

가 가
 Polyvinylacetate(PVAc) 가 Embol
 45% 55%
 가 . 15 , 0.8(0.5 - 0.9) cc
 Embol 5
 5 3 3 (I), 2 (II),
 4 (III)
 1 DMSA
 3 1, 3, 5, 7, 14 BUN,
 Creatinine, Sodium(Na), Potassium(K)
 : Embol
 5
 14 , (interlobar artery) 1
 가
 I III 1
 가
 I II
 III 가 3 가 . I
 , III , II III
 III
 : Embol
 가

가 (4), 가
 , (6). 가
 가
 (1-5). , 가 ,

1 가 (7, 8).
 2 가 (radiolucency)
 3

: (Embol)
 (9 - 11). 가 15 . 가
 (10 mg/ml, ,) 3 cc
 Rompun(xylazine 23.3 mg/cc, Bayer Korea Ltd., Seoul)
 가 (acetic acid), 1 cc 가
 Polyvinyl acetate, Ethibloc Rompun 1.5 cc, 0.5 cc 가
 (12 - 15). . 가
 Park (16) Embol 21G 0.018 -
 in (hair wire) 4F micropuncture
 sheath(COOK, Bloomington, U.S.A.)
 . sheath 0.016 - in (guide wire)
 3F (Fastracker; Boston scientific,
 Watertown, U.S.A.)
 Embol
 가 가 . 30%
 0.2 cc
 Embol
 polyvinyl acetate(PVAc)
 (Polysciences, Warrington, PA) 가 . 5
 Park (16) Embol
 . PVAc sheath
 PVAc vinyl acetate(VAc) 가 5 3 3 (I), 2
 vinyl alcohol(VA) 가 가 (II), 4 (III)
 VA VAc
 VAc VA
 VA 10%
 가 . Embol 20
 g PVAc 172 ml 18.3 ml hematoxylin - eosin
 , 22% VAc가 가 VA 78%
 가 .
 48 ,
 2 ,
 12 g 44 ml . 3
 Ultravist 370(Schering, Berlin, Germany) 3 , 2 , 4 DMSA
 56 ml , 0.8 μm , 3 1, 3, 5, 7, 14
 가 BUN,
 (autoclave) Embol - 78 - 12 PVAc
 가 .
 190 mg I/ml
 (radioopacity) . Embol
 /
 가 가 . (Fig. 1A). 15 13 ,
 2 ,
 Embol 0.8(0.5 - 0.9)cc . Embol
 가
 2 kg

7
 K 19 mg/dl, 0.6 mg/dl, 143 meg/l, 4.4 meg/l
 (Table 1).
 Embol 5 (interlobar artery) (nephrogram)
 14 (Fig. 1B), 1
 (recanalization) (collaterals)
 DMSA

가
 가
 I II

Table 1. Mean Value of Blood Chemistry Before and After the Procedure in Three Rabbits

	pre	1 d	3 d	5 d	7 d	14 d
BUN(mg/dl)	21	26	23	23	21	23
Creatinine(mg/dl)	0.6	1.1	0.9	0.8	1.0	0.8
Na(meg/l)	143	143	142	143	142	142
K(meg/l)	4.5	4.5	4.9	4.9	4.8	4.7

Note. - d = day(s), pre = pre-embolization.

Table 2. Volume Changes of the Kidney after Renal Artery Embolization with Embol

Group	Mean Volume Ratio*
I	1.13
II	0.79
III	0.64

* Volume ratio = volume of the embolized kidney/volume of the normal kidney

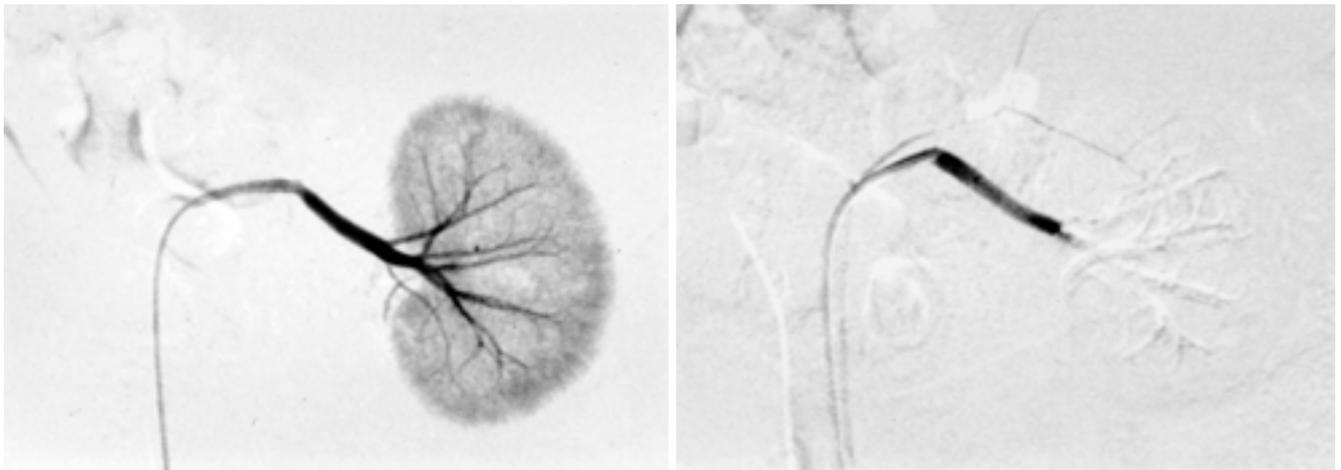
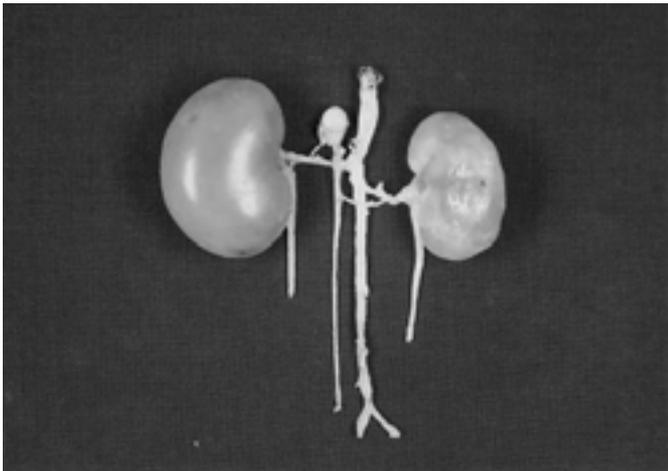


Fig. 1. Radiograph of renal artery embolization with Embol.
A. Selective renal arteriogram shows single left renal artery with normal nephrogram.
B. Post-embolization angiogram at 5 minutes shows a complete occlusion of renal artery.
C. Post-embolization angiogram at 4 weeks demonstrates complete occlusion of left renal artery (arrow). Prominent capsular artery and its branches are seen proximal to the occluded left renal artery. There is no evidence of collateral vessels in the renal bed.

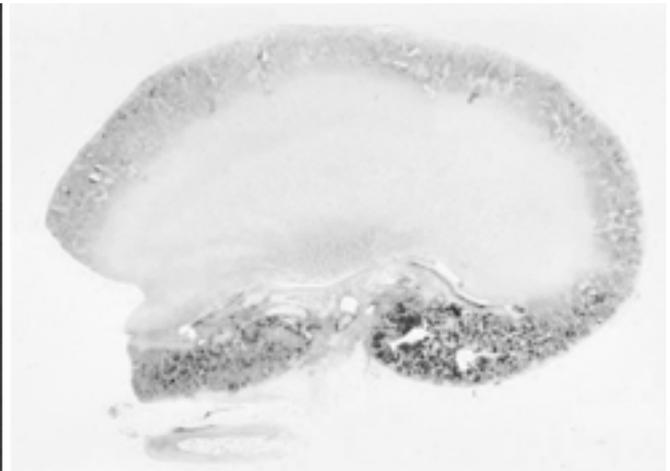
III 가 (Table 2).



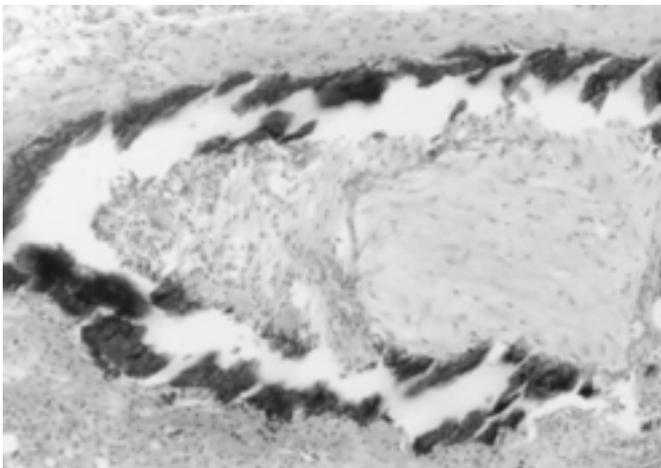
Fig. 2. Gross photograph of kidney of the rabbit in group I shows normal color and texture of right kidney and slightly enlarged and pale appearance of left kidney. Scattered areas of depression and necrotic foci are visible in the embolized kidney.



A



B



C

Fig. 3. Photograph of gross and microscopic findings of embolized kidney of the rabbit in group III.

A. Gross photograph of both kidneys shows marked shrinkage of embolized left kidney. Marked surface irregularity and anemic color changes are evident when compared with that of normal right kidney.

B. Microscopic section of the embolized kidney shows completely necrotic cortical region with extensive basophilic calcifications. (H & E, 1:1)

C. Renal artery is severely damaged and contains completely organized thrombus. Irregular calcifications along the arterial wall as well as along the thrombus are evident. (H & E, × 400)

(Embol)

I (Fig. 2).

(intima) (media)

가 가

II

가

가

III

(Fig. 3A).

(Fig. 3C).

가

가 (Fig. 3B).

(monomer)
(polymerization)가
, Embol

. Histoacryl
()
가

I, II, III

ronment)
가

/
(water envi-

가
Embol

가

Embol PVAc 가
VA

VAc
56%

PVAc가
Embol 45%

1900

가

PVAc가 100 mg l/ml
Embol 190 mg l/ml
PVAc

가 , Coil, Polyvinyl alcohol(Ivalon),
Cyanoacrylate, (4, 5, 7, 8, 17-21).
가 , coil

0.8 cc Embol
, 4

(17).

가
. I III 1

Cyanoacrylate,

. Ivalon,

Embol (spasm)

Ivalon

가

Cyanoacrylate
가 (4, 22).

Cyanoacrylate

가

Embol

가

(7, 8).

(9-11).

lipiodol
(occlusion balloon catheter)

4

가

(1, 23).

Embol Su (22)

PVAc 가

(Embol)

(7). Embol 40%

Embol

(16).

3
2 4

가

Embol

가

Embol

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가

Embol

. Kaufmann (14)

, Embol

Ekelund (8)

27

가

52

가

2

가

4

가

. Kaufmann (24)

가

(dystrophic calcification)가

(25). Ekelund

가

가

가

Polyvinyl acetate(PVAc)

Peregrin

(13)

95%

. Su (22)

50%

가

Embol

가 40%

(13, 22),

(giant cell)

BUN, Creatinine, Na, K

(BUN: 13.1 - 29.5 mg/dl, Creatinine: 0.5 - 2.65 mg/dl,

Na: 138 - 155 meg/l, K: 3.70 - 6.80 meg/l) (26).

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A New Liquid Embolic Agent(Embol) for Transcatheter Renal Artery Embolization: An Experimental Study in Rabbit¹

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Purpose: To evaluate the effectiveness and safety of a new liquid embolic agent in renal arterial embolization in the rabbit, and its clinical applicability.

Materials and Methods: A new embolic agent, Embol, was obtained by partial hydrolysis of polyvinyl acetate and dissolved in a mixture of 45% ethanol and 55% non-ionic contrast medium. Its radioopacity was therefore good. An average of 0.8 cc(0.5 - 0.9 cc) of Embol was used to embolize the renal artery of one kidney in 15 rabbits. The immediate effect of this was examined angiographically 5 minutes after the procedure. To permit histologic examination, five rabbits in each group were sacrificed 3 days (I), 2 weeks (II), and 4 weeks (III) after embolization: prior to embolization and prior to sacrifice, one rabbit in each group underwent renal scanning, and prior to sacrifice all underwent follow-up angiography. In three rabbits, blood urea nitrogen (BUN), creatinine, sodium(Na), and potassium(K) levels were measured before and 1, 3, 5, 7 and 14 days after embolization.

Results: Embol was easy to use and its radiopacity was good. Five minutes after embolization, angiography showed that total occlusion of the main renal or interlobar artery had been achieved in all rabbits. Serum BUN, creatinine, Na and K levels were within normal limits. Follow-up angiogram obtained in each group showed persistent occlusion of the renal artery in all but one rabbit in group I and one in group III. Renal scans revealed no evidence of radionuclide uptake in embolized kidneys, which were slightly enlarged in group I but became gradually smaller in groups II and III. In all animals, histologic examination showed diffuse coagulation necrosis of the embolized kidneys and in group III the cortex of these was extensively calcified. In group I the renal artery showed an apparently fresh occluding thrombosis, and in groups II and III a completely organized thrombosis was present. In group III this was calcified.

Conclusion: Because of its good radioopacity, Embol is easy to control, and is effective for renal artery embolization. As a permanent embolic agent, it appears suitable for clinical applications.

Index words : Animals

Arteries, therapeutic blockade

Kidneys, interventional procedure

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