CLINICAL STUDY

CT-Guided Percutaneous Needle Biopsy of Retroperitoneal and Pelvic Lymphadenopathy: Assessment of Technique, Diagnostic Yield, and Clinical Value

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ABSTRACT

Purpose: To assess the technical success rate, diagnostic yield, and clinical value of computed tomography (CT)–guided percutaneous needle biopsy (PNB) for retroperitoneal and pelvic lymphadenopathy.

Materials and Methods: This retrospective study included 344 patients evaluated for safety and technique and 334 patients evaluated for diagnostic yield and clinical analyses. PNBs were performed with fine-needle aspiration (FNA) in 315 patients and with core biopsy in 333 patients. Follow-up analyses, including repeat biopsy, open surgery, imaging, and clinical indicators, were conducted for 94 patients who had nonspecific malignant or benign results. Diagnostic yields were calculated based on biopsy and follow-up results. Factors associated with final diagnoses were compared and modeled by multivariate analysis.

Results: Technical success rate was 99.7%. Thirty-nine patients (11.3%) had minor complications. From biopsy results and follow-up analyses, final malignant diagnoses were determined for 281 patients (84.1%). Overall sensitivity, specificity, and accuracy rates of PNB were 91.5%, 100%, and 92.8%, respectively. For patients with a history of malignancy, the likelihood of nodal involvement was 84.6% and that of a new, different malignancy was 3.7%. Older age (odds ratio [OR], 1.03; 95% confidence interval [CI], 1.00–1.05), history of malignancy (OR, 3.44; 95% CI, 1.71–6.92), multiple lymph nodes (LNs; OR, 2.65; 95% CI, 1.38–5.09), and new or enlarging LNs (OR, 2.62; 95% CI, 1.25–5.48) were independent risk factors for malignancy diagnosis.

Conclusions: CT-guided PNB is a safe, effective procedure that can achieve high diagnostic yields for patients with retroperitoneal and pelvic lymphadenopathy.

ABBREVIATIONS

CI = confidence interval, FNA = fine-needle aspiration, IVC = inferior vena cava, LN = lymph node, OR = odds ratio, PNB = percutaneous needle biopsy, SAD = short-axis diameter

Percutaneous needle biopsy (PNB) is a well-established interventional procedure that is routinely used for tissue diagnosis, disease staging, and treatment planning (1). PNB of lesions in solid organs, such as liver, kidney, adrenal gland, and prostate, has been comprehensively studied for its indications, techniques, diagnostic yields, and complications (2,3). The lymphatic system is also commonly involved in primary or metastatic disease, for which PNB plays an increasingly important role. In 2016, 136,960 new cases of lymphoma, which frequently presents as lymphadenopathy, were diagnosed in the United States (4). Metastatic disease also often presents as lymphadenopathy, for which nodal

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biopsy is essential for cancer staging, genotype identification, and molecular analysis (5). Few reports have focused on the technical and diagnostic details of PNB of retroperitoneal and deep pelvic lymph nodes (LNs). This may result in part from the technical challenges associated with targeting nodes commonly associated with major vessels, solid organs, and skeletal structures. Therefore, the purpose of the present study was to evaluate the technique, diagnostic yield, and clinical value of PNB for retroperitoneal and pelvic lymphadenopathy.

MATERIALS AND METHODS

Patients

The institutional review board approved this retrospective study and waived the requirement for informed consent. An interventional radiology database was searched by using the key words "retroperitoneal," "pelvic," "aspiration," and "biopsy" for the period from April 1, 2013, to March 30, 2016. **Figure 1** shows the exclusion and inclusion criteria applied to the workflow of cases. This search yielded 344 cases of computed tomography (CT)–guided PNBs of retroperitoneal and/or pelvic nodal masses for assessment of technical success and complications and 334 cases (174 men and 160 women; mean age, 63.9 y ± 14.5; range, 12–90 y) for assessment of diagnostic yield and clinical characteristics. Medical records were reviewed to determine the indication for biopsy (ie, to establish a new diagnosis or to confirm suspected metastatic disease). Of the 334 cases, 246 (73.7%) had a specific history of malignancy; of these, 33 had a history of 2 or more malignancies.

Imaging Characteristics

The targeted LNs were evaluated based on the cross-sectional images (CT, positron-emission tomography/CT, or magnetic resonance [MR] imaging) obtained during and/or shortly before the PNB procedures. According to the LN distribution classification previously reported (6–8), the LNs were assigned to 1 of 8 anatomic regions: paracaval, precaval interaortocaval, preaortic, paraaortic, common iliac, external iliac, and obturator. Nodal size was measured at the central slice of the cross-sectional images, taking the short-axis diameter (SAD) as length. The median SAD was 2.2 cm (interquartile range, 1.5–3.4 cm). The number of nodes was categorized as solitary or multiple. By reviewing CT or MR images within 1 year before the biopsy procedure, the chronicity of nodes was characterized as stable if the node was unchanged in size or as new or enlarging if the node was not present on the previous imaging or increased more than 30% in SAD. Nodes without available comparison images were characterized as new.

Biopsy Procedures

All PNB procedures were performed under CT guidance (LightSpeed; GE Healthcare, Chicago, Illinois). Intravenous conscious sedation was administered by radiology nursing staff, and continuous hemodynamic and respiratory monitoring was performed. A 17-gauge coaxial introducer was used to establish access to the targeted LN (N = 344). To obtain cytologic and histologic samples, fine-needle aspiration (FNA) was performed with a 22-gauge aspiration needle (n = 315), followed by core biopsy (n = 333) with an 18-gauge core needle, both directed through a 17-gauge introducer (needles were manufactured by Bard [Tempe, Arizona] or Cook [Bloomington, Indiana]). Only fine-needle aspirates were obtained for biopsies for which procurement of core specimens was deemed too dangerous as a result of proximity of vital structures and increased risk of complications. Technical success was defined as successful coaxial needle placement within the nodes. Complications were evaluated with immediate postbiopsy unenhanced CT scans and by review of the post-procedural medical records. Complications were classified as absent, minor, or major based on the Society of Interventional Radiology Standards of Practice Committee classification system (1).

Pathologic Diagnosis and Follow-up

The FNA and core specimens were sent to the pathology department for evaluation. Cytologists and histologists made final cytologic and histologic diagnoses separately. Pathologic results were classified as specific malignancy (*i*), nonspecific malignancy (*ii*), benign disease with nonspecific histologic or cytologic components (*iii*), or nonevaluable specimen (*iv*). Final diagnoses were determined in cases of (*i*), and follow-up analyses, including repeat biopsy, endoscopic or open surgery, imaging, clinical indicators, and autopsy, were conducted for cases of (*ii*) and (*iii*). The minimum time for imaging follow-up of stable-sized nodes was 6 months. Cases lacking follow-up information as well as cases with nonevaluable specimens were excluded from diagnostic yield analysis.

Data Analyses

A true-positive result was defined as (*i*) or as (*ii*) with repeat biopsy or surgical confirmation, with progressive disease on follow-up imaging, or with favorable response to chemotherapy. A false-positive result was defined as (*ii*) for which there was no evidence of malignancy on follow-up surgical resection, or if there was regression of the node on follow-up imaging in the absence of therapy. A true-negative result was defined as (*iii*) for which follow-up imaging indicated shrinkage, disappearance, or stationary condition of the node over a period of 6 months without specific treatment, or if subsequent repeat biopsy or surgery revealed a benign pathologic result. A false-negative result was defined as (*iii*) for which node growth was evident or if follow-up surgery confirmed the malignancy. Diagnostic yield for malignancy detection was defined in terms of sensitivity, specificity, positive predictive value, negative predictive value, and accuracy. These indicators were calculated based on the aforementioned definitions.

Continuous variables are presented as mean ± standard deviation, and categoric variables are presented as proportions. Sensitivity and accuracy between FNA and core biopsy were compared with the Pearson χ^2 test. Factors