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가

가

· 3

54

가 35 (

)

19 ( )

Polyvinyl alcohol

가 15

12

가 8

( ),

(paired t-test)

Kaplan-Meier

가

(p<0.001),

·

(n=1),

(n=2),

(n=1),

(n=1)

28 (

24

4 )

10

29.5 ± 5.4

10.3 ± 3.1

(p=0.0002), PVA

가 가

(p=0.01).

·

가

(11).

(1),

(transarte-

rial chemoembolization, TACE)

(nega-

tive prognostic factor)

(2-5),

TACE

(6, 7).

(arteriportal shunt)

(8-10),

가

가

TACE

가

polyvinyl alcohol

(8, 9, 11).

가

(12),

1995 1 1998 5 TACE  
1500  
가 62 (Fig.1).  
8  
54  
CT  
5  
-fetoprotein  
가 49 가 5  
52.5 ( , 37-71)  
CT  
, 3  
Fig. 1  
가  
, 3 1  
(chemoinfusion), 2  
. 54  
가 35 ( , embolization  
group), 19 ( , control group)  
Child-Pugh  
Table 1 , CT

cis-diamine-  
dichloroplatinum(Cisplatin; Dong-A, Seoul)  
8  
3 Fr  
(MicroFerret infusion catheter; COOK)  
250-355  $\mu$  Polyvinyl alcohol(PVA, Contour emboli;

Table 1. Clinical and CT Findings of the Two Groups, Embolization Group and Control Group

		Embolization group	Control group
Child-Pugh Classification	Class A	14 (40.0%)	4 (21.1%)
	Class B	12 (34.3%)	11 (57.8%)
	Class C	9 (25.7%)	4 (21.1%)
Tumor size (cm)	10	22 (62.9%)	15 (78.9%)
	< 10	13 (37.1%)	4 (21.1%)
Ascites	None	12 (34.3%)	7 (36.8%)
	Mild	6 (17.1%)	5 (26.3%)
	Moderate	14 (40.0%)	4 (21.1%)
	Massive	3 ( 8.6%)	3 ( 5.3%)
Portal vein Tumor thrombosis	Peripheral*	13 (37.1%)	7 (36.8%)
	Main	22 (62.9%)	12 (63.2%)
Total		35	19

\*The extent of portal vein tumor thrombosis is confined within first order branch of the intrahepatic portal vein.

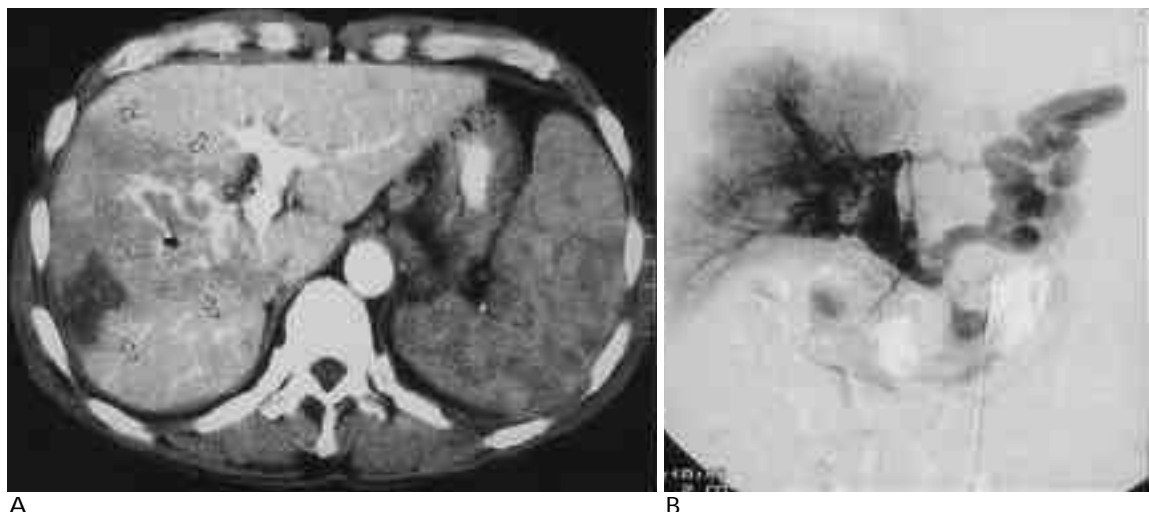


Fig. 1. A 45-year-old female patient with diffuse infiltrative hepatocellular carcinoma in the right hepatic lobe.  
A. The arterial-dominant spiral CT scan of the liver shows very early opacification of the portal vein. The right portal vein is nearly occluded by tumor thrombosis. Ill-defined, low-density tumor with a wedge-shaped, low-density area (empty arrows) of the adjacent hepatic parenchyma is noted suggesting severe arteriportal shunt through the tumor thrombi (black arrow) within the portal vein.  
B. Late arterial phase of hepatic arteriography of the same patient shows severe arteriportal shunt which opacifies tortuous dilated coronary vein as well as intra- and extrahepatic portal veins.

Interventional Therapeutics Corpora-tion, Fre-mont, U.S.A.)

가 15 , (Gelfoam; Upjohn, Kala-mazoo, Michigan, U.S.A.) 12 , PVA

가

가 8

가

(siphon effect)가

가

가

가

symptom),

1

(post-embolization

ALT(al-  
anine aminotransferase), total bilirubin, albumin, AFP ( -fetopro-  
tein) , 1

가

가

,

가

가

Fig. 1

가 가

paired t-test

43 ( 30 , 13 )

. 9

6

가

(Lipiodol; Andre Guerbet, Aulnay-sous-Bois,

France) 10ml 10mg Cisplatin

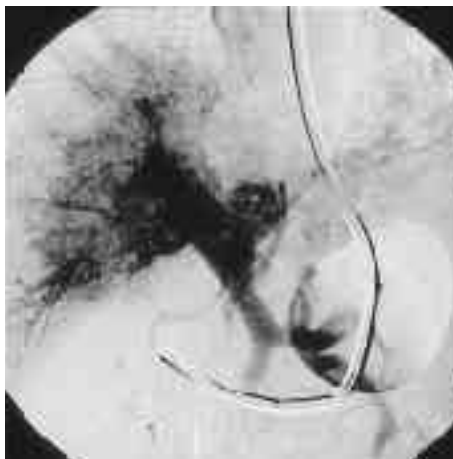
가

, 1

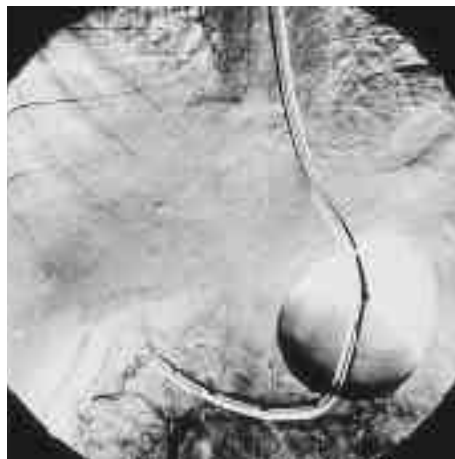
Kaplan-Meier

, Child-Pugh

Cisplatin 15



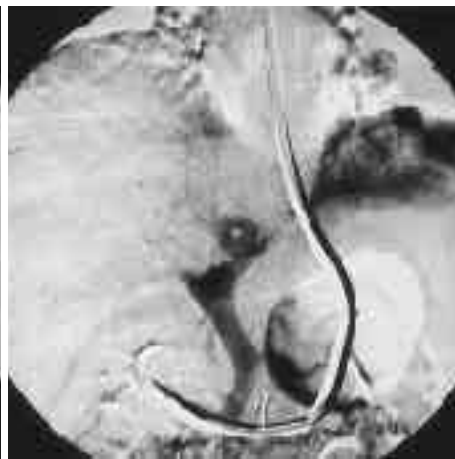
A



B



C



D

Fig. 2. A 39-year-old male patient with hepatocellular carcinoma, who admitted due to massive variceal bleeding. The bleeding was controlled with a Sengstaken-Blakemore balloon.

A. The late arterial phase of hepatic arteriography shows diffuse infiltrative hepatocellular carcinoma of the right hepatic lobe with severe arteriportal shunt which opacifies part of the splenic and superior mesenteric veins as well as the portal veins due to regurgitant blood through the tumor within the portal vein.

B. A late phase of indirect portography performed through superior mesenteric artery failed to visualize portal vein, mimicking complete obstruction of the main portal vein - functional obstruction.

C. After partial embolization of the arteriportal shunts using PVA particles, the amount of regurgitant blood through the thrombi is markedly decreased.

D. The indirect portogram performed after embolization of the shunt shows restoration of hepatopetal portal flow through the patent main and left portal veins. The right portal vein is still occluded by tumor thrombi.

38.0 °C, 24, 23, 25, 5, 8, 6, (p=0.004), (p=0.009), (n=1), (n=2), (n=1), (spontaneous bacterial peritonitis), (n=1), 1, 11 (5, 6), 1, Table 2, ALT 가 (log transformation), AFP 가, 1, 가 28 (24, 4), 가 (improved), 가 (not improved), Table 3, 24, 10

Table 2. Mean Values of Clinical Laboratory Data in Two Groups

	Embolization group	Control group	p value <sup>‡</sup>
Pre ALT* (U/L)	71.0 ± 51.5	88.8 ± 94.2	0.75
Post ALT*	67.2 ± 59.1	205.8 ± 393.7	0.09
Pre total bilirubin (mg/dL)	2.01 ± 1.53	2.24 ± 1.11	0.47
Post total bilirubin	4.58 ± 6.80	4.84 ± 5.09	0.53
Pre albumin (g/dl)	3.36 ± 0.47	3.42 ± 0.55	0.65
Post albumin	3.30 ± 0.59	3.15 ± 0.53	0.49
Pre AFP <sup>†</sup> (ng/ml)	15297 ± 37906	10106 ± 9590	0.14
Post AFP	34346 ± 126463	17997 ± 54131	0.17

Pre: the lab values obtained before procedure

Post: the lab values obtained 1 month after the procedure

\*ALT: alanine aminotransferase

<sup>†</sup> AFP : -fetoprotein

<sup>‡</sup> p values of paired t tests

Table 3. Change of Arteriportal Shunt before and One Month after Procedure

	Improved	Not improved
Control group	0 (0%)	4 (100%)
Embolization group	10 (42%)	14 (58%)
PVA	6	5
PVA and Gelfoam	2	4
Gelfoam	2	5

4 TACE가 가 (mean survival period) 29.5 ± 5.4 10.3 ± 3.1 (p=0.0002) (Fig. 3). , PVA 가 (23.9 ± 6.0) 38.6 ± 8.2 (23.0 ± 6.9 ) (p=0.01) (Fig. 4). 10cm 10cm 33.9 ± 6.7 17.9 ± 3.1 (p= 0.023). 10cm 39.7 ± 8.1 15.9 ± 6.9 (p=0.058). 10cm 24.0 ± 4.8 9.0 ± 2.1 (p=0.007). Child

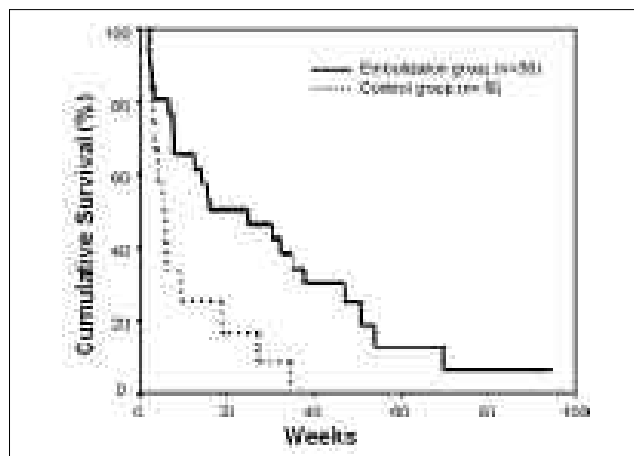


Fig. 3. The graph shows the cumulative survival rates of both the embolization and control groups.

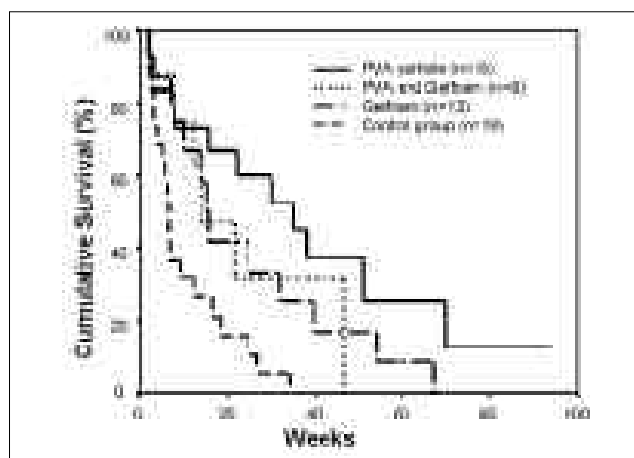


Fig. 4. The graph shows the differences in the cumulative survival rates within the embolization group according to the embolic materials used.

(p=0.04), Child B (p=0.0005) (Fig. 5). , Child C (p=0.92), Child A (p=0.037) (Fig. 7). TACE가 가 4 1 38 3 28 TACE Table 4

(Fig. 6).

12.4 ± 4.8 (p=0.034) , 36.1 ± 9.0  
25.9 ± 4.2 9.4 ± 2.1 (p=0.0008) . 1  
28

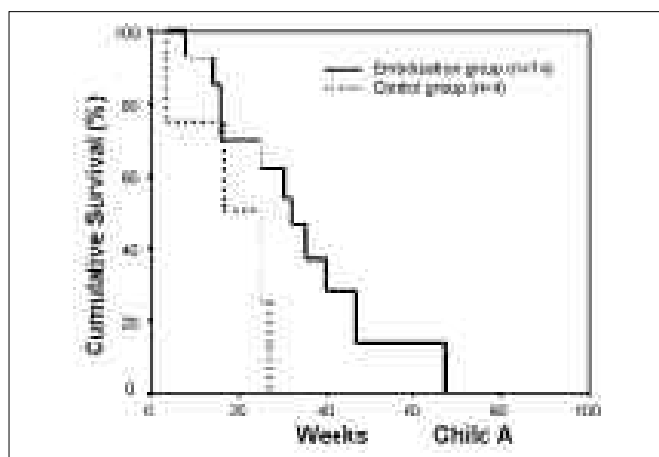
56.6 ± 11.2 27.5 ± 4.3 13).

가

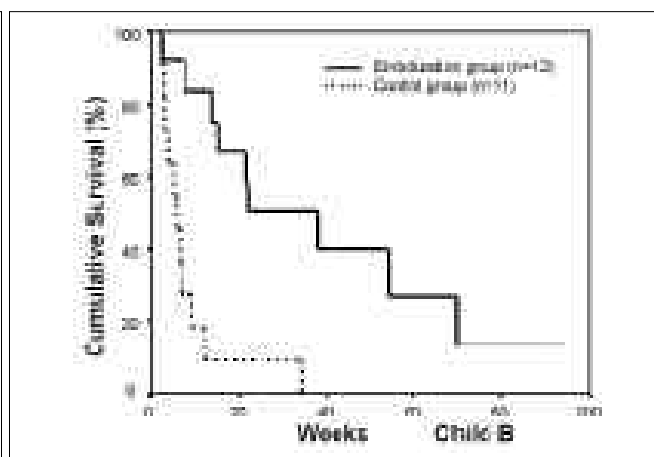
(tumor thrombus)

Table 4. Causes of Death

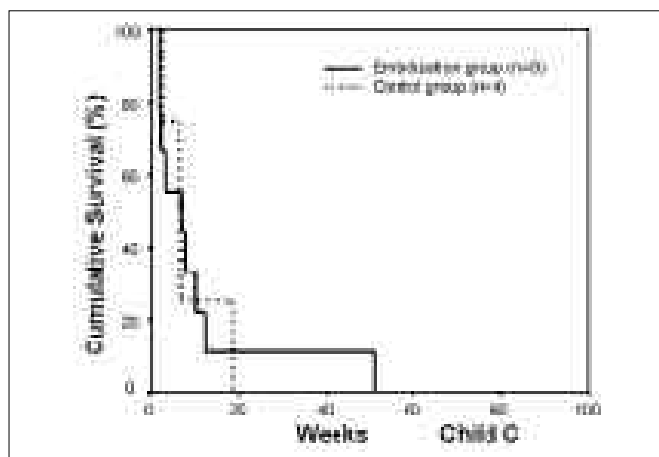
Cause	Embolization group	Control group
Gastrointestinal bleeding	15	4
Hemoperitoneum	2	1
Hepatic failure	7	9
Metastasis	1	1
Spontaneous bacterial peritonitis	3	3
Unknown	1	1



A



B



C

Fig. 5. These graphs show the cumulative survival rates of both the embolization and control groups in Child classes A (A), B (B), and C(C).

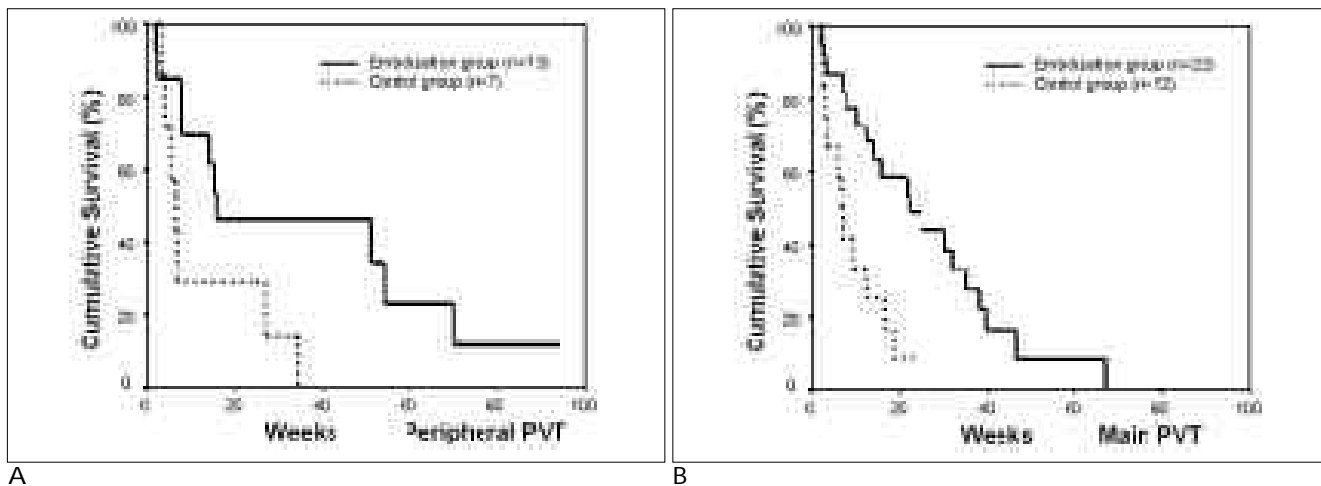


Fig. 6. These graphs show the cumulative survival rates of both the embolization and control groups in the peripheral portal vein thrombosis group (A) and the main portal vein thrombosis group (B)

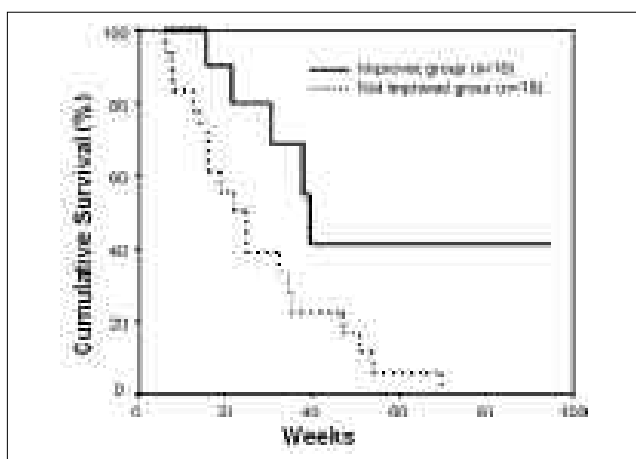


Fig. 7. The graph shows the cumulative survival rates of the groups with improvement of the shunt (improved group, n= 10) and without improvement of the shunt (not improved group, n= 18) one month following the embolization.

5% 1 11%  
(1), TACE  
1 1  
31% 68.6% (3, 4).  
가  
(19). Furuse 1  
1  
(16). (15%) 12% ( , 4.3 )  
(11),  
, “thread and streak”  
(10)  
(hepatofugal flow)  
(functional obstruction)  
(17). 가 TACE 가 가  
, Okuda 25.4% 가  
(18). 가 63.2% 가 4.3%



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## **Embolization of Severe Arterioportal Shunts in the Patients with Hepatocellular Carcinoma : Safety and Influence on Patient Survival<sup>1</sup>**

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**Purpose :** To evaluate the safety and the influence of embolization of severe arterioportal shunts, and the effect of the procedure on the survival rate of patients with hepatocellular carcinoma combined with portal vein tumor thrombosis.

**Materials and Methods :** This study involved a total of 54 patients with hepatocellular carcinoma in whom hepatic arteriography revealed severe arterioportal shunt. From among this total, 34 patients (embolization group) underwent chemoinfusion after shunt embolization, while 19 (control group) underwent chemoinfusion only. The embolic materials included PVA particles and/or Gelfoam pieces. The frequency of postembolization symptoms (Chi-squared test) and changes in laboratory values (paired t-test) were compared between the two groups, and shunt improvement was also evaluated. Patient survival was tested using the Kaplan-Meier method.

**Results :** Fever and RUQ pain were more frequent in the embolization group ( $p < 0.001$ ). The complications of embolization included severe postembolization syndrome ( $n = 1$ ), acute hepatic failure ( $n = 2$ ), hepatic infarction ( $n = 1$ ), and sepsis ( $n = 1$ ). There were no significant changes in laboratory values. Among the 28 patients (24 of embolization group and four of control group) who underwent follow-up angiography, arterioportal shunt became less severe or disappeared in ten of the embolization group. For the embolization and control groups, the mean survival interval was  $29.5 \pm 5.4$  weeks and  $10.3 \pm 3.1$  weeks ( $p = 0.0002$ ), respectively. The best results were seen in the PVA particle group ( $p = 0.01$ ).

**Conclusion :** The embolization of severe arterioportal shunts is relatively safe and increases patient survival rate.

**Index words :** Liver neoplasms, angiography  
Liver neoplasms, chemotherapeutic infusion  
Portal vein, flow dynamics  
Hepatic arteries, therapeutic blockade

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