

## 관상동맥 조영술과 중재술을 위한 요골 접근법 : 시술 건수가 많은 심도자실에서 경험과 안전성

차광수 · 김무현 · 김영대 · 김혜진 · 손영기 · 박성욱  
이철중 · 이종훈 · 박정운 · 김성현 · 김종성

### Transradial Approach for Coronary Angiography and Interventions : Practical Applicability at a High-Volume Laboratory and Safety in Korean Patients

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#### ABSTRACT

**Background and Objectives :** Transradial approach was introduced as a route for coronary angiography or interventions. We assessed clinical applicability at a high-volume laboratory and safety. **Materials and Method :** Procedure-related results were compared between phase I period including learning curve and phase II period in 326 patients, in whom coronary angiography or interventions were performed by radial approach. **Results :** 1) Success rate was 90% (292/326) in all patients, which significantly increased to 95% (246/259) during phase II compared to 69% (46/67) during phase I. 2) Time from local anesthesia to sheath placement and time for first coronary cannulation were  $4.3 \pm 2.7$  min,  $3.1 \pm 1.9$  min, respectively, in all patients, which significantly decreased to  $3.8 \pm 3.6$  min,  $2.7 \pm 2.4$  min during phase II compared to  $7.0 \pm 3.2$  min,  $5.7 \pm 4.7$  min during phase I. Total examination time was  $21.7 \pm 5.5$  min in all patients, which significantly decreased to  $20.4 \pm 6.2$  min during phase II compared to  $28.3 \pm 8.0$  min during phase I. 3) Overall procedural success rate of coronary interventions was 94% (98/104). Guidewire didn't pass in 5 (5%) patients with chronic total occlusion and stent wasn't delivered in 1 (1%) due to poor guiding backup. 4) During follow-up of  $61 \pm 25$  days, weak or absent radial pulse, abnormal reverse Allen test were observed in 13 (5%), 3 (1%), 15 (6%) patients, respectively, but no claudication observed. **Conclusion :** Coronary angiography and interventions by transradial approach was safe and could be performed without more time delay after learning curve. (Korean Circulation J 1998; 28(9):1452-1464)

**KEY WORDS :** Transradial approach · Coronary angiography and interventions · Safety · Korean patients.

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: 1998 9 25  
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## 서 론

## 대상 및 방법

### 환자의 선택

1997 11 1998 6  
(femoroiliac artery)  
326 (Table 1, 2).  
가 가 56±8 ( : 24~81) , 236 (72%)  
90 (28%) . 151 (46%)  
, 72 (22%)  
(claud - 43 (13%) , 60 (18%)  
ication) (median nerve) 55.0  
±5.9%( : 30~65%) . 126 (39%)  
가 . 75 (23%)  
1-3)  
가 (Allen test)  
( ,  
10 가  
,)

**Table 1.** Clinical characteristics of the 326 patients

	All patients (n=326)	Phase I period (n=67)	Phase II period (n=259)
Age (yr) (mean±SD[range])	56.8±8.7 (24 - 81)	56.3±7.6 (24 - 81)	56.9±8.9 (33 - 80)
Male	236 (72%)	51 (76%)	185 (71%)
Height (cm) (mean±SD[range])	163.1±6.7 (143 - 180)	163.7±4.6 (148 - 172)	162.9±7.1 (143 - 180)
Weight (kg) (mean±SD[range])	65.7±7.7 (42 - 97)	64.8±7.0 (45 - 83)	65.4±7.8 (42 - 97)
Diabetes mellitus	73 (22%)	13 (19%)	60 (23%)
Hypertension	118 (36%)	20 (30%)	98 (38%)
Reason for coronary angiography			
Unstable angina	151 (46%)	37 (55%)	114 (44%)
Acute MI	72 (22%)	8 (12%)	64 (25%)*
Stable angina	43 (13%)	4 (6%)	39 (15%)
Confirm or rule out CAD	60 (18%)	18 (27%)	42 (16%)*
Previous MI	39 (12%)	11 (16%)	28 (11%)
Previous interventions	43 (13%)	7 (10%)	36 (14%)
Previous CABG	2 (0.6%)	1 (1.5%)	1 (0.4%)
Outpatients	126 (39%)	28 (42%)	98 (38%)
Proportion of radial approach (%)	63	29	82*

MI ; myocardial infarction, CAD ; coronary artery disease, CABG ; coronary artery bypass graft surgery.

\* : p<0.05 compared with Phase I period

가 , 가  
(intraaortic balloon) 20 gauge

(needle), (guidewire)  
(arterial sheath), 5 6 7 French  
(guidewire) (catheter) 1  
가 (1998 3 ) 8.5 cm 12 cm(DAIG,  
(learning curve)가 1 (Phase I) 2 USA) 23 cm(Cordis, USA DAIG, USA)  
(Phase II)

가

요골동맥의 천자

60~70 (elbow joint)

(radial styloid process) 0.5~1 cm

2%  
(#11) 관상동맥 조영술과 중재술  
1 22 ga -  
uge (D & B - cath , Shindongbang (5 French  
medical, Korea) 45 Multipurpose, Judkins, Amplatz, Pigtail)  
가 1 Multipurpose (Radiofocus OPTI -  
(0.0 TORQUE, Terumo, Japan) Judkins  
21", 50cm) 5 6 French  
(8.5 cm Pediatric hemostasis introducer, 2 1  
DAIG, USA) Multipurpose (ENVISION soft tip MPA - 2  
heparin 5000 unit, 2% lidocaine 5F 110 cm, USCI, USA) 1  
40 mg, nitroglycerin 150 ug (Radiofocus , 0.035" 150 cm,  
10 ml (side arm) Terumo, Japan)  
(bur - (fluoroscopy)  
ning sense) 2 , 2  
(20 gauge, Cook, USA) (PTFE coated GUIDE WIRE  
(Hemostasis introducer, DAIG, with 3 mm "J" fixed core, 0.035" 145 cm, USCI,  
USA Transradial kit, 0.019" 11 cm, Cordis, USA)  
USA) (20 gauge)  
가 (145 cm)  
(0.025" 50 cm 0.019" 50 cm) (subclavian or innominate artery)  
0.025 inch Terumo 0.021  
inch (Radiofocus GUIDE WIRE M, 0.035" 260 mm,

Terumo, Japan)

10 ml

(SIMTRAC

C, Siemens, Germany, 1991)

동맥 유도관의 제거와 지혈

가

Multipurpose

(Jud -

kins, Amplatz, Multipurpose)

(guiding ca -

5~10

theter)

(rotational atherectomy)

3.5 mm

가

(7 French)

6 French

가

4~6

가

가

6 French

6

(deep intubation technique).

정 의

1

4

가

(

protamine sulfate

)

가

(entry site)

가

6~12

-

(

) ,

가

임상 추적

(cannulation)

(

,

,

) ,

(

-

)

1~2

1~2

,<sup>4)</sup>

(patency)

(claudication)

(reverse Allen test)(

통계 및 분석

PC - SAS version 6.12

Student's t test

Chi-square( $\chi^2$ ) test

Fisher's exact test

p

0.05

결과

요골동맥의 천자 및 관상동맥의 삽관

323 (99%)

(Table 3).

90%(292 /326 ) , 2

95%(246 /259 ) 1

69%(46 /67 ) 가 .

4.3±2.7 , 3.1±1.9 , 2

3.8±3.6 , 2.7±2.4 1

7.0±3.2 , 5.7±4.7

**Table 2.** Angiographic data and additional examinations or coronary interventions

	All Patients (n=326)	Phase I period (n=67)	Phase II period (n=259)
Angiographic diagnosis			
Normal or insignificant lesion	90 (28%)	6 ( 9%)	84 (32%)*
1 vessel disease	101 (31%)	25 (37%)	76 (29%)
2 vessel disease	85 (26%)	21 (31%)	64 (25%)
3 vessel disease	35 (11%)	10 (15%)	25 (10%)
Left main disease	15 ( 5%)	5 ( 7%)	10 ( 4%)
LVEF (%) (mean ± SD [range])	55.0 ± 5.9 (30 - 65)	53.0 ± 7.1 (30 - 65)	54.7 ± 5.9 (30 - 60)
LVEDP (mmHg) (mean ± SD [range])	12.8 ± 4.8 ( 2 - 28)	13.7 ± 4.5 (4 - 24)	12.0 ± 4.6 ( 2 - 28)
One-staged coronary intervention	75 (23%)	7 (10%)	68 (26%)*
Additional examinations			
LIMA angiography	19 ( 6%)	1 ( 1%)	18 ( 7%)
Iliofemoral, carotid angiography	27 ( 8%)	3 ( 4%)	24 ( 9%)
SVG angiography	2 (0.6%)	1 ( 1%)	1 (0.4%)
Coronary spasm test	13 ( 4%)	1 ( 1%)	12 ( 5%)

LVEF ; left ventricular ejection fraction, LVEDP ; left ventricular end-diastolic pressure, LIMA ; left internal mammary artery, SVG ; saphenous vein graft.

\* : p<0.05 compared with Phase I period

**Table 3.** Procedural data for transradial approach

	All Patients (n=326)	Phase I period (n=67)	Phase II period (n=259)
Successful examinations	292 (90%)	46 (69%)	246 (95%) <sup>†</sup>
Right transradial approach	323 (99%)	66 (96%)	257 (99%)
Second right transradial approach	34 (10%)	2 ( 3%)	32 (12%) <sup>†</sup>
Procedural time* (min) (mean ± SD [range])			
Anesthesia to sheath time	4.3 ± 2.7 (1 - 24)	7.0 ± 3.2 ( 4 - 24)	3.8 ± 3.6 (1 - 15) <sup>‡</sup>
First coronary cannulation time	3.1 ± 1.9 (1 - 23)	5.7 ± 4.7 ( 1 - 21)	2.7 ± 2.4 (1 - 23) <sup>‡</sup>
Total examination time	21.7 ± 5.5 (9 - 55)	28.3 ± 8.0 (15 - 50)	20.4 ± 6.2 (9 - 55) <sup>‡</sup>

\* : applied for successful examinations

† : p<0.05 compared with Phase I period    ‡ : p<0.005 compared with Phase I period

31%(21 /67 )  
10%(34 /326 )  
가  
, 2 5%(13 /259 ) 1 (65%) (Table 4).

**Table 4.** Data for failed transradial approach

	All Patients (n=34)	Phase I period (n=21)	Phase II period (n=13)
Reason of failure			
Guidewire entry failure	22 (65%)	15 (71%)	7 (54%)
Puncture failure	6 (18%)	4 (19%)	2 (15%)
Severe radial artery spasm	3 ( 9%)	1 ( 5%)	2 (15%)
Severe tortuosity at subclavian or innominate artery	1 ( 3%)	0 ( 0%)	1 ( 8%)
Anomalous origin of radial artery	2 ( 6%)	1 ( 5%)	1 ( 8%)
Alternative approach for failed cases			
Ipsilateral brachial	19 (56%)	16 (76%)	3 (23%)*
Femoral	11 (32%)	4 (19%)	7 (54%)
Contralateral radial	4 (12%)	1 ( 5%)	3 (23%)

\* : p<0.05 compared with Phase I period

**Table 5.** Catheters and arterial sheaths used in transradial angiography

	All Patients (n=292*)	Phase I period (n=46*)	Phase II period (n=246*)
Total number of catheters used (mean ± SD [range])	1.6 ± 0.8 (1 - 5)	2.3 ± 0.6 (1 - 5)	1.4 ± 0.8 (1 - 3) †
Left coronary angiography			
Multipurpose	181 (62%)	6 (13%)	175 (71%) †
Judkins Left 3.5	91 (31%)	37 (80%)	54 (22%) †
Judkins Left 4	6 ( 2%)	1 ( 2%)	5 ( 2%)
Amplatz Left 1 or 2	14 (5%)	2 ( 4%)	12 ( 5%)
Right coronary angiography			
Multipurpose	208 (71%)	14 (30%)	194 (79%) †
Judkins Right 4.0	72 (25%)	30 (65%)	42 (17%) †
Amplatz Right 1 or 2	12 ( 4%)	2 ( 4%)	10 ( 4%)
Left ventriculography			
Multipurpose	216 (74%)	12 (26%)	204 (83%) †
Pigtail	76 (26%)	34 (74%)	42 (17%) †
Single multipurpose catheter used for CAG and LVG	182 (62%)	0 ( 0%)	182 (74%) †
Arterial sheath diameter (Fr)			
5	108 (37%)	29 (63%)	79 (32%) †
6	165 (57%)	17 (37%)	148 (60%) †
7	20 ( 7%)	0 ( 0%)	20 ( 8%)
8	1 (0.3%)	0 ( 0%)	1 (0.4%)
Arterial sheath length (mm)			
8.5	5 ( 2%)	3 ( 7%)	2 (0.8%)
11 - 12	267 (91%)	43 (93%)	224 (91%)
23	20 ( 7%)	0 ( 0%)	20 ( 8%)

CAG ; coronary angiography, LVG ; left ventriculography.

\* : Cases of successful transradial approach

† : p<0.05 compared with Phase I period

6 216 (74%) Multipurpose , 76  
 (26%) Pigtail 가 . 2  
 (56%), (32%), 182 (74%) Multipurpose  
 (12%) 가 .  
 21.7 ± 5.5 , 2  
 관상동맥 및 좌심실 조영술 20.4 ± 6.2 1 28.3 ± 8.0  
 181 (62%) Mul - (Table 3).  
 tipurpose 가, 91 (31%) Judkins left 3.5  
 가 (Table 5). 관상동맥 중재술  
 208 (71%) Multipurpose 가, 72 (25%) 326  
 Judkins right 4 가 . 90 , 15 221 (68%)

**Table 6.** Transradial coronary interventions at 131 lesions in 104 patients

	All Patients (n=104)	Phase I period (n=15)	Phase II period (n=89)
Balloon angioplasty	44 (42%)	7 (47%)	37 (42%)
Stenting	62 (60%)	12 (80%)	50 (56%)
Rotational atherectomy and balloon angioplasty or stenting	9 ( 9%)	0 (0%)	9 (10%)
Multivessel interventions	27 (26%)	3 (20%)	24 (27%)
Deep intubation technique	19 (18%)	2 (13%)	17 (19%)
Primary intervention in AMI	19 (18%)	1 ( 7%)	18 (20%)
LAD (lesions)	64 (49%)	12 (63%)	52 (46%)
LCx (lesions)	23 (18%)	5 (26%)	18 (16%)
RCA (lesions)	44 (34%)	2 (11%)	42 (38%)
Type B <sub>2</sub> (lesions)	56 (43%)	7 (37%)	49 (44%)
Type C (lesions)	32 (24%)	3 (16%)	29 (26%)
Procedural success	98 (94%)	15 (100%)	83 (93%)
Death or CABG	0 ( 0%)	0 ( 0%)	0 ( 0%)
Nonfatal myocardial infarction	2 ( 2%)	0 ( 0%)	2 ( 2%)
Cerebral infarction	0 ( 0%)	0 ( 0%)	0 ( 0%)
Stent embolization or incorrect placement	0 ( 0%)	0 ( 0%)	0 ( 0%)
Guiding catheter for LCA			
Judkins Left 3.5	58 (56%)	9 (60%)	49 (55%)
Judkins Left 4	8 ( 8%)	2 (13%)	6 ( 7%)
Amplatz Left 1 or 2	3 ( 3%)	1 ( 7%)	2 ( 2%)
Multipurpose	4 ( 4%)	0 ( 0%)	4 ( 4%)
Voda	4 ( 4%)	1 ( 7%)	3 ( 3%)
Extra backup	1 ( 1%)	0 ( 0%)	1 ( 1%)
Guiding catheter for RCA			
Judkins Right 4	14 (13%)	2 (13%)	12 (13%)
Amplatz Right 1 or 2	8 ( 8%)	0 ( 0%)	8 ( 9%)
Amplatz Left 1 or 2	2 ( 2%)	0 ( 0%)	2 ( 2%)
Multipurpose	2 ( 2%)	0 ( 0%)	2 ( 2%)

AMI ; acute myocardial infarction, LAD ; left anterior descending coronary artery, LCx ; left circumflex coronary artery, RCA ; right coronary artery, LCA ; left coronary artery, CABG ; coronary artery bypass graft surgery.

\* : p<0.05 compared with Phase I period





10~20% 가

(learning curve) (median nerve) 가 (median nerve) 가

6 F 5 F

가<sup>23)</sup>가

가 가

(6% vs 32%),

관상동맥 조영술과 중재술을 위한 요골 접근법 도입의 필요성

(aspirin ticlopidine ) 가

가 ,<sup>24)</sup>

<sup>25)</sup>

가

Lewin<sup>19)</sup> Cowling<sup>20)</sup> (learning curve)

4 : 1, 27 . Benit<sup>15)</sup> 5.4%

83,068 540 . Marco Fajadet<sup>26)</sup> 20

2~8% (aorto - 15% 60 5%

iliofemoral artery) 100 3%

가 가 . Louvard<sup>27)</sup> 40

10% 10.3% 300 1.7%

bare needle(18~19 gauge)

, Friedman<sup>22)</sup> 100 Kiemeneij (radial set)

55 (claudication)

18

(radial loops, spa - (0 )  
stic, ectopic radial artery) . (1 ) 6.6%( 8.9% 5.8%)  
1 67 21 .  
31%  
22 gauge 20 gauge bare . Lefevre  
needle 2 5% 33)  
. Karam 10) 가  
가 70% .  
10000~15000IU  
Yoon 18) 89 3~4%  
(59±9 , 61 28 ) , 29) 5000IU  
2.8 mm( 2.9 mm, 2.7 mm) 3.2%  
. Saito 11) 250 ( . 26) 가 (hepariniza -  
170 80 ) 3.1±0.6 mm tion)  
( ), 2.8±0.6 mm( ) Fujita 28) aspirin ticlopidine coumadin  
100 3.3±0.6mm . Saito 11)  
Wu 6) / (RAID/SOD)가 1 12.  
가 5% , 1 3.3%  
Saito 11) 250 / (RAID/SOD)가  
, , 가  
5 F ,  
(57%) 6 F  
61±25 5%(13 ) 1%(3 )  
3~4% 29) , 20 - gauge 6%  
(cannula) 25~30% (15 ) (reverse Allen test)  
30 - 32)  
(arterial cannulation) 가  
. Saito 4) 1,360 , 가  
3  
가  
0 , 1 , 2 , 3 5%, 12%, 14%, . 11) 2~6  
53% 0%, 5%, 7%, 88% , . 19)  
0 , 1 , 2 , 3 7 F Saito 11)  
2%, 13%, 14%, 68% 3%, 5%, 7%, 85% 1  
가 1 7 F 가 . 250 (  
가 170 80 )  
72% , 40% 7 F  
7 F (TERUMO) 가 , 42%  
250 11) 21% 8 F 가

(bifurcation lesion)<sup>35)</sup>

5 F 6<sup>36)</sup>

F 7 F

(antegrade flow)가, Sueda

12) 7 F 48%

52%

(over - stretched) 가

4 1

7 F

가 . 가 .

우측 요골동맥과 좌측 요골동맥의 선택

요 약

연구배경 :

. Wu<sup>6)</sup>

가

( 70%) (Amplatz )

가 .

2 74%(1

대상 및 방법 :

82 ) Multipurpose (ENVISION soft tip

1997 11 1998 6 326

MPA - 2 5F 110 cm, USCI, USA)

56±8 ( : 24~81) 236 (7

2%) 1 2

가 가

가

결 과 :

1) 90%(292 /326 )

, 2 95%(246 /259 )

1 69%(46 /67 )

가 .

가 4.3±2.7 , 3.1±

가 1.9 , 2 3.8±3.6 , 2.7±

가 . Saito<sup>4)</sup> 2.4 1 7.0±3.2 , 5.7±4.7

가

99.4% 96.9%

(65%) .

(56%), (32%),

Judkins left (12%) 가 .

2) Multipurpose 가 (62%) (71%)

(74%)

가<sup>19)</sup> ,<sup>34)</sup> . 2 182 (74%) Multip -

urpose

21.7 ± 5.5

, 2 20.4 ± 6.2 1

28.3 ± 8.0

3) 94%(98

/104 ) 5 (5%)

1 (1%)

가 가

(deep intubat -

ion technique) 19 (18%)

4)

61 ± 25 13 (5%)

3 (1%) , 15

(6%)

(claudication)

결 론 :

중심 단어 :

감사문 \_\_\_\_\_

(setting)

## REFERENCES

- Campeau L. Percutaneous radial artery approach for coronary angiography. *Cathet Cardiovasc Diagn* 1989;16:3-7.
- Kiemeneij F, Laarman GJ, de Melker E. Transradial artery coronary angioplasty. *Am Heart J* 1995;129:1-7.
- Kiemeneij F, Laarman GJ. Transradial artery Palmaz-Schatz coronary stent implantation: results of a single-center feasibility study. *Am Heart J* 1995;130:14-21.
- Saito S, Miyake S, Hosokawa G, Tanaka S, Yamamoto S, Kawamitsu K, et al. The feasibility of transradial coronary intervention in Japanese patient population. In: *The 5th Kamakura live demonstration*;1998. p.TC1-TC14.
- Radner S. Thoracic aortography by catheterization from the radial artery: preliminary report of a new technique. *Acta Radiologica* 1948;29:170-80.
- Wu CJ, Lo PH, Chang KC, Fu M, Lau KW, Hung JS. Transradial coronary angiography and angioplasty in Chinese patients. *Cathet Cardiovasc Diagn* 1997;40:159-63.
- Mann JT III, Arrowood M, Cubeddu G. PTCA using the right radial artery access site. *J Invas Cardiol* 1995;7:142-7.
- Kiemeneij F, Laarman GJ. Percutaneous transradial approach for coronary Palmaz-Schatz stent implantation. *Am Heart J* 1994;128:167-74.
- Schneider JE, Tift M, Cubeddu G, Arrowood ME. Transradial coronary stenting: a United States experience. *J Invas Cardiol* 1997;9:569-74.
- Karam C, Loubeyre C, Fajadet J, Laborde JC, Jordan C, Cassagneau B, et al. Seven French (7F) transradial approach allows widespread use of coronary stenting with low complication rate in selected patients. *J Am Coll Cardiol* 1997;29(Suppl A):416A.
- Saito S, Ikei H, Hosokawa G, Tanaka S, Kawamitsu K, Shiono T, et al. The feasibility to use the guiding catheters equal to or bigger than seven French during transradial coronary intervention. In: *The 5th Kamakura live demonstration*;1998. p.Tf1-Tf15.
- Sueda S, Mineoi K, Kondou T, Yano K, Ochi T, Ochi N, et al. Experience with transradial intervention using 6F and 7F guiding catheter. *Jpn J Interv Cardiol* 1998;13:38-42.
- 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 5th Kamakura live demonstration*;1998. p.TR1-TR5.
- Kiemeneij F, Laarman GJ, Odekerken D, Slagboom T, van der Wieken R. A randomized comparison of percutaneous transluminal coronary angioplasty by the radial, brachial and femoral approaches: the ACCESS study. *J Am Coll Cardiol* 1997;29:1269-75.
- Benit E, Missault L, Eeman T, Carlier M, Muyldermans L, Materne P, et al. Brachial, radial, or femoral approach for elective Palmaz-Schatz stent implantation: a randomized comparison. *Cathet Cardiovasc Diagn* 1997;41:124-30.
- Kiemeneij F, Laarman GJ, Slagboom T, van der Wieken R. Outpatient coronary stent implantation. *J Am Coll Cardiol* 1997;29:323-7.
- Park SH, Shin GJ, Lee WH. Percutaneous transradial approach for coronary angiography. *Kor Circ J* 1995;25:803-10.
- Yoon JH, Lee HJ, Kim IH, Choi YJ, Kim SN, Lee MO, et al. Usefulness of radial approach for coronary angiography (Abstract). *Kor Circ J* 1997;26(Suppl):147.
- Lewin RF. The radial approach to selective carotid artery angiogram. *J Invas Cardiol* 1997;9:181-3.
- Cowling MG, Buckenham TM, Belli AM. The role of transradial diagnostic angiography. *Cardiovasc Intervent Radiol* 1997;20:103-6.
- Hessel SJ, Adams DF, Abrams HL. Complications of angiography. *Radiology* 1981;138:273-81.
- Friedman SA, Pandya M, Greif E. Peripheral arterial occlusion in patients with acute coronary heart disease. *Am Heart J* 1973;86:415-9.
- Park SW, Oh DJ, Park CG, Rha SW, Kim EJ, Ahn JC, et al. The Efficacy and safety of outpatient coronary angiography. *Kor Circ J* 1997;27:1303-9.
- Dimas AP, Grigera F, Arora RR, Simpfendorfer CC, Hollman JL, Frierson JH, et al. Repeat coronary angioplasty as treatment for restenosis. *J Am Coll Cardiol* 1992;19:1310-4.
- Meier B, King SB, Gruentzig AR, Douglas JS, Hollman J, Ischinger T, et al. Repeat coronary angioplasty. *J Am*

- Coll Cardiol* 1984;4:463-6.
- 26) Marco J, Fajadet J. *Coronary angiography using the left radial approach: a dualcenter prospective pilot study. In: Endovascular Therapy Course Coronary and Peripheral: Ninth Complex Coronary Angioplasty Course Book. Paris; 1998. p.338-43.*
  - 27) Louvard Y, Lefevre T, Morice MC. *Radial approach: what about the learning curve? Cathet Cardiovasc Diagn* 1997; 42:467-8.
  - 28) Fujita T, Koshiyama H, Enomoto M. *Brachial and radial artery size sonographic evaluation in Japanese patients. Jpn J Interv Cardiol* 1997;12:418-23.
  - 29) Stella PR, Kiemeneij F, Laarman GJ, Odekerken D, Slagboom T, Wieken RVD. *Incidence and outcome of radial artery occlusion following transradial artery coronary angioplasty. Cathet Cardiovasc Diagn* 1997;40:156-8.
  - 30) Davis FM, Stewart JM. *Radial artery cannulation: a prospective study in the patients undergoing cardiothoracic surgery. Br J Anaesth* 1980;52:41-6.
  - 31) Bedford RE, Wollman H. *Complications of percutaneous radial artery cannulation: an objective prospective study in man. Anesthesiology* 1973;38:228-36.
  - 32) Slogoff S, Keats AS, Arlund C. *On the safety of radial artery cannulation. Anesthesiology* 1983;59:42-7.
  - 33) Lefevre T, Thebault B, Spaulding C, Funck F, Chaveau M, Guillard N, et al. *Radial artery patency after percutaneous left radial artery approach for coronary angiography: the role of heparin. Eur Heart J* 1995;16:293.
  - 34) Marco J, Fajadet J. *Transradial angioplasty of saphenous vein graft. In: Endovascular Therapy Course Coronary and Peripheral: Ninth complex coronary angioplasty course book. Paris;1998. p.280-1.*
  - 35) Louvard Y, Lefevre T, Morice MC. *Transradial complex coronary angioplasty: stenting of bifurcation lesions. In: Endovascular Therapy Course Coronary and Peripheral: Ninth Complex Coronary Angioplasty Course Book. Paris; 1998. p.318-21.*
  - 36) Marco J, Fajadet J. *Transradial stenting of unprotected left main coronary artery stenosis. In: Endovascular Therapy Course Coronary and Peripheral: Ninth complex coronary angioplasty course book. Paris;1998. p.298-9.*