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Original Article

Comparison of percutaneous microwave ablation and laparoscopic resection in the prognosis of liver cancer

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Abstract: The effect of percutaneous microwave ablation and laparoscopic resection on the prognosis of liver cancer was investigated. Ninety patients with liver cancer treated at our hospital from March 2010 to March 2012 were divided into group A and group B (n=45) by using a random number table, and the surgical conditions and the prognosis were compared. The surgical conditions of patients in group A were significantly better than those in group B (P<0.05). The incidence of complications in group A was 6.67%, which was obviously lower than that of group B (P<0.05). The local recurrence rate of group A was 20.00%, and that of group B was 8.89%, which showed a significant difference (P<0.05). The two groups did not differ significantly in terms of either total recurrence rate (P>0.05) or 1-year, 2-year and 3-year survival (P>0.05). Both percutaneous microwave ablation and laparoscopic resection had a good long-term efficacy in liver cancer. However, percutaneous microwave ablation was superior as it caused less invasiveness, reduced the incidence of complications and improved prognosis of liver cancer.

Keywords: Liver cancer, laparoscopic resection, percutaneous microwave ablation, prognosis

Introduction

Primary liver cancer is a common malignancy with high incidence and mortality, ranking the fifth in terms of incidence among all malignancies in China [1]. The growing incidence of primary liver cancer in recent years has caused widespread concern. The pathogenesis of primary liver cancer is unclear, and most cases are diagnosed in middle to late stage due to the lack of specific symptoms in early stage. The common treatments of liver cancer are surgery, chemotherapy, radiotherapy and biotherapy [2-4]. Laparoscopic resection and microwave ablation, emerging as the new techniques, have been widely used recently [5, 6]. But only a few studies focused on the comparison of the prognosis of the two techniques. In this study, we compared the prognosis of laparoscopic resection and percutaneous microwave ablation for patients with liver cancer.

Data and methods

General information

Ninety patients treated at our hospital from March 2010 to March 2012 were enrolled, and the informed consent was obtained from all patients and their relatives. The experimental protocol was approved by the hospital ethics committee. Using the random number table method, 90 cases were divided into group A and group B (n=45). Group A consisted of 32 males and 13 females aged 27-76 years old, with an average of 57.9±3.4; the tumor size was 2-5 cm with an average of 3.8±0.9 cm; 20 cases had single nodules and 15 had multiple nodules. Group B was comprised of 34 males and 11 females, aged 26-78 years old with an average of 58.3±3.1; the tumor size was 1-5cm with an average of 3.6±0.7 cm; 21 cases had single nodules and 14 cases had multiple nodules. The two groups did not show significant differences in general information (P>0.05), and therefore were clinically comparable.

Inclusion criteria: Cases diagnosed as liver hepatic by relevant standards and confirmed by imaging examinations and laboratory tests, tumor size ≤5 cm, classified as grade A and B by Child-Pugh staging with no surgical contraindications, and showing good compliance with this research.

Table 1. Comparison of surgical time and intraoperative blood loss in the two groups ($\bar{x} \pm s$)

Group	n	Surgical time (min)	Intraoperative blood loss (ml)
Group A	45	96.7±27.8	231.9±74.2
Group B	45	134.2±34.3	320.5±89.4
t		5.69	5.11
P		0.0000	0.0000

Table 2. Comparison of incidence of complications between the two groups [n, (%)]

Group	n	Bile leakage	Pleural effusion	Postoperative blood loss	Incidence of complications (%)
Group A	45	1 (2.22)	1 (2.22)	1 (2.22)	6.67
Group B	45	3 (6.67)	3 (6.67)	2 (4.44)	17.78
x^2		2.33	2.33	0.76	5.75
P		0.1268	0.1268	0.3816	0.0164

Exclusion criteria: Cases already presenting with extrahepatic metastases; classified as grade C by Child-Pugh staging; combined with portal hypertension; diffuse liver cancer; severe organ insufficiency; coagulation disorders.

Equipments

MTC-3-type microwave generator (Medical Device Regulation Certificate (2001) No. 325-0271) manufactured by Nanjing Forsea Microwave & Electronic Research Institute, with power 0-120 W adjustable and frequency of 2450 MHZ; Philips Allura Xper FD20 fixed X-ray system; whole-body CT scanner (GE Corporation, USA), 5 mm slice thickness, 128×64, 3-5 slice thickness for local focus.

Treatment

Preoperative routine tests were performed for the two groups, including routine blood test, coagulation test, liver and kidney function test and viral marker test, along with liver and chest CT scans. Blood pressure, body temperature and pulse were recorded.

Cases in group A were treated by modified percutaneous microwave ablation. The number, position and size of tumors were assessed preoperatively. Site of puncture was selected after local anesthesia, and puncture was made away from the important tissues such as the portal vein. The needle was inserted under CT guidance. The tumors were ablated successively from deep to superficial position, with an ablative safety margin of at least 0.5 cm for 8-15 min under the power of 50-70 W. After ablation, contrast-enhanced ultrasound was performed to check if the ablation was complete. The vital signs were monitored closely during surgery.

Laparoscopic resection was performed for group B. An arc incision measuring 1 cm was made at the lower margin of umbilical region after general anesthesia. Veres needle was used for umbilical puncture, and artificial pneumoperitoneum was constructed with the pressure of 10-12 mmHg. After exploration using 30° laparoscope, trocars were inserted under laparoscopic guidance and the tumors were resected. The incision was closed with sutures, and the resected tissues were placed into specimen bags and cut into pieces.

Criteria for efficacy assessment

Surgical time, intraoperative blood loss and incidence of complications were recorded for the two groups. All cases were followed up for 1-3 years by telephones and outpatient services. The recurrence rates and the 1-year, 2-year and 3-year survival of the two groups were compared.

Statistical method

Statistical analysis was performed by using SPSS17.0 software. T-test was adopted for comparing the measurement data of the two groups, which was expressed as $\bar{x} \pm s$. The rates were analyzed with χ^2 test and expressed as percentages (%). $P<0.05$ indicated statistically significant difference.

Results

Surgical conditions

The surgical time of patients in group A was obviously shorter than that in group B, and the intraoperative blood loss was also less in group A. The differences were of statistical significance ($P<0.05$) (see **Table 1**).

Table 3. Comparison of recurrence between the two groups [n, (%)]

Group	n	Local recurrence	Total recurrence
Group A	45	9 (20.00)	22 (48.89)
Group B	45	4 (8.89)	20 (44.44)
x^2		4.99	0.39
P		0.0254	0.5282

Table 4. Comparison of long-term survival between the two groups [n, (%)]

Group	n	1-year survival	2-year survival	3-year survival
Group A	45	40 (88.89)	30 (66.67)	15 (33.33)
Group B	45	41 (91.11)	31 (68.89)	17 (37.78)
x^2		0.27	0.11	0.43
P		0.6007	0.7369	0.5109

Incidence of complications

The incidence of complications was 6.67% in group A, which was significantly lower than that of group B (P<0.05) (see **Table 2**).

Recurrence

The local recurrence rate of group A was 20.00%, which showed an obvious increase compared with group B (8.89%) (P<0.05); the total recurrence rate was 48.89% in group A, and that of group B was 44.44%, indicating no significant difference (P>0.05) (see **Table 3**).

Long-term survival

Group A showed no significant differences from group B in terms of 1-year, 2-year and 3-year survival (P>0.05) (see **Table 4**).

Discussion

Very little about the pathogenesis of primary liver cancer which has high incidence and mortality is known. In China, most patients with primary liver cancer progress from hepatitis B. Surgical treatment is no longer suitable for patients who are diagnosed in late stage, and the prognosis of liver cancer is poor due to high recurrence. It is of high importance to improve prognosis and prolong survival by using appropriate treatment methods. Tumor resection is considered to be the most effective treatment for liver cancer, and a long-term survival rate can be achieved by this method. However, the laparotomic surgery is disadvantageous in invasiveness, high incidence of complications and poor prognosis.

At present, laparoscopic resection of tumors has found wide clinical applications. Laparoscopic resection had the advantages of minimal invasiveness, high safety, low incidence of complications, and less adverse impact on immune functions as compared with laparotomy [7]. In spite of these advantages, it is still uncertain as to the effect of laparoscopic resection for liver cancer patients who also have liver cirrhosis or other liver diseases. Liver has complex blood vessel distribution and abundant blood supply. Portal hypertension associated with liver cirrhosis can increase the risk of intraoperative bleeding due to poor coagulation function in these patients. Moreover, the boundary between liver cirrhosis tissues and tumor is obscure, and therefore the safety margin is hard to guarantee, increasing the risk of complications. Laparoscopic resection for liver cancer was not suitable for patients with large tumor size, involvement of portal vein or inferior vena cava, or combined hepatic insufficiency and cirrhosis. Patients at late stage of liver cancer usually should have impaired liver functional reserve. Therefore excess resection of liver parenchyma may lead to severe complications such as liver failure.

Percutaneous microwave ablation is a novel technique for the treatment of tumors, and the ablation need is inserted under CT guidance. Intense heat produced by microwave radiation in local tissues can kill the tumor cells by inducing the solidification of proteins in tumor cells. So far percutaneous microwave ablation has been extensively accepted for the treatment of small hepatocellular carcinoma [8, 9]. Some studies [10, 11] showed that there were no significant differences in short- and long-term efficacy in early-stage liver cancer and small hepatocellular carcinoma using percutaneous microwave ablation and conventional surgery. We found that the two groups treated by different methods did not differ significantly in total recurrence rate, 1-year, 2-year and 3-year survival (P>0.05). However, the local recurrence rate of group A treated by percutaneous microwave ablation was significantly higher than that of group B treated by laparoscopy (P<0.05),

probably due to the large tumor size in some cases. Poulou et al. [12] discovered that microwave ablation reduced liver damage and preserved normal liver tissues to the maximum extent, with less impact on liver function. In addition, microwave ablation was easier to implement for lesions located in the center of the liver. Microwave ablation had the advantages of minimal invasiveness, less complications and better prognosis, and the applicability was wider and the patient acceptance was higher as compared with surgical resection. As indicated by the present study, the surgical time of patients in group A was obviously shorter than that in group B, and the intraoperative blood loss was smaller ($P<0.05$). The incidence of group A was much lower than that of group B ($P<0.05$). Therefore, microwave ablation is ideal for improving the prognosis of liver cancer.

Puncture and burning process in percutaneous microwave ablation may cause damage to normal tissues and lead to complications. To solve this problem, microwave ablation can be carried out under laparoscopic or CT guidance and the treatment scheme can be tailored to individual situations. Li et al. [13] also confirmed the effectiveness of CT-guided percutaneous microwave ablation. Some scholars pointed out that the treatment effect of microwave ablation could be improved and the incidence and recurrence be reduced with the assistance of 3D visualization system and robotic system [14, 15]. Whether microwave ablation is suitable for pancreatic diseases needs to be demonstrated by a large number of prospective trials.

Percutaneous microwave ablation can achieve comparable effect as laparoscopy for the treatment of primary liver cancer, with additional benefits of minimal invasiveness, high safety, reduced incidence of complications and improved prognosis.

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Disclosure of conflict of interest

None.

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References

[1] Wang R, Chen XZ, Zhang MG, Tang L, Wu H. Incidence and mortality of liver cancer in mainland china: Changes in first decade of 21st century. Hepatogastroenterology 2015; 62: 118-121.

[2] Zhao J, Lawless MW. Resminostat: Opening the door on epigenetic treatments for liver cancer. Hepatology 2015; [Epub ahead of print].

[3] He F, Lin X, Xie F, Huang Y, Yuan R. The effect of enhanced recovery program for patients undergoing partial laparoscopic hepatectomy of liver cancer. Clin Transl Oncol 2015; 17: 694-701.

[4] Greene CM, Varley RB, Lawless MW. Micrornas and liver cancer associated with iron overload: Therapeutic targets unravelled. World J Gastroenterol 2013; 19: 5212-5226.

[5] Gamblin TC, Holloway SE, Heckman JT, Geller DA. Laparoscopic resection of benign hepatic cysts: A new standard. J Am Coll Surg 2008; 207: 731-736.

[6] Liu F, Liang P, Yu X, Lu T, Cheng Z, Lei C, Han Z. A three-dimensional visualisation preoperative treatment planning system in microwave ablation for liver cancer: A preliminary clinical application. Int J Hyperthermia 2013; 29: 671-677.

[7] Day A, Smith R, Jourdan I, Fawcett W, Scott M, Rockall T. Retrospective analysis of the effect of postoperative analgesia on survival in patients after laparoscopic resection of colorectal cancer. Br J Anaesth 2012; 109: 185-190

[8] Qian GJ, Wang N, Shen Q, Sheng YH, Zhao JQ, Kuang M, Liu GJ, Wu MC. Efficacy of microwave versus radiofrequency ablation for treatment of small hepatocellular carcinoma: Experimental and clinical studies. Eur Radiol 2012; 22: 1983-1990.

[9] Wang ZL, Liang P, Dong BW, Yu XL, Yu de J. Prognostic factors and recurrence of small hepatocellular carcinoma after hepatic resection or microwave ablation: A retrospective study. J Gastrointest Surg 2008; 12: 327-337.

[10] Kuang M, Lu MD, Xie XY, Xu HX, Mo LQ, Liu GJ, Xu ZF, Zheng YL, Liang JY. Liver cancer: Increased microwave delivery to ablation zone with cooled-shaft antenna–experimental and clinical studies. Radiology 2007; 242: 914-924.

[11] Livraghi T, Meloni F, Solbiati L, Zanus G. Complications of microwave ablation for liver tumors: Results of a multicenter study. Cardiovasc Intervent Radiol 2012; 35: 868-874.

[12] Poulou LS, Botsa E, Thanou I, Ziakas PD, Thanos L. Percutaneous microwave ablation vs radiofrequency ablation in the treatment of hepatocellular carcinoma. World J Hepatol 2015; 7: 1054-1063.
[13] Li X, Fan WJ, Zhang L, Zhang XP, Jiang H, Zhang JL, Zhang H. Ct-guided percutaneous microwave ablation of liver metastases from nasopharyngeal carcinoma. J Vasc Interv Radiol 2013; 24: 680-684.
[14] Stättner S JR, Yip VS. Microwave ablation with or without resection for colorectal liver metastases. Eur J Surg Oncol 2013; 39: 844-849.
[15] Swan RZ, Sindram D, Martinie JB, Iannitti DA. Operative microwave ablation for hepatocellular carcinoma: Complications, recurrence, and long-term outcomes. J Gastrointest Surg 2013; 17: 719-729.