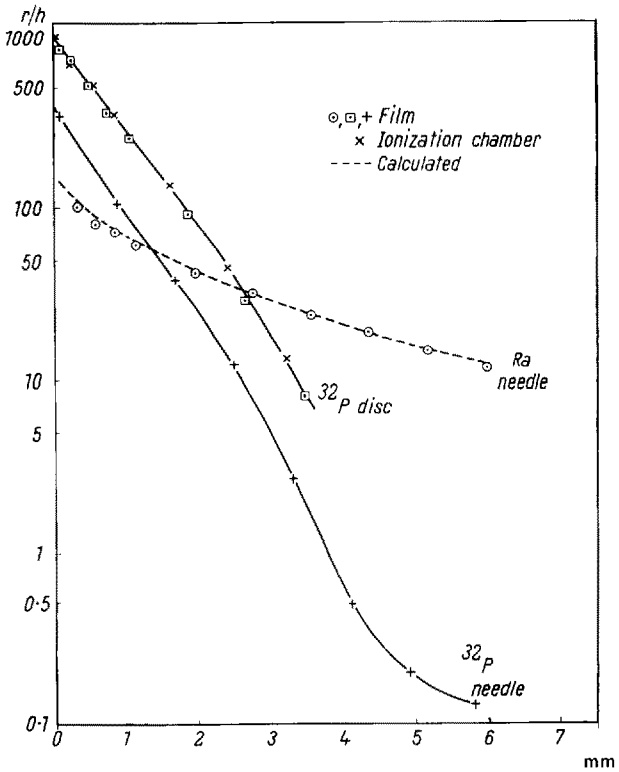
Dose Measurements with Photographic Films on a Beta-Ray Needle

The clinical use of thin-walled tubes containing a beta-ray emitter has already been reported[1], and it is evidently of some importance to know the dose-rates delivered by such tubes at the surface and at a depth in tissue. Because of the source geometry, the measurement of these dose-rates with ionization chambers is difficult, and a film method such as has already been used on plane beta-ray sources[2], is more likely to meet with success. The purpose of this note, reporting the results of some measurements made with films on a beta-ray needle loaded with phosphorus 32, is to demonstrate that films may be used with a reasonable degree of accuracy to measure the dose-rates from beta-ray tubes and needles.



Variation of dose-rate with distance from surface of sources in cellulose acetate.

The needle was a hollow duralumin tube (external diameter 2 mm; wall thickness 0·2 mm), closed with a point at one end, and having a tight fitting plug at the other. The internal space, 2·5 cm long, was filled with phosphorus 32 solution. The film used for the measurements was Ilford Industrial F, the suitability of this film for dosimetry having already been demonstrated[3]. Each film was exposed separately in a plane parallel to that of the needle, with different thicknesses of cellulose acetate absorbers (density 1·32 g/cm³) in between. Films were also exposed similarly to a 1 mg radium needle (active length 15 mm; external diameter 1·85 mm; filtration 0·6 mm Pt.), and to a disc of phosphorus 32 plastic, 22 mm diameter and 0·5 mm thick. Each batch of films was developed in Ilford ID 19 developer together with a series of films that had received standard gamma-ray exposures from a 25 mg radium tube. For these standard exposures, the films were sandwiched between layers of Perspex 6 mm thick, and set up in a Perspex jig at distances varying from 14·5 to 65 cm from the tube for a period of about 16 h. By this means a series of known exposures from 0·8 to 16 r were obtained. After processing, the films were densitometered with an EEL Universal Minor Densitometer using a 1 mm spot size. Readings of density were then converted to dose in roentgens by comparison with the films that had received known doses from the 25 mg radium tube.

The results are shown in the Figure. The estimated dose-rates on the phosphorus 32 plastic were in good agreement with values measured on the same disc with a shallow thin-windowed ionization chamber having a collecting volume 1 cm in diameter by 1 mm deep. The validity of the film technique for beta-ray dosimetry was thus confirmed. Film measurements on the 1 mg radium needle agreed well with values calculated using SIEVERT's integrals taking into account oblique filtration. This agreement supported the view that the film method might be especially suitable for the dosimetry of line sources. Finally, the measurements on the beta-ray needle, made when its activity was about 160 μc, showed very clearly the limitations of this form of therapy for other than very superficial conditions. By comparison with the radium needle, the dose fell off extremely rapidly with depth, and, as was to be expected from geometrical consideration, the half-value depth (0·45 mm of absorber, equivalent to 0·56 mm of tissue), was a little less than that for the disc-shaped beta-ray source.

We are grateful to Professor J. S. MITCHELL for his interest and advice.

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Department of Radiotherapeutics, University of Cambridge, December 4, 1956.

Zusammenfassung

Es werden Messungsergebnisse mitgeteilt, die zeigen, dass die photographische Filmtechnik geeignet ist, Dosismessungen an linearen Betastrahlern (Nadeln oder Tuben) vorzunehmen.

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A Microradiographic Study of Bone Tissue in Ovarian Dermoid Cyst

Dermoid cyst is a teratoma and one of the common tumors of the ovary. The cyst has a yellow colour, a doughy consistency and its wall is lined with a cubical epithelium. The contents of an ovarian dermoid show many variations. Mostly it is a yellowish, turbid, oily material containing hair and skin (hence the name dermoid). One often sees bone, teeth, cartilage, thyroid, brain, intestine, striated muscle, adrenal, etc.