



가

: 1995 2001 105  
 . 38 67 . 53  
 47

가 , ,  
 , ,  
 , 가

: 83.8% (88/105)  
 6  $58.7 \pm 5.2\%$  , 1  $43.0 \pm 6.0\%$  , 2  $18.1 \pm 6.0\%$   
 / 6  $55.9 \pm 9.2\%$  /  $57.8 \pm 6.5\%$  , 1  $45.8 \pm$   
 $10.0\%$  /  $42.7\% \pm 8.4\%$  , 2  $21.8\% \pm 9.8\%$  /  $18.9 \pm 8.4\%$  . 2  
 $40.0 \pm 8.1\%$  95% 30%  
 ( $p = 0.054$ )

: 30%

, , ,  
 ,  
 , (artificial arteriovenous fistula, AVF)  
 . (renal replacement) (graft arteriovenous fistula, AVG)  
 . 1995 16,000 1966 Brescia Cimino (2)가  
 가 28.9%가 , 17.2%가 가 가 , ,  
 , 가 53.8%가 가 가  
 15% 가 가  
 (1).  
 , , ,  
 (polytetrafluoroethylene, PTFE)  
 (3).

21 /45

(6, 7).

(4, 8, 9)

(7)

(10).

70

(11),

(12).

50%

(Fig. 1).

(percutaneous transluminal angioplasty, PTA)

(pulse - spray pharmacomechanical thrombolysis, PSPMT)

18G 5F (vascular sheath)

(Digital subtraction angiography, DSA)

가

가

4 - 8 mm

(Blue - Max, Boston Scientific, Galway, U.S.A.)

12 - 20 30 1

5

1995 8 2001 7

105 59 46

22 - 88 ( 55.5 )

51 , 10 , 7 , 4

가 22

38 /67

38

/ 35 /3 67 /

60 /7 , / 59 /8

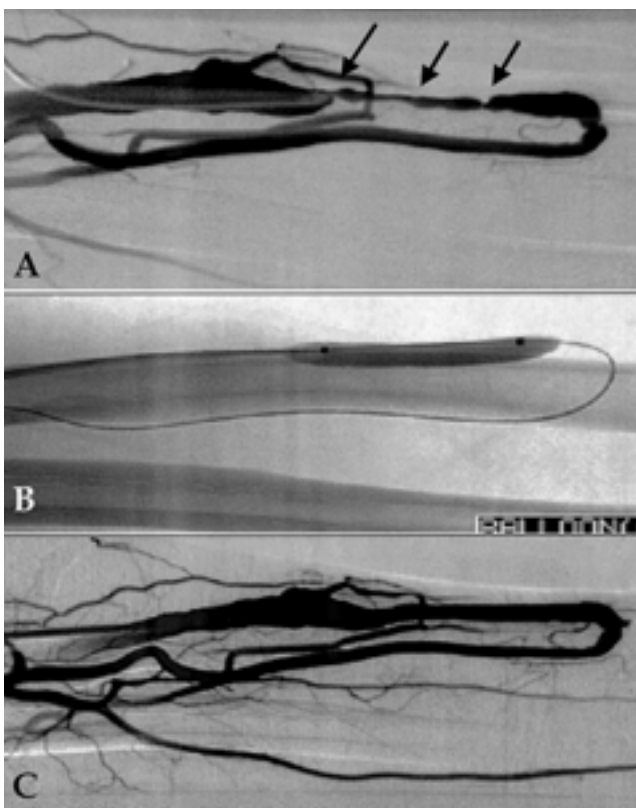
/ 56 /11 가 . 38

4 34

가 32 /2 , 67

1 66

/



**Fig. 1.** An example of PTA of AVF.  
**A-C.** There are multifocal stenoses (arrows) in the draining vein of insufficient AVF (**A**). These stenoses were managed with PTA (**B**). After the PTA, follow-up angiogram shows successful recanalization of AVF (**C**).

5 - 10 cm  
6F (Vascular sheath, Terumo,  
Tokyo, Japan)

1 47  
6 , 1 , 2 SPSS  
(version 7.5, SPSS Science, Inc., Chicago, IL) Kaplan -  
Meier

가 SPSS  
log - rank

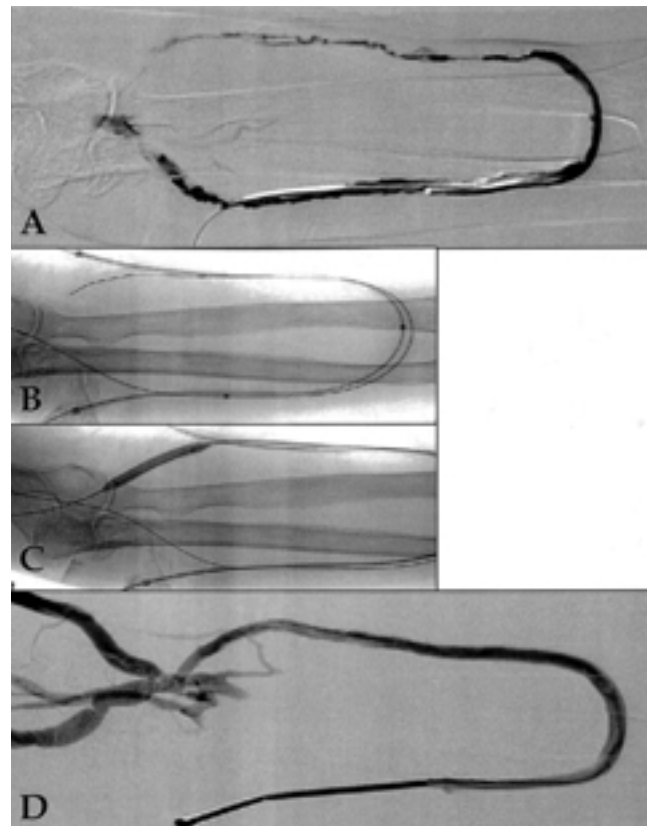
가  
5 - 10 cm 6F  
(crisscross method)  
(Shower catheter, Solco Intermed, Seoul, Korea)

가 , ,  
가 , ,  
(Table 1).  
105 88 (83.8%).  
38 30  
(78.9%), 67 58  
(86.7%). 17  
가 5 ,

500,000  
5,000 20 ml  
3 - (3 - way stopcock)  
1 ml  
0.2 - 0.4 ml 30  
15 ml ,  
5 ml .  
(Fig. 2).

가  
가  
50% , 가 ,  
1  
153 1 - 5  
( 1.5 ).

가  
(13).



**Fig. 2.** An example of PSPMT with PTA of AVG.  
**A-D.** There is the thrombotic occlusion of AVG (**A**). PSPMT was initially tried (**B**) and additional PTA was applied (**C**). Postoperative angiogram shows successful recanalization of AVG (**D**).

10 ,

2 .

1 105 78

(74.3%).

1 가 가 , 9 가 가

.

6 58.7 ± 5.2% , 1 43.0 ± 6.0%, 2 18.1 ± 6.0% (Fig. 3A, Table 2)

424 ± 59 329 ± 70

/ 6

55.9 ± 9.2%/57.8 ± 6.5%, 1 45.8 ± 10.0%/42.7 ± 8.4%, 2 21.8 ± 9.8%/18.9 ± 8.4% . Log - rank 가

(p = 0.441) (Fig. 3B, Table 2).

**Table 1.** Sites of Stenosis of Insufficient AVF and AVG

	AVF (n = 38)		AVG (n = 67)	
	No.	%	No.	%
Artery	1	3	0	0
AV anastomosis	29	78	-	-
Arterial anastomosis	-	-	2	3
Venous anastomosis	-	-	63	94
Draining vein	30	81	21	31
Central vein	2	5	9	13

AV = Arteriovenous

153

1 27 ( 8 ), 2 가 9 , 3

4 가 1 , 1 50

( 9 ), 2 8 , 3 4 , 4

가 2 , 5 가 3 . 6

70.0 ± 4.8%, 1 60.5 ± 5.7%, 2 40.0 ± 8.1% ,

/ 6 69.6

± 8.4%/67.7 ± 6.1%, 1 64.2 ± 9.3%/58.4 ± 7.3%, 2 41.3 ± 14.8%/30.7 ± 10.3% . Log - rank 가

(p = 0.220).

60

가

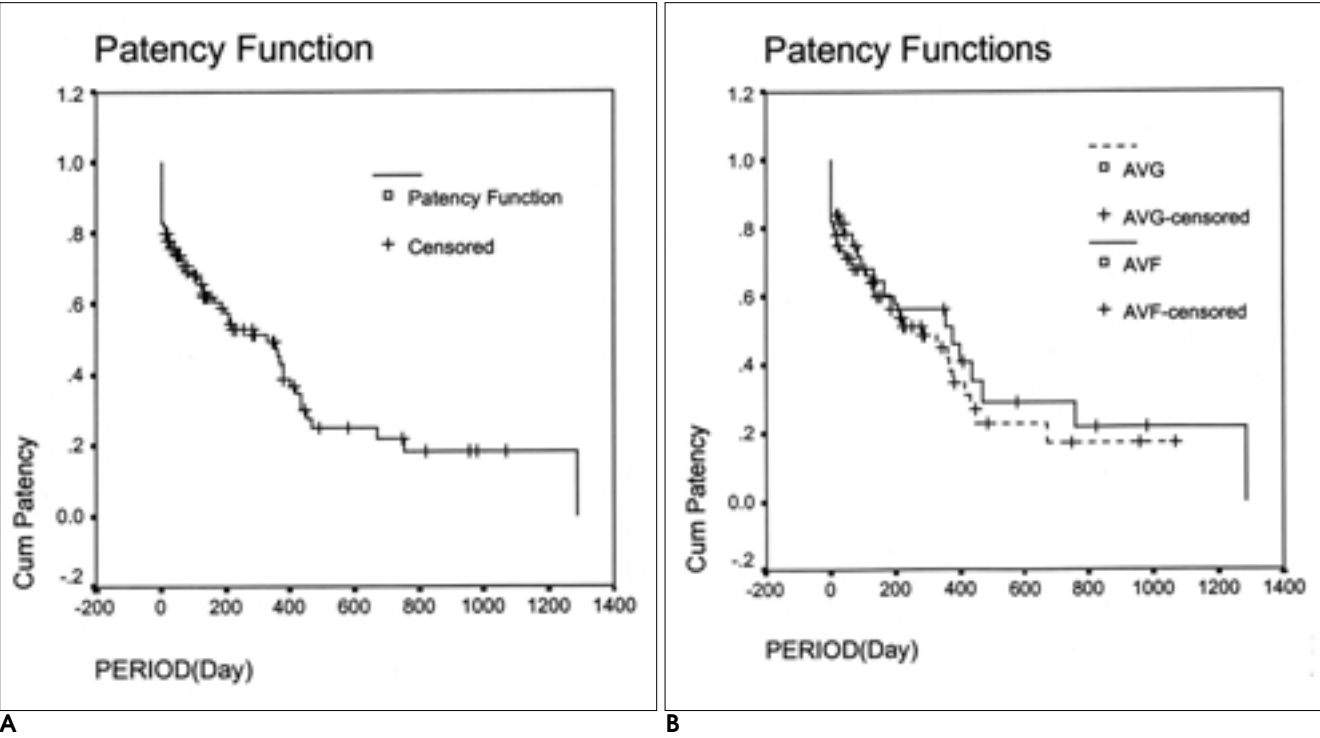
(p = 0.787), 60 AVF AVG , 60

AVF AVG 가

**Table 2.** Primary Patency Rates of Interventional Recanalization for Insufficient Hemodialysis Access

	6MPR	1YPR	2YPR
Total (n = 105)	58.7 ± 5.2	43.0 ± 6.0	18.1 ± 6.0
AVF (n = 38)	55.9 ± 9.2	45.8 ± 10.0	21.8 ± 9.8
AVG (n = 67)	57.8 ± 6.5	42.7 ± 8.4	18.9 ± 8.4

6MPR = 6 months patency rates, 1YPR = 1 year patency rates  
2YPR = 2 year patency rates, p = 0.441 (log-rank test with Kaplan-Meier survival analysis)



**Fig. 3.** Primary patency of interventional recanalization of hemodialysis access.  
**A, B.** There are primary patency diagram of total cases (**A**) and each group of AVF and AVG (**B**). No statistical difference of primary patency between AVF (solid line) and AVG (dotted line) groups is noted (p = 0.441).

( $p=0.753$ ).

( $p=0.787$ ),

AVF AVG , AVF AVG  
( $p=0.756$ ).

( 51 , 54 ) log - rank  
가 ( $p=0.468$ ),

AVF ( $n=22$ ) AVG ( $n=29$ ),  
AVF ( $n=16$ ) AVG ( $n=38$ )  
( $p=0.736$ ).

PTFE

가 , 가  
(6, 14).

( $p=0.401$ ), AVF  
AVG , AVF AVG  
( $p=0.048$ ) AVF  
( $n=3$ )

가 , (4, 5, 8, 15).

가 (16, 17),

( $p=0.365$ ), AVF,  
AVG ( $p=0.385$ ). , (18).  
AVG ( $p=0.519$ ). AVG

, 가  
( $p=0.855$ ).

( $p=0.441$ ),

AVF AVG ,  
AVF AVG  
( $n=2$ ) AVF  
( $p=0.070$ ).

PTA PSPMT PTA 6  $58.7 \pm 5.2\%$  , 1  
( $p=0.170$ ), PSPMT PTA  $43.0 \pm 6.0\%$ , 2  $18.1 \pm 6.0\%$   
AVF , PTA AVF , AVG , PSPMT / 6  $55.9 \pm 9.2\%$  /  $57.8 \pm 6.5\%$ , 1  $45.8 \pm 10.0\%$  /  $42.7 \pm 8.4\%$ , 2  $21.8 \pm 9.8\%$  /  $18.9 \pm 8.4\%$   
PTA AVF , AVG . 6 , 2  
( $p=0.503$ ).

30% ,  
30% 61 , 30% 39  
Kaplan - Meyer 6 Kaplan - Meyer 가  
90% 186 , AVG 197

, 186  
( $p=0.054$ ), 6  $71.2 \pm 6.7\%$ ,  $44.5 \pm 9.1\%$  95% 가  
 $379 \pm 60$  ,  $109 \pm 163$  가  $0.4886 - 0.6916$ , AVF  $0.3940 - 0.7472$ , AVG  
. 30% AVF, AVG  $0.4509 - 0.7045$  186  
가 ( $p=0.140$ ). 186 가  
2 가 , ,

(4, 8, 9) 가 ,

3

2

6  
38%  
43% (19), 58%  
8

:

(20), 424

PTA  
PSPMT PTA

PSPMT PTA

Gaylord (6)

가

가  
Bookstein (21, 22)

Valji (23)

, Sullivan (25)

40%

가

30%

90%

(23), 1

26%  
(24)

1

43%

10

(percutaneous aspiration thrombectomy)  
(mechanical thrombectomy) (26).

가

90 - 100%

가 (11, 12),

(27, 28), Turmel - Rodrigues (27) 43

가

1, 6, 12

85, 33, 24%

가

가

가

가

(58% 33%, 6

). (Pull - back thrombectomy)

가

. Trerotola (29) 34  
94%

가

(26),

(Venturi effect)

Hydrolyser device (Cordis Co.), Angiojet  
rheolytic thrombectomy catheter (Possis Medical), Oasis  
system (Boston Scientific)

가

Amplatz  
thrombectomy device, Arrow - Trerotola percutaneous

thrombolytic device가 .

Hydrolyser catheter 86 -

89% (30, 31), 17%

15% (31). Angiojet catheter (32)

3 26%

. Oasis thrombectomy device (33)

Oasis device ,

. Amplatz thrombectomy device (34) 89%

, 1 47%

가 .

가 (26). Arrow - Trerotola percutaneous thrombolytic device 가 (35).

95% , 3

40% (75 85 )(36). , pull - back thrombecomy , 가

, 가

, 가

1% (7),

, (37), 가

30%

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## Percutaneous Intervention for Permanent Hemodialysis Access<sup>1</sup>

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**Purpose:** To evaluate the effectiveness of percutaneous transluminal angioplasty (PTA) and pulse-spray pharmacomechanical thrombolysis (PSPMT) using urokinase for the management of insufficient hemodialytic access, and to identify contributory patency-related factors following interventional procedures.

**Materials and Methods:** Between August 1995 and July 2001, 105 cases of insufficient hemodialytic access involving 38 artificial arteriovenous fistulae (AVF) and 67 graft arteriovenous fistulae (AVG) were treated interventionaly. The patients underwent PTA alone in 53 cases and PSPMT combined with PTA in 47, and procedural success and long-term patency were evaluated in terms of a patient's age and sex, the presence of diabetes, the location of access, the type of AVG, the draining vein of AVG, the presence of central vein stenosis, the degree of residual stenosis, and the method of interventional procedure, and contributory factors were thus identified.

**Results:** The overall technical success rate of interventional management was 83.8% (88/105), while the overall primary patency rate was  $58.7 \pm 5.2\%$  at 6 months,  $43.0 \pm 6.0\%$  at 1 year, and  $18.1 \pm 6.0\%$  at 2 years. In AVF/AVG groups, primary patency rates were  $55.9 \pm 9.2\%/57.8 \pm 6.5\%$  at 6 months,  $45.8 \pm 10.0\%/42.7 \pm 8.4\%$  at 1 year, and  $21.8\% \pm 9.8\%/18.9 \pm 6.5\%$  at 2 years. The overall secondary patency rate was  $40.0 \pm 8.1\%$  at 2 years. No contributory factors were found (95% confidence level), though patency of access decreased when residual stenosis was more than 30% ( $p = 0.054$ ).

**Conclusion:** Interventional management of insufficient hemodialytic access has high success and patency rates, and is an effective primary method. There appear to be no contributory factors, though residual stenosis of more than 30% tends to decrease the patency of hemodialytic access.

**Index words :** Fistula, arteriovenous  
Graft arteriovenous fistula  
Transluminal angioplasty  
Thrombolysis

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