

LAPAROSCOPIC ASSISTED PER-CUTANEOUS RADIO-FREQUENCY ABLATION (LAPRFA) AS A NEW MODALITY FOR TREATMENT OF HCC IN CIRRHOTIC LIVER

By

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Abstract

Laparoscopic assisted percutaneous radiofrequency ablation (LAPRFA) for hepatocellular carcinoma (HCC) under guidance of intra-operative laparoscopic ultrasound (IOLUS) is a new modality for obtaining additional assessment of the liver situation, better tumor staging and effective treatment for the hepatic focal lesion (HFL), in patients with a difficult percutaneous approach. Between September 2010 and July 2014, 1150 patients with HCC on top of liver cirrhosis were referred to HCC clinic (MDT clinic) at National Hepatology and Tropical Medicine Research Institute (NHTMRI). Fourty nine patients were submitted to LAPRFA under IOLUS guidance by the Multidisciplinary team decision. Operation time, hospital stay, post procedure complications were recorded. A routine spiral CT scan one month postoperative and laboratory investigations with AFP were mandatory during follow up.

The results showed that LAPRFA was completed in all patients. The IOLUS examination identified new HFL in three patients. A total of 52 lesions were treated. The mean operative time was 92 minutes; eight procedures were associated in six patients: cholecystectomy (6) and adhesiolysis (2). A complete tumor ablation was observed in all patients during the procedure by the U/S assessment intra-operatively, and was documented via spiral computed tomography (CT scan) one month after treatment.

Key words: Cirrhotic liver, Laparoscopic Assisted Per-Cutaneous Radio-Frequency Ablation

Introduction

Llovet *et al.* (2003) reported that the hepatocellular carcinoma, the most common primary liver cancer, occurs in 90% of the cases in patients with chronic liver disease (CLD). Hepatocellular carcinoma (HCC) is one of the leading causes of cancer-related death in the world. Infection with hepatitis C virus (HCV) represents one of the most common risk factors for HCC development, and cases of HCV-related complications have been rising over the last 2 decades (Li and Chung, 2015). The optimal treatment for hepatocellular carcinoma is surgical resection. However, only a small percentage of patients are candidates for surgical resection. The French scientist D'Arsonval described the principle of radiofrequency ablation demonstrating that an alternative electric current greater than 10 kHz could pass through living tissue without neuromuscular

effect (D'Arsonval, 1891). However, it was only in the late 1980s that new radiofrequency technology was developed which enabled ablation done within the body tissues (Mc-Gahan *et al.*, 1990). Radiofrequency procedure can be performed via percutaneous, laparoscopic or thoracoscopic percutaneous assisted and open approaches. Percutaneous radiofrequency ablation has been shown to be efficacious in the treatment of unresectable HCC, with complication rate around 2.1% (Livraghi *et al.*, 2003).

The optimal treatment for hepatocellular carcinoma (HCC) is surgical resection. However, only a small percentage of patients are operative candidates due to associated liver cirrhosis. The laparoscopic RFA guided with laparoscopic ultrasound is an excellent use of existing technology in the improvement of safety and efficacy of detec-

tion and treatment of intrahepatic tumors in patients with liver cirrhosis (Salama *et al*, 2010). Although, RFA and laparoscopy appeared to be safe procedures with low rates of morbidity and mortality the indication should always be discussed in multi-disciplinary meetings and the procedure should be performed only following guidance and adequate training.

Patients, Materials and Methods

A total of 45 patients with HCC were treated using laparoscopic assisted percutaneous radio-frequency ablation (LAPRFA) from September, 2010 to July, 2014 at National Hepatology and Tropical Medicine Research Institute. Forty nine patients were contraindicated for per-cutaneous RFA, whom underwent laparoscopic assisted percutaneous RFA following the inclusion criteria: 1- Surgical resection is not recommended, 2- Contraindication of using percutaneous radiofrequency, 3. HCC near to vital organs such as diaphragm or gut, 4. Patients with Child-Pugh (A and B), 5- Patients with an additional surgical indication such as, cholelithiasis, umbilical hernia, 6. Patients with hepatocellular carcinoma < 5 cm in diameter, and 7- Patients with American Society of Anesthesiologists (ASA) I, II, and III patients

Medical sheets were filled out on each patient including history, physical examination, laboratory tests including complete blood picture, prothrombin time, liver functions, HBV and HCV profiles and serum alpha-fetoprotein (AFP) levels were obtained preoperatively. Abdominal ultrasound (US), triphasic helical computed tomography (CT), and in some cases Magnetic Resonance Imagie (MRI) with Special liver Protocol were needed in some doubting cases.

Laparoscopic assisted percutaneous RFA technique (LAPRFA): The procedure was performed with the patient under general anesthesia and placed in a supine position, with epi-dural catheter placed in 31 cases (63.26%). The surgeon stood on the left side

of the patient and the first assistant on the opposite side. The monitors were placed at the head of the table, through a periumbilical incision; carbon dioxide pneumoperitoneum was carried out using **Veress** needle (closed method) in 39 cases (79.59%). In patients with prior open abdominal operations, the abdominal cavity was entered by using the open technique (safer for start with) in eight patients (16.32%). In two patients the **veress** needle was introduced in the left hypochondrium-midclavicular point (4.08%) due to difficult umbilical introduction.

Routine Laparoscopic exploration was performed with a zero degree laparoscope, Another 10-12mm port was placed according to the location of the HCC, with or without addition of another 5mm port (the third port was put in 7 cases 14.28%).

Laparoscopic ultrasound was carried out for whole liver followed by localization of HCC. The vital organs near HCC such as stomach, colon or diaphragm were protected by abdominal towels soaked in hot normal saline solution, introduced through the 10 mm port by small extension of the opening (Fig. 1), or omentum (Fig. 2), dissection of the falciform ligament was carried out in nine cases (18.36%) for better exposure, and dissection of the right triangular ligament of the liver was dissected in four cases (8.16%) for better identification of the lesion, and in 15 cases (30.16%), creation of artificial ascites by infusion of 5% dextrose to displace or protect adjacent viscera was indicated (Fig. 3).

The LAPRFA was performed under ultrasonography guidance, utilizing a generator providing 460 kHz (RITA medical system, Mountain View, California) alternating current and a semi-flax retractable multi-pronged curved electrode-needle (Figs. 4 & 5).

The average target temperature was set at 100°C to 110°C, and ablation was continued for 25 - 30 minutes depending on the desired ablation size (3-5cm in diameter). The process was monitored by real- time ultrasound

to ensure 1 cm margins. The narrow-band specificity of the laparoscopy demonstrates the complete ablation of the tumor as well as the change of the vascularity in the tumor tissue (Figs. 6&7). The drain was left behind. Drains were removed within 24-48 hours; the naso-gastric tube was introduced with the induction of anesthesia and was removed at the end of the procedure to deflate the stomach during the procedure. Operative time, complication and hospital stays were recorded. A routine abdominal ultra-sonography, and chest X ray (antero-posterior position) were realized on D1 post-operative prior to removal of the drain.

Abdominal Ultra-sound & Triphasic CT scan were routinely obtained one month post-operatively as well as the AFP. all patients were re-enrolled for the screening program for HCC and be considered as high risk group candidates with the routine abdominal ultrasound and AFP to be done every two months during follow up period and strictly follow the guidelines for the HCC screening program.

The local recurrence was defined as tumor recurred at treated site (reactivation of the ablated lesion). However, new tumor appeared in different hepatic parenchyma was defined as new HCC. For these recurrences or new HCC RFA may be considered and performed either per-cuteanous or laparoscopic or any other modality of treatment according to the decision in MDT meeting advice.

Results

Table 1: Distributions of Lesion Site

Items	Results
Mean age	48 years
Mean operative time	95 minutes
Mean hospital stay	1.2 days
Mean lesion size	3.1 cm
Lesion site	Segment-II: 5 cases Segment-III: 13 cases Segment-IV: 4 cases Segment-V: 2 cases Segment-VI: 7 cases Segment-VII: 10 cases + one new lesion Segment-VIII: 8cases + two new lesions

Laparoscopic Assisted Per-cutaneous Radio Frequency Alation (LAPRFA) was performed in 49 patients. The mean age was 48 years (38-75 years), there were 31 males and 18 females. All patients were hepatitis C positive, 41 patients were classified as CHILD (A) (83.67%), (score 5 =27 cases (55,10), and score 6 = 14 cases 28.57%), regarding their liver cirrhosis scoring system, while 8 patients (16.32%), were classified as early B in their CHILD score (score 8) and all patients, underwent pre-operative assessment for the oesophageal varices by upper GIT endoscopy +/- ligation of the OV's if Grade III or more. Nine patients (22.44%) had pre-operative oesophageal varices grade III that necessitated ligation once for eight patients (16.32%) and twice for one patient (2,04%), operation was postponed for 15 days after the ligation. The mean operative time was 95 minutes (60±135 minutes). Mean lesion size was 3.1 cm (1.5±4.9 cm). The mean hospital stay was 1.2 days (1-3 days). There was no mortality (within 30 days of surgery) in this series. Complications were noted as following, nine patients (18.36%) underwent ascites, three case (6.12%) had local recurrence that underwent trans-arterial chemoembolization (TACE), and 18 (36.73%) patients has temporary ascites for ten to fifteen days post-operative and were prescribed for diuretics regular from D1 post-operatively. Six cases (12.24%) had a new intra-hepatic HCC; one of them (2.04%) underwent a second attempted of laparoscopic RFA.

Discussion

In the present study, LAPRFA was able to avoid two of most frequent complications, bleeding, which could be controlled by direct recognition & control during laparoscopic technique as well as colonic injury by different ways of protection as mention before. Haemothorax was one of less frequent complication could be avoided in laparoscopic radiofrequency ablation by using a technique of creation of artificial ascites as described in this series. However, the other complications were not detected in this series during follow up period. A laparoscopic approach gave the advantages of laparoscopic ultrasonography, which provides better resolution for the number and location of liver tumors, and a survey of the peritoneal cavity to exclude the presence of extrahepatic disease. The laparoscopic ultrasound permits more precise positioning of the radiofrequency needle multiple arrays near major blood vessels. In this study, a laparoscopic approach for patients was used according to the inclusion criteria (Barcelona guidelines & Egyptian guidelines for treatment of HCC).

In our series, laparoscopic ultrasound was able to detect a new lesion in three patients which treated simultaneously.

Generally speaking, the hepatocellular carcinoma is the fifth most common cancer worldwide. Hajarizadeh *et al.* (2013) stated that the worldwide, an estimated 130-170 million people have HCV infection. HCV prevalence was highest in Egypt at >10% of the general population and China had the most people with HCV (29.8 million). They concluded that chronic hepatitis C generally progresses slowly in the initial two decades, but could be accelerated during this time as a result of advancing age and co-factors such as heavy alcohol intake and HIV co-infection. The treatment of HCC in patients with chronic liver disease is a major challenge. Although there was a certain agreement about avoiding surgery in patients with more advanced chronic liver disease, which

treatment has to be offered to patients with a relatively preserved liver function is still a matter of debate (Bruix *et al.*, 2002). However, only selected patients are suitable for surgical resection because of advanced tumors, major vascular invasion, multifocal tumors, poor hepatic reserve or extra hepatic disease. With the intention of avoiding the risk of hepatic failure that can follow hepatic resection in such patients, per-cutaneous ablative treatments have been proposed; of which radiofrequency ablation is progressively gaining consensus due to the efficacy, tolerability and low-risk of the procedure (Befeler and Di Bisceglie, 2002).

Therefore, the need of alternative treatments of HCC local ablative therapies including per-cutaneous ethanol injection, acetic acid injection, cryotherapy, microwave coagulation, laser and radiofrequency ablation, have been investigated. Currently, the last has been most enthusiastically utilized. Rossi *et al.* (1995) were the first who described RFA of human liver tumors in a large study in the early 1990s. Bleeding, liver abscesses and colonic injury were the most frequently reported complications, and less-frequent complications were bilomas, biliary strictures and haemothorax (Nicoli *et al.*, 2005).

Wiggermann *et al.* (2012) stated that the thermal ablation procedures, including the radiofrequency ablation (RFA) or laser-induced interstitial thermotherapy (LITT), are now well established in the treatment of malignant unresectable hepatic tumors. They concluded that achievement of complete ablation is a highly important predictor of long-term survival and that tumor size is by far the most important predictor of the likelihood of achieving complete ablation.

Conclusion

Ultimately, the best management of HCC would involve prevention of viral hepatitis, early detection and liver transplant. However, laparoscopic assisted per-cutaneous RFA is much less invasive, involves a short hospital stay, and an extremely the low mortality

ty and morbidity associated with the procedure.

LAPRFA of HCC proved to be a safe and effective technique. IOLUS is an accurate modality as well as spiral CT scan in detection of HCC and in some cases it was even superior over the CT scan (three cases-6.122%) either to confirm the previously detected by other modality or new detection of HCC not previously detected by these different modalities.

Feasible treatment modality to achieve good tumor ablation with great accuracy under laparoscopic ultrasound guidance permitting to detect new lesion missed at preoperative imaging modalities.

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Explanation of Figures

Fig. 1: Colon protected with abdominal gauze soaked in saline solution.

Fig. 2: Stomach protected by omentum.

Fig. 3: Creation of ascites by instillation of Dextrose 5% to protect diaphragm.

Fig. 4: Semi-flex retractable multi-pronged curved electrode needle.

Fig. 5: Introduction of semi-flex needle under vision & U/S guidance.

Fig. 6: During ablation.

Fig. 7: after ablation with vascularity changes by Narrow band specificity.

