Characterization of Malignancy of Adnexal Lesions Using ADC Entropy: Comparison With Mean ADC and Qualitative DWI Assessment

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Purpose: To establish the utility of apparent diffusion coefficient (ADC) entropy in discrimination of benign and malignant adnexal lesions, using histopathology as the reference standard, via comparison of the diagnostic performance of ADC entropy with mean ADC and with visual assessments of adnexal lesions on conventional and diffusion-weighted sequences.

Materials and Methods: In all, 37 adult female patients with an ovarian mass that was resected between June 2006 and January 2011 were included. Volume-of-interest was drawn to incorporate all lesion voxels on every slice that included the mass on the ADC map, from which whole-lesion mean ADC and ADC entropy were calculated. Two independent radiologists also rated each lesion as benign or malignant based on visual assessment of all sequences. The Mann–Whitney test and logistic regression for correlated data were used to compare performance of mean ADC, ADC entropy, and the visual assessments.

Results: No statistically significant difference was observed in mean ADC between benign and malignant adnexal lesions ($P = 0.768$). ADC entropy was significantly higher in malignant than in benign lesions ($P = 0.009$). Accuracy was significantly greater for ADC entropy than for mean ADC ($P = 0.018$). ADC entropy and visual assessment by the less-experienced reader showed similar accuracy ($P = 0.204$). The more experienced reader’s accuracy was significantly greater than that of all other assessments ($P \leq 0.039$).

Conclusion: ADC entropy showed significantly greater accuracy than the more traditional metric of mean ADC for distinguishing benign and malignant adnexal lesions. Although whole-lesion ADC entropy provides a straightforward and objective measurement, its potential benefit decreases with greater reader experience.

Key Words: ovary; diffusion-weighted imaging; apparent diffusion coefficient; entropy; MRI


THE ACCURATE CHARACTERIZATION of an adnexal mass as benign or malignant is crucial to avoid unnecessary surgery. Magnetic resonance imaging (MRI) is an important clinical tool in making this determination (1,2). A spectrum of morphologic and signal intensity features of adnexal lesions using conventional MR sequences can be used to favor benignity or malignancy in a given case. However, the imaging findings are frequently nonspecific, and accurate characterization can remain difficult.

Previous studies have demonstrated that qualitative assessment of diffusion-weighted imaging (DWI) can contribute to the characterization of adnexal lesions (3–6). DWI can also be evaluated in a quantitative fashion, which most typically is achieved by computing apparent diffusion coefficient (ADC) values. ADC measures the rate of random motion of water molecules and has been shown to be decreased by increased tumor cellularity (7,8). However, prior investigations of the role of ADC values in differentiating benign and malignant adnexal lesions have yielded controversial results (5,6,9). For instance, endometriomas and teratomas, both common benign adnexal lesions, exhibit decreased ADC values that mimic the decreased ADC of neoplasms (6,9).

Entropy is a texture-based statistical measure of the variation in the histogram distribution of a given metric and represents the predictability of the intensity of the metric within the tissue. High entropy images contain a large number of voxels with different values, each of which is more or less equally prevalent. A disease process that affects a tissue heterogeneously is expected to result in less predictable intensity characteristics within the tissue and thus higher entropy (10). ADC entropy has been shown to

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be of value in the characterization of liver fibrosis and multiple sclerosis (11,12). The purpose of this study was to establish the utility of ADC entropy in the discrimination of benign and malignant adnexal lesions, using histopathology as the reference standard. Diagnostic performance of ADC entropy was compared with mean ADC and with visual assessments of adnexal lesions on conventional and DWI MR sequences.

**MATERIALS AND METHODS**

**Patients**

This retrospective study was compliant with the Health Insurance Portability and Accountability Act and approved by our Institutional Review Board, with waiver of the requirement for written informed consent. One author (ASK, 2nd-year radiology resident) who served as the data coordinator for the study, searched institutional databases to identify adult women with an adnexal mass that was resected between June 2006 and January 2011 and who had undergone preoperative pelvic MRI that included DWI. Lesions were excluded for the following reasons: severe artifact on DWI (n = 1); MRI performed at 3T (n = 3); and delay of greater than 180 days between MRI and surgical resection (n = 1). This yielded a final study cohort of 37 patients (mean age 54 ± 14 years, range 27–91 years). Histopathologic analysis of the 37 resected adnexal lesions established nine as malignant and 28 as benign. The mean time interval between MRI and surgery was 35 ± 29 days (range 6–137 days). The diagnoses for the nine malignant lesions were as follows: epithelial ovarian carcinoma (n = 7); borderline epithelial neoplasm (n = 1); carcinomasarcoma (n = 1). The diagnoses for the 28 benign lesions were as follows: endometrioma (n = 9); teratoma (n = 2); cystadenofibroma (n = 3); Brenner tumor (n = 1); other benign epithelial neoplasm (n = 3); benign sex-cord stromal tumor (n = 5); nonepithelial cyst (n = 4); benign hyperplastic lesion (n = 1). In one patient with bilateral endometriomas and one patient with bilateral teratomas, the larger lesion was selected for analysis.

**MRI Technique**

All patients underwent pelvic MRI on one of three 1.5-T clinical systems (Avanto [n = 20], Symphony [n = 11], or Sonata [n = 6], Siemens Healthcare, Erlangen, Germany) using a torso phased-array coil (six-element anterior and posterior coil arrays for the Avanto scanner and four-element anterior and posterior coil arrays for the Sonata and Symphony scanners). Conventional MRI sequences performed in all patients included multplanar turbo-spin echo T2-weighted imaging (T2WI), axial in-and-opposed-phase gradient-echo T1-weighted imaging (T1WI), and dynamic 3D fat-suppressed gradient-echo T1WI performed before and following intravenous administration of gadolinium-chelate. One patient was pregnant at the time of MRI and did not receive intravenous contrast. All examinations included a fat-suppressed single-shot echo-planar DWI axial or sagittal sequence of the pelvis that used tridirectional motion-probing gradients, and included b-values of 0 and 500 s/mm². Although acquisition parameters of the DWI sequence varied slightly based on scanner, imaging plane, and patient size, representative parameters were as follows: TR/TE 2100–2500/76–82 msec; slice thickness 6–8 mm; field-of-view 350 mm with 75%–80% rectangular field-of-view; matrix 144 × 192; 3 signal averages; receiver bandwidth 1300 Hz/voxel. The data coordinator constructed ADC maps on a pixel-wise basis for each case on a commercial workstation (Leonardo, Siemens Healthcare) using the b-values of 0 and 500 s/mm² and a monoexponential fit.

**Quantitative Analysis**

A single radiologist (ABR, with 3 years experience in body MRI) who was unaware of histologic findings used in-house developed software (FireVoxel; https://files.nyu.edu/hr18/public/projects.html) to perform a quantitative analysis of the ADC maps generated by the data coordinator. This software allowed placement of 3D volumes of interest (VOI) encompassing multiple slices. For each lesion a VOI was drawn on every slice that included the mass on the ADC map. The VOI was placed just inside the outer margin of the lesion on each slice to minimize partial volume error. The mean ADC and ADC entropy were calculated for the entire VOI. Entropy was computed as \( \Sigma (-p_i \log p_i) \), in which \( p_i \) represents the frequency of ADC values in the VOI (ie, the number of corresponding voxels normalized to the total number of lesion voxels) (11,12). At the time of entropy calculation, the lesion histogram was constructed for ADC values expressed in units of 10⁻⁵ mm²/s. In addition, for each lesion the bin width of the histogram was fixed at 10⁻⁵ mm²/s.

**Qualitative Analysis**

Qualitative analyses were performed independently by two radiologists fellowship-trained in abdominal imaging and with experience in evaluation of DWI (TCM with 2 years experience [R1], and GLB with 15 years experience that included dedicated experience in women’s imaging [R2]) who were both unaware of histologic findings. Cases were reviewed in different orders during two sessions, separated by at least 3 weeks. The readers knew that all lesions had undergone surgical resection but were unaware of other clinical or pathologic details. During session 1 (S1), conventional MRI sequences alone were reviewed. During session 2 (S2), conventional sequences were reviewed in combination with DWI, including acquired images obtained using b-values of 0 and 500 s/mm² as well as the ADC map. The readers characterized each adnexal lesion based on a qualitative visual assessment using the following 5-point scale: 1 = definitely benign, 2 = probably benign, 3 = indeterminate, 4 = probably malignant, 5 = definitely malignant. When reviewing DWI, increased signal on the high b-value image with corresponding low ADC
Lesions, When Including All 39 Lesions in Study Cohort

Diagnostic Performance of Mean Entropy, ADC Entropy, and Qualitative Reader Assessments, for Distinguishing Benign and Malignant

were performed both with and without the inclusion of

on conventional MRI alone (2,6), statistical analyses

teratomas can exhibit highly specific imaging features

positive for malignancy. Because endometriomas and

reader assessments, scores of 4 and 5 were considered

the previous analyses. When evaluating the qualitative

characteristic curve analysis was used to identify

threshold values in terms of mean ADC and ADC en-

tropy that achieved greatest accuracy in performing

the previous analyses. When evaluating the qualitative

reader assessments, scores of 4 and 5 were considered

positive for malignancy. Because endometriomas and

teratomas can exhibit highly specific imaging features

on conventional MRI alone (13) or teratoma (a lesion demon-

strating microscopic or macroscopic lipid (14).

Statistical Analysis

Mean ADC and ADC entropy of benign and malignant adnexal lesions were compared using an exact Mann-Whitney test. Logistic regression for correlated data was used to compare the performance of mean ADC, ADC entropy, and the subjective interpretations of the two radiologists during each session for distinguishing benign and malignant adnexal lesions. Specifically, generalized estimating equations based on a binary logistic regression model was used to model the likelihood of a correct diagnosis relative to pathology as a function of the diagnostic test used for the evaluation. The results from all six tests (mean ADC; ADC entropy; and the subjective interpretations of both readers, with and without DWI) were combined within an overall analysis. The correlation structure resulting from the inclusion of multiple test results per subject was modeled by assuming results to be correlated only when acquired from the same subject. Receiver-operating-characteristic curve analysis was used to identify threshold values in terms of mean ADC and ADC entropy that achieved greatest accuracy in performing the previous analyses. When evaluating the qualitative reader assessments, scores of 4 and 5 were considered positive for malignancy. Because endometriomas and teratomas can exhibit highly specific imaging features on conventional MRI alone (2,6), statistical analyses were performed both with and without the inclusion of

<table>
<thead>
<tr>
<th>Study group</th>
<th>n</th>
<th>Mean ADC</th>
<th>ADC entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>All benign lesions</td>
<td>30</td>
<td>1.90 ± 0.93</td>
<td>4.54 ± 0.44</td>
</tr>
<tr>
<td>Endometriomas and teratomas</td>
<td>11</td>
<td>1.68 ± 0.85</td>
<td>4.47 ± 0.53</td>
</tr>
<tr>
<td>Other benign lesions</td>
<td>19</td>
<td>2.04 ± 0.97</td>
<td>4.58 ± 0.39</td>
</tr>
<tr>
<td>All malignant lesions</td>
<td>9</td>
<td>2.00 ± 0.53</td>
<td>4.94 ± 0.40</td>
</tr>
</tbody>
</table>

*×10^-3 mm²/s.

(restricted diffusion) was considered suggestive of malignancy. However, the readers were not required to characterize a lesion showing restricted diffusion as malignant if the lesion showed other features highly specific for a benign diagnosis. The readers also recorded if the lesion demonstrated MRI features indicative of an endometrioma (a nonenhancing T1-hyperintense lesion exhibiting "shading" on T2-weighted images (13) or teratoma (a lesion demonstrating microscopic or macroscopic lipid (14).

RESULTS

Quantitative Analysis

Table 1 summarizes the mean ADC and ADC entropy within the study cohort. The slightly lower mean ADC among endometriomas and teratomas compared with other benign lesions was not statistically significant \( P = 0.353 \); in addition, endometriomas and teratomas showed similar ADC entropy as other benign lesions \( P = 0.853 \). The mean ADC of benign lesions was not significantly different from that of malignant lesions \( P = 0.768 \). However, the ADC entropy of benign lesions was significantly lower than that of malignant lesions \( P = 0.009 \). When endometriomas and teratomas were excluded, the other benign lesions continued to show no significant difference in mean ADC \( P = 0.833 \), but had significantly lower ADC entropy \( P = 0.016 \), compared with malignant lesions.

Tables 2 and 3 show the diagnostic performance in distinguishing benign and malignant lesions, including and excluding endometriomas and teratomas, respectively. When including all lesions, significantly greater diagnostic accuracy was achieved for ADC entropy than for mean ADC (83.8% vs. 56.8%, \( P = 0.018 \)). After excluding endometriomas and teratomas, diagnostic accuracy was greater for ADC entropy than for mean ADC, although this was not statistically significant (76.9 vs. 61.5, \( P = 0.246 \)).

Based on ROC analysis, mean ADC was most predictive of malignancy when greater than 2.15 \( \times 10^{-3} \) mm²/sec. The greater likelihood of malignancy in the setting of higher mean ADC was due to the lower mean ADC in endometriomas and teratomas than in other lesions. After excluding endometriomas and teratomas, mean ADC was most predictive of malignancy when less than 2.34 \( \times 10^{-3} \) mm²/sec. ADC entropy was most predictive of malignancy when greater than 4.92 when including all benign lesions and when greater than 4.91 when excluding endometriomas and teratomas.

Representative examples of benign and malignant lesions are shown in Figures 1–3.

Qualitative Analyses

The diagnostic performance of the qualitative assessments of the two readers, in terms of differentiating

Table 2

Diagnostic Performance of Mean Entropy, ADC Entropy, and Qualitative Reader Assessments, for Distinguishing Benign and Malignant Lesions, When Including All 39 Lesions in Study Cohort

<table>
<thead>
<tr>
<th>Test</th>
<th>Accuracy</th>
<th>Sens.</th>
<th>Spec.</th>
<th>NPV</th>
<th>PPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ADC</td>
<td>56.8% (21/37)</td>
<td>55.6% (5/9)</td>
<td>57.1% (16/28)</td>
<td>80.0% (16/20)</td>
<td>29.4% (5/17)</td>
</tr>
<tr>
<td>ADC entropy</td>
<td>83.9% (31/37)</td>
<td>66.7% (6/9)</td>
<td>89.3% (25/28)</td>
<td>89.3% (25/28)</td>
<td>66.7% (6/9)</td>
</tr>
<tr>
<td>R1, without DWI</td>
<td>73.0% (27/37)</td>
<td>66.7% (6/9)</td>
<td>75.0% (21/28)</td>
<td>87.5% (21/24)</td>
<td>46.2% (6/13)</td>
</tr>
<tr>
<td>R1, with DWI</td>
<td>81.1% (30/37)</td>
<td>66.7% (6/9)</td>
<td>85.7% (24/28)</td>
<td>88.9% (24/27)</td>
<td>60.0% (6/10)</td>
</tr>
<tr>
<td>R2, without DWI</td>
<td>97.3% (36/37)</td>
<td>88.9% (8/9)</td>
<td>100.0% (28/28)</td>
<td>96.6% (28/29)</td>
<td>100.0% (8/8)</td>
</tr>
<tr>
<td>R2, with DWI</td>
<td>94.6% (35/37)</td>
<td>88.9% (8/9)</td>
<td>96.4% (27/28)</td>
<td>96.4% (27/28)</td>
<td>88.9% (8/9)</td>
</tr>
</tbody>
</table>
benign and malignant lesions, is included in Tables 2 and 3. When including all lesions, R1’s accuracy was 73.0% using conventional MRI alone, compared with 81.1% for conventional MRI combined with DWI. R2’s accuracy was 97.3% for conventional MRI alone, compared with 94.6% for conventional MRI combined with DWI. After excluding endometriomas and teratomas, R1’s accuracy during the two sessions was 69.2% and 76.0%, respectively, and R2’s accuracy was 96.2% and 92.3%, respectively. R2’s qualitative assessments using conventional MRI alone achieved significantly greater accuracy than mean ADC, ADC entropy, and R1’s qualitative assessments, irrespective of the inclusion of endometriomas and teratomas (P = 0.003–0.039); in addition, R2’s qualitative assessments using conventional MRI combined with DWI achieved significantly greater accuracy than mean ADC and R1’s qualitative assessments, irrespective of the inclusion of endometriomas and teratomas (P = 0.004–0.042). R1’s performance using conventional MRI combined with DWI achieved nearly significantly greater accuracy compared with mean ADC (P = 0.050). No other comparison involving qualitative reader assessments was statistically significant (P > 0.10).

Of the nine endometriomas, R1 correctly identified six of these as endometriomas during both sessions, whereas R2 correctly identified seven endometriomas during both sessions. Of the two teratomas, both readers correctly identified one as a teratoma during both sessions.

DISCUSSION

A number of studies have investigated the role of DWI in the characterization of adnexal lesions (3–6) and have proposed mean ADC as a metric that can aid in this assessment (6,15). However, results in the literature regarding the utility of ADC in discriminating benign and malignant adnexal lesions have been conflicting (5,6,9). In an early article on ovarian DWI, Moteki and Ishizaka (15) demonstrated significantly lower mean ADC in malignant than in benign cystic adnexal lesions, although only cystic elements were evaluated in their study. In addition, this study used a maximal b-value of 106 s/mm²; this is much lower than b-values used in clinical practice today and indicates a strong perfusion contribution to their ADC measurements. On the other hand, Bakir et al and Fujii et al (3,9) both found no significant difference in mean ADC between benign and malignant adnexal lesions when evaluating the solid component. It was speculated that this overlap in mean ADC relates to desmoplastic stroma and interstitial edema in malignant lesions (3,9).

In our study, when evaluating the mean ADC of entire adnexal lesions, including cystic and solid components, we similarly found no significant difference in mean ADC between benign and malignant lesions. In fact, the mean ADC of these two groups was nearly identical. The lack of a significantly lower ADC in malignant lesions, as has been observed in other tissues, in part could relate to the low ADC observed in endometriomas and teratomas. However, even when these lesions were excluded from analysis, substantial overlap in mean ADC between benign and malignant lesions continued to be observed. We note that the SD of mean ADC of benign lesions was approximately half the average value, and this large variability in mean ADC across benign lesions also likely contributed to the poor discrimination of benign and malignant lesions using this metric.

ADC entropy represents the predictability of intensity characteristics within various tissues and increases as the distribution of signal intensities becomes more heterogeneous (10,12). In our study, there was a significant increase in ADC entropy in malignant adnexal lesions, and ADC entropy performed significantly better than mean ADC in discriminating benign and malignant adnexal lesions. The utility of ADC entropy in adnexal lesion characterization may reflect the sensitivity of entropy to macroscopic and microscopic cellular changes (12). Histopathologically, malignant epithelial ovarian tumors generally exhibit a mixture of cystic, papillary, and solid growth patterns, often with foci of necrosis, hemorrhage, and stromal invasion, while benign tumors generally have a more uniform composition (16). Our observation of increased ADC entropy within malignant adnexal lesions presumably reflects this increased structural heterogeneity within such lesions.

Similar to previous studies, we demonstrated a lower mean ADC in endometriomas and teratomas compared with other adnexal lesions (6,9). This observation has been attributed to the intracystic clot within endometriomas and keratonoid substance within teratomas (6,9,17). Potentially, the low ADC within these particular benign lesions could confound assessment of DWI and contribute to a misinterpretation. Despite this difference in mean ADC, we observed endometriomas and teratomas to exhibit nearly identical ADC

### Table 3 Diagnostic Performance of Mean Entropy, ADC Entropy, and Qualitative Reader Assessments, for Distinguishing Benign and Malignant Lesions, When Excluding 11 Endometriomas and Teratomas

<table>
<thead>
<tr>
<th>Test</th>
<th>Accuracy</th>
<th>Sens.</th>
<th>Spec.</th>
<th>NPV</th>
<th>PPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ADC</td>
<td>61.5% (16/26)</td>
<td>77.8% (7/9)</td>
<td>52.9% (9/17)</td>
<td>81.8% (9/11)</td>
<td>46.7% (7/15)</td>
</tr>
<tr>
<td>ADC entropy</td>
<td>76.9% (20/26)</td>
<td>66.7% (6/9)</td>
<td>82.4% (14/17)</td>
<td>82.4% (14/17)</td>
<td>66.7% (6/9)</td>
</tr>
<tr>
<td>R1, without DWI</td>
<td>69.2% (18/26)</td>
<td>66.7% (6/9)</td>
<td>70.6% (12/17)</td>
<td>80.0% (12/15)</td>
<td>54.5% (6/11)</td>
</tr>
<tr>
<td>R1, with DWI</td>
<td>76.9% (20/26)</td>
<td>66.7% (6/9)</td>
<td>82.4% (14/17)</td>
<td>82.4% (14/17)</td>
<td>66.7% (6/9)</td>
</tr>
<tr>
<td>R2, without DWI</td>
<td>96.2% (25/26)</td>
<td>88.9% (9/9)</td>
<td>100% (17/17)</td>
<td>94.4% (17/18)</td>
<td>100% (8/8)</td>
</tr>
<tr>
<td>R2, with DWI</td>
<td>92.3% (24/26)</td>
<td>88.9% (9/9)</td>
<td>94.1% (16/17)</td>
<td>94.1% (16/17)</td>
<td>88.9% (8/9)</td>
</tr>
</tbody>
</table>
entropy as other benign lesions. Furthermore, teratomas and endometriomas have highly specific characteristic imaging features on conventional MRI sequences that often allow for a definitive diagnosis (1,17) and thus obviate the need for additional functional sequences such as DWI to provide a diagnosis. Indeed, the majority of endometriomas and teratomas were correctly identified as such by both readers in our study, whether or not DWI was included during their subjective assessments.

We had two abdominal radiologists with different levels of experience qualitatively evaluate all lesions, both with and without DWI, to compare the performance of these subjective assessments with the quantitative metrics of mean and entropy of ADC. This analysis suggested a possible benefit of qualitative DWI
assessment for the less experienced radiologist. This reader’s accuracy increased from 73% to 81% after including DWI; lack of statistical significance of this increase may relate to the small number of malignant lesions in our cohort. This reader’s performance, whether or not including DWI, was greater than that of mean ADC. Alternatively, ADC entropy had an accuracy of 84%, which was similar to this reader’s performance when including DWI. However, an advantage of ADC entropy was that this metric incorporated all lesion voxels, whether cystic or solid, on all slices that included the mass. This approach allowed for a straightforward and objective measurement, mitigating the subjectivity inherent in placement of a small region-of-interest within a selected portion of a lesion. On this basis, ADC entropy may serve as a useful quantitative metric for adnexal lesion evaluation for less experienced readers.

It is interesting to note that the more experienced radiologist did not benefit from incorporation of qualitative DWI assessments in adnexal lesion characterization. This radiologist had 15 years of experience in women’s imaging and achieved 97% accuracy using conventional MRI alone, correctly classifying 36 of 37 lesions during this session. This nearly perfect performance using conventional MRI alone essentially precluded the ability to demonstrate a substantial benefit from any additional functional MR technique. The primary limitation of our study was the relatively small number of malignant lesions. This was due to the requirement of surgical resection and a histopathologic reference standard for all lesions, a feature that we feel reflects a key strength of our study. Further prospective studies would be helpful to validate our preliminary observations regarding a potential role of ADC entropy in assisting adnexal lesion evaluation.
Figure 3. A 70-year-old female with pathologically confirmed right ovarian malignant mixed Mullerian tumor. 

a: Sagittal turbo-spin echo T2-weighted image shows large complex mixed cystic and solid right ovarian mass (arrow).

b: Subtracted axial postcontrast gradient-echo T1-weighted image shows extensive solid enhancement within the right lateral aspect of the mass (arrow).

c: Diffusion-weighted image with b-value of 500 s/mm² shows increased signal intensity predominantly with the right lateral aspect of the mass (arrow).

d: ADC map shows heterogeneous ADC of the map, with areas of both low (solid arrow) and high (dashed arrow) ADC.

e: Section of tumor shows carcinoma (malignant epithelial) component in lower portion with sarcomatous component in upper portion. Frequent mitotic figures are present in the atypical neoplastic cells of both the malignant compacted epithelial and loosely arranged sarcomatous components (H&E stain; 400×). Whole-lesion VOI analysis yielded mean ADC of $1.43 \times 10^{-3}$ mm²/s and ADC entropy of 5.46. The high ADC entropy was consistent with malignancy in our cohort. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
characterization. In addition, we note that recent studies have shown potential of other functional techniques such as DWI with biexponential fitting (18), MR spectroscopy (19), and quantitative dynamic contrast-enhanced MRI (20) in adnexal lesion characterization; these techniques may also be worthwhile to pursue given the limited utility of mean ADC that was observed in this study.

In conclusion, ADC entropy exhibited significantly greater accuracy than the more traditional metric of mean ADC in distinguishing benign and malignant adnexal lesions. An advantage of ADC entropy was that it was measured in a straightforward and objective fashion by incorporating all lesion voxels. However, our data indicate that the potential benefit of entropy measurement decreases with greater reader experience.

REFERENCES