ORIGINAL ARTICLE

Variation in Downstream Relative Costs Associated With Incidental Ovarian Cysts on Ultrasound

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Abstract

Purpose: To explore variation in downstream relative costs associated with ovarian cysts incidentally detected on ultrasound.

Methods: For 200 consecutive incidental ovarian cysts on ultrasound, ultrasound reports were classified in terms of presence of a radiologist recommendation for additional imaging. All downstream events (imaging, office visits, and surgery) associated with the cysts were identified from the electronic health record. Medical costs associated with these downstream events were estimated using national Medicare rates. Average cost per cyst was stratified by various factors; cost ratios were computed among subgroups.

Results: Average costs per cyst were 1.9 times greater in postmenopausal than premenopausal women. Relative to when follow-up imaging was neither recommended nor obtained, costs were 1.1 times greater when follow-up imaging was recommended but not obtained, 5.1 times greater when follow-up imaging was both recommended and obtained, and 8.1 times greater when follow-up imaging was obtained despite not being recommended. Costs were 2.5 times greater when the radiologist underrecommended follow-up compared with Society of Radiologists in Ultrasound (SRU) guidelines for management of ovarian cysts, 3.0 times greater when the ordering physician overmanaged compared with the radiologist's recommendation, as well as 1.7 times and 3.8 times greater when the ordering physician undermanaged and overmanaged compared with SRU guidelines, respectively. Four ovarian neoplasms, although no ovarian malignancy, were diagnosed in the cohort.

Conclusion: Follow-up costs for incidental ovarian cysts are highly variable based on a range of factors. Radiologist recommendations may contribute to lower costs among patients receiving follow-up imaging. Such recommendations should reflect best practices and support the follow-up that will be of likely greatest value for patient care.

Key Words: Ovarian cyst, ultrasound, costs, recommendations, utilization

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INTRODUCTION

Ovarian cysts are commonly detected on imaging [1] and are overwhelmingly benign [2,3]. Yet ovarian lesions on imaging remain a source of concern given the potential for cancer and the poor prognosis for advanced metastatic disease compared with the high survival for localized disease [4]. To address this issue, in 2010 the Society of Radiologists in Ultrasound (SRU) released recommendations to guide the follow-up management of incidental ovarian cysts detected on ultrasound [5]. The SRU recommendations call for varying intensity of follow-up depending on the patient's menopausal status and the cyst's size and complexity on imaging [5]. Application of the recommendations has been reported to help reduce radiologists' follow-up recommendations [6]. Nonetheless, even when radiologists and ordering physicians attempt to adopt the recommendations, a considerable fraction of benign cysts will still undergo follow-up imaging and possibly surgery [6-9]. This relates to not only the algorithms themselves within the

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SRU recommendations, but also potential incomplete adherence to the recommendations by radiologists and ordering physicians alike [8,9].

Given this context, incidental ovarian cysts are susceptible to highly variable downstream resource consumption despite their commonly benign nature. Such downstream resource consumption has the potential to become quite extensive and is important to consider given the rising and unsustainable expenditures of US health care [10], the wide variability of care delivery, as well as the increasing federal mandate to focus on value in health care delivery to improve the nation's health care system [11]. Nonetheless, downstream resource consumption has generally not been well studied by earlier investigations relating to incidentally detected ovarian cysts [1-3,7,12-15]. Given the wide variation among patients in the number and type of follow-up events that occur, one strategy for investigating resource consumption is to use estimates of cost to consolidate the chain of follow-up events occurring over time to a single overall numeric value. In this study, we explore variation in downstream relative costs associated with ovarian cysts incidentally detected on ultrasound.

METHODS

This retrospective study was HIPAA-compliant and approved by the local institutional review board, which provided a waiver of written informed consent. All cost data reflect estimates based on national rates (sources described below) and not actual local institutional costs.

The institutional enterprise data warehouse was searched for adult female patients undergoing a pelvic ultrasound in which the impression report mentioned the presence of an ovarian cyst. Cases in which the patient had a known history of ovarian cysts or in which the stated reason for the examination was to assess for ovarian pathology were excluded to provide a cohort of incidental cysts. The search provided results beginning in January 2013, reflecting the first month of availability of complete clinical data within the enterprise data warehouse. Consecutive patients were selected until reaching a predefined sample size of 200 unique patients (mean ± SD of patient age in final 200 patient sample of 46 ± 14 years). This process resulted in the inclusion of cysts initially detected on examinations performed through March 2014 (total of approximately 5,700 adult female pelvic ultrasound examinations performed during this interval). Patients' menopausal status at the time of the baseline examination was recorded when available in the electronic health record (EHR). Patients without a recorded menopausal status (n = 4) were classified as postmenopausal when reaching the age of 52 based on the average age of menopause in the United States [5].

The EHR was manually reviewed in detail to identify all downstream events that occurred related to the incidentally detected ovarian cysts in the 200 patients (mean follow-up interval among the 200 patients of 374 ± 425 days). These events were categorized into general broad categories: pelvic ultrasound; pelvic MRI; abdominopelvic CT; ^{18}F-fluorodeoxyglucose whole-body PET/CT; follow-up office visit; and pelvic surgery. For patients in whom follow-up imaging was obtained, the imaging modality of the first obtained follow-up imaging study after the initial cyst detection was recorded. The timing of the downstream events relative to the baseline examination was also recorded, and the time interval between the initial pelvic ultrasound and the final follow-up event was computed. In addition, any confirmed diagnoses of ovarian neoplasm were recorded.

The impressions of the baseline examinations were manually reviewed and classified in terms of whether or not they recommended follow-up imaging. Reports that did not provide an explicit recommendation were deemed to not recommend any follow-up imaging. These radiologist recommendations were then compared against the SRU recommendations and classified as adherent or as representing overrecommending or underrecommending relative to the recommendations. This classification was based on the patient's menopausal status, the cyst size, as well as description of the cyst within the ultrasound report. Examinations with a vague recommendation (eg, for follow-up imaging, but not specifying the modality or time interval of such follow-up) could not be adequately compared with the SRU recommendations given the specificity of such recommendations and were therefore classified as giving an incomplete recommendation rather than as representing over- or underrecommending. Next, cases were classified in terms of whether or not any follow-up imaging was obtained. The actual follow-up management that occurred was then classified as adherent, overmanagement, or undermanagement relative to the radiologists' recommendations (regardless of whether either were adherent to the SRU recommendations) and as adherent, overmanagement, or undermanagement relative to the SRU recommendations (regardless of the radiologists' recommendations) (Fig. 1). Each case was also classified in terms of whether follow-up imaging was neither recommended nor obtained, was not recommended but was obtained, was