0.17	3.05 ± 0.23
% DS (pre/post)	74.5/32.0	75.8/26.0
Eccentricity	0.43 ± 0.32	0.60 ± 0.23

Table 3. Proportions of plaque compression & vessel expansion

	Immediate	180sec
Soft plaque	80% vs 20%	81% vs 19%
Others	70% vs 30%	88% vs 12%
Total	75% vs 25%	82% vs 18%

Table 4. Changes of target vessel EEM diameter

Diameter	Pre	Immediate	60s	180s
T soft	3.9 ± 0.5	4.1 ± 0.3	4.0 ± 0.4	4.1 ± 0.4
(EEM) others	4.0 ± 0.4	4.2 ± 0.5	4.1 ± 0.3	4.1 ± 0.5

10.4 ± 3.3mm², 10.7 ± 2.4mm²
7.6 ± 2.7mm², 8.1 ± 2.4mm² 180 7.9 ± 2.9mm²,
8.5 ± 3.4mm² (Fig. 2).

Table 5. Time-sequencing quantitative changes of target vessel

CSA	Pre	Immediate	60s	180s
T S	4.0 ± 1.1	7.5 ± 1.1	6.9 ± 1.5	7.1 ± 1.3
(Lumen) O	3.6 ± 2.0	7.3 ± 3.2	6.3 ± 1.6	6.0 ± 1.7
T S	14.4 ± 2.9	15.1 ± 2.5	14.8 ± 2.9	15.0 ± 2.8
(EEM) O	14.3 ± 3.8	15.4 ± 3.7	14.6 ± 2.1	14.5 ± 3.9
T S	10.4 ± 3.3	7.6 ± 2.7	7.9 ± 3.5	7.9 ± 2.9
(P+M) O	10.7 ± 2.4	8.1 ± 2.4	8.3 ± 2.5	8.5 ± 3.4

Table 6. Time-sequencing differences of target vessel

CSA	Immediate	60s	180s
T Soft	3.5 ± 1.3	-0.6 ± 0.1	-0.4 ± 0.3
(Lumen) Others	3.6 ± 1.5	-1.0 ± 0.9	-1.2 ± 1.8
T Soft	0.7 ± 0.6	-0.3 ± 0.2	-0.1 ± 0.3*
(EEM) Others	1.1 ± 0.4	-0.8 ± 0.8	-0.8 ± 0.3
T Soft	-2.8 ± 1.8	0.3 ± 1.0	0.3 ± 0.3
(P+M) Others	-2.5 ± 1.7	0.2 ± 0.9	0.4 ± 2.1

*p < .05

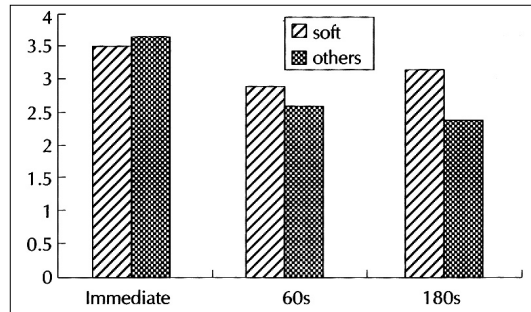


Fig. 1. Time-sequencing changes of target lesion lumen CSA.

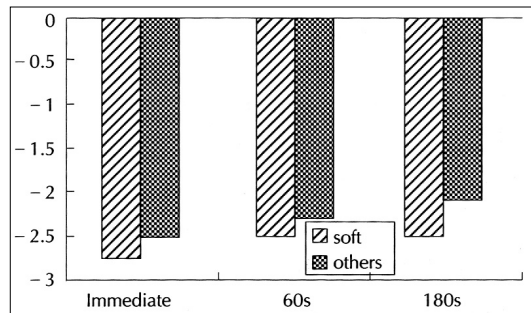


Fig. 2. Time-sequencing changes of target lesion P+M CSA.

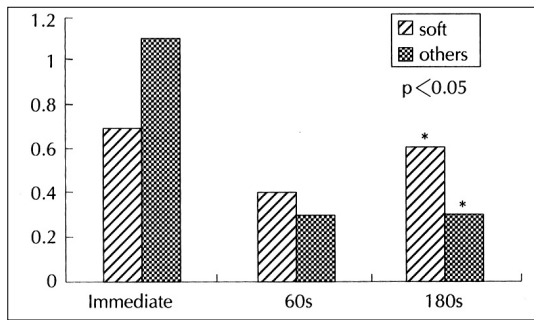


Fig. 3. Time-sequencing changes of target lesion EEM CSA.

EEM CSA
 soft plaque 14.4 ± 2.9mm², others 14.3 ± 3.8mm²
 15.1 ± 2.5mm², 15.4 ± 3.7mm² 180
 15.0 ± 2.8mm², 14.5 ± 3.9mm²
 (Table 5, Fig. 3)
 EEM CSA 가 P+M CSA
 Lumen CSA 가 soft
 plaque 4.0 ± 1.1mm² 7.5 ± 1.1mm² 180
 7.1 ± 1.3mm² others
 3.6 ± 2.0mm² 7.3 ± 3.2mm² 180
 1.7mm² others 가
 180
 (Table 5, Fig. 1).

고 안

1970 Andreas Gruentzig¹⁾
 (revascula-
 rization)
 가 가
 가 가
 가 가 7,8)
 9,11)

가
 10) intravascular ultra-
 sound balloon catheter
 12,13) human necropsy ex vivo
 2) 3)
 Losordo¹⁴⁾ plaque compression
 and/or redistribution, The¹⁵⁾
 가 plaque compression(and/or redistribution)
 vessel expansion P+M
 CSA soft 10.4 ± 3.3mm²
 7.6 ± 2.7mm² (EEM
 CSA 가) 14.4 ± 2.9mm² 15.1 ± 2.5mm²
 plaque compression 80%
 Serruys^{16,17)}, Hodgson¹⁸⁾, Mintz¹⁹⁾
 others
 plaque compression vessel expansion
 10.7 ± 2.4mm² 8.1 ± 2.4mm², 14.3 ± 3.8mm²
 15.4 ± 3.7mm² plaque compression
 70% soft
 (Table 3, 4) others
 EEM CSA vessel expan-
 sion (30% 12%).
 plaque compression
 (Table 6).
 lumen CSA
 가 vessel expansion EEM CSA
 가 () plaque+
 media(P+M) CSA P+M
 CSA 가
 echo density가 soft plaque
 fibrous plaque calcific plaque

P+M CSA 가 ²⁰⁾
 soft -2.8 ± 1.8mm²
 others -2.5 ± 1.7mm² soft

요 약

연구배경 :

(Table 6, Fig. 2, p = NS).
 EEM CSA soft 0.7 ±
 0.6mm² 가 others 1.1 ± 0.4mm²
 가 others 가 180
 soft -0.1 ± 0.3mm² others
 -0.8 ± 0.3mm² others EEM
 CSA 가

가

(Table 6, Fig. 3, p < 0.05).

²⁴⁾가

Tobis ⁷⁾

가

가

Frab ²⁰⁾

intravascular ultrasound balloon catheter가

가

^{6,10,23,24)}

soft

others

방 법 :

(Table 2)

10 (3 ,

th -

5 , 2)

romboxane A2,

, 60 , 180 NTG 200ug

soft plaque group

group others group

S - VHS

fibrous plaque group, mixed group

가

²¹⁾

결 과 :

3

mpression and/or redistribution plaque co -
 expansion vessel
 soft plaque

가

80%, others 70%

intravascular

plaque compression

ultrasound balloon catheter

^{13,22)}

가

P+M CSA

EEM CSA

가

others (p < 0.05).

P+M CSA EEM CSA 가

lumen CSA 가 other plaque

결 론 :
intravascular ultrasound balloon
catheter
가
가

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