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Bleeding control by radiofrequency in penetrating trauma of the liver

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SUMMARY: **Bleeding control by radiofrequency in penetrating trauma of the liver.**

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Termocoagulation by radiofrequency (RF) is widely used for ablation of liver neoplasms. Recently, innovative uses of RF were proposed, as to assist liver resection, to help partial splenectomy, or to treat ruptured hepatocellular carcinoma.

A 21 years old man was admitted for massive haemorrhage from a right thoraco-abdominal knife wound. Massive haemothorax was drained but arterial bleeding was caused by a deep penetrating wound on liver segment VIII. During operation, considering the difficult exposure of the source of bleeding, it was tought to stop haemorrhage using RF termocoagulation, under ultrasonographic guidance. Termocoagulation of the pedicle of the liver segment VIII was performed.

In this patient with haemorrhagic shock the RF method for bleeding control was very easy and effective, and avoided risks of morbidity due to a major procedure.

RIASSUNTO: **Emostasi mediante radiofrequenza in un caso di ferita penetrante del fegato.**

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La termocoagulazione mediante radiofrequenza (RF) è estesamente impiegata per l'ablazione delle neoplasie epatiche. Di recente sono state proposte alcune applicazioni innovative della RF, come ausilio durante le resezioni epatiche, la splenectomia parziale o nel trattamento della rottura di epatocarcinoma.

Un uomo di 21 anni è stato ricoverato nel nostro Ospedale per emorragia massiva da ferita penetrante toraco-addominale da arma bianca. Drenato un emotorace massivo, si rilevava che l'emorragia proveniva dalla penetrazione della lama nel segmento VIII del fegato. Nel corso dell'intervento, considerate le difficoltà nella adeguata esposizione della fonte dell'emorragia arteriosa, si è pensato di bloccare il sanguinamento impiegando la RF, sotto guida ecografica. Si è proceduto quindi a termocoagulazione del peduncolo vascolare per il segmento VIII.

In questo paziente in shock emorragico, l'uso della RF per controllare l'emorragia è stato semplice ed efficace, evitando i rischi di complicanze legati ad interventi chirurgici maggiori.

KEY WORDS: Liver - Trauma - Radiofrequency - Bleeding - Surgery.
Fegato - Trauma - Radiofrequenza - Emorragia - Chirurgia.

Introduction

Radiofrequency (RF) is a high frequency alternating current that causes thermal coagulation and protein denaturation when delivered by thin electrodes in the parenchymal tissue (1). Termocoagulation by RF is increasingly and widely used for ablation of liver neoplasms (2). Reported complications are necrosis or perforations of sourrounding organs or involvement of the biliary tree with subsequent abscess or biliary fistula.

Recently, innovative uses of RF were proposed, like the use of RF to assist liver resection (3), to help partial splenectomy (4), or to treat ruptured hepatocellular carcinoma (5).

We report the first case in wich RF was used to control bleeding in liver trauma.

Case report

A 21 years old Chinese man was referred to our hospital after a knife wound in the right anterior lower thorax, under the right sixth rib. At admission chest X-ray showed gross right haemothorax (Fig. 1) and ultrasonography (US) demonstrated a small hemoperitoneum and inhomogeneity on the liver segment VIII.

After US, 2500 cc of blood were drained from the chest, and the patient was taken in the operative room in impending shock.

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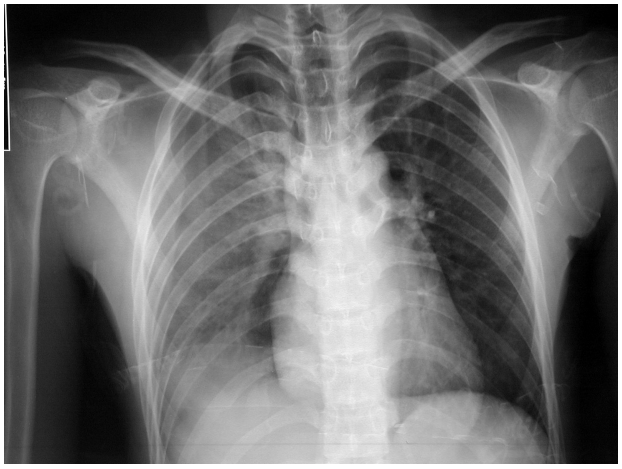

Fig. 1 - Chest X-ray. Radiogram was taken in supine position. Massive haemothorax in the right chest is evident.

At preliminary exploration of the wound, it was found that the active arterial bleeding was originating from the injured liver, and the chest cavity filled of blood through the wounded diaphragm. At midline laparotomy, it was confirmed that arterial bleeding came from a deep cut, about 8-10 cm, in liver segment VIII. During Pringle's manouvre, it was attempted to obtain hemostasis by suturing or clipping the source of bleeding, but the cut was too deep, and the attempts to achieve haemostasis by stitches and clips were unsuccessful due to inadequate exposure. So, under clamping of the hepatic pedicle, we used a RF Cool-tip single 200 Watt electrode needle trying to control haemorrhage. The first attempt was made putting the needle inside the wound, and was unsuccessful. Then, we inserted the needle in the parenchyma, under US guidance, along the wound, about 5 mm from the cut surface, reaching the pedicle of segment VIII. After the first cicle of 6 minutes arterial hemorrhage completely stopped. Haemostasis was completed with 2 other cicles of 5 minutes in the opposite side of the wound. The right lung was inspected through the diaphragm to exclude other sources of bleeding. The diaphragm was sutured with interrupted stitches. Ten units of red blood cells were transfused during operation.

After a short stay in the intensive care unit, the patient came back to our ward. Postoperative course was completely uneventful, and the patient was discharged in the 6th post-operative day. Two months after, RMN cholangiography shows the efficacy of coagulation on the liver (Fig. 2).

Discussion

Liver trauma is important cause of morbidity and mortality, depending on the severity of trauma, asso-

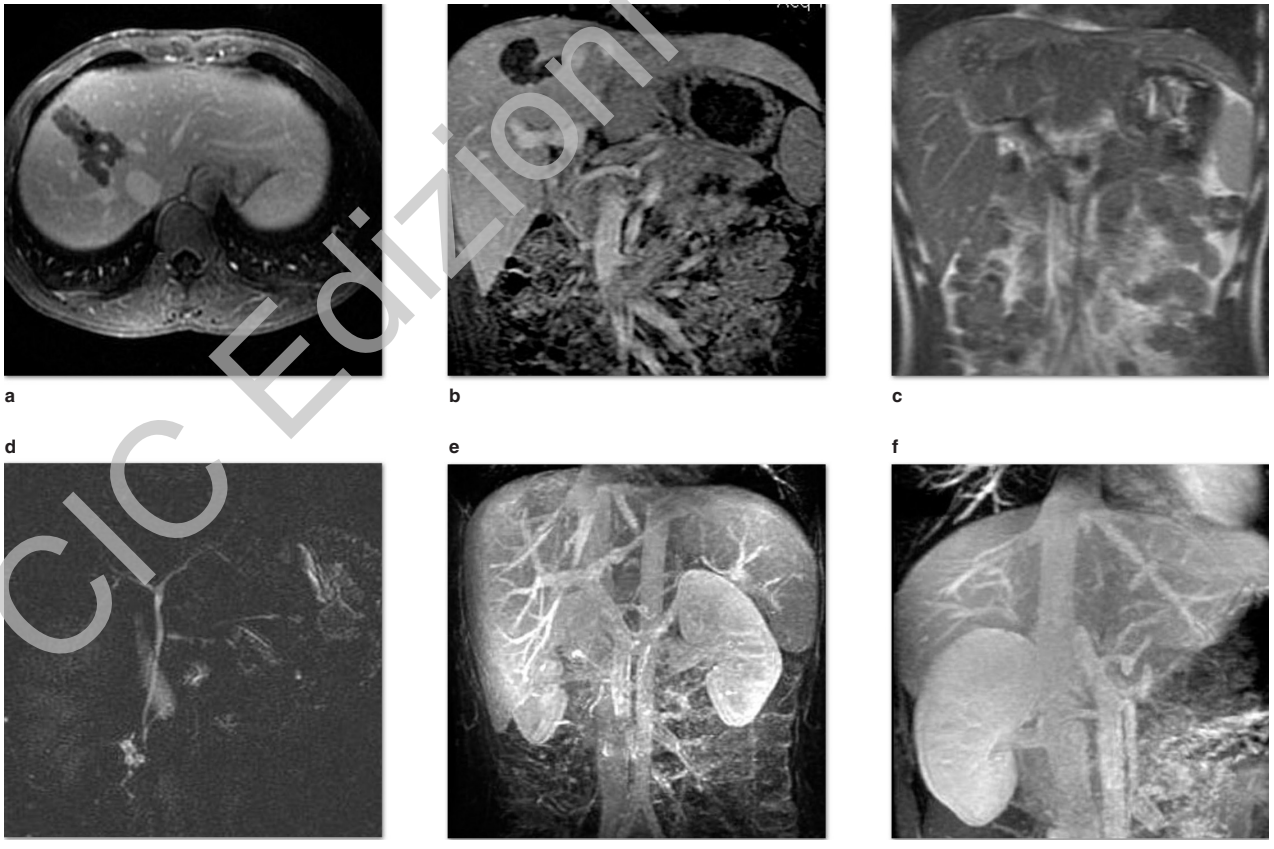

Fig. 2 a-f - Angio-MR study performed 2 months after the tratment demonstrates the residual necrosis in the RF treated area that appears ipointense in the T1 gradient-echo sequences (a, b). The coagulative necrosis is dark on T2-weighted images (c). No fluid collection were seen. Magnetic resonance cholangiopancretography demonstrates normal findings of biliary tree (d). At magnetic resonance angiogram (e, f) portal vein and sovrahepatic vessels are normal.

ciated lesions, and the operation required to manage traumatic lesions. Conservative treatment is suggested in hemodynamic stable patients (6), and arterial bleeding control plays a crucial role to achieve haemostasis in major trauma (7). Surgical control of liver injury can be technically very demanding. Haemostasis is very difficult when resuscitation requires massive transfusion, and the patient develop acidosis, coagulopathy, hypothermia. In these conditions, patients can not tolerate large liver resection. Packing and subsequent reoperation are often required in these cases, with very high morbidity and mortality.

RF is an increasing modality to treat liver neoplasms and was recently employed to assist liver resection, also in cirrhotics, taking advantage of the coagulation power (3). The general aspects and mechanisms of action of radiofrequency ablation were reviewed by Ni Y and Coll. (1). Experimental studies on pigs (8-9) confirms that RF is effective in sealing vessels in simulated IV degree liver trauma. The model of central injury was created by deeply cutting the parenchyma in the central part of the liver, and the lesion was treated by InLine RF. The reduction of blood loss was significant in comparison with traditional technique (diathermy and suture).

There are not reported cases in literature in which RF was used to treat liver trauma in the clinical setting. This method was very simple, safe and effective to control bleeding in this case, in wich bleeding originated from an important branch of the hepatic artery, like a segmentary artery. This method avoided a more complex operation, like hepatotomy, for direct haemostasis or ligation of the right branch of the hepatic artery. It was also seen that the presence of clips did not affect the efficacy of RF in human.

Conclusions

RF is to be considered a powerful method to control arterial bleeding from the liver, as in case of knife or gunshot wounds, expecially when a traditional surgical approach would require larger dissection or hepatectomy.

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