AFTERLOADING—A CONTRIBUTION TO THE PROTECTION PROBLEM

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THE adoption of mechanical needle stabilizers for radium implants has converted this type of treatment to a precision technique of great accuracy (Green and Jennings, 1951).

The scope of the method has been considerably extended by the substitution of a hollow stainless steel needle loaded with radon seeds for the conventional type of needle (Mead and Stevens,

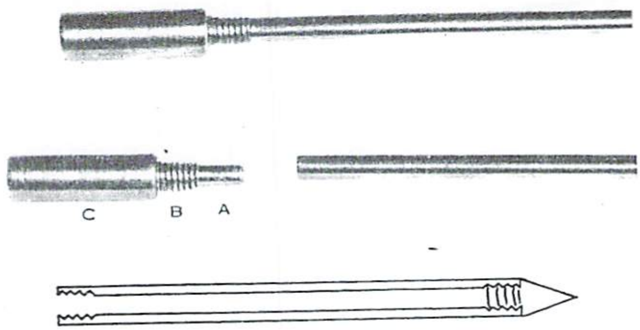

Fig. 42.—The insert assembly with component parts, the hollow steel needle, the insert and the insert lock.

Fig. 43.—Demonstrating the activation of needles through a perspex stabilizer, using the handle.

1955). This has overcome the restrictions which are imposed on radium implants in the average department by the few needle strengths available.

By using varying units of radium, radon, radio-active cobalt, or other selected isotope, within these hollow needles a large range of length and linear strength of source is readily available.

The radiotherapist can now undertake, with confidence and precision, implants which are more extensive or more exacting than previously. This increase in versatility is offset by the increase in the exposure to the radiotherapist on three counts :—

1. Larger implants.

2. More difficult, and hence more lengthy procedures.

3. The adoption of an increased number of these procedures.

If the radio-active materials are not inserted into the hollow needles until the implant has been completed, the exposure to the radiotherapist is eliminated. This technique of *afterloading* permits the radiotherapist to perform, without danger, any number of large and complex implants in a careful and unhurried manner.

Further, the accuracy of the implant can be verified by radiography and if necessary an adjustment made before it is activated. This offers an obvious and important advantage in centres concerned with the training of radiotherapists.

The method is extremely simple and provides full protection for all concerned.

TECHNICAL DETAILS

Afterloading requires implantation of hollow needles followed later by the activation of these needles with radio-active sources. The hollow needles used at the Queensland Radium Institute are constructed of stainless steel tubing with an outside diameter of 2·4 mm. and an internal diameter of 1·7 mm. Each has its point made of stainless steel rod, threaded and silver-soldered into position, and the other end has a 9 B.A. thread cut on its inner surface to a length of 0·25 cm. The length of the point is 0·65 cm. (*Fig.* 42.)

Activation of the implant requires :—

1. An insert, which has previously been loaded with radio-active sources and which fits into the stainless steel needle ;

2. An insert lock which attaches the insert to the steel needle (*Fig.* 42).

The insert is constructed of stainless steel tubing of outer diameter 1·6 mm. and inside diameter 1·2 mm. One end is spun over to prevent the radio-active sources from sliding out while the other end fits tightly on to the insert lock.

The insert lock (*Fig.* 42) is made of $\frac{1}{8}$ in. brass or steel rod. One end (A in *Fig.* 42) is turned down to a spigot which fits tightly into the insert. The central section B carries an external 9 B.A. thread which screws into the internal 9 B.A. thread of the stainless steel needles and so attaches the insert assembly to the needle. The section labelled C is unthreaded and enables a handle to be attached for transport and loading.

The handle (*Fig.* 43) is of aluminium tubing 20 cm. long with a brass cap attached to one end. This cap is split so that it is a spring fit over the outer end of the insert lock.

The sources used at the Queensland Radium Institute are radon seeds in 0·5 mm. or 0·3 mm. gold capillary tubing. These sources fit easily into the insert and are introduced by use of a special chuck (Eddy and Oddie, 1936) mounted behind suitable lead barriers.

For greater protection in the final loading and during sterilization, the inserts are mounted in a special lead block with steel tubes set into it vertically. One insert slides into each tube. The handle can be easily and rapidly fitted to the insert assembly for loading into the hollow needles.

Technique of Implantation.—The actual implantation by the afterloading method involves :—

1. The implantation of hollow steel needles through a perspex stabilizer (*Fig.* 43).

2. A verification X-ray film is then taken. With the use of the stabilizer the geometric pattern usually varies little from the pre-operation plan but an X-ray film enables the implant to be assessed in relation to anatomy. This is especially useful in training centres where the implant has been performed by a trainee under instruction. As no radio-active material has been used the operator is receiving no exposure and alterations in positions of the hollow needles can be made without hazard. If a re-arrangement of the implant is necessary, a change in the distribution of the radio-active sources within the inserts can be made before the next step is taken.

3. The hollow steel needles are then activated by means of the inserts, which with their handles attached, are mounted in the lead block. They are now introduced into the needles screwed up, and the handle removed. The average time taken to load one needle is 7 seconds, hence activation is only a very small fraction of the total time of implantation.

CASE REPORT

E. Mc., female, aged 64. Presented with invasive squamous-cell carcinoma of the urethra which surrounded the orifice and extended along the urethra almost as far as the internal meatus. Spread had also occurred anteriorly to involve the vulva, and posteriorly within the anterior vaginal wall.

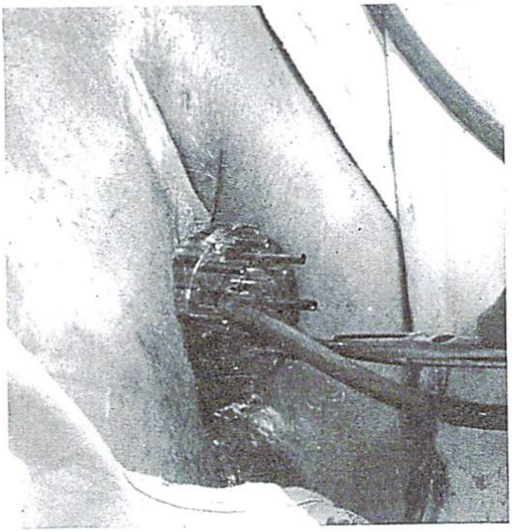

Fig. 44.—Implantation of stainless steel needles through the stabilizer.

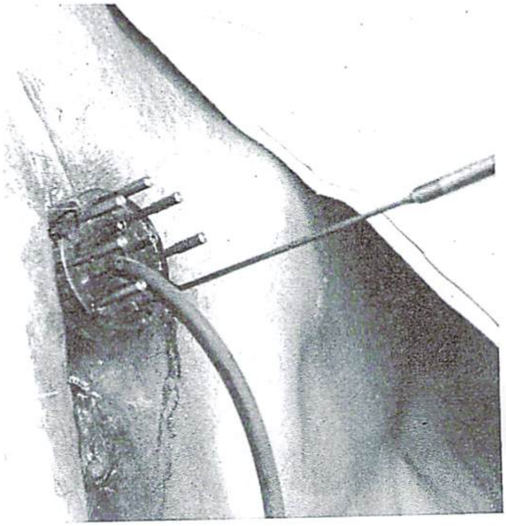

Fig. 46.—Loading the needles with prepared inserts.

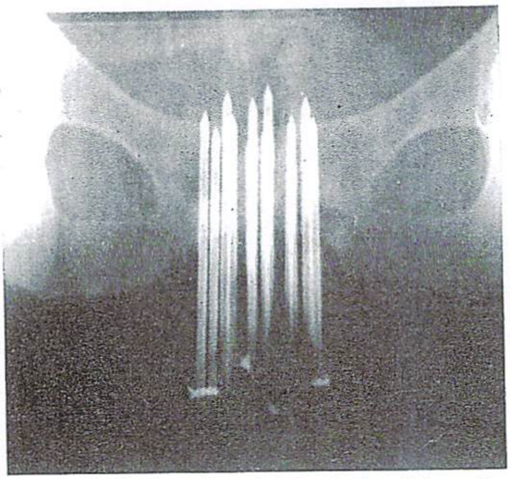

Fig. 45.—Verification radiograph before loading of the needles with inserts.

A stabilized implant was performed around this tumour area. Twelve needles were inserted, each 2·65 millicuries, of 6 cm. active length and 8·65 cm. overall length.

This was a cylindrical implant, needles with 'dumb-bell loading' being utilized, eight on the periphery and four in the core (*Fig.* 44). An overall volume dose of 5000 r was delivered in four days.

This procedure took twenty-five minutes to complete and the 'afterloading' was completed within ninety seconds.

A verification film was taken with a portable X-ray machine (*Fig.* 45). Thereafter the implant was activated (*Fig.* 46) and routine localization films taken.

SUMMARY

A simple method of carrying out implantation techniques without exposure to the radiotherapist is described. This removes the hazards previously associated with difficult implants or with those requiring many sources.

The method is of particular interest to those concerned with the training of radiotherapists.

A case is described in which the exposure time associated with an implant was reduced from twenty-five minutes to ninety seconds.

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