COMPUTERIZED AXIAL TOMOGRAPHY IN NEOPLASTIC PATHOLOGY OF THE FEMALE PELVIS

G. DAL POZZO (*), G. NORI BUFALINI (*), R. DE DOMINICIS (**), A. BOZZA (**), G. B. MASSI (***), F. GASPARRI (***)

(*) S. Maria Nuova Hospital, Florence

(**) Institute of Radiology, University of Florence

(***) Department of Gyn. and Obst., University of Florence

SUMMARY

The Computerized Axial Tomography (CAT) is a new method of radiologic investigation which is an important contribution to the staging of malignant tumors of the female genital organs and the differential diagnosis of expansive processes of the pelvis. The results obtained from the evaluation of neoplastic relapse and formulation of radiotherapic treatment plans show the undeniable need for this method.

A good and reliable diagnostic exam of primary neoplastic disease found in the internal genital organs of the female can be had in most cases by an accurate gynecologic examination followed by simple instrument insertion (colposcopy, cystoscopy) completed by an echography and traditional radiologic exams (urography, barium enema). A more detailed evaluation can be obtained by a more involved contrast medium exams such as the lymphography, arteriography and phlebography. As reliable as they may be however, there still exist limits in each one of these methods which make it difficult to judge the real extent of neoplastic disease in the organ, above all when we wish to examine metastatic diffusion to both the pelvic and para-aortic lymphatic regions. An even larger difficulty encountered is that of evaluating relapse of neoplasia after both surgery and radiotherapy.

For these reasons our Center and many others began using systematic application of the Computerized Axial Tomography (CAT) in assessing gynecologic neoplasias especially since the pelvis particularly lends itself to a tomodensitometric study.

The constant presence of fatty tissues, even in thin patients, makes for optimal definition of pelvic outlines and the organs contained therein. These organs have almost unchanging topographic locations and therefore can be easily seen by opacification. Finally, a definite advantage from a technological point of view is the total independence of these structures from respiratory movements. This means that no artefacts are produced and it is possible to use a slow scan with consequent densitometric analysis being more accurate than that of other abdominal areas.

In our research we preferred to use slow scans (22 sec.) employing an E.M.I. C.T. 5005 Total Body *.

* The Authors would like to thank the Istituto Prosperius of Florence for the use of their equipment.

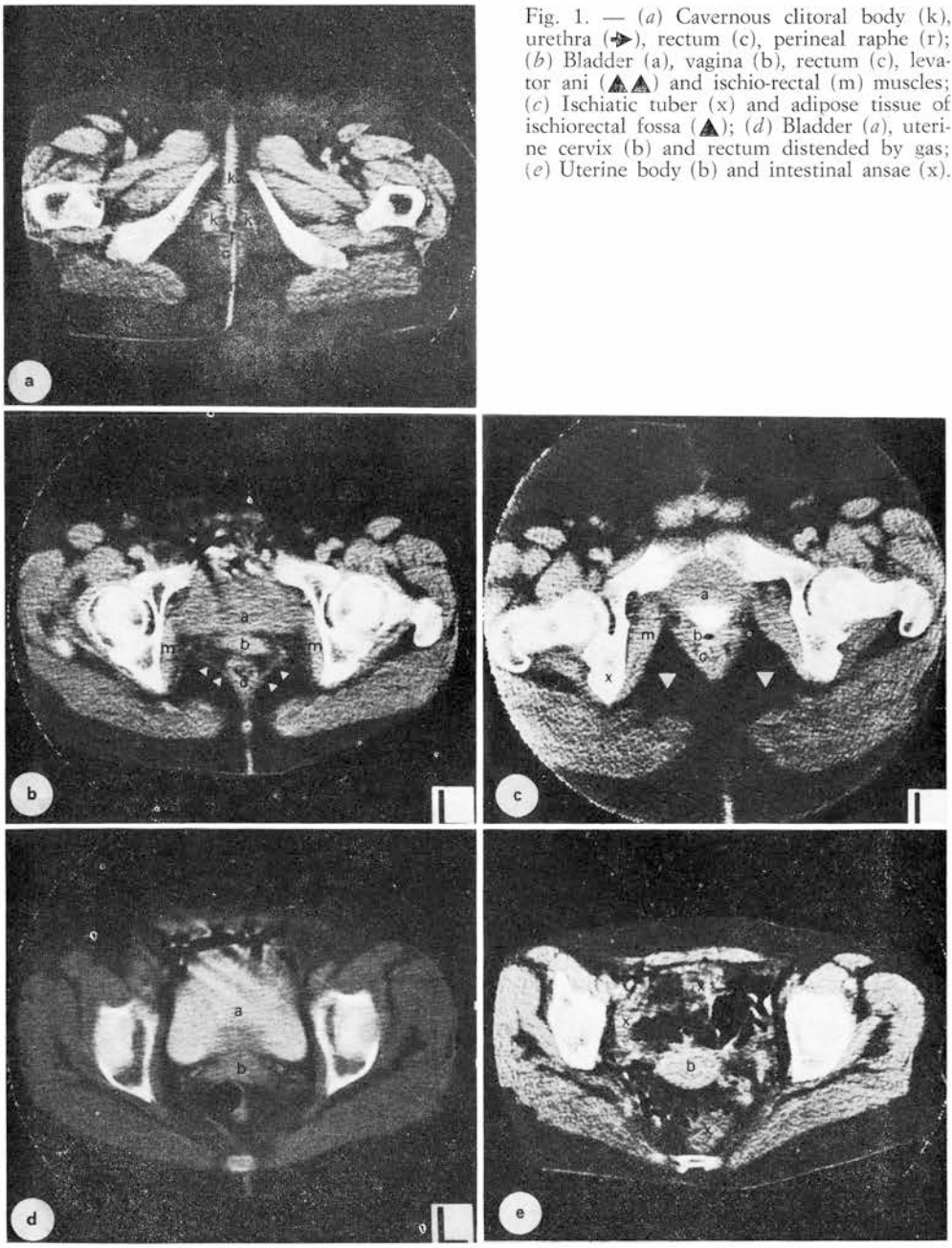

Fig. 1. — (*a*) Cavernous clitoral body (k), urethra (➔), rectum (c), perineal raphe (r); (*b*) Bladder (a), vagina (b), rectum (c), levator ani (▲▲) and ischio-rectal (m) muscles; (*c*) Ischiatic tuber (x) and adipose tissue of ischiorectal fossa (▲); (*d*) Bladder (*a*), uterine cervix (b) and rectum distended by gas; (*e*) Uterine body (b) and intestinal ansae (x).

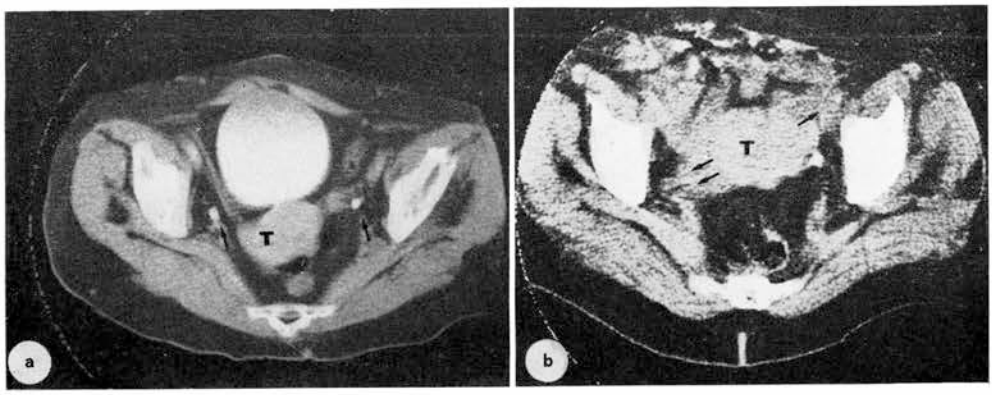

Fig. 2. — (*a*) Uterine fibromioma (T): uterine neoformation with precise outlines. - (*b*) Cervical carcinoma (T): neoplasia extension to the lateral wall (→) adenopathy of right hypograstic lymphonodes (⇉).

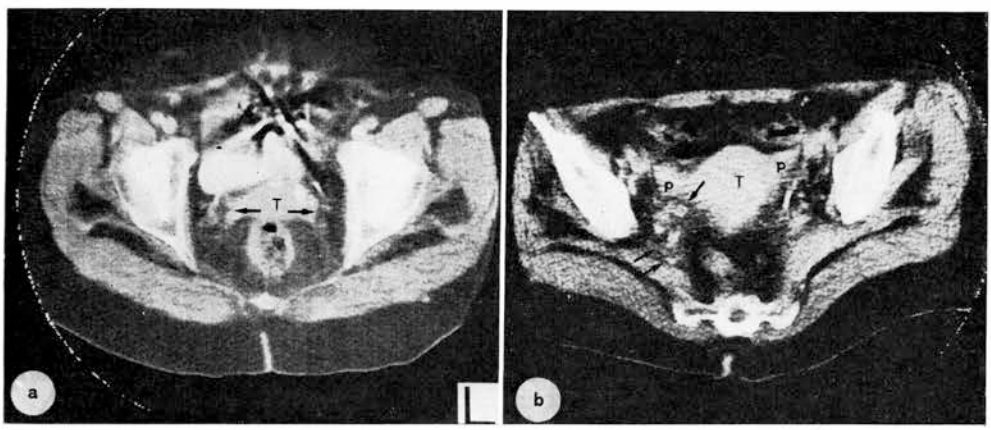

Fig. 3. — (*a*) Cervical carcinoma (T) with parametrial infiltration (→). - (*b*) Cervical carcinoma (T) with parametrial infiltration (p) and right hypograstric and presacral lymphonode metastasis (⇉).

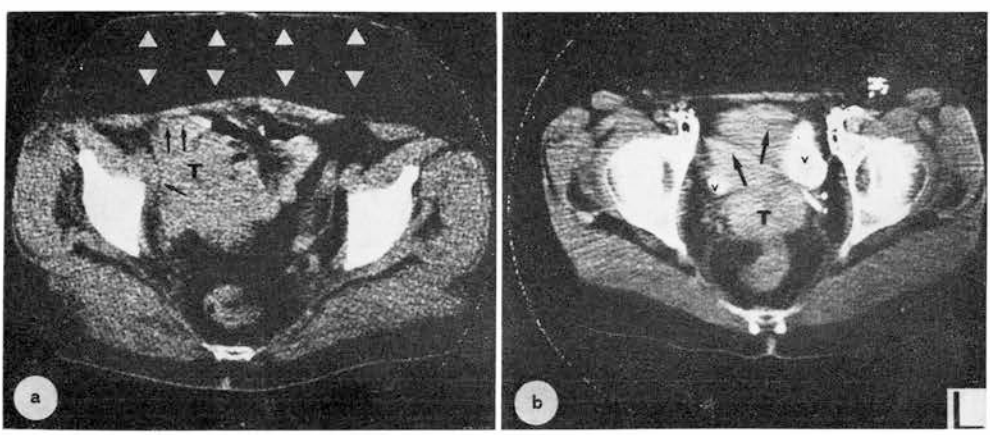

Fig. 4. — (*a-b*) Cervical carcinoma (T) extended to the lateral pelvic wall (→) and along the bladder to the abdominal wall (⇉) in a very obese patient (▲▲).

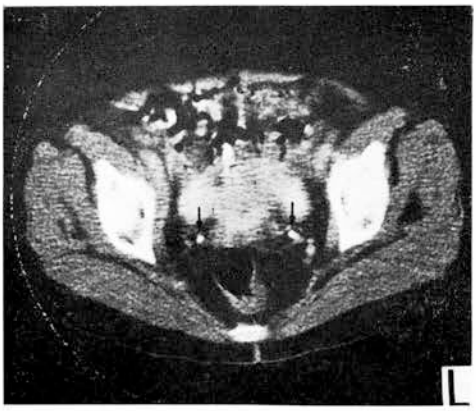

Fig. 5. — (*a-b*) Opacification of the ureters by the contrast medium in the intraparametrial tract (→).

In the days preceding investigation the patients received adequate care in order to ensure proper cleansing of the intestine. One hour before the beginning of the exam they were orally administered 400 ml of 3% Gastrografin solution in order to produce opacification of the intestinal ansae and keep false interpretations to a minimum. Immediately before the beginning of the scan an i.v. hydrosoluble dose of contrast medium was administered with the purpose of obtaining opacification of the bladder und ureters, especially in the parametrial tract. In some cases introduction of the contrast medium into the rectum and by a thin catheter into the uterus was required. All of the exams were carried out with transverse and adjoining 13 mm sections, starting from the lower contour of the pubic symphisis up to the height of the first sacral metamere. Other scans, 2 inches apart from each other, were done at the level of the lombo-aortic lymphatic regions in order to specify eventual metastasis in this area and also to obtain a standard in order to have a comparison for future control exams.

Exploratory scans were done at the level of the liver for those neoplasias with elevated frequence of blood carried metastases.

It is obvious that analysis of tomographic images and subsequent identification of pathologic disorders requires a good knowledge of the pelvic region's topographical anatomy according to each axial section. We therefore thought it oppor-

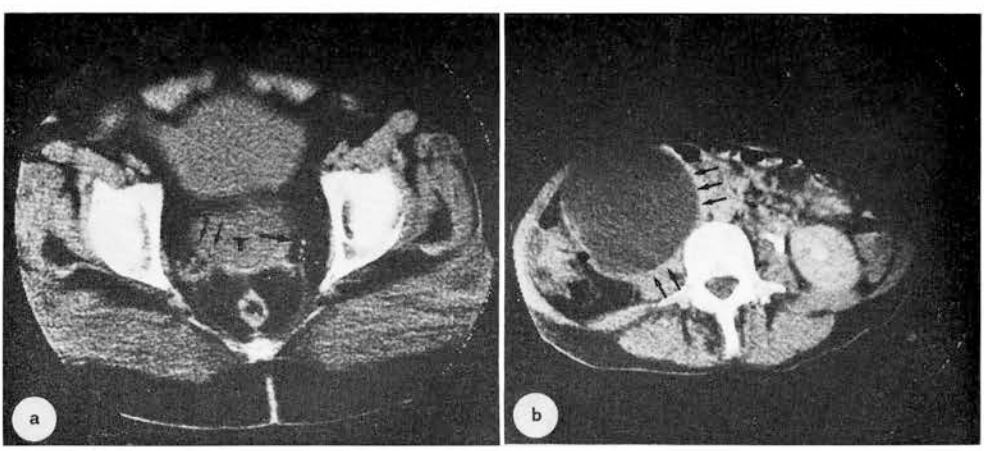

Fig 6. — (*a*) Cervical carcinoma (T) with extension into the right side of the pelvis and ureter infiltration on this side (⇉). - (*b*) Marked hydronephrosis of the renal cavity (⇉). The urinary tract of the left side is normal.

tune to present several normal transverse sections taken at various levels in the female pelvis.

In the lowest section, carried out at the level of the ischiopubic branch, we are able to distinguish the cavernous bodies of the clitoris, ureter, vagina and rectum (fig. 1 a).

In the next layer done at the level of the pubic symphisis (fig. 1 b) we see the bladder trigone in front, the vagina and the rectum centrally located and the levator ani muscles of the anus and ischio cavernous muscles immersed in the fatty tissue of the ischiorectal fossa.

Continuing on with the scan we observe the bladder, vaginal and rectal ampulla and also well defined are the internal obturating muscles stretched between the ischiotuberosity and pubis.

In the following layer (fig. 1 d) there appear the uterine cervix and parametrial structures found between the bladder and rectal ampulla.

Finally in the highest section (fig. 1 e) we see the uterine body surrounded by fatty tissue and intestinal ansae.

If the ovaries have normal dimensions they are difficult to locate.

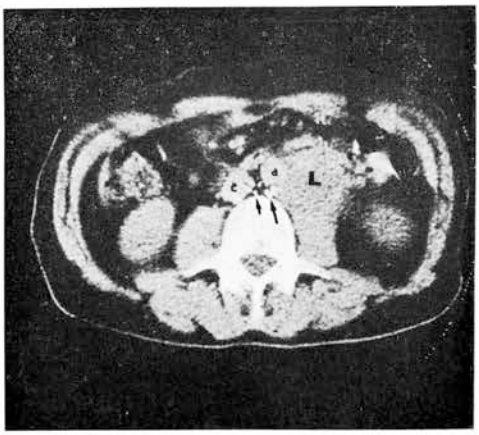

Fig. 7. — Lymphonode tumor invasion (L) of the left lombo-aortic regions not seen with the lymphography. Small opaque lymph nodes were seen behind the aorta (a) and vena cava (c).

Obviously the CAT does not have a single advantage over the more traditional exams when we are dealing with diagnosis of a primary neoplasia (stages I and II a) of the uterus, that is when the tumor is still confined within the organ or has spread little to the adjoining structures. In fact, tumors of small dimensions which are limited to the cervix or uterine body are seen with the CAT only in exceptional

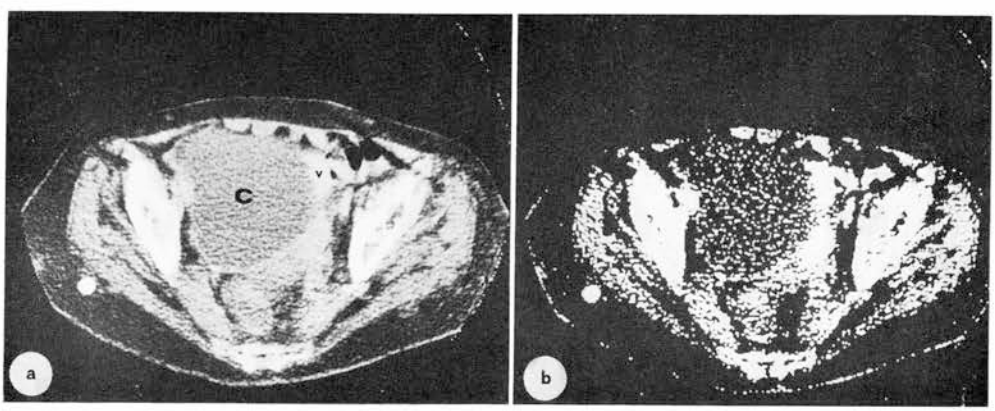

Fig. 8. — (*a*) Ovarian cyst (C): large neoplasm with thin walls in the pelvis which presses on the bladder (v). - (*b*) The densitometric values of the lesion are the same as that of water.

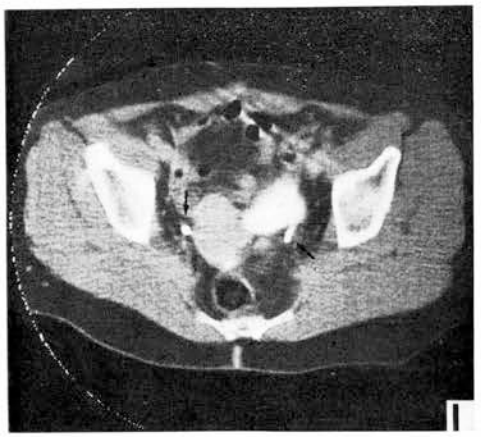

Fig. 9. — Recurrence (R) of cervical carcinoma, in the site of the primary tumor, two years after surgical operation. Note the relationships between the lesion and the ureters (→) and bladder.

cases, while more voluminous forms are distinguished in proportion to the enlargement and deformation of the organ.

In benign forms the outlines of the mass are more or less bumpy but always very clear, whereas in the malignant forms there is no clean separation between the organ and surrounding structures (fig 2b).

Nevertheless, we can say that the CAT is indispensable and of utmost diagnostic importance in both the advanced forms of the disease (stages IIb and III) where one can obtain greater diagnostic precision, and in those cases where there is uncertain evaluation at the time of the gynecologic exam or where for various reasons (obesity or previous operations) clinical exploration can not be carried out without difficulty.

The large advantage of the CAT is that it directly identifies a neoplasia and it's real extension (fig. 3a-b, 4a-b).

Immediately after i.v. contrast medium infusion, we are able to see with the CAT the complete course of the ureters, including the intraparametrial tract: the axial secions which are peculiar to this method particularly allow for study of the relations between the neoformation and the ureter itself (fig. 5). We can obtain useful data on tumoral invasion of the ureter, even in the cases of non-functioning kidney at the urographic examination, since it is possible to directly identify the hydronephrotic renal cavity (fig. 6b) and sometimes even the ureter if it is distended by urine.

Moreover, the CAT is able to demon-

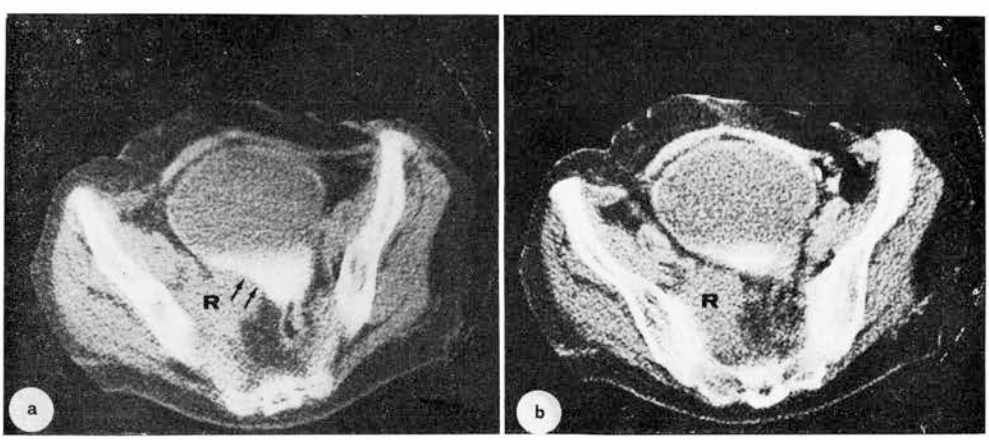

Fig. 10. — (*a*) Recurrence (R) of cervical cancer in the right presacral lymphonodes. Note deformation of bladder wall (⇉). (*b*) The same case in a higher secretion.

strate neoplastic dissemination into the lymph node satellites both at the level of the pelvis and para-aorta (fig. 7) even if the value of this method is obviously limited to those cases in which the neoplastic disease have produced a volume increase in the lymph glands.

In cases of ovarian tumor, where diagnosis is performed in order to determine malignant or benign status, the same considerations as above are used. Identifying micro-calcifications in ovarian neoplasms which are otherwise non-distinguishable with radiologic methods is a semiologically important factor in diagnosing malignant neoplasia.

The CAT, like the echography, can distinguish solid and cystic tumors on the basis of unmistakable densitometric characteristics (fig. 8a-b). It is clear, however, that the echography is preferable to the CAT in these cases since it is less costly and offers more protection, thus being a safer form of diagnosis.

The CAT assumes a fundamental role, according to our experience and that of other Centers, in the study of neoplastic relapse after surgical operation and above all after radiotherapy. In fact, it is well known that traditional gynecologic exams

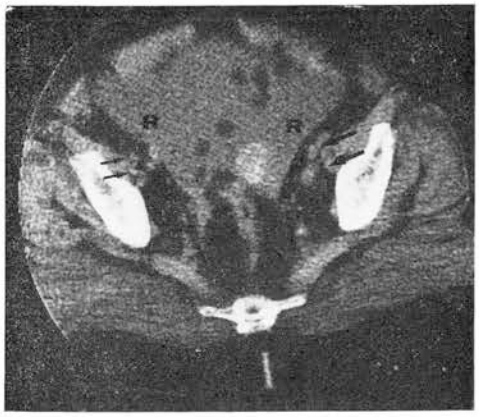

Fig. 11. — Recurrence of neoplasia in the omentum (R): tent-like neoplastic infiltration, 2 years after surgical operation. Note also enlargement of the iliac lymphonodes (⇉).

and other commonly used diagnostic methods have difficulty in distinguishing between recurrence and results of surgery or radiologic treatment. Indeed, particularly in these last situations, difficulties become much greater in identifying fibrotic phenomenons that sometimes are so intense and irregualr that they simulate resumption of neoplastic infiltration.

With the tomodensitometric exam tumor recurrence is distinguishable as solid

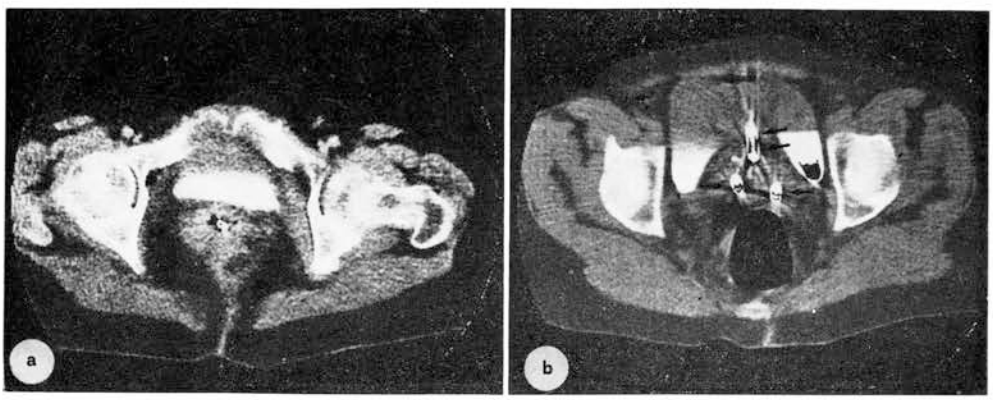

Fig. 12. — (*a-b*) Correct position of the utero-vaginal applicator (→) in endocavital radiotherapy. Note relationships between the bladder and radium source.

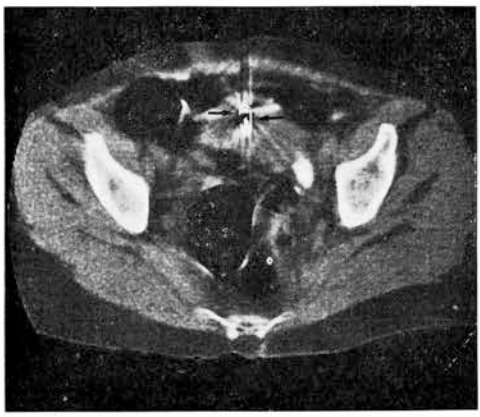

Fig. 13. — Too anterior position of radium source after introduction of the utero-vaginal applicator.

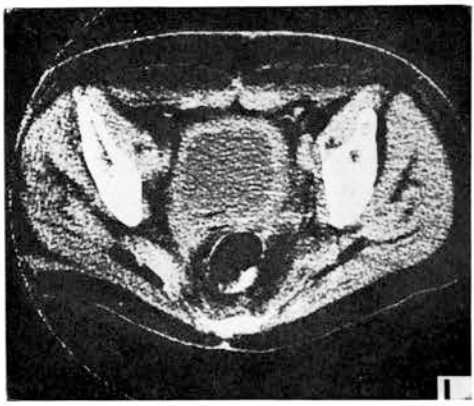

Fig. 15. — C.A.T. control in a patient with neoplastic presacral recurrence of the cervical carcinoma (same case as reported in fig. 10), 1 month after the end of radiation treatment.

masses of variable dimensions with rather elevated density, somewhat clear outlines, often with necrotic zones, which are usually found at the site of the primary neoplasia (fig. 9) or at the level of the drainage lymphonodes (fig. 10b). With the CAT it is also possible to document neoplastic infiltration of the omentum. In this case a tentlike image appears which stretches over the bladder along the abdominal wall (fig. 11).

The CAT fulfils the requirements for a correct plan of treatment by permitting us to evaluate the degree of radiation absorption in both healthy and critical tumor structures on the basis of densitometric measures and reconstruction of the image according to transverse planes. This is valid for both percutaneous and endocavital radiation treatments (figs. 12a-b) in which it is particularly important to establish and keep in consideration the immediate movement of the various organs after intro-

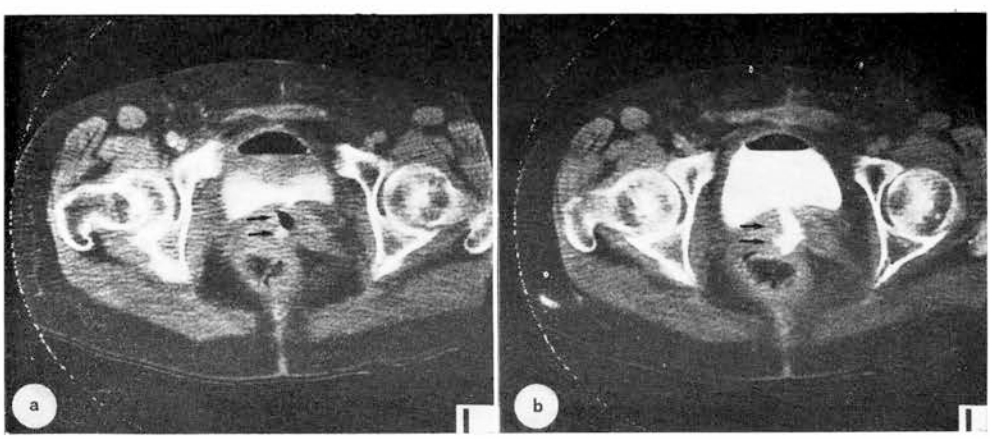

Fig. 14. — Vescical-vagino-rectal fistula (*a*) containing air (⇉) and contrast medium from the bladder (*b*).

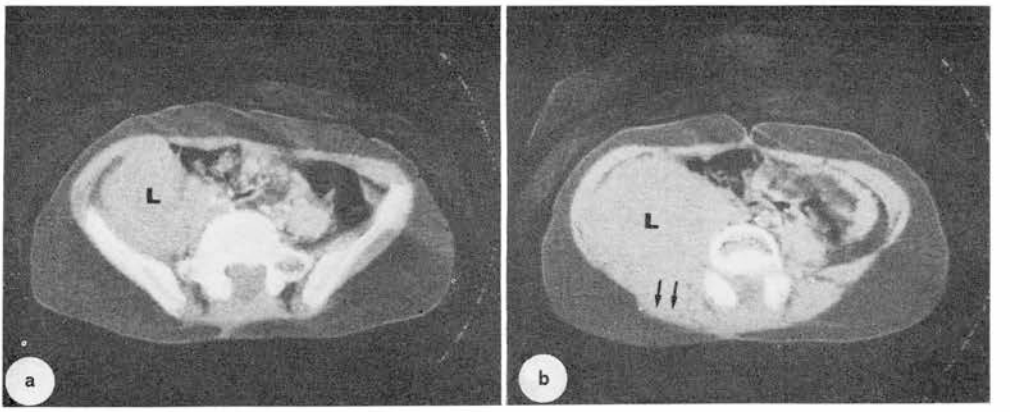

Fig. 16. — Pelvic reticulum cell carcinoma: (*a*) large lymph node neoplasia in the iliac and presacral regions which reaches the inferior lombo-aortic regions (*b*). - Note involvement of the right lombar muscles (⇉).

duction of the applicator (fig. 13). With this evaluation we can precisely calculate the dose to the tumor and critical organs thereby obtaining a more efficacious treatment and minimizing radiation damage (fig. 14a-b).

The simplicity of the execution of the tomodensitometric exam and the important elements which it provides makes the CAT particularly ideal for continued follow-up of patients with neoplasia (fig. 15).

Finally, the capacity of the CAT in interpreting pelvic masses, at times defining the nature of the expansion process and other times at least the area of origin, is equal if not superior to the echography (fig. 16a-b).

BIBLIOGRAPHY

1) Lee J. K. T., Stanley R. J., Sagel S. S., McClennan B. L.: *Am. J. Roentgenol, 131,* 675, 1978.
2) Levitt R. G., Sagel S. S., Stanley R. J.: *Am. J. Roentgenol., 131,* 835, 1978.
3) Redman H. C.: *C.A.T. in the Pelvis.* The First European Seminar on C.A.T. in Clinical practice, London, 1978.
4) Rohde U., Brett A.: *La Tomografia Computerizzata in Ginecologia.* Comunicazione al 2° Convegno di Tomografia Computerizzata, Firenze, 19-20 maggio 1978.