

# Transrectal Ultrasound in the Follow-up of Patients with Prostatic Cancer

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Prostatic volume and echo pattern of the prostate were evaluated in 30 patients with prostatic cancer stage A-C prior to radiotherapy and up to 12 months following treatment. When compared with patients who underwent castration because of metastatic prostatic carcinoma, the volume reduction of the prostate was less pronounced. After only 1 month, a significant volume decrease was measured in both groups. After radiotherapy, a continuous concentration of echogenity resulted, whereas after orchiectomy, a discrete disintegration of the echoes was noted followed by increased echogenity.

**Key words:** transrectal ultrasound, prostatic cancer, radiotherapy, orchiectomy.

Transrectal ultrasound provides a simple and easily reproducible form of follow-up in patients after external radiotherapy or orchiectomy in patients with prostatic carcinoma.<sup>1-4</sup> The size of the prostate, the contour, the seminal vesicles, and the echo pattern within the prostate can be documented. In addition to rectal digital palpation, ultrasonography offers an exactly reproducible way of monitoring the results of radiotherapy and orchiectomy and discovering patients not responding to therapy or recurrent growth in an early stage of the disease.<sup>5-7</sup>

## MATERIALS AND METHODS

Transrectal ultrasound was performed with a 5-MHz Aloka scanner with the patient in a left lateral position with the legs slightly elevated. The ampulla recti should be empty and the bladder moderately filled. Transverse tomograms were recorded at 1 cm intervals beginning at the cephalad margin to the apex of the prostate. The B-mode echograms were photographed from the screen on Polaroid film, type 611, and the most prominent area of the prostate measured planimetrically. The total volume was calculated by adding all recorded volumes. Because the specific gravity of prostatic tissue is about 1.06 g/ml, the prostatic volume was equal to the prostatic weight.<sup>8</sup>

Prostatic scans were evaluated with respect to prostatic contour, density of echos, volume, and seminal vesicles. Prostatic volume and echogenity of the prostate were assessed in 30 patients with external Betatron radiotherapy, in 8 patients with castration before and after therapy without further medication, in 7 patients with DES (diethylstilbestrol), and in 12 patients with Estramustine medication after previous orchiectomy. Estramustine was given in a dose of 420 mg/day and DES (Honvan) of 360 mg/day starting immediately after orchiectomy. Transrectal ultrasound was performed before therapy, 1 month after therapy, and at 3-month intervals up to 1 year. The statistical method employed was the Wilcoxon rank sum test.

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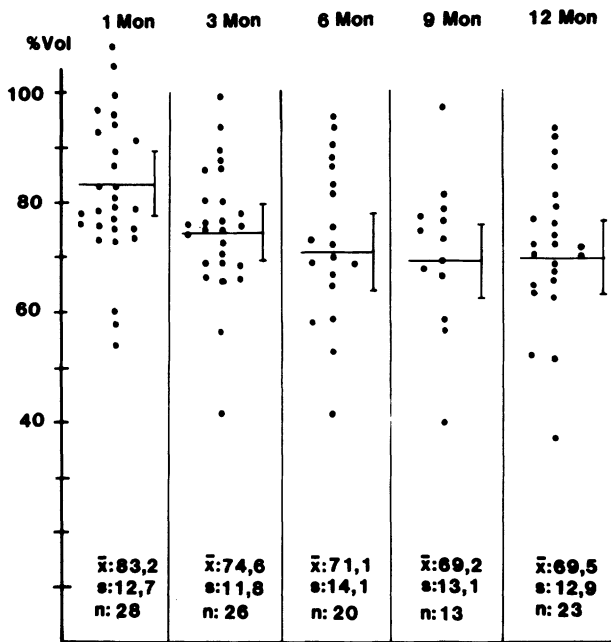


FIG. 1. Relative prostatic volumes following radiotherapy in percent of pretreatment volume (mean  $\pm$  standard deviation [SD]).

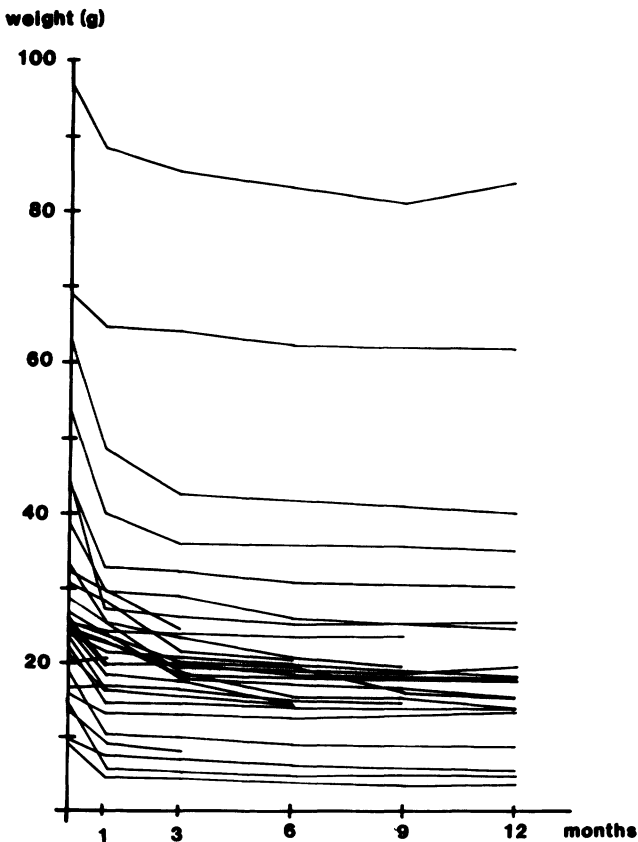


FIG. 2. Prostatic weight (g) after external radiotherapy (n = 30).

## RESULTS

Variability between prostatic volume measurements was 5%, also reported by other authors.<sup>9</sup>

### Radiotherapy

The volume, the outline, and the echos of the malignant prostate were evaluated prior to planning radiotherapy. All patients had a significant reduction in volume following irradiation. The most pronounced volume reduction was noted within the first month ( $P < 0.001$ ). Only two patients showed a slight increase of total prostate volume after 1 month (Figs. 1 and 2). Volume gradually decreased to about 75% of pretreatment size. An increase of echogenicity within the prostate was noted during the follow-up. Initially, increased echogenicity was noted dorsally with a gradual increase in the echogenicity in the entire prostate after some months.

### Orchiectomy

A marked volume reduction ( $P < 0.001$ ) was found following orchiectomy for prostatic cancer

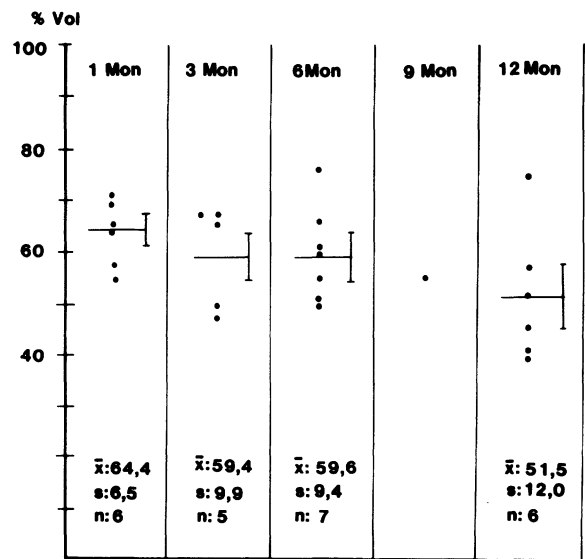


FIG. 3. Relative prostatic volume after orchiectomy in percent of pretreatment volume (mean + SD).

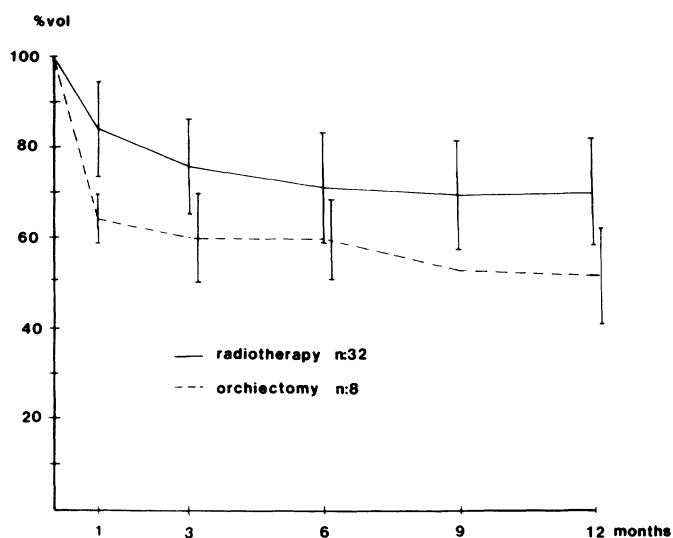


FIG. 4. Relative prostatic volumes after radiotherapy and orchiectomy in percent of pretreatment volume (mean + SD).

stage D. No increase in volume was noted throughout the entire study (Figs. 3 and 4). In the initial 3-month interval following surgery, discrete "disintegration" of echoes with an increase of low echogenic areas was found. Thereafter, concentration of echogenicity, similar to the radiation group, resulted; however, this was not as intensive as that following radiotherapy. All patients having undergone orchiectomy were in stable condition or remission at the time of follow-up.

### Orchiectomy and Additional Medical Therapy

DES or Estramustine-treated patients showed a pronounced volume reduction after orchiectomy within the first month, which was greater than in patients treated with orchiectomy alone ( $P < 0.05$ ). No difference could be found between DES or Estramustine-treated patients. Two patients with DES and four patients with Estramustine medication showed progression of their disease (progression of the metastatic lesions). The initial response in volume reduction of these patients, compared with patients in remission, was less. All patients still in remission after 1 year had a relative volume reduction of more than 30% of the pretreatment

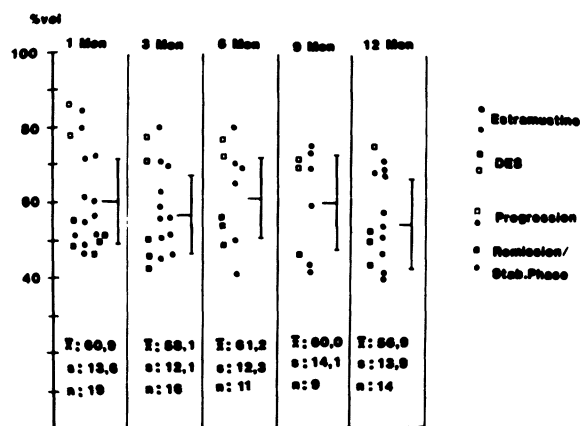


FIG. 5. Relative prostatic volumes after orchiectomy and medication. Patients in remission or with stable disease after 1 year had an initial volume decrease of more than 30% after 3 months.

prostatic volume after 3 months, whereas all patients who developed progressive disease later on had an initial relative volume reduction of less than 30% (Fig. 5). Only in two patients was an increase of bone metastasis associated with a local malignant enlargement of the prostate. The echo pattern of the prostate showed "disintegration" of the echogenicity after hormone treatment with a "mixed pattern" of high and low echogenic areas (Figs. 6 and 7).

No distinct echo pattern could be attributed to hormone treatment.

## DISCUSSION

After radiotherapy and orchiectomy, a volume reduction of the prostate was found. The most distinct decrease in size was noted 1 month after therapy. A more pronounced volume reduction was observed in the radiotherapy group ( $P < 0.001$ ) than in the group of patients having had orchiectomy (Fig. 5). An increase in echogenicity follows radiotherapy, whereas the response to castration therapy is at first a decrease of echogenicity within the prostate for approximately 3 months. A volume increase was recorded in two patients 1 month after radiotherapy as a sign of local inflammatory reaction with edema.

At the present time, a recurrent growth has been found in one patient 2 years after radiotherapy,

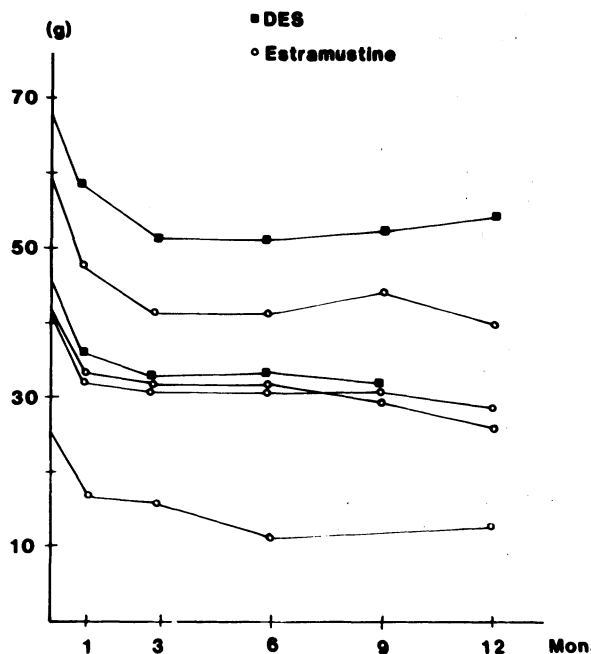


FIG. 6. Prostatic weight (g) in patients with progressive disease after orchiectomy. Relative volume reduction is less than 30% of pretreatment size.

which could be proven histologically. This patient subsequently underwent orchiectomy.<sup>7</sup>

After orchiectomy and medication, a local tumor enlargement was observed in four patients, and



FIG. 7. Prostatic carcinoma on the left side penetrating the capsule (T<sub>3</sub>). Low echogenic area indicating the prostatic tumor.

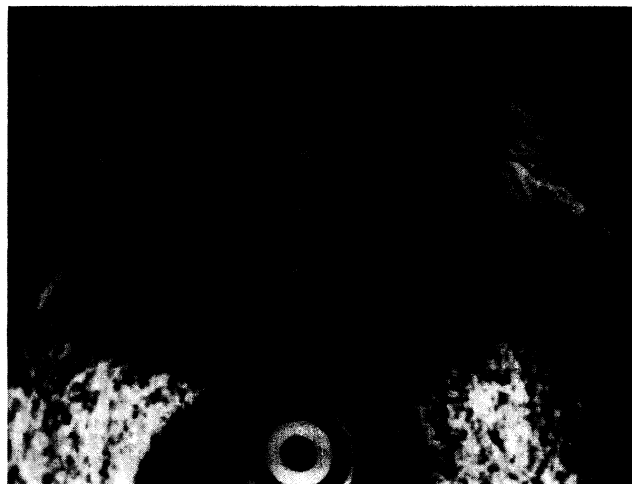


FIG. 8. The same prostate as in Figure 7, 3 months after orchiectomy and hormone treatment.

four other patients had an increase of bone metastases without prostatic tumor growth, indicating that metastasis is not correlated with the primary tumor enlargement. Therefore, two different pathogenetic mechanisms for tumor increase are suggested. Transrectal ultrasound provides an accurate technique for measuring prostatic volume and evaluating echogenicity before and after castration or radiotherapy. The volume reduction is a direct sign of a response to the therapy only in patients who underwent castration or castration and subsequent medication for the prostatic carcinoma. Pretreatment volume was not significant in the relative reduction of prostatic size, because benign tissue should react to hormone depletion equally well.

As yet, data on patients with progressive disease after orchiectomy and hormone treatment are limited. Initial response to therapy, measured as volume reduction of the whole prostate, seems crucial. All patients with a relative volume reduction greater than 30% after 3 months had remission of stable disease for 1 year, while less initial volume decrease was later followed by progression.

Thorough documentation of the ultrasonic examination on Polaroid films before and after radiotherapy allows a local recurrent growth to be revealed by comparison of the pictures. This proves to be helpful especially in patients after radiotherapy where interpretation of prostatic biopsies for 1 year after irradiation is often difficult.

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### Answers May/June SDMS-JDMS CME Test

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| 1. a. | 6. d  |
| 2. c  | 7. e  |
| 3. e  | 8. a  |
| 4. b  | 9. c  |
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