EPITHELIOMAS OF THE FACE AND THEIR TREATMENT WITH RADIUM*

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Chronic lesions of the face are of great importance to dermatologists on account of their frequency and because the patient expects not only a cure, but a good cosmetic result. In patients past the fourth decade, epitheliomas make up a large percentage of these chronic lesions. The two great classes of skin cancer occurring on the face are the basal-cell epitheliomas and the squamous-cell epitheliomas. The first is by far the most common. It fortunately can usually be diagnosed at a glance and is the most readily cured. The squamous-cell type often presents more difficulty in diagnosis and the prognosis should always be guarded, because it is this type in which there is a tendency to lymphatic involvement.

CLINICAL FACTS REGARDING EPITHELIOMAS

It is not our purpose to enter into a discussion of the etiology of epithelioma, but a few clinical facts may not be amiss. In the first place, it is striking that the great majority of these lesions of the face are associated with numerous keratoses and a seborrheic skin. It is, of course, not possible to state with certainty when seborrheic keratoses become cancerous; for they may be present for years before showing evidence of malignancy and, again, a single keratosis may change to an epithelioma in a few weeks. It is quite evident that keratoses develop most frequently in those exposed to the elements, as farmers and sailors. The rather uncalled for names of "sailor's cancer" and "farmer's cancer," applied to cases of epithelioma developing in men following these occupations, are merely specific instances of the malignant degeneration of keratoses due, in part, to exposure. The influence of chronic irritation in the production of epithelioma, particularly of the lips, is not proved by statistics of large numbers of cases to be more than a predisposing factor. Once a malignancy has developed, it is certain that chronic irritation increases the rate of growth. This is seen particularly in the cases of rodent ulcers which become much more active under inefficient treatment with cautery, freezing, electrolysis, roentgen ray, radium or surgery. The development of epithelioma on the basis of

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Fig. 1.—Leukoplakia of lip or early epithelioma; very superficial thickening; 10 mg. full strength plaque, aluminum 0.1 mm., total two and one-half hours.

Fig. 2.—Epithelioma of lip; infiltration limited to mucous membrane; 5 mg. half strength plaque, rubber only, total two hours; three bare tubes, total 2 mc. into the mass.

chronic lesions, especially lupus vulgaris and roentgen-ray atrophy, is well known and of frequent occurrence. It is interesting to note that basal-cell epitheliomas of the face are much more common in men than in women, but with the exception of epithelioma of the lip, this does not appear to be true for the squamous-cell epitheliomas.

The most common type of epithelioma of the face, as stated before, is the basal-cell type or rodent ulcer. The typical clinical features are: a history of long duration, usually of years; a rolled waxy border with fine telangiectases, with or without ulceration, and the absence of metastases. The malignancy consists in a tendency to extend to and destroy neighboring structures, a liability to recurrence when insufficiently treated and the frequency with which the ulcer occurs in inaccessible positions. Basal-cell epitheliomas should be subdivided clinically into the rodent nodule, the superficial ulceration, the deep ulceration and the cicatrizing variety.

VARIOUS METHODS OF TREATMENT

The types of basal-cell epithelioma which present special difficulty are the very extensive ones, with or without bone involvement, and those involving the canthi or the lids of the eyes. The very extensive cases are the result of neglect on the part of the patient, or, even more frequently, are due to inadequate treatment by incomplete removal or superficial cauterization. Inefficient cauterization is usually represented by the use of a relatively superficial chemical caustic. Deforming rodent ulcers in which large portions of the face have been destroyed are becoming much less common. This is probably due to the greater knowledge of the general practitioner and to the education of the laity to look with suspicion on any enlarging nodule or chronic ulceration. The successful eradication of any extensive epithelioma, especially when the underlying bone is involved, will necessarily involve the production of a considerable amount of deformity. Rodent ulcers involving the canthi, even when small, are to be handled with care because of the danger of injuring the eye and the probability of extension into the orbit if the growth is not entirely destroyed. Epitheliomas of the eyelid are usually of the rodent nodule type, relatively deeply situated. They must be treated by some means which will obviate the destruction of the lid, because plastic surgery at best cannot give a good result if there has been much loss of tissue.

The great majority of dermatologists are now ready to admit that in most cases of basal-cell epithelioma, radiotherapy alone or in combination with curettage is the treatment of choice. The advantages of radium in the average case are that it is painless in application, the resulting scar is the smallest possible and recurrences are as few following proper radium therapy as following any other form of treatment. The one disadvantage in these cases is the time that it takes. It is in

Fig. 3.—Same patient as Fig. 2; ten days after starting treatment, showing reaction.

Fig. 4.—Diffuse superficial epithelioma involving entire vermillion border of lower lip; 115.4 mc. in four tubes, silver 0.5 mm., one hour to surface; four bare tubes, total 3.2 mc., buried.

the extensive and difficult cases which have been mentioned that radium stands out as the only satisfactory form of treatment. When bone is involved the use of radium can frequently bring the process to a standstill even when it is impossible to produce a cure. In these cases it is probably best to curet out as much of the involved bone as possible, following which radium in the form either of plaques or tubes should be applied for a sufficient time to produce a shallow bone necrosis. This often leads to the formation of a sequestrum, and after removal healing may take place, following which plastic surgery may be employed. In very extensive cases the application of radium can usually accomplish a rapid clinical cure, which, however, is followed frequently by small recurrences for which we must be constantly on the lookout. It is often impossible to irradiate lesions on the lids without giving the sclera a considerable dosage, but this need not deter us, because the resulting reaction clears up readily.

TREATMENT OF RODENT ULCERS

In treating rodent ulcers of the face, surface applications of plaques or tubes of either radium salt or of the emanation are to be preferred to burying needles or bare tubes of emanation. The use of needles or bare buried tubes is rarely indicated because they cause a large amount of scarring and are no more efficient in these superficial lesions than the surface application. The only exception to be noted is in the case of the deep rodent nodule which is refractory to the usual form of radium treatment. This is occasionally found at the canthi where infiltration may be deep, as the result of time or inadequate treatment. In treating a superficial rodent, a full strength plaque, screened with rubber dam only or with 0.1 mm. of aluminum, is fastened over the lesion for a total dose of from three to four hours, divided between two or three successive days. This dose may be given at one sitting, but this increases the reaction without improving the result. If the lesion is relatively deep, from 0.3 to 0.5 mm. of brass is employed as a screen and the time increased to five or six hours. If tubes are used the dosage is roughly 40 millicurie hours per square centimeter of surface, the tubes being distributed as nearly as possible so that there is one tube to each square centimeter. The usual screen when tubes are utilized is 0.5 mm. of silver and 1 mm. of rubber tubing. Any of these methods produces a severe reaction, starting on from the seventh to the tenth day and reaching the height at the end of the second week. Exudation and crusting occur and finally, about the sixth week, the last crust comes away leaving a smooth, white, supple scar. It is, of course, necessary to irradiate the edges of the rodent thoroughly and any attempt to screen the surrounding tissues to lessen the area of reaction leads to a poor result. In

Fig. 5.—Deeply infiltrated epithelioma ; hard, discrete glands, palpable ; surgical removal.

Fig. 6.—Deeply infiltrated epithelioma ; no palpable glands ; operation refused ; five bare tubes, total 8.7 mc., inserted into mass ; 10 mg. full strength plaque, brass 0.3 mm., two and one-half hours.

the few cases in which it is necessary to use bare buried tubes, the dosage should be conservative, that is, one or two tubes of 0.5 millicuries each or less may be inserted into the mass, and this is augmented by screened applications to the surface. The great advantage of radium over roentgen ray is that the most severe reaction with the first eventually clears up without undue scarring, while any reaction beyond a faint erythema from the latter may lead to disastrous after-effects, the least of which are telangiectases and the worst of which is a new and more malignant carcinoma.

EPITHELIOMAS OF THE EAR AND OF THE LIP

Epitheliomas of the external ear are of special interest because they present considerable difficulty both in treatment and in diagnosis. The differential diagnosis between squamous and basal carcinoma of the ear is at times impossible without a biopsy. It is clinically true that squamous epitheliomas of the ear are usually less malignant than those occurring elsewhere, in that their growth is slow and involvement of the neighboring lymph glands is late. Satisfactory surgical treatment of malignant lesions of the ear involves a considerable loss of tissue and a poor cosmetic result. It has been reported that radium treatment of lesions of the ear is unsatisfactory on account of the intractable reaction following adequate treatment. It has been our experience that the reaction following radium therapy of cancer of the ear is rather severe and more painful than elsewhere; but this usually clears within a reasonable time. The results, particularly in the smaller and superficial cases, have been good. The technic in the treatment of epitheliomas of the ear is similar to that of superficial epitheliomas elsewhere, except that thicker screens should be used and the time increased correspondingly. Buried bare tubes should only be used in very extensive fungating cases. Unless one is sure that he is dealing with a basal-cell type, the regional lymph nodes should be irradiated with the roentgen ray in spite of the fact that the squamous-cell type in this locality metastasizes late.

Until recently the treatment of carcinoma of the lip has always been surgical. At the present time, surgical treatment is usually efficient in curing those cases in which the growth is limited to the lip, but the operative technic must be perfect, particularly in reference to the excision of a suitable margin of normal tissue with the neoplasm.

Many epitheliomas of the lip commence as keratoses, and it is frequently impossible to differentiate a keratosis from an early malignancy. The differential diagnosis in difficult cases can often be made by palpation. A deep, tight keratosis is never cleared permanently by the application of ointments, and even superficial cauterization may prove insufficient. Such a lesion clears promptly and permanently under adequate radium therapy, and surgery is unneces-

Fig. 7.—Squamous-cell epithelioma of nose tip and septum involving part of upper lip; three bare tubes, total 3.3 mc., buried into lip; plaques to surface, aluminum 0.1 mm., total ten hours.

Fig. 8.—Same patient as Fig. 7, one month after starting treatment.

Fig. 9.—Malignant papilloma of neck; sixteen bare tubes, total 15 mc., buried in mass: Rodent ulcer of cheek; 10 mg., 2 mm. lead, 1 cm. distant, for fifteen hours. Both lesions developed on the basis of a scar following a burn.

sary. A half or full strength plaque of sufficient size to cover the keratosis, screened with 0.1 mm. of aluminum, applied for a total of two to three hours, has proved satisfactory.

The early epithelioma of the lip, in which the mass is distinctly palpable, but which is apparently limited to the superficial structures, can usually be readily cured by the surface application of radium either in plaques or tubes. If the plaque is used, a full strength applicator, screened with 0.1 mm. of aluminum, should be used, and a total dose of four to five hours given in two or three sittings. Should tubes be used, a screen of 0.5 mm. of silver and 1.0 mm. of rubber is satisfactory, if from 40 to 50 millicurie hours are given to each square centimeter of surface. Since metastases are rarely seen in epitheliomas at this stage if efficiently treated in the first place, prophylactic treatment of the cervical glands is unnecessary, though they should be watched for some time after the initial lesion is treated.

The more extensive cases, in which the subcutaneous tissues are involved, require more strenuous therapy. In this clinical variety of lip cancer, proper surgical removal of the growth with dissection of the regional lymph nodes, even though they are not palpable, is usually satisfactory, but for a number of reasons it may be desirable to treat it with radium. For these cases, in addition to the surface treatment advised in the more superficial type, from two to eight bare tubes of emanation should be buried in the tumor. These tubes should be from 0.5 to 1 millicurie each. This combined method of treatment will practically always clear the original lesions. The lymph glands of the neck should be irradiated in every case of this type, either with the roentgen ray or with a suitable radium pack, whether the glands are palpable or not. If the roentgen ray is used, 60 milliamperes minutes at a 10 inch distance, with a 10 inch spark gap and 5 mm. aluminum filter, should be applied to each of three areas every three or four weeks for three or four times. Should a radium pack be used, 3,000 to 4,000 millicurie hours at 3 cm., filtered through 2 mm. of lead, may be given each of three areas every four or five weeks for three or four times. Should palpable nodes be present at the outset they should be surgically removed a week or two after the first irradiation and the areas irradiated again subsequently. If metastatic nodes develop during treatment, radical removal is indicated.

Very extensive carcinomas of the lip, involving the greater part of the lip and with massive metastases are as hopeless under radiotherapy as under surgery. Some of these cases may receive some palliation, particularly in decreasing pain and in healing ulcerative areas. Massive doses of radium or roentgen ray do more harm than good and conservative therapy only is indicated.

Fig. 10.—Superficial basal-cell epithelioma of inner canthus; 10 mg. full strength plaque, 0.1 mm. aluminum, total four hours.

Fig. 11.—Epithelioma, basal-cell, of inner canthus. This appeared to be a superficial ulceration but proved to be a deep infiltration, involving the bone; five mg. half strength plaque, brass 0.3 mm., total five hours; one bare tube, 0.5 mc., buried into the mass; subsequent surgical removal of the sequestrum.

THE TWO TYPES

Aside from cornifying carcinoma of the lip and ear, these lesions may and do occur anywhere on the face. In general they conform to one of two types: (1) the mushroom or fungating type, and (2) the infiltrating type. These types are not at all distinct, and the one often merges into the other. In general, it may be said that when the fungating form predominates, metastases occur relatively late and the prognosis is therefore better. The infiltrating type may clinically resemble closely a rodent ulcer and when this occurs the only differentiating feature is the rapidity of growth. In these cases surgery is of value, but wide excision will be necessary for a cure. In treating them with radium, the most efficient possible radiation is imperative. Halfway measures are worse than useless. Cosmetic results cannot be thought of. Wherever possible, buried bare tubes of emanation should be employed, and this treatment augmented by the use of applicators on the surface. The lymph glands draining the area involved should be treated as outlined for epithelioma of the lip.

CONCLUSIONS

In the treatment of basal-cell carcinoma of the face it is seldom necessary to employ buried bare tubes. Surface application, except in the deeply infiltrated and very extensive cases, are usually satisfactory.

In the great majority of squamous-cell carcinomas, buried bare tubes used in conjunction with surface applications have been very helpful. In the radium treatment of deep carcinomatous infiltrations, buried bare tubes are almost a necessity.

ABSTRACT OF DISCUSSION

DR. HENRY H. HAZEN, Washington: It seems to me that the therapeutic action of radium and that of roentgen rays is practically identical. A few weeks ago I reported a series of over 100 cases of epithelioma treated by roentgen rays and followed to end-results. The results were very good. In these cases we had nineteen recurrences. Some of these were sent in for radium treatment after roentgenotherapy had failed; not in one instance was the cure affected by radium. We might also add that several of the patients had been treated by radium before they came to us for roentgenotherapy. Some of them were treated by a doctor who was a gynecologist, not a dermatologist, but in this series the radium showed no advantage over roentgenotherapy.

In regard to sequelae, in the cases with basal-cell growths which we handled, we found telangiectasis resulted in only seven cases, and the scarring was no more marked than in cases in which radium is used. There is one thing which is rather striking, and that is that when roentgen rays are used up to two or two and a half skin units in an area not over three fourths of an inch square, telangiectasis is not likely to result; but if a much larger dose is used on the same patient over a larger area telangiectasis may result. We do not, it seems to me, have more sequelae from roentgen therapy than from radium therapy.

In regard to the ear, we are in doubt about treating basal-cell carcinoma of the ear either with radium or with roentgen rays. We have found that they are not particularly effective in a large series of cases. It is our practice now to take these growths out with a cautery rather than to attempt removal with roentgen therapy.

I often wonder if in the use of radium and roentgen therapy we do not employ too heavy filtration. It is not unusual to see a case of prickle-cell or basal-cell carcinoma in which a heavy filtration has been used without response, treated only once or twice with a heavy, almost unfiltered ray, followed by good healing almost at once. The same thing is at times true in the cases of lymph nodes. I am sure we obtain better results in employing a rather light filter of aluminum, about 2 mm. instead of 5 mm.

DR. AUGUST RAVOGLI, Cincinnati: I must emphasize the work that Dr. Morrow has shown us and must add also to the praise for radium. I have felt that in radium we have the ideal treatment for the superficial epithelioma of the skin. The great question, as Dr. Fox has said, is to have the technic standardized, and eliminate the alpha rays, which are irritating and produce a constant reaction without doing any good. We should use only the beta and gamma rays, and this work is done entirely by the screen. In my office, we use the silver and copper screen and also black paper, according to the depth of the epithelioma. I had a patient, referred to me by Dr. Carmichael, who had a large basal-cell carcinoma of the temporal region. I treated it by scraping, and burning and obtained a pretty good result; but the patient returned two years later with a big tumor, and was treated with radium. The tumor disappeared, leaving only a thin scar. Recently the patient returned with a small, ulcerating epithelioma in the center of the scar and has received two hours more of 50 mg. of radium. I do not know yet what the result will be, but surely we can say this is the ideal method for treating epithelioma.

Of course, when the glands are affected I believe surgical treatment is necessary, together with radium therapy. The radium dissolves and makes innocuous the cells which constitute the cancer. About two weeks after the application of radium, when the reaction starts, if a piece of the epithelioma is taken and examined microscopically, one finds no more of the epithelial cells, but only the connective-tissue cells which take the place of the old cancer cells, and in this way all the cancerous appearance is entirely gone.

I agree with Dr. Morrow that radium therapy for the epithelioma or superficial cancer of the skin is the ideal treatment, and we can congratulate ourselves that we have a means of relieving patients who were condemned to suffer.

DR. RICHARD L. SUTTON, Kansas City, Mo: On one or two points I differ with Dr. Morrow. In the treatment of carcinoma of the ear, my experience does not coincide with his. In cartilage involvement, we have found both radium and the roentgen rays of little use. Careful dissection gave us the best results.

In the treatment of simple, noncomplicated basal-cell carcinoma of the skin, curettage, followed by acid nitrate of mercury (as originally recommended by Sherwell), with radium later, gives the best cosmetic results and the best guarantee of a permanent cure. We have secured better results from the use of radium plaques in these cases than from tubes, probably because of the larger area treated when the plaques are employed. Short, oft repeated doses, have, in my hands, proved superior to single, long exposures. In other words,

ten or a dozen exposures, of one-half hour each, give better results than a single exposure of five or six hours. I am glad to learn that Dr. Morrow and Dr. Pusey have had the same experience.

In attacking cancer of the lip, cross firing, with plaques or with needles has given the best results in my hands.

DR. DOUGLASS W. MONTGOMERY, San Francisco: There are possible explanations of the excellent results we get with carcinoma of the lip treated with radium. We now, in physiology, recognize five tissues instead of four—epithelial tissue, connective tissue, tissue of muscle, tissue of nerve, and in addition we regard blood as a tissue. Blood tissue happens to be the richest in metal. Only those rays of electromagnetic energy, however, which are absorbed are of value in the treatment of epithelioma, and we know that the presence of metal causes the absorption of those rays. Therefore, the probable reason why we get such brilliant results on the lip and on the eyelid is that, in these situations, there is a great deal of blood, with its heavy load of metal, causing the absorption of the electromagnetic energy.

I confess that the results we get in cancer of the lip now are astonishing to me. I never could get them with roentgen rays, but, of course, it may be that in my practice I never had attained to the expertness with roentgen rays that Dr. Pusey had. He showed results that we, in our office, could not attain. I do not know what the difference in technic was.

There is another point I wish to mention. It refers to the advantage of the split dosage, and there may be a physiologic reason for that also. Karyokinesis plays an important part in all malignant growths. Karyokinesis consists, first, in the complete disappearance of the nuclear membrane; then the cell contents, including the nuclear constituents, are scrambled; then two poles are formed, and around each pole a nucleus appears. Then nuclear membranes are formed and the cell divides into two parts, each with its nucleus, and so two cells are born. There is, therefore, a time in the division of the cell when the nucleus, the nub of the cell so far as vitality is concerned, is unprotected by its membrane and is sensitive to injuries as at no other time. Now, if the gamma rays hit that cell at the particular time, it is only fair to suppose that it will kill that cell much more readily than if it had a nuclear membrane.

As new cells are being formed continuously, an interrupted treatment would hit more of these sensitive cells than a continuous treatment. In other words, an interrupted treatment would be equivalent to fractional sterilization. This would indicate that fractional dosage is the best method to employ. In conversation, Dr. Pusey has said that the foregoing would explain why he, with interrupted dosage, gets better results than by continuous application.

These two points, I think, are exceedingly interesting in our treatment of these cases.

DR. WILLIAM ALLEN PUSEY, Chicago: These papers on radium and the roentgen ray are always interesting, and I think we all are getting about the same results. I would call attention to the fact that I have been getting practically all the results with roentgen rays for at least twenty years. I have had radium for at least seventeen years and have used it in these cases, and have carefully tried to see some difference between the results; but I will reiterate what I have said before—that I can see no difference whatever, even as to the point of radium burn.

The point which Dr. Hazen brought up about telangiectasis in small areas and not in large, I think is explainable. When you produce a roentgen-ray scar you destroy most of the blood vessels and those that remain are enlarged

to compensate for those that are gone. If you have an area the size of a small coin, the amount of compensating hypertrophy is small, but if the area is as large as a foot, you get more telangiectasis. That to my mind is an explanation of what I think is a fact. My experience agrees with his as to telangiectasis.

As to the different kinds of results Dr. Morrow has obtained, they conform with mine. After a short experience I formulated this rule: I was willing to treat with roentgen rays any epithelioma, basal cell or squamous cell, which did not require the removal of adjacent glands or other deeper tissues. I have lived up to that rule ever since, according to my best judgment, and have had no reason to depart from it, or to believe it not a good rule. Very early in my experience, through some surgeon, I began to treat epithelioma of the lip. Patients with epithelioma down deep in the substance of the lip I do not wish to treat, but if there are superficial lesions involving some portion of the lip I am willing to treat them. The ex cathedra statement was often made that the treatment of epithelioma of the lip except by a surgeon was a crime. I have been doing it for twenty years, and I would be willing to put my results against anybody else's results. As a matter of fact, when you find carcinoma in the glands of the neck, surgery has nothing to hold up its head and be proud about.

About epithelioma of the eyelid: I have treated these for many years. I am willing to take the position that any one who treats an epithelioma of the lid by incision without considering radium or roentgen rays is not giving the patient his best chance. In the inner canthus the lesions are likely to go into the orbit, and when they do so treatment is of little avail. At the outer canthus I get better results. I have no difficulty in avoiding radium dermatitis about the lids.

About the ear, I do not see the trouble that Dr. Sutton spoke of. Of course if you have carcinoma where there is nothing but cartilage it heals slowly, but I treat these carcinomas with considerable success. I have plaques that are small enough to get down into the small folds and I secure good results.

DR. HAROLD N. COLE, Cleveland: I just wish to mention a therapeutic suggestion. An article was published in the *Annals of Otology* about a year ago giving a method for protecting the eye by means of a brass ovoid that fits over the ball. Having filled the interpalpebral space with liquid petrolatum, one coats one of these ovoids with paraffin and slips it over the eyeball. Treatment can then be continued for an hour without effecting the eye. I secured one of these ovoids from V. Mueller and Company, Chicago, and think it is the finest thing that has ever been devised for protecting the eye during radiotherapy.

DR. HENRY H. HAZEN, Washington: It has been the fashion recently for a large number of institutions to rent radium to people in the town. They form a company and secure a certain amount of radium which they rent. I believe one thing should be emphasized: Radium treatment cannot be standardized except by biologic tests. You cannot measure the millimeters and time and so forth, as with roentgen rays, and if a man goes to an institute and rents radium he will get into trouble at times. I think it should be emphasized that a physician cannot rent radium and obtain the same results that Dr. Pusey or Dr. Morrow can.

DR. WILLIAM ALLEN PUSEY, Chicago: I have treated these cases for twenty years for surgeons and am sure some of them think it does well. There have been cases in which there have been nodules even in the armpit and the nodules have disappeared. I believe it can be established that you can get rid of many

carcinomatous glands in certain localities by means of roentgen therapy. I feel very doubtful about the efficiency of any technic in the neck, but in the axilla and breast I think the probability is strong that you can destroy those masses. I have seen some cases that seemed to leave no possible doubt that roentgen therapy had cured recurrent carcinoma that was inoperable. For example, I treated a woman, a physician, eighteen or nineteen years ago, who had a family history with more carcinoma in it than I had ever known, and who had had two and perhaps more operations for recurrences on the chest wall. There was nothing left except skin and ribs, but she had some recurrence in the axilla at that time and a little under the glands of the skin surface. With all her history and those recurrences, that woman still sends me some sort of memento every Christmas.

DR. HOWARD MORROW, San Francisco: In regard to the subject of screening, two years ago I was inclined to think that we should use heavy screens and prolonged exposures, but little by little I have come to the conclusion that we want to screen less and use shorter exposures. I believe all applicators should be screened, certainly with rubber, and even in superficial cases should have at least 0.1 mm. of aluminum. In the deeper lesions we can use a longer time and screen with 0.2 mm. of aluminum. If a massive dose is necessary, we can screen with 0.5 mm. of silver and 0.1 mm. of rubber. Beyond that greater screening is seldom necessary in superficial lesions.