

# Pancreatic cancer palliation using radiofrequency ablation. A new technique

## Case Report

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**Abbreviations:** radiofrequency ablation, (RFA)

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## Summary

We present the use of a new radiofrequency ablation (RFA) system, in five patients, with inoperable pancreatic cancer. In the current literature these cases are the only treated by this RFA device. We performed RFA in five patients with advanced pancreatic cancers. Four of them had obstructive jaundice and the other had gastric outlet obstruction. The pancreatic cancers considered as unresectable during the laparotomy, due to advanced local disease in all patients. We used the newer Cool-tip™ RFA system (Radionics), with the cooled electrode. The electrode circulates water internally to cool the tissue adjacent to this, maximizing energy deposition. Especially, in the patient with the huge tumor in the pancreatic body we used the Cool-tip™ Cluster electrode (Radionics) to increase the coagulation volume. None of our patients developed a significant complication from the treatment, such as pancreatitis or bleeding. RFA of unresectable pancreatic cancer is a safe palliative procedure according to our preliminary results in five patients. Probably in some cases RFA may slow tumor growth resulting in long-term survival, as in one of our patients, who lives 15 months after surgery without evidence of disease progression.

## I. Introduction

Pancreatic cancer is the fifth cause of cancer death in the United States and one of the leading causes of cancer death in the 'western' countries becoming so a major worldwide public health problem. The radical surgical resection represents the only chance for cure but, unfortunately is possible in only 15% of patients. Even at experienced centers the 5-year survival rates for the most favorable patients who undergo resection and adjuvant therapy are less than 20% (White et al, 2003).

Treatment options in the advanced unresectable pancreatic cancer are very limited. Palliation involves either biliary stenting or surgical bypass. Combined chemoradiation has been associated with improvements in pain, wasting and obstructive symptoms over chemotherapy alone and offers some benefits in these patients (Fisher et al, 1999). The ablation of unresectable pancreatic cancers with the use of radiofrequency devices is a relatively new treatment option. Only a few papers

have been published in the medical literature (Goldberg et al, 1999; Yoichi et al, 2000; Elias et al, 2004). On the other hand there is an extensive experience with the radiofrequency ablation (RFA) in the treatment of unresectable liver tumors and promising results have also been obtained in tumors of the kidney, breast, lung, bones and prostate (Mirza et al, 2001).

This article presents the use of a RFA system (Cool-tip™, Radionics), in five patients, with inoperable pancreatic adenocarcinoma. In the current literature these cases are the only treated by this RFA device.

## II. Cases report

In our departments the last year, we performed radiofrequency ablation in five patients with advanced pancreatic cancers. Four of the patients had obstructive jaundice due to pancreatic head tumors and the other had gastric outlet obstruction from a huge tumor (10X7cm) in the body of the pancreas. The treatments were performed

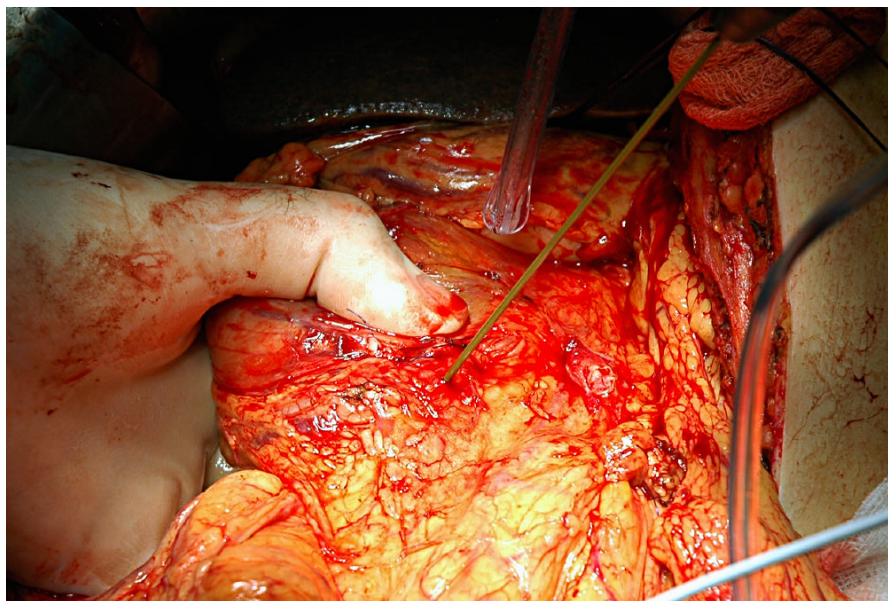
from February 2004 to March 2005. **Table 1**, summarizes patients characteristics.

Herein, we describe the technical details of the procedure in a particular patient (we followed the same procedure in all of our patients). A 65 years old man, with progressive painful obstructive jaundice was admitted to the surgical department, Messologi General Hospital. A radiologic investigation with ultrasound and computed tomography demonstrated a tumor of the head of the pancreas (4,5 cm) with local invasion of the superior mesenteric vein. A laparotomy was performed in which the tumor was confirmed (positive tumor FNAC/ frozen

section positive). There was not evidence of lymph node (lymph node of hepatoduodenal – frozen section negative) or liver metastasis. After an extensive dissection of the pancreatic head the tumor was considered unresectable due to infiltration of the superior mesenteric vein. Due to the above we decided for palliative operation and radiofrequency ablation of the tumor. We performed two ablations, one at the anterior and the other at the posterior surface of the pancreatic head (**Figures 1** and **2** respectively), for 6 and 7 minutes each, under direct vision of the duodenum to avoid burn damage to it.

**Table 1.** Characteristics of the patients: response to treatment and outcome

Patient	_, 65y	_, 74y	_, 79y	_, 66y	_, 64y
<b>Symptoms</b>	Painless obstructive jaundice (POJ)	POJ	POJ	Gastric outlet obstruction	POJ
<b>CT</b>	Tumor 3 cm (head), vessel infiltration	Tumor 3 cm (head)	Tumor 4,5 cm (head)	Tumor 10 cm (body)	Tumor 3 cm (head), vessel infiltration
<b>Criteria of inoperability</b>	Superior mesenteric vein obstruction – Positive tumor cytology	Hepatoduodenal lymph node positive in frozen section	Positive cytology, locally advanced tumor	Locally advanced disease – gastric outlet obstruction	Superior mesenteric vein obstruction Positive tumor cytology
<b>Operation</b>	Biliary-Gastric bypass + RFA (B-G bypass+RFA)	B-G bypass+RFA	B-G bypass+RFA	Gastric bypass + RFA	B-G bypass+RFA
<b>RFA device and technique</b>	Cool-tip™, two ablations 6 and 7 minutes	Cool-tip™, one ablation, 7 minutes	Cool-tip™, three ablations, 8, 2 and 4 minutes	Cool-tip™ Cluster electrode, two ablation, 7 minutes each	Cool-tip™, two ablations 6 minutes each
<b>Postoperative complications related to RFA</b>	None	None	None	None	None
<b>Follow - up Outcome</b>	15 months Alive without evidence of disease progression (locally or distant)	8 months Liver metastases Died	14 months Alive without any problem (diabetes, diarrhea, or jaundice)	9 months Alive	2 months Alive



**Figure 1.** RFA of the tumor at the anterior surface of the pancreatic head.

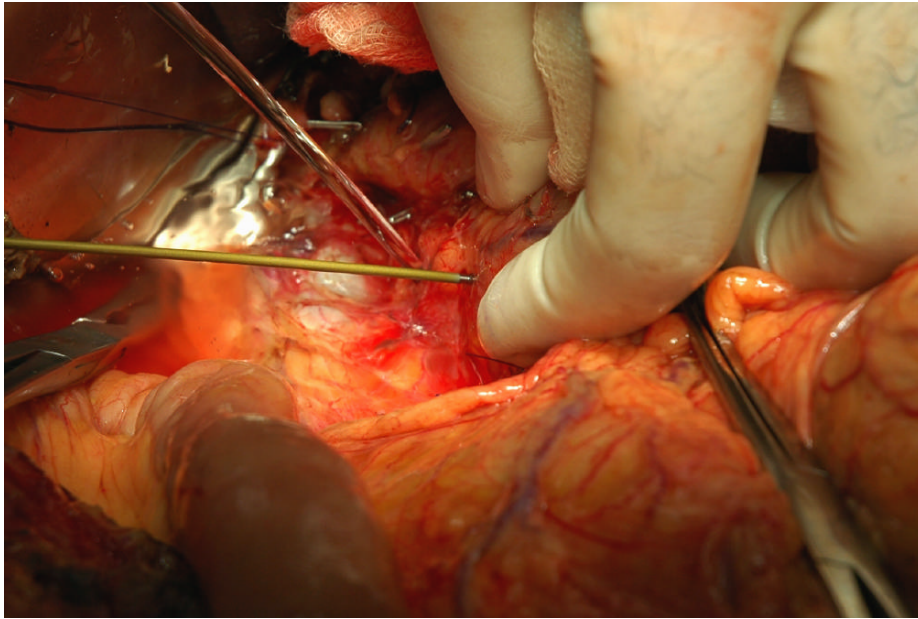
Also continuous infusion/perfusion of the area of the head of pancreas with cold normal saline was done during the radiofrequency ablation (**Figure 3**).

We used the newer Cool-tip™ RF ablation system (Radionics), with the cooled electrode (a 17-gauge, 20 cm with a 3 cm exposure length for rapid tumor destruction). The “biopsy needle” design allowed the accurate placement decreasing the potential injury of surrounding vital structures (common bile duct, duodenum, vessels). The electrode circulates water internally to cool the tissue adjacent to this, maximizing energy deposition. We completed the operation with a double anastomosis operation (a common bile duct-jejunostomy plus a gastro-jejunostomy). A drainage tube was left in the area of the

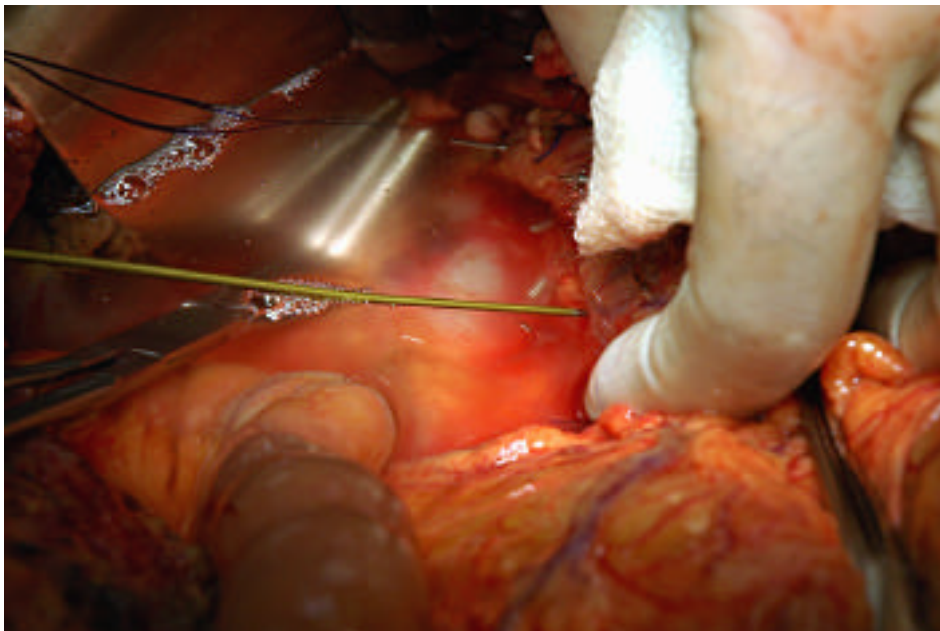
ablated tumor. We used the same technique (ablation under direct vision and palpation of the tumor) for all patients. Post-operatively the patients were covered with subcutaneous octreotide (Sandostatin) and antibiotics. We had not any postoperative complication related to the tumor ablation (pancreatitis, bleeding, hyperamylasemia) in anyone of our five patients.

### **III. Discussion**

Radiofrequency energy has been used in the last decades for the destruction of solid tumors. Unresectable liver tumors, mainly metastases from colon and rectal cancer, is the primary indication for the method.



**Figure 2.** RFA of the tumor at the posterior surface of the pancreatic head.



**Figure 3.** Infusion/perfusion of the area of the head of pancreas with cold normal saline during the RFA.

Promising results have also been reported for many other tumors as early stage breast cancer, osteoid osteoma, osseous metastases, solid renal tumors, pulmonary malignancies, brain and prostate tumors.

Proximity of the target tumor to a fragile structure (bowel, nerve, bile duct, vessel) is considered as a relative contraindication for the radiofrequency ablation (Elias et al, 2004). For the above reason (fragility of pancreatic parenchyma and fear of postoperative complications) the use of the RFA in the treatment of advanced pancreatic tumors is not so usual in the surgical routine. A recently published paper reports two patients with multiple metastases from renal cancer in the pancreas, who were treated with RF destruction. The authors used a high local temperature ( $>90^{\circ}\text{C}$ ) for the ablation, resulting in the effective tumor destruction. However, the two patients presented postoperatively severe necrotizing pancreatitis (Elias et al, 2004). The authors ascribed the complication to the lack of adequate device or to inadequate use of the existing device to perform intrapancreatic RFA. They used for the first patient a monopolar small 10-gauge needle electrode (1 cm tip) with the Elektrotom<sup>TM</sup> perfused system (Berchtold, Tuttigen, Germany) and for the other a bipolar device with two small 10-gauge needle electrodes (1cm tip) placed parallel each side of the tumor. In both cases a high temperature ( $>90^{\circ}\text{C}$ ) was used. Conclusively, the authors do not recommend the RFA of pancreatic tumors because of severe complications (Elias et al, 2004).

A decade ago, Goldberg et al, used the RF energy for the ablation of normal pancreatic tissue of 13 pigs. They used a modified electrode (19-gauge) without internal cooling maintained an electrode tip temperature of  $90^{\circ}\text{C}$ . They noticed foci of coagulation necrosis from 8 to 12 mm in diameter. Only one animal (13%) from the eight pigs that were not immediately sacrificed, presented a focal pancreatitis (Goldberg et al, 1999).

In our patients, we used the newer Cool-tip<sup>TM</sup> RF ablation system (Radionics), with the cooled electrode for rapid tumor destruction. The electrode is a 17-gauge, 20 cm with a 3 cm exposure length. The entire electrode can easily imaged on the intraoperative ultrasound. Furthermore it is easy to reposition allowing coagulation of varying lesion sizes. The "biopsy needle" design allows the accurate placement and decreasing the potential injury of surrounding vital structures (common bile duct, duodenum, vessels). The electrode circulates water internally to cool the tissue adjacent to this, maximizing energy deposition. So, the result is reduced treatment time (8-12 min) and maximal ablation zone. The hyperthermia was maintained for 7 min, twice, with different directions at a controlled temperature of  $80^{\circ}\text{C}$ -  $90^{\circ}\text{C}$  in the RF field. The temperature of the surrounding tissue was maintained at  $< 35^{\circ}\text{C}$  with continuous cooling with perfusion, infusion of cool normal saline solution. The patients were subsequently monitored by computed tomography (CT) scanning. None of our patients developed a significant complication from the treatment, such as pancreatitis or bleeding. The levels of serum amylase were within normal limits in all of the cases.

Our excellent results are very similar to these of the pioneer of the pancreatic cancer ablation. From September

1994 to February 1999, Yoishi and coworkers performed RF ablation in 20 patients with pancreatic adenocarcinomas which were judged to be unresectable based on the presence of distal metastases and/or local invasion into major blood vessels. The authors used a completely different RF ablation system than ours (OMRON Co. Ltd. Kyoto, Japan). The electrodes consisted of 4 needles, which were 2 cm long and 0,8 cm in diameter and which were positioned in a square array at intervals of 2 cm. They had only two serious complications (one patient with a cyst formation who required percutaneous drainage and another who developed an abscess in the peritoneal cavity). Both patients died 23 and 21 days after treatment respectively (Yoichi et al, 2000).

Our preliminary results, together with the results of Yoishi et al and Goldberg et al, indicate that the different RF ablation devices aren't responsible for the appearance of the post treatment severe pancreatitis observed in Elias et al cases. It seems more logical that the ablation of multiple pancreatic tumors (as the multiple pancreatic metastases in Elias et al cases) resulted in extensive destruction of the pancreatic parenchyma and it was the reason for the development of severe post treatment complications. So, based on our preliminary result we can recommend the use of RF ablation in solitary unresectable pancreatic tumors.

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