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Carcinomas Following Grenz Ray Treatment of Benign Dermatoses

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During the years 1977-1986 five patients were referred to the Department of Plastic Surgery, University Hospital, Århus, for treatment of carcinomas occurring in the skin on the sites previously treated with Grenz rays for benign dermatoses. Grenz ray treatment had been given for eight to nineteen years. The dose given, in one case, was very extensive. Otherwise a dose between 10000 rad (100 Gy) and 29300 rad (293 Gy) was given. The tumours were squamous cell carcinomas in four cases and basal cell carcinoma in one case. One person developed both squamous and basal cell carcinomas. The tumours behaved aggressively and in one young patient the dura and the parietal bone had to be replaced by tensor fasciae latae graft and a free latissimus dorsi flap. None of the patients had been exposed to other known carcinogens. Caution in applying Grenz ray treatment is stressed. (Received February 26, 1987.)

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Grenz rays (Bucky) have been used in treating a variety of dermatoses and has been considered relatively safe with only minor adverse reactions, such as erythema, hyperpigmentation and telangiectasia (1, 2).

Grenz rays are ionizing radiation at 8 to 15 kV with a HVL of 0.018 to 0.036 mm Al. The electromagnetic waves are of relatively long wavelength (1 to 3 Å), between the borderlines of ultraviolet rays and X-rays, and were developed by Bucky in 1923 (1). The radiation effects are limited to a tissue depth of 2 to 3 mm, as thoroughly investigated by E. Ebbenhøj in 1937 (3).

The first case of carcinoma caused by Grenz rays in extensive doses was reported by F. Kalz in 1959 (2). Since then 14 additional cases have been verified in the literature (4, 5, 6, 7, 8, 9).

Over a five-year-period, at the Department of Plastic Surgery, University Hospital, Århus, we have treated five patients with carcinomas following treatment with Grenz rays for benign dermatoses. Three of the patients developed metastases.

The purpose of this report is to draw attention to the fact that there still may be serious sequelae following treatment of benign dermatoses with Grenz rays.

PATIENTS, TREATMENT AND RESULTS

The clinical data of the patients are summarized in Table I. The five patients were 2 women and 3 men, aged from 33 to 57 years on admission to our department. All, except one, had received Grenz radiation for psoriasis. Patient 1 had administered the treatment on her own, working as a secretary in a dermatologic clinic. The radiation treatment was given over extended periods. Patient 4 was treated in four different clinics. None of the patients had any arsenicals or conventional X-ray treatment.

The interval between tumour development and termination of Grenz ray treatment was between 1 and 14 years. As to the tumour type three patients developed squamous cell carcinomas. Patient 3 developed more than 15 basal cell carcinomas in the scalp. Patient 2 had a basal cell carcinoma on the left lower leg in 1979 and on the anterior aspect of the left femur in 1984. In 1981 the first carcinoma appeared parietally with metastasis from a squamous cell carcinoma to the neck in 1982.

All patients are at present well with no clinical recurrences. Primary excision of the carcinoma was performed in patient 4. All the other patients had up to 16 excisions and covering by splitskin grafting. Patient 5 had a left axillary gland dissection performed in 1983, with metastasis in one lymph node. In patient 2, the tumour of the scalp invaded the parietal bone, which had to be resected and a neck dissection showed invasion of one lymph node. In 1985 he developed a local recurrence. It was excised together with the underlying dura, which showed invasion. The dura was replaced by a tensor fascia latae graft and covering accomplished by a free latissimus dorsi flap and a split skin graft.

DISCUSSION

Grenz rays, causing carcinomas after the use of extensive doses, was first described by F. Kalz in 1959. He reported of a physician, who had been exposed to Grenz rays over a 15-year-period. An additional dose of 1800 r at the age of 51 on the fingers, was followed by marked erythema. Eight years later a squamous cell carcinoma appeared on the left index finger. The total dose was estimated to exceed by far conventional therapeutic doses. No

Table I. *Clinical and pathological findings in five patients with carcinomas appearing in areas treated with Grenz rays in excessive doses*

No.	Sex	Age	Skin disorder	Site	Grenz ray therapy			Interval between Grenz ray treatment and tumour (years)
					Dose administered to the site of tumour Rad (Gy)	Duration of treatment	Type and site of carcinoma	
1	F	57	Hyperkeratosis	Scalp	Very extensive	1960-1970	Squamous cell	14
2	M	33	Psoriasis	Scalp	29 300 (293)	1965-1973	Squamous cell	8
				Lower leg	16 000 (160)	1965-1973	Basal cell	6
3	F	37	Psoriasis	Scalp	10 000 (100)	1960-1976	Basal cell	1
4	M	33	Psoriasis	Scalp	20 400 (204)	1966-1985	Squamous cell	1
5	M	52	Psoriasis	Arms	10 000 (100)	1970-1983	Squamous cell	1

X-rays of higher voltage was applied (2). Sagher, in 1962, reported on a dermatologist who at the age of 68 developed a squamous cell carcinoma on the left thumb, resulting in amputation of the finger. During the first four years of treating eye lesions, he had used thin leather gloves for protection. He had kept the patients lids separated by his own fingers. Over an 18-year-period the total dosage was estimated to be 60 000 to 70 000 r (4). Since the report of these initial patients, a total of thirteen cases of carcinoma of the skin treated with Grenz rays has been reported (5, 6, 7, 8, 9).

In our own material the given doses varied from 10000 r (100 Gy) to 29300 r (293 Gy), but in one case the doses could only be estimated.

None of the patients had any additional therapy of the skin in the site, where the tumours developed. The doses given were known from the patients records.

It is characteristic that some of our patients were treated by several dermatologists, and the patients in some cases were persuasive in getting Grenz ray therapy because of the relief of symptoms that followed the treatment. Grenz ray radiation treatment have been used quite extensively in dermatologic practice. Lindelöf & Eklund (9) found among 14 140 patients, treated with Grenz rays for benign skin diseases, only eight patients who developed squamous cell carcinoma. High doses ≥ 10000 r (100 Gy) gave no malignancies in 481 patients.

Comparing this with our material, one might assume that patients have different sensitivity to ionizing radiation. This assumption is supported by Munch-Petersen & Frenz (10) who found increased cellular sensitivity to UV radiation in patients, previously exposed to low energy radiation.

From our material and the previous reported cases, it is clear, that sequelae after Grenz ray therapy may be severe. Over the years a greater caution in application of Grenz ray therapy have been undertaken (11) stressing the importance of registration of dosages and awareness of treatment given elsewhere.

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