

## 관상동맥질환에서 고속회전 죽상반절제술의 초기경험

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## Initial Experience of Rotational Atherectomy in Coronary Artery Disease

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## ABSTRACT

**Background :** Rotational atherectomy has been developed for several years. It is a useful tool in complex coronary lesion morphologies such as diffuse, calcific, ostial and angulated lesion. We report initial experience of the rotational atherectomy in complex coronary artery morphology. **Methods :** We included 64 patients who was treated with rotational atherectomy since July 1997 to February 1999. Mean age was  $56 \pm 9$  years with 47 male patients. Clinical diagnosis was 12 acute myocardial infarction, 49 unstable angina, and 3 stable angina. Rotational atherectomy was done by transfemoral or transradial approach with adjunctive ballooning and/or stenting in all patients. **Results :** Ninety-one percent of the treated lesions showed complex lesion morphologies (B2/C lesion) with 43 left anterior descending artery and 19 right coronary artery. Rotational atherectomy was done in 37 de novo lesion (58%) and 27 (42%) restenosis patients. Transradial approach was done in 33 patients (52%). Mean maximal burr size was 1.68 mm and mean burr to reference artery ratio was 0.63. Rotastenting were done in 58% of the patients with higher post-procedure minimal lumen diameter, % diameter stenosis and net gain than rotablator with adjunctive balloon angioplasty. Overall procedural success was 94% (62/64). Complications were one non-Q infarction, one coronary artery perforation, two slow flow, and one guidewire fracture. None of the patients showed in-hospital mortality or 30 day cardiac event (death, emergency CABG, Q-infarction, or re-intervention). **Conclusion :** Rotational atherectomy is a useful technique with high success rate without showing major cardiac events during in-hospital period and within 30 days. (**Korean Circulation J 1999;29(6):567-574**)

**KEY WORDS :** Rotational atherectomy · Complex lesion · Stent restenosis.

## 서 론

(percutaneous transluminal  
coronary angioplasty, PTCA)

가

가

가

가

: 1999 3 12

: 1999 5 7

: , 602 - 715

3가 1

16 180,000

5 10  $\mu$  m

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가<sup>5)</sup> PTCA 0.014 가 0.009  
(non-compliant atheroma)  
(differential cutting)<sup>6)</sup>  
cocktailed cuff  
solution no flow 가 cocktail solution(verapamil 10 mg+nitro-glycerin 5 mg+heparin 5,000 unit in normal saline 1 liter pack)<sup>5)7)</sup>  
Kim<sup>8)</sup> 가 가 (platform speed) 1.25, 1.5 mm (burr)  
180,000 / , 1.75  
가 165,000 /  
가 가<sup>9)</sup> (good alignment) 가 5,000  
15 30 2 4  
가  
0.25 0.5 mm

## 대상 및 방법

대 상 1997 6 1999 2 (burr to artery ratio) 0.6 0.7  
( 64 가 PTCA PTCA  
56 가  
47 12 ,  
49 , 3  
시술전후의 약물투여 2 3  
aspirin(100 200 mg) ticlopidine(500 mg/day)  
heparin 10,000 15,000  
ACT(activated clotting time) 300  
350 가  
ticlopidine(500 mg/day) 1 aspirin 5 6 , 10 12

죽상반절제술의 시술방법 CK, CK -  
MB, troponin , creatinine  
7 9 Fr  
8 Fr 용어의 정의  
가 : 20%  
7 Fr over - the - wire 50% (Q ,



)

Q Q CK - MB

3

t - test

Chi - square test Fisher's exact test

p 0.05

관상동맥조영술의 분석

Tagarno

결 과

cine projector 가

caliper

가

1) (B2/C) 58 91%(58/64) 43 19 ,

2 de novo 37

(MLD : minimal lumen diameter), (RD : reference lumen diameter), (%DS : % diameter stenosis), (LL : lesion length)

58%), 27 (42%) (Table 1).

2) 33

31 7 8 Fr

가 (58/64). 6 6 Fr

통계학적 분석

Macintosh Statview version

4.5

(maximal burr size)

1.68 ± 0.16 mm ,

Student 1.74 ± 0.54 (burr to re -

**Table 1.** Baseline characteristics (%)

No. of procedure	64
Age	56.4 ± 8.50
Male	47 (73)
Female	17 (27)
Clinical diagnosis	
Acute myocardial infarction	12 (19)
Unstable angina	49 (77)
Stable angina	3 ( 5)
Type of target lesion	
A-B1	6 ( 9)
B2	17 (27)
C	41 (64)
Target artery	
Left anterior descending	43 (67)
Left circumflex	2 ( 3)
Right coronary	19 (30)
De novo lesion	37 (58)
Restenotic lesion	27 (42)
Stent	18 (28)
PTCA	9 (14)
Long lesion	39 (61)
Calcified lesion	5 (23)
Ostial lesion	4 ( 6)
Chronic total occlusion	21 (32)

**Table 2.** Procedural characteristics

Approach	Radial (n = 33)	Femoral (n = 31)	p Value
Guiding catheter size			0.057
6	4	1	
7	28	21	
8	1	8	
9	0	1	
Maximal burr size	1.65 ± 0.15	1.71 ± 0.14	NS
No. of burr used	1.77 ± 0.48	1.77 ± 0.58	NS
Rotastenting	18 (55%)	19 (63%)	NS
Burr to reference vessel ratio	0.61	0.64	NS

**Table 3.** Angiographic data

	Rota+Stent (n = 37)	Rota+Ballon (n = 27)	p value
Pre RD	2.74 ± 0.46	2.53 ± 0.48	0.17
MLD	0.69 ± 0.24	0.6 ± 0.21	0.59
%DS	79.26 ± 18.07	79.06 ± 14.66	0.55
Lesion length	17.78 ± 7.70	19.19 ± 9.56	0.73
Post RD	2.87 ± 0.32	2.47 ± 0.43	0.031
MLD	2.81 ± 0.36	2.01 ± 0.4	<0.001
%DS	1.83 ± 11.8	17.0 ± 10.9	0.0006
Net gain	2.38 ± 0.58	1.59 ± 0.4	<0.001

RD : Reference diameter, MLD : Minimal lumen diameter, %DS : Percent diameter stenosis



ference artery ratio)  $0.63 \pm 0.12$  (Table 2). 4) (Ta-  
 3) 가 (rota - balloon : ble 4) : 64 62  
 RB) (rotastent : RS) (Table 3) : 94% .  
 (RDpre) RS  $2.74 \pm 0.46$  1  
 mm RB  $2.53 \pm 0.48$  mm 1 . 1 ,  
 (%DSpre) Q 1 , troponin 가 3 , slow flow 2  
 가 . (MLDpost), , (guidewire fracture) 1  
 (%DSpost), (net gain : MLDpost - , Q  
 MLDpre) RS  $2.8 \pm 0.3$  mm,  $1.83 \pm 11.8\%$  , (Inhospital) 30 (major  
 $2.38 \pm 0.58$  mm RB  $2.01 \pm 0.4$  mm,  $17 \pm 10.9\%$  , cardiac event ; , ,  
 $1.59 \pm 0.4$  mm . ) 1 . 1 rotastent

**Table 4.** Procedural success rate and complications (%)

Procedural success	62(94)
Complications	
Dissection	6( 9.3)
Slow flow	2( 3.1)
Non-Q infarction	1( 1.6)
Troponin elevation	3( 3.7)
Vessel rupture & tamponade	1( 1.6)
Death & emergency CABG	0
30 days MACE	0

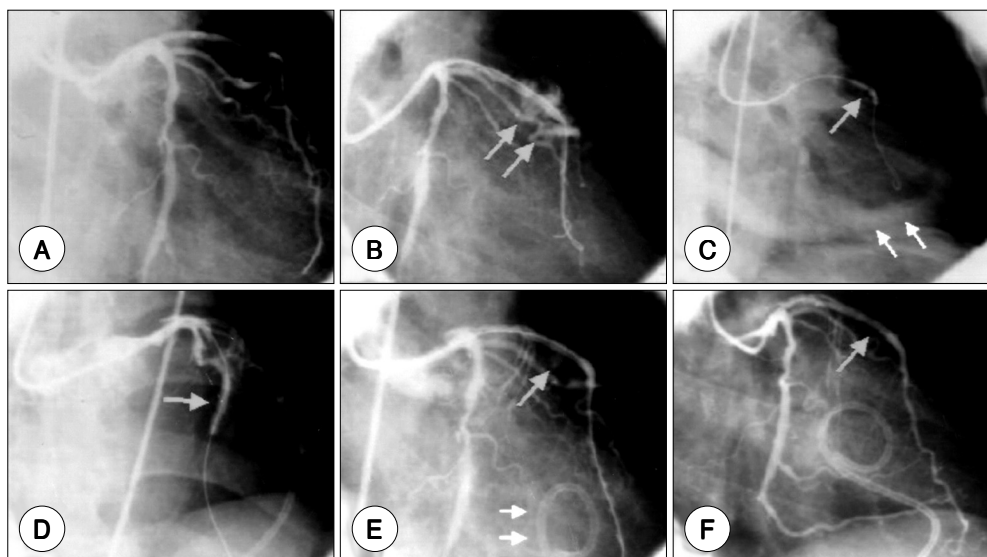
CABG : Coronary artery bypass graft

Jo graft stent 가

(Fig. 1).

고 찰

20



**Fig. 1.** A case of coronary artery perforation after rotastenting. A : Pre-rotablator image, diffuse lesions in LAD. B : After rotastenting in proximal to mid-LAD, coronary artery perforation was noted (arrows). C : During the hypotensive response, immediate balloon inflation (arrow) was done again with stent balloon to prevent further leakage. Pericardial effusion was noted by fluoroscopic view (small arrows). D : After insertion of pericardiocentesis catheter, Jo graft stent (19 mm) was inserted (arrow). E : Minimal leakage was noted after Jo graft stent insertion (large arrow). Pericardiocentesis catheter was noted (small arrows). F : Coronary angiogram which was done next morning showed no leakage (arrow).



(compliance) 가 . Moussa  
 (differential cutting) rotastent 22.5%  
 가 15) Kobayashi 16) less aggressive  
 , strategy  
 (50%) aggressive strategy  
 , (31%) ( 20%) rotas -  
 5 - 9) tenting 60%(37/64) 1

복합병변에서의 고속회전 죽상반절제술 Jo graft stent(19 mm)  
 (ACC/AHA classification B2/C lesion) aggressive de -  
 bulking  
 10)11) 가 가  
 (compliance) 스텐트재협착과 죽상반절제술  
 elastic recoil  
 ‘ facilitated angioplasty ’ ( ± 가  
 , )  
 (>20mm) 12) (MLDpost) (clinical res -  
 , ‘ faci- tenosis ; 20 vs 36%)  
 litated angioplasty ’ 17)  
 가 80% 18) Sharma 19)  
 1 가 가 0.6  
 13) 가 가  
 가  
 8) 0.63 Silber 20)  
 가 가

스텐트시술전 죽상반절제술(Rotastenting) 만성폐색성병변에서의 유용성  
 145  
 2)3) Q 91%  
 , 1.4% 4.3%  
 (dissection) 14) 62.5%(49% ) 5)  
 19 (32%)  
 가 mm 가 1.25  
 4) 가  
 571



요골동맥을 경유한 죽상반절제술의 의의

Fr 7 Fr 8

Kawamitsu<sup>21)</sup>

7 8 Fr

8 Fr (arterial sheath)

3.1 3.2 mm (2.7 mm, 2.8

mm & 2.5 mm)

22)

가

6 Fr 1.5 mm burr

( )

가

가

가

aminophylline

15, 2.0 mm

160,000 165,000 (/ )

(rpm)가 5,000

7)24)

no flow 2 slow

5)

flow가

non - aggressive strategy

slow flow 가

25)26)

가

Q

1.1%, Q 3.6%(CK or CK - MB>

2 )

가

(5.5%) 27)

1

Jo graft stent

(Fig. 1).

Q 1

고속회전 죽상반절제술의 향후 전망

가

고속회전 죽상반절제술과 합병증

가 ‘ slow flow ’ ‘ no flow ’

가

10 15%

Sharma<sup>23)</sup>

3가

48 ),

500

2,000

7)

(flush solution)

nitroglycerin verapamil 가

가 (stepwise 가

increase in the burr size), 10 10 15% 가

가 가 가

15% 가 330 , 10%

500 ).



가 0.75 STRATAS(Study to Determine Rotablator System and Transluminal Angioplasty Strategy) 0.7 CARAT (Coronary Angioplasty and Rotablator Atherectomy Trial) (conventional or non-aggressive debulking method) (aggressive debulking method)

<sup>5)</sup>

## 요 약

연구 배경 :

가 (differential cutting)

대상 및 방법 :

1997 6 1999 2

64 56  
가 47 12  
49 3  
7 9 Fr  
결 과 :  
1) (B2/C) 58 91%  
(58/64) 43 ,  
19 , 2 de novo  
37 (58%), 27 (42%) . 2)  
33 ,  
31 7, 8Fr가

(56/64). 6 6Fr  
5  
(maximal burr size) 1.68 mm ,  
1.74  
(burr to reference artery ratio) 0.63  
(rotastent :  
3)  
RS) 가 (rota-balloon : RB)  
(MLDpost),  
(%DSpost), (net gain : MLDpost - MLDpre)  
RS . 4)  
64 62 94%  
1 , Q  
1 , troponin 가 3 , slow flow 2 ,  
(guidewire fracture) 1  
, Q  
(In-hospital) 30 (major cardiac event ;  
, , )  
결 론 :

중심 단어 :

감사문 \_\_\_\_\_

## REFERENCES

- 1) Baim DS, Detre K, Kent K. *Problems in the development of new devices for coronary intervention: Possible role for a multicenter trial.* J Am Coll Cardiol 1989;14: 1193-202.
- 2) Ellis S, Rubin G, King SI, Douglas JJ, Cox W. *Importance of stenosis morphology in the estimation of restenosis risk after elective percutaneous transluminal coronary angioplasty.* Am J Cardiol 1989;63:30-4.
- 3) Sharma S, Israel D, Kamean J, Bodian C, Ambrose J. *Clinical angiographic, and procedural determinants of major and minor coronary dissections during angioplasty.* Am Heart J 1993;126:39-47.
- 4) Fitzgerald P, for the STRUT Registry Investigators. *Lesion composition impacts size and symmetry of stent expansion: Initial report from the strut registry.* J Am Coll Cardiol (Supp) 1995;49A:902-2.
- 5) Reisman M. *Rotablator atherectomy.* In: Freed M, Grines C, Safian RD, editors. *The new manual of interventional*



- cardiology, 1st ed. Michigan: Physician' Press;1996. p.521-33.
- 6) Reisman M. Technique and strategy of rotational atherectomy. *Cathet Cardiovasc Diagn (Supp)* 1996;3:2-14.
  - 7) Stertzer SH, Pomerantsev EV, Fitzgerald PJ, Shaw RE, Walton AS, Singer AH, et al. Effects of technique modification on immediate results of high speed rotational atherectomy in 710 procedures in 656 patients. *Cathet Cardiovasc Diagn* 1995;36:304-10.
  - 8) Kim JW, Park SW, Hong MK, Lee SG, Lee IS, Lee CW, et al. Coronary rotational atherectomy: Initial experience in 101 complex lesions. *Kor Circ J* 1997;27:373-6.
  - 9) Sharma SK, Kini A, Duvvuri S, Sterling FD, Vidhun RR, Garapatti AB, et al. Randomized trial of rotational atherectomy vs balloon angioplasty for in-stent restenosis (ROSTER): Intrim analysis of 100 cases. *Circulation (Supp)* 1988;98:I-511.
  - 10) Reifart N, Vandormael M, Krajcar M, Gohrin S, Preusler W, Schwart F, et al. Randomized comparison of angioplasty of complex coronary lesions at a single center: Excimer laser, rotational atherectomy, and balloon angioplasty comparison (ERBAC) study. *Circulation* 1997;96:91-8.
  - 11) Dietz U, Kuechler R, Ekinci O, Adollahnia R, Dill T. Analysis of factors influencing acute and long term results of PTCA and PTCR of complex coronary artery stenosis-results of the COBRA study. *Circulation (Supp)* 1998;98:I-350.
  - 12) Safian RD, Freed M, Reddy V, Kuntz RE, Baim DS, Grines CL, et al. Do excimer laser angioplasty and rotational atherectomy facilitate balloon angioplasty? Implications for lesion-specific coronary intervention. *J Am Coll Cardiol* 1996;27:552-9.
  - 13) Levin TN, Holloway S, Feldman T. Acute and late clinical outcome after rotational atherectomy for complex coronary disease. *Cathet Cardiovasc Diagn* 1998;45:122-30.
  - 14) Fitzgerald P, Ports T, Yock P. Contribution of localized calcium deposits to dissection after angioplasty: An observational study using intravascular study. *Circulation* 1992;86:64-70.
  - 15) Moussa I, Mario CD, Moses J, Reimers B, Francesco LD, Martini G, et al. Coronary stenting after rotational atherectomy in calcified and complex lesions: Angiographic and clinical follow up results. *Circulation* 1997;96:128-36.
  - 16) Kobayashi Y, Albiero R, Vaghetti M, Kobayashi N, Finci L. Rotational atherectomy prior to stenting: Comparison between an aggressive and not aggressive strategy. *Circulation (Supp)* 1998;98:I-351.
  - 17) Sharma SK, Kini A, Duvvuri S, Sterling FD, Vidhun RR, Garapatti AB, et al. Randomized trial of rotational atherectomy vs balloon angioplasty for in-stent restenosis (ROSTER): Intrim analysis of 100 cases. *Circulation (Supp)* 1998;98:I-511.
  - 18) Lee S, Lee C, Cheong S, Hong M, Kim J, Park S, et al. Immediate and long term outcomes of rotational atherectomy versus balloon angioplasty alone for treatment of diffuse in-stent restenosis. *Am J Cardiol* 1998;82:140-3.
  - 19) Sharma SK, Duvvuri S, Dangas G, Kini A, Vidhun R, Venu K, et al. Rotational atherectomy for in-stent restenosis: Acute and long-term results of the first 100 cases. *J Am Coll Cardiol* 1998;32:1358-65.
  - 20) Silber S, Muehling H, Kirschke J, Gessler B. Rotablation is not the cure for diffuse in-stent restenosis. *Circulation (Supp)* 1998;98:I-511.
  - 21) Kawamitsu K, Saito S, Hosokawa G, Tanaka S, Inaba H, Ikei H, et al. Comparison of coronary rotational atherectomy by transradial and transfemoral approaches. In: The 5 th Kamakura live demonstration. 1998;Mar:TR1-TR5.
  - 22) Yoon JH, Lee SH, Lee HH, Kim JY, Kim IH, Choe YJ, et al. Usefulness of trans-radial coronary angiography in Wonju. *Kor Circ J* 1998;28:1670-6.
  - 23) Sharma SK, Dangas G, Mehran R, Duvvuri S, Kini A, Cocke TP, et al. Risk factors for the development of slow flow during rotational atherectomy. *Am J Cardiol* 1997;80:219-22.
  - 24) Whitlow PL. Rotablator technique and complications? *Cathet Cardiovasc Diagn* 1995;36:311-2.
  - 25) Tsubokawa A, Ueda K, Iwaase T, Shirasaka A, Tanaka T, Nakae I, et al. Efficacy of intracoronary nicorandil infusion on preventing no-reflow and slow flow during rotational atherectomy. *Circulation (Supp)* 1998;98:I-351.
  - 26) Diez JG, Fish RD, Croitoru M, Haas CP, Ferguson JJ. The slow flow, no-flow phenomena during rotational atherectomy: Does abciximab help? *Circulation (Supp)* 1998;98:I-558.
  - 27) Waksman R, Ghazzal ZMB, Baim DS, Steenkiste AR, Yeh W, Detre KM, et al. Myocardial infarction as a complication of new interventional devices. *Am J Cardiol* 1996;78:751-6.
  - 28) Saito S. Rotablator Guideline. *Jpn J Interv Cardiol* 1998;13:198.