Colon Perforation Secondary to Radiofrequency Ablation of Hepatic Tumor

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We present a case of nasopharyngeal carcinoma, which was treated by radiotherapy combined with chemotherapy. Hepatic metastases was noted, and thus referred to our department for Radiofrequency (RF) ablation therapy. Pain was noted after the procedure and was given analgesics. However, the pain persisted with direct and rebound tenderness over the whole abdomen on the 4th day after ablation. CT scan of the abdomen revealed focal free air and inflammatory strandings on the right pericolic and adjacent mesenteric fat plane associated with mucosal disruption at the hepatic flexure of colon. Iatrogenic colon perforation secondary to RF ablation was diagnosed and he underwent right hemicolecction with side-to-side anastomosis.

Post-operative course was smooth except of intermittent fever and anemia.

Antibiotic therapy and blood transfusion were given and he was discharged as improved 13th days post-operatively.

We report a case of colon perforation secondary to RF ablation of metastatic hepatic tumor. We emphasize that the performing physician should be aware and careful selection of patient is necessary to avoid this complication. The radiologist must be familiar with the various imaging features of this complication for early diagnosis and appropriate management.

Key words: Liver neoplasm; Therapy; Radiofrequency (RF) ablation; Complication

Radiofrequency (RF) ablation of hepatic tumors has been performed worldwide as a treatment of both primary and secondary hepatic tumors [1-4]. Compared to surgical resection, the potential advantage of this technique is to decrease morbidity and can preserve more liver parenchyma [5]. Nowadays, this percutaneous local treatment has largely replaced surgical resection for treating patients with primary or secondary hepatic malignancies especially to those patients with underlying liver cirrhosis. Although RF ablation is now considered as a safe and effective technique for local treatment of hepatic tumors, physicians must be aware of serious complications of this procedure.

CASE REPORT

A 45-year old male was diagnosed from another hospital to have a nasopharyngeal carcinoma, WHO type III, T1N2M0, stage III and underwent combined chemotherapy and radiotherapy. Chemotherapy regimen included Taxol, cisplastin, and Ifosfamide combined with intra-oral cavity brachytherapy. During his follow-up period, abdominal sonography and CT scan studies revealed two masses at the segment V of the right liver lobe measuring about 1.0 × 0.8 cm and 2.8 × 3.0cm in diameters. The patient was then referred to our hospital for RF-ablation therapy of the liver metastases.

The patient was a hepatitis B virus carrier with an alpha-fetoprotein level of 7.77ng/ml. Before RF ablation, sono-guided percutaneous liver biopsy was done and confirmed the diagnosis of liver metastases. During admission, RBC was 328X10^6/UL,
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The white blood cell count was 2800/UL, platelet of $15.6 \times 10^4$/UL, prothrombin time was 12 seconds and PTT was 24.4 seconds.

A day after admission, RF-ablation was performed using a 3cm cool tip for 12 minutes duration under sonographic guidance. Ablation was only done on the larger tumor and the patient felt abdominal discomfort after the procedure. He was given Demerol 50mg for the pain and was discharged the following day.

Two days later, he was brought back to our ER because of severe abdominal pain. On examination, direct and rebound tenderness over the whole abdomen were noted. Emergency CT-scan demonstrated tumor necrosis at the segment V of the right liver lobe with pneumoperitoneum on the anterior abdominal cavity (Fig. 1). Colon mucosal disruption at the region of hepatic flexure associated with extraluminal air and minimal fluid at the right pericolic area. Stranding on the adjacent omentum and with thickening of the right lateroconal ligament (Fig. 2, 3). Iatrogenic colon perforation on the hepatic flexure secondary to thermal injury from RF-ablation of hepatic tumor was diagnosed. He underwent right hemicolectomy with side-to-side anastomosis with rubber drains place on the right abdomen and pelvic regions. Turbid ascitis with exudative fluid within the abdominal cavity was drained. Surgical resected colon specimen revealed a 0.5cm × 2.0cm perforation at the hepatic flexure with evidence of colon necrosis from thermal injury (Fig. 4). Ascitic fluid culture grew Escherichia coli, enterococcus species, and anaerobic bacteroides thetaiotaimicron.

The patient had intermittent fever with leucopenia post-operatively, so Amikacin 250mg IV drip every 12 hours. Blood transfusions were given to correct the anemia. The rubber drains were removed on the 11th post-operative day and he was discharged improved on the 13th hospital day. He returned to our department one month later for percutaneous ethanol injection therapy of the smaller hepatic tumor on segment VI. No complication occurred this time and he was followed at the out-patient department regularly.

DISCUSSION

Radiofrequency (RF) thermal ablation has been gaining popularity with very promising results for treating of focal malignant tumors of the liver, kidney, and lungs [1-4, 6, 7]. Although RF-ablation is now accepted as a safe and effective local technique for the treatment of the solid tumors involving the liver, kidney, adrenal and lungs, serious complications can still result from this procedure. Reported complications following percutaneous RF ablation of malignant liver tumors in 2320 patients treated at 41 different hospitals in Italy showed a mortality rate of 0.3% with an overall complication rate of 7.1% [8]. Curley et al reported a procedure-related mortality of 0.5% and combined overall early and late complication rate was 9.5% in a total of 608 patients with malignant liver tumors who underwent RF ablation [9].

Rhim et al [10] divided the complications resulting to RF ablation into two categories: A. those related to imaging guided electrode placement, and B. those related to thermal therapy. The complications

![Figure 1](image1.png) Hypodensity at the segment V of the right liver lobe, suggestive of tumor necrosis (arrows). Peritoneal free air was evident lateral to the liver margin and on the anterior abdominal cavity (arrow heads).

![Figure 2](image2.png) Mucosal wall disruption on the lateral wall of the colon (arrow) with inflammatory stranding adjacently.
included in the category A were bleeding, infection, tumor seeding, and pneumothorax. The complications in the category B was further subdivided into those that can occur with all methods of thermal ablation, and those that are specific to RF ablation.

Our case categorized as a non-target thermal damage to the colon. The thermal energy that destruct tumor cells can also irreversibly coagulate adjacent structure and can damage vital structures adjacent to a targeted lesion. The gallbladder, bile duct, and bowel are sensitive to thermal injury and can result to bile duct stricture, cholecystitis, and possible bowel perforation. Non-target damage resulting to perforation of the gastrointestinal wall has been reported to cause death [8, 11, 12].

The risk of bowel perforation has been observed only when the target lesion is within 1 cm of the liver capsule or is adjacent to a gastrointestinal lumen. Several patients with perforation have a history of abdominal surgery, chronic cholecystitis in the region adjacent to the tumor that resulted in adhesion of the bowel loops to the liver margin. The adhesion of a bowel loop to the liver may affect normal bowel movement and migration of bowel away from the liver, which may be incidentally heated and injured during the procedure. The colon appears to be at a greater risk than the stomach or small bowel for this kind of injury. Gastric complications are rare, probably due to a relatively greater wall thickness of the stomach and its remote location from the liver. The mobility of the small bowel may also be a factor providing bowel protection compared to a relatively fixed colon [8]. However, in experience hand, successful ablation of the hepatic tumors has been performed within 1 cm of the gallbladder and bowel without any complication. One study published by the Korean colleagues focused on the usefulness of percutaneous radiofrequency ablation of hepatic tumors abutting the bowel. No procedure-related bowel injury was encountered except a small perihepatic abscess [13]. We believe that the complication rate may decrease as we have more experience with this procedure [2]. The prevalence of major complications in 1,135 patients has been reported as 2.4% and a mortality rate of 0.09% [12]. An Italian multicenter study with 1,766 patients reported a complication rate of 1.52% and 0.11% mortality rate [8]. The causes of two deaths in this series were septic shock due to peritonitis and liver failure. The most important complication due to thermal damage was that of perforation of the gastrointestinal wall, which occurred in 0.2% of patients [12-16].

In order to detect injury to the gastrointestinal tract, care should be taken in regard to thickening of the injured bowel wall, fat stranding around the injured site, free air, and ascites in post-RF ablation CT scan follow up study. Bowel injury occasionally causes liver abscess or outside it, therefore if abscess formation is observed after RF-ablation high suspicion of gastrointestinal tract injury must be considered [17]. Conservative methods for management of gastrointestinal tract injury include fasting, antibiotic therapy, draining of the abscess, and closure of the fistula. In some cases however, laparotomy may be required if the injury does not respond to the conventional management. In our case, we were unable to
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detect this complication although pain was observed after the procedure. However, clinical symptoms of perforation can be manifested several days after the procedure. These delayed was likely due to the several days are required to damage the mucosal wall. In our case, the followed up abdominal CT scan performed 4 days after the procedure showed a typical features of colon injury with free air and minimal ascites. To prevent this complication, Chen et al [18] recommended some maneuvers to those lesions located near the hepatic flexure of the colon: A. the patient must be place in the right anterior oblique position, so that the transverse colon and intestine would displace to the left and away from the liver; B. during ablation, the patient was instructed to make repeated abdominal breath to keep the bowel moving and to avoid continual hyperthermia in the bowel wall; C. after the ablation, the patient needs to fast for 24 hours and then semi-fluid diet for 2 days.

In conclusion, physicians performing RF ablation for various tumors must be aware the spectrum of complications. Knowledge of various imaging features of each complications , alertness during the procedure could minimizes and allow early detection of these life-threatening complications . Three important strategies for decreasing the rate of complications are prevention, early detection, and proper management [11].

REFERENCES
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經無線射頻肝腫瘤治療所引起之大腸穿孔

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無線射頻燒灼術已經是廣泛地應用在原發或次發之肝腫瘤。雖然無線射頻燒灼術已被認為是安全且有效率之肝癌腫瘤局部治療法，但臨床上仍需注意到一些嚴重的併發症。

本案例是位患有鼻咽癌合併肝轉移之個案，經轉介至放射科做無線射頻燒灼術之治療。持續性的腹部疼痛至術後第四天變為全腹反彈式壓痛。腹部電斷層檢查在右側大腸周圍及腸間膜脂肪影像學檢查判定為無線射頻燒灼術所引發之大腸穿孔，病人立刻進行右半側之大腸切除，而病理組織證實為位於肝迴轉大腸之穿孔並伴隨有網膜壞死。

病人術後平順地恢復，除了一些間隔性地發燒及貧血，在經抗生素及輸血治療後，病人於住院後第13天出院。

在我們這次所報告之因無線射頻燒灼術所引發之腸穿孔中，我們須再次強調術前之病人評估及篩選的重要性。而放射科醫師也必須熟稔各種影像特徵，才能做出早期診斷並給予適當處置。

關鍵詞：肝腫瘤  治療  無線射頻燒灼術  併發症