

가

()¹

.² .² .² .³ .³

: 가 (high - intensity focused ultrasound system, HIFU,)
 : 가 18 19

MRI

: 4 cm .
 가 89% . 2 MRI 79%
 가 . 89%
 , 10
 가 가 12 24 , 가 가
 6 가
 : 가 ,

5)
 (1), 80% (8 - 10). 0.8 - 3.5
 가 , , MHz (: 1 - 20 MHz)가 , 0.8
 3 - 6 (2). 6 - 10 , 가 MHz가 (8).
 , 80
 가 (heating effect) 가
 (compression)

(radiofrequency ablation), (laser (rarefaction)
 ablation), (cryotherapy), (microwave (acoustic cavitation)
 therapy) (3 - 7) , (8).
 (high - intensity focused ultrasound, HIFU,) 2005 Wu (11) 8 가
 (8 - 11).

(median survival time) 11.25 ,

(

가

¹가
²가
³가

: 가 ()

, 6
18 가

가

2

2006 1 16 가 2007 1 15 18 (MRI)

. 1 T1
6

18 가 9 , 가 9 , score 3 ,
63 (47 -70), 가 50% score 2,
가 가 가 50% score 1 ,
score 0 .

CT MRI CA19-9 3,888 U/mL
(13 - 20,000 U/mL) . CA19-9 , 3
9 , 6

score 3, 가
score 2, 가
score 1 , 가
score 0 . MRI

3

SPSS 9.0 (SPSS Inc, Chicago, IL, U.S.A.)
(Pearson)

. 18 19 , p
< 0.01

high-intensity focused
ultrasound system (Chongqing Haifu; Chongqing Haifu,
Chongqing, China) , 120 mm , 135 mm
, 0.8 MHz

120 - 240 MHz score 2, score 3, 가 score 1 ,
가 score 0 .

10

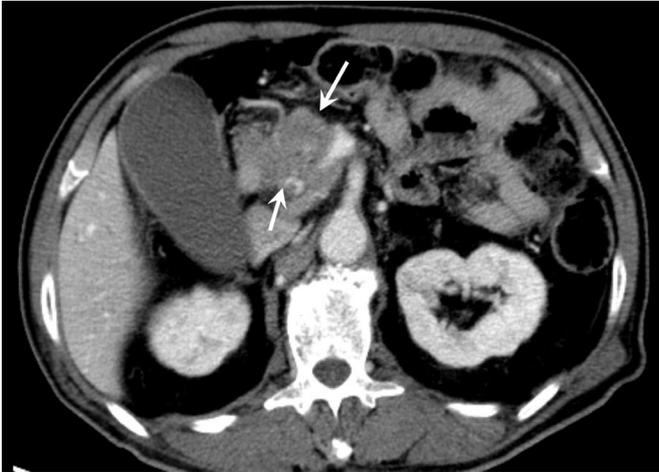
, 3
, 2

300 - 500 mL 가

18 17 CT MRI . 2 MRI
1 가
2

46 (17) . 18
6 가 2-15 , 8 .

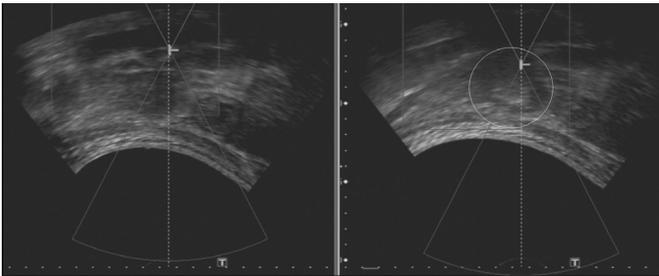
4 cm (2.5 cm - 7
cm) , 가 11 , 가 6 ,



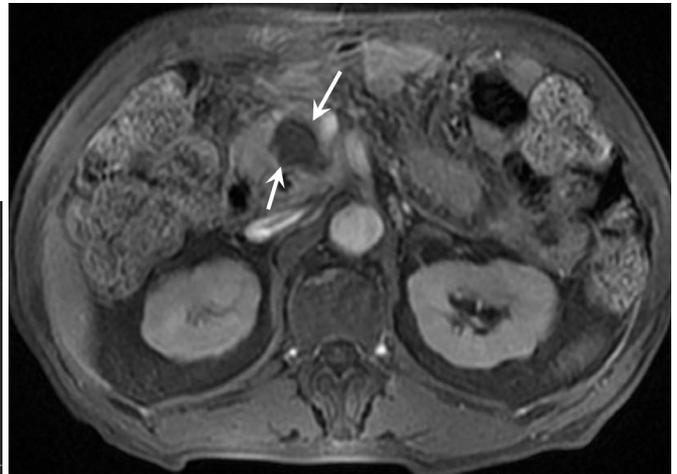
A



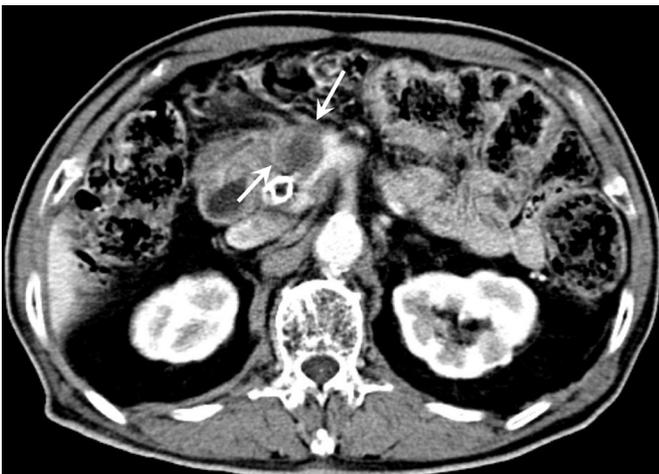
B



C



D



E

Fig. 1. A 80 year-old man with pancreatic head cancer. **A, B.** Initial enhanced CT (**A**) and fat suppressed T1 weighted MR (**B**) images. There is an about 3.5 cm sized mass in the pancreatic head portion with invasion of adjacent vessel (arrows). **C.** During HIFU treatment, the target area of the tumor was changed to echogenic focus on ultrasonography (white circle). Total anesthesia time was 175 minutes, total procedure time was 110 minutes and treatment time was 1599 sec. **D.** Fat suppressed enhanced T1 weighted MR image after 2 weeks from HIFU treatment. Hypointense change of the mass is noted, suggesting necrosis of treated pancreatic cancer (arrows). **E.** After 7 months from HIFU treatment, enhanced CT scan shows decreased size of the ablated tumor (arrows).

24 (9 - 46) ,
 가 4 4
 가
 2 (Fig. 2). 10 5
 가
 가 12
 Table 2
 12 4
 , 1 21 - 31
 , 1 가
 , 6 가

가 , , , , ,
 가 (12).
 가 (11).

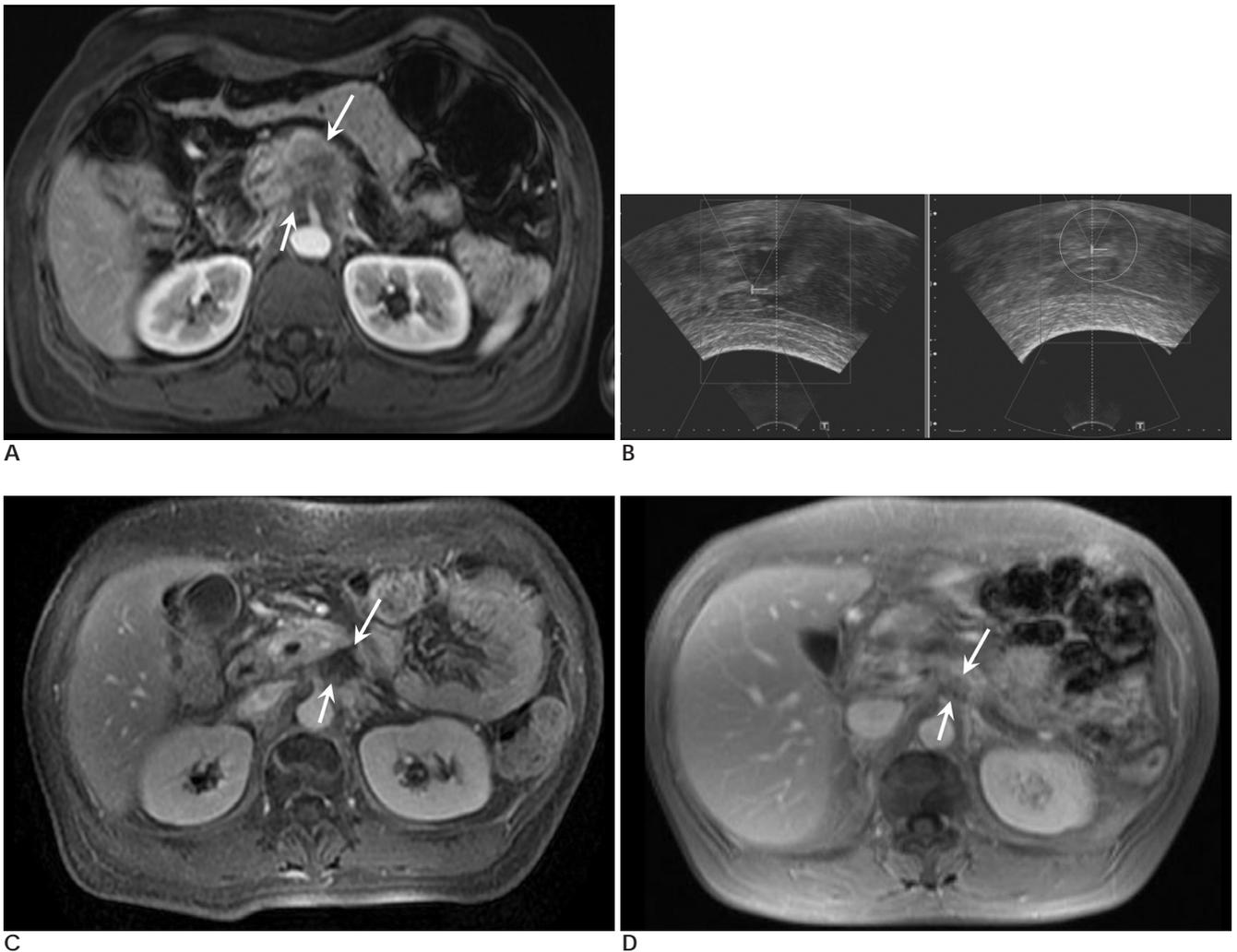


Fig. 2. A 51 year-old-woman with pancreatic body cancer
A. Before HIFU treatment, fat suppressed enhanced T1 weighted MR image shows an about 3 cm sized low signal intensity mass in the pancreatic body portion with invasion of adjacent vessel (arrows).
B. There is hyperechoic change of target tumor on ultrasonography during the HIFU treatment (white circle). Total anesthesia time was 275 minutes, total procedure time was 170 minutes and treatment time was 3067 sec.
C. 2 weeks after HIFU treatment, fat suppressed enhanced T1 weighted MR image shows clear coagulative necrosis in the target area (arrows).
D. 3 months after HIFU treatment, fat suppressed enhanced T1 weighted MR image shows decreased size of the treated mass in the pancreatic body from 3 cm to 1.5 cm (arrows).

High-intensity Focused Ultrasound Treatment (HIFU) for the Advanced Pancreatic Cancer¹

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Purpose: We wanted to evaluate the levels of effect and safety of high-intensity focused ultrasound ablation (HIFU) for treating patients with advanced pancreatic cancer.

Materials and Methods: Nineteen sessions of HIFU, with the patients under general anesthesia, were performed in 18 patients with advanced pancreatic cancer. The change of the gray-scale of the target lesion was analyzed during HIFU, and MRI was performed before and after HIFU. We assessed the extent of coagulative necrosis, the change of pain and the complications after HIFU. The change of tumor size and the survival of patients were also evaluated.

Results: The average size of tumor was 4 cm in diameter. Eighty nine percent of the target tumors showed increased echogenicity. On MRI, necrosis of the entire target tumor occurred in 79% of the patients. After treatment, effective pain relief was noted in 89% of the patients. There were no major complications. No size increase of the treated tumor was noted during 24 weeks of follow-up for 10 patients. Six patients among 12 patients who were available for follow-up are still alive and they are receiving chemotherapy. Six patients expired due to other disease or progression of metastasis.

Conclusion: HIFU is a safe method without any major complications, and it is effective for inducing tumor necrosis and achieving pain control for patients with advanced pancreatic cancer.

Index words : Pancreas, neoplasms
Interventional procedures
Neoplasms, therapeutic radiology
Ultrasound (US), therapeutic
Therapeutic radiology

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