SUPERVOLTAGE X-IRRADIATION OF EPITHELIAL TUMOURS OF THE LACRIMAL GLAND*

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HOGAN AND ZIMMERMAN (1962) divided epithelial tumours of the lacrimal gland into about 50 per cent. carcinomata and about 50 per cent. mixed tumours, only about 10 per cent. of the latter being malignant. Before this differentiation was established, the prognosis of the mixed tumours was regarded as just as bad as that of the carcinomata, and radical orbital exenteration was recommended by most authors regardless of the histological classification (Verhoeff, 1905; Benedict, 1939; Duke-Elder, 1952). Reese (1956), however, concluded that although the carcinomata required radical surgery the benign mixed tumours could be treated conservatively; he described a recurrent true mixed tumour of the lacrimal gland which receded and was arrested for 16 years without further recurrence after x-ray treatment.

The literature contains few reports of x-irradiation but the poor results of excision or orbital exenteration of mixed tumours have been fully discussed (Sanders, 1939).

The different histopathological types of epithelial tumour of the lacrimal gland and the effects of supervoltage x-irradiation on their recurrence and malignancy have been studied in the eight following cases.

Case Reports

The age, sex, and clinical particulars of the eight cases are set out in the Table.

TABLE
CLINICAL PARTICULARS IN EIGHT CASES

Case No.	Age (yrs)	Sex	Proptosis			Fundus	Visual Acuity	Tumour Encapsulated	Diagnosis	Recurrence †
			Side Affected	Duration (mths)	Size (mm.)					
1	29	F	R	36	25	Normal	6/12	Yes	Benign mixed tumour	
2	27	M	L	48	20	Normal	6/9	Yes	Benign mixed tumour	
3	20	M	R	2	26	Post-papilloedemic optic atrophy	1/60	No	Malignant mixed tumour	None
4	45	F	R	7 Recurrent	32	Lagophthalmos Nebulous cornea	1/60	Thin capsule which ruptured	Malignant mixed tumour with involment of orbital bones	Yes
5	46	M	L	2	22	Normal	6/12	Yes	Adenoid-cystic carcinoma	None
6	48	M	L	4	30	Temporal pallor of optic disc	6/60	Yes	Adenoid-cystic carcinoma	None
7	50	M	R	2	30	Optic atrophy	3/60	No	Adenoid-cystic carcinoma	None
8	49	F	R	5	33	Cornea ulcerated	Blind	No	Anaplastic carcinoma with involment of orbital bones	Yes

† 6-yr Follow-up. Re-recurrence after treating. Recurrence with supervoltage x-irradiation.

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In each case the body temperature, blood pressure, and total and differential blood counts were normal. The urine was free from albumin and sugar, and the faeces from parasites. The blood Wassermann reaction was negative. The liver, spleen, and lymph glands were not enlarged.

In Case 8 skull x-rays showed destruction of the roof and lateral wall of the orbit on the affected side. In each case the eye in the unaffected orbit was normal, with normal fundus, and visual acuity 6/9 or 6/12. On the affected side the eye was proptosed downwards and nasally with limitation of upward and lateral ocular movements, and there was a palpable mass in the region of the orbital lobe of the lacrimal gland.

Method of Exploration.—An incision over the lacrimal gland tumour was made below the lateral side of the brow. In each case the globe and optic nerve were found to be unaffected by the tumour. The four encapsulated tumours were adherent to the bone of the lacrimal fossa and had to be separated by using the handle of the Bard-Parker knife. Palpation with the little finger revealed tumour involvement of the lacrimal bony fossa in Cases 4 and 8. Metastases were present in Case 4.

Treatment.—Because all these patients refused orbital exenteration, we were able to test the effect of supervoltage x-rays on the various types of tumour involved.

Results

Case 1 (Fig. 1).—The tumour was encapsulated, hard, grey, and non-vascular, measuring 2×2 cm.

FIG. 1.—Case 1, right proptosis due to benign mixed lacrimal gland tumour of 3 years' duration in a woman aged 29 years.

FIG. 2.—Case 1, section of benign mixed lacrimal gland tumour, showing acini and nests of epithelial cells in myxomatoid matrix. $\times 120$.

Histology.—Nests and acini of epithelial cells were seen in the myxomatoid matrix (Fig. 2). Serial sections showed no tumour tissue outside or in the tumour capsule.

Diagnosis.—Benign mixed tumour of the lacrimal gland.

Follow-up.—No recurrence after 6 years.

Case 2.—The tumour was well encapsulated, hard, and grey, measuring 2 × 3 cm.

Histology.—Nests and acini of epithelial cells were seen in the myxomatoid matrix. Serial sections showed the presence of tumour tissue outside and in the tumour capsule.

Diagnosis.—Benign mixed tumour of the lacrimal gland.

Progress.—2 years later the tumour recurred. It was not encapsulated, and biopsy showed the same histopathological appearance as that of the original one.

Therapy.—With indirect ocular protection, using supervoltage x-irradiation, 6000r were given to the recurrent tumour in 6 weeks (Lederman, 1962a).

Follow-up.—No recurrence after 6 years.

Case 3.—A non-encapsulated, vascular, friable tumour on the lateral side of the rectus muscle cone was adherent to the lateral and superior orbital walls and extended backwards into the orbit.

Histology.—In addition to nests and acini of epithelial cells in the myxomatoid matrix, there were areas of carcinomatous infiltration.

Diagnosis.—Malignant mixed tumour of lacrimal gland.

Therapy.—As in Case 2.

Follow-up.—No recurrence after 6 years.

Case 4 (Fig. 3).—This patient had been operated upon for a non-encapsulated mixed lacrimal

FIG. 3.—Case 4, right recurrent proptosis due to a malignant mixed lacrimal gland tumour of 7 months' duration in a woman aged 45 years.

FIG. 4.—Case 4, postero-anterior skull x ray, showing soft tissue opacity of right orbit with evidence of right orbital widening.

gland tumour through an incision below the eyebrow. A postero-anterior skull x ray showed soft tissue opacity of the right orbit with evidence of right orbital widening and opacity of the right maxillary antrum (Fig. 4); a lateral skull x ray showed skull bone metastases (Fig. 5).

FIG. 5.—Case 4, lateral skull x ray, showing metastases in skull bones.

The new tumour was adherent to the periosteum, and covered by a thin capsule which ruptured during blunt dissection. It was soft and friable, and extended posteriorly into the orbit.

Histology.—In addition to nests and acini of epithelial cells in the myxomatoid matrix (Fig. 6), there was carcinomatous infiltration (Fig. 7).

FIG. 6.—Case 4, recurrent malignant mixed lacrimal gland tumour, showing nests and acini of epithelial cells in a myxomatoid matrix. $\times 120$.

FIG. 7.—Case 4, epitheliomatous infiltrations in recurrent malignant mixed lacrimal gland tumour. $\times 120$.

Diagnosis.—Malignant mixed tumour of the lacrimal gland with involvement of orbital bones.

Therapy.—As in Case 2.

Follow-up.—The patient died of liver metastases 6 months after the x-irradiation of the orbit.

Case 5 (Fig. 8, opposite).—The tumour was adherent to the periosteum of the lateral bony wall of the orbit. It was encapsulated, hard, and pink, measuring 3×2 cm.

Histology.—There were large and small aggregations of small, tightly packed cells containing hyperchromatic nuclei and scanty cytoplasm. The epithelial aggregations were sharply outlined, with small rounded cystic foci containing mucin. Cord-like patterns of epithelial cells with hyalinized stroma were present (Fig. 9, opposite).

The same tumour tissue was found outside and inside the capsule.

Diagnosis.—Adenoid-cystic carcinoma of the lacrimal gland.

Progress.—3 months later the tumour recurred in the lacrimal fossa and lower outer part of the orbit (Fig. 10, opposite). This tumour was not encapsulated but showed the same adenoid-cystic carcinoma histology.

Therapy.—As in Case 2.

FIG. 8.—Case 5, left proptosis due to adenoid-cystic carcinoma of lacrimal gland of 2 months' duration in a man aged 46 years.

FIG. 10.—Case 5, recurrent left proptosis due to recurrent adenoid-cystic carcinoma of lacrimal gland, showing tumour extension in lower outer part of orbit.

FIG. 9.—Case 5, adenoid-cystic carcinoma of lacrimal gland. $\times 120$.

Follow-up.—No recurrence after 6 years.

Case 6.—The tumour was adherent to the periosteum. It was encapsulated, hard, and pink, measuring 3×3 cm.

Histology.—Similar to Case 5.

Diagnosis.—Adenoid-cystic carcinoma of lacrimal gland.

Progress.—4 months later the tumour recurred in the lacrimal fossa. This tumour was not encapsulated but showed the same adenoid-cystic carcinoma histology.

Therapy.—As in Case 2.

Follow-up.—No recurrence after 6 years.

Case 7.—4 months previously a non-encapsulated lacrimal gland tumour had been removed through a skin incision below the eyebrow. The new tumour was non-encapsulated, and was invading the orbital tissue.

Histology.—Similar to Case 5.

Therapy.—As in Case 2.

Follow-up.—No recurrence after 6 years.

Case 8 (Fig. 11).—8 months previously a lacrimal gland tumour had been removed through a skin incision below the eyebrow. A postero-anterior skull x ray showed destruction of the roof and lateral wall of the right orbit (Fig. 12). The tumour was vascular and non-encapsulated.

FIG. 11.—Case 8, right recurrent proptosis due to recurrent carcinoma of lacrimal gland of 5 months' duration in a woman aged 49 years.

FIG. 12.—Case 8, postero-anterior skull x ray view showing destruction of roof and lateral wall of right orbit.

Histology.—Carcinomatous characteristics (Fig. 13).

FIG. 13.—Case 8, anaplastic carcinoma of lacrimal gland. $\times 540$.

Diagnosis.—Anaplastic carcinoma of lacrimal gland, with involvement of orbital bones.

Therapy.—As in Case 2.

Follow-up.—The anaplastic carcinoma recurred 6 months after x-irradiation.

The following general observations were made:

(1) It is easier to excise an encapsulated tumour or to take a biopsy of a non-encapsulated tumour of the lacrimal gland through an incision just below the eyebrow than through a canthotomy and upper outer fornix conjunctival incision.

(2) Malignant mixed tumours and adenoid-cystic carcinomata of the lacrimal gland grow rapidly, usually in 2 to 4 months, while benign mixed tumours grow slowly, usually in 2 to 4 years.

(3) Recurrence of a malignant mixed tumour or adenoid-cystic carcinoma occurs quickly, usually in 3 to 6 months, while recurrence of benign mixed tumours occurs slowly, usually in 2 to 4 years. The histology of the recurrent tumour resembles that of the original tumour previously removed.

(4) This series of eight epithelial tumours of the lacrimal gland included no case of adenoma of the lacrimal gland.

(5) Serial sections to enable a search for the tumour tissue inside and outside the capsule are important in considering the possibility of recurrence.

Discussion

Recent views on the treatment of epithelial tumours of the lacrimal gland may be summarized as follows:

(1) Godtfredsen (1948) described the excision of benign mixed tumours by Kronlein's operation or anterior orbitotomy; for malignant tumours pre-operative *x*-ray therapy (4 to 5,000r) was followed a month later by evisceration of the orbit (even if the tumour responded to irradiation) because of the danger of recurrences. He described two recurrences which were regarded histologically as benign mixed tumours which disappeared after *x*-irradiation.

(2) Jones and Stallard (1959) recommend for benign tumours complete surgical excision by an extended Kronlein's operation; if excision is incomplete and histological examination reveals possible malignancy, post-operative *x*-irradiation is given to the orbit, a dose of 4,000r in 4 weeks at 250 kV. with indirect protection of the lens.

For malignant tumours, radical supervoltage *x*-irradiation is given to the orbit (5 to 6,000r in 6 weeks without ocular protection), but in recurrent cases exenteration of the orbit is the only feasible measure.

(3) Lederman (1962b) reports that the radiosensitivity of certain tumours of the lacrimal gland is the greater the more the histological picture diverges from that of the simple mixed tumour.

In my series of recurrent or malignant epithelial tumours, Lederman's method of giving 6,000r supervoltage *x*-irradiation in 6 weeks with indirect ocular protection gave good results; the superiority of these results to those obtained by surgical treatment even including exenteration is due to the use of supervoltage *x*-irradiation, and to the fact that the *x* rays reach the multicentric sites, including those invading the bone.

Summary

Among 150 histologically diagnosed orbital tumours were eight epithelial tumours of the lacrimal gland of the following types:

- (a) Two encapsulated benign mixed tumours.
- (b) Two malignant mixed tumours, one of them with orbital bone involvement and metastases.
- (c) Two pseudo-encapsulated adenoid-cystic carcinomata and one non-encapsulated adenoid-cystic carcinoma.
- (d) One anaplastic carcinoma with orbital bone invasion.

Good results were obtained by supervoltage x-irradiation for recurrence after excision of encapsulated benign mixed tumours. When there was no invasion of orbital bone and no metastases, the results were also good in cases of malignant mixed tumours or adenoid-cystic carcinomata.

The results of supervoltage x-irradiation have so far proved to be better than those previously reported for surgical treatment.

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