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Immediate laparoscopic adrenalectomy versus observation: cost evaluation for incidental adrenal lesions with atypical imaging characteristics

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Abstract

BACKGROUND: Because of controversy in the management of nonfunctional adrenal masses <6 cm with lipid-poor imaging characteristics, the study was conducted to compare the costs of observation versus immediate laparoscopic adrenalectomy.

METHODS: A total of 370 patients who were evaluated for incidental adrenal masses between January 1999 and December 2007 were identified, and 32 (8.7%) patients had lesions with imaging characteristics that were inconsistent with a benign adenoma (ie, atypical appearing). Sixteen patients underwent immediate surgery and 16 had observation with serial imaging and biochemical studies. The associated total costs were subjected to intention-to-treat analysis.

RESULTS: In the observation cohort, 7 patients converted and underwent adrenalectomy after a mean of 13.1 months. Initially, costs of immediate surgery exceeded those of observation ($12,015.72 vs $11,601.18, $P = .10$). After projecting costs of annual surveillance, a cost advantage for immediate surgery was demonstrated after 9 years ($P = .02$).

CONCLUSIONS: In patients with <6 cm atypical-appearing adrenal lesions, the costs of surgery and of observation are initially equal. After 9 years, the costs of surveillance exceed that of initial laparoscopic adrenalectomy.

The prevalence of incidental adrenal masses on cross-sectional imaging is 5%, based on several series,[1] and is known to increase with age.[2] With the aging population and the ever advancing sophistication of imaging techniques, the clinical management of adrenal incidentalomas will become increasingly relevant. In 2002, the National Institutes of Health published a consensus statement on the management of adrenal incidentalomas.[3] The panel concluded that patients with functional and/or >6 cm tumors should undergo adrenalectomy, those with nonfunctioning tumors <4 cm with benign imaging characteristics may be serially followed, and the appropriate management of lesions between 4 and 6 cm should consider factors such as radiographic characteristics, growth, and patient concern. The panel recognized that knowledge of the natural history of incidental adrenal lesions is limited, making decisions about duration and type of follow-up challenging.

An important consideration in the evaluation of incidental adrenal lesions is the characteristics on computed tomog-

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raphy (CT) or magnetic resonance (MR) imaging. Korobkin et al[4] were the first to describe features on CT and MR that are associated with lipid-rich adenoma, the so-called typical adrenal adenoma. These characteristics include low attenuation (<10 Hounsfield units) on unenhanced CT, absolute signal washout ≥ 60% or relative contrast washout ≥ 40% on contrast-enhanced CT, and/or loss of signal intensity on out-of-phase MR images. We recently reviewed a large series of adrenal lesions comparing imaging characteristics with histopathology and found that characteristics on CT or MR imaging consistent with lipid-rich lesions predict benign adrenal lesions with 100% positive predictive value.[5]

Our study also demonstrated that malignant adrenal lesions have imaging characteristics not associated with benign adenoma (ie, atypical appearance) and that most atypical-appearing adrenal lesions are benign, lipid-poor adenomas. Unfortunately, there is a paucity of literature to guide the management of atypical-appearing adrenal tumors. The options include resection or observation with serial imaging and biochemical studies, but the optimal duration and type of nonoperative follow-up are unknown.

In the modern era of adrenal surgery, laparoscopic adrenalectomy is associated with low morbidity and mortality.[6] When true equipoise exists, and within the current health care climate, it is reasonable to factor cost into clinical decision-making algorithms. We hypothesized that for adrenal incidentalomas with imaging characteristics inconsistent with benign adenomas, proceeding with minimally invasive adrenalectomy is less costly than pursuing serial follow-up. We compared the actual costs of immediate laparoscopic adrenalectomy with those of observation for patients with nonfunctional adrenal lesions that were associated with atypical-appearing imaging characteristics, and we also evaluated the long-term cost differential between the 2 management strategies.

Methods

We identified all patients age >18 years who were evaluated for incidental adrenal lesions at our institution between January 1, 1999 and December 30, 2007. All patients were routinely evaluated for hormonal hypersecretion (1-mg overnight dexamethasone suppression test and/or 24-hour urine cortisol, 24-hour urine fractionated metanephrines and/or plasma metanephrines, and, when indicated, plasma renin and aldosterone levels). All patients received CT and/or MR axial imaging. Patients with lesions that were functional, >6 cm, or suspicious for malignancy (ie, with malignant imaging features including irregular borders, local invasion, and/or adjacent lymphadenopathy and/or with a diagnosis of malignancy after needle biopsy) underwent immediate adrenalectomy. All other adrenal lesions were categorized according to characteristics on imaging. Characteristics inconsistent with benign adenoma were considered atypical appearing and included no loss of signal on out-of-phase MR, >10 Hounsfield units on non-contrast-enhanced CT, and/or lack of signal washout on contrast-enhanced CT. Once identified to have an atypical-appearing adrenal lesion, patients underwent either immediate surgery or observation with serial imaging and biochemical studies. The decision was based on patient and surgeon preference. The number and type of imaging studies (CT or MR), biochemical studies, operative procedure, postoperative complications, and length of follow-up were determined. One of 2 dedicated endocrine surgeons performed all operative procedures. In all cases, the procedure performed was a transperitoneal laparoscopic adrenalectomy under general anesthesia. Patients were seen for routine follow-up 7 to 10 days after surgery.

Cost-related outcomes

Data regarding actual hospital costs were provided by the hospital financial services department and obtained for each of the study patients. The first imaging study (initially discovering the incidentaloma) was not included in analysis, because it was a cost incurred by every patient. Our primary outcome of interest was total hospital costs, including direct costs associated with patient care (eg, laboratory tests, radiologic studies, and physician fees) and indirect costs that cannot be directly identified with patient care (eg, food services, laundry, and other facility fees). All actual hospital costs surrounding the operation and subsequent hospital stay were included in the costs associated with adrenalectomy.

According to the National Institutes of Health consensus recommendations,[3] patients undergoing observation should undergo annual non-contrast-enhanced CT of the abdomen, low-dose dexamethasone suppression test, and plasma metanephrine evaluation. Although the recommendations are for benign-appearing adenomas, we applied the same guidelines to our cohort because a specific recommendation for atypical-appearing lesions does not appear in the literature. To compare long-term costs between observation and immediate surgery patients, a threshold analysis was performed using our hospital's 2009 cost data (Table 1) projecting for ongoing yearly surveillance of observation patients and incorporating an annual 3% discount rate.

Statistical analysis

Our analysis was performed using an intent-to-treat model. Hence, patients who initially belonged to the observation arm and later converted to surgery remained in the observation cohort. Means and standard deviations were calculated for continuous variables, and absolute and relative frequencies were measured for discrete variables. Differences between groups were examined for statistical significance using the Mann-Whitney test in the case of continuous variables and χ^2 analysis in the case of discrete variables. All statistical analyses were performed using