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Original research

The impact of an adrenal incidentaloma algorithm on the evaluation of adrenal nodules

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ABSTRACT

Objective: To determine the impact of the use of an electronic medical record tool on the evaluation of adrenal incidentalomas.

Methods: Retrospective chart review was used to compare rates of hormone testing and follow up imaging for adrenal incidentalomas. Patients whose radiology reports contained an algorithm with recommendations, based on our 2013 clinical guideline for the workup of these nodules, were compared to those whose imaging reports did not contain the algorithm.

Results: For patients whose Radiology reports contained the algorithm, 69% had hormonal testing versus 43% of controls ($p < 0.0001$). By contrast, 57% of study group patients had a follow up imaging study, compared to 51% of controls ($p = 0.1000$). However, when the 18% of controls that were given guidance by the radiologist to perform follow-up imaging were excluded from those who received no guidance, there was a statistically significant difference in the rate of follow up imaging (57% vs 48%, $p < 0.0001$).

Conclusion: Implementation of a clinical algorithm for the evaluation of adrenal incidentalomas in radiology reports and on the intranet site of a major clinical center led to improved rates of hormone testing. There was also a significant increase in the rate of follow up imaging, compared to when no guidance was given. Additional efforts to further improve performance are needed to increase the detection of clinically significant lesions, particularly hormone secreting tumors that should be removed.

Introduction

The aim of this study was to determine the impact of the use of an electronic medical record tool on the evaluation of incidentally discovered adrenal nodules (adrenal incidentalomas).

The 2002 National Institutes of Health (NIH) guidelines defined an incidentaloma as a 'clinically inapparent adrenal mass discovered inadvertently in the course of diagnostic testing or treatment for other clinical conditions that are not related to suspicion of adrenal disease.' Further, the definition excluded patients undergoing imaging procedures as part of the staging and workup of cancer [1]. Consistent recommendations for the follow up of these lesions have been lacking, due to the absence of large evidence-based trial data outlining an effective long term approach [2], and guidelines for management of adrenal incidentalomas continue to evolve.

In 2009, the American Association of Clinical Endocrinologists (AACE) and American Association of Endocrine Surgeons (AAES) published guidelines that reinforced recommendations for biochemical evaluation, both at the time of diagnosis and annually up to 5 years. The AACE/AAES guidelines also recommend additional imaging for lesions that do not fulfill criteria for surgical resection, namely those that are not pheochromocytomas, aldosteronomas, or cause Cushing's syndrome and have imaging characteristics of benign adrenal nodules, every 3–6 months for 1–2 years [3].

At the end of our study period, the 2016 European Society of Endocrinology (ESE) and European Network for the Study of Adrenal Tumors (ENSAT) clinical practice guideline emerged, recommending in patients with no known extra-adrenal malignancy, no further imaging for < 4 cm adrenal masses with clearly benign imaging features, due to virtually no risk of malignant transformation. For patients with an indeterminate lesion who do not undergo adrenalectomy, a 6–12 month repeat imaging study to assess for growth is recommended [4].

Subsequently, a 2017 American College of Radiology (ACR) white paper, which is a revision of the 2010 publication recommending

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biochemical testing of adrenal hormones only when "clinical signs and symptoms of adrenal hyperfunction are present" [5], was published, advising "routine biochemical testing for most incidentally discovered adrenal masses," based on AACE/AAES guidelines [6].

In 2008, we examined the laboratory and imaging evaluation of incidentally discovered adrenal nodules at a large metropolitan health care center [7]. We found that although most adrenal incidentalomas are benign, nonfunctional tumors that don't often change significantly in size, the adherence to existing guidelines for the clinical evaluation of these nodules, published in 2002 by the NIH [1], was poor. In our study, only 30% of patients with incidentalomas had documented laboratory evaluation for hormone secretory status, while 76% of patients had at least one follow-up CT scan. When patients were seen by an endocrinologist, the nodules were routinely evaluated for hormone secretion. We concluded that more education was needed for primary care clinicians about the appropriate evaluation and follow-up of these nodules. Other studies, both within the USA and in other countries, performed in community hospitals and university centers, have also confirmed low rates of hormone testing and imaging follow up for adrenal incidentalomas [8–10]. This study is a follow up to our 2008 study.

Patients and methods

We retrospectively reviewed imaging studies performed at Harvard Vanguard Medical Associates/Atrius Health, a multispecialty group comprised of primary care clinicians including family practitioners and internists, as well as staff radiologists and endocrinologists, that provides care to over 700,000 patients in and around the Boston area. We included all chest or abdominal CT scans or MRI studies done at multiple sites within our health system during the study period between April 2013 and October 2016. The scans were read either by a radiologist who incorporated the clinical algorithm in the Impression section of the report, and/or a link to the intranet site where the algorithm is posted, or a radiologist who did not have access to or utilize the algorithm or link. The clinical algorithm contains specific recommendations for the ordering clinician about laboratory evaluation and follow up imaging ([11], and Appendix Fig. 1).

Using a key word search for "adrenal nodule", "adrenal mass/masses" and "adrenal lesion(s)", 1020 patients with 1210 adrenal nodules were identified on imaging done during the 3.5 year study period. Radiology reports and medical records were manually reviewed by two individuals. Patients whose imaging study was performed as part of the workup of a known extraadrenal malignancy, or who had a subcentimeter, poorly defined nodule, or adrenal gland thickening were excluded from the study group. Patient groups were separated into those that had the clinical algorithm and/or link to the intranet site in their radiology reports, versus those that did not. For scans that did not contain the algorithm or link, the presence of a clinical recommendation by the radiologist was recorded. We separately analyzed those who had an adrenal nodule detected prior to the study period and compared them to those that were identified during the study period. Laboratory evaluation, including at least one of the following measurements: 24 h urine collection for catecholamines, metanephrines, VMA (vanillylmandelic acid), overnight dexamethasone suppression testing for serum cortisol or 24 h urine free cortisol, and when indicated for those with either hypokalemia or hypertension, determination of serum aldosterone to plasma renin activity ratio, was documented. When reported, lesion size, density, characteristics (including those based on CT washout studies), follow-up size, a clinical diagnosis or treatment associated with the adrenal nodule, and whether the patients were seen by an endocrinologist, were recorded. Statistical analysis was performed with chi-square testing.

This study was approved by the Institutional Review Board (IRB) of Harvard Pilgrim Health Care. Individual patient authorization was waived by the IRB, according to the HIPAA Waiver of Authorization criteria.

Table 1
Reported Size and Imaging Characteristics of All Adrenal Nodules.

Extraadrenal Malignancy (number of patients)	Size < 4 cm	Size ≥4cm	Low density, HU ≤ 10 or loss of signal intensity on MRI	High density, HU > 10, heterogeneous, or no loss of signal intensity on MRI
No (n = 893)	813	28	313	104
Yes (n = 127)	102	8	15	12
Total (n = 1020)	915	36	328	116

Results

During the study period, 1020 patients with one or more adrenal nodules were identified. 127 patients were known to have extraadrenal malignancy and their imaging was done for staging purposes. A total of 1210 adrenal nodules were found (see Table 1 for imaging characteristics). The average size for the 951 nodules that were measured was 17.6 mm. Of those, 915 measured less than 4 cm, and 36 nodules measured greater than or equal to 4 cm. Eight of the nodules that were > 4 cm in size were in patients who were known to have an extraadrenal malignancy. Hounsfield unit density (HU) or MRI signal intensity was reported for 444 nodules: 328 were described as low density, had HU ≤ 10, or loss of signal intensity on out-of-phase (OOP) MRI and 116 nodules were reported as either high density, heterogeneous, HU > 10, or had no loss of signal intensity on OOP MRI. Of the 328 with low density nodules, 313 were in patients without a known extraadrenal malignancy, and of the 116 high density nodules, 104 nodules were in patients without a known malignancy (Table 1).

Table 2
Use of Clinical Algorithm.

	Algorithm and/or link (183 scans)	Control (710 scans)	P-value
Follow up scan	105 (57%)	359 (51%)	0.1000
Prior scan	44 (24%)	247 (35%)	0.0057
No prior or post scan	34 (19%)	104 (15%)	0.1895
Hormonal Testing	126 (69%)	308 (43%)	< 0.0001
Seen by Endocrinologist	79 (43%)	291 (41%)	0.5929