Percutaneous Radiofrequency Ablation and Endoscopic Esophageal Stenting for Undifferentiated Thyroid Cancer

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Abstract
We report a 69-year-old woman who received chemotherapy and radiation for thyroid tumor (undifferentiated cancer) after surgery in 1998. Chemotherapy was regularly repeated in order to avoid relapse. However, the tumor increased gradually, eventually causing dysphagia. Although we offered nutritional management through intravenous hyperalimentation or gastrostomy, she strongly preferred the oral intake of nutrition. Therefore, after obtaining her consent, we performed percutaneous radiofrequency ablation (RFA) for the tumor using a Cool-Tip needle, on April 2, 2003. The algorithm of RFA was 9 min: 30/50/120W, 12 min: 50/110W, 9 min: 50/100W. After 2 days, a covered stent was implanted to the esophagus, and oral intake was started. Although the operation for poorly differentiated thyroid cancer is controversial, we performed RFA and esophageal stenting to improve the patient’s QOL. We believe this is the first such case in the world.

Key words  Radiofrequency ablation (RFA), Thyroid cancer, Esophageal stent

Introduction
Radiofrequency ablation (RFA) is used for the treatment not only of primary hepatocellular carcinoma but also of other tumors including metastatic liver cancer,1 lung cancer,2,3 renal cancer,4,5 adrenal tumor,6 bone tumor,7,8 and metastatic bone tumor.9 In addition, extension of its application to pancreatic cancer is now under consideration.10 Although the invasive treatment of undifferentiated thyroid cancer is controversial, we carried out RFA and esophageal stenting in a patient with this type of tumor for the first time in the world. Improvement in quality of life (QOL) was achieved in this patient. Although RFA was markedly effective, a tracheo-cutaneous fistula formed as a post-operative complication. This case is reported herein.

Case Report

[Chief complaint] Dysphagia.
[Family history] Thyroid disease (–).
[Past history]
Age 26: Resection of right goiter (details unknown).
Age 29: A mass occurred in the right cervical area.
Right lobectomy and radiotherapy for thyroid cancer (histopathology: papillary carcinoma).
Age 40: Postoperative hypothyroidism (thyroid hormone replacement therapy initiated).

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Age 64: Undifferentiated thyroid cancer occurred. Treated by tumor resection (non-curative operation: histopathology: undifferentiated carcinoma) and 4 cycles of EP therapy (etoposide and cisplatin).

[Present illness] The patient was admitted to Shinshu University Hospital in 2001, at the age of 67, because of recurrence of undifferentiated thyroid cancer and its metastasis to the lung. There was no surgical indication because of involvement of the trachea and artery. Four cycles of chemotherapy (EP therapy) achieved a marked decrease in the tumor growth rate. Despite periodic implementation of the same chemotherapy regimen after discharge, the tumor increased gradually to cause dysphagia in December 2002. The patient was admitted to the hospital for close examination in March 2003.

[Physical findings on admission] The patient had hoarseness. There were depigmented macules throughout the cervical area, and a surgical scar 7 cm long was noted in the anterior cervical region. There was a palpable mass measuring 5 cm in diameter (no mobility, elastic hard, no tenderness) in the right cervical region (Fig. 1a). No abnormality was found in the thoracoabdominal region. There was no pretibial edema.

[Laboratory data on admission (Table 1)] No abnormality was found in blood count or biochemistry. Among the parameters of thyroid function, free T3 and free T4 were normal, TSH was suppressed to 0.9 μIU/ml, and thyroglobulin was less than 5.0 ng/ml.

[Imaging data on admission] Chest radiography: The cardiothoracic ratio (CTR) was 45%. The trachea was slightly deviated to the left. There was no pleural effusion or tumor shadow.

Upper gastrointestinal endoscopy (Fig. 1b): Occlusion of the esophageal orifice was noted.
Ultrasound findings (Fig. 1c): The thyroid tumor with capsules was heterogenous in pattern and 5×5 cm in size.

CT (Fig. 2a): The thyroid tumor, which measured 32×42×48 mm, pressed the trachea from the right posterior side, and the esophagus from the right anterior side, with distinct infiltration into the artery.
Although the patient was given an explanation of the need for nutritional management by intravenous hyper-alimentation or gastrostomy, she persistently refused such procedures and strongly requested oral feeding. After sufficient information had been provided, the patient consented to RFA for treatment of the tumor.

RFA was performed on April 2, 2003. The apparatus used was an ALOKA SSD-5000.
with the use of a convex intraoperative probe (10 MHz). Under ultrasonography, a 17 G Cool-Tip needle (Radionics: 20 mm in diameter, 20 cm in length) was punctured to provide ablation (9 min: 30 → 120 W, 12 min: 50 → 110 W, 9 min: 50 → 100 W) (Table 2). Two days later, CT evaluation revealed a necrotic area measuring 30 × 33 × 38 mm, although there was no change in tumor size (Fig. 2b).

[Endoscopic esophageal stenting (Fig. 3)] A covered stent (Ultraflex, Boston Scientific: outside diameter of the covered part, 22 mm; stent length, 12 cm; cover length, 9 cm) was implanted endoscopically 2 days after RFA (Fig. 3a,b,c). Oral feeding was resumed after favorable passage of contrast medium was confirmed by postoperative esophageal fluoroscopy (Fig. 3d).

[Postoperative course] RFA was carried out on April 2. The patient had a feeling of esophageal narrowing without pain on the following day, and she was able to eat an entire serving of 50% rice gruel diet. The perceived esophageal narrowing seemed to be attributable to temporary inflammation caused by tumor ablation. The day after RFA, palpation of the skin just above the tumor revealed obvious softening of the tumor, although there was no change in its size. On April 4, endoscopic esophageal stenting was performed. The patient complained of pharyngeal pain on April 6, but there was no sense of discomfort attributable to stent implantation. On April 9, esophageal fluoroscopy was performed. Since favorable passage of contrast medium was confirmed, oral feeding was resumed with fluid diet. Although the patient complained of severe sore throat, she was able to take food while controlling the pain with antipyretic analgesics (loxoprofen sodium; trade name: Loxonin®) and diclofenac sodium suppository (trade name: Voltaren suppository®). On April 19 (17 days after RFA), a tracheo-cutaneous fistula was formed, creating a whistling sound as air leaked out when the patient had a fit of coughing, and oral feeding was suspended (Fig. 4a,b). The tracheo-cutaneous fistula likely was formed by the following mechanism. First, a laceration of the skin occurred in the area burned by RFA. Then, the leading edge of the tumor that invaded the tracheal wall developed necrosis as a result of RFA and exfoliated, creating a hole in the tracheal wall. Owing to the increased intra-tracheal pressure created by coughing, the hole in the tracheal wall formed a connection to the laceration of the skin, resulting in the development of a tracheo-cutaneous fistula.

After the patient was intubated for respiratory management, a tracheal stent was placed, and extubation was performed. Although the patient’s
spontaneous respiration was restored once, she showed worsening of her general condition, and she eventually died of subarachnoidal hemorrhage 56 days postoperatively.

The patient’s preoperative performance status (PS) was rated as 2. Before performing RFA, oral feeding was not possible, but the patient refused hyperalimentation and was on nutritional management only through a peripheral vessel. Although the improvement unfortunately did not last long, the patient and her husband were delighted with her postoperative ability to ingest food and water without mis-swallowing. Because of the unexpected complication of tracheo-cutaneous fistula, oral feeding lasted only for about 2 weeks, but it improved the patient’s QOL.

**Discussion**

According to Ain KB, undifferentiated thyroid cancer is characterized by rapid growth of a cervical mass, which causes tracheal stenosis, leading to dyspnea, hoarseness, and dysphagia. The prognosis is extremely poor, with the 5-year survival rate just 13.6%. Most patients are reported to die within a year of diagnosis because of suffocation, infiltration into the superior mediastinum, or distant metastasis. Surgical treatment for undifferentiated thyroid cancer is controversial. In general, partial resection, radiotherapy following tracheostomy, and chemotherapy are repeated depending on the case. RFA may create change in the treatment strategy for this disease.

The undifferentiated thyroid cancer in the present case was harder than primary hepatocellular carcinoma, and therefore required substantial force for puncture. The tumor was considered to be rich in connective tissue and to have poor thermal conductivity, judging from its hardness. However, taking into account that it was an encapsulated tumor that bordered on the trachea and carotid artery, partially infiltrated these organs, and was expected to have an oven effect, ablation was performed for a 9-min period (beginning with 30 W and increasing in steps to 120 W), a 10-min period (beginning with 50 W and increasing in steps to 110 W), and another 9-min period with the puncture needle drawn 5 mm backward (beginning with 50 W and increasing in steps up to 100 W).

In regard to the use of RFA in treating thyroid tumor, its use for well-differentiated carcinoma has been reported in the literature. However, to our knowledge, there have been no reports on RFA employed for undifferentiated thyroid cancer. Although the optimal conditions were unclear, we adopted the above conditions based on our experience with RFA in cases of primary hepatocellular carcinoma. These conditions are considered to be adequate in view of the CT findings for evaluation of efficacy. To enhance safety, it seems better to apply a lower power for a shorter period of time, and to use an additional application, if necessary, based on the evaluation of efficacy.

We placed an interval of 2 days between the RFA session and esophageal stent implantation, expecting that the thyroid cancer would become softer after RFA. The tumor was obviously softened upon palpation of the skin just above the tumor the day after the RFA session. The esophageal orifice, which did not allow endoscopic entry preoperatively, allowed the endoscope to pass through 2 days after RFA. Thus, the 2-day interval seemed to be adequate for esophageal stenting.

Shiina et al. reported that RFA caused burn injury in about 1% of patients with hepatocellular carcinoma treated by this procedure. In our patient, the skin at the site of puncture already had a surgical scar and radiodermatitis as a result of previous radiotherapy, and the subcutaneous connective tissue layer was thin because of the presence of the thyroid (carcinoma) just under the skin. Therefore, it is presumed that these poor skin conditions interfered with healing of the skin burn, resulting in rupture of the skin. On the other hand, it is thought that the leading part of the tumor, having infiltrated into the tracheal wall, developed coagulative necrosis and reduction after RFA, and the resultant hole in the tracheal wall was connected with the necrotic tumor and the crack in the skin, resulting in the formation of a tracheo-cutaneous fistula. Tracheal burn or injury caused by the tip of the Cool-Tip needle was considered a possibility, but was excluded because it was apparent that the Cool-Tip needle was oriented in a different direction. Due consideration must be given to the conditions of the skin at the site of puncture. This is thought to be a lesson from the present case.
Current controversy surrounds invasive treatment for undifferentiated thyroid cancer. However, RFA and esophageal stenting were used for this tumor for the first time in the world, and improvement of the patient’s QOL was achieved.

References