Prospective Comparison between Clinical and CT Staging in Primary Cervical Carcinoma

James W. Walsh[1]
Dean R. Goplerud[2]

For 32 months, clinical and computed tomographic (CT) staging were compared prospectively in 75 patients with primary untreated cervix carcinoma. Clinical stages evaluated were IA (one patient), IB (nine) IIA (five), IIB (18), IIIB (38), IVA (one), and IVB (three). CT agreed with clinical stage in 65%, upstaged tumors in 19%, and downstaged tumors in 16%. In comparison with surgical stage in 25 patients, CT was inaccurate in differentiating IB from IIB lesions but highly accurate in diagnosing IIIB, IVA, and IVB tumors. Pretreatment CT was most valuable in assessing parametrial and sidewall tumor extension, uterine size, endometrial tumor extension, pelvic adenopathy, and adnexal masses. Posttreatment CT in 15 patients was most valuable in assessing extrapelvic metastases to liver, paraaortic lymph nodes, and bowel mesentery. CT offers distinct advantages over current radiologic staging techniques and can be integrated into the present International Federation of Gynecology and Obstetrics classification of cervix carcinoma.

Current staging of cervix carcinoma is based on clinical and limited radiologic assessment of disease extent. Routine pretreatment evaluation usually consists of physical examination, chest radiography, cystoscopy, excretory urography, sigmoidoscopy, and barium enema study. However, many studies have demonstrated an error of 34%–39% in comparing clinical with surgical stage [1–4]. Moreover, current staging techniques do not determine tumor volume or assess lymph node metastases.

Several reports have evaluated the use of computed tomography (CT) in a small number of patients with cervix carcinoma [5–8]. However, no studies have compared CT with accepted clinical staging methods. We report a prospective comparison between clinical and CT staging in 75 cases of primary untreated cervix carcinoma.

Subjects and Methods

During a 32 month period, 77 selected patients with primary untreated cervix carcinoma were prospectively evaluated with CT. Histologic diagnosis of cervix carcinoma was established by cervical biopsy, vaginal biopsy, or dilatation and curettage. Routine clinical staging workup included physical examination, chest radiography, cystoscopy, excretory urography, sigmoidoscopy, and barium enema study. In selected patients, data from pelvic examination under anesthesia or biopsy of supraclavicular lymph nodes, inguinal lymph nodes, or bladder were used to determine clinical stage. Clinical stage was based on the International Federation of Gynecology and Obstetrics (FIGO) staging classification, and CT staging criteria were developed from the FIGO classification (table 1). CT stage was diagnosed from objective CT findings without knowledge of clinical stage or pelvic examination. Two patients were excluded from discussion because of insufficient pelvic fat for CT analysis.

The patients were 30–90 years old (average age, 56 years). Clinical stages were IA (one patient), IB (nine), IIA (five), IIB (18), IIIB (38), IVA (one), and IVB (three). Histologic diagnoses were squamous carcinoma (67 patients), adenocarcinoma (six), and mixed

Received March 12, 1981; accepted after revision August 4, 1981.

Presented at the annual meeting of the American Roentgen Ray Society, San Francisco, CA, March 1981.

J. W. Walsh is a junior faculty clinical fellow, American Cancer Society.

[1]Department of Diagnostic Radiology, Virginia Commonwealth University/Medical College of Virginia, Box 615 MCV Station, Richmond, VA 23298. Address reprint requests to J. W. Walsh.

[2]Department of Obstetrics and Gynecology, Division of Gynecologic Oncology, Virginia Commonwealth University/Medical College of Virginia, Richmond, VA 23298.

AJR 137:997–1003, November 1981
0361–803X/81/1375–0997 $00.00

TABLE 1: **International Federation of Gynecology and Obstetrics (FIGO) Classification and CT Criteria in Staging Cervix Carcinoma**

Stage	FIGO Classification	CT Criteria
0	In situ	. . .
I	Confined to cervix	Tumor confined to cervix
IA	Microinvasive	. . .
IB	All other cases of stage I	. . .
II	Extends beyond cervix but not to pelvic sidewall or lower third of vagina	. . .
IIA	No obvious parametrial involvement	. . .
IIB	Obvious parametrial involvement	Irregular cervix borders; parametrial mass; separation of mass and sidewall by pelvic fat
III	Extends to pelvic sidewall or lower third of vagina, or ureteral obstruction	. . .
IIIA	No extension to pelvic sidewall	. . .
IIIB	Extension to pelvic sidewall, or ureteral obstruction	Pelvic sidewall extension; hydronephrosis
IV	Extends beyond the true pelvis or invades mucosa of bladder or rectum	. . .
IVA	Spread to adjacent organs	Bladder or rectal involvement
IVB	Spread to distant organs	Inguinal node metastases, intraperitoneal metastases

adenosquamous carcinoma (two). Histologic tumor grades were well differentiated (nine patients), moderately well differentiated (31), poorly differentiated (29), and undifferentiated (six). The interval between histologic diagnosis and CT scan was 1 day to 3 weeks (average interval, 6 days).

CT was performed on a Delta 50 FS Scanner (Ohio Nuclear Corp.). The scan duration was 18 sec and the images were displayed on a 256 × 256 matrix and recorded on film. Patients received 1 mg of intravenous glucagon to limit bowel peristalsis, 400 ml of 4% oral meglumine diatrizoate (Gastrografin, Squibb) to outline the small bowel, and 300 ml of intravenous 30% meglumine diatrizoate (Reno-M-Dip, Squibb) to outline the urinary tract. In selected patients, a tampon was used to outline the vaginal canal and a Gastrografin enema was administered to delineate the rectosigmoid colon. Then, consecutive 13-mm-thick sections were scanned from the xiphoid to below the ischial tuberosities.

In 75 patients, 103 CT scans were reviewed and correlated with clinical stage. In 15 patients with suspected recurrent tumor and in five patients on chemotherapy protocols, more than one CT scan was obtained. In 25 patients, clinical and CT stage were correlated with surgical stage established by radical hysterectomy (eight patients), exploratory laparotomy (six), retroperitoneal lymph node dissection (seven), and percutaneous needle aspiration biopsy (four). The official CT report on the day of examination was used for data analysis.

Results

CT Findings

CT characterized the cervix tumor as uniformly solid in 38 (51%) patients or solid with low density areas in 37 (49%) patients. Low density areas corresponded to clinically detectable necrotic or ulcerated tumor replacing normal cervix tissue. The cervix mass was best seen on sections at the level of the femoral heads, immediately superior to a tampon outlining the vagina.

In seven patients, CT stage I tumors were characterized by slight cervix enlargement (>3 cm in anteroposterior diameter), smooth lateral cervix margins, and normal parametrial fat (fig. 1). CT could not characterize clinical stage IIA tumors because of inadequate delineation of intravaginal tumor. In 32 patients, CT stage IIB tumors were characterized by disrupted, irregular lateral cervix borders with parametrial soft tissue mass extension, but demonstrable separation of the mass from the pelvic sidewall by intervening pelvic fat (fig. 2). CT stage IIB tumors were 3–6 cm in anteroposterior diameter (average, 4 cm).

In 29 patients, CT stage IIIB tumors were characterized by hydronephrosis or tumor extension to the pelvic sidewall. Pelvic sidewall tumor extension was characterized either by direct tumor growth to the obturator internus and/or pyriformis muscles in 21 patients (fig. 3) or by linear soft tissue strands extending to these muscles in eight patients (fig. 4). CT stage IIIB tumors were 4–9 cm in anteroposterior diameter (average, 5.5 cm). Six patients with clinical stage IIB or IIIB tumors had an abnormal uterine corpus due to a low density center (fig. 5). Fractional dilatation and curettage in three of six patients indicated endometrial extension of cervix carcinoma.

In four patients, CT stage IVA tumors were characterized by tumor involvement of the bladder (three patients) or the rectum (one patient). Bladder involvement was characterized by nodular indentations along the the posterior bladder wall or intraluminal tumor mass (fig. 6). Another sign of bladder involvement was focal loss of the posterior perivesical fat plane, which was present on sections above or below the abnormal section. Prone and postvoid bladder sections were used to differentiate extrinsic mass impression from tumor involvement. These additional views showed widening of the posterior perivesical fat stripe in patients with extrinsic compression.

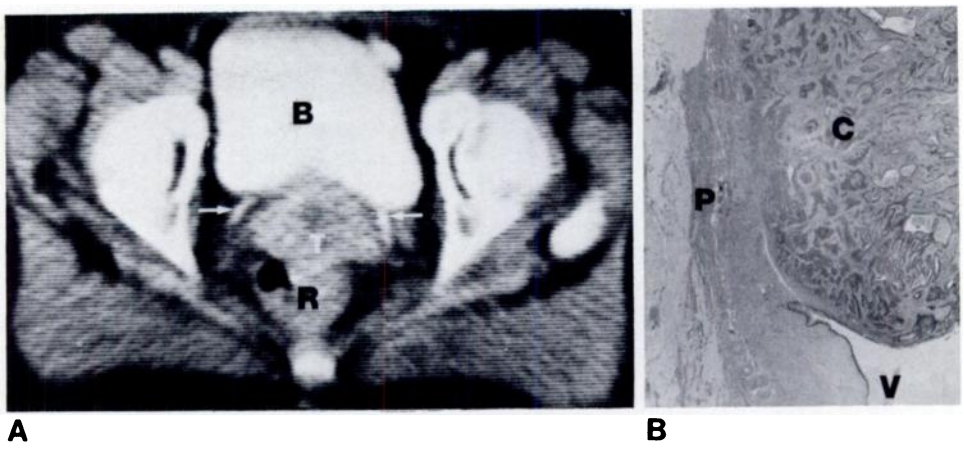


Fig. 1.—Stage IB cervix carcinoma. **A**, CT scan through bladder (B) and rectum (R). Cervix tumor (T) has low density center and normal parametrial tissues between tumor and distal ureters (*arrows*). **B**, Whole mount section after radical hysterectomy. Complete replacement of cervix (C) by keratinizing squamous cell carcinoma. Parametrium (P) and vagina (V) are free of tumor.

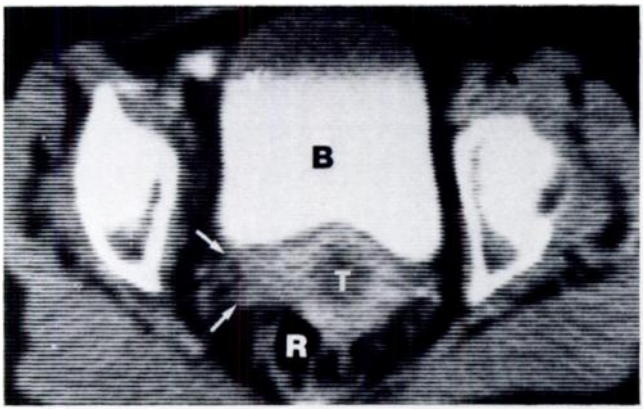


Fig. 2.—Stage IIB cervix carcinoma. CT scan through bladder (B) and rectum (R). Cervix tumor (T) with soft tissue mass extension into right parametrium (*arrows*).

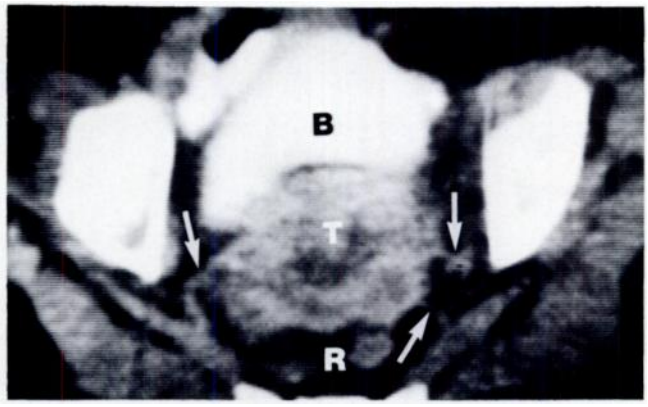


Fig. 4.—Stage IIIB cervix carcinoma. CT scan through bladder (B) and rectum (R). Large cervix tumor (T) with inhomogeneous density, irregular borders, and linear soft tissue extensions to both pelvic sidewalls (*arrows*) confirmed at laparotomy.

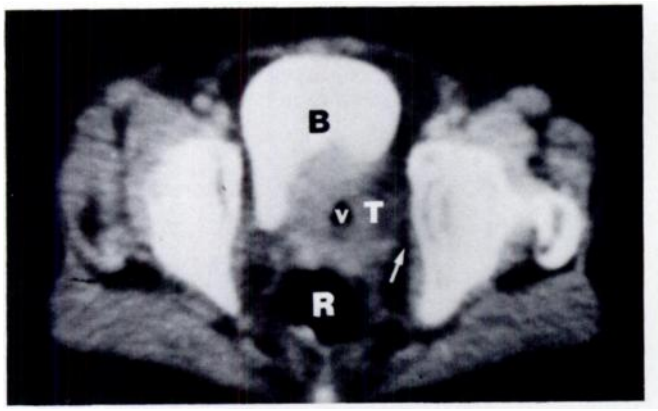


Fig. 3.—Stage IIIB cervix carcinoma. CT scan through rectum (R) and vaginal apex (v). Cervix tumor (T) indents bladder (B) and extends directly to left pelvic sidewall (*arrow*).

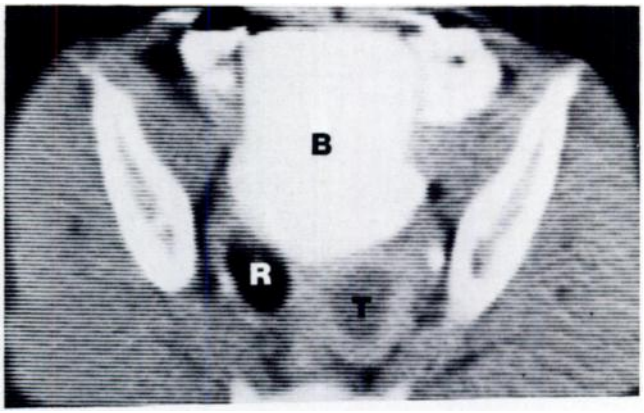
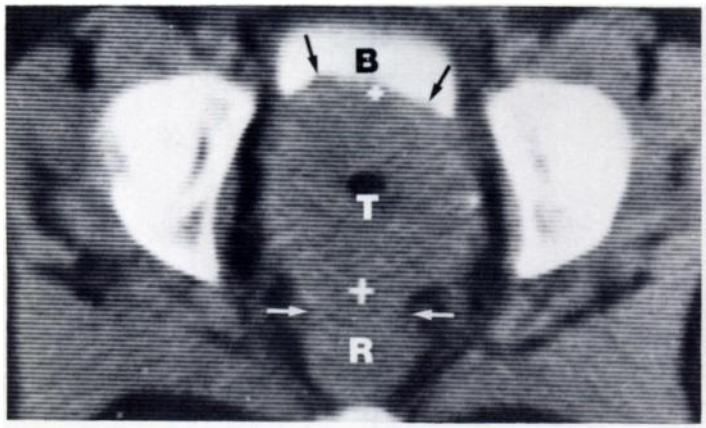


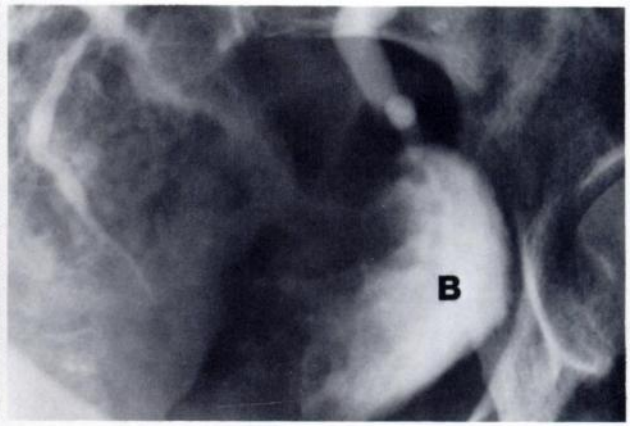
Fig. 5.—Stage IIB cervix carcinoma with endometrial extension. CT scan through bladder (B) and rectum (R). Low density center in uterine corpus (T) due to endometrial extension of cervix carcinoma confirmed by fractional dilatation and curettage.

Cystoscopic biopsy confirmed bladder mucosal involvement in one patient and laparotomy showed bladder serosal involvement in another. Rectal involvement was characterized by focal obliteration of the fat plane surrounding the anterior surface of the rectum. Barium enema study showed irregularity of the right anterolateral wall and intact mucosa. Sigmoidoscopy showed an extrinsic mass displacing normal rectal mucosa.

In three patients, CT stage IVB tumors were characterized



A



B

Fig. 6.—Stage IVA cervix carcinoma. **A**, CT scan through bladder (B). Large cervix tumor (T) with invasion into bladder lumen (*black arrows*) and obliteration of normal fat plane (*white arrows*) anterior to rectum (R). **B**, Left posterior oblique pelvis during urography. Extensive mucosal destruction, nodular indentations, and displacement of contrast-filled bladder (B). Cystoscopy and biopsy confirmed bladder mucosal involvement by poorly differentiated squamous carcinoma.

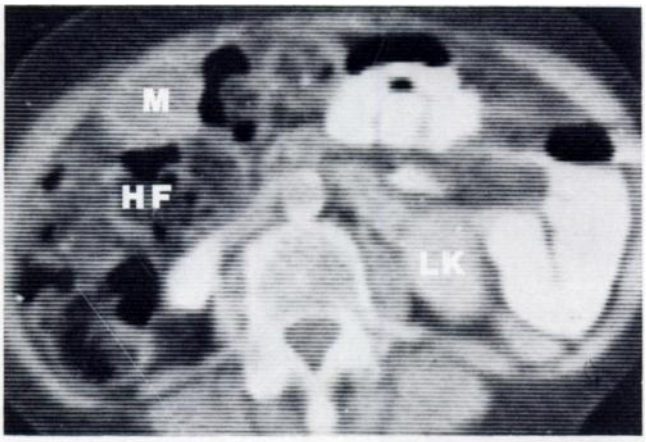


Fig. 7.—Stage IVB cervix carcinoma. CT scan through hepatic flexure of colon (HF) and left kidney (LK). Metastasis (M) under right anterior abdominal wall confirmed by percutaneous needle aspiration biopsy.

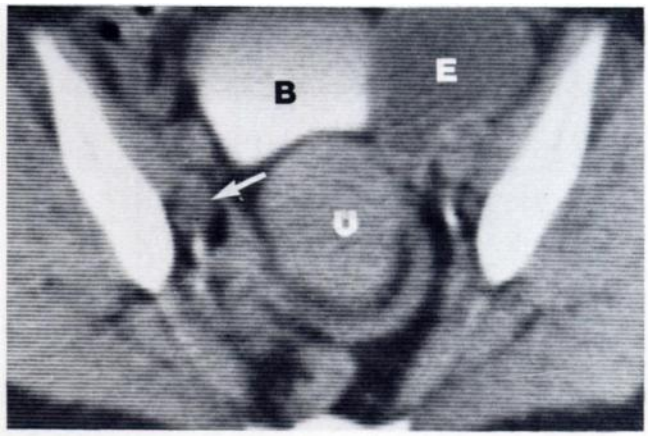


Fig. 8.—Stage IIB cervix carcinoma. CT scan through bladder (B) and uterine corpus (U). A 2 cm right obturator lymph node metastasis (*arrow*) and left ovarian endometrioma (E) confirmed at laparotomy.

by tumor extension outside the true pelvis. Two previously reported patients had 1.5–2.5 cm superficial inguinal lymph node metastases confirmed by needle aspiration biopsy [9]. One patient had a 5 cm solid intraperitoneal metastasis confirmed by percutaneous aspiration biopsy (fig. 7).

In three patients, CT showed adnexal masses that necessitated exploratory laparotomy prior to radiation therapy (fig. 8). Pathologic examination after unilateral salpingo-oophorectomy in each patient showed a 6 × 7 cm tuboovarian abscess, a 5 cm ovarian endometrioma, and a 5 cm ovarian cystadenoma.

Stage Correlation

CT stage in 75 patients is correlated with clinical stage in table 2. CT and clinical stage were identical in 49 (65%) patients. CT indicated more advanced disease than clinical examination in 14 (19%) patients and less extensive disease in 12 (16%) patients.

CT in 25 patients is correlated with surgical stage in table 3. CT agreed with surgical stage in 16 (64%) patients and disagreed in nine (36%) patients. Eight (89%) of nine errors were in the CT stage IIB category. In four CT stage IIB patients, CT indicated parametrial tumor not present on pathologic examination of radical hysterectomy specimens. In three CT stage IIB patients, surgery showed pelvic sidewall tumor extension, although a fat plane was present between the tumor and sidewall on CT. In one CT stage IIB patient, supraclavicular lymph node biopsy indicated stage IVB disease. In one CT stage IIIB patient, laparotomy indicated IVB disease due to an omental metastasis not detected by CT. CT was correct in 11 (92%) of 12 IIIB, IVA, or IVB lesions.

TABLE 2: **Prospective Comparison between Clinical and CT Stage in 75 Cases of Primary Cervix Carcinoma**

Clinical Stage	No. Cases	CT Stage				
		I	IIB	IIIB	IVA	IVB
IA	1	1	0	0	0	0
IB	9	3	5	1	0	0
IIA	5	3	2	0	0	0
IIB	18	0	16	2	0	0
IIIB	38	0	8	26	3	1
IVA	1	0	0	0	1	0
IVB	3	0	1	0	0	2
Total	75	7	32	29	4	3

TABLE 3: **Prospective Comparison between CT Stage and Surgical Stage in 25 Cases of Primary Cervix Carcinoma**

CT Stage	No. Cases	Surgical Stage				
		IB	IIB	IIIB	IVA	IVB
I	4	4	0	0	0	0
IIB	9	4	1	3	0	1
IIIB	7	0	0	6	0	1
IVA	2	0	0	0	2	0
IVB	3	0	0	0	0	3
Totals	25	8	1	9	2	5

Lymph Node Correlation

CT detected lymph node metastases in 18 (24%) of 75 cases. Paraaortic lymphadenopathy was identified in two (3%) cases, common iliac in one (1%), obturator in 13 (17%), and inguinal in two (3%). CT criteria for pelvic and inguinal lymph node metastases have been reported [9]. Histologic correlation was obtained in eight (44%) of 18 cases. Node dissection indicated reactive hyperplasia in paraaortic nodes in one patient and obturator node metastases in five (fig. 8). Needle aspiration biopsy in two patients confirmed inguinal node metastases. Clinical stages of seven patients with pelvic or inguinal node metastases were IB (two patients), IIIB (two), IVA (one), and IVB (two). Both clinical stage IB patients were CT and surgical stages IIB and IIIB, respectively.

In 17 patients, histologic examination of pelvic lymph node was performed by pelvic lymph node dissection (13 patients) or laparotomy and selected node biopsy (four). In two patients, needle aspiration biopsy confirmed inguinal node metastases. CT was true-positive in seven of 10 patients with pelvic or inguinal lymph node metastases (sensitivity, 70%), false-negative in three (30%) of 10 patients with metastases, true-negative in seven of nine patients without metastases (specificity, 78%), and false-positive in two (22%) of nine patients. CT was correct in 14 (74%) of 19 patients.

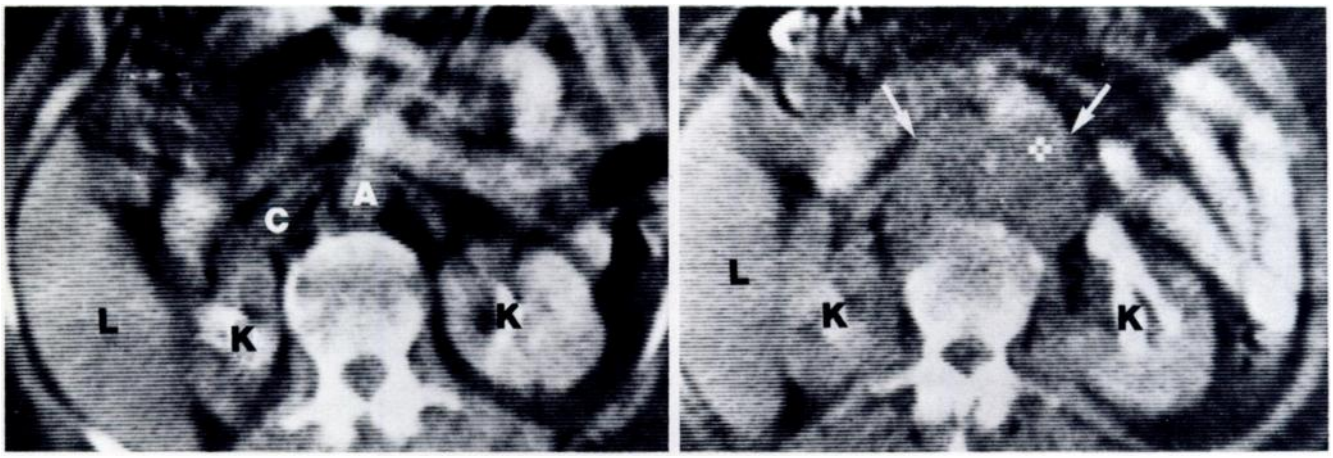
Recurrent Tumor

CT evaluated 15 patients for recurrent tumor 6–10 months after radiation therapy. Clinical stages were IB (two patients), IIB (two), IIIB (10), and IVA (one). Both clinical IB patients were CT and surgical stage IIB and IIIB, respectively. In nine (60%) of 15 patients, CT scans were equivocal for recurrent tumor. CT could not differentiate an irradiated uterus from central tumor recurrence. In six (40%) of 15 patients, CT detected new areas of disease not present on pretreatment baseline scans. Three patients had 2–3 cm paraaortic or common iliac lymph node metastases (fig. 9). One patient had a 5 cm presacral mass that was a metastasis on the sigmoid mesentery at laparotomy. One patient had liver metastases. One patient had liver metastases, paraaortic lymphadenopathy, and an ischial metastasis.

Discussion

Several studies indicate that clinical staging of cervix carcinoma has decreasing accuracy with advanced disease [1, 2]. The most common error is the failure to accurately define the extent of parametrial disease. Averette et al. [3] advocate exploratory laparotomy to accurately define extent of disease and individualize treatment. Berman et al. [10] surgically stage cervix carcinoma by an extraperitoneal approach to avoid small bowel adhesions and subsequent radiation therapy complications. Thus the management of advanced cervical cancer is currently in a state of evolution.

Current radiologic techniques used in staging cervix carcinoma yield minimal information about disease extent. In a retrospective study of 227 patients with invasive carcinoma of the cervix, Griffin et al. [11] reported tumor-related findings in only 1% of chest films, 3.4% of barium enema



A B

Fig. 9.—Recurrent stage IIIB cervix carcinoma. **A**, Baseline CT scan through liver (L) and kidneys (K). Normal aorta (A) and inferior vena cava (C). **B**, Follow-up scan 9 months later. Extensive retroperitoneal lymph node metastases (*arrows*) obliterate borders of aorta and inferior vena cava.

studies, and 7.3% of excretory urograms. CT offers distinct advantages over conventional radiologic techniques in staging cervix tumors. CT displays cervix tumor mass, parametrial and sidewall tumor spread, pelvic and inguinal lymph node metastases, and hydronephrosis [5–9]. Three dimensional quantitative demonstration of tumor volume is also important in planning radiation therapy [6].

In our series, CT demonstrated bulky 4–9 cm IIB, IIIB, IVA, and IVB cervix tumors in relation to bladder, rectum, vagina, distal ureters, and pelvic sidewall. This objective assessment of tumor size may provide important prognostic information. Cervix tumor size is directly related to the incidence of parametrial involvement and pelvic lymph node metastases [12, 13]. Moreover, patients with a bulky tumor mass, a barrel-shaped lesion, or endometrial involvement are at increased risk for central recurrence [14]. CT indicated endometrial extension when the uterus corpus contained low density tissue. Fractional dilatation and curettage differentiated endometrial tumor from low density areas due to hematometra or pyometra.

CT stage differed from clinical stage in 35% of patients. This result is similar to the 34%–39% discrepancy between clinical and surgical stage [1–4]. In comparison with clinical stage, CT upstage tumors in 19% and downstage them in 16%. The large number of advanced tumors treated with radiation therapy precluded surgical stage confirmation in 50 patients. However, CT-surgical correlation in 25 patients yielded some preliminary conclusions. CT was not sufficiently accurate to differentiate IB and early IIB lesions and thus alter treatment decisions. CT overstaged four (50%) of eight clinical IB lesions due to minimal parametrial irregularity. CT demonstration of a parametrial soft tissue mass is necessary to diagnose IIB disease. Current developments in high resolution, fast CT scanners and coronal and sagittal reconstruction [15] should improve recognition of normal and abnormal parametria. CT errors in differentiating IIB from IIIB tumors were probably not significant since treatment was not affected.

CT was correct in 92% of stage IIIB, IVA, or IVB lesions. These data indicate a high accuracy in advanced tumors, the disease category in which most clinical staging errors occur. However, more surgically proven cases are needed to verify this conclusion. CT staging was a noninvasive alternative to surgical staging in advanced tumors. In our series, CT confirmed advanced disease in patients with obesity, an equivocal pelvic examination, or a medical contraindication to surgical staging. In addition, CT provided the radiation therapist with an objective tumor volume along with its spatial relationships to normal pelvic structures.

CT staging has several disadvantages. CT was not effective in demonstrating intravaginal tumor. Stage IIA and IIIA tumors are best evaluated by clinical examination. CT staging of IVA tumors was problematic since tumor involvement of the serosa and muscularis without mucosal penetration could escape cystoscopic or sigmoidoscopic detection.

CT detection of lymphadenopathy in 24% of patients was similar to the 23%–25% incidence of lymph node detection in two reported CT studies of pelvic malignant tumors [6, 9]. CT was most useful in detecting obturator and inguinal lymph node metastases [9], thus identifying one group of patients whose prognosis is poor. This group of patients can be further evaluated by lymphangiography with percutaneous needle biopsy [16] or extraperitoneal lymph node dissection to document common iliac or paraaortic node metastases in normal sized nodes. In our study, CT was not useful in identifying paraaortic or common iliac node metastases in primary untreated tumors. However, CT detected 2–3 cm paraaortic node metastases 6–10 months after radiation therapy. CT detection of retroperitoneal node metastases in recurrent carcinoma of the cervix has been reported [17].

Our 74% overall accuracy of CT pelvic lymph node detection does not yet match the reported 78%–87% overall accuracy of lymphangiography in cervix carcinoma [10, 18, 19]. However, the accuracy of lymphangiography is not high enough to make treatment decisions without tissue confir-

mation [20, 21]. In our series, pelvic node dissection confirmed five of 13 obturator node metastases. According to the FIGO classification, CT detection of pelvic node metastases did not alter clinical stage.

Another advantage of CT was detection of recurrent tumor in patients with treated IIB to IVB lesions. In 40% of patients with baseline scans at initial treatment, follow-up CT documented metastatic disease to paraaortic lymph nodes, the bowel mesentery, or the liver. These metastases were outside the field of radiation therapy. CT images guided percutaneous biopsy [22] and outlined measurable disease for chemotherapy follow-up [17]. In 60% of cases, CT could not distinguish radiation fibrosis from recurrent tumor, a disadvantage that has been reported [17]. Recurrent tumor was documented in these patients by cervix biopsy or parametrial needle biopsy under anesthesia.

ACKNOWLEDGMENTS

We thank Pauline E. Friedman for manuscript preparation, the Medical College of Virginia Visual Education Department for photographic assistance, and our CT technologists for performing the scanning.

REFERENCES

1. van Nagell JR Jr, Roddick JW Jr, Lowin DM. The staging of cervical cancer: inevitable discrepancies between clinical staging and pathologic findings. *Am J Obstet Gynecol* **1971**;110:973–978
2. Averette HE, Dudan RC, Ford JH Jr. Exploratory celiotomy for surgical staging of cervical cancer. *Am J Obstet Gynecol* **1972**;113:1090–1096
3. Averette HE, Ford JH Jr, Dudan RC, Girtanner RE, Hoskins WJ, Lutz MH. Staging of cervical cancer. *Clin Obstet Gynecol* **1975**;18:215–232
4. Lagasse LD, Ballon SC, Berman ML, Watring WG. Pretreatment lymphangiography and operative evaluation in carcinoma of the cervix. *Am J Obstet Gynecol* **1979**;134:219–224
5. Walsh JW, Rosenfield AT, Jaffe CC, et al. Prospective comparison of ultrasound and computed tomography in the evaluation of gynecologic pelvic masses. *AJR* **1978**;131:955–960
6. Brizel HE, Livingston PA, Grayson EV. Radiotherapeutic applications of pelvic computed tomography. *J Comput Assist Tomogr* **1979**;3:453–466
7. Photopulos GJ, McCartney WH, Walton LA, Staab EV. Computerized tomography applied to gynecologic oncology. *Am J Obstet Gynecol* **1979**;135:381–383
8. Chen SS, Kumari S, Lee L. Contribution of abdominal computed tomography (CT) in the management of gynecologic cancer: correlated study of CT image and gross surgical pathology. *Gynecol Oncol* **1980**;10:162–172
9. Walsh JW, Amendola MA, Konerding KF, Tisnado J, Hazra TA. Computed tomographic detection of pelvic and inguinal lymph-node metastases from primary and recurrent pelvic malignant disease. *Radiology* **1980**;137:157–166
10. Berman ML, Lagasse LD, Watring WG, et al. The operative evaluation of patients with cervical carcinoma by an extraperitoneal approach. *Obstet Gynecol* **1977**;50:658–664
11. Griffin TW, Parker RG, Taylor WJ. An evaluation of procedures used in staging carcinoma of the cervix. *AJR* **1976**;127:825–827
12. Piver MS, Chung WS. Prognostic significance of cervical lesion size and pelvic node metastases in cervical carcinoma. *Obstet Gynecol* **1975**;46:507–510
13. Burghardt E, Pickel H. Local spread and lymph node involvement in cervical cancer. *Obstet Gynecol* **1978**;52:138–145
14. Durrance FY, Fletcher GH, Rutledge FN. Analysis of central recurrent disease in stage I and II squamous cell carcinoma of the cervix on intact uterus. *AJR* **1969**;106:831–838
15. Federle MP, Moss AA, Boyd DP, Royal SA. Coronal and sagittal reconstructions using a 4.8 second CT body scanner: development and applications. *AJR* **1979**;133:625–632
16. Zornoza J, Lukeman JM, Jing BS, Wharton JT, Wallace S. Percutaneous retroperitoneal lymph node biopsy in carcinoma of the cervix. *Gynecol Oncol* **1977**;5:43–51
17. Walsh JW, Amendola MA, Hall DJ, Tisnado J, Goplerud DR. Recurrent carcinoma of the cervix: CT diagnosis. *AJR* **1981**;136:117–122
18. Piver MS, Wallace S, Castro JR. The accuracy of lymphangiography in carcinoma of the uterine cervix. *AJR* **1971**;111:278–283
19. Fuchs WA, Seiler-Rosenberg G. Lymphography in carcinoma of the uterine cervix. *Acta Radiol [Diagn]* (Stockh) **1975**;16:353–361
20. Brown RC, Buchsbaum HJ, Tewfik HH, Platz CE. Accuracy of lymphangiography in the diagnosis of paraaortic lymph node metastases from carcinoma of the cervix. *Obstet Gynecol* **1979**;54:571–575
21. Kolbenstvedt A. Lymphography in the diagnosis of metastases from carcinoma of the uterine cervix stages I and II. *Acta Radiol [Diagn]* (Stockh) **1975**;16:81–97
22. Jaques PF, Staab E, Rickey W, Photopulos G, Swanton M. CT-assisted pelvic and abdominal aspiration biopsies in gynecological malignancy. *Radiology* **1978**;128:651–655