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A THERAPEUTIC APPROACH TO EARLY VOCAL CORD CARCINOMA

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Abstract

One hundred and twenty patients with early glottic carcinoma received radiation therapy at the University of Maryland Hospital from 1959 to 1977. The radiation dose ranged from 55 Gy in 4 weeks for small T1a lesions to 65 Gy in 6½ weeks for T2 lesions. The local control rates by irradiation alone for stages T1a, T1b, and T2 were 92, 91 and 88 per cent, respectively, while 5-year determinate disease-free survival rates were 96 per cent for stage I disease and 88 per cent for stage II disease. Most of the local failures were salvaged by surgery, with a low complication rate. Regional metastases were uncommon, and occurred in 7 per cent in stage I and in 6 per cent in stage II disease. Factors increasing the risk of failures appeared to be bulky tumor, anterior commissure involvement and subglottic extension.

Vocal cord carcinoma is not an uncommon disease, and accounts in the USA for about 1 per cent of all cancers in man (12). This malignancy occurs predominantly in males, with a male to female ratio of about 10:1 (4, 5). Cigarette smoking and abuse of alcohol have been shown to be associated with an increased risk of developing vocal cord carcinoma (14).

Even though it has been known for some time that early vocal cord cancer may be cured by either surgery or radiation therapy (4-7, 9-11, 13), the treatment should never be selected on the basis of cure rate alone; the method chosen should be one that will best preserve the physiologic function of the larynx. Radiation treatment, when effectively

applied, has been reported to give a high cure rate with low morbidity and a high chance of voice preservation (1, 4, 6-8, 11, 13).

The following report describes our own experiences in treating early vocal cord cancer by irradiation, with special reference to the technique of radiation treatment and results.

Material and Methods

One hundred and twenty patients with early squamous cell carcinoma of the vocal cord (116 men, 4 women, aged 42-85 years; median age 60) were given radiation therapy for cure at the University of Maryland Hospital from January 1959 to December 1977. (One patient with T1 was seen but not treated at the Maryland Hospital.) Only patients with histologic proof of malignancy with no previous treatment were included in the analysis. The patients were staged according to the UICC TNM Classification (2): T1s = pre-invasive carcinoma (carcinoma in situ); T1 = tumor limited to the glottis with normal motility; T1A = tumor confined to one cord; T1B = tumor involves both cords; T2 = tumor extends to either the subglottic or the supraglottic region with normal or impaired motility. Fifty-two patients were in stage IA, 34 in stage IB, and 34 in stage II (23 patients with subglottic extension and 11 with supraglottic extension). All patients were followed in the clinic for at least 5 years or until death.

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Policy of radiation treatment. The policy of management at the University of Maryland Hospital for early vocal cord cancer during the period under review was primary radiation treatment and surgery for salvage of recurrent disease. All patients were treated with supervoltage equipment (^{60}Co teletherapy or a 4 MeV linear accelerator). Treatment technique, field size and total tumor dose varied depending on the extent and volume of the malignancy. If the lesions involved one vocal cord and did not involve the anterior commissure, only 1 homolateral portal was used. Patients with small tumors localized to the mid portion of one vocal cord were treated with one homolateral 45° oblique portal with 4×5 to 5×5.5 cm² field size. A tumor dose of 55 Gy/4 weeks was given. The field was set and checked daily by the radiation therapist.

Patients with large tumors or tumors involving the anterior or posterior commissure, or supraglottic or subglottic extension, were treated with two open opposing lateral portals with a field size of 5.5 to 6×6 to 7 cm² and a tumor dose of 60 to 65 Gy/6 to 6½ weeks.

Results

Five-year disease-free survival. Glottic carcinoma usually affects elderly patients, and therefore assessment of the results of the radiation treatment must take into account the intercurrent deaths with cancer-free status. Of 120 patients at risk for evaluation, 20 patients died of intercurrent disease without any evidence of malignancy and were excluded from the disease-free survival analysis. For stage I disease, 12 patients died of intercurrent disease, 3 died of glottic cancer, and therefore the determinate 5-year disease-free survival was 71/74, or 96 per cent (Table 1). For stage II disease the determinate survival was 23/26 (88%). The determinate overall survival for both stages was 94/100 (94%; Table 1) and the absolute survival 94/120 (78%).

Local control and local failures. Local control is a measure of the effectiveness of radiation treatment. Table 2 details the local control. As seen, in stage T1a and T1b local control was achieved in 92 and 91 per cent, respectively. Local control was slightly better in T2 supraglottic (11/11, 100%) than in T2 subglottic cancer (19/23, 83%). Also shown in Table 2 are surgical salvage and ultimate local control. In stage T1a, 4 failures were noted (4/52) and all were salvaged by surgery. Two of 3 failures in T1b were

Table 1

Early vocal cord carcinoma. Determinate 5-year disease-free survival by stage. University of Maryland (1959-1977)

Stage	No. of patients	Dead of intercurrent, disease and NED	Dead of glottic ca.	Determinate survival
I	86	12	3	71/74 (96%)
II	34	8	3	23/26 (88%)
Total	120	20	6	94/100 (94%)

Table 2

Early vocal cord carcinoma. Local control related to stage. University of Maryland (1959-1977)

Stage	Local control	Salvage by surgery	Ultimate local control
T1A	48/52 (92%)	4/4	52/52 (100%)
T1B	31/34 (91%)	2/3	33/34 (97%)
T2 Subglottic	19/23 (83%)	2/4	21/23 (91%)
T2 Supraglottic	11/11 (100%)	-	11/11 (100%)

successfully salvaged by surgery. In T2 subglottic cancer, 2 of 4 were salvaged. For stage I disease the ultimate local control rate was 85/86 (99%) and for stage II disease it was 32/34 (94%).

Regional failures. Regional failures are given in Table 3. Regional node metastases are uncommon in early glottic carcinoma. In the present series, 6 patients (7%) with stage I disease (3 patients had concomitant local failures), and 2 patients (6%) with stage II disease developed neck node metastases within two years. The ipsilateral, subdiaphragmatic nodes were most commonly involved.

Distant metastasis. One patient subsequently developed pulmonary metastasis after having been found to have neck node metastasis 2 years after treatment.

Salvage treatment. The overall salvage rate was 64.3 per cent. A higher salvage rate was obtained in stage I than in stage II (70% versus 50%). The majority of local failures (8/11) were salvaged by laryngectomy. Three patients underwent hemilaryngectomy for salvage treatment, but only in one case was the disease controlled by this procedure. Four out of 7 patients with regional metastases were

Table 3*Early vocal cord carcinoma. Local and regional failures by stage. University of Maryland (1959-1977)*

Stage	No. of patients	Local failures	Regional failures only	Salvage by surgery	Ultimate failures
I	86	7*/86 (8.1%)	3/86 (3.5%)	7/10 (70%)	3/86 (3.5%)
II	34	4*/34 (11.8%)	1/34 (2.9%)	2/4 (50%)	3/34 (8.8%)
Total	120	11/120 (9.2%)	4/120 (3.3%)	9/14 (64.3%)	6/120 (5.0%)

* Three patients in stage I and one patient in stage II had associated neck failures.

Table 4*Early vocal cord carcinoma. Local control with initial radiation therapy and surgical salvage*

Institutions	Stage I		Stage II	
	Control with irradiation	Ultimate control with surgical salvage	Control with irradiation	Ultimate control with surgical salvage
U. of Florida (6)	83/90 (92%)	88/90 (98%)	33/49 (67%)	46/49 (94%)
M. D. Anderson (7)	180/210 (86%)	206/210 (98%)	85/120 (71%)	108/120 (90%)
Washington U. (11)	53/59 (90%)	59/59 (100%)	20/28 (71%)	24/28 (86%)
This series	79/86 (92%)	85/86 (99%)	30/34 (88%)	32/34 (94%)

Table 5*Early vocal cord carcinoma. Local failures related to involvement of one or both cords. University of Maryland (1959-1977)*

Vocal cord involvement	Stage I	Stage II	
		Supra-glottic extension	Sub-glottic extension
One cord	4/52 (7.7%)	0/11	0/15
Both cords	3/34 (8.8%)	0	4/8 (50%)
Total	7/86 (8.1%)	0	4/34 (11.8%)

controlled by surgery or radiation therapy, or both. Complications from salvage treatment were few. One patient developed a scar in the tracheostomy stoma which required surgical removal.

Complications from radiation therapy. Severe complications were rare. Two patients (2/120, 1.7%) developed chondronecrosis of the thyroid cartilage, and one of them required laryngectomy. Persistent edema of the arytenoid was noted in 5 patients and edema of the false cords in 2 patients. Most of these patients had no other symptoms than hoarseness.

Voice preservation. The voice was preserved in 79 patients (92%) in stage I and in 30 patients (88%) in stage II, with overall voice preservation of 91 per cent. Among the 109 patients who retained their voice, 100 patients (92%) had a normal voice and 9 patients (8%) a slightly impaired voice.

Discussion

Success. The value of radiation therapy in the treatment of early vocal cord cancer with voice preservation is once again demonstrated in this series. The results compare very well with reports from many major centers (Table 4). The local control rate for stage I was comparable to the other listed reports while the local control rate for stage II was higher.

The high success rate in this series could probably be attributed to the following factors: a) careful assessment of the extent of the disease before treatment (tomography or laryngography was used regularly to determine subglottic extension); b) the choice of an appropriate plan and tumor dose depending on the site and the extent of the tumor; c) daily treatment set-up by the physician and a weekly portal film to assure quality of treatment; d) close

follow-up by a laryngologist and a radiation oncologist. Early recurrence was amenable to salvage surgery (3).

Failures. Early vocal cord cancer is a fairly well-predictable disease in its clinical behavior and response to radiation treatment. Early glottic cancer rarely has regional lymphatic spread, and therefore the principle of curing this disease is to control it locally. In this series, there were few local failures, and most of these could be salvaged by surgery with low morbidity.

The following factors seemed to increase the probability of failure:

1) **Tumor volume.** In our opinion a large tumor volume necessitates an increase in total tumor dose or increase in fraction size (7, 8) in order to achieve a good tumor control. A bulky tumor and involvement of both cords or extension beyond the cord are examples of increased tumor volume. Table 5 illustrates this point. In stage I disease the local failure rate tended to increase if the malignancy involved both cords. In stage II subglottic extension, local failures were recorded in 50 per cent (4/8) compared with 0 per cent (0/15) in stage II supraglottic extension.

2) **Involvement of anterior commissure.** The importance of anterior commissure involvement for the spreading of cancer, the treatment results, and the choice of treatment method has previously been discussed briefly (7, 8). Its significance must, however, again be underlined and is very well demonstrated in Table 6. For T1 lesions, regional failures occurred at a rate of 1.9 per cent (1/52) for disease without anterior commissure involvement, but when the anterior commissure was involved the regional failure rate rose to 14.7 per cent (5/34). Similar observations were made in T2 lesions.

3) **Inadequate treatment.** a) Total dose. A total dose level of 55 Gy in 4 weeks was in this series adequate for small lesions and it was increased to 65 Gy in 6½ weeks for bulky lesions. Nevertheless, the failure rate was higher in bulky lesions. This problem has been raised in many series (7, 8, 11, 13), and can perhaps be solved by increasing the fraction size while maintaining the total dose (shorter overall time).

b) Geographical miss. This issue has been considered previously in some reports (7, 8). It is, however, extremely difficult to prove that a failure really is caused by a geographical miss. The probability of geographical misses can be minimized by setting the

Table 6

Early vocal cord carcinoma. Regional failures related to anterior commissure involvement. University of Maryland (1959-1977)

Stage	With ant. commissure involvement	Without ant. commissure involvement
T1	5/34 (14.7%)	1*/52 (1.9%)
T2	2/8 (25%)	0/26 (0%)
Total	7/42 (16.7%)	1/78 (1.3%)

* This patient failed locally first.

treatment portal by a radiation therapist on a daily basis as done in the present series, or by increasing the field size which, however, may increase the risk of complications. In one reported series (8) the local recurrence rate was reduced from 18 to 9 per cent by increasing the field size while maintaining the same technique and relatively low total dose. Probably, increasing the field size has a dual effect, one minimizing the risk of a geographical miss and the other increasing the biologic effectiveness of irradiation.

Treatment modifications (irradiation plus surgery) have been advocated by some departments for treating early glottic cancer, in order to achieve a better control rate. We believe, however, that radiation treatment alone, given at its best, can achieve an optimal result with good voice preservation (4, 6, 7, 8, 11, 13), and that surgery should be reserved for salvage of recurrences only. Radiation treatment alone of early glottic cancer in our institution cured 91 per cent of the patients with 91 per cent preservation of the voice. Including surgical salvage for local and regional recurrences the ultimate cure rate was 95 per cent.

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