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Comparison of spinal and general anesthesia approaches for MRI-guided brachytherapy for cervical cancer

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ABSTRACT

PURPOSE: To evaluate the impact of general versus spinal anesthesia on postprocedure narcotic use and of extradepartmental planning MRI on treatment time in high-dose-rate brachytherapy for cervical cancer.

METHODS AND MATERIALS: Twenty-five patients (10 general anesthesia and 15 spinal anesthesia) who collectively received 96 brachytherapy fractions (39 general and 57 spinal) for cervical cancer between February 2015 and April 2017 were retrospectively reviewed. Over this time, institutional practice shifted from operating room–based general anesthesia to intradepartmental spinal anesthesia for tandem and ring placement. In some cases, extradepartmental planning MRI was performed. Administrations of narcotics after tandem and ring placement were recorded, and dosages were converted to intravenous (IV) morphine equivalents. Total treatment times for fractions using spinal anesthesia were documented.

RESULTS: The general anesthesia group included a significantly higher proportion of fractions using postprocedure narcotics (100.0% vs. 31.6%, $p < 0.0001$). The general and spinal anesthesia groups required an average of 16.9 mg (range: 2.0–59.2) and 1.4 mg (range: 0.0–17.5) IV morphine equivalents per fraction, respectively ($p < 0.0001$). When using spinal anesthesia, the average total treatment time with MRI was 311.0 min (range: 218–379) versus 306.6 min (range: 177–429) without MRI ($p = 0.810$).

CONCLUSION: Intradepartmental spinal anesthesia results in significant decreases in postprocedure narcotic usage compared with operating room–based general anesthesia. When using spinal anesthesia, addition of extradepartmental MRI does not increase treatment time. This workflow avoids transporting patients under general anesthesia, minimizes the need for MRI-compatible monitoring, allows treatment of multiple patients per day, and provides adequate analgesia.

Keywords: Cervical cancer; Brachytherapy; Spinal anesthesia; Postprocedure narcotic; MRI-guided planning

Introduction

In 2017, there were an estimated 12,820 new cases of cervical cancer in the United States and an estimated 4210 deaths occurred as a result of this malignancy (1). Globally, cervical cancer represents the fourth most common malignancy among women (2). In the treatment of locally advanced cervical cancer (International Federation of Gynecology and Obstetrics [FIGO] Stages IB2 to IVA), the current standard of care is concurrent chemoradiation with weekly cisplatin and daily external-beam radiation therapy (EBRT) followed by intracavitary or interstitial brachytherapy.

The current guidelines from the American Brachytherapy Society (ABS) do not specify a preferred anesthesia approach for applicator placement and the type of anesthesia modality used varies by institution based on multiple factors including the availability of clinical staff, logistics and configuration of treatment centers, and personal preferences of providers (3).

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According to an international survey of the Gynecologic Cancer Intergroup completed in 2009, 46% of anesthesia-assisted high-dose-rate (HDR) brachytherapy device insertions for cervical cancer involved general anesthesia and 27% used spinal anesthesia with intravenous (IV) conscious sedation and oral pain medications representing alternative methods (4). Given that the brachytherapy treatment applicator must remain in place for simulation, planning, and treatment delivery, continued pain control after its initial placement is a key consideration in improving patient experience and willingness to complete treatment as well as consistency in applicator position for treatment accuracy. In this setting, analgesia can be provided via a number of methods, such as oral and IV medications including narcotics and continuous epidural or spinal anesthesia.

An additional aspect of HDR brachytherapy treatment that differs between institutions is the type of imaging modality used for treatment planning. According to the Gynecologic Cancer Intergroup study, 57% (41/72) of surveyed centers worldwide used CT imaging after brachytherapy applicator placement, whereas 25% (18/72) of centers used MRI. Of those centers using MRI, 56% (10/18) only obtained this imaging for the first fraction along with CT imaging for each fraction (4). A 2014 survey of the ABS showed that 95% of respondents reported using CT imaging for dose specification to the target in HDR brachytherapy for cervical cancer. Since a similar survey in 2007, the percentage of respondents using MRI for this purpose rose from 2% to 34% ($p < 0.0001$) (5). Both the Groupe Européen de Curiethérapie−European Society for Radiotherapy & Oncology (GEC-ESTRO) and ABS guidelines state the superiority of MRI for delineating gross tumor volume and adjacent normal tissue and the impact of MRI-guided planning has been increasingly studied (3,6−10). Despite the advantages of MRI in terms of treatment planning, practical workflow concerns represent additional factors to consider when determining optimal analgesia for gynecologic brachytherapy. These include longer duration of MRI scans compared with CT imaging and the need at many institutions to transport the patient to an MRI scanner outside of the radiation oncology department.

The goal of this study was to evaluate the impact of spinal versus general anesthesia on postprocedure analgesia. In addition, given the logistical concerns with MRI-based planning described previously, the effect of extradepartmental planning MRI on total treatment time for fractions using spinal anesthesia was also assessed.

Methods and materials

This study involved a retrospective review of the medical records of 25 patients who underwent HDR brachytherapy for cervical cancer between February 2015 and April 2017 at the University of Cincinnati. A total of 96 fractions (39 with general anesthesia and 57 with spinal anesthesia) were evaluated. In late 2015, a shift in institutional practice occurred from the use of general anesthesia in the operating room (OR) for tandem and ring (T&R) placement followed by treatment delivery in the Department of Radiation Oncology to intradepartmental spinal anesthesia for both T&R placement and treatment delivery. Spinal anesthesia was applied by members of the Department of Anesthesiology just before T&R placement in the Department of Radiation Oncology. The dose varied according to provider preference, but typically involved 1.4 to 1.6 mL of 0.75% bupivacaine with a 3-min sitting period after placement to allow for a dense block of the perineal region and to limit overall sympathectomy. Minimal sedation with midazolam during placement was typically sufficient. This allowed for rapid patient recovery and minimization of anesthesia time. Contraindications to spinal anesthesia included a platelet count of <85,000/μL and current use of anticoagulants. If these issues were present, patients underwent monitored anesthesia care using IV propofol, ketamine, fentanyl, and dexmedetomidine. These patients were excluded from this analysis. In each case, packing was performed with saline-soaked gauze placed in a C-shaped fashion from left to right between the rectal retractor and ring for applicator stability. After T&R placement with either general or spinal anesthesia, CT simulation and HDR treatment occurred in the Department of Radiation Oncology. In some fractions, MRI-based planning was used that involved transporting the patient to the extradepartmental radiology suite after T&R insertion and before intradepartmental CT simulation and treatment delivery for one or more fractions. The radiology suite was located in the main hospital, which was connected by tunnel to the Department of Radiation Oncology. Transport for MRI procurement took approximately 5 min each way. Images from CT simulation were then fused with those obtained with MRI for treatment planning.

From the medical records, data were collected for age, MRI utilization in treatment planning, FIGO stage, and opioid tolerance as defined by the U.S. Food and Drug Administration (11) for demographic comparisons between the groups of patients receiving general and spinal anesthesia. Opioid tolerance was formally assessed to compare potential baseline differences in preprocedural opioid use in the general anesthesia and spinal anesthesia groups. Opioid tolerance was determined by documenting opioids listed on each analyzed patient's medication list at the first fraction under general or spinal anesthesia. Prior medication lists were then reviewed to ensure that doses of opioids above the tolerance threshold were prescribed for at least 1 week before the first fraction. For pro re nata (as needed) medications, it was assumed that the patient was taking the opioid to the greatest degree allowed by the prescription. In cases where a narcotic dose per tablet was listed but not a frequency, the patient was documented as being opioid tolerant.

The use of oral (p.o.) and/or IV narcotics after T&R placement was documented for each fraction in a binary