Transabdominal ultrasonography of the bladder as a staging examination for cervical carcinoma

E. T. M. de Jonge, S. Miskin

Objective. To determine the potential of transabdominal ultrasonography to demonstrate the presence or absence of bladder infiltration in patients with cervical carcinoma.

Design. A descriptive study.

Setting. The oncology unit in a tertiary medical centre serving a black rural and urban population.

Study population. 110 consecutive unstaged patients with histologically proven cervical carcinoma.

Main outcome measurements. The findings — designated normal, suspicious or infiltration — on ultrasonography and cystoscopy.

Results. Transabdominal bladder ultrasonography in this study had a sensitivity of 100%, a specificity of 76,5%, a positive predictive value of 60,4% and a negative predictive value of 100% compared with cystoscopy in the evaluation of the bladder for infiltration by cervical carcinoma.

Conclusion. Although not accepted as a staging procedure by the International Federation of Gynecology and Obstetrics, transabdominal bladder ultrasonography can be used as a triage for bladder infiltration by cervical carcinoma in a cost-effective way, referring only those patients with abnormal cystoscopic and biopsy findings.

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Carcinoma of the uterine cervix is the most common gynaecological malignancy in South Africa,[1] especially among the black population.[2] Most patients still present at a late stage of the disease,[3] which not only carries a poor prognosis[2] but also requires prolonged hospitalisation, which in turn depletes already limited financial resources.[4]

Oncology units in South Africa have to deal with a large turnover of patients — 2 824 new cervical carcinoma patients for 1991 (Cancer Registry of South Africa — unpublished data), and a lack of funds and manpower. These conditions have forced us to look for equally reliable but more cost-effective pre-treatment work-up protocols, in order to utilise the available resources most appropriately.

Departments of Obstetrics and Gynaecology and Diagnostic Radiology, Kalafong Hospital and University of Pretoria

E. T. M. de Jonge, M.B. CH.B., M.MED. (O.& G.)

S. Miskin, M.B. CH.B.

This trend is obvious in previously published work from other units in South Africa.[5,6] For example, Frohlich *et al.*[5] found that, compared with excretory urography, renal ultrasonography was a cost-effective and reliable screening test for ureteric obstruction in patients with cervical carcinoma.

Bladder involvement caused by local infiltration by cervical carcinoma has important therapeutic and prognostic implications. Evaluation of the bladder for infiltration is therefore an integral part of the clinical staging procedure. Cystoscopy, supported by cystoscopically directed biopsy, is the only investigation accepted by the International Federation of Gynecology and Obstetrics (FIGO) as the gold standard for the diagnosis of bladder infiltration.[7] Cystoscopy, however, is an invasive investigation which yields only a 7 - 14% positive rate depending on the population studied.[6,8] Du Toit[5] also found that waiting for the available theatre time necessary to perform a large number of cystoscopies, when no outpatient theatre facilities were available, caused a substantial delay in the pretreatment work-up of these patients — an average of 12,3 days in our unit (unpublished data). Ultrasonography of the bladder, on the other hand, has been shown to be an accurate investigation for the evaluation of primary bladder neoplasms.[9] It was therefore decided to compare bladder ultrasonography with cystoscopy for the detection of bladder infiltration in patients with cervical carcinoma. It was hoped that if ultrasonography of the bladder were shown to be a useful technique, delays in the pretreatment work-up could be avoided.

Material and methods

Between November 1991 and June 1992 all new patients with histologically proven cervical carcinoma admitted to the Oncology Department of Kalafong Hospital, a referral centre serving a mixed rural and urban black population, were included in the study. A total of 110 patients underwent cystoscopy and bladder ultrasonography after informed consent was obtained. Both examinations were performed by independent investigators unaware of each other's findings. The cystoscopy was performed in theatre by a urologist, while the ultrasound examination was done by the ultrasonographer (S.M.). The transabdominal approach employed used the Acuson 218 ultrasound apparatus with a 3,5 MHz sector scanning probe. The technique required a full bladder in order to visualise the posterior bladder wall, which was then examined by transverse and coronal sections. A normal posterior bladder wall shows up as a smooth echo-dense lining about 3 mm thick (Fig. 1). Bladder infiltration is seen as a nodular irregularity (Fig. 2). All the patients were clinically staged by one of the authors (E. de J.), whereafter the results of the ultrasonography were disregarded.

Fig. 1. Normal posterior bladder wall: coronal section of the cervix (c) and the bladder (b).

The results of the bladder ultrasonography and cystoscopy were then compared in order to find out the potential of each of these techniques to diagnose bladder infiltration. Bladder infiltration has to be proven histologically if the cystoscopy indicates infiltration. To conform with these requirements, laid down by FIGO, cystoscopically directed biopsy was regarded as the gold standard against which to compare bladder ultrasonography. However, in cases of a negative cystoscopy, ultrasonography was compared with

Fig. 2. Bladder infiltration (i) seen on a coronal section of the cervix (c) and the bladder (b).

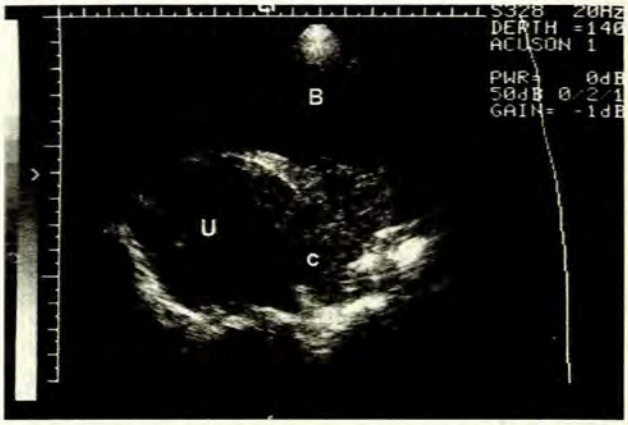

Fig. 3. False-positive bladder ultrasound scan. In this case, both ultrasound examination and cystoscopy suggested bladder infiltration; biopsy showed cystitis cystica.

cystoscopy unsupported by biopsy. In the analysis it was taken for granted that the biopsy, although not taken, was negative. A potential criticism of this study is that the normal cystoscopies were not verified by a biopsy.

Results

The clinical staging of the 110 patients was as follows: stage I — 5 (4,5%); stage II — 39 (35,5%); stage III — 37 (33,6%); stage IV — 29 (26,4%). In 4 of the 110 cases, ultrasonography failed to show the posterior bladder wall. In all these cases the bladder did not fill because of a malignant vesicovaginal fistula. A sonographically empty bladder after intravesical saline infusion per Foley catheter thus indirectly diagnosed all these patients. Table I shows the results of the bladder ultrasonography compared with cystoscopy and biopsy. Of the 110 ultrasounds, 62 were reported to be negative for infiltration, 7 suspicious and 41 positive. None of the 62 negative reports was shown to be falsely negative on cystoscopy. Of the 41 positive reports, 29 were true positives and 12 were false positives. The latter included 6 cases in which the cystoscopy was negative and another 6 where the cystoscopy also showed a picture consistent with bladder infiltration; the biopsy, however, was negative for carcinoma (2 biopsies truly negative, 3 biopsies with cystitis and 1 with bilharziasis). An interesting example is shown in Fig. 3, where both the ultrasonography and the cystoscopy indicated bladder infiltration, but the biopsy showed cystitis cystica.

Table I. Comparison between ultrasonography and cystoscopically directed biopsy

		Bladder ultrasonography		
		Negative	Positive	Total
Cystoscopy + biopsy	Negative	62	19	81
	Positive	0	29	29
Total		62	48	

Sensitivity — 29/29 + 0 = 100%; specificity — 62/62 + 19 = 76,5%; positive predictive value — 29/29 +19 = 60,4%; negative predictive value — 62/62 + 0 = 100%; prevalence of bladder infiltration in this study — 26,4%.

To put the value of cystoscopy as a staging examination in perspective, we found that in 9 cases where the cystoscopy indicated bladder infiltration, the biopsy was negative; in 5 of these cases the bladder ultrasonography was also negative, while in the remaining 4 cases ultrasonography suggested infiltration. Of the 7 patients whose bladder ultrasound scans were reported to be suspicious, 5 were normal on cystoscopy and 2 with a negative biopsy were cystoscopically reported to have bullous oedema. These were classed in the analysis as false positives. In a triage set-up, one would approach a suspicious ultrasound finding in a similar way to positive ultrasonography.

Discussion

Ultrasound staging of cervical carcinoma has been studied extensively, especially with regard to parametrial invasion and tumour volume quantification.[10-13] However, only a few studies have specifically investigated the role of ultrasonography in the diagnosis of bladder infiltration by cervical carcinoma using the transurethral,[10,14] the transrectal[15,16] or a combination of techniques.[11,13,17] In most of the studies dealing with ultrasound staging of cervical carcinoma in which reference is made to bladder infiltration, the study sample was very small or the prevalence of bladder infiltration, if any, was low.[11,13-18]

This is the first study on the use of transabdominal ultrasonography in the evaluation of bladder infiltration by cervical carcinoma in a population with a significant incidence of bladder infiltration (26,4%). Because of its high sensitivity and good negative predictive value, transabdominal ultrasonography proved to be a useful triage method for the evaluation of the bladder for infiltration by cervical carcinoma.

The ultrasound examination is non-invasive and takes 3 - 5 minutes to complete. Transvaginal ultrasonography, as opposed to the transabdominal technique, requires a full bladder to evaluate the posterior bladder wall in the region of the trigone. In a population with a high incidence of stage IV disease, this could in fact be seen as an advantage, as all cases of malignant vesicovaginal fistulas were detected

because of the bladder's failure to fill up. A smooth posterior bladder wall can safely be accepted as indicative of an absence of bladder infiltration. In these cases our findings suggest that cystoscopy is unnecessary. The fact that all 7 patients with ultrasound examinations suspicious of infiltration showed no infiltration on cystoscopy underlines the poor positive predictive value of bladder ultrasonography. If ultrasonography is implemented as a triage for bladder infiltration in patients with cervical carcinoma, and only those with a sonar finding suspicious of infiltration are referred for cystoscopy (and biopsy), it would result in a decrease of 60% in the number of cytoscopies performed in this hospital without any decrease in diagnostic accuracy.

A cost analysis has indicated that this triage is more economical: the total cost of an intravenous pyelogram and cystoscopic examination, including theatre time, is R308,10 per patient; the total cost of a renal and bladder ultrasound examination, including cost involved in confirming a positive finding, is R259,90 per patient. In an ideal setting, where an intravenous pyelogram and cystoscopic examination can be completed within 48 hours or less, this still represents a saving of 15,6% per patient on staging costs. However, as we mentioned earlier, in Third-World centres where pre-treatment work-up by intravenous pyelogram and cystoscopy can be substantially delayed by a lack of theatre facilities and staff, staging by ultrasound could save up to 40%.

Transvaginal ultrasonography has been found to be superior to transabdominal ultrasonography in the visualisation of pelvic pathology.[19] The posterior bladder wall can easily be inspected by the transvaginal route[20] in the absence of gross vaginal pathology. However, the value of transvaginal ultrasound to detect posterior bladder wall infiltration has not been conclusively investigated yet. It is not unrealistic to say that large exophytic cervical tumours, which bleed easily on contact, might even contraindicate the transvaginal approach. It is interesting that the only case of stage IV disease in a series of 37 patients was missed by a combination of transvaginal and transrectal ultrasonography.[11]

Although it is encouraging that transabdominal ultrasonography in this set-up proved to have a good sensitivity, specificity still remains the most important aspect of this study. Improved specificity is important to avoid inappropriate palliative treatment in patients in whom radical treatment is indicated. A more favourable concomitant positive predictive value could bring down the number of patients who need cystoscopy to verify an ultrasonographic finding of infiltration. This would add to the cost-effectiveness of bladder ultrasonography. Whether these goals can be achieved by transvaginal ultrasonography remains to be established.

Based on the findings of this study, we advocate the use of ultrasonography of the bladder as a screening test for bladder infiltration by cervical carcinoma, and that only those patients with abnormal cystoscopic and biopsy findings be referred. There is no doubt in our minds that the use of ultrasound as a triage method for both ureteric obstruction[5] and bladder wall infiltration in patients with cervical carcinoma is more cost-effective, more reliable and less time-consuming than excretory urography and cystoscopy. This approach is highly appropriate for a Third-World environment where advanced disease is prevalent and available hospital beds and resources are limited.

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