Detecting Lymphatic Metastases from Prostatic Carcinoma: Superiority of CT

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CT scanning was performed on 29 consecutive patients with clinically localized prostatic carcinoma (stage A or B). Bipedal lymphangiography was performed in 12 cases. Histologic confirmation was obtained in 15 cases (pelvic lymphadenectomy in 12 and positive percutaneous needle biopsy in three). In these 15 proven cases, the overall accuracy of CT was 93% with one false positive and no false negatives. Lymphangiography was far less accurate (55%) with two false positives and three false negatives in 11 proven cases. The greater accuracy of CT resulted primarily from its ability to detect abnormal nodes in the pelvis, particularly hypogastric nodes, which are rarely opacified by lymphangiography. Preliminary experience suggests that CT is superior to lymphangiography in detecting early lymphatic spread from prostatic carcinoma in the pelvis. In the future, CT-guided percutaneous needle biopsy should be useful for documenting metastases in these patients.

Carcinoma of the prostate is the second leading cause of death from cancer in men over age 55 [1]. Accurate staging of the disease is essential both for assessing prognosis and planning therapy. Unfortunately, clinical staging (based on digital rectal examination, serum acid phosphatase level, bone scan, excretory urography, and cystoscopy) frequently underestimates the true anatomic extent of disease, particularly when there is lymphatic involvement [1, 2]. This can be a significant problem as therapeutic failures may be related to unrecognized lymphatic metastases at the time of initial staging [2–4].

As a result, bipedal lymphangiography has received considerable attention as a technique for detecting early metastases to pelvic and retroperitoneal lymph nodes. The reported accuracy of lymphangiography has varied from 48% to 89% [2, 3, 5–8]. Because of the limitations of lymphangiography, pelvic lymphadenectomy is often advocated as the diagnostic procedure of choice for assessing lymphatic spread from prostatic carcinoma [9–12].

The value of computed tomography (CT) in detecting pelvic and retroperitoneal adenopathy in patients with lymphoma has been clearly established [13, 14]. CT has also been useful in recognizing adenopathy in patients with testicular tumors [15]. However, its role in staging other pelvic neoplasms is less clear. The purpose of this study was to evaluate the accuracy of CT as a primary screening procedure for lymphatic metastasis in patients with prostatic carcinoma. Our preliminary experience was encouraging.

Materials and Methods

CT was performed on 29 consecutive patients with newly diagnosed, apparently localized prostatic carcinoma (stage A or B) by clinical staging criteria (table 1). All 29 patients were evaluated by CT for evidence of pelvic or retroperitoneal lymphadenopathy. In 12 cases, bipedal lymphangiography was also performed.

CT scanning was performed on an EMI 5005 18 sec scanner. Patients were studied from the diaphragm caudad to the pubic symphysis with sections taken at 2 cm intervals in

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the abdomen and 1 cm intervals in the pelvis. Lymph nodes with a diameter greater than 1.5 cm were considered abnormal, except for deep pelvic nodes (i.e., hypogastric or obturator nodes) which were considered abnormal if greater than 1.2 cm. This smaller number has not been cited in the literature, but reflects our experience with nodal metastases from all types of pelvic neoplasms thus far evaluated by CT. Oral contrast material was administered in all cases and intravenous contrast material was given when there was uncertainty about the nature of soft-tissue densities on precontrast scans. All of the scans were reviewed and interpreted retrospectively by a senior member of our section without knowledge of the surgical results.

Comparison of the CT findings was made with bipedal lymphangiography. Percutaneous needle biopsy was performed to document nodal metastases in five cases with abnormal lymphangiograms. A positive biopsy (i.e., class 5 cytology) obviated surgery in three. Pelvic lymphadenectomy was performed in 12 other cases to verify the CT or lymphangiographic findings.

If this work-up revealed no evidence of metastatic tumor, the protocol of our referring urologists called for interstitial irradiation with ^{125}I or external beam irradiation to the prostate for attempted cure. As a result, radical prostatectomies were not performed and histologic confirmation of extracapsular spread of tumor to the seminal vesicles, bladder, or periprostatic tissues could not be obtained. Thus no attempt was made in this study to evaluate the accuracy of CT in detecting local spread of prostatic tumor in the pelvis.

TABLE 1: **Clinical Staging in Carcinoma of the Prostate**

Stage	Characteristics
A	Occult carcinoma: one or two microscopic foci found incidentally at operation for benign disease or at autopsy.
B	Carcinoma confined within prostatic capsule with no elevation of serum acid phosphatase level.
C	Carcinoma extending beyond prostatic capsule, including seminal vesicles, bladder, and urethra, or confined within capsule with elevated serum acid phosphatase level.
D	Bone, lymph node, or extrapelvic metastases.

Note.—From [5]

Results

CT accurately identified the presence or absence of lymphadenopathy in 14 of 15 proven cases with seven true positives and seven true negatives. There were no false negatives by CT. However, there was one false positive (fig. 1) in which suspiciously enlarged common iliac nodes proved to be free of metastatic tumor at surgery. In these 15 proven cases, the overall accuracy of CT was 93%.

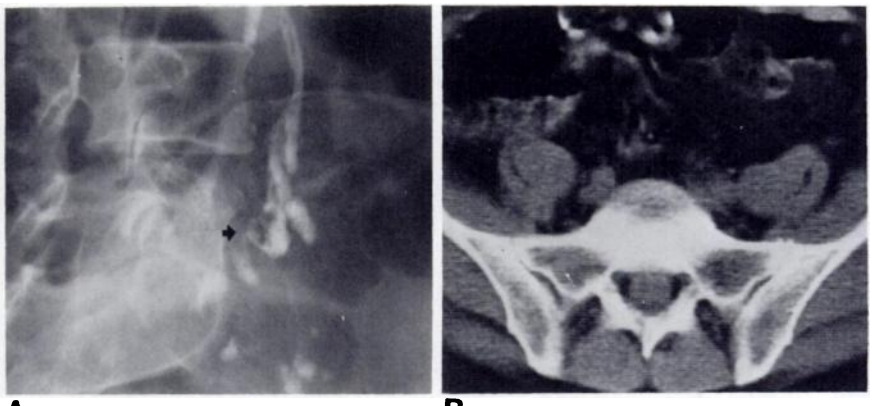
In contrast, lymphangiography was accurate in only six of 11 proven cases with three true positives and three true negatives. In addition, one lymphangiogram was technically unsatisfactory owing to inadequate filling of nodes. There were two false positives and three false negatives by this technique. In both false positives (fig. 2A), filling defects that were identified in common iliac nodes proved at surgery to be secondary to fatty replacement without evidence of metastatic tumor. CT was negative in both of these cases (fig. 2B). In all three false negatives by lymphangiography, CT demonstrated adenopathy in common iliac or hypogastric nodes (figs. 3 and 4). In 11 proven cases, the overall accuracy of lymphangiography was 55%.

There were 14 cases in which histologic confirmation of the CT findings was not obtained. CT detected adenopathy in three of these unproven cases. In two, there was such bulky retroperitoneal adenopathy (fig. 5) that pelvic lymphadenectomy was not performed because of the near certainty of metastatic disease. In one, surgery was refused by the patient. In 11 other negative cases by CT, patients either refused surgery or it was contraindicated on medical grounds.

Discussion

The use of CT for detecting lymph node metastases in patients with prostatic carcinoma (stage D) thus far has been limited. Lee et al. [16] compared CT to lymphangiography in patients with all types of pelvic neoplasms and concluded that CT was less sensitive than lymphangiography because of its inability to recognize alterations in inter-

Fig. 1.—False-positive CT: Soft-tissue prominence in left common iliac region (*arrow*). Nodes were negative at surgery. In retrospect, this finding was secondary to prominent vascularity.



A B

Fig. 2.—False-positive lymphangiogram. **A,** Definite filling defect in left common iliac node (*arrow*) on oblique view. **B,** CT through common iliac region. No evidence of adenopathy. At surgery, there was fatty replacement of nodes, but no tumor.

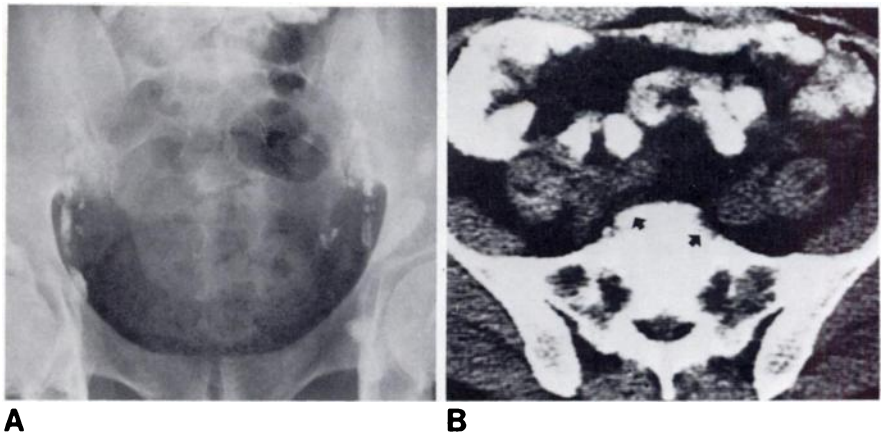


Fig. 3.—False-negative lymphangiogram. **A,** Suboptimal image, but no evidence of metastases. **B,** CT through common iliac region. Asymmetric soft-tissue prominence (*arrows*), greater on right. Nodes were positive at surgery.

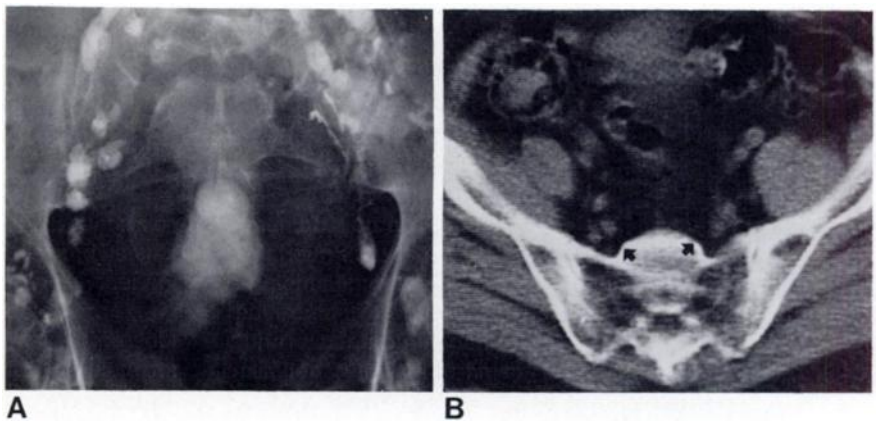


Fig. 4.—False-negative lymphangiogram. **A,** Negative. (Note contrast in colon from prior barium study.) **B,** CT through pelvis. Bilateral soft tissue prominence in hypogastric nodes (*arrows*). Nodes were positive at surgery.

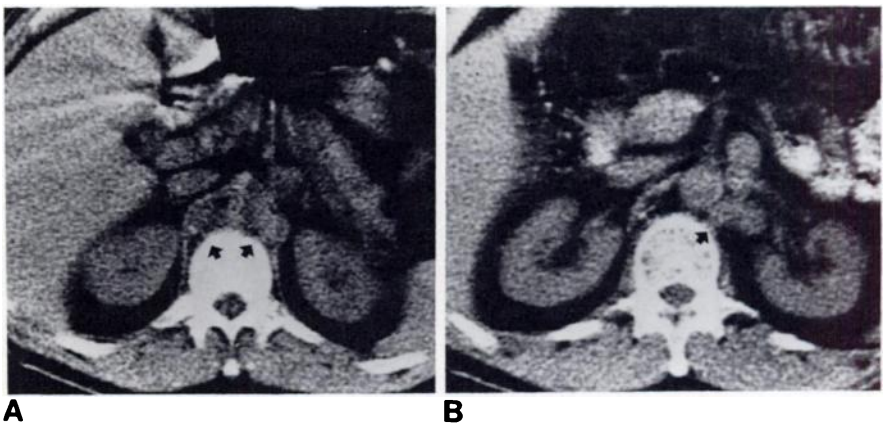


Fig. 5.—Probable retroperitoneal metastases, but no surgical proof. **A,** CT through upper abdomen. Bulky adenopathy in retrocrural region (*arrows*). **B,** CT through renal hilum. Enlarged nodes (*arrow*) in left renal area.

nal nodal architecture in nodes which are not enlarged. Others have also noted that CT cannot differentiate between normal nodes and normal-sized nodes that have been partially or completely replaced by tumor [17]. Lee et al. [15] found CT to have greater value in assessing lymphatic involvement by testicular neoplasm, due to a tendency for metastases from this tumor to grossly expand nodes.

Although the number of proven cases in this preliminary study is small, CT had an overall accuracy of 93% in detecting metastases to pelvic or retroperitoneal lymph nodes. The single false positive (fig. 1) resulted from soft-tissue prominence in common iliac nodes, probably related to unopacified vessels mistaken for adenopathy. Rapid sequence CT scanning with contrast enhancement should help to eliminate this problem in the future.

In contrast to CT, bipedal lymphangiography was rela-

tively unsatisfactory in evaluating lymph node metastases with an overall accuracy of 55%. There were two false positives in which the typical filling defects associated with metastases were present (fig. 2A). CT was negative in both cases (fig. 2B). It is known that lymph nodes can be replaced by benign processes (e.g., fatty degeneration or postinflammatory scarring) which totally mimic the appearance of metastatic deposits [3, 6, 7]. For this reason, percutaneous needle biopsy is required to document metastases in abnormal-appearing nodes.

There were also three false negatives by lymphangiography (figs. 3A and 4A) in which nodal metastases were subsequently documented by staging lymphadenectomy. False negatives are known to occur, somewhat paradoxically, when lymph nodes are totally replaced by tumor and hence are not opacified at all by lymphangiography [5]. It has also been suggested that microscopic foci of tumor or "micrometastases" (too small to produce discrete filling defects in nodes) account for a significant number of false negatives by this technique [3, 4, 18]. However, we found that CT accurately detected lymphadenopathy in all three cases missed by lymphangiography. In one case, CT demonstrated adenopathy in common iliac nodes (fig. 3B). In two cases, CT detected adenopathy in hypogastric nodes without significant involvement of common or external iliac nodes (fig. 4B).

It is well documented that the earliest lymphatic spread of prostatic carcinoma occurs via obturator and hypogastric nodes in the pelvis [3, 4, 6, 9–11, 18, 19]. These may be the only nodes involved in 30% of patients with nodal metastases [9]. Yet these nodes are rarely opacified by lymphangiography [3, 4, 6, 7, 10, 11, 18, 20]. In contrast, deep pelvic nodes (particularly hypogastric nodes) are readily visualized by CT. It therefore is not surprising to find that CT was superior to lymphangiography in detecting early nodal metastases in the pelvis.

Despite the accuracy of CT in this preliminary study, we recognize the inherent limitations of an imaging method whose criterion for lymphatic metastasis is simply nodal enlargement. As a result, CT cannot detect tumor deposits that derange nodal architecture without grossly expanding nodes [15, 16]. We therefore believe that patients with negative CT should undergo pelvic lymphadenectomy for more certain staging of their disease. Lymphangiography might alternatively be performed in order to demonstrate metastases causing discrete filling defects in normal-sized nodes. For reasons already discussed, percutaneous needle biopsy or pelvic lymphadenectomy will subsequently be required to document the lymphangiographic findings.

In our series, patients with positive CT also underwent pelvic lymphadenectomy for confirmation. In the future, needless surgery can be avoided in such cases if histologic proof of metastasis (i.e., class 5 cytology) is obtained via percutaneous CT-guided needle biopsy. In experienced hands, this is a safe and reliable procedure with minimal if any complications [21–24]. Major exploratory surgery can thus be avoided in patients with documented nodal metastases. However, staging lymphadenectomy will still be required if needle biopsy is negative, since the presence of metastatic tumor cannot be excluded on this basis [22]. Our current approach for evaluating lymphatic metastasis from prostatic carcinoma is presented in figure 6.

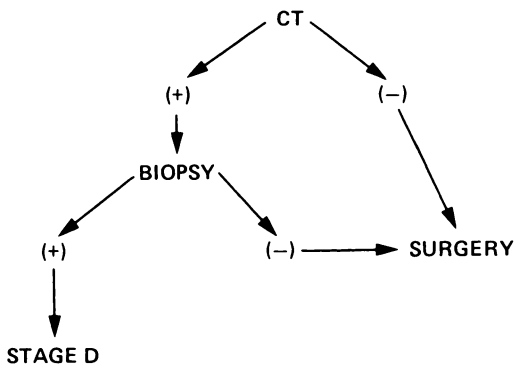


Fig. 6.—Suggested protocol for evaluating lymphatic metastasis from prostatic carcinoma using CT as primary screening procedure. Although not shown here, lymphangiography might alternatively be used before staging surgery in patients with negative CT.

More data are obviously needed to further elucidate the role of CT. However, our preliminary findings suggest that CT is superior to lymphangiography in detecting early lymphatic spread in the pelvis. In addition, it is a less time-consuming, less expensive, and less invasive procedure that can be performed on patients with cardiopulmonary disease who are at greater risk for developing complications secondary to lymphangiography. With the development of newer, more rapid scanners that have increased spatial and contrast resolution, the accuracy of CT should improve even further. We therefore believe that CT (complemented by percutaneous needle biopsy if positive or pelvic lymphadenectomy if negative) constitutes an excellent screening technique for early lymphatic metastasis and probably should replace lymphangiography in the initial staging evaluation for prostatic carcinoma.

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