

가

CT

1

1,2

3

4

: 가

CT

I : 18 가 2 0.4cc , II , III 6 0.4cc (II), 0.4cc (III) , IV 5% 0.2cc 0.4cc 5 가 , 5% , V 10% - 10% 5 IV , CT , 1 , 2 , 3-4 , 가 3 3-4 , CT : III-V CT CT CT 가 , CT (5%, 10%) CT , IV V 가 , CT 가 IV V , 가 IV V , CT (1) 99% () CT 4 4

1
2
3
4

1998 7 14

1998 12 18

CT

(1,2).

(3-5),

2.5-3.5kg

가 1

CT

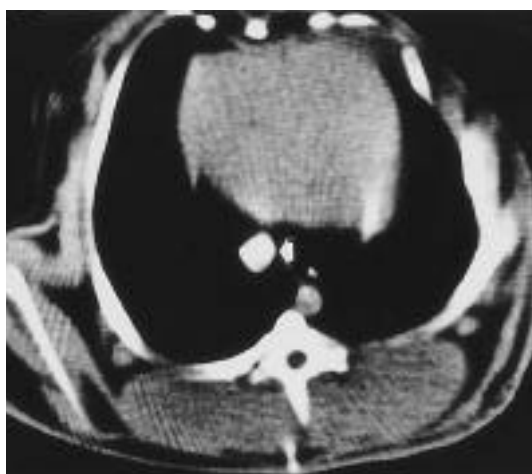
가

가

4 가

CT

가 , (99% ethyl alcohol anhydrous, Carlo ERBA, France) 2cc , 5% (ethyl ester of the fatty acid of poppy seed oil, 38% iodine by weight, Laboratories Guerbet, France) (5% -) 2cc , CT



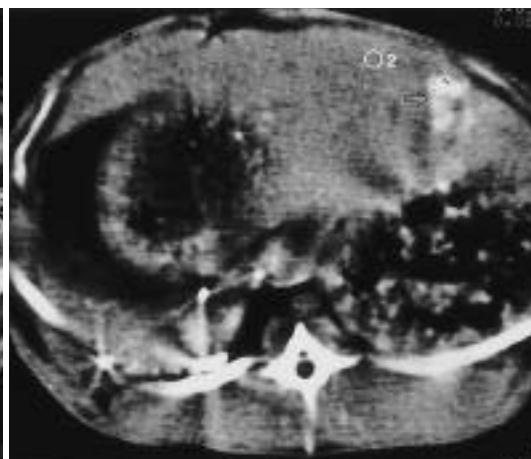
A



B



C



D

Fig. 1. A-C. Serial CT scans obtained immediately after 0.4cc Lipiodol injection show dense opacification of IVC(white arrow) by Lipiodol(A), and linear distribution of Lipiodol(curved arrow) along vascular structures(B). Ovoid area of intrahepatic localization of Lipiodol(black arrow) is well demonstrated(C). D. Follow-up CT after three weeks reveals residual intrahepatic localization of Lipiodol(open arrow), which shows much decreased attenuation and more punctate distribution.

가 0.5cc
CT
가 5% 0.2cc 0.4cc
가 10% 0.2cc, 0.4cc
0.2cc 0.4cc
가 18 5
2
6, 5% 5, 10%
5 (Table 1).
2 가 0.4cc
3, 2
6 가 0.4cc (II)
, 0.4cc (III)
2 CT 3
, 1, 2, 3-4 CT, CT
5%
5% 0.2cc 0.4cc 5
가, II, III 가
CT 2 3 3 3 4

V 10%
10% 5 가 IV
가 ketamin 20-30mg/kg
10MHz 5MHz (SonoAce
7700, Medison, Korea)
26 1/2 1 1cc
2-5
CT
CT
4mm, pitch 1 CT (Somatom
Plus S, Siemens, Erlangen, Germany)
16 가
44 CT
CT (16), CT 1 10, 2 8
, 3 4 10
가 KCl 2-3cc/kg
가 CT
가 10%
3-5 μ m
Hematoxylin-
Eosin(H & E)



Fig. 2. CT scan obtained immediately after 0.4cc Lipiodol injection shows diffuse linear distribution(white arrows) of Lipiodol at both hepatic lobes. Subcapsular or intraperitoneal leakage(open arrow) is also revealed.

Table 1. Summary of Experimental Groups

Group	No. of cases/ No. of rabbits	Injected material	Dose	No. of rabbits sacrificed on 3rd day/3-4wk
I	2/2	normal saline	0.4cc	1/1
II	6/6*	ethanol	0.4cc	2/4
III	6/6*	Lipiodol	0.4cc	2/4
IV	10/5	5% Lipiodol-ethanol	0.2cc at Rt. lobe 0.4cc at Lt. lobe	2/3
V	10/5	10% Lipiodol-ethanol	0.2cc at Rt. lobe 0.4cc at Lt. lobe	2/3
Total No. 34 cases /18 rabbits				

* Group II & III were injected into left and right hepatic lobe at the same 6 rabbits.

가

(Fig. 1). 3

CT . CT

(Fig. 2). 1 5

(Fig. 1A), 4

CT CT

(Fig. 1D), 4 CT

1 5

가

가 10 6 ,

가 10 4

가 10 2 3

가 2 3

가 CT

, 0.2cc 5% -

10% -

350 HU vs 423 HU) 0.4cc 가 CT

(424HU vs 446HU)(Fig. 3).

CT III

(Table 3)

CT (Table 2)

CT 6 2 4

가

가

가 1

가 (Fig. 4).

가

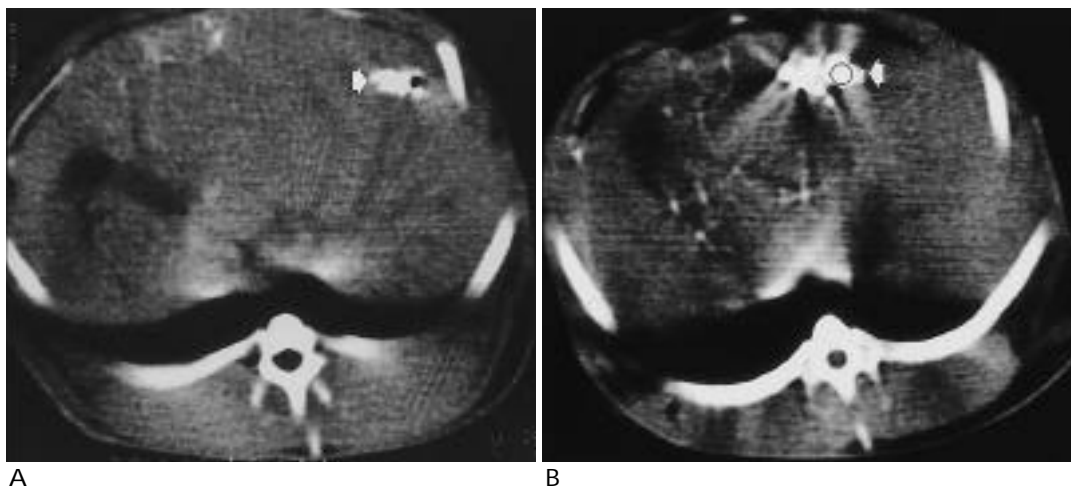


Fig. 3. A. B. CT scans obtained immediately after 0.4cc 5% Lipiodol-ethanol(A) and 0.4cc 10% Lipiodol-ethanol(B) injection at different rabbits show well intrahepatic localizations(white arrow) of Lipiodol-ethanol. There was no gross difference in CT attenuation.

가 , 가
, 가
(Fig. 5).
가
,
, 1 가
(vacuole)가 (Fig. 6).



Fig. 4. Histopathologic findings of rabbit liver on three days after 0.4cc ethanol injection show coagulation necrosis(asterisks), surrounding inflammatory cell infiltration, early fibrosis at portal areas(arrows) and portal vein thrombosis(open arrows)(H&E, $\times 40$).



Fig. 5. Microscopic features on four weeks after 0.4cc ethanol injection reveal small area of necrosis(open arrows), surrounding marked fibrosis (black arrows), inflammatory cell infiltration and well organized fibrosis at portal area (H&E, $\times 40$).

가 ,
1 (Fig. 7).
V
, 2 가
(vacuole)가
3 , 1 , 2
1 (Fig. 8). IV V
가 가

Kawano (4)

Table 2. CT Findings of Liver in Five Groups of Rabbits

Group CT findings	Group I (n= 2)	Group II (n= 6)	Group III (n= 6)	Group IV (n= 10)	Group V (n= 10)
Intrahepatic localization of Lipiodol or ethanol	.	2	3	6	6
Linear distribution of Lipiodol	.	.	3	4	4
Opacification of IVC by Lipiodol	.	.	5	2	3
Intraperitoneal leakage of Lipiodol	.	.	4	2	3
Complete disappearance of Lipiodol on F/U CT	.	.	1	.	.

n: number of cases

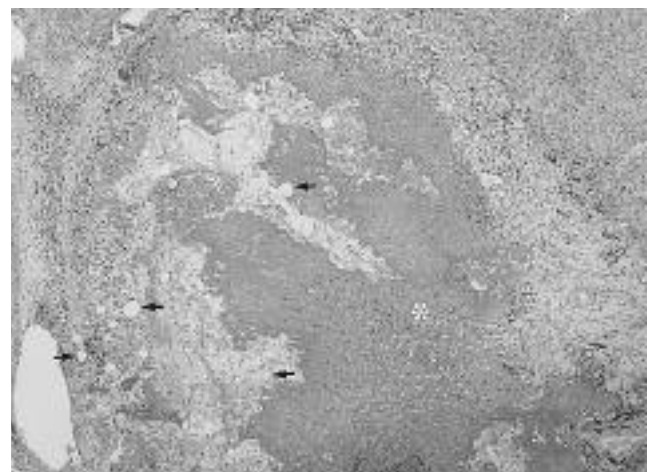


Fig. 6. Histopathologic features on three days after 0.4cc 10% Lipiodol-ethanol injection show large area of coagulation necrosis(asterisk), surrounding early fibrosis(open arrows) and several fat vacuoles (black arrows) at necrotic or fibrotic areas(H&E, $\times 40$).

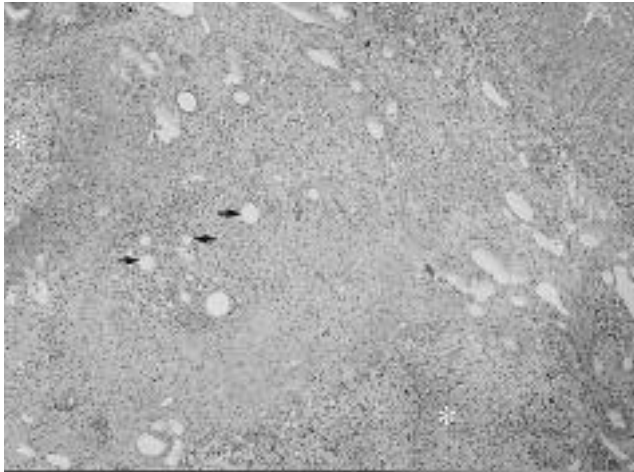


Fig. 7. Microscopic features on four weeks after 0.4cc 5% Lipiodol-ethanol injection show fat vacuoles(black arrows), multinucleated giant cells (open arrow), macrophages at fibrotic area and small regenerating nodules(asterisks) (H&E, $\times 40$).

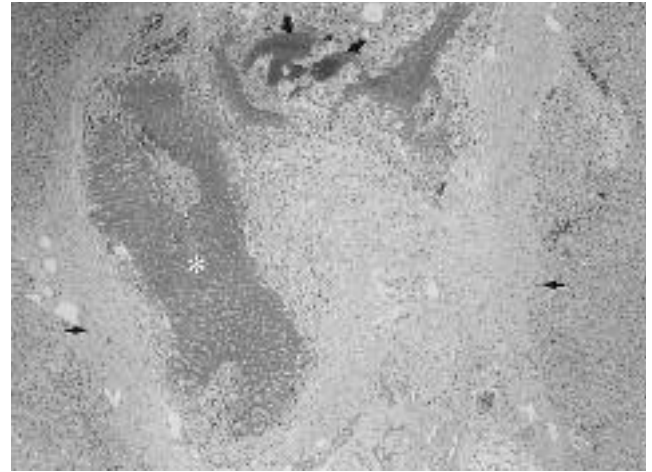


Fig. 8. Histopathologic features on three weeks after 0.4cc 10% Lipiodol-ethanol injection show coagulation necrosis(asterisk), surrounding fibrosis(black arrows), fat vacuoles, multinucleated giant cell and calcifications(curved arrows)(H&E, $\times 40$).

Table 3. Histopathologic Findings of Liver in Five Groups of Rabbits

Histopathologic findings	Group I		Group II		Group III		Group IV		Group V	
	A (n= 1)	C (n= 1)	A (n= 2)	C (n= 4)	A (n= 2)	C (n= 4)	A (n= 4)	C (n= 6)	A (n= 4)	C (n= 6)
Coagulation necrosis	.	.	2	2	.	.	4	3	4	4
Eosinophilic degeneration	.	.	2	.	.	.	2	1	.	2
Inflammatory reaction	.	.	2	3	.	.	3	1	2	.
Fibrosis	.	.	1	4	.	.	2	6	3	6
Fat vacuole	1	1	2	3
Foreign body reaction	1	.	3
Granuloma	1	.	1
Regenerating nodule	1	.	.
Calcification	2
Portal vein thrombosis	.	.	1	.	.	.	1	.	.	1
Periportal fibrosis	.	.	1	4	.	.	2	6	3	5
Subcapsular fibrosis	.	.	1	4	.	.	3	6	2	5

A: acute phase on 3rd day, C: chronic phase on 3rd or 4th week, n: number of cases

[illegible]

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An Experimental Study on the Effect of Mixture of Absolute Ethanol and Lipiodol Injected into Normal Liver of Rabbit : CT Features and Histopathologic Changes¹

Mee Ran Lee, M.D.^{1,2}, Yun Hwan Kim, M.D., In Ho Cha, M.D.
Kyoo Byung Chung, M.D., Won Hyuk Suh, M.D., Soon Ho Um, M.D.³, Young Hee Choi, M.D.⁴

¹Department of Diagnostic Radiology, Korea University College of Medicine,

²Department of Diagnostic Radiology, Hallym University College of Medicine,

³Department of Internal Medicine, Korea University College of Medicine,

⁴Department of Pathology, Hallym University College of Medicine

Purpose: To investigate the safety and usefulness of Lipiodol-percutaneous transhepatic ethanol injection(L-PEI) and to determine the appropriate concentration of Lipiodol during L-PEI. This was achieved by evaluating CT findings and histopathologic changes according to the concentration of Lipiodol, amount of ethanol, and the time interval after injection into normal rabbit liver.

Materials and Methods: This experimental study involved 18 New Zealand rabbits under US guidance. They were divided into five groups according to injected materials; two rabbits with 0.4cc of normal saline(group I), six with 0.4cc of ethanol in the left hepatic lobe(group II), and 0.4cc of Lipiodol in the right hepatic lobe(group III), five rabbits with 5% Lipiodol-ethanol(5% vol. of Lipiodol+ 95% vol. of ethanol), 0.2cc in the right hepatic lobe, and 0.4cc in the left(group IV); and five rabbits with 10% Lipiodol-ethanol as per group IV(group V). CT was performed immediately, one week, two weeks, and three-four weeks after injection, and pathologic specimens were obtained on the third day(acute phase) and during the third or fourth week(chronic phase) after injection.

Results: On CT, intrahepatic localization of the L-PEI injection site was well demonstrated as a focal high attenuated area which gradually decreased in attenuation on follow up CT. The opacification of the inferior vena cava by Lipiodol, the linear distribution of Lipiodol along portal veins or fissures, and peritoneal leakage were clearly demonstrated in groups III-V, though the effects gradually disappeared during follow-up CT. There was no remarkable difference in gross CT attenuation between group IV and group V. The main pathologic findings during the acute phase of group II were coagulation necrosis surrounded by macrophage, inflammatory reaction, and early periportal and subcapsular fibrosis. The findings in group IV and V were similar to those in group II and additional fat vacuole accumulations in the necrotic area were also seen. During the chronic phase of group II, areas of necrosis were absent or smaller and were surrounded or replaced by more organized fibrosis, macrophage or multinucleated giant cell infiltration. Periportal, subcapsular fibrosis was also found. In group IV and V, the findings were similar to those of group II, though additional fat vacuoles in fibrotic or necrotic areas, foreign body reaction to fat vacuole, regenerating nodule and calcification were also observed.

Conclusion: L-PEI is more useful for the detection by CT of an injection site than PEI alone, and with regard to CT and histopathologic findings, there was no significant difference between the 5% and 10% Lipiodol-ethanol groups. Compared to PEI, L-PEI provoked no significant additional hepatic injury; only fatty change and foreign body reaction were noted. Thus, L-PEI is more useful than PEI for the management of HCC.

Index words: Animals

Liver, interventional procedure

Liver, CT

Alcohol

Contrast media, fatty acid

Address reprint requests to : Yun Hwan Kim, M.D., Department of Diagnostic Radiology, Korea University College of Medicine

126-1, Anam-Dong, Sungbuk-ku, Seoul 136-705, Korea.

Tel. 82-2-920-5573 Fax. 82-2-929-3796 E-mail. yhkku@netsgo.com