Gynecologic Oncology 130 (2013) 421–425

Contents lists available at SciVerse ScienceDirect

Gynecologic Oncology

journal homepage: www.elsevier.com/locate/ygyno

Cost analysis of colposcopy for abnormal cytology in post-treatment surveillance for cervical cancer

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HIGHLIGHTS

- Colposcopy adds substantial cost to surveillance for recurrent cervical cancer.
- Colposcopy for low grade Pap does not improve detection of salvageable recurrences.

ARTICLE INFO

Article history:
Received 13 February 2013
Accepted 26 May 2013
Available online 5 June 2013

Keywords:
Surveillance
Cost analysis
Cervical cancer
Colposcopy

ABSTRACT

Objective. The aim of this study was to estimate cost and outcomes associated with colposcopy following abnormal Pap for women with a history of cervical cancer.

Methods. Decision models compared the costs and number of isolated local recurrences (ILR) detected using two strategies, colposcopy and no colposcopy, for women with a history of cervical cancer and low grade or high grade Pap. Clinical data for input were derived from a cohort of women with a history of cervical cancer undergoing surveillance Paps at 2 institutions. Costs were obtained using national reimbursement data.

Results. Five hundred fifty-six patients underwent 2900 surveillance Paps. Twenty-seven of 50 women with a low grade Pap underwent colposcopy. One of 3 recurrences in the colposcopy group was an ILR diagnosed colposcopically. Colposcopy following low grade Pap costs $354 more and resulted in a lower rate of diagnosis of ILR compared to no colposcopy (3.7% vs 8.6%). Sixty of 78 women with a high grade Pap underwent colposcopy. Three of 15 recurrences in the colposcopy group were ILR diagnosed colposcopically. Colposcopy following high grade Pap costs $623 more than no colposcopy but resulted in a higher rate of diagnosis of ILR (5% vs 0%; $7481 per additional ILR).

Conclusions. Colposcopy following low or high grade surveillance Pap smear adds substantial cost to the management of women with cervical cancer. Only colposcopy following a high grade Pap is associated with a higher probability that cervical cancer recurrence will be detected when salvageable. These findings support withholding colposcopy for abnormal surveillance Pap tests less than high grade.

Introduction

Cervical cancer is the third most common gynecologic malignancy in the United States, with approximately 12,710 new cases and 4290 deaths occurring annually [1]. The overall five-year survival for all women diagnosed with cervical cancer living in the US is 70%, and up to 90% for women presenting with localized disease [1]. The International Federation of Gynecology and Obstetrics reported that the overall risk of recurrence was 22.2%, but as high as 64% to 74% for patients presenting with a stage IV cancer [2]. There is a substantial difference in the site of recurrence between early and advanced stages, with a predominance of local recurrence in early stages, and a predominance of distant or multiple sites of recurrence in advanced stages [2]. In a recent systematic review of studies reporting data on follow-up strategies for patients with cervical cancer, 14% to 57% of patients had a central recurrence, and 15% to 61% of patients had distant or multiple sites of recurrence [3]. While isolated central recurrences are often salvageable, distant recurrences are rarely amenable to curative therapy.

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http://dx.doi.org/10.1016/j.ygyno.2013.05.037

Post-treatment surveillance for cervical cancer to identify salvageable recurrence is largely determined by convention, as there is a paucity of evidence regarding the most effective protocol for post-treatment surveillance. The most recent National Comprehensive Cancer Network (NCCN) guidelines recommend interval history and physical examination every 3 to 6 months for 2 years, every 6 to 12 months for another 3 to 5 years, and then annually after 5 years of increased surveillance, with cervical and/or vaginal cytology as indicated for detection of lower genital tract dysplasia [4]. This increased frequency of surveillance is based upon the premise that early detection of recurrent disease will lead to improved outcomes from potentially curative salvage therapy [5]. Recent evidence from a large retrospective review of cervical/vaginal cytology after treatment for cervical cancer demonstrated that a third of cervical cancer survivors had abnormal Pap tests, but very few of these tests led to diagnosis of recurrence [6]. Similarly, in a literature review on this topic, only 2 published studies have shown a survival benefit resulting from post-treatment surveillance [7]. Neither the NCCN nor the American Society for Colposcopy and Cervical Pathology guidelines provide recommendations for management of abnormal cytologic results obtained in the post-treatment setting.

In addition to the possible impact on survival, another important aspect that should be taken into consideration in evaluating post-treatment surveillance is the impact of the chosen strategy on healthcare expenditures and resource allocation. This is particularly relevant in the current era of rising cancer costs, which are projected to rise from $104 billion in 2006, to over $173 billion in 2020 [8]. The objectives of this study, in a population of women with a personal history of cervical cancer are: [1] to describe the outcomes of women who are evaluated with colposcopy compared to those who do not receive colposcopy following abnormal Pap test; [2] to model the cost and outcomes associated with performance or non-performance of colposcopy following an abnormal Pap test.

Methods

Study population

After obtaining Institutional Review Board approval, we identified all patients treated for invasive cervical cancer at Washington University in St. Louis, Missouri, and Greater Baltimore Medical Center in Baltimore, Maryland, through local cancer registries and patient databases. All women with a histologically confirmed diagnosis of cervical cancer who were treated at these two institutions from the year 2000 to 2010 were included. Patients were excluded if they did not have at least one post-treatment cytologic or colposcopic evaluation. Decisions regarding the clinical management of abnormal cervical cytology were made at the discretion of the treating physician. Pathologic findings of cervical and vaginal intraepithelial neoplasia were combined for analysis. Pap tests were read according to the Bethesda system for cervicovaginal cytologic diagnosis with the following categories: negative for intraepithelial lesion or malignancy (NILM), atypical squamous cells of undetermined significance (ASC-US), atypical squamous cells of undetermined significance with high risk human papillomavirus positivity (ASCUS + HPV), low grade squamous intraepithelial lesion (LSIL), high grade squamous intraepithelial lesion (HSIL), atypical glandular cells (AGC), atypical squamous cells favor high grade (ASC-H), and favor neoplasia. There was no central pathologic review of the Pap tests, and all patients with ASCUS Pap results had reflex HPV testing. The medical record and pathology reports were abstracted and data regarding occurrences and results of surveillance Pap tests, occurrences and results of colposcopic evaluations, site of cervical cancer recurrence, method of cervical cancer recurrence, and vital status were recorded.

Model and analysis

For the purposes of the current analysis, Pap test results were categorized as follows: NILM and ASCUS with negative high risk HPV results were considered normal; ASCUS + HPV and LSIL results were categorized as low grade; HSIL, AGC, ASC-H, and favor neoplasia were categorized as high grade. Recurrence was defined as invasive cancer. Simple decision models were constructed using commercially available software (TreeAge Pro Suite, Williamstown, MA) to compare the costs and the number of isolated local recurrences detected using two surveillance strategies for women with a history of cervical cancer and either a low grade or high grade Pap result: [1] colposcopy; [2] no colposcopy. Decision trees mirrored the clinical outcome diagrams presented in Figs. 1 and 2. Outcomes were modeled based on retrospective cohorts of women with a low grade Pap and women with a high grade Pap following a diagnosis of invasive cervical cancer. Costs of colposcopy (Current Procedural Terminology (CPT) code 57421 = $169) and of treatment for high grade dysplasia (CPT code 57065 for laser ablation, plus Ambulatory Payment Classification code 0193 = $1228) were obtained using 2009 Medicare national unadjusted average physician and hospital outpatient reimbursement data and adjusted to 2012 dollars. Costs associated with the performance of Pap tests were not incorporated into the models because these costs were incurred universally by all cohorts. Due to the small retrospective cohort of women with abnormal Pap test on which our model is based, we did not model events occurring after a diagnosis of cervical cancer recurrence.

Results

We identified a total of 556 patients with invasive cervical cancer who met inclusion criteria and collectively underwent 2900 surveillance Pap tests, with a median follow-up of 34 months. As shown in Table 1, the vast majority (95.6%) of Pap tests were normal. A total of 148 colposcopic evaluations were performed for 233 abnormal Pap tests. Among the entire cohort, 97 (17.4%) patients were diagnosed with a recurrence. Of the 97 patients in the cohort who were diagnosed with a recurrence, less than one third (28.9%) had either a low grade or high grade surveillance Pap test result.

Among 50 women with a low grade Pap following a diagnosis of invasive cervical cancer, 27 underwent colposcopy and 23 did not undergo colposcopy (see Fig. 1). Among the women with a low grade Pap who underwent colposcopy, on average, 1.6 colposcopies were performed per woman. Table 2 shows all recurrences in the group of women with a low grade Pap result. There were 3 (11%) recurrences among women with a low grade Pap who underwent colposcopy, 1 of which (33%) was isolated, local, and diagnosed due to colposcopy. The other two recurrences were distant and were detected by positron emission tomography (PET) scan. Of the 6 (26%) recurrences among women with a low grade Pap who did not undergo colposcopy, 2 (33%) were isolated and local. One of these isolated and local recurrences was detected by physical examination; the other was detected by physical examination and CT scan. The other four recurrences among women with a low grade Pap who did not undergo colposcopy were distant. The colposcopy strategy costs on average $354 more than no colposcopy and was associated with a lower rate of diagnosis of isolated pelvic recurrence (8.6% compared to 3.7%).

Among 78 women with high grade Pap following a diagnosis of invasive cervical cancer, 60 underwent colposcopy and 18 did not undergo colposcopy (see Fig. 2). Among the women with a high grade Pap who underwent colposcopy, on average, 1.7 colposcopies were performed. Table 3 shows all recurrences in the group of women with a high grade Pap result. There were 15 (25%) recurrences among the 60 women with a high grade Pap who underwent colposcopy, 9 of which were isolated and local. Of these 9 isolated and local recurrences among the 60 women with a high grade Pap who underwent colposcopy, 5 were diagnosed as a direct result of the colposcopy. Therefore,