Original Article

Microwave ablation as palliative treatment of locally recurrent colorectal cancer

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Abstract

BACKGROUND: Patients suffering local recurrence of colorectal cancer which cannot be surgically removed are troubled with severe pain and poor quality of life. The aim of this study is to evaluate the efficacy and safety of computed tomography (CT)-guided microwave ablation (MWA) as palliative treatment for recurrent unresectable colorectal cancer. **MATERIALS AND METHODS:** Thirty-one patients were suffering locally recurrent colorectal cancer underwent MWA with CT guidance. The MWA power was set at 60–80 W, 6–8 min. Effectiveness was evaluated by visual analog scale (VAS) with a follow-up of 6-month. Complications were also recorded. **RESULTS:** Technical success was achieved in all patients. Mean VAS preprocedure was 7.10. Mean VAS postprocedure were as follows: 1 week, 2.65 ($P < 0.001$); 1 month, 0.81 ($P < 0.001$); 3 months 0.45 ($P < 0.001$); and 6 months 0.19 ($P < 0.001$). No serious complications were observed including intestinal fistulas, bladder fistulas, or peripheral vascular or nerve injury. **CONCLUSIONS:** CT-guided MWA as treatment of recurrent colorectal cancer can quickly and effectively relieve pain. It is a minimally invasive, safe, and efficient palliative treatment of recurrent colorectal cancer.

Key Words: Colorectal cancer, microwave ablation, pain

Introduction

Colorectal cancer becomes the third common causes of cancer death among males and females.[1] Despite great progress in the treatment of colorectal cancer being made during the past 20 years, distant metastasis and local recurrence are still the main factors associated with a poor prognosis. Approximately 15–30% of patients develop local recurrence within 2 years postoperatively, and the median survival time is about 8 months without local treatment.[2-4] The presacral space is the most common site of local recurrence. Local recurrences without the pelvic wall being invaded can be surgically removed. However, if the dorsal and dorsolateral pelvic walls have been invaded, the recurrences cannot be completely resected, and the 5-year survival rate of such patients is very low (<5%).[5] Their quality of life is also seriously affected; the majority of patients experience severe pain. Chemoradiotherapy can reduce the pain to some extent;[6] however, it has a high incidence of complications, and the benefits for patients are therefore limited. For these reasons, the development of safe and effective treatments is imperative. As a novel technique for tumor ablation in the recent decade, microwave ablation (MWA) has been widely applied to treat multiple types of malignant tumors including liver, lung, metastatic bone, and renal tumors.[7-10] We treated 31 cases of unresectable recurrent colorectal cancer with MWA under computed tomography (CT) guidance and performed the present study to investigate the safety and efficacy of this treatment.

Materials and Methods

Patients

Thirty-one patients with colorectal cancer (20 male, 11 female; age, 36–82 years) underwent MWA in our hospital from May 2009 to May 2013. Among these 31 patients, there were 31 lesions (2.3–6.5 cm); 16 were eccentric, and 15 were central. The diagnosis was established by a history of colorectal cancer; clinical manifestations, mainly pain; newly formed pelvic masses on CT or magnetic resonance imaging (MRI); and pathologic changes in biopsy specimens. All 31 patients had histories of colorectal cancer; a pelvic mass was discovered by CT and MRI in 28 and 3 patients, respectively. All patients' diagnoses were confirmed by biopsy. The time to recurrence was 5–33 months. Four patients had concurrent distant metastases (three to the liver, one to the lung). Twenty-two patients received concurrent chemoradiotherapy (45–50 Gy, oxaliplatin or irinotecan + 5-FU, 3–4 cycles). Two patients underwent ^{125}I-brachytherapy, and seven underwent neither chemotherapy nor radiotherapy. All patients had normal liver, kidney, and coagulation function and no other contraindication for invasive surgery, and their platelet counts were $\geq 50 \times 10^9$. The study was approved by Ethics Committee of the Shandong Provincial Hospital affiliated to Shandong University. The patients were informed in details about the risks and benefits associated with MWA treatment and provided written informed consent for the ablation procedure.

Instruments

The GE LightSpeed 16 or GE LightSpeed VCT 64 spiral CT system (GE Healthcare, USA) was used for imaging guidance and monitoring. A microwave platform (i) KY-2450B; Kangyou Microwave Institute, Nanjing, China. Registration standard: YZB/country 0247-2011. SFDA (III) 2011 NO: 3251059 or; (ii) MTC-3C MWA system; Nanjing Qi Ya Research Institute of Microwave Electric, China. Registration standard: YZB/country 1408-2003. NO: SFDA (III) 20073251059 was used. The main frequency was 2450 GHz, and the output power was 0–100 W. Microwave antenna has effective length of 100–180 mm, and 14–18 G outside diameter, with a 15 mm active tip, using water circulation cooling system to reduce the surface temperature of the antenna.

Therapeutic protocol

A combination of local and preemptive analgesia was applied. All patients fasted for 12 h. Venous access was established in the lower extremity. Thirty minutes before the procedure, 10 mg of morphine was administered

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by subcutaneous injection, and 10 mg of diazepam was administered by intramuscular injection. Fifteen minutes before the procedure, 50 mg of flurbiprofen was administered intravenously as preemptive analgesia, and a second dose was given 8 h after the procedure. Local analgesia comprised a combination of 2% lidocaine and 0.75% bupivacaine (10 ml lidocaine and 5 ml bupivacaine, diluted to 40 ml with normal saline). MWA procedure was performed under CT-guidance. The detailed of MWA was described in a previous publication.[9,11] One antenna was applied for tumors ≤3.5 cm in diameter, and two antennae for >3.5 cm in diameter simultaneously.[11-14] MWA with an output of 60–70 W/5–7 min and an ablative zone of nearly 3.5 cm × 3 cm was used with a proposed ablative margin of 0.5 cm.

Evaluation

All patients received visual analog score (VAS) training and provided written informed consent. A 10-point score was used for VAS evaluation: 0 point, no pain; 1–3 points, mild pain; 4–6 points, moderate pain; 7–9 points, severe pain; and 10 points, intolerable pain. All 31 patients had various degrees of pain before therapy with VAS score ranging from 4 to 10. Twenty-two of the 31 patients (71%) had a VAS score ≥7. VAS score was assessed by physicians before (baseline) and at 1 week, 1, 3, and 6 months after the procedure. The dose of daily morphine was also recorded.

Complication assessment

Complication assessment was guided by standards which were set by the International Working Group on Imagine-guided Tumor Ablation in 2005.[15] Major complications were defined as follows: Clinical symptoms after or during image-guided ablation that may be life-threatening if not managed, resulting in substantial damage and dysfunction; patients requiring hospitalization or prolonged hospitalization. Minor complications were defined as follows: Self-limiting without sequelae and requiring only a short hospital stay for observation or treatment.[14,16-21] Side effects were also noted such as pain, postablation syndrome, and asymptomatic minor bleeding or fluid accumulation on CT.

Statistical analysis

SPSS 11.5 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Comparison between groups was performed by the Chi-square test. Statistical significance was set at $P < 0.05$.

Results

Pain control

All patients experienced pain before MWA. VAS scores ranged from 4 to 10, and 22 patients had a VAS score of ≥7. One week after MWA, 23 of 31 patients (74.2%) had a VAS score of ≤3, and 4 (12.9%) had a VAS score of 0. At 1 month, 30 of 31 patients (96.8%) had a VAS score ≤3, and 14 (45.2%) had a VAS score of 0. At 3 months, 23 of 31 patients (74.2%) achieved a VAS score of 0 point. At 6 months, excluding the 4 patients who died, all 27 patients (100.0%) had a VAS score ≤1, and 25 (92.6%) had a VAS score of 0. One patient had PD at 3 months, and two patients had PD at 6 months; however, these three patients showed no increase in their VAS score [Figure 1].

Side effects and complications

Side effects

All patients experienced different levels of pain during ablation. Six patients experienced moderate or severe pain during MWA. Another 12 patients experienced mild pain within 24 h after MWA. No patients experienced severe pain or intolerable which were after MWA. Ten patients (32.3%) developed postablation syndrome, which manifested as a mild fever (<38.5°C), fatigue, malaise, nausea, and vomiting.

Complications

Two patients (6.5%) developed temperature and sensory disturbances associated with lower extremity pain, which was relieved by Vitamin B12 treatment 1–3 months after ablation. One patient (3.2%) developed a postablation abscess, which was controlled by drainage and antibiotic therapy. One patient (3.2%) developed an impediment of the left ankle, which improved in 3 months by Vitamin B12 treatment and rehabilitation. One patient (3.2%) developed difficulty urinating and urinary retention, which were relieved 1 month later by urinary catheter placement, Vitamin B12 treatment, and bladder function training. No patients exhibited intestinal fistulas, bladder fistulas, peripheral vessel or nerve damage. No patient died during the procedure or in 30 days after MWA. The average hospital stay was 4.7 days (range, 3–15 days).

Discussion

Pelvic recurrence is not only associated with a poor prognosis but also seriously affects patients' quality of life; most patients experience intolerable pain. In this study, 71% of the patients had a VAS score of ≥7 before ablation [Figure 1]. The VAS score decreased to ≤3 for 74.2% of the patients 1 week after MWA and for 96.8% of the patients 1 month after MWA. Notably, 45.2% of the patients achieved a VAS score of 0 1 month after MWA, and 74.2% and 100.0% of the patients achieved a score of 0 at 3 and 6 months after MWA. This shows that MWA can quickly and effectively relieve severe pelvic pain in patients with local recurrence after colorectal cancer surgery,

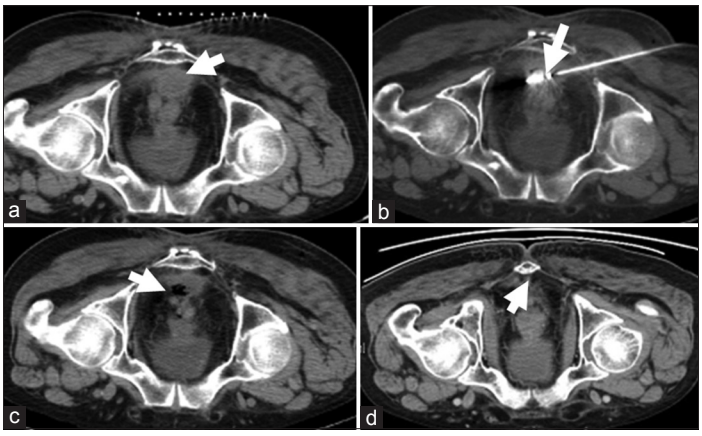

Figure 1: A 61-year-old male patient with pelvic recurrence 13 months postsurgery. (a) The lesion was located in the presacral space near the rectum and measured about 3.0 cm × 2.8 cm (arrow, premicrowave ablation). (b) The tumor was punctured with a microwave antenna (arrow). (c) The lesion exhibited obviously reduced density, and the central portion appeared empty immediately after microwave ablation (arrow). (d) Sixty months after microwave ablation, the lesion almost disappeared (arrow)

including patients who have undergone failed synchronous chemoradiotherapy (in our group, 22 patients underwent failed chemoradiotherapy). This pain relief was constant, even in patients with local tumor progression (3 patients in this group developed local advancement within 6 months). These results are similar to those of Mylona *et al*.[22] and Ohhigashi and Watanabe,[23] who performed radiofrequency ablation in their studies. Possible causes of this effect may include:[24] (i) destruction of the sensory fibers of the sacral plexus by thermal ablation; (ii) shrinkage of the tumor, leading to reduction of its stimulation of the sacral nerve plexus after ablation; and (iii) tumor necrosis after ablation, reducing the production of certain cytokines such as tumor necrosis factor-α, various interleukins, and transforming growth factor-β secondary to central sensitization, and pain upregulation. If pain relief is mild or very short-lived after MWA, complications should be suspected, especially abscess formation. One patient with a postablation abscess developed pain recurrence after only a short period of relief.

The safety of this treatment was a major concern with respect to pelvic recurrence. We used CT guidance and avoided blind performance of ablation. Because the lesions were relatively fixed, all treatments were completed accurately by CT guidance without unintentional damage to surrounding structures. The major side effects in this study were intraoperative pain and postablation syndrome. The major complication was abscess formation, and minor complication was peripheral nerve injury. These side effects and complications were successfully managed.

Conclusion

This study has shown that CT-guided MWA for recurrent colorectal cancer achieves quick, effective pain relief. This therapy is a minimally invasive, safe, and efficient new technology.

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