Observation of High Intensity Focused Ultrasound Treating 40 Cases of Cancer of Pancreas

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Abstract **objective** To evaluate the recent curative efficacy and security of high intensity focused ultrasound (type FEP–BY01) in patients with pancreas cancer. **Methods** 40 patients with pancreas cancer were treated by FEP–BY01. **Results** The overall response rate was 90% (36/40), including 20% (8/40) complete response (CR) and 70% (28/40) partial response (PR). The inefficiency rate was 10% (4/40) The cancerous pain was relieved in 80% patients (32/40). No complications such as pancreatic juice leakage, bleeding, perforation of gastrointestinal tracts, scalding of skin in the group occurred. **Conclusion** this study shows that HIFU is a efficacious and safe therapy for the patients with pancreas cancer.

Key Words high intensity focused ultrasound (HIFU); cancer of pancreas

Pancreas cancer is one of the common malignant tumors of digestive system, which is characterized by long course, fast development, high death rate, and a median life span (not sure if this is right) of 6 months. It is hard to treat–only a limited number of pancreatic head cancers can be treated with surgery; most of the pancreatic body and tail cancers are not treatable with surgery. Our department used high intensity focused ultrasound (HIFU) to treat the patients with pancreas cancer .

The results were gratifying and are reported as the following:

MATERIALS AND METHODS

Clinical materials

40 cases of pancreas cancer were collected from Mar 2001 to Mar 2002 in first haspital of ji liu university, of them, male were 28, female 12. ages of the patients ranged from 55 to 78 years old (average age 64 years old). 29 cases with the cancer located at the head of the pancreas, 8 cases in the body, and 3 at the tail; tumor sizes was 3.0~7.8 cm in diameter, averaged 5.4cm. All the patients were not suitable for surgery.

29 atients were diagnosed having obstructive jaundice. They were treated with HIFU after surgical removal of the jaundice.

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Equipments and Parameters

Equipments: Model FEP–BY01 high intensity focused ultrasonic therapy apparatus for tumor (developed and manufactured by The People´s Hospital, Beijing Medical University). Output Power is 1~2kW, effective curative depth 3.5~14.0cm, curative media is DAW (defect air water), the field–detected focus are 0.3cm×0.3cm×0.8cm, 0.6cm×0.6cm×1.0cm. Cumulative points method was used to form a curative matrix. And the method of treating one subsection at a time was administrated to treat relatively large tumors. Major parameters: output power 1~2kW; single discharge time (t1), the duration of emitting one pulse series, is 0.1~0.28s; rest interval (t2), the duration between two series of pulses, t1: t2=2:1. Single point counts (T), the number of discharges needed to complete the treatment of one point, is 30~80. All the parameters can be adjusted according to the tumor´s position and depth, the density of the tumor organ, and the ultrasound attenuation rate. For the therapies of the 40 cases in this group, we set single discharge time to 0.2s, rest interval 0.1s, and single point counts 50. The whole therapy process was computer–automated.

Evaluation of the Curative Effects

Complete Response(CR): CT value of the tumor increases substantially after the therapy; B–ultrasonic echo from the treated area increases sharply or the tumor disappears; Colored Doppler(CDFI) shows that colored blood streams disappears in the tumor

area; clinical symptoms improve evidently or disappear; tests of the tumor markers return to normal or decrease evidently to below 50%. Partial Response (PR): CT value increases, B-ultrasonic echo from the treated area increases, and CDFI shows a few point-like bleeding in the tumor area; clinical symptoms improves; result of tumor marker test decreases by 25%~50%. Pathological Development: CT value doesn't change or decreases, B-ultrasonic diagnose shows a tendency of the tumor enlarging, CDFI shows a rich blood supply for the tumor area; no improvement in the clinical symptoms; results of tumor marker test increase evidently.

RESULTS

Clinical Curative Effects Among the 40 cases of pancreas cancer in this group, 20% (8/40) showed complete response to the therapy, 70% had a partial response; the effective rate is 90% (36/40) and the ineffective rate is 10%. The therapy results of the 40 cases are listed in table 1.

Out of the 29 patients with pancreatic head cancer, 20 were diagnosed with obstructive jaundice. Before HIFU therapy, surgical removal of the jaundice was administrated first. The HIFU therapy was applied after their incision healed. in the 11 cases of non-pancreas-head-cancer patients, we didn't find obstructive jaundice after the HIFU therapy.

The pain-relief effect of HIFU All 40 cases in this group had cancerous pain of various degrees, including 5 cases of class I, 4 cases of class II, 10 of class III, and 20 of class IV. 80% of the patients had complete or partial relief after the therapy.

Safety of the HIFU Therapy Through all the 280 therapies taken by the 40 patients, no local pain occurred and no anesthetic was needed.

Except for the local humidity and heat feeling in 20 patients, no complications such as pancreatic juice leakage, bleeding, perforation of gastrointestinal tracts, scalding of skin occurred.

Table 1 HIFU Therapy Results of 40 patients with Pancreatic Cancers

Cancer Location	Cases	CR	PR	PD	Number of HIFU Therapies (average)
Pancreatic Head	29	4	23	2	8
Pancreatic Body	8	3	4	1	7
Pancreatic Tail	3	1	1	1	6
Total	40	8	28	4	7

DISCUSSION

Pancreas cancer is one of the common malignant tumors found in digestive system. Surgical removal is suitable for only about 20% of the patients with pancreatic head cancer. Moreover, because of the histological characteristics of the pancreas, conventional treatments such as surgery, chemical therapy, radiation therapy has little, if none, curative effects on most of the patients. The clinical application of HIFU therapy created a new epoch of non-intrusive local treatment. Our department introduced HIFU therapy apparatus model FEP-BY01 and used it to treat 40 patients with pancreatic cancer. The effective rate was 90% and the rate of cancerous pain relief was 80%. These results are similar to that reported by the literature [1].

According to our observation of treating 40 with patients pancreas cancer, the method has evident curative effects on patients with small (<3cm3) focuses, while being less effective on patients with relative large (>5cm3) focuses. The main reason: FEP-BY01 therapy apparatus can finish the treatment of a small tumor in 2~4 times while more times are needed for larger tumors. Thus, the treatment of a large tumor is hard to completely control the treatment area or the boundary between treatments, and hence cannot completely inhibit the growth of the tumor. Another possible reason is that the not-yet-treated tumor cells propagate and invade the treated area. Moreover, large tumors have a large load capacity and abundant blood vessels inside and around them, blocking the ultrasonic energy from reaching its target. The consequences are that the focal temperature is too low and that

the targeted cells won´t necrosis. Thus, satisfying results could not be observed[2].

For patients with obstructive jaundice, the jaundice must be surgically removed before HIFU therapy. Among the 40 patients in this group, various degrees of obstructive jaundice were found in 20 patienttic with pancreas head cancer. HIFU therapy was administrated after jaundice removal. No reoccurrence of obstructive jaundice were found. Based on the above results, we think if a pancreatic cancer patient has obstructive jaundice, the jaundice must be surgically removed before application of HIFU therapy.

HIFU therapy has an evident effect of relieving pancreas cancerous pain[3]. 39 out of the 40 patients in this group had various degrees of cancerous pain. After HIFU therapy was applied, 32 of them had notable relief, an effective rate was 80%. The patients´ life quality was raised substantially. Of course, as a new therapeutic method, various aspects of HIFU therapy have to be studied further. Still, HIFU therapy could be regarded as a safe, non-intrusive, and reliable treatment, whose clinical application is worthy of popularization.

REFERENCES

1. He Shenxu, Xiong Liulin,Yu Jinsheng,et al.High intensity focused ultrasound in the treatment of abdominal and pelvic malignant tumors :prediminary result in 140 cases. Chinese Journal General Surgury, 2000,15(8):480–482.
2. Mu Qingxia, Shu Yongqian, Huang Jinsheng, et al. Observation of high Intensity Focused Ultrasound Treating 30 cases of Lymph Nodes Metastasis Cancer in Abdomen or Pelvis Cavity. Chinese Clinical Oncology, 2002, 7(2): 97–99.
3. He Shenxu, Xiong Liulin, Yao Songsen, et al. The preclinical research of high intensity focused ultrasound. Journal of Medical University, 1997, 31:573–565.