

PRE-OPERATIVE SHORT INTENSIVE RADIATION THERAPY OF T3-T4 LARYNGEAL CARCINOMA

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Surgery or irradiation may be used in the treatment of advanced carcinoma of the larynx. The overall results, however, of either modality applied separately is rather disappointing. Pre-operative radiation therapy followed by radical surgery for the treatment of advanced but resectable carcinoma of the larynx and laryngopharynx was first introduced by GOLDMAN & SILVERSTONE (1961). Similar approaches were later suggested by HENDRICKSON & LIEBNER (1968), and OGURA & BILLER (1970 a), and it is now generally accepted that pre-operative irradiation significantly improves the results, at least in supraglottic and laryngopharyngeal carcinoma. However, a controversy still exists in respect to the dose and the timing of the pre-operative radiation therapy. GOLDMAN et coll. (1970, 1972), supported by WANG et coll. (1972) and CONSTABLE et coll. (1972) recommend high doses: 5 500 rad is given to the tumour bearing volume in 5 to 6 weeks followed by surgery within a rest period of three to six weeks. HENDRICKSON (1970) and OGURA & BILLER (1970 b) on the other hand suggested a low-dose therapy. HENDRICKSON employed a dose of 2 000 R delivered in 8 treatments over 10 days, followed promptly by surgery. OGURA & BILLER ad-

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Table 1*Summary of all cases of T3-T4 laryngeal carcinoma treated in the period 1968 to 1972*

Region		Treatment modality			Total
		Radiation therapy only	Pre-oper. R.T. + surg.	Surgery only	
Glottic	T3	19	10	2	
	T4	0	1	0	32
	A11	19	11 (2N +)	2 (1N +)	(3N +)
Supraglottic	T3	18	14	1	
	T4	18	6	1	58
	A11	36 (17N +)	20 (8N +)	2	(25N +)
Subglottic	T3	2	1	1	
	T4	0	1	0	5
	A11	2	2	1	
Total		57	33	5	95 (28N +)

N + : palpable cervical nodes

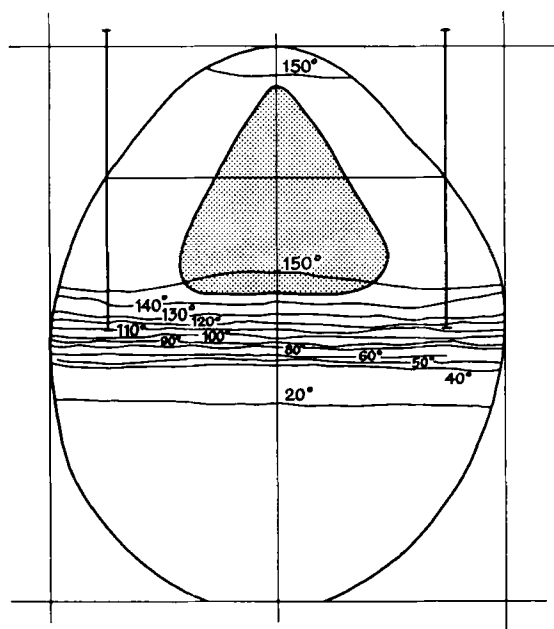
ministered a dose ranging between 1 500 and 3 000 R over two to three weeks followed by surgery three to four weeks later. The experiences of short intensive pre-operative irradiation of T3-T4 laryngeal carcinomas is now reported.

Material and Methods

In the period 1968 to 1972, 95 patients with T3-T4 laryngeal carcinoma were treated; 57 patients received radiation therapy only, 33 pre-operative irradiation followed by surgery, and 5 patients were primarily treated by surgery only (Table 1).

All patients had microscopically confirmed squamous cell carcinoma. Clinical, endoscopic and radiographic examinations were performed in all patients. Site and primary tumour classification were assigned according to the international TNM classification recommended for the period 1963 to 1972. Three patients of the 32 with glottic carcinoma had palpable cervical nodes; two of these were in the pre-operative group and one was treated primarily with surgery. In the supraglottic group 25 patients had palpable nodes; 17 of these were in the group irradiated only (48 per cent) and eight in the pre-operative irradiation group (40 per cent).

Radiation therapy only. The irradiation is administered to the tumour bearing volume using two parallel opposing fields. Telecobalt gamma radiation is utilized with an additional diaphragm applied to the beam (Figure). The field size ranges from 6 cm × 8 cm to 7 cm × 9 cm depending on the extent of the tumour and the presence of palpable nodes. A total tumour dose of 6 000 to 6 500 rad is delivered in 6 to 7 weeks.



Radiation treatment plan of an illustrative case of laryngeal carcinoma to demonstrate the isodose summation lines of two parallel opposing fields. Telecobalt gamma radiation used with additional tungsten diaphragm. Field size 8 cm × 8 cm.

Pre-operative radiation therapy. The same planning procedure, field sizes and radiation quality as in the former group are employed. A total dose of 2 500 rad in 5 equal sessions on five successive days is given. This is usually administered on Monday through Friday, and surgery is performed the following Monday with the week-end between the end of radiation therapy and operation.

Surgery. Total laryngectomy is performed, neck dissection only when lymph nodes with possible metastases are encountered. Horizontal incisions are always employed. If a neck dissection is indicated, the incision is drawn up to the mastoid tip and down to the acromion. Three point junctions are avoided. The larynx is mobilised and removed together with the hyoid bone, and in case of subglottic extension together with part of the thyroid gland. Tracheostomy is made through a separate incision. The pharyngeal defect is closed in one line avoiding three point junctions. The pharynx is closed in three layers, with continuous stitches using dexon, a synthetic suture material which is slowly resorbed.

Results

All patients were evaluated for at least one year. To enhance the meaning of the results over the rather short period of observation only tumour free survival is reported for one year, two years and three years. The following categories of patients are

Table 2*Overall one-year tumour free survival, T3-T4 laryngeal carcinoma*

Treatment modality	Total number treated	Number alive	Per cent
Radiation therapy only	57	23	40
Pre-operative irradiation + surgery	33	23	64
Surgery only	(5)	(3)	(60)

Table 3*One-year tumour free survival, T3-T4 glottic carcinoma*

Treatment modality	Total number treated	Number alive	Per cent
Radiation therapy only	19	11	57
Pre-operative irradiation + surgery	11	7	64

Table 4*Two-year tumour free survival, T3-T4 glottic carcinoma*

Treatment modality	Total number treated	Number alive	Per cent
Radiation therapy only	16	8	50
Pre-operative irradiation + surgery	8	4	50

counted as failures and are not included in the tumour free survival: (1) Patients dead of causes related or unrelated to their laryngeal carcinoma, and (2) patients alive with local or distant metastases.

Table 2 gives the overall one-year tumour free survival for all regions grouped according to treatment modality. The number of patients in this series treated with surgery only is too small to allow any conclusions. The group treated with combined pre-operative radiation therapy shows an overall higher rate (64 per cent) compared with the group irradiated only (40 per cent). When patients were grouped according to regions an obvious difference was noted in glottic tumours compared to supra-glottic tumours. The one-year tumour free survival of T3-T4 glottic tumours appears in Table 3. There is a slightly higher survival rate (64 per cent) in the pre-operative group compared to the survival rate (57 per cent) in the group irradiated only. However, the two-year tumour free survival rate for both treatment modalities is identical (50 per cent, Table 4).

Table 5
One-year tumour free survival, T3-T4 supraglottic carcinoma

Treatment modality	Total number treated	Number alive	Per cent
Radiation therapy only	36	11	31
Pre-operative irradiation + surgery	20	15	75

Table 6
Two- and three-year tumour free survival, T3-T4 supraglottic carcinoma

Treatment modality	2-year survival		3-year survival	
	No.	Per cent	No.	Per cent
Radiation therapy only	11/32	34	6/20	30
Pre-operative irradiation + surgery	11/13	84	8/9	88

The tumour free survival rates for supraglottic tumours are given in Tables 5 and 6. The group receiving pre-operative radiation therapy demonstrates significantly superior results after one year (75 per cent), two years (84 per cent), and three years (88 per cent). In comparison the group of patients with T3-T4 supraglottic tumours irradiated only yielded 31 per cent, 34 per cent and 30 per cent for the one-year, two-year and three-year tumour free survival, respectively.

Complications. There is no operative mortality in this series. No significant complications attributed to the pre-operative radiation was observed in any of the patients. All wounds healed promptly and no incidence of fistulas was recorded.

Discussion

The results confirm published data about the value of pre-operative radiation therapy combined with surgery for the treatment of advanced supraglottic carcinoma. The data, however, demonstrate no advantage of such treatment in the case of advanced glottic carcinoma. Almost identical results in terms of tumour free survival may be obtained with radiation therapy only.

The short, intensive pre-operative irradiation used, offers the advantage of an effective radiation dose in a short treatment interval. This saves the patient and hospital several weeks of treatment time as well as avoids the delay of surgical treatment.

It seems that the controversy regarding high or low dose for pre-operative irradiation of advanced laryngeal carcinoma may be settled by employing the short, intensive treatment schedule. The nominal standard dose (NSD) equivalent to 2 500 rad in 5 days calculated according to the formula proposed by ELLIS is 1 423 ret. This amounts to about 77 per cent of the normal tissue tolerance estimated at an NSD of 1 800 ret. A dose of 2 500 rad given in 5 equal successive daily fractions is probably biologically equivalent to a dose of 4 500 rad given in a period of 4 to 5 weeks. The treatment schedule proposed in this report thus combines the efficacy of the high dose schedule with the convenience of the low dose schedule. Further, short intensive radiation therapy is well-tolerated and surgery is usually performed before the onset of reaction.

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SUMMARY

A group of 33 patients with T3-T4 laryngeal carcinomas received in the period 1968 to 1972 pre-operative irradiation with ^{60}Co followed by surgery. A total dose of 2 500 rad was given in 5 equal sessions. The tumour free survival rates of these patients are compared to those of a comparable group of 57 patients receiving radiation therapy only. The overall results in the pre-operative group (64 per cent) are superior to those in the group irradiated only. In glottic tumours the results were similar in both groups, but significantly superior in supraglottic tumours receiving pre-operative radiation therapy. The treatment schedule proposed is well-tolerated and surgery is usually performed before the onset of reaction.

ZUSAMMENFASSUNG

Eine Gruppe von 33 Patienten mit T3-T4 Larynxkarzinomen erhielt während der Periode zwischen 1968 und 1972 präoperative Bestrahlung mit ^{60}Co , gefolgt von Chirurgie. Eine Gesamtdosis von 2 500 rad wurde in 5 gleichgrossen Fraktionen gegeben. Die Tumor-freie Überlebensfrequenz dieser Patienten wurde mit derjenigen einer vergleichbaren Gruppe von 57 Patienten, die lediglich Strahlentherapie erhalten hatte, verglichen. Die Gesamtergebnisse der präoperativen Gruppe (64%) sind gegenüber derjenigen der Gruppe, die nur bestrahlt worden war, überlegen. Bei Glottistumoren waren die Ergebnisse bei beiden Gruppen ähnlich, aber signifikant überlegen bei Supraglottistumoren, die präoperative Strahlentherapie erhalten hatten. Das vorgeschlagene Behandlungsschema wird gut vertragen, und Chirurgie wird gewöhnlicherweise vor dem Einsetzen der Reaktionen ausgeführt.

RÉSUMÉ

Un groupe de 33 malades atteints de cancer laryngé T3-T4 ont été traités au cours de la période 1968 à 1972 par une irradiation pré-opératoire au ^{60}Co suivie d'intervention chirurgicale. Une dose totale de 2 500 rad a été donnée en 5 séances égales. Le taux de survie sans tumeur de ces malades est comparé à celui d'un groupe comparable de 57 malades traités

uniquement par les radiations. Les résultats d'ensemble dans le groupe des malades irradiés avant l'opération (64%) sont supérieurs à ceux des malades qui n'ont eu que l'irradiation. Dans les tumeurs glottiques les résultats sont similaires dans les 2 groupes mais ils sont significativement supérieurs dans les tumeurs supra-glottiques ayant eu une irradiation pré-opératoire. Le schéma de traitement proposé est bien toléré et l'intervention chirurgicale est habituellement exécutée avant le début de la réaction.

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