Gynecologic Oncology 137 (2015) 285–290

Contents lists available at ScienceDirect

Gynecologic Oncology

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

Preoperative imaging of uterine malignancy: A low-value service☆,☆☆,★

William Baker *, Elizabeth Pelkofski, Jonas Te Paske, Sarah Erickson, Linda Duska

Department of Obstetrics & Gynecology, University of Virginia, Charlottesville, VA, United States
Department of Radiology and Medical Imaging, University of Virginia, Charlottesville, VA, United States

HIGHLIGHTS

- Many patients undergo CT or MRI imaging prior to hysterectomy for uterine malignancy.
- Preoperative CT or MRI is unlikely to alter surgical planning.
- Preoperative imaging for uterine cancer patients should be identified as a low value service.

ARTICLE INFO

Article history:
Received 21 November 2014
Accepted 13 February 2015
Available online 25 February 2015

Keywords:
Uterine cancer
Imaging
Health care delivery outcomes
Minimally invasive surgery

ABSTRACT

Objective. The aim of this study is to examine the value of computed tomography (CT) or magnetic resonance imaging (MRI) before surgical treatment of uterine malignancy.

Methods. Retrospective chart review was undertaken of women who underwent hysterectomy for uterine cancer at the University of Virginia. Radiologic reports were examined for evidence of cervical or extrauterine disease or incidental findings and correlated with detection of extrauterine disease at surgery.

Results. Overall, 204 of 448 patients (45%) had preoperative imaging. Scans were ordered nearly evenly by referring clinicians and gynecologic oncologists (GO) (95 vs. 122, 44% vs. 56%). Imaging was most common among patients with grade 3 endometrioid or non-endometrioid histology (86 of 101, 85%). Women referred with low grade disease had more false positive (4 of 112, 4%) than true positive scans (2 of 113, 2%). Overall, 23 of 190 (12%) reviewed preoperative scans indicated suspected extrauterine disease. Two of these 23 women were low risk by intra-operative "Mayo criteria" and had stage 1A disease; 14 of 23 (61%) had stage II or greater disease.

Conclusions. Preoperative CT or MRI is of low value in predicting extra-uterine disease among uterine cancer patients with low grade disease. Women with low grade disease had false positive results more frequently than true detection of extrauterine disease. Abnormal imaging findings are more common and predictive of extrauterine disease in women with grade 3 or non-endometrioid histology but the value of these scans remains unclear.

Introduction

It is estimated that more than 49,000 women were diagnosed with uterine malignancy in the United States in 2013, with more than 8100 women dying of this disease [1]. Uterine cancer is the most common gynecologic malignancy and a common indication for hysterectomy by gynecologic oncologists. Treatment of uterine malignancy in the United States costs an estimated $2.62 billion in 2010 and it is projected that annual national costs will increase to as high as $4 billion by 2020 [2].

"Low-value services" are variably defined but include medical tests, treatments, or procedures that should be avoided due to minimal prognostic value, potential harm, or comparably effective less expensive alternatives [3]. Overuse of imaging studies has been targeted as a source of rising healthcare costs in the United States and may subject patients to potentially injurious or expensive additional evaluation [4]. Among services listed as low-value by various specialty groups in the Choosing Wisely campaign begun by the American Board of Internal Medicine (ABIM) foundation, radiological services are the most common, making up 29% of identified low-value services [5].

☆ Acknowledgments: Mark Smolkin, MS provided statistical review and Peyton Taylor, Jr., MS, MD assisted with revision of this manuscript.
☆☆ The findings of this study were presented in poster format at the SGO Annual Meeting on Women's Cancer March 22–25, 2014.
★ Funding: No external funding sources.
* Corresponding author at: PO Box 800712, Division of Gynecologic Oncology, Department of Obstetrics & Gynecology, University of Virginia Health System, Charlottesville, VA 22908-0712, United States.
E-mail address: wdbaker@virginia.edu (W. Baker).

http://dx.doi.org/10.1016/j.ygyno.2015.02.015
0090-8258/

Uterine carcinoma commonly presents as postmenopausal bleeding and more than 50% of women present for medical evaluation within 14 days of clinical symptoms [6]. The diagnosis is most often made by outpatient endometrial biopsy or curettage prior to referral to a gynecologic oncologist (GO). Most patients with uterine cancer present with stage I disease (approximately 70%) [7]. A surgical-pathologic staging study (GOG 33) revealed women with clinical stage I disease to have lymphatic metastases in approximately 11% of cases with 9% having pelvic nodal and 6% paraaortic nodal disease [8].

Numerous studies have evaluated the accuracy of preoperative computed tomography (CT) and magnetic resonance imaging (MRI) to predict stage of uterine cancer as well as depth of myometrial and/or cervical invasion [9–11]. The sensitivity of preoperative imaging for detecting nodal metastasis is 45% for CT and 72% for MRI in pooled analyses [9]. Studies describing utilization of positron emission tomography (PET) or combined PET/CT report modestly improved sensitivities but the relative benefit and cost effectiveness of these imaging studies do not seem to justify their increased cost [12,13]. Neither the 2014 National Comprehensive Cancer Network (NCCN) guidelines nor the 2013 American Congress of Obstetricians and Gynecologists (ACOG) practice bulletin on uterine cancer recommend preoperative imaging beyond chest radiograph for endometrial cancer clinically confined to the uterus [11,12]. The NCCN guidelines reserve imaging for when clinically indicated to evaluate non-endometrioid cancers or in cases where stage II disease is suspected [14]. The ACOG practice bulletin states that imaging is not necessary and surgeons should be prepared to resect metastatic disease if present [15]. As both guidelines recommend surgical staging of medically operative patients, the potential value of imaging is accurate detection of extrauterine disease or incidental findings that lead to altered surgical management.

Despite the above guidelines, the utilization of pre-operative imaging in endometrial cancer patients in central Virginia continues to be significant. While many of these scans are ordered by the referring providers (most often benign gynecologists or family physicians), they are also ordered by gynecologic oncologists prior to surgery, primarily to assist in surgical planning (for example, making a decision between minimally invasive surgery versus laparotomy). It was our overall impression that regardless of the ordering provider, pre-operative imaging was generally not useful in treatment planning. We undertook the current study to retrospectively investigate the rate of pre-operative imaging in our patient population and determine who orders these scans, with the ultimate goal of determining the value of these studies in surgical planning.

Methods

Following approval by our institutional review board, all women with a final diagnosis of uterine malignancy who underwent hysterectomy between January 1st, 2009 and December 31, 2012 were identified using the University of Virginia Health System cancer registry. Patients included were referred with complex atypical hyperplasia (CAH) or endometrial cancer. Patients referred for evaluation of a pelvic mass, or cases where non-corpus malignancy was suspected, were excluded.

Data abstracted from the institutional electronic medical record by authors (W.B. & J.T.) included demographic details regarding diagnosis at time of referral to our cancer center, imaging studies obtained prior to referral, imaging studies obtained by our surgeons, preoperative diagnosis, details of surgical management including approach to hysterectomy (laparotomy, laparoscopy, robotic-assisted laparoscopy, or vaginal), number and location of lymph nodes resected, removal of omentum or additional surgical procedures, and details from frozen and final pathology.

Among patients who underwent imaging, radiologic reports were abstracted for evidence of pelvic or paraaortic lymphadenopathy, cervical tumor involvement, extrauterine disease, or incidental findings based upon the radiologist's assessment. Suspicious lymphadenopathy was determined not by a specified radiographic nodal dimension but whether the radiologist reported an abnormal or suspicious appearance. All imaging scans were reviewed by attending radiologists. Due to the rural nature of our referral network imaging scans were often performed outside of the University of Virginia Health System, particularly those obtained before referral to a gynecologic oncologist. Images from referring clinicians are generally made available on our picture archiving and communication system (PACS) and reviewed by surgeons preoperatively.

Imaging studies were classified as true positive when cervical invasion, retroperitoneal lymphadenopathy, or extrauterine disease was identified and the patient had advanced stage disease following surgical staging. Imaging studies were classified as false positive when evidence of lymphatic or other extrauterine disease was reported and the patient had disease confined to the uterus. True negative scans are normal results in patients with disease confined to the uterus. Cases with normal imaging results but advanced stage disease (stage II–IV) were classified as false negatives.

Statistical analysis was performed using Microsoft excel or SAS version 9.3. Categorical variables were analyzed using Chi square tests of association.

Results

During the 4 year study period, 512 women were treated for uterine malignancy at the University of Virginia. Of these, 448 met inclusion criteria and were included in the analysis. The patient and tumor characteristics for the study population are shown in Table 1. Mean age at the time of surgery was 62.9 (range 26–93). Mean preoperative body mass index (BMI) was 35.3 kg/m^2 (range 15–73 kg/m^2) in the 437 patients for whom data were available, with 300 of 437 (67%) obese (BMI $\geq$ 30 kg/m^2).

Table 1
Patient demographics.

	($N = 448$)
Age, mean (range), y	62.9 (26–93)
BMI, mean (range), kg/m^2	35.3 (18–73)
Final histology, n (%)	
Endometrioid	383 (85%)
Endometrioid Grade 1	288 (64%)
Endometrioid Grade 2	59 (13%)
Endometrioid Grade 3	36 (8%)
Non-endometrioid	65 (15%)
Papillary serous/clear cell	42 (9%)
Carcinosarcoma (MMMT)	23 (5%)
2009 FIGO surgical stage, n (%)	
IA	319 (71%)
IB	57 (13%)
II	17 (4%)
IIIA	11 (3%)
IIIC1	22 (5%)
IIIC2	16 (4%)
IVA	1 (<1%)
IVB	5 (1%)
Route of hysterectomy, n (%)	
Laparotomy	196 (44%)
Robotic assisted laparoscopy	176 (39%)
Traditional laparoscopy	73 (16%)
Vaginal	3 (1%)
Additional surgical procedure, n (%)	
Pelvic lymphadenectomy	222 (49%)
Para-aortic lymphadenectomy	112 (25%)
Omental biopsy or omentectomy	48 (11%)
Intraoperative frozen pathology, *n* (%)	285 (64%)