

Prostate HDR Radiation Therapy: A Comparative Study Evaluating the Effectiveness of Pain Management With Peripheral PCA vs. PCEA

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Treatment of prostate cancer can include surveillance, "watchful waiting," androgen hormone ablation, internal (brachytherapy — permanent seed implant or high dose rate radiation) or external radiation, surgery, chemotherapy, or a combination of any of these modalities. Selection of treatment options includes the patient's age, medical history

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Pain management is essential for patients requiring high dose rate (HDR) brachytherapy due to required immobility and supine positioning as well as invasive equipment (HDR catheters) sutured to the perineum to administer the radiation into the prostate. The use of patient controlled epidural analgesia for the management of pain associated with HDR radiation therapy for prostate cancer appears to be more effective than peripheral patient controlled analgesia, and is considered a "best practice" for effective pain management resulting in positive patient outcomes.

(including International Prostate Symptom Score), tumor stage, and contributing family medical history. The term *brachytherapy* (short-distance therapy) refers to internal radiation. High dose rate

(HDR) brachytherapy implant gives the advantage of applying a higher dose of radiation directly to the tumor while sparing healthy tissue and surrounding organs. HDR radiation delivered

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Introduction

High dose rate (HDR) brachytherapy is considered one of the most advanced treatment technologies currently available for treatment of localized prostate cancer. It gives the advantage of applying higher dose radiation, with greater precision, directly to the tumor while sparing healthy tissue and surrounding organs, thereby resulting in fewer side effects. In this facility, the treatment requires an overnight stay in the hospital, in a supine position, with a perineal template sutured to the perineum to prevent catheter movement or dislodgement.

Purpose

To compare the effectiveness of pain management methods for men with prostate cancer being treated with HDR brachytherapy using peripheral patient controlled analgesia (PCA) or patient controlled epidural analgesia (PCEA).

Method

A comparative study was conducted evaluating the effectiveness of two pain management methods for men with prostate cancer receiving HDR brachytherapy. Pain assessments were conducted by scoring pain from the Foley catheter, interstitial catheters (perineal) and back (lumbosacral), using the Brief Pain Inventory Scale.

Results

Patients receiving pain management with the PCEA experienced significantly less pain.

Conclusions

These findings suggest that use of PCEA with bupivacaine and fentanyl is more effective in managing pain related to HDR brachytherapy for prostate cancer, and results in a positive patient outcome thereby improving patient satisfaction.

over minutes is more potent than lower rates delivered over months. Radiation most effectively attacks the reproducing cells. It is thought to work by damaging the DNA in the cells, which is responsible for the division and growth of the cells.

Background

High dose rate brachytherapy, in the authors' institution, requires admission to the hospital and operating room time for the placement of interstitial catheters through the perineum into the prostate gland. HDR radiation is delivered by inserting multiple plastic flexible catheters interstitially through the perineal area into the prostate gland under transrectal ultrasound guidance. The HDR flexible catheters are sutured to the perineum with a perineal template for a period of 36 hours. Positioning is essential and patients are required to remain supine and immobile throughout their hospitalization to prevent catheter movement. Movement of the catheters would require replanning or re-implantation for

the radiation treatment to take place. In this project, patients received four HDR radiation treatments during their hospital stay. On day 1, the first treatment was given after the development of treatment plan, and the second treatment was 6 hours later. On day 2, the third treatment was given early in the morning and the fourth treatment was given 6 hours later. The perineal template sutured to the perineum and HDR catheters were removed after the fourth treatment on day 2 and the patient was discharged home.

Pain management is essential for patients requiring HDR brachytherapy due to required immobility and supine positioning as well as invasive equipment (HDR catheters) sutured to the perineum to administer the radiation into the prostate. Bladder spasms and pain can also result from the Foley catheter, which is left in place throughout the hospital stay. Peripheral (intravenous) patient controlled analgesia (PCA) had typically been used to manage the pain associated with

brachytherapy; however, patients expressed dissatisfaction with the effectiveness of this modality through their self-evaluation of pain when the team analyzed the data. Intravenous PCA morphine dose escalation was required to control pain but resulted in increased side effects such as nausea and vomiting, mental confusion, and restlessness. A problem confounding the management of pain in these patients was the fact that a universal pain assessment tool was not used to quantify and record data related to pain. The data collected was largely the nurses' subjective evaluation of the patient's pain. Inconsistencies in this kind of documentation made it difficult to objectively evaluate the interventions taken for pain relief. Thus, the purpose of this performance improvement project was to examine the effectiveness of two different types of patient controlled analgesia — peripheral (intravenous) vs. epidural — in an effort to develop the "best practice" in pain management for this population.

Study Questions

Two questions guided this performance improvement study:

- What are the differences in pain management between the use of peripheral (intravenous) patient controlled analgesia (PCA) versus the patient controlled epidural analgesia (PCEA) for patients with prostate cancer?
- Do patients with prostate cancer receiving PCEA during brachytherapy treatment experience improved satisfaction with pain management?

Literature Review

Few studies have been conducted evaluating the effectiveness of intravenous PCA vs. PCEA. However, the literature suggests a variety of instances in which both pain treatment methods have been used including postoperative surgical pain management of abdominal and spinal surgery, as well as pain manage-

ment for the elderly. According to Carli et al. (2002), thoracic epidural analgesia produced optimal postoperative pain relief for patients who had undergone elective colon resection, and was more beneficial than intravenous PCA in promoting earlier postoperative mobility, return of bowel function, and resumption of oral intake.

Steinberg et al. (2002) compared analgesic effects of PCEA vs. PCA for perioperative analgesia after open colon surgery. The PCEA group had superior analgesia with a >50% reduction in pain scores assessed at rest, during cough, and a more rapid recovery.

Fischer et al. (2003) concluded that either method of pain management was effective and provided good patient satisfaction, but that PCEA offered spinal fusion patients the benefit of less opioid consumption during the pain treatment period. Joris et al. (2003) found that the use of PCEA with spinal opioids and local analgesics act synergistically at the spinal level, requiring less medication to produce pain relief thereby less side effects than with the use of intravenous PCA morphine. They concluded that the current gold standard of small-dose lipid-soluble epidural opioids (fentanyl) with small-dose bupivacaine produced excellent analgesia with minimal patient toxicity for patient pain satisfaction and postoperative pain management. More recently, Farag, Dilger, Brooks, and Tetzlaff (2005) compared intravenous PCA with PCEA for patients having undergone total knee replacement. They concluded that the use of PCEA in the first 7 days postoperatively promoted improved early rehabilitation due to excellent pain relief effect.

These studies consistently suggest that PCEA was more effective for pain relief than the intravenous PCA, thus having a positive impact on the patient in relation to satisfaction with pain relief. Since there were no published studies identified on the

pain management of HDR brachytherapy for prostate cancer, this project was selected and conducted as a performance improvement activity in the authors' institution.

Methodology

At Hackensack University Medical Center, a multidisciplinary team consisting of members from the Departments of Radiation Oncology, Urology, and Anesthesiology was formed to collaborate on utilizing a "best practice" approach for pain management of the patient receiving HDR brachytherapy for prostate cancer. The goal of the team was to determine if patients would experience improved pain management if the pain intervention was changed from peripheral (intravenous) PCA to PCEA. Institutional review board approval was not necessary since this study was conducted as a performance improvement project, incorporating the institution's performance improvement organizational goals.

Sample and setting. The project site selected was the radiation oncology department in an acute care, university medical center. The rationale for selecting this setting was that 100% of the HDR radiation therapy patients are brought to this department upon discharge from the post anesthesia recovery area. Patient selection was a nonrandomized, convenience sample evaluating the effectiveness of pain management for a total of 100 men receiving HDR brachytherapy. In phase I of the project, a control group of 50 patients received pain management using peripheral (intravenous) PCA with morphine sulfate. In phase II of the project, an experimental group of 50 men received pain management using PCEA with bupivacaine and fentanyl. Data collection included documentation of pain assessments and the number of HDR catheters, as well as co-morbid conditions that could contribute to pain (for example, arthritis, diabetes, and obesity).

Pain assessments were con-

ducted at five points in the treatment process: (a) baseline pain assessment at time of admission, (b) pre-CT scan (2 hours after HDR implant), (c) HDR 1 (5 hours after implant), (d) HDR 2 (13 hours after implant), HDR 3 (24 hours after implant), and (e) HDR 4 (30 hours after implant). The Brief Pain Inventory Scale (BPIS) was used to assess the patients' perception of pain and provide the statistical analysis. The sites of pain evaluated were Foley catheter, interstitial catheters (perineum) and back (lumbosacral). Pain scoring was given verbally to the nurse and recorded.

Instruments. BPIS has been used extensively in research with reasonable validity and reliability (Daut, Cleeland, & Flanery, 1983). It consists of a self-reporting rating scale for pain ranging from 0 to 10 (0 = no pain; 10 = severe pain, evaluating worst, least, average, and right now pain). This was used to assess the patients' perception of pain. For purposes of this project, it was decided to use the BPIS to isolate areas of pain providing details about the intensity of pain in each area (such as back, Foley, and perineum) comparing the PCA vs. the PCEA.

Health History

The nursing assessment and physician's history and physical were used to gather data related to the health history. Data related to co-morbid conditions that could contribute to pain (for example, arthritis, diabetes, and obesity) as well as total number of HDR catheters were collected.

Procedures. The phase I (control group) project was conducted from July 2003 to November 2003 and the phase II project (experimental group) from December 2003 to February 2004. The effectiveness of pain management was evaluated for 50 men in each study group, for a total of 100 men receiving HDR brachytherapy. In phase I, the control group of 50 patients received pain management using peripheral PCA with morphine sulfate intravenously, demand

Table 1.
Comparison of Pain Reports of Clients Receiving PCA or PCEA

Variable	PCA N=50	PCEA N=50	t*	p
Mean back pain	2.7	0.5	4.86	<0.0001
Mean Foley catheter pain	3.4	0.6	6.35	<0.0001
Mean perineal catheter pain	3.0	0.7	5.17	<0.0001

* 95% confidence interval

Table 2.
BPIS PCA/PCEA Five Assessment Points Pain Ranges

	Mean Back Pain	Mean Foley Catheter Pain	Mean Perineal Catheter Pain
Peripheral PCA	0-3.1	0.3-3.8	0.2-3.3
Epidural PCEA "worst pain"	-0.8	0.3-1.4	0.2-1.8

dosing (patient-controlled administration as needed). In phase II, the experimental group of 50 men received pain management with spinal PCEA. PCEA was administered using bupivacaine and fentanyl, basal rate (automatic preset dosing), and demand rate dosing (patient controlled administration as needed). Pain assessments were conducted at designated points in the treatment process. Pain scoring was given verbally from the patient to the nurse and recorded.

Results

The *t*-test and multivariate analysis were used to statistically interpret the data. The *t*-test was used to evaluate the differences in pain ratings between the two groups (control group in phase I and experimental group in phase II) with the use of peripheral PCA and PCEA using the BPIS at the sites of Foley catheter, perineum and back. In phase I (control group with peripheral PCA morphine), the mean ratings for pain using the BPIS were: back 2.7, Foley catheter 3.4, and perineal interstitial catheters 3.0. In phase II (experimental group with bupivacaine and fentanyl PCEA), the mean ratings for pain using the BPIS were: back 0.5, Foley

catheter 0.6, and perineal interstitial catheters 0.7 (see Table 1).

Multivariate analysis was used to identify independent predictors contributing to the patient's pain (for example, number of HDR catheters, diabetes, arthritis, and obesity). Ninety-two patients were implanted with a mean of 20 interstitial HDR catheters (median 19, range 14-26, SD=3.02). Thirteen percent of patients had diabetes mellitus, 36% had osteoarthritis, and 11% were obese. The number of HDR catheters, diabetes, arthritis, and obesity as co-variants demonstrated that PCA use was associated with increased pain intensity. Foley catheter pain was worse with arthritis ($p=0.0025$) and obesity ($p=0.001$). Univariate analysis over time showed back pain increased ($p=0.001$), interstitial pain decreased ($p=0.005$), and pain increased with the number of catheters ($p=0.001$). The experimental group, with PCEA, experienced significantly less pain at their five points of pain assessments than the control group, with parenteral PCA, at their five points of pain assessments (see Table 2). Patients, with the morphine sulfate peripheral PCA, experienced greater pain and less pain relief

($p<0.0001$) than patients receiving bupivacaine and fentanyl PCEA. The *t*-test showed that epidural PCEA was the better choice for pain management.

Limitations

In phase I (control group), 50 patients received peripheral (intravenous) PCA with demand dosing, and no basal rate dosing (automatic dosing). In phase II (experimental group), 50 patients received spinal PCEA with bupivacaine and fentanyl demand and basal rate dosing (automatic dosing). It is difficult to ascertain if pain management improved because of the combined basal and demand dosing versus demand dosing only used in the phase I group.

The drug of choice for pain management changed, as well as the route. In phase I, intravenous morphine sulfate was used for 50 patients. In phase II, epidural bupivacaine and fentanyl was used for 50 patients. Therefore, it is difficult to isolate if the improved pain relief was from the change in drug route from intravenous to epidural or drug choice from morphine to bupivacaine/fentanyl.

This study was conducted only at Hackensack University Medical Center; therefore, there are no comparative data regarding pain management between other facilities performing HDR catheter implant for prostate cancer. Future studies should be conducted to more carefully examine the differences between combined basal and demand dosing versus demand dosing, as well as the effectiveness of various drugs selected for PCA and PCEA for patients receiving HDR brachytherapy for prostate cancer.

Nursing Implications

Pain is a major factor in patient satisfaction, and satisfaction a core outcome measured in health care as an indicator of the quality of care provided, according to Struts (2001). These findings emphasize the importance of nursing assessments of the individual patient's perception of

pain and assuring that effective pain management interventions are implemented to effectively control the individual's pain, resulting in a positive patient outcome thereby improving patient satisfaction. This was validated through our patient satisfaction surveys that indicated a mean score of 94.2 for "nurses sensitivity/responsiveness to pain." As patient advocates and health care providers, nurses should become more actively involved in patient treatment research issues, as performance improvement indicators identify patient care needs. These study outcomes will facilitate practice changes to "best practices," improving the quality of care and resulting in improved patient satisfaction.

Conclusion

Patient-controlled analgesia using either intravenous or epidural routes provides effective postoperative analgesia; however, the epidural route (combined with a local anesthetic and opioid) renders better pain relief (Mann, Pouzeratte, & Eledjam, 2003). The findings of this project were consistent with our literature review demonstrating more effective pain management and positive patient outcomes with the PCEA. The BPIS was used as a benchmark to document improvement of pain. As demonstrated in the published studies reviewed, patients experience better pain management and fewer side effects (for example, nausea/vomiting) with the use of the PCEA than with peripheral PCA. The use of PCEA for managing pain associated with HDR radiation therapy for prostate cancer appears to be effective, and is considered a "best practice" for effective pain management resulting in positive patient outcomes. Based upon the findings of this study, the team at one institution agreed to implement PCEA as a standard of practice for male patients receiving HDR radiation therapy. □

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Additional Readings

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