

Can Ga-67 Scans Predict Radiation Effect in Patients with Intrathoracic Esophageal Carcinoma?

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Introduction

Ga-67 scans may be valid to evaluate responses of cancers after radiotherapy (1-5). Both positive and negative scans are obtained after irradiation in the patients with pretreatment positive scans; negative scans may indicate disappearance of tumors or good prognosis. However, a few reports provided follow-up data, and value and implications of such reverted scans remain to be defined. To our knowledge, there has been no report concerning histological findings in the patients with reverted scans.

Ga-67 scans have proved to be of value in some patients with esophageal carcinoma; positivity in the thorax indicates extraesophageal extension or gross lymph node metastases with few false positives (6, 7). The purpose of this study is to provide data about changes of histological findings in the irradiated patients with intrathoracic esophageal carcinoma and pretreatment positive Ga-67 scans.

Materials and Methods

A total of ten patients with intrathoracic esophageal carcinoma was selected for this study. These patients had positive Ga-67 uptake at the primary site, and repeated Ga-67 scanning im-

mediately after radiotherapy. Initially, these ten patients were planned for radical surgery with preoperative irradiation; four patients were subsequently found to be inoperable, and received irradiation alone.

Anterior and posterior scans of the neck, chest, and upper abdomen were obtained 48 hours after intravenous administration of 2 mCi of Ga-67 citrate. The scans were obtained with a Toshiba dual-probe rectilinear scanner with 12.7-cm NaI crystals, using medium-energy collimators (focal depth, 10 cm). The degree of Ga-67 accumulation was graded as 0 (negative), 1+(uptake<liver), or 2+(uptake≥liver). Equivocal activity was interpreted as negative. Since Ga-67 readily accumulates in the bones while the mediastinum often shows diffusely increased activity, only an apparent localized increase in activity was interpreted as positive.

In all patients, histological diagnosis was made by biopsied specimens obtained during fiberoptic esophagoscopy before radiotherapy. Rebiopsy was made immediately after radiotherapy in all patients. Biopsied specimens were obtained from the primary site and were composed of three to eight pieces of the tumor tissue. In six patients with radical surgery, the resected esophagus was also examined. The degree of radiation effect was graded microscopically as Ef 1 (viable cancer cells occupy ≥1/3 of the material), Ef 2 (viable cancer cells occupy <1/3 of the material), or Ef 3 (no viable cancer cells) (8).

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Results

The degree of Ga-67 uptake at the primary site before and after irradiation is tabulated in Table 1 with microscopic radiation effect and follow-up information. All but one patient showed disappearance of Ga-67 uptake at the primary site after irradiation (Fig. 1). Only one patient (Case #7) showed complete disappearance of the primary tumor at the completion of radiotherapy. The primary tumors of the other nine patients showed incomplete response judged from esophagography and endoscopy. The nine patients with the reverted scans had inconsistent pathological findings; four showed nonviable cells (Ef 3), and five had viable cells (Ef 1 or 2). The prognosis of the nine patients was very poor. Only one patient is alive and well at this writing, and the others died within several months after therapy. Four patients with radical surgery and radiation (Case #3, 4, 5, and 6) had autopsy, and showed no remaining tumor at the primary region.

Of four patients with radiotherapy alone, one patient had positive Ga-67 scans after irradiation with little radiation effect noted in the biopsied specimens, who died secondary to progression of the primary tumor (Case #8). In the other three patients, the primary tumors remained stable or regressed until death as far as clinically investigated.

Discussion

Although the mechanism of Ga-67 uptake in the tumors has not been wholly understood (9), the presence or absence of Ga-67 accumulation might be well correlated with biological characteristics of the tumors. In an animal model, a good correlation is found between Ga-67 uptake and the amount of viable tissue left in the tumor after local irradiation (10). However, in the current study, little relationship was found between Ga-67 scan findings and the amount of viable cancer cells after irradiation. Since viable cancer cells remained in five out of nine patients with negative Ga-67 scans after irradiation, reverted Ga-67 scans after irradiation did not indicate disappearance of viable cancer cells. On the other hand, viable cancer cells may not necessarily be clonogenic. Some patients receiving radiotherapy alone, and with viable can-

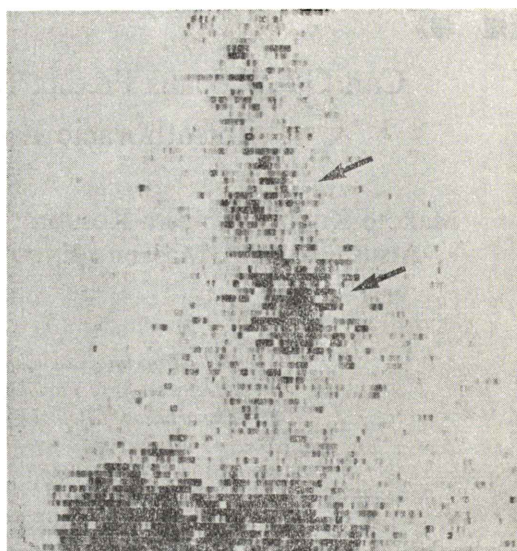


Fig. 1a Ga-67 scan of case #6 before radiotherapy showed 2+ uptake at the primary site (arrows).

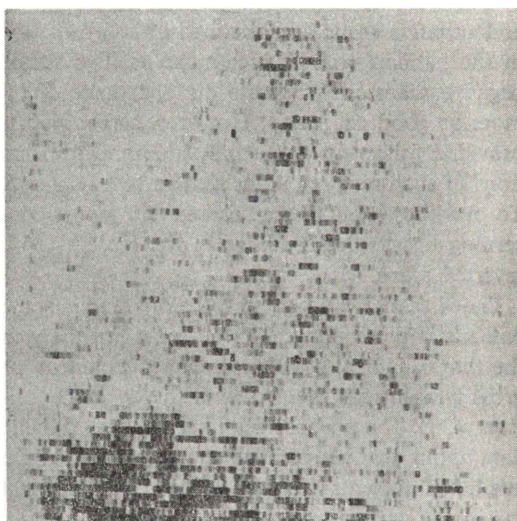


Fig. 1b After irradiation of 3,000 rad, no gallium uptake was seen. Pathological examinations after biopsy and esophagectomy revealed no viable cancer cells (EF 3).

cer cells after irradiation, experienced no regrowth of the primary tumor until death, although the follow-up periods were short. Ideally, reverted Ga-67 scans should indicate disappearance of the tumor and also a good prognosis.

In one study (5), Ga-67 uptake in malignant

Table 1 The degree of Ga-67 uptake compared with pathological radiation effect in ten patients with esophageal carcinoma.

Case No.	Radiation Dose (rad)	Ga-67 Uptake		Radiation Effect	Last Follow-up	
		1st Scan	2nd Scan		Months	State
1	3,000	1+	0	Ef 1 #	11	DOD
2	3,000	2+	0	Ef 3 #	24	A&W
3	6,000	1+	0	Ef 2 #	6	DOD
4	5,800	2+	0	Ef 3 #	5	DOD
5	3,000	2+	0	Ef 2 #	4	DOD
6	3,000	2+	0	Ef 3 #	6	DOD
7	3,400	1+	0	Ef 3 ##	5	DOD
8	4,100	2+	2+	Ef 1 ##	3	DOD
9	6,000	2+	0	Ef 1 ##	4	DOD
10	5,600	2+	0	Ef 2 ##	3	DOD

Surgical specimen

Biopsied specimen

DOD: Died of cancer or disease related problems

A&W: Alive and well

tumors of the head and neck decreased or reverted to negative after irradiation with or without chemotherapy in 23 out of 24 patients. In these 23 patients, five had local recurrence after therapy. Only four out of the 23 patients were alive and well for eight to 12 months, and 16 died of tumor related problems within 11 months. There seemed to be no prognostic significance of reverted Ga-67 scans in this group of patients. Unfortunately, no information concerning histological findings was presented. As in esophageal carcinoma which has little tendency to localize, outcomes of many malignancies of the various sites are not affected by local treatment. Thus, monitoring the effect of the local treatment by Ga-67 scans portend little, if anything, about the prognosis of these patients. Moreover, initial positivity of Ga-67 scans at the primary site itself may carry a worse prognosis than negative scans; positive uptake at the primary sites of esophageal carcinomas indicates extraesophageal extension with few false positives (6, 7), which is accepted as a sign of a grave prognosis.

In conclusion, although the number of the patients in the current study was small, there seemed to be very little relationship between the scan appearance and the prognosis in the patients who almost uniformly are deceased within a few months after evaluation and therapy. We do not recommend repeat Ga-67 scanning after radiotherapy in patients with intrathoracic esophageal carcinoma.

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要 旨

食道癌患者における放射線治療効果と Ga-67 スキャン

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Ga-67 シンチグラムで陽性像を得た10例の胸腔内食道癌症例に、放射線治療後に再スキャンを行った。原発巣の Ga-67 の取り込みは9例において消失した。放射線治療後の組織学的検索では9例中4例に生存可能癌細胞の消失をみた。Ga-67 の取り込みが消失しなかった1例を含め9例が食道

癌のために数か月内に死亡した。Ga-67 スキャンを放射線治療後に再施行して、放射線の効果を判定しようという試みは益が少ないと思われる。

Key words: Ga-67 citrate, esophageal carcinoma, tumor scanning, radiotherapy, histological diagnosis.