

Clinical report

Acute thermal injury of the gallbladder in the course of interstitial radiofrequency hyperthermia treatment for hepatocellular carcinoma

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Abstract

A case of acute thermal injury of the gallbladder occurring during interstitial radiofrequency hyperthermia (IRH) for hepatocellular carcinoma is described. The gallbladder wall showed a layered thickening (up to 13 mm) that progressively disappeared within 2 weeks from the IRH therapy, under conservative management.

Keywords: Ultrasound; Acute cholecystitis; Hepatocellular carcinoma; Thermotherapy

1. Introduction

In recent years, ultrasound-guided percutaneous ablative methods of primary and secondary liver neoplasms have been developed with promising results in terms of efficacy in inducing neoplastic tissue necrosis (Livraghi et al., 1995, 1991; Amin et al., 1993; Rossi et al., 1993) and, as far as Percutaneous Ethanol Injection (PEI) of Hepatocellular Carcinoma (HCC) is concerned, impres-

sive long-term survival rates (Livraghi et al., 1995).

One of the newest percutaneous modalities in the treatment of HCC is Interstitial Radiofrequency Hyperthermia (IRH) (Rossi et al., 1993; McGahan et al., 1993; Marone et al., 1993; Rossi et al., 1990). A thermal lesion is induced through the activation of a radiofrequency generator connected to an electrode needle inserted into the liver neoplastic nodule under US guidance.

After preliminary experiences in animal models (McGahan et al., 1993; Rossi et al., 1990), the clinical application proved effective in achieving

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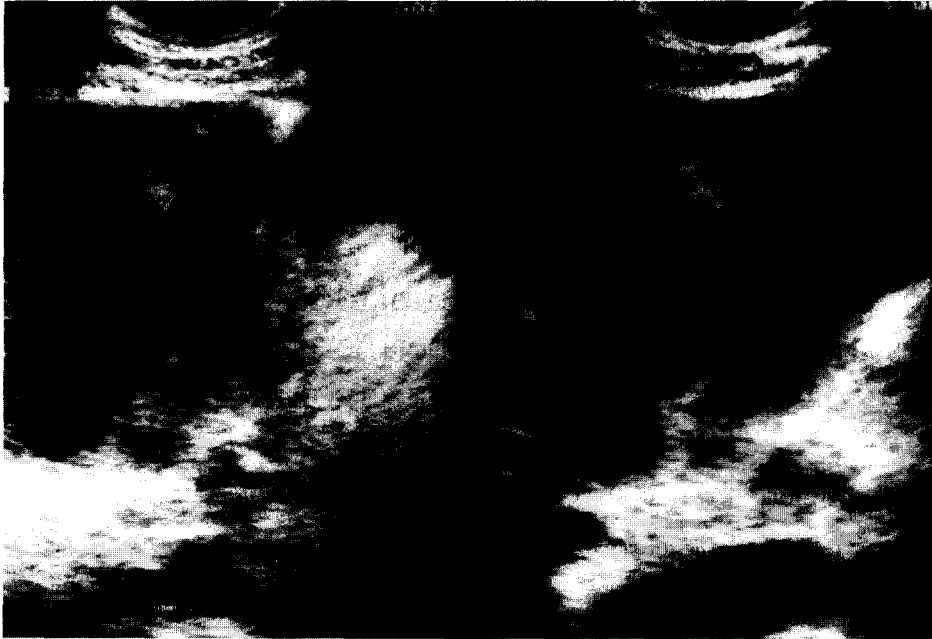


Fig. 1. A 29-mm HCC nodule is displayed in the V segment near to the gallbladder.

complete necrosis of small HCC (< 3 cm), and safely in that no side effects occurred (Rossi et al., 1993).

In this report, we present the clinical and US findings of an acute 'thermal' cholecystitis encountered in a patient treated with IRH for his HCC nodule.

2. Case report

In November 1992 C.G., a 50-year-old man with a HCV-positive liver cirrhosis in Child's Class A, was referred to our Department for the treatment of a 3-cm HCC nodule located in the V segment (Fig. 1). The patient was deemed eligible to IRH therapy (Rossi et al., 1993): the focal lesion was punctured under US guidance with a 1.8-mm electrode needle connected to a radiofrequency generator (RFG-3C Radionics). At that time, the needle tip was at 25 mm from the gallbladder wall.

Three thermal lesions at 90°C for 120 s each were generated in the area with an anticipated volume of necrosis of about 6 cc.

The needle was slowly withdrawn after each lesion had been generated to increase the area of necrosis.

Just after the completion of the third thermal lesion, the patient began to complain of a dull epigastric pain radiating to the back, associated with nausea. The interventional procedure was suspended: at physical examination no abdominal tenderness was elicited and analgesics were given. A US scan performed 2 h later displayed diffuse thickening (13 mm) of the gallbladder wall showing a striated ('layered') aspect (Teefey et al., 1990) due to alternate hyperechoic and hypoechoic layers (Fig. 2). The endoluminal content was normally anechoic and no pericholecystic fluid collections were found.

The US findings along with the clinical symptoms suggested an acute cholecystitis presumably 'thermal' in origin.

Laboratory tests, including serum transaminases, white blood cell count, bilirubinemia and an hemocult test did not show any change from the pre-therapy values throughout the hospital stay.



Fig. 2. Layered thickening (13 mm) of the gallbladder wall. Note the alternate hypoechoic and hyperechoic areas. The luminal content is normally anechoic and no pericholecystic fluid collections are seen.

The patient was managed conservatively and broad spectrum antibiotics and analgesics were administered. Over the following 3 days, the abdominal pain subsided whereas the US findings remained unchanged. The patient was discharged 1 week after the IRH therapy: at that time the gallbladder wall thickness was still 6 mm but returned to normality at the follow-up US scan 2 weeks after the percutaneous treatment (Fig. 3).

The development of multinodular HCC during the following few months prevented any further form of therapy. In January 1995, the patient died from diffuse neoplastic involvement of the liver.

3. Discussion

The increasing and widespread use of diagnostic and therapeutic interventional ultrasound procedures entails, as an ineluctable counterpart, a larger number and a wider spectrum of complications (Fornari et al., 1989; Nolsoe and Nielsen, 1990).

Interstitial Radiofrequency Hyperthermia is a new percutaneous modality of treatment for small (< 3 cm) HCC (Marone et al., 1993; Rossi et al., 1993). The technique has been reported as extremely safe in the recent paper by Rossi et al. (1993) in that no complications, either minor or major, occurred.

The case of acute 'thermal' cholecystitis we described is noteworthy since it represents the first complication of IRH which needs treatment. Although complete clinical and anatomic resolution was quickly achieved, thermal injury of hepatobiliary structures is a real possibility during this form of treatment for HCC.

However, it should be stressed that such a complication occurred early in our experience with IRH, whereas no side effects were encountered in patients treated afterwards (Marone et al., 1993).

To obtain a finer modulation of the necrosis without damaging adjacent structures, we have used a smaller electrode needle (1.3 mm) when the HCC nodule was located near to vital areas (e.g.

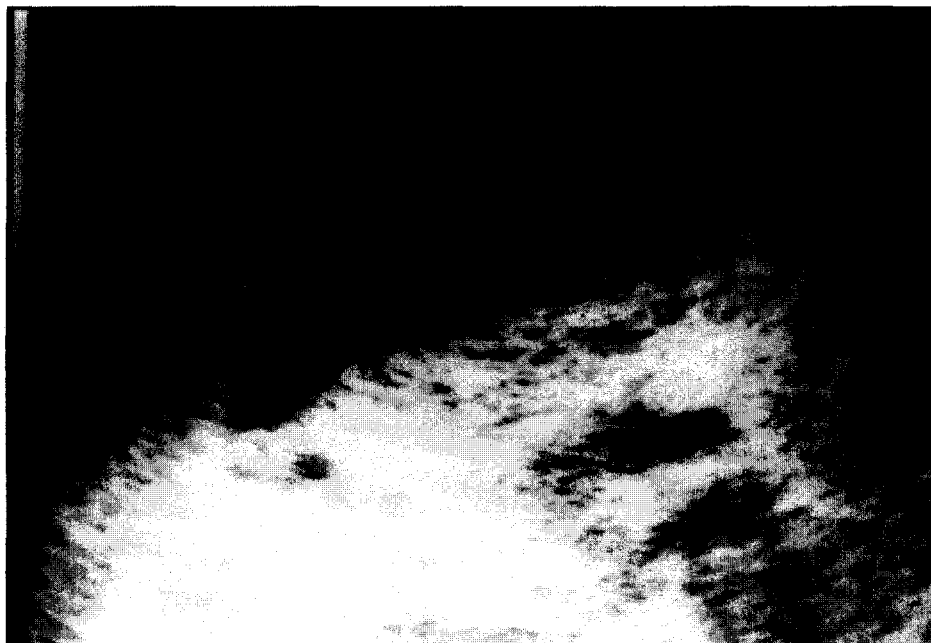


Fig. 3. The gallbladder wall has regained its pre-treatment width 2 weeks after IRH.

gallbladder, portal vein, main bile ducts, subdiaphragmatic paracardiac area).

Another point deserving mention is that the US findings, i.e. diffuse striated gallbladder wall, represents, to our knowledge, the first US demonstration of gallbladder injury caused by a physical agent such as heat.

The 'layered' gallbladder wall at US has been recognized in a variety of conditions often unrelated to gallbladder disease and has been interpreted as expression of edema or inflammatory changes involving the cholecystic wall in a diffuse or focal form (Teefey et al., 1990).

It is likely that the increase in tissue temperature at the gallbladder wall, albeit lower than the cut-off level of 48°C for a lesion to be generated (Haines and Watson, 1989), may have caused parietal edema due to vascular congestion as it has been observed at the periphery of thermal lesion experimentally produced in porcine liver (McGahan et al., 1993; Rossi et al., 1990). However, alternative explanations, such as blockage of the venous and/or lymphatic drainage, may be taken into account.

The observation that in 'thermal' cholecystitis US findings are similar to those encountered in other pathological conditions suggests that the 'layered' thickening of the gallbladder wall represents a common response to a variety of infectious, toxic, metabolic and physical injuries.

In conclusion, thermal damage of the gallbladder, albeit not clinically severe, can occur during IRH therapy of small HCC and US appearance is that of 'layered' thickening of the wall.

References

- Amin Z, Donald JJ, Masters A, Kant R, Steger AC, Bown SC, Lees WR. Hepatic metastases: interstitial laser photocoagulation with real-time US monitoring and dynamic CT evaluation of treatment. *Radiology* 1993; 187: 339–347.
- Fornari F, Civardi G, Cavanna L, et al. Complications of ultrasonically guided fine-needle abdominal biopsy: results of a multicenter Italian study and review of the literature. *Scand J Gastroenterol* 1989; 24: 949–955.
- Haines DE, Watson DD. Tissue heating during radiofrequency catheter ablation: a thermodynamic model and observations in isolated perfused and superfused canine right ventricular free wall. *PACE* 1989; 12: 962–976.

- Livraghi T, Vettori C, Lazzaroni S. Liver Metastases: Results of percutaneous ethanol injection in 14 patients. *Radiology* 1991; 179: 709–712.
- Livraghi T, Giorgio A, Marin G, et al. Hepatocellular Carcinoma and cirrhosis: long-term results after Percutaneous Ethanol Injection. *Radiology* 1995; 197: 101–108.
- Marone G, Francica G, Iodice G, Picciotti E. Radiofrequency Hyperthermia (RFH) under Ultrasound (US) guidance in the treatment of hepatocellular carcinoma (HCC). Preliminary results. *Ital J Gastroenterol* 1993; 25: 120 (Abstract).
- McGahan JP, Schneider P, Brock JM, Tesluk H. Treatment of liver tumors by percutaneous radiofrequency electrocautery. *Seminars Intervent Radiol* 1993; 10: 143–149.
- Nolsoe C, Nielsen L, Torp-Pedersen S, Holm HH. Major complications and deaths due to interventional ultrasonography: a review of 8,000 cases. *J Clin Ultrasound* 1990; 18: 179–184.
- Rossi S, Fornari S, Pathies C, Buscarini L. Thermal lesions induced by 480 KHz localized current field in guinea pig and pig liver. *Tumori* 1990; 70: 54–57.
- Rossi S, Fornari F, Buscarini L. Percutaneous Ultrasound-guided radiofrequency electrocautery for the treatment of small Hepatocellular Carcinoma. *J Intervent Radiol* 1993; 8: 97–103.
- Teefey SA, Baron RL, Bigler SA. Sonography of the gallbladder: significance of striated (layered) thickening of the gallbladder wall. *AJR* 1990; 156: 945–947.