



# Pain assessment during conscious sedation for cervical cancer high-dose-rate brachytherapy

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## ABSTRACT

### Background

This observational study set out to evaluate the effectiveness of conscious sedation anesthesia for pain control during high-dose-rate (HDR) brachytherapy using a ring-and-tandem applicator system for patients with cervical cancer.

### Methods

At the time of initiation of the HDR cervical cancer brachytherapy program at our institution, patients received a detailed symptom assessment during the procedures. Brachytherapy was carried out using a Smit sleeve, together with a ring-and-tandem applicator. Midazolam and an opioid—hydromorphone, morphine, or fentanyl—were the main agents used to achieve conscious sedation.

### Results

From January 2009 to October 2010, 20 patients (median age: 45 years) underwent 57 procedures. All patients received chemoradiation with curative intent. The median duration of the procedures was 1.4 hours, and no significant cardiovascular events were noted. The total dose of intravenous midazolam used ranged from 0.5 mg to 8.5 mg (median: 2.5 mg). The total dose of intravenous morphine equivalent used ranged from 2.5 mg to 60 mg (median: 8 mg). The mean and median pain scores during the procedures were 1.4 and 1.1 respectively. Brief moments of moderate to severe incidental pain were noted at the time of certain events during the procedure—specifically during insertion of the ring-and-tandem applicator. The maximal pain score during the entire procedure ranged from 0 to 10 (median: 4.7). The period of recovery from conscious sedation was relatively brief (median discharge time: 1 hour).

## Conclusions

We were able to demonstrate that patients undergoing HDR brachytherapy for cervical cancer can achieve good pain control with conscious sedation.

## KEY WORDS

Cervical cancer, carcinoma of the cervix, conscious sedation, high-dose-rate brachytherapy, pain and symptom assessment, incidental pain, recovery time

## 1. INTRODUCTION

Cervical cancer is commonly treated with radiotherapy, and brachytherapy remains an essential component of treatment<sup>1,2</sup>. Anesthesia during high-dose-rate (HDR) brachytherapy for cervical cancer is not well reported in the literature, and the modalities used in practice vary greatly<sup>3</sup>. Our goal was to see if conscious sedation could be effectively used to control pain or discomfort during HDR brachytherapy for cervical cancer.

Treatment plans for cancer of the cervix show an increasing prevalence of HDR brachytherapy. Compared with low-dose-rate brachytherapy, the HDR technique has well-documented logistics and patient comfort advantages<sup>2</sup>, including shorter treatment times, reduced periods of immobilization or bed rest, and less chance for movement of the applicator during treatment. Those advantages translate into the potential for outpatient rather than inpatient treatment and greater patient throughput, reducing the use of resources<sup>2</sup>.

For the advantages of HDR brachytherapy to be realized, the method of analgesia must be effective<sup>4-7</sup>. According to the American Brachytherapy Society, HDR brachytherapy for carcinoma of the cervix should utilize conscious sedation whenever possible<sup>2</sup>. Lower complication rates with conscious sedation as opposed to general anesthetic during HDR brachytherapy of the cervix have also been reported<sup>3</sup>. Our centre

stopped its low-dose-rate cervical brachytherapy program in 2007 and developed a new protocol and new processes for HDR brachytherapy in 2008, which were fully implemented by 2009. In keeping with American Brachytherapy Society guidelines and the advantages of HDR already mentioned, an outpatient-based program incorporating conscious sedation was developed at The Ottawa Hospital Cancer Centre.

The aim of our retrospective observational study was to assess, throughout the developmental stage of the HDR brachytherapy program at our institution, the patient's experience under conscious sedation. We could then incorporate that feedback into the evaluation of the sedation protocol and potentially improve the experience for future patients.

## 2. METHODS

Patients treated between January 2009 and October 2010 with HDR brachytherapy for biopsy-proven cervical cancer at The Ottawa Hospital Cancer Centre were included in the study. All brachytherapy procedures were conducted as part of an integrated treatment plan that included external-beam radiation and concurrent weekly chemotherapy. Before the initiation of brachytherapy, an examination under anesthesia and placement of a Smit sleeve were performed under general anesthesia. The patients were treated to a dose of 8 Gy per treatment in 3 weekly fractions. A ring-and-tandem applicator was used, with the patient remaining on the same table throughout the entire procedure (applicator insertion, imaging, treatment planning, treatment delivery, and applicator removal) so that no transfers were required. A rectal retractor attachment was also used with the applicator so that no packing was required. Brachytherapy imaging was performed with fluoroscopy and plain radiography, and computerized dosimetry was performed using the Plato software (Elekta, Stockholm, Sweden). The conscious sedation protocol used an intravenous opioid (morphine, hydromorphone, or fentanyl) in addition to intravenous midazolam. An initial dose was given to patients at the start of the procedure, with repeated dosing every 5–10 minutes as needed based on reassessment of pain in communicative patients throughout the procedure. The patients also received premedication (acetaminophen or tramadol, pregabalin, and metoclopramide) in addition to local anesthesia with lidocaine spray to the cervix. The whole procedure was performed in a brachytherapy suite with dedicated and specialized staff, including registered nurses, radiation therapy technologists, and physicists, together with the attending radiation oncologist. In addition, members of the anesthesia staff were available on call in an adjacent part of the hospital to assist as needed, although they were never actually in the brachytherapy suite itself.

During the procedure, pain scores were recorded on a linear analogue 11-point scale (0–10) by the

nurses, who assessed pain in the communicative patients. Patients were evaluated at least every 10 minutes and during certain procedural events such as Foley catheter insertion, applicator insertion, and applicator removal. The medications and doses were all recorded in addition to the procedure and recovery times. The dose in morphine equivalents was calculated assuming the equivalency of either hydromorphone 2 mg or fentanyl 100 µg to morphine 10 mg<sup>8</sup>. Qualitative notes kept by the nursing staff were also temporally correlated with the pain scoring system. Finally, in the recovery area after completion of the entire procedure, patients were asked by the nursing staff how they felt about the procedure and whether they were satisfied with the degree of pain control.

## 3. RESULTS

From January 2009 to October 2010, 20 patients (median age: 45 years) underwent 57 procedures (median: 3 procedures per patient). All patients received chemoradiation with curative intent.

The median duration of the procedure was 1.4 hours (standard deviation: 0.5 hours), although the actual brachytherapy treatment delivery time was generally only 10–20 minutes. The procedure time was calculated as the time from insertion of the Foley catheter to removal of the ring-and-tandem apparatus. No significant cardiovascular events occurred during any of the procedures.

The total dose of intravenous midazolam used per procedure ranged from 0.5 mg to 8.5 mg (median: 2.5 mg; standard deviation: 2.0 mg). The total dose of intravenous opioid, in morphine equivalents, ranged from 2.5 mg to 60 mg (median: 15 mg; standard deviation: 8.0 mg)<sup>8</sup>. Table 1 shows the medians and standard deviations for the procedure times and doses of medications used.

During the procedure, the mean pain score was 1.4, and the median was 1.1. Before fentanyl was used as

TABLE 1 Procedure duration, medication doses, and pain scores

<i>Variable</i>	<i>Median</i>	<i>SD</i>
Procedure duration (hours)	1.4	0.5
Midazolam dose (mg)	2.0	2.0
Morphine or equivalent (mg)	15	8
Procedural pain <sup>a</sup> (mean: 1.2)	1.0	1.1
Maximal score <sup>b</sup>	4.7	2.5
Recovery time (hours)	1	0.8

<sup>a</sup> Mean and median of the median pain score during each of the 57 procedures.

<sup>b</sup> Median of the maximal pain score during each of the 57 procedures.

SD = standard deviation.

the opioid, the mean and median pain scores were 1.3 and 1.1 respectively (first 10 patients). Brief moments of moderate-to-severe incidental pain were noted at specific events during the procedure, most notably during insertion of the ring-and-tandem applicator.

The maximal pain score during the procedure ranged from 0 to 10 (median: 4.7). Before use of fentanyl as the opioid, the median of maximal pain during each procedure was 4.5. Figure 1 shows the maximal pain level during each procedure as a frequency distribution.

The recovery period from the conscious sedation was relatively brief, with minimal nausea and mild-to-moderate levels of pain. Median time to discharge home after completion of treatment was 1 hour. Analysis of qualitative data found that the maximal levels of pain during the procedure coincided with applicator manipulation during insertion and removal. After completion of treatment, all patients commented that they were satisfied with pain control during the procedure.

#### 4. DISCUSSION

The patients observed in the present study represent the initial cohort of patients with cervical cancer treated with HDR brachytherapy at The Ottawa Hospital Cancer Centre. Overall, the patients—and the radiation oncologists and nurses—were satisfied with the level of pain and symptom management during the procedure and did not feel that pain compromised the quality of the treatment. In addition, the conscious sedation protocol allowed for a rapid consistent treatment time, as Table 1 shows. Although no other recovery times have been reported for the various methods of sedation in HDR brachytherapy for cervical cancer, the short recovery times in the present conscious sedation protocol shows its applicability to outpatient

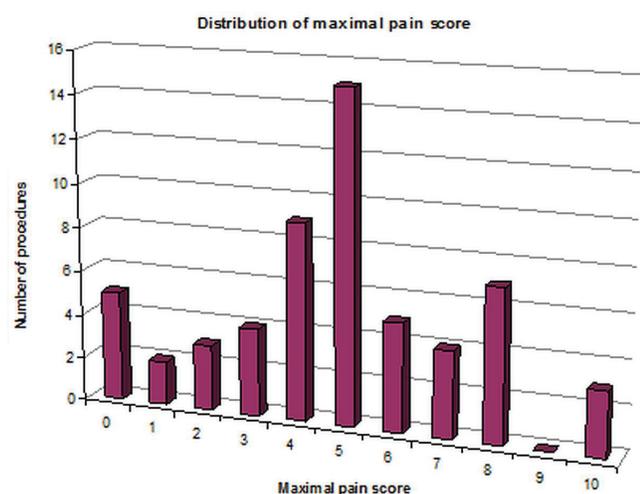


FIGURE 1 Distribution of maximal pain scores over 57 brachytherapy sessions.

treatment. The low median doses of midazolam and opioids used likely aided in the ease of recovery. The wide variability in the drug doses used demonstrates that it is possible to customize medication doses depending on each patient's specific needs. The continuous patient assessment and feedback is particularly useful in allowing for medication doses to be thus adjusted. The doses of midazolam used in our study were less than those reported in colonoscopy<sup>9</sup>. However, the doses of opioid used were slightly greater than those used in colonoscopy, likely reflecting the large difference in the length of the two procedures<sup>9</sup>.

The use of fentanyl rather than hydromorphone or morphine did not result in a significant decrease in the mean or median of the maximal pain during the procedure. The 27 procedures conducted using intravenous fentanyl resulted in a mean maximal pain score of 4.8; the first 30 procedures, which used intravenous hydromorphone or morphine, resulted in a mean maximal pain score of 4.7. Keeping in mind the standard deviation of the maximal pain score (see Table 1), those results are not significantly different. However, fentanyl has now become our analgesic of choice because of its fast onset of action and rapid clearance.

The maximal level of pain reported during the procedures was centred on the 4–5 range out of 10, with a few incidents of 9–10 (Figure 1). That result is consistent with a well-tolerated pain management system. In addition, the maximal pain occurred during a very brief period of time (during manipulation of the applicator), as demonstrated in Figure 2, which shows the reported pain relative to time (in approximately 10-minute intervals) for one of the procedures. Another indication that the pain management system was well tolerated was the low mean and median pain scores. Anecdotally, we also noticed that giving patients opioid boluses just before insertion and removal of the applicator seemed to improve pain control and tolerance of the procedure.

In the 20 patients treated, 3 treatments were abandoned because the Smit sleeve fell out before

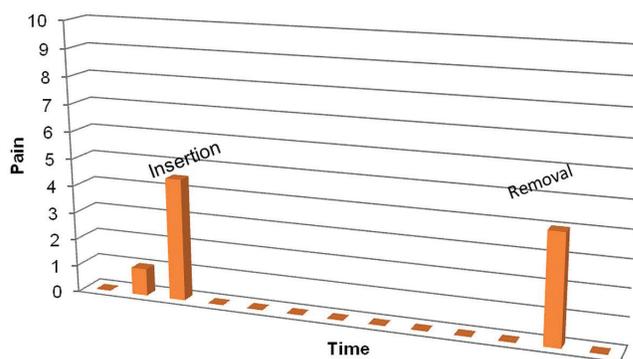


FIGURE 2 Temporal distribution of pain during a brachytherapy session, in 10-minute intervals.

the final treatment (2 patients) and because of poor medical wellness for the brachytherapy treatment (1 patient). During the research period, 1 patient was treated under general anesthesia and was therefore excluded from the study. The general anesthesia was a result of patient preference, because the individual was virginal, with an intact hymen, and the friability of the cervical tumour made for an extremely difficult applicator insertion.

When our data are compared with those from a similar study of conscious sedation in HDR brachytherapy for cervical cancer, the results are quite similar<sup>10</sup>. The mean of the pain scores was still in the mild range, and the mean of the maximal pain score was in the moderate range. However, the doses of midazolam and opioid observed in our study were lower<sup>10</sup>.

A limitation of the present study is its lack of assessment of the patient's experience hours, days, or weeks after the procedure was completed. All the pain data were obtained during the procedure, and so we have not been able to assess the amnesic effects of the conscious sedation system. Particularly with the use of midazolam, the perceived pain well after the event may be significantly different from that assessed during the procedure. Also, in future, as we develop better imaging and brachytherapy planning (based on computed tomography or magnetic resonance imaging data rather than plain radiography, which may require patient transfers), we will have to determine whether good pain control can still be maintained.

## 5. CONCLUSIONS

We have been able to successfully perform HDR brachytherapy for cervical cancer with conscious sedation. Most patients tolerated the procedures well, with just relatively brief periods of moderate-to-severe incidental pain at times of applicator manipulation. With anticipation of uncomfortable events and continuous patient feedback, the system allows for individualized analgesic dosing, which was demonstrated by the variability in the doses of opioids and midazolam used in the present study. In addition, the system allowed us to treat patients efficiently, within a relatively consistent treatment time. The consistency and short procedure time demonstrate adequate applicator placement on the initial attempt, because the patients are comfortable. The recovery times observed were also shorter than would be expected with general anesthesia. Importantly, this system allowed for all patients to avoid hospitalization for brachytherapy by receiving outpatient treatment.

## 6. CONFLICT OF INTEREST DISCLOSURES

None of the authors has any financial conflict of interest to declare.

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