Use and Usefulness of Adrenal Core Biopsies Without FNA or On-site Evaluation of Adequacy

A Study of 204 Cases for a 12-Year Period

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Key Words: Adrenal; Core biopsy; Metastatic; Specificity; Immunohistochemistry

Abstract

While several studies have assessed the efficacy of adrenal fine-needle aspiration, there are few data regarding adrenal tissue core biopsies. We performed a retrospective study, for a 12-year period, of 204 percutaneous adrenal core biopsy specimens. A core was the only specimen obtained, and on-site evaluation was not used. About half of the cases (104/204) were diagnosed as metastatic carcinoma, with lung as the most common origin (78/204). A specificity and sensitivity of 100% for benign vs malignant was calculated, with a specificity of 88% and sensitivity of 86% for specific diagnoses. Diagnostic and sampling errors were identified. False-negatives were limited to biopsies using 20-gauge needles. Cases with a clinical history provided had specific diagnoses made at a slightly higher frequency compared with cases without an available history. Immunohistochemical workup was performed in more than half of the cases; specific diagnoses were made more frequently than in cases without immunostains.

Adrenal masses are a common finding in abdominal imaging studies and, when incidentally detected, are referred to as adrenal incidentalomas.1 Approximately 4% of abdominal computed tomography (CT) scans reveal an adrenal incidentaloma.2 A clinically inapparent adrenal mass is identified at autopsy in fewer than 1% of people younger than 30 years but is found in approximately 7% of people older than 70 years.1 The etiology of adrenal incidentalomas is approximately 52% adrenal cortical adenoma, 12% adrenal cortical carcinoma, 11% pheochromocytoma, 8% myelolipoma, and 2% metastasis, with the remainder consisting of lesions such as adrenal cysts.3 In patients with a known history of cancer, three fourths of adrenal incidentalomas ultimately prove to be metastases.1 The workup and diagnostic approach to managing incidentalomas is not well established, and adrenal core biopsies may have a possible role.1

An adrenal biopsy may be used to confirm metastatic spread from a known primary tumor or in the workup of an incidentaloma.4 Specimens obtained from an adrenal biopsy include fine-needle aspirate (FNA), tissue cores, or a combination of aspirate and tissue cores. Side effects from adrenal biopsies include hemorrhage, pneumothorax, needle track metastasis, and pheochromocytoma tumor puncture, leading to hypertensive crisis.5-7 Because of the potential usefulness in clinical management, as well as known side effects, knowledge regarding the effectiveness of adrenal biopsies as a diagnostic tool is important. Several studies have reported the efficacy of FNA of the adrenal gland,5-7,14 but to our knowledge, only 1 study, by Saeger et al,13 examined the diagnostic efficacy of core biopsies without FNA. Saeger et al13 performed ex vivo adrenal needle core biopsies on
adrenalectomy specimens, but these results are difficult to extrapolate to clinical practice.

The purpose of this study was to investigate the use and usefulness of adrenal core needle biopsies. We performed a 12-year retrospective study on adrenal core needle biopsies performed without the use of FNA or on-site assessment of adequacy. It is the intent to obtain more clinically relevant data on the usefulness of adrenal core biopsies for diagnostic purposes.

Materials and Methods

A retrospective search of adrenal core biopsies from the pathology database at The Ohio State University Medical Center, Columbus, from 1998 through 2009 was performed. All surgical pathology reports were obtained. Cases with FNA of the adrenal gland or a combination of FNA and needle core biopsy were eliminated to isolate cases in which only a needle core biopsy was collected. On-site evaluation of adequacy is available at our institution but is provided as a requested service on a case-by-case basis. Data compiled from the pathology report included age, sex, clinical history provided on the pathology requisition, diagnosis, and immunohistochemical workup. Cases that involved outside slides sent to The Ohio State University Medical Center for rereview or consultation were marked as such. Radiology records were electronically retrieved to obtain the average number of cores obtained, the needle gauge, and the average size of the lesion on CT. All previous and follow-up pathology and radiology reports were additionally examined. Slides available from cases with discrepant follow-up were rereviewed. Statistical analysis was performed to test the correlation between patient history vs diagnosis, immunohistochemical staining vs diagnosis, and 18- vs 20-gauge diagnostic results using a $\chi^2$ test. A $P$ value of .05 or less was considered statistically significant.

Results

There were 204 adrenal core biopsies at The Ohio State University Medical Center from 1998 through 2009. There were 198 patients total, with 1 biopsy performed on 192 patients and 2 biopsies on 6 patients. Of the 204 biopsies, 46 were received by The Ohio State University Medical Center as outside slides for consultation rereview. Our institution demonstrated an average increase in adrenal core tissue biopsies. From 1998 to 2001, there was a yearly average of 6.5 adrenal core biopsies performed. From 2002 to 2005, there was an average of 15.5 per year, and from 2006 to 2009, an average of 29.8 adrenal core biopsies were performed each year. The average age of the patients represented in this study was 61 years (range, 21-89 years). Of the patients, 58.3% were men and 41.7% were female. For 162 biopsies, CT-guided radiology reports were available for review. According to the CT records, the average lesion size was 4.9 cm (range, 1.2-22 cm). In 150 cases, there was a record of the number of cores obtained, with an average of 2.8 cores (range, 1-9) per biopsy. Of the 204 biopsies, 165 cases provided information on the needle gauge used in the biopsy. These data showed that in 76.4% ($n = 126$), an 18-gauge needle was used; in 23.0% ($n = 38$), a 20-gauge needle was used; and in 0.6% ($n = 1$), a 22-gauge needle was used.

![Figure 1](https://academic.oup.com/ajcp/article-abstract/137/1/124/1766590)

**Figure 1** shows the pathologic diagnostic categories, including metastatic carcinoma (104 [51.0%]) **Image 1A**, benign adrenal tissue/adrenal cortical adenoma/ndiagnostic (65 [31.9%]), lymphoma (8 [3.9%]), melanoma (7 [3.4%]) **Image 1B**, malignant, not otherwise specified (5 [2.5%]), myelolipoma (3 [1.5%]) **Image 1C**, adrenal cortical carcinoma (3 [1.5%]) **Image 1D**, pheochromocytoma (3 [1.5%]), sarcoma (2 [1.0%]), schwannoma (2 [1.0%]), infectious (1 [0.5%]), and neoplasm, not otherwise specified (1 [0.5%]).

Provided patient history was categorized in order of frequency as nonadrenal carcinoma (125 [61.3%]), adrenal cortical adenoma/adrenal mass/nonrelevant history/no history (54 [26.5%]), melanoma (7 [3.4%]), bilateral adrenal masses (7 [3.4%]), lymphoma (5 [2.5%]), adrenal cortical carcinoma (4 [2.0%]), and sarcoma (2 [1.0%]). Specific history and diagnostic categories were metastatic carcinoma, melanoma, lymphoma, myelolipoma, adrenal cortical carcinoma, pheochromocytoma, sarcoma, schwannoma, and infectious disease. The histories and diagnoses that were not specific included...
Image II: Histologic examples. A, Metastatic lung carcinoma in an adrenal core biopsy specimen, the most frequent diagnosis in our study (H&E, ×20). B, Malignant melanoma in an adrenal core biopsy specimen. Marked pleomorphism, prominent nucleoli, and necrosis are present (H&E, ×20). C, Myelolipoma in an adrenal core biopsy specimen characterized by adipose with hematopoietic elements including a megakaryocyte in the center of the photomicrograph (H&E, ×20). D, Adrenal cortical carcinoma in an adrenal core biopsy specimen. Mild pleomorphism and focal necrosis are present (H&E, ×20). E and F, Adrenal gland biopsy specimen with a diagnostic error. E, The original diagnosis was benign adrenal tissue. Rereview shows fragments of clear cell renal cell carcinoma on the left with nonneoplastic adrenal cortex on the right (H&E, ×10).
F, Follow-up adrenalectomy contained metastatic clear cell renal cell carcinoma (H&E, ×20). G and H, Adrenal gland biopsy specimen with a diagnostic error. G, The original diagnosis was benign adrenal medulla. Rereview shows nested adrenal medulla “suspicous” for pheochromocytoma (H&E, ×20). H, Follow-up adrenalectomy revealed pheochromocytoma (H&E, ×20). I and J, Adrenal gland biopsy with a sampling error. I, Kidney parenchyma involved by lung carcinoma is seen, with no adrenal tissue present (H&E, ×20). J, Follow-up adrenal gland biopsy had only blood with no tissue seen (H&E, ×20).
adrenal cortical adenoma/adrenal mass/nonrelevant history/no history, benign adrenal tissue/adrenal cortical adenoma/ nondiagnostic, malignant not otherwise specified, bilateral adrenal masses, and neoplasm not otherwise specified. Of the 61 cases with a nonspecific provided medical history, 36 (59.0%) had a specific pathologic diagnosis given. Of the 143 cases with a specific provided clinical history, 97 (67.8%) had a specific pathologic diagnosis. The difference was not statistically significant ($\chi^2 = 1.6; P = .22$). The 104 cases diagnosed as metastatic carcinoma had a provided history of nonadrenal carcinoma for 85 of the cases (81.7%). The following were the origins of the metastatic carcinoma: lung, 78 (75.0%); renal, 11 (10.6%); breast and pancreatic cancer, 3 each (2.9%); colorectal, bladder, and hepatocellular, 2 each (1.9%); and esophageal, ovarian, and prostate, 1 each (1.0%).

An adrenal core biopsy was the first tissue diagnosis of metastatic carcinoma in 4.8% of cases ($n = 5$; 4 lung and 1 pancreas primary). For the remaining diagnostic categories, a provided history that matched the diagnosis was present much less frequently than for metastatic carcinoma (benign adrenal tissue/adrenal cortical adenoma/nondiagnostic, 30.7%; lymphoma, 50.0%; melanoma, 57.1%; myelolipoma, 0.0%; adrenal cortical carcinoma, 33.3%; pheochromocytoma, 0.0%; sarcoma, 50.0%; schwannoma, 0.0%; and infectious, 0.0%).

Of the 204 total adrenal core biopsies, follow-up pathology material was available for 45 patients as follows: repeated adrenal core biopsy, 6; adrenalectomy, 21; subsequent finding of the same diagnosis in another anatomic location, 16; and/or autopsy confirmation, 2; infectious case was confirmed by treatment provided to the patient for cryptococcosis. Only cases with definitive diagnoses that were completely concordant with follow-up were considered supported. All 18 cases with an initial adrenal core biopsy diagnosis of metastatic carcinoma were confirmed on follow-up. For 12 benign adrenal tissue/adrenal cortical adenoma/nondiagnostic diagnoses, there was additional pathology material, with 7 diagnoses supported, whereas 5 had discrepant follow-up.

A diagnostic error was identified in which clear cell renal cell carcinoma was misdiagnosed as adrenal cortical tissue [Image 1G] and [Image 1F]. Several sampling errors were noted. One patient had a biopsy diagnosis of nonneoplastic adipose, no adrenal tissue present, with no change in diagnosis on rereview. The adrenalectomy contained metastatic lung carcinoma. Another patient had 2 adrenal biopsies, with the first specimen containing only nonneoplastic adrenal tissue with no diagnostic change on rereview. The second adrenal biopsy specimen contained renal cell carcinoma, clear cell type. One biopsy had scant adrenal tissue, favoring an adrenal cortical neoplasm with an adrenalectomy revealing an adrenal cortical carcinoma. A diagnostic error occurred in which a biopsy was misinterpreted as adrenal medulla but was later diagnosed in an adrenalectomy specimen as a pheochromocytoma [Image 1G] and [Image 1F]. There were 2 schwannoma cases with postbiopsy follow-up confirming one diagnosis, whereas the other was unremarkable on adrenalectomy. Follow-up of this discrepant case included an exploratory laparotomy for the patient’s retroperitoneal mass revealing a gastrointestinal stromal tumor arising from the posterior wall of the stomach (sampling error). All melanoma ($n = 4$), pheochromocytoma ($n = 3$), adrenal cortical carcinoma ($n = 2$), myelolipoma ($n = 1$), lymphoma ($n = 1$), and infectious ($n = 1$) diagnoses were supported with follow-up pathology. A double sampling error in which 1 patient had an adrenal gland biopsy that revealed renal parenchyma involved by metastatic lung carcinoma [Image 1I] and a follow-up biopsy with blood only was identified [Image 1J]. This case was excluded from calculations of sensitivity and specificity because neither the original biopsy nor the subsequent biopsy specimen contained adrenal tissue, and, therefore, we did not have an actual adrenal follow-up specimen. Table 1 summarizes postbiopsy follow-up pathology, excluding this case. In total, 4 diagnostic (9%) and 5 sampling (11%) errors were identified.

### Table 1

<table>
<thead>
<tr>
<th>Subset of Adrenal Core Biopsies With Follow-up Data</th>
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<tr>
<td>Diagnosis Supported</td>
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<tr>
<td>Metastatic carcinoma ($n = 18$)</td>
</tr>
<tr>
<td>Benign/adrenal cortical adenoma/nondiagnostic ($n = 12$)</td>
</tr>
<tr>
<td>Melanoma ($n = 4$)</td>
</tr>
<tr>
<td>Pheochromocytoma ($n = 3$)</td>
</tr>
<tr>
<td>Adrenal cortical carcinoma ($n = 2$)</td>
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<tr>
<td>Myelolipoma ($n = 1$)</td>
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<tr>
<td>Lymphoma ($n = 1$)</td>
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<td>Infection ($n = 1$)</td>
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</table>
To compare the results of our study with the findings of prior studies using FNA, we calculated a specificity and sensitivity using follow-up data by categorizing samples as benign/likely benign or malignant/likely malignant. Any sample that was nondiagnostic, inadequate, or diagnosed as pheochromocytoma was eliminated from the data used for calculations. Based on this method, we calculated a specificity of 100% and a sensitivity of 100%. Because a precise diagnosis may be expected from a needle core biopsy, we performed calculations to reflect the test as it is clinically used. Diagnoses with any discrepancy from follow-up were considered incorrect. Sampling errors, including nondiagnostic, inadequate, and not sampling the lesion, were considered incorrect based on follow-up. By using these much more stringent criteria, we calculated a specificity of 88%, sensitivity of 86%, positive predictive value of 97%, and negative predictive value of 58%. For the metastatic carcinoma diagnostic category, a sensitivity of 86% and positive predictive value of 100% were observed. Of the 44 cases with follow-up, 35 had data on the size of the needle used during the biopsy. From these 35 cases, false-negatives were identified only in biopsies using a 20-gauge needle (2 false-negatives), and true-negatives were identified only in biopsies using an 18-gauge needle (4 true-negatives), which was statistically significant ($\chi^2 = 6.17; P = .013$). The remaining cases in both groups were true-positives.

For an adrenal core biopsy to be a practical diagnostic tool, it must be performed at a reasonable cost. We used the 2011 United States Medicare allowable billing for each Current Procedural Terminology (CPT) code to estimate the cost of pathologic analysis of an adrenal core biopsy. Including the billing for surgical pathology examination (CPT code 88305, $103.05) and immunohistochemical analysis (CPT code 88342, $101.41 per immunostain), the average billing for an adrenal core biopsy in our 204 cases was $470.90. Immunohistochemical workup is summarized in Table 2. Immunostains were ordered in the majority of cases (120 [58.8%]). In total, 741 immunohistochemical stains were ordered. The average number of immunostains performed per case was 3.6. For the 120 cases with immunohistochemical stains, an average of 6.2 immunostains were performed. There were 88 types of immunostains used, with thyroid transcription factor 1, cytokeratin 7, AE1/3, cytokeratin 20, and inhibin the most common. Immunohistochemical analysis added $370.17 for each case, or $626.21 for the subset of cases in which immunostains were performed. Of the 84 cases without immunohistochemical stains, 35 (42%) were given a specific diagnosis. Of the 120 total cases that had immunohistochemical stains, most (114 [95.0%]) were given a specific diagnosis, significantly different from the group without immunohistochemical stains ($\chi^2 = 71.6; P < .0001$). For comparison, the billing for FNA cytology examination (CPT code 88173) is $134.54, and on-site evaluation of adequacy (CPT code 88172) is $49.63.

### Table 2

**Immunohistochemical Parameters for 204 Adrenal Core Biopsy Cases**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases with immunohistochemical stains</td>
<td>120 (58.8%)</td>
</tr>
<tr>
<td>Range of No. of immunohistochemical stains ordered</td>
<td>0-30</td>
</tr>
<tr>
<td>Average No. of stains in subset with immunohistochemical staining</td>
<td>6.2</td>
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Most commonly ordered immunohistochemical stains (n = 120)

- Thyroid transcription factor-1: 63 (52.5%)
- Cytokeratin 7: 59 (49.2%)
- AE1/3: 56 (46.7%)
- Cytokeratin 20: 46 (38.3%)
- Inhibin: 44 (36.7%)
- S-100: 37 (30.8%)
- Melan-A: 31 (25.8%)
- Chromogranin: 30 (25.0%)
- Vimentin: 25 (20.8%)
- Synaptophysin: 23 (19.2%)
- CD10: 23 (19.2%)
- CD45: 19 (15.8%)
- Cytokeratin cocktail (AE1, AE3, MAK6, and CAM5.2): 18 (15.0%)

* Data are given as number (percentage) unless otherwise indicated.

### Discussion

FNA is a widely used biopsy technique, and several studies have analyzed the efficacy of FNA for diagnosing adrenal lesions. However, little research has been done on the usefulness of adrenal percutaneous needle core biopsy specimens as a sole specimen. In this retrospective study, we examined a large number of adrenal core biopsy specimens to determine diagnostic usefulness.

Based on cases with follow-up in the form of a repeated adrenal core biopsy, adrenalectomy, subsequent finding of the same diagnosis in another anatomic location, or autopsy confirmation, we calculated a specificity of 88%, sensitivity of 86%, positive predictive value of 97%, and a much lower negative predictive value of 58% for diagnoses made in adrenal needle core biopsy specimens. Diagnostic and procedural sampling errors were identified, with sampling errors occurring more frequently and contributing to our lower reported negative predictive value. Known diagnostic pitfalls such as misdiagnosing clear cell renal cell carcinoma as adrenal cortex, definitively diagnosing adrenal cortical carcinoma vs adrenal cortical neoplasm, and misdiagnosing pheochromocytoma as adrenal medulla occurred in our study.

There has been 1 other report of adrenal core biopsy specimens obtained without FNA or on-site evaluation of specimen adequacy by Saeger et al. Saeger et al performed ex vivo adrenal needle core biopsies on adrenalectomy specimens.
Correct insertion of the needle into the tumor tissue could be obtained much more easily than in the clinical setting, increasing the likelihood of retrieving tumor. An adrenalectomy was performed in every case, which is not the population of typically used adrenal biopsy specimens. A 9-antibody immunopanel was performed on every biopsy specimen, with additional immunostains used for suspected soft tissue or hematopoietic tumors. This was much more workup than our average of 3.7 immunostains per biopsy. Saeger et al found incorrect diagnoses in 10% of the biopsies with errors including misdiagnosing metastatic carcinoma, adrenal cortical adenoma, adrenal cortical carcinoma, pheochromocytoma, and non-Hodgkin lymphoma. A sensitivity of 94.6% and a specificity of 95.3% for benign vs malignant diagnoses were reported. The higher sensitivity and specificity compared with our study may be attributed to the ex vivo method or that our calculations were based on making specific diagnoses, rather than benign vs malignant.

Studies examining FNA usefulness in adrenal lesions have reported excellent results with specificity between 96.3% and 100% and sensitivity between 81% and 100%. Widely differing methods make it difficult to compare FNA data between studies or with our findings for adrenal tissue cores. In particular, most authors of FNA studies considered only benign and malignant as diagnostic categories, although a more precise diagnosis may be needed. To compare our data with these studies, we performed calculations using similar methods, producing a specificity and sensitivity of 100%. Welch et al used FNA combined with core biopsy and immediate cytologic and frozen section analysis. A specificity of 99% and sensitivity of 81% were reported, but the authors did not describe the methods for calculation. Fassina et al obtained FNA only, used on-site evaluation of adequacy in all cases, and compared FNA diagnoses with subsequent diagnoses from histologic specimens. A specificity of 96.3% and sensitivity of 100% for benign diagnoses and a specificity of 100% and sensitivity of 93.7% for malignant diagnoses were computed. Lumachi et al evaluated FNA in patients without cancer and did not clearly state whether on-site evaluation was used. This article compared the pathology diagnosis of FNA with findings for adrenalectomy specimens or follow-up CT scans, producing a specificity of 100% and a sensitivity of 93.3%. Another investigation by Lumachi et al compared the efficacy of FNA, CT, and magnetic resonance imaging in patients with nonfunctional adrenal masses. FNA was the only specimen, and this study had on-site evaluation. Adrenalectomy and follow-up imaging data were used to obtain a specificity of 100% and a sensitivity of 83.3%. Harisinghani et al examined the validity of benign adrenal biopsy diagnoses in oncology patients. This study retrieved FNA and core samples and used on-site evaluation during the biopsy. Long-term patient follow-up, imaging, repeated biopsies, and autopsy were used to calculate a negative predictive value of 100%. On-site evaluation of adequacy has been used in most of the prior studies and likely improves sampling, therefore reducing false-negatives. Calculations of specificity and sensitivity using methods similar to FNA studies produced comparable results. However, in our opinion, classifying specimens only as benign or malignant and eliminating insufficient or nonlesional samples does not accurately describe the usefulness of adrenal biopsies as a diagnostic procedure. Especially concerning is that false-negatives are not reflected in a sensitivity calculated using these methods, possibly leading to inappropriate confidence in a negative result.

Because the presence of metastatic disease in oncology patients can significantly impact staging, treatment, and prognosis, the diagnosis of a metastasis to the adrenal gland is relevant. Adrenal biopsies, needle core and FNA, have been reported to be useful in confirming the presence of metastatic carcinoma in adrenal lesions. We found a sensitivity of 86% and positive predictive value of 100% for diagnoses of metastatic carcinoma. The majority of metastatic carcinoma (75%) was lung in origin. Other investigators have observed a high frequency of lung carcinoma metastases in adrenal biopsies, ranging from 57% to 65% of metastatic lesions. Although metastatic carcinoma within the adrenal gland is usually not removed, Saeger et al examined 14 cases of metastatic carcinoma in their ex vivo study, with a sensitivity of 90.9% and a specificity of 96.4% for this subset. Similarly, Welch et al described an accuracy of 93% in patients with lung cancer with possible adrenal metastasis. It is interesting that the first tissue diagnosis of metastatic carcinoma was from the adrenal core biopsy in several cases in our study. Although methods and specimens varied, all reports confirmed that adrenal biopsies are useful for diagnosing metastatic carcinoma.

Although rare in our study, we calculated a sensitivity of 75% in diagnosing pheochromocytoma via needle core biopsy. One error in which pheochromocytoma was misinterpreted as nonneoplastic adrenal medulla was identified. Saeger et al reported a sensitivity of 94.5% and a specificity of 100% for pheochromocytoma. Biopsy of suspected pheochromocytoma is usually avoided because contact with the tumor can cause the secretion of catecholamines. Documented side effects from biopsy of pheochromocytoma include life-threatening blood pressure, acute headaches, and uncontrollable hemorrhaging, potentially leading to death. Because of these hazards, urine and serum catecholamine testing should be done before biopsy if a pheochromocytoma is suspected. Some authors recommend serum testing before biopsy for all patients because up to 14% of pheochromocytomas do not produce typical clinical symptoms. This is the first study that has examined the relationship between provided needle gauge or medical history.
and adrenal biopsy diagnosis. We observed false-negatives using 20-gauge needles, but not in specimens obtained with 18-gauge needles. The correlation with needle size was statistically significant and may be due to the increased tissue obtained with a larger needle. Concordant provided history and diagnosis occurred in the majority of metastatic carcinoma and much less frequently for all other diagnoses. Cases with a provided specific history had a specific diagnosis given 9% more frequently than cases that did not have a specific history. Although medical history intuitively assists in obtaining a medical diagnosis, our study showed no evidence of a correlation between given history and making a specific diagnosis. In addition, clinical history may guide the immunohistochemical workup, thereby preserving tissue and reducing cost. Immunohistochemical analysis was performed in more than half of the cases in our study. Immunostains more than tripled the cost per case, yet were associated with more specific diagnoses than cases without immunohistochemical stains. Because immunohistochemical analysis was frequently performed, histology laboratories may consider cutting 4 to 6 unstained slides at the time of initial sectioning in anticipation of additional workup.

This large retrospective study examined the clinical usefulness of adrenal core biopsies. A specificity of 88%, sensitivity of 86%, positive predictive value of 97%, and negative predictive value of 58% were calculated using strict follow-up criteria. Diagnostic and sampling errors were identified. The most frequent indication to perform an adrenal core biopsy in our study was metastatic carcinoma. Clinicians can be confident in a diagnosis of metastatic carcinoma, whereas caution is recommended for a benign diagnosis.

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References


