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PERSPECTIVE

Caveat regarding CMS Merit-based Incentive Payment Systems incidental adrenal nodule measure

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Abstract

Current Medicare MIP measures encourage radiologists not to recommend follow-up for ≤ 1 cm adrenal nodules. However, a radiologist may be the first to discover a small, subclinical pheochromocytoma. As such, recognition of the enhancement pattern of pheochromocytoma is important to ensure detection and properly guide management, which begins with clinical and laboratory assessment for elevated catecholamines.

Keywords Merit-based Incentive Payment Systems (MIPS) · Incidental adrenal nodule · Pheochromocytoma · Computed tomography (CT)

The 2018 Merit-based Incentive Payment System (MIPS) measure for incidental abdominal lesions reads as follows [1]:

> Percentage of final reports for abdominal imaging studies for asymptomatic patients aged 18 years or older with one or more of the following noted incidentally with follow-up imaging recommended: liver lesion ≤ 0.5 cm, cystic kidney lesion ≤ 0.1 cm, or adrenal lesion ≤ 1.0 cm

Under current rules, if imaging follow-up is recommended on a ≤ 1 cm adrenal nodule, Medicare will apply a penalty to reimbursement unless there is a exception stated such as a known malignancy or known fever in an immunocompromised state. The ACR White Paper on incidental adrenal nodules indicates that "In general, an incidental adrenal mass that is < 1 cm in the short axis need not be pursued" [2]. The caveat for the MIPs measure and white paper relate to incidentally identified pheochromocytoma. Multiple studies demonstrate that the majority of pheochromocytomas (up to 57%) are discovered incidentally during imaging for other indications [3, 4]. Patients often have long standing elevated blood pressure, but a catecholamine-induced etiology hypertension may not have been clinically suspected or investigated. While the most common presenting symptom for a pheochromocytoma is hypertension, patients may have paroxysmal hypertension or be normotensive, particularly in cases identified incidentally [5].

The primary risk of missing a small pheochromocytoma lies in prolonged exposure to elevated levels of catecholamines. Historically, stroke and provoked hemodynamic instability during invasive surgical procedures were the some of the main causes of death due to pheochromocytoma [6]. Prolonged uncontrolled hypertension results in accelerated atherosclerosis and its most serious sequelae, including stroke and myocardial infarct. Less commonly, untreated pheochromocytoma may lead to tachycardia induced cardiomyopathy and fatal arrhythmias [6].

Pheochromocytoma has a range of imaging appearances, but hypervascularity is a finding that distinguishes pheochromocytoma (Fig. 1) from adrenal adenoma. Two studies published by Northcutt et al. [7, 8] delineated enhancement features specific for pheochromocytoma by comparing to lipid rich and lipid poor adenomas (Table 1).

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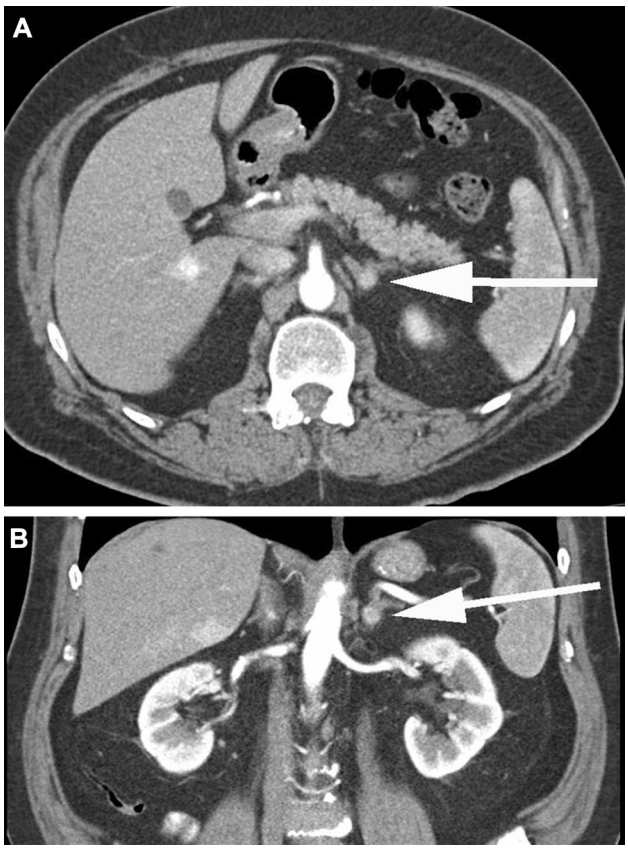

Fig. 1 58-year-old man with hypertension, von Hippel Lindau syndrome and a pathologically proven 9 mm left adrenal pheochromocytoma identified on renal protocol CT. Axial arterial phase CT image (**a**) and coronal arterial phase image (**b**) demonstrate a small hypervascular left adrenal nodule (arrow), which measured 102 HU on the arterial phase

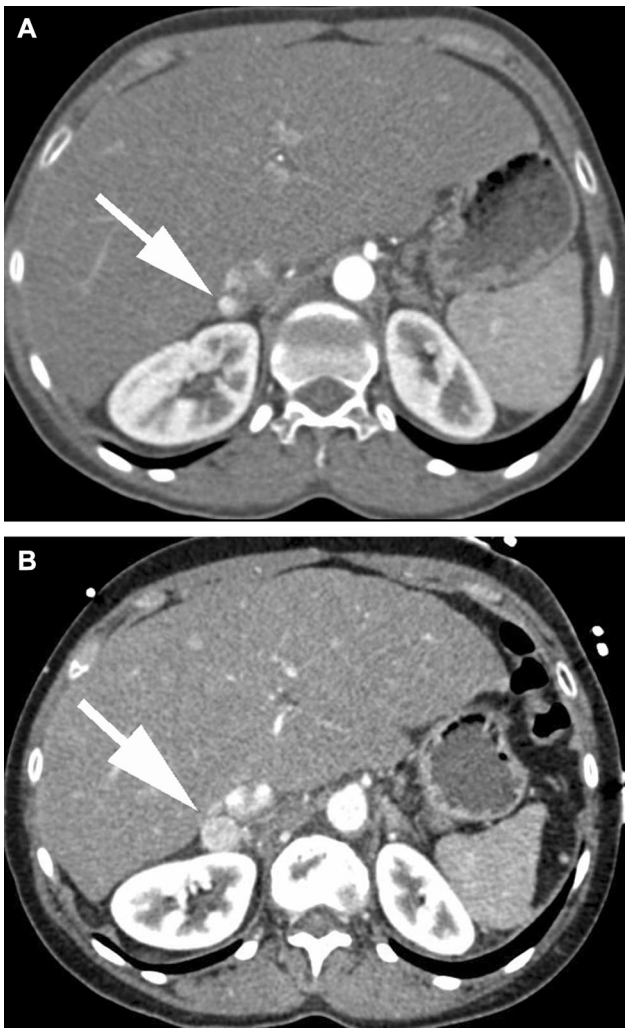

Fig. 2 28-year-old woman presented with shortness of breath, and pulmonary CTA demonstrates a hypervascular right adrenal nodule measuring 0.7 cm and 236 HU (**a**). Subsequent pulmonary CTA performed 7 years later reveals enlargement of the nodule to 1.6 × 1.4 cm (**b**), which enhanced to 145 HU arterial phase and 127 HU venous phase on dedicated adrenal CT for suspicion of pheochromocytoma. Urinary metanephrines were elevated to 3011 mcg/24 h (normal range 115–695 mcg/24 h). Right adrenalectomy confirmed a 2.2 cm pheochromocytoma

No adrenal adenomas enhanced to greater than 85 HU on the arterial phase [7] or surpassed 130 HU on the venous phase [6]. An enhancement threshold of 110 HU on arterial phase or 130 HU on venous phase has 100% specificity, with much lower sensitivity (38–58%) [7, 8]. Additionally, adenoma peak enhancement occurs during the venous phase, but 25% of pheochromocytomas will enhance more on the arterial phase than the venous phase [7].

The radiologist may be the first to discover a small, subclinical pheochromocytoma. If a ≤ 1.0 cm incidental adrenal nodule is suspected to be a pheochromocytoma based on its enhancement pattern, the most cost-effective management is clinical assessment in conjunction with laboratory testing [9]. Of note, serum metanephrine testing is more sensitive than urine metanephrines and catecholamines [10]. If the patient's metanephrines are not elevated, repeat laboratory testing in 1 year can dictate

Table 1 Imaging features of adrenal nodules suspicious for a pheochromocytoma on IV contrast enhanced CT

Arterial phase enhancement ≥ 110 HU (or ≥ 90 HU for higher sensitivity)
Venous phase enhancement ≥ 130 HU
Degree of arterial phase enhancement > degree of venous phase enhancement
Heterogeneous enhancement pattern

HU Hounsfield units

whether a follow-up CT is warranted. Further investigations are warranted to determine what percentage of these lesions grow, as demonstrated in Fig. 2. Finally, adrenal wash-out CT is not reliable for distinguishing pheochromocytoma from adenoma, and should not be recommended for further characterization [8].

In summary, given the MIPs measure suggesting that all adrenal nodules 1 cm should be considered benign, radiologists must be cognizant of CT findings of pheochromocytoma before dismissing a small nodule as clinically insignificant. Hypervascular adrenal nodules that meet enhancement thresholds warrant clinical and laboratory evaluation for pheochromocytoma.

Compliance with ethical standards

Conflict of interest Joseph Holman and Roberto Salvatori have nothing to disclosures. Elliot K. Fishman received grant funding from GE Healthcare and Siemens and Founder and stockholder of HipGraphics. Pamela T. Johnson is a Consultant to Oliver Wyman.

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