

USE OF A PORTABLE DENTAL X-RAY UNIT IN THE SURGICAL REMOVAL OF RENAL CALCULI*

*Doğan Remzi MD**, İlhan Erkan MD***, Haluk A. Özen MD*****

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Although the surgical treatment of renal calculi has improved dramatically in the last 15-20 years, the incidence of residual stones after surgical removal of staghorn or multiple renal calculi is still reported to be as high as 24 to 45%¹⁻⁴. Therefore, the need for intraoperative radiography is essential for complete removal of all the stone fragments. For this purpose various roentgenological techniques and films have been proposed⁵⁻⁸ and in this study we present a practical, simple, inexpensive intraoperative radiological technique using a portable dental X-ray unit.

Technique

We have used a Costruzioni Elettro Meccaniche Medicali portable dental X-ray unit which rotates at 10 milliamperes per second at 50 kV. The cost of this unit is about £1000. Cardboard (non-screen) films are used in this procedure.

Cardboard films measuring 30 × 40 centimeters are tapered to given sizes and closed tightly, by means of adhesive tapes, in a darkroom. (In some cases regular screen films were used in the cardboards instead of non-screen films, and similar results were obtained.)

Nylon bags used for covering both the unit and the films are sterilized in a gas autoclave. (These sterile bags are used to cover the distal end of the unit.) After the removal of all visible stones from the kidney by various surgical techniques, the film in the sterile nylon bag is placed behind the kidney by the surgeon.

Preliminary studies with this unit on cadaver kidneys revealed that it will give a 12 cm circle on the film if the cone of the unit is placed 7 cm from the kidney. At this distance the exposure is one second, and this is set on the timer by the technician. Usually the anesthesiologist will suspend respiration during the exposure.

Films are developed by hand in the darkroom of the operating theater.

* From the Department of Urology, Hacettepe University Faculty of Medicine, Ankara.

** Professor of Urology, Hacettepe University Faculty of Medicine.

*** Associate Professor of Urology, Hacettepe University Faculty of Medicine.

**** Lecturer in Urology, Hacettepe University Faculty of Medicine.

Discussion

Intraoperative radiography has been described previously as an aid in the localization of renal calculi as small as 1-2 millimeters in diameter⁸. In 1954 Carr introduced a method for the localization of intrarenal calculi during surgery. Later, Leusch and Baur used dental X-ray units for this purpose. Recently, technical progress in films for use in intraoperative stone surgery has further advanced intraoperative radiography. Proper positioning of the tube, kidney and films is extremely difficult with presently used portable X-ray units, and it usually lengthens the operation time significantly. Portable dental X-ray units have therefore gained wide acceptance, for these, being simpler and more flexible, have yielded more satisfactory results. These techniques, however, have certain disadvantages, for example multiple radiograms may be needed, and this naturally requires extra time. In order to obtain adequate intraoperative radiograms the kidney must be extensively dissected to be free from its adhesions. During mobilization, vascular and parenchymal traumatic lesions may occur due to the enormous tension applied to the renal pedicle⁸. Particularly in secondary cases, it is often impossible to carry out this much dissection and in these instances radiograms are insufficient.

Although most of the tiny stone fragments can be seen on intraoperative radiograms, since localization is in two dimensions only it is not always easy to localize the residual stones in the kidney¹².

Some recent innovations in this sphere such as intraoperative ultrasound and mobile image intensification fluoroscopy seem to be overcoming these problems¹³⁻¹⁵, but we still suggest that in developing countries like Turkey a portable dental X-ray unit with cardboard films is a suitable alternative.

Summary

The intraoperative use of a dental X-ray unit as an aid to complete removal of all stone fragments during surgical intervention for renal calculi is described.

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