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A WEDGE FILTER FOR COBALT 60 SUPPLEMENTATION OF CARCINOMA OF THE CERVIX UTERI PREVIOUSLY TREATED BY RADIUM

by

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The treatment of carcinoma of the cervix uteri by vaginal and intra-uterine radium sources is frequently followed by the external application of gamma or roentgen ray fields to supplement the radium dosage in the parametria.

A criticism of many techniques for such supplementation is that they raise a region of non uniform dosage to a higher level of dosage while still preserving the non-uniformity of the dose. This is particularly true for gamma or roentgen fields divided by a central lead strip and used in parallel anterior-posterior opposition.

The penumbra produced by the extended source of a cobalt unit, when a simple rectangular lead block of suitable dimensions is placed centrally across the radiation field, may be used to attain some degree of matching of increasing cobalt and falling radium dosage. However, the relatively level peaks, particularly for large cobalt fields, when combined with the still falling radium contribution, produce a falling total dosage distribution. The usefulness of this method is very limited and may only be used if one accepts a restricted plateau followed by a region of falling dosage which extends to the edge of the radiation field.

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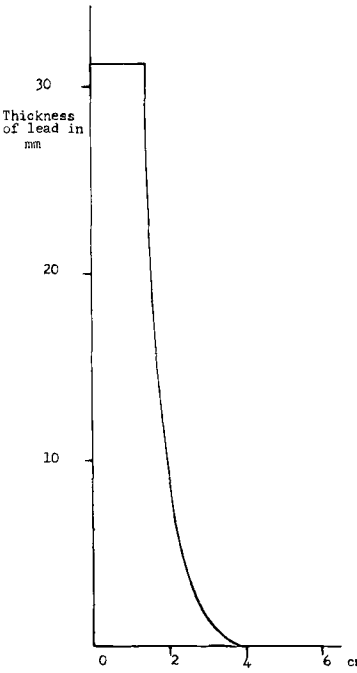

Fig. 1 (left). Variation in wedge thickness in mm with distance from the mid-line of the wedge.

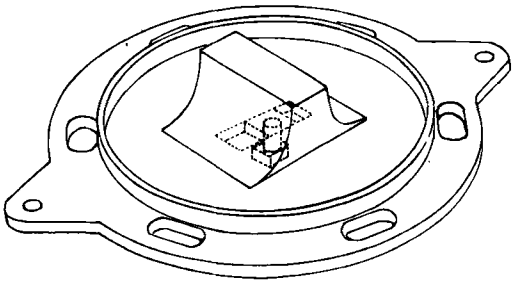

Fig. 2 (above). Diagrammatic representation of lead wedge, perspex base plate and slide mounting.

One method by which the above criticism may be removed is to replace the central lead 'strip' by a wedge designed so that the dose from the supplementary fields is a minimum at points already adequately irradiated by radium and thereafter increases laterally in such a way that it matches the falling radium dosage. This solution has been proposed (TRANTER 1959) for use with a linear accelerator and could clearly be applied to a cobalt unit. The consequent reduction of output and associated increased treatment time is not unreasonable compared to many other wedged or 'drawn-back' field techniques, and will become of less importance as higher activity cobalt sources become available.

The dimensions of a lead wedge found suitable for use with an Orbitron cobalt 60 unit fitted with a 2 cm diameter, 2 000 curie source are illustrated in Fig. 1. This lead wedge and perspex base plate (see Fig. 2) are attached to the diaphragm cover of the Orbitron treatment head, so that the wedge lies between the base plate and the source, i. e. between and below the lower diaphragm system. Little difference is found in the dosage distribution pattern if the wedge and/or base plate are inverted, but the present choice is mechanically desirable.

The wedge is mounted on a slide in the base plate and is capable of rotation on its axis so that, as recommended by TRANTER, the thickest portion of the wedge may be adjusted within the cobalt radiation field to cover the position formerly occupied by the uterine radium.

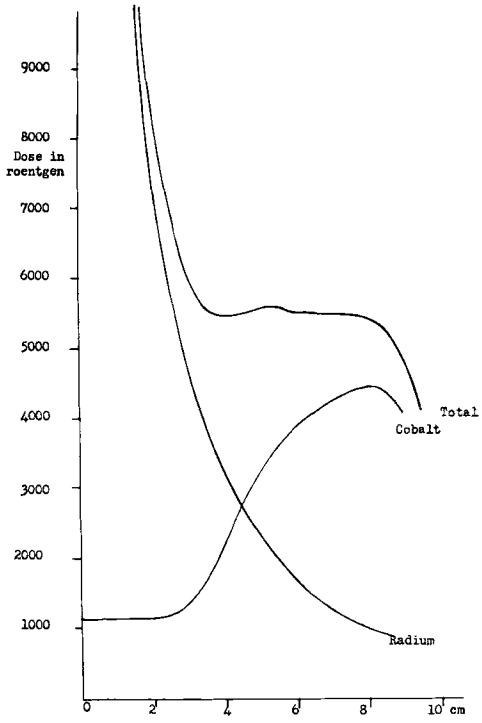

Fig. 3. Radium, cobalt and combined dosage distributions at the mid-line of a patient 20 cm thick for a field of 16 × 12 cm.

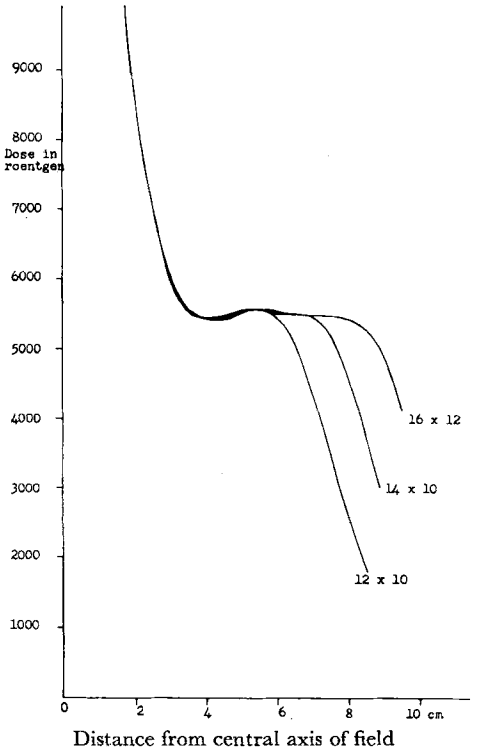

Fig. 4. Variation of combined radium and cobalt distributions with distance from the central axis of the field for various field sizes.

The radium, cobalt and combined dosage distributions at the mid-plane of a patient, 20 cm thick, with the radium centrally placed, are illustrated in Fig. 3. The combined dosage distributions obtained for field sizes of 16 × 12 cm, 14 × 10 cm, and 12 × 10 cm, when the cobalt treatment times are adjusted to give a plateau of 5 500 r are illustrated in Fig. 4. On the same basis, the combined distribution curve obtained for a 14 × 12 cm field was virtually coincident with that of a 14 × 10 cm field and is therefore not recorded. Similar combined dosage distributions will apply for other thicknesses of patients, as the isodose curves for this wedge maintain their cross field distribution sensibly constant over a range of depths.

Direct addition of cobalt and radium doses was adopted to obtain the combined dosage distributions shown in Figs 3 and 4. It is, however, clear that, as pointed out by TRANTER for the linear accelerator wedge, it would be possible to adjust treatment times to achieve the same degree of matching if other assumptions are made as to the mode of summation of dose.

SUMMARY

A lead wedge filter is described which, when suitably placed in the radiation beam, ensures that the dose from the supplementary fields is a minimum at points already adequately irradiated by radium and thereafter increases laterally in such a way that it matches the falling radium dosage. A typical combined radium and cobalt dosage distribution is illustrated and the effect of variation in the cobalt field size considered.

ZUSAMMENFASSUNG

Ein Bleikeilfilter wird beschrieben, das nach korrekter Anordnung im Strahlenkegel die Dose von den Hilffeldern an den Stellen, die bereits eine ausreichende Bestrahlung erhalten haben, auf ein Minimum reduziert und das lateral zunehmende Strahlung durchlässt entsprechend der dort abnehmenden Radiumstrahlung. Eine typische kombinierte Radium und Kobalt Bestrahlungsanordnung wird beschrieben und die Einwirkung von Feldgrössenveränderung der Kobaltstrahlung besprochen.

RÉSUMÉ

Description d'un filtre cunéiforme en plomb qui, placé convenablement dans le faisceau de radiation, permet de délivrer aux points correctement irradiés par le radium une dose minimale par les champs complémentaires et de donner latéralement une dose croissante compensant la diminution de la dose curiethérapique. Les auteurs présentent un cas typique comme exemple de la distribution de dose combinée par le radium et le cobalt et étudient l'influence des variations des dimensions du champ de cobaltthérapie.

REFERENCE

TRANTER F. W.: A wedge filter for use in the treatment of carcinoma of the cervix uteri with 4 MV X-rays. Brit. J. Radiol. 32 (1959), 350.