

## ·临床研究 Clinical research·

## 肝肿瘤射频消融术后 CT 表现及其临床意义

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**【摘要】 目的** 探讨肝肿瘤经皮射频消融(RFA)治疗后的 CT 表现并分析其临床意义,以指导临床治疗。**方法** 回顾性分析 59 例(82 个病灶)肝肿瘤患者经皮 RFA 前后的 CT 影像学资料,分析病灶的大小、密度及强化方式等变化特点。**结果** RFA 治疗后 1 个月内完全坏死病灶范围较术前有所增大,呈无强化的低密度影,或呈囊状更低密度影。坏死灶周围常见一层薄而均匀的环形强化,强化特点和正常肝实质基本一致,随着时间的变化逐渐模糊,最终消失。2 个月内完全坏死灶范围较术前可略显增大、相仿或略缩小,呈低密度影或更低囊变影。增强扫描无明显强化或动脉期消融区边缘出现一层薄而均匀的环形强化,但较前模糊,显示欠清。2 个月以后完全坏死区范围逐渐缩小,增强扫描无明显强化。当肿瘤组织残存时,术后即刻 CT 显示消融区范围没有完全包括术前病灶的范围,动脉期病灶边缘出现不规则局灶样或结节状强化,门脉期迅速减退,延迟期强化程度低于肝实质,呈“快进快出”特点。如肿瘤复发,病灶局部出现异常强化。血供良好的肿瘤组织显示病灶范围有所增大,动脉期消融区出现局灶样或结节状强化;乏血供的病灶消融区范围较前增大,边缘不光整。**结论** 肝肿瘤 RFA 术后的 CT 检查具有特征性的影像学表现,能有效检出肿瘤的残存或(和)复发,指导临床作出进一步合理、有效的治疗。

**【关键词】** 肝肿瘤;消融技术;CT

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**CT manifestation and its clinical significance of liver tumors after radiofrequency ablation** XU Shou-jun, DU Duan-ming, LIU Peng-cheng, LUO Li-li, GAN Yun-gen. Department of Radiology, Shenzhen Children's Hospital, Shenzhen 518026, China

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**【Abstract】 Objective** To analyze CT findings of hepatic tumors after percutaneous radiofrequency ablation (RFA) and to discuss their clinical significance in guiding clinical treatment. **Methods** A total of 59 patients with hepatic tumor (82 lesions in total) were enrolled in this study. The diseases included primary liver tumor ( $n = 42$ ) and hepatic metastases ( $n = 17$ ). RFA was carried out in all patients. Both pre-operative and post-operative CT findings were retrospectively analyzed, focusing on the lesion's size, density, enhancement pattern, etc. The results were analyzed. **Results** Within one month after RFA, the completely necrotic areas, which were characterized by non-enhanced low density areas or lower cystic density areas, became larger than before. A thin layer of annular uniform enhancement was often seen around the necrotic area, and the enhancement feature was basically consistent with the normal liver parenchyma, and the enhancement became blurred gradually with increasing time until it faded away finally. About 2 months after RFA, the completely necrotic areas became slightly larger, or equal to, or slightly smaller than the necrotic areas observed before RFA. And the necrosis was manifested as low density area, or cystic shadow with much lower density. On enhanced scanning, the lesions showed no obvious enhancement, Sometimes a thin uniform annular enhancement at the border of the treated area could be seen in arterial phase. However, the thin uniform annular enhancement was more subtle than that observed before and its clearance usually took longer time. Two months after RFA, the necrotic areas became smaller gradually and showed no contrast enhancement. When there was residual tumor, the ablation zone showed on CT that was performed immediately after RFA would be smaller than the tumor extent that was determined on preoperative CT

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scanning, besides, irregular local thickening or nodular enhancement could be found at the lesion's periphery in arterial phase, which rapidly vanished in portal venous phase, and the degree of enhancement was much lower than that of liver parenchyma, carrying the feature of "fast entering and fast leaving". When the tumor relapsed, abnormal enhancement could be seen at the lesion. In such situation, the lesion became larger and there was local or nodular enhancement at the ablated area if the tumor was of hyper-vascularity. When the tumor was of hypo-vascularity, the ablated size of the lesion became larger than before and its margin became irregular. **Conclusion** On CT scanning, the hepatic tumor after RFA carries characteristic features, which enable the radiologists to detect the residual tumor tissue as well as the recurrence of tumor. Therefore, the CT feature is of great significance in guiding clinical treatment.(J Intervent Radiol, 2014, 23: 69-73)

**【Key words】** liver tumor; ablation technique; CT

近年来,影像导向下经皮射频消融(radio frequency ablation,RFA)已越来越多地应用于肝肿瘤的治疗,可明显提高不能手术患者的生存率。CT具有较高的组织分辨率,后处理功能比较完备,在评价 RFA 疗效中广泛应用。本研究拟对 59 例患者 RFA 治疗后肝脏局部 CT 影像变化作一总结,以了解这种变化的临床意义。

## 1 材料与方法

### 1.1 材料

1.1.1 一般资料 回顾性分析 2009 年 3 月—2011 年 7 月于我院接受 RFA 治疗的肝肿瘤患者 59 例,其中男 47 例,女 12 例,年龄 17 ~ 88 岁,平均(54 ± 16)岁。诊断根据 WHO 病理组织学检查标准<sup>[1]</sup>及美国肝脏疾病研究协会和日本肝病学会指南<sup>[2-3]</sup>提出的诊断标准,结合临床资料、超声和(或)CT 及 MRI 典型影像学表现进行综合诊断。入选标准:①经病理组织学证实;②虽未经病理组织学证实,但 2 种或以上影像学表现均指认为同一种肝肿瘤特征;③转移瘤均有明确原发病灶,且原发病灶均经病理证实。本组 59 例患者共 82 个病灶,其中原发性肝肿瘤 42 例 54 个病灶(经病理证实 30 例 42 个病灶),转移瘤 17 例 28 个病灶(原发灶均有病理证实)。

肿瘤最大径为 1.1 ~ 16.2 cm。肿瘤所在位置(以肿瘤最大径所在叶为准):肝左外叶 11 个病灶,肝左内叶 18 个病灶,肝右前叶 17 个病灶,肝右后叶 36 个病灶。

1.1.2 手术设备 采用 AngioDynamics RITA 1500X 射频消融治疗系统,单极多针尖伸展型电极针,长 10 ~ 15 cm,最大消融径 3 ~ 5 cm。导向设备为 SOMATOMPLVS4 CT 扫描机。

### 1.2 方法

1.2.1 射频消融术 于 CT 导向下行 RFA 治疗,取患者最佳体位,体表定位。行 CT 扫描明确病灶的位置和范围,选择肿瘤中心层面为穿刺层面和最佳进针路径。全麻后将穿刺点皮肤切适当小口,穿入射频电极针,将子针展开合适直径,进行消融治疗。对直径较大的肿瘤采取多位点消融,以确保肿瘤组织的充分坏死。

1.2.2 检查方法 采用东芝 Aquilion 16 排螺旋 CT 机扫描。扫描参数:管电压 120 kV,管电流 300 mA,扫描层厚 1 mm,螺距 15,7 mm 重叠重建。平扫后经肘静脉高压注射碘海醇,速率 3.5 ml/s,总量 100 ml。对比剂注射后 20 s、50 s 和 180 s 行三期增强扫描。扫描完成后由 2 名有经验的放射科医师独立进行分析。

## 2 结果

### 2.1 术前 CT 检查

术前 51 例行增强 CT 检查,其中原发性肝肿瘤 38 例,包括原发性肝细胞癌 35 例,肝血管肉瘤 1 例,肝胆管细胞癌 2 例;转移瘤 13 例,原发肿瘤位于结肠 5 例,直肠 4 例,胆囊、胃、乳腺各 1 例,间质瘤肝转移 1 例。

### 2.2 术后 CT 检查

术前 51 例接受增强 CT 检查的患者术后 1 个月内 10 例(11 个病灶)复查,完全坏死 8 例(9 个病灶),残存 2 例(2 个病灶)。术后第 2 个月 13 例(17 个病灶)复查,完全坏死 9 例(12 个病灶),残存 4 例(5 个病灶)。2 个月以后 26 例(31 个病灶)复查,完全坏死 16 例(20 个病灶),残存或复发 10 例(11 个病灶)。

本组肝肿瘤在 RFA 术后第 1 个月内完全坏死灶范围较术前病灶范围有所增大,呈低密度影,或

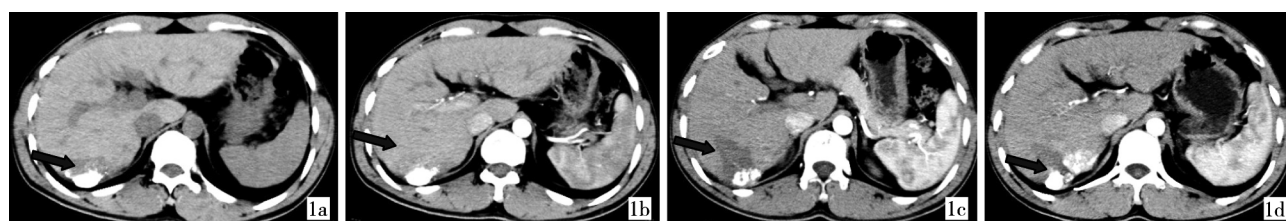
呈囊状更低密度影。增强扫描坏死灶无明显强化,其周围常见一层薄而均匀的环形强化。本组术后 1 个月内 CT 检查尚有 1 例(1 个病灶)平扫消融区见不均匀片状高密度影,在以后的随访复查中逐渐减退,消融灶边缘未见明显强化,考虑为术后出血所致。8 例(9 个病灶)增强扫描消融区无明显强化或仅消融区边缘见少许薄而均匀的环形强化。

术后第 2 个月内完全坏死灶范围较术前病灶范围可略显增大、相仿或略有所缩小。其内呈低密度影或更低囊变影。增强扫描无明显强化或动脉期消融区边缘出现一层薄而均匀的环形强化,但较前模糊,显示欠清(图 1)。本组术后 2 个月内行 CT 检

查,9 例(12 个病灶)增强扫描消融区边缘无明显强化或只见少许薄而均匀的环形强化,部分强化环显示较前模糊。原考虑术后出血的 1 例 1 个病灶原消融区见少许不规则淡薄斑片状稍高密度影,但有所减退,显示欠清。

2 个月以后完全坏死灶范围逐渐缩小,呈低密度影,增强扫描无明显强化。部分病灶边缘见少许淡薄且较均匀的环形强化影,显示较为模糊,部分消融灶周围环形强化影消失(图 1)。本组 2 个月以后行 CT 检查,1 例(1 个病灶)消融区尚见少许低密度气体影。

肿瘤组织残存的表现表现为消融区未完全包括术

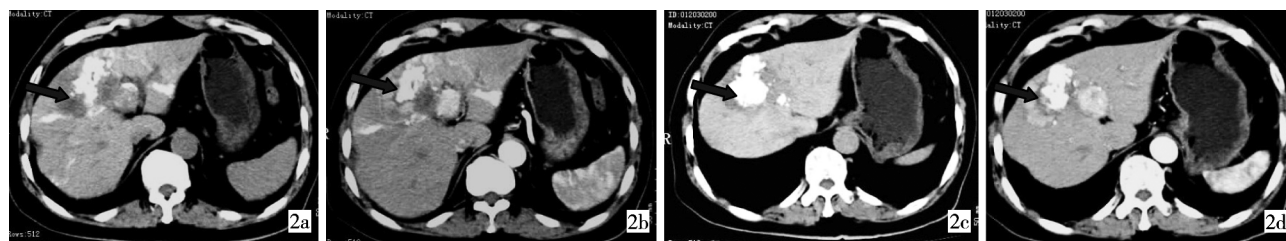


1a RFA 术前肝右后叶不规则形低 1b 增强扫描动脉期不均匀强化 1c RFA 术后 2 个月,消融区范围 1d RFA 术后 4 个月消融区范围  
密度灶,内见团状高密度碘油沉积影 较前明显缩小,动脉期无明显强化 (箭示病灶)

图 1 原发性肝细胞癌 RFA 治疗后完全坏死

前病灶的范围。动脉期残存病灶边缘呈不规则局灶样、结节状强化,门脉期迅速减退,延迟期强化程度低于正常肝实质(图 2)。肿瘤复发表现为原认为完全坏死的病灶消融区范围随时间的推移非但不减小,反而有所增大。动脉期消融区出现局灶样、结节

状强化,门脉期及延迟期呈相对低密度影。部分乏血供病灶,表现为消融区范围有所增大,边缘不光整。本组术后 2 个月以后 CT 检查,尚有 1 例(1 个病灶)消融区动脉期见明显强化的迂曲血管影。



2a RFA 术前肝左内叶不规则形 2b 增强扫描动脉期呈多发强化结 2c RFA 术后 2 个月,消融区范围 2d 增强扫描动脉期多发强化  
低密度灶,内见团状高密度碘油沉积影 节影,结节数目较术前增多,强  
化更为明显(箭示病灶)

图 2 原发性肝细胞癌 RFA 治疗后残存

### 3 讨论

#### 3.1 RFA 术后 CT 的征象及病理基础

完全坏死灶呈低密度影,是病灶凝固坏死的表现。消融区中央经常可见沿电极针道处呈高密度炭化影,表明细胞发生了较严重的坏死,有学者认为这种密度的不均匀性是 RFA 术后病灶内出血或组

织细胞明显脱水所致<sup>[4-8]</sup>。本组中术后 1 个月内 1 例(1 个病灶)显示为不均匀片状高密度影,2 个月内再次复查显示高密度影较前减退,模糊,消融灶边缘未见明显强化,考虑为手术所致病灶内出血表现。

消融区常出现少许气泡影。一般术后 1 个月消失,这些气泡的存在会使射频消融区域边缘显示不清<sup>[8-11]</sup>。本组 2 个月以后 1 例 1 个病灶复查 CT,消融

区见少许小气泡影,考虑可能是由于坏死组织产生。当伴有发热且超过 2 周时,应考虑到合并肝脓肿存在的可能。一般由肝脓肿产生的气泡形状及大小不规则,且随时间的变化非但不减少,反而可能增加。增强扫描脓肿可见较均匀环形厚壁强化影。

消融区的形状通常是圆形或椭圆形,当肿瘤位于大的肝血管分支之间时,消融区的形状是不规则的,这是由于“热沉降”效应所致,该效应会使消融针温度降低,可导致肿瘤坏死不彻底,是 RFA 术成功与否的一个主要因素<sup>[12-13]</sup>。无论形状如何,消融区的体积必须大于术前病灶的体积。否则,认为肿瘤没有完全消融。但是,对于有完整包膜的肝肿瘤,即使病灶周围消融范围小于 0.5 cm 也认为完全消融<sup>[9]</sup>。在以后的随访过程中完全坏死的病灶范围逐渐减小。

消融区边缘经常可见一薄而均匀的环形强化影,强化特点和正常肝组织基本一致,为组织对热损伤的正常生理反应,它的病理基础是肉芽组织增生及充血性水肿,一般 1 个月后消失,长者可达 6 个月之久<sup>[7-8,14]</sup>。本组术后 1 个月内 10 例(11 个病灶)复查 CT,8 例(9 个病灶)未见明显强化或边缘见少许薄而均匀的环形强化,表明部分消融灶边缘肉芽组织增生活跃,同时存在充血水肿。2 个月内 13 例(17 个病灶)复查 CT,9 例(12 个病灶)边缘无明显强化或只有少许轻度环形强化,部分显示较前模糊,提示对热反应充血肝细胞已修复。此表现应与消融区边缘肿瘤组织残存或复发相鉴别,病灶残存时,CT 显示消融范围过小,没有完全包括术前病灶的范围,消融区边缘动脉期出现局灶状或结节状强化,门脉期及延迟期减退。局部复发病灶血供丰富,表现为先前认为完全坏死的病灶消融区边缘动脉期出现局灶状强化,厚薄不均,门脉期迅速减退,延迟期强化程度低于肝实质,强化方式符合“快进快出”特点,这是因为肝肿瘤组织主要为动脉供血,正常肝组织主要为门脉供血,两者强化峰值具有一定的时间差,肿瘤组织早期强化明显。如果病灶是乏血供的,则消融区边缘不光整,范围有所增大,这是由于肿瘤组织血供不均匀、生长速度不一致,从而表现为局部肿瘤组织形态不规整所致。局部不规则强化是肿瘤残存还是局部肿瘤复发往往很难鉴别。

### 3.2 RFA 术后 CT 的临床应用价值

增强 CT 是目前术后最常用的检查方法,广泛应用于疗效评价、术后并发症、病灶残存和复发的

发现。术后即刻 CT 检查,如发现消融区未完全包括原病灶范围或有存活的肝肿瘤组织存在时,可立即进行再次消融治疗。术后增强 CT 检查有一定的局限性,存在一定的假阴性。首先,消融区常出现少许气泡影使得消融区边缘显示较为模糊,不易判断肝肿瘤病灶是否完全消融。其次,消融术后早期复查时,消融区边缘环形强化影往往难以鉴定为残存或复发的肿瘤组织,亦或是正常肝组织充血水肿。对于直径较小的肝肿瘤病灶也不易发现,容易漏诊。

综上所述,RFA 术后肝肿瘤区的 CT 表现能够有效判断肿瘤残存或复发,对于指导临床进一步治疗有着重要意义。

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## ·临床研究 Clinical research·

### 经皮胃冠状静脉栓塞术后预防肝穿刺道出血的方法探讨

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**【摘要】 目的** 探讨经皮肝穿刺胃冠状静脉栓塞术(PTVE)后预防肝穿刺道出血的方法。**方法** 回顾分析 112 例肝硬化门脉高压症食管胃底静脉曲张破裂出血的患者行 PTVE 术后分别采用穿刺道填塞明胶海绵条和金属弹簧圈栓塞穿刺道两种方法预防术后腹腔内出血的疗效。**结果** 58 例患者采用穿刺道填塞明胶海绵条, 54 例用金属弹簧圈栓塞穿刺道, 术中发生弹簧圈脱入肝静脉, 进入左肺动脉小分支 1 例。术后随访未发生肝穿相关的腹腔内出血病例。**结论** PTVE 术后采用弹簧圈或明胶海绵条栓塞穿刺道简单、有效, 是预防术后腹腔内出血的重要措施。

**【关键词】** 腹腔内出血; 经皮经肝食管胃静脉曲张栓塞; 肝穿刺道; 预防

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**Prevention of liver puncturing tract bleeding occurring after percutaneous transhepatic gastroesophageal varices embolization** LI Jin-bao, QUAN Hui, XUE Ke, YANG Juan-hong. Department of Interventional Radiology, Baoji Municipal Central Hospital, Baoji, Shaanxi Province, 721008, China

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**【Abstract】 Objective** To discuss the preventive measures for liver puncturing tract bleeding occurring after percutaneous transhepatic gastroesophageal varices embolization (PTVE). **Methods** A total of 112 cases with variceal bleeding from esophagus and gastric fundus due to cirrhosis were enrolled in this study. PTVE was carried out in all patients. After PTVE, gelatin sponge strips ( $n = 58$ ) or metal coils ( $n = 54$ ) were used to fill the puncturing tract in order to prevent postoperative intra-abdominal hemorrhage. The clinical results were analyzed. **Results** Filling of puncturing tract with gelatin sponge strips or metal coils was performed in all patients. During the procedure the coil dropped into the hepatic vein in one case, which then went into a small branch of the left pulmonary artery. During the follow-up period no liver puncture-related intra-abdominal hemorrhage occurred. **Conclusion** For the prevention of intra-abdominal hemorrhage after PTVE, filling of puncturing tract with gelatin sponge strips or metal coils is technically simple and clinically effective. Therefore, this technique should be recommended in clinical practice. (J Intervent Radiol, 2014, 23: 73-75)

**【Key words】** intra - abdominal hemorrhage; percutaneous transhepatic gastroesophageal varices embolization; liver puncturing tract; prevention