

CARCINOMA OF THE MANDIBLE

Result of radiation therapy

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In the orthovoltage radiation era, the presence of bone involvement by squamous cell carcinoma of the oral cavity was usually considered an indication for surgery. This was due to the inability to give large doses of radiation without producing severe damage to the vasculo-connective tissue of the jaw bone which eventually could progress into a full-fledged necrosis of bone. Lower doses of radiation were incapable of controlling the primary tumor.

With the advent of supervoltage irradiation, the soft tissues constituting the matrix of the bone did not receive such large doses of scattered radiation and therefore the ensuing damage to the vasculo-connective tissue was minimized, thus permitting a higher dose to the primary lesion at tolerable levels to the bone. In this fashion it was possible to irradiate the primary lesion without producing significant damage to the bone irradiated.

At the University of Michigan, we obtained supervoltage radiation in the year 1955, in the form of a Cobalt 60 unit. Since that year to the end of 1969 we have completed treatment in 55 patients with involvement of the mandible to variable degrees. This investigation is to report on the incidence of the mandibular involvement, its treatment, and complications, local results, actuarial survival and complications.

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Table 1*Mandibular bone involvement. Sex and age distribution*

Age	Male	Female	Total
30—39	1	0	1
40—49	5	2	7
50—59	15	0	15
60—69	13	4	17
70—79	9	3	12
80—89	2	0	2
90—99	0	1	1
Total	45	10	55

Table 2*Mandibular bone involvement. Site of origin of the primary lesion*

Site	No. of patients	
Floor of the mouth	8	(14 %)
Lower alveolus	29	(53 %)
Tonsillar region	17	(31 %)
Mouth, site undeterminate	1	(2 %)
Total	55	(100 %)

Table 3*Mandibular bone involvement. Distribution of lesions by stages*

	No. of patients	
Stage I	1	(2 %)
Stage II	35	(64 %)
Stage III	19	(34 %)
Total	55	(100 %)

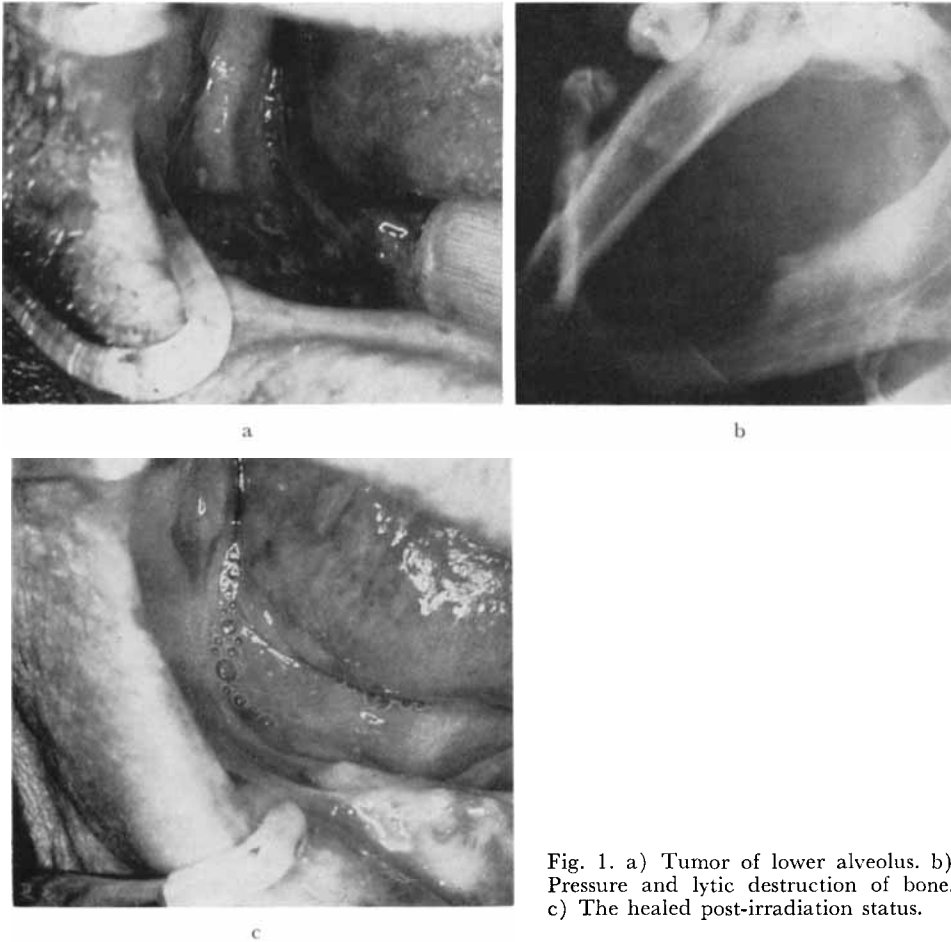


Fig. 1. a) Tumor of lower alveolus. b) Pressure and lytic destruction of bone. c) The healed post-irradiation status.

Material

Age and sex. Table 1 shows the distribution of patients according to sex and age in cases treated from 1955 through 1969. The mean age is 62 with a standard deviation of 12 years.

Distribution of cases. The sites of origin of the primary lesion are shown in Table 2. The most common primary lesion originated in the mucosa of the lower alveolus. They constituted about half of the carcinomas that involved the jaw. Next in frequency were lesions arising in the tonsillar region, mainly in the retro-molar triangle. It is common for this type of tumor to grow posteriorly and inferiorly and to involve the adjacent bone.

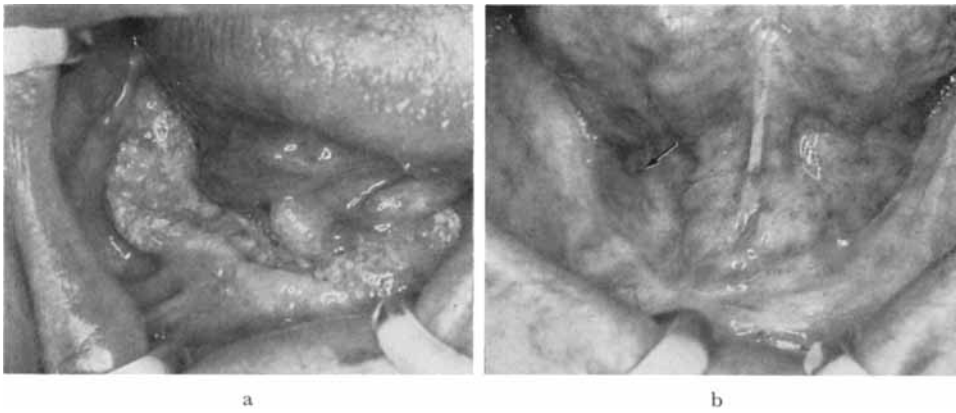


Fig. 2. a) Extensive lesion of the right lower alveolus without osseous involvement. b) Post-irradiation appearance of lower jaw. Loss of alveolar ridge on the right (arrow).

Two per cent of the lesions were classified as stage I, 64 per cent were stage II and 34 per cent were stage III (Table 3). We classified as stage I those small primary lesions with no metastasis (T1, T2, N0, M0 cases). Stage II were those lesions with large primaries and no metastasis in the neck or with small primaries having early metastasis to the neck lymph nodes (T3, T4, N0, M0 and T1, T2, N1, M0 cases).

In stage III we recorded all of the remaining cases, some with neck metastasis of considerable extent. In this stage the prognosis is always poor, reflecting the biologic effects of metastasizing neoplasm.

Degree of bone involvement. The degree of bone involvement was classified into three groups depending on the findings of pre-irradiation films. The lesion in one patient with an intra-alveolar squamous cell carcinoma of the jaw was considered in this review as arising in the gum. The cases classified as having erosion of bone (33 per cent), were those in which the cortex of the bone appeared depressed and eroded as if produced by tumor pressure (SWEARINGEN et coll. 1966). The invasive group (49 per cent) had some mottled destruction of bone. We included in this group not only those cases with massive destruction of bone, but also those in which the elements of lytic destruction were associated with elements of erosion of the cortex (Fig. 1). Finally in 18 per cent of the cases, routine films of the mandible did not show bony abnormalities, due either to the incipient character of the destruction, to its position, or to poor bony details of the routine mandibular films. However, in these cases there was unequivocal clinical evidence of destruction of bone, particularly the alveolar

Table 4
Mandibular bone involvement. Actuarial survival

Year interval	Alive at beginning of interval	Died of neoplasm during interval	Died of intercurrent disease during interval	Withdrawn alive during interval	Cumulative proportion surviving at end of interval	
					di = wa*	Relative survival**
0—1	55	16	1	0	0.71	0.72
1—2	28	9	2	1	0.53	0.53
2—3	26	2	1	0	0.49	0.49
3—4	23	4	2	0	0.40	0.37
4—5	17	0	3	3	0.40	0.31

* Dead of intercurrent disease considered as withdrawn alive at that interval.

** Observed survival/expected survival.

crest. The initial clinical impression of involvement of bone was reinforced by the appearance of the mandible in the post-irradiation period: a mandibular defect at the site of the previous tumor (Fig. 2). Currently the routine mandibular films are supplemented when indicated by Panorex- and occlusal dental films.

Treatment

Invariably the patients were treated with Cobalt 60 radiation at a source-skin distance of 73 to 80 cm. Most often the lesion was irradiated using opposing cervico-facial fields that encompassed the primary lesion and the neck metastasis, if present. Both fields were treated on a daily basis; in the early years 6 days a week and more recently 5 days. The daily tumor dose was 200 R or slightly larger for a total dose of about 6 500 R given in a period of 6 to 7 weeks.

Results

For the calculation of survival we have utilized the actuarial method of calculation. Results from 1 to 5 years are presented taking into consideration whether the patients who died of an intercurrent disease were withdrawn alive or not at the interval in which the event occurred; in this fashion a 40 per cent 5-

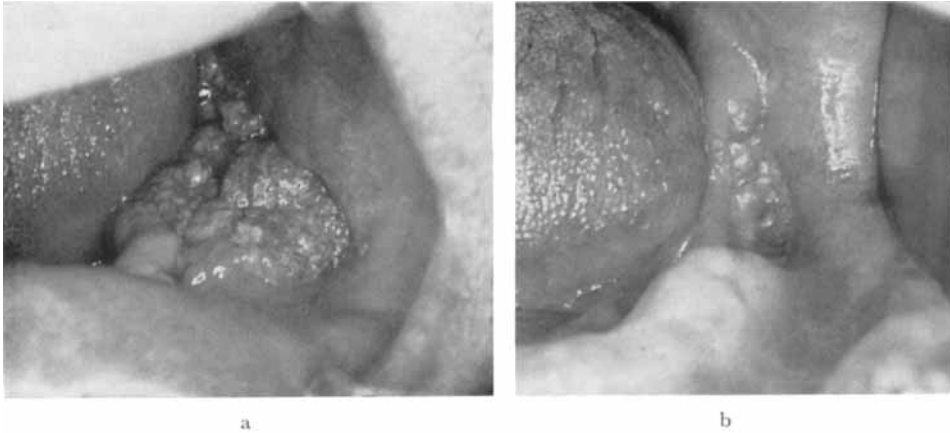


Fig. 3. a) Carcinoma of lower alveolar mucosa with bony erosion. b) Primary lesion controlled with radiation therapy. Uncomplicated healing of the neoplastic bony defect.

year survival was obtained (Table 4). The relative survival (ratio of observed to expected survival) was 31 per cent at 5 years.

If we correlate the survival of patients and their stage, we find that the patient in stage I died of the disease. Of the 35 patients in stage II, 7 were alive at 5 or more years, 3 alive less than 5 years, 18 died of the neoplasm and 7 died before 5 years of an intercurrent death with no evidence of disease at the time of death. Of the 19 patients in stage III, 4 were alive more than 5 years, 1 was alive without disease less than 1 year, 12 died of the disease and 2 died an intercurrent death.

In order to determine the effectiveness of radiation as a curative agent for carcinomas involving the mandible, we ascertained in each case whether radiation therapy did or did not control the primary lesion. By control we mean that the primary lesion did not show evidence of recurrence at any time after treatment until the last follow-up. If the patient died of intercurrent disease, the minimal post-irradiation period was one year. If the patient with controlled tumor died within one year the case was placed with the unknown group together with the ones in which complete information was not available. Not controlled were those cases that at any time in the post-irradiation period developed a recurrence; strictly, these are failures of radiation therapy. The primary tumors irradiated responded in the following way: Controlled 20 patients (36 per cent), not controlled 32 patients (58 per cent), unknown 3 patients (5 per cent).

It is of interest that some patients died of advancing neoplasm either in the neck or beyond while their primary lesion was controlled. In 9 patients, recurrence after a complete course of irradiation was treated surgically. In one a small residuum was successfully excised locally without recourse to further surgery (this patient was alive 12 years after initial treatment). In the rest, more extensive surgery was employed and usually consisted of resection of the residual tumor, hemimandibulectomy, and radical neck dissection. In none of the cases were there any post-operative complications attributable to previous irradiation. The mucosa healed over the resected bone without apparent difficulties.

Of the 9 patients that had post-irradiation surgery, 6 were alive (4 after 5 years and 2 less than 5 years) and 3 died of the disease with an uncontrolled primary.

Complications

In all cases of controlled primary the mucosa of the area involved healed without difficulty (Fig. 3).

One patient developed focal exposure of the jaw in the post-irradiation period. This sequestrum was eliminated spontaneously and the mucosa healed over the area of necrosis without further complications. Another patient had necrosis of the soft tissues of the mouth but healed spontaneously without sequelae. In one patient marked induration of the subcutaneous tissues of the face developed several years after irradiation. This was due to the technique of treatment employed: only an ipsilateral field to an incidence dose of 7 250 R was used. No instance of progressive necrosis of the jaw was found.

Discussions

The concept that irradiation is not indicated whenever there is involvement of bone by squamous cell carcinoma is no longer tenable if supervoltage radiation is used (CATANTA et coll. 1970, PORTER 1971). In 55 cases with involvement of the jaw in patients treated from 1955 through 1969, the local control of the lesion was 36 per cent. In the 9 patients that had an uncontrolled primary and were operable, 6 had control of the primary lesion after post-irradiation surgery. The other 3 patients died of the disease with uncontrolled primaries. It is worth emphasising that no patient having post-irradiation surgery developed bone complications, and healing of the mucosa and skin proceeded without apparent difficulty.

The actuarial relative survival at 5 years is 40 per cent. This figure was obtained counting as alive patients salvaged by post-irradiation surgery. Most of the lesions treated were in intermediate and advance stages, 64 per cent in stage II and 34 per cent in stage III. In the later stage, the prognosis is ominous in view of the advanced nature of the disease at the primary and metastatic sites, yet a certain number of patients in this stage were cured of the neoplasm (of 19 stage III patients, 4 were alive more than 5 years and 2 died an intercurrent death; the rest died of the disease).

From the findings of this investigation we would advocate continuation of the present program of supervoltage irradiation of the squamous cell carcinoma infiltrating bone, followed by radical surgery if a radiation failure becomes evident in the post-irradiation period.

The number of complications following irradiation was low. Only one patient developed exposure of mandibular bone, with the exposed area healing after removal of the sequestrum. Another patient developed marked induration of the subcutaneous tissues of the face. This patient was treated using an ipsilateral field with a high incident dose. This technique, although rarely used, was abandoned. Instead, two opposing lateral fields are used, each field treated daily, 5 or 6 times a week. In this fashion we believe that the radiation damage to the vasculo-connective tissue is diminished due to a more homogenous irradiation of the area treated.

SUMMARY

Fifty-five patients with squamous cell carcinoma involving the mandible were treated with Cobalt 60 irradiation. A 5 year actuarial survival of 40 per cent was found. Nine patients had post-irradiation surgery for recurrence, 6 had control of the neoplasm. No post-operative complications were recorded. The rate of radiation complications was low. Only one patient developed exposure of bone, which healed spontaneously. We advocate supervoltage radiation therapy to squamous cell carcinoma involving the mandibular bone, followed by radical surgery only if tumour remnants or recurrence become evident in the post-irradiation period.

ZUSAMMENFASSUNG

Fünfundfünfzig Patienten mit einem Schuppenzellkarzinom unter Beteiligung des Unterkiefers wurden mit Cobalt-60-Bestrahlung behandelt. Es wurde eine 5-Jahre Überlebensrate von 40 % gefunden. Neun Patienten wurden wegen eines Rezidivs nach der Bestrahlung chirurgisch behandelt, bei 6 war das Neoplasma unter Kontrolle. Es wurden keine post-operative Komplikationen gefunden. Die Frequenz von Strahlenkomplikationen war niedrig. Bei nur einem Patienten entwickelte sich eine Freilegung des Knochens, welche spontan abheilte. Wir befürworten Hochvolt-Strahlentherapie von Schuppenzellkarzinomen unter Beteiligung des Unterkiefer-Knochens mit nachfolgender radikaler Chirurgie nur, wenn der Tumor noch vorhanden ist oder wenn in der Nachbestrahlungs-Perioden ein Rezidiv auftritt.

RÉSUMÉ

Cinquante-cinq malades présentant un carcinome épidermoïde atteignant la mandibule ont été traités par les radiations au Cobalt 60. La survie actuarielle à 5 ans a été 40 %. Neuf malades ont subi une intervention chirurgicale après l'irradiation pour une récurrence; 6 malades étaient guéris. On n'a pas constaté de complications post-opératoires. La fréquence des complications due aux radiations a été faible. L'os n'a été mis à nu que chez un seul malade qui a guéri spontanément. Nous recommandons le traitement par les radiations de haute énergie pour les carcinomes épidermoïdes intéressant l'os mandibulaire, suivi de chirurgie radicale seulement si les restes de tumeur ou une récurrence se manifestent dans la période après l'irradiation.

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