

## 短篇论著

## 膈面肝肿瘤腹腔镜超声引导消融治疗体会

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**[摘要]** **目的**·探讨膈面肝肿瘤腹腔镜超声引导下微波消融治疗的安全性、有效性, 以及具体的使用体会。**方法**·回顾性分析2019年11月—2021年4月于浙江中医药大学附属温州中医院接受腹腔镜超声引导下微波消融治疗的13例膈面肝肿瘤病例。腹腔镜下观察腹腔内有无转移, 根据需要离断镰状韧带、冠状韧带、三角韧带, 在肝脏膈面裸区或脏面填塞纱布垫。腹腔镜超声扫查肝脏, 确定肿瘤位置及有无新发肿瘤, 同时活检后使用超声造影剂对肿瘤多点多角度消融, 在退针过程中腹腔镜直视观察有无出血, 并行针道消融。消融后再次超声造影, 必要时追加消融。观察围手术期并发症, 比较术前、术后的血生化指标、白细胞水平以及术后磁共振成像(magnetic resonance imaging, MRI)表现。**结果**·13例患者均成功施行腹腔镜超声引导下微波消融治疗, 所有患者围手术期均未出现膈肌损伤、心率失常、肺炎、气胸、大出血、胆瘘、肠管损伤等严重并发症; 术前白细胞 $[(4.9\pm 1.0)\times 10^9/\text{L}]$ 和术后第2日白细胞 $[(8.7\pm 2.5)\times 10^9/\text{L}]$ 的差异具有统计学意义( $P=0.000$ )。术前谷丙转氨酶 $[15.0(22.0, 77.5)\text{ U/L}]$ 和术后第2日谷丙转氨酶 $[69.0(135.0, 371.0)\text{ U/L}]$ 的差异具有统计学意义( $P=0.013$ ); 术后1月复查MRI增强证实, 病灶完全坏死率达100%。**结论**·腹腔镜超声引导下肝肿瘤消融, 首先是在腹腔镜下进行的手术, 通过建立气腹、离断韧带、纱布隔离等方法使肝脏周围形成一个安全的隔离带; 然后在腹腔镜超声探头的直视下对膈面肝肿瘤进行消融, 以提供一种更加安全、有效的治疗方法。

**[关键词]** 肝癌; 腹腔镜; 腹腔镜超声; 消融; 微波消融**[DOI]** 10.3969/j.issn.1674-8115.2023.03.017 **[中图分类号]** R735.7 **[文献标志码]** B

## Experience of laparoscopic ultrasound-guided ablation of diaphragmatic liver tumors

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**[Abstract]** **Objective**·To investigate the safety and effectiveness of laparoscopic ultrasound-guided microwave ablation for phrenic surface liver tumors, as well as the specific experience of its use. **Methods**·A retrospective analysis was performed on 13 cases of diaphragmatic liver tumor who received laparoscopic ultrasound-guided microwave ablation in Zhejiang University of Traditional Chinese Medicine Affiliated Wenzhou Hospital from November 2019 to April 2021. The falciform ligament, coronal ligament and deltoid ligament were severed according to the need, and gauze pads were filled on the diaphragmatic surface or visceral of the liver. Laparoscopic ultrasound scan of the liver was performed to determine the location of the tumor and whether there were new tumors. Meanwhile, ultrasound contrast agent was used to perform multi-point and multi-angle ablation of the tumor after biopsy. During the process of needle withdrawal, laparoscopic direct observation was performed to observe whether there was bleeding, and needle path ablation was performed. After ablation, contrast-enhanced ultrasound was repeated and additional ablation was performed if necessary. Perioperative complications were observed and preoperative and postoperative blood biochemical indexes, white blood cells level and postoperative MRI manifestations were compared. **Results**·All the 13 patients were successfully treated with laparoscopic ultrasound-guided microwave ablation. There were no serious complications such as diaphragm injury, arrhythmia, pneumonia, pneumothorax, massive bleeding, biliary fistula and intestinal injury. The white blood cells before surgery  $[(4.9\pm 1.0)\times 10^9/\text{L}]$  and day 2 after surgery  $[(8.7\pm 2.5)\times 10^9/\text{L}]$  were significantly different ( $P=0.000$ ). The glutamic-pyruvic transaminase  $[15.0(22.0, 77.5)\text{ U/L}]$  before surgery and day 2 after surgery  $[69.0(135.0, 371.0)\text{ U/L}]$  were significantly different ( $P=0.013$ ). One month after the operation, MRI enhancement confirmed that the total necrosis rate of the lesion was 100%. **Conclusion**·Laparoscopic ultrasound-guided hepatic tumor ablation, which is first performed under

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laparoscopy, forms a safe isolation zone around the liver through the establishment of pneumoperitoneum, severed ligament, gauze isolation and other methods. Then, under the direct vision of laparoscopic ultrasound probe, the diaphragmatic liver tumors are ablated to achieve a safer and more effective method.

**[Key words]** liver cancer; laparoscope; laparoscopic ultrasound; ablation; microwave ablation

对于小肝癌,消融与手术切除可以达到相似效果,而消融的安全性更高<sup>[1-3]</sup>。消融有经皮、开腹手术、腹腔镜手术3种治疗方式。腹腔镜超声(laparoscopic ultrasound, LUS)引导肝肿瘤消融治疗与经皮超声引导有相同的适应证<sup>[4]</sup>。通过器械协助保护周围脏器从而对肝脏表面、膈顶、第二肝门、肝尾状叶、胆囊旁以及肝脏脏面等“危险部位”肿瘤进行LUS引导消融有着更好的安全性和有效性<sup>[5-6]</sup>。2009年, SANTAMBROGIO等<sup>[7]</sup>报道了102例腹腔镜下射频消融术,经LUS发现了术前影像学检查未发现的新病灶26处(25%); SALAMA等<sup>[8]</sup>于2010年发现,LUS辅助的射频消融可以发现18.4%术前未发现的肿瘤。LUS引导肝肿瘤消融对膈顶部及左外叶的肿瘤有着经皮超声无法比拟的优势<sup>[9-10]</sup>。本研究通过回顾13例膈面肝肿瘤经LUS引导下微波消融的治疗体会,总结这种术式操作要点。

## 1 对象与方法

### 1.1 研究对象

收集2019年11月—2021年4月在浙江中医药大学附属温州中医院开展的LUS引导微波消融的肝肿瘤病例13例,所有病例均含膈面肝肿瘤,资料齐全。

### 1.2 仪器

佳能I700超声+PET-805LA腹腔镜超声探头,康友KY-2000A微波治疗仪(发射频率为2 450 MHz,基本功率为60 W,采用KY-2450B消融针)。

### 1.3 方法

术前肠道准备,术前1 d患者冲服恒康正清(3盒)。术前留置胃管、留置导尿,采用全麻下LUS引导微波消融。具体操作步骤如下:全身麻醉,腹腔镜下先分离腹腔粘连,检查是否存在腹腔内转

移,根据需要离断镰状韧带、冠状韧带、三角韧带,在肝脏脏面或膈顶裸区填塞纱布垫。LUS下从右侧向左侧扫查肝脏,确定肿瘤位置及有无新发肿瘤后,使用超声造影剂进一步确认及判断肿瘤性质。LUS下行肿瘤活检(一般取2~3个标本),然后在LUS造影模式下消融,多点多角度消融,单一点消融3~4 min,最后行针道消融。在退针过程中腹腔镜直视观察有无出血。消融后即刻予速尿针静推,观察尿量。腹腔镜下腹内注水使灶区降温后,10~15 min后再次超声造影观察有无残留,如有残留予再次消融。

### 1.4 观察指标

记录术前病灶大小、术后1个月复查MRI时消融范围,术前及术后第2日的生化、血常规结果。

### 1.5 统计学方法

采用SPSS 18.0软件进行数据分析。符合正态分布的定量资料以 $\bar{x} \pm s$ 表示,采用 $t$ 检验比较2组差异;不符合正态分布的定量资料以 $M(Q_1, Q_3)$ 表示,采用秩和检验比较2组差异。 $P < 0.05$ 为差异具有统计学意义。

## 2 结果

### 2.1 病例基本信息

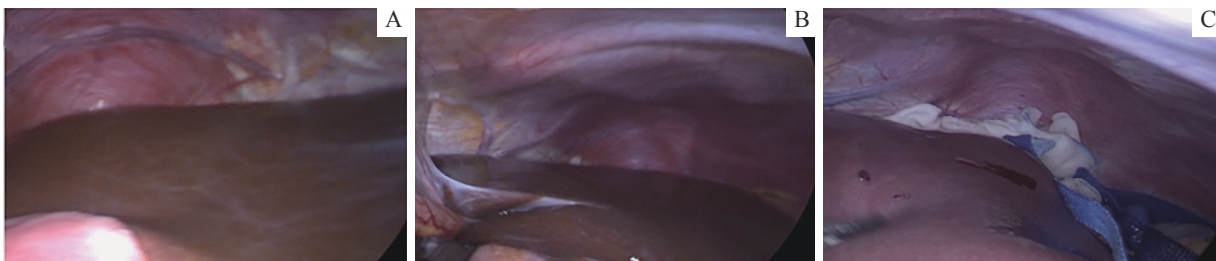
13例病例均含膈面肝肿瘤并予消融治疗,其中5例位于膈顶,共计21个肝内病灶。男性10例,女性3例,年龄32~73岁,平均年龄( $55 \pm 12$ )岁;膈面肿瘤直径1.0~3.9 cm,平均直径( $2.1 \pm 0.9$ ) cm;肝功能Child分级A到B;原发性肝癌12例,肝转移瘤1例;既往有腹部手术史6例。

### 2.2 手术情况

通过气腹,肝脏脏面、脏面填塞纱布等方法,使膈面肝肿瘤周围形成隔离带(图1~2),13例患者均

成功施行LUS引导下微波消融治疗,所有患者术中情况平稳,术中及术后均未出现膈肌损伤、心率失

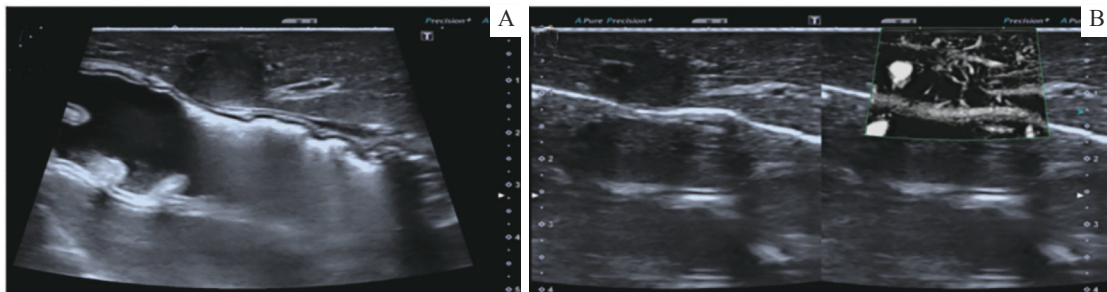
常、肺炎、气胸、大出血、胆瘘、肠管损伤等并发症。



**Note:** A. Diaphragmatic surface of right liver and abdominal wall after pneumoperitoneum establishment. B. Diaphragmatic surface of left liver and abdominal wall after pneumoperitoneum establishment. C. Gauze was packed in the bare area of the diaphragmatic roof after the left coronary ligament was severed.

图1 腹腔镜下肿瘤消融的隔离带

Fig 1 Isolation zone of tumor ablation from laparoscopic perspective



**Note:** A. Image before gauze packing. B. Image after gauze stuffing.

图2 腹腔镜超声下左肝外叶肿瘤

Fig 2 Tumor in the left lateral lobe of liver under LUS

### 2.3 术前术后化验项目比较

术前、术后第2日的血生化、血常规指标比较如表1所示。其中,术后第2日白细胞均值、

谷丙转氨酶均值和术前比较差异有统计学意义( $P=0.000$ ,  $P=0.013$ );术后1周内转氨酶及胆红素回复正常。

表1 手术前后血生化指标和白细胞水平的变化( $n=13$ )

Tab 1 Changes of blood biochemical indexes and white blood cells level before and after operation ( $n=13$ )

Item	Preoperative	Postoperative	$t/Z$ value	$P$ value
White blood cell/ $(\times 10^9 \cdot L^{-1})$	$4.9 \pm 1.0$	$8.7 \pm 2.5$	6.437	0.000
Direct bilirubin/ $(\mu mol \cdot L^{-1})$	7.8 (11.9, 19.5)	5.4 (8.8, 23.5)	1.153	0.249
Alkaline phosphatase/ $(U \cdot L^{-1})$	63.5 (78.0, 94.5)	60.5 (84.0, 103.0)	0.490	0.624
Alanine transaminase/ $(U \cdot L^{-1})$	15.0 (22.0, 77.5)	69.0 (135.0, 371.0)	2.481	0.013
Creatinine/ $(\mu mol \cdot L^{-1})$	51.0 (56.0, 69.0)	50.5 (57.0, 68.5)	0.981	0.327

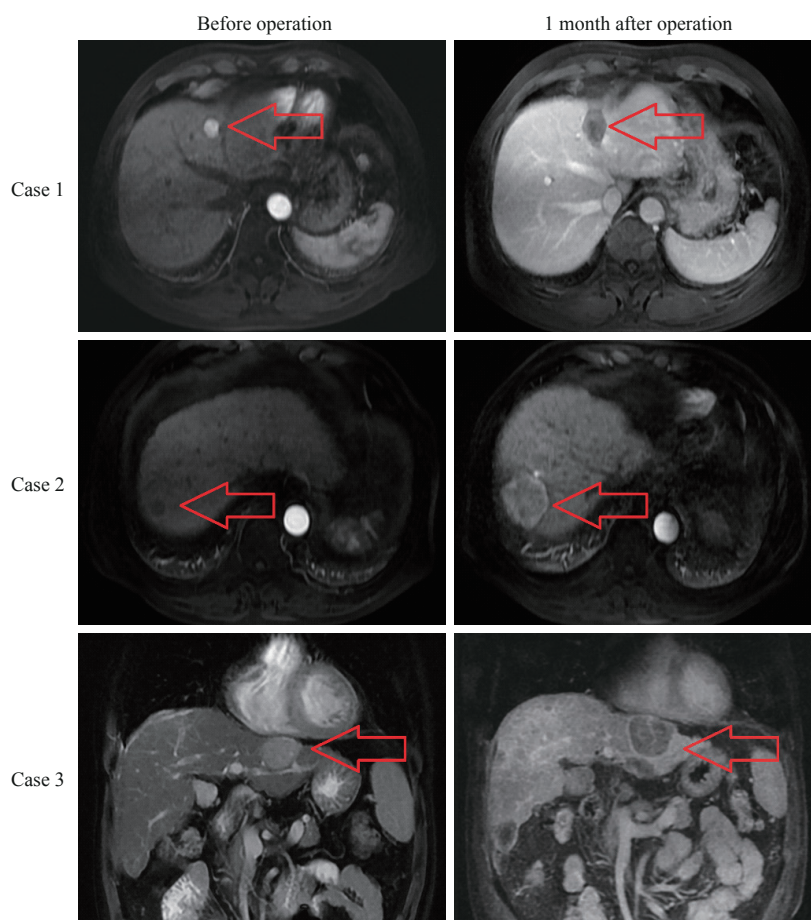
### 2.4 术后MRI增强表现

部分病例术前及术后1月复查MRI增强扫描结果比较如图3所示,所有膈面、膈顶肝肿瘤均达到完全消融效果,且在所有病例中,术后膈面肿瘤直径均值 $[(3.7 \pm 1.2) \text{ cm}]$ 较术前 $[(2.1 \pm 0.9) \text{ cm}]$ 有所增加( $P=0.000$ )。

### 2.5 术中、术毕超声造影

术中、术毕即刻均予超声造影,部分病例肝肿瘤的消融前、中、后LUS下图像如图4所示。由于术后即刻消融范围的患者资料不全,故未进行统计。





**Note:** Red arrow indicates the location of the tumor.

图3 部分病例的术前及术后1月MRI对比

Fig 3 Preoperative and 1-month postoperative MRI comparisons of some cases

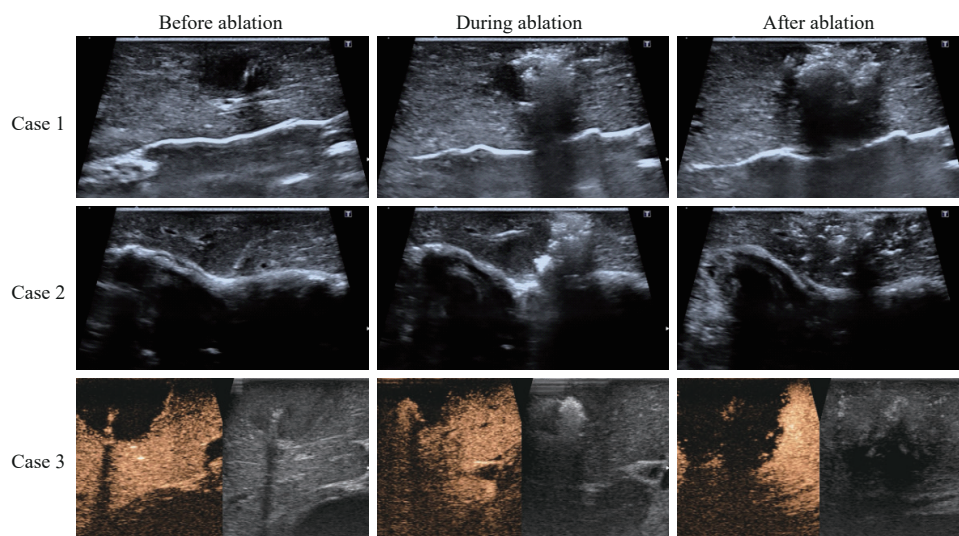


图4 部分病例肝肿瘤的消融前、中、后LUS下图像

Fig 4 LUS images of some cases before, during and after ablation

### 3 讨论

膈顶肝肿瘤邻近肺脏，容易受到肺部气体的干

扰，经皮超声较难完整显示，消融治疗难度较大，容易引起膈肌损伤、肺炎、气胸等并发症<sup>[11]</sup>。由于膈顶部肿瘤位置的特殊性，很多学者探索使用人工诱导

胸水、气胸,CT引导下经胸穿刺等途径进行消融,由此提高消融的彻底性和安全性,并取得了令人满意的结果<sup>[12-15]</sup>,但仍存在膈肌损伤等风险。然而这在LUS引导下肝肿瘤消融发生率极低。LUS引导下消融是在腹腔镜下进行的,它整合了腹腔镜技术及高频超声探头技术,使得膈顶部位肿块变得不再危险,也使肿瘤在超声下显示得更加清晰。本研究中膈面及膈顶肝肿瘤经过LUS引导下消融均达到完全消融效果,而且术后均未出现膈肌损伤、气胸、大出血、胆瘘、肠管损伤等并发症。

对于膈顶肝肿瘤消融,首先需考虑怎样避免周围器官损伤,然后再考虑进针消融。在腹腔镜下,气腹状态使得肝脏与腹壁已经分开,这使得膈面的肿瘤不需考虑腹壁损伤风险。通过离断镰状韧带使肝脏与腹壁的距离进一步增大,离断冠状韧带、三角韧带使肝脏从膈肌上分离,然后在膈顶裸区盐水纱布填塞使肝脏与膈肌的距离进一步增大,背侧也就是脏面也可以垫纱布。此时,在肝脏的前面、上方、背侧均形成一个隔离带,对于肝脏膈面、脏面的肿瘤都有一个安全边界来进行消融。对于6、7段背侧的肝肿瘤,可以在术前于患者右侧肩、背、臀部垫垫子,使得右侧躯体抬高约30°,手术台头高脚低位及向左侧倾斜,同时可以通过填塞盐水纱布来进一步暴露视野。

LUS引导消融的难点在于如何在超声探头下找到消融针、针尖及设计消融方案。LUS引导消融是在超声探头的侧后方进针,LUS下只能看到一个点或一片,通过移动探头或转动探头来完整观察消融针、针尖,这需要一定的时间积累。建议探头扫描平面和消融针进针角度尽量小,消融针贴着探头进针更容易。LUS引导消融可以通过多次穿刺来逐步调整以达到满意的消融针针尖位置,不需要担心肝表面穿刺点是否出血,因为全程是在腹腔镜的直视下进行且可以直接进行止血处理,这降低了穿刺的难度。对于针道上存在大血管或胆管还是需要避免穿刺损伤,如果针尖刺入肿块内需注意针道消融。如何进行消融设计呢?LUS引导下的消融是在超声探头的侧后方进针来进行消融的,直角楔形模型可以了解针尖位置的消融范围<sup>[16]</sup>,通过先从肿块近消融针进针侧进行消融,然后向远端平移超声探头进行消融,同一超声平面先深部再浅部消融。

超声造影在消融过程中有非常大的作用。对于无法鉴别、病变太小难以显示或消融治疗后仍有残余或复发需要再次消融的小肝癌和肝硬化结节,普通超声往往难以提供精准的定位信息。超声造影具备准确检测普通超声难以显示或治疗后残留的小肝癌和肝硬化结节的能力,同时能够清晰呈现其大小和范围。此外,该技术还能明显增强难以清晰显示的癌灶边界并可视化肿瘤的血供情况,从而实现精准的进针引导和针对性的消融操作,提高治疗的成功率并降低术后并发症的风险<sup>[17]</sup>。

总之,LUS引导下消融全程在腹腔镜及LUS双重直视下进行,直接观察进针是否引起出血并给予处理,气腹的建立使得肝脏膈面与腹壁分离,腹腔镜器械的操作、纱布填塞使肝脏周围形成一个隔离带,可以大胆地进行消融,也需要结合超声造影来观察消融效果。虽然,随着高频超声探头的使用,超声图像更清晰,但进针的难点仍需要实践来学习、体会。腹腔镜超声引导下肝肿瘤消融,对于危险部位肝肿瘤治疗更具优势,更加值得推荐。

#### 利益冲突声明/Conflict of Interests

所有作者声明不存在利益冲突。

All authors disclose no relevant conflict of interests.

#### 伦理批准和知情同意/Ethics Approval and Patient Consent

本研究涉及的所有实验均已通过温州中医院伦理委员会的审核批准(文件号:WTCH-H-X-2019024)。受试对象或其亲属已经签署知情同意书。

All experimental protocols in this study were reviewed and approved by Ethics Committee of Wenzhou Hospital of Traditional Chinese Medicine (Approval Letter No. WTCH-H-X-2019024). Consent letters have been signed by the research participants or their relatives.

#### 作者贡献/Authors' Contributions

张寅参与了论文的写作和修改,王奕、吴贤、谢炳奎、张寅参与了手术操作,王奕参与了论文的审阅。所有作者均阅读并同意了最终稿件的提交。

The manuscript was drafted and revised by ZHANG Yin. The surgery was performed by WANG Yi, WU Xian, XIE Binglun and ZHANG Yin. The manuscript was reviewed by WANG Yi. All the authors have read the last version of paper and consented for submission.

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