Comparison of epidural and intravenous patient controlled analgesia in patients undergoing radical cystectomy

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Objective: *Postoperative analgesia is an important factor influencing surgical outcomes. We aimed to evaluate the role of patient controlled epidural analgesia (PCEA) versus intravenous (IV) patient controlled analgesia (PCA) in patients undergoing radical cystectomy.*

Methods: *We reviewed data from consecutive patients who had a radical cystectomy at our institution between 2003 and 2007 to evaluate the effect of either PCEA or IV PCA on the patients' postoperative pain--the primary outcome--as well as secondary outcomes including time to begin eating solid food, time to ambulation, and length of hospital stay. The patients received either hydromorphone or morphine via IV PCA, or bupivacaine and hydromorphone or ropivacaine via PCEA. Pooled t tests and Wilcoxon rank sum tests were used to compare outcomes. A mixed model regression analysis was used to compare pain scores.*

Results: *Data was analyzed from 131 patients to compare 73 patients (56%) who received PCEA versus 58 patients (44%) who received IV PCA. No significant differences in patient mobilization, progress to eating solid food, or length of hospital stay were detected, although there was a trend for earlier progress to eating solid food for patients in the PCEA group ($p = 0.09$). Using a mixed model analysis, we found no significant difference in pain scores at rest ($p = 0.11$). However, pain scores during activity were significantly lower for patients in the PCEA group, ($p = 0.02$), with a significant interaction effect ($p = 0.03$), indicating that the benefit with PCEA occurred in the early postoperative period.*

Conclusion: *Our findings suggest that compared with IV PCA, PCEA for radical cystectomy patients can result in lower immediate postoperative pain during activity, with a trend to earlier progress to eating solid foods, but no shortening of hospital stay.*

Key Words: cystectomy, postoperative pain, epidural analgesia, patient controlled analgesia

Introduction

Advances in postoperative pain management methods in recent years have increased patient satisfaction and have had a positive influence on the recovery period. In particular, epidural analgesia is now widely used in major surgeries including vascular, abdominal, and thoracic operations. Segmental analgesia, facilitated through the use of appropriate opioids and local anesthetics given via epidural infusion, has been shown to provide superior pain control over traditionally administered systemic opioids.[1] By acting directly on afferent pain fibers, it is thought that the epidural infusion both provides analgesia and decreases the surgical stress response that is mediated via autonomic pathways.[2]

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A recent systematic meta-analysis comparing epidural versus intravenous (IV) analgesia found that patients had superior pain control in the first 72 hours following surgery if they had been given epidural analgesia.[2] The only opiate related side effect that was significantly worse with epidural analgesia was pruritis.[2] There was insufficient evidence to compare length of hospital stay or side effects such as ileus in patients who had received the two types of analgesia.[2] A previous meta-analysis comparing the two types of analgesia similarly found that the only outcome that was significantly better with epidural analgesia was that patients had significantly lower pain scores.[1,3]

While many studies have been done in patients who have undergone general surgery,[1,3,4] few studies have looked at postoperative effects of epidural analgesia compared to IV patient controlled analgesia (PCA) in patients who have undergone urologic surgery.[4-6] One prospective, double blind study of patients undergoing radical prostatectomy showed some improvement in postoperative pain and respiratory function in patients who received epidural analgesia.[6] Another study suggested that there was earlier postoperative passage of flatus with the use of epidural analgesia.[5]

Radical cystectomy differs from other abdominal surgeries in that it encompasses both extensive pelvic and retroperitoneal tissue dissection as well as intra-abdominal bowel anastomosis.

We performed a retrospective review to compare outcomes in patients who underwent a radical cystectomy and had either patient controlled epidural analgesia (PCEA) or IV PCA. We assessed the effect of analgesic modality on postoperative pain--the study's primary outcome--as well as secondary outcomes including time to ambulation, time to eating solid food, length of hospital stay, and side effects.

Methods

Following study approval from our hospital's Institution Review Board, we reviewed retrospective data (from pain, transfusion, and bladder cancer databases) from patients who, during January 2003 to March 2007, underwent a radical cystectomy for bladder cancer at our institution, all of whom had their post-operative pain managed by the our acute pain service. The study included patients who underwent total exenterative cystectomy or had a neobladder or other concomitant procedure, and it excluded patients who only had a partial cystectomy or had insufficient data. At our hospital, continuous PCEA is offered on a case-by-case basis at the discretion and preference of the patient's anesthethesiologist. PCEA is placed at the midthoracic level. An infusion of bupivacaine and hydromorphone or ropivacaine, given via an epidural catheter, is initiated in the recovery room. Alternatively, hydromorphone or morphine IV PCA is administered in the recovery room.

Postoperatively, patients are reassessed daily by either the attending anesthesiologist or a nurse who has advanced training in pain management. Adjustments to pain regimes are made as required. Pain scores at rest and with activity, on a scale of 0 to 10, are recorded daily, except on weekends. Side effects of analgesia routines are also assessed daily. In this study, patients in the IV PCA group were typically followed until they were switched to oral narcotics, while patients in the PCEA group were typically followed until the day after the epidural was removed.

Using an intent-to-treat analysis, data from patients in the PCEA group who had dislodged or non-functioning epidural catheters were analyzed with results for the PCEA group. We tested for significant differences between the two analgesic modalities in pain scores--the study's primary outcome. Since pain scores were not consistently recorded on weekends, we used a mixed model to account for the repeated measurements and missing data.[7] Secondary outcomes were time to eating solid food, time to ambulation, transfusion requirements, side effects, patient satisfaction, and length of hospital stay. Pooled t tests and Wilcoxon rank sum tests were used to compare means between groups. All p values were two sided and p values < 0.05 were considered statistically significant. All statistical analysis was performed using SAS version 9.1 (SAS Institute, Cary, NC) and R version 2.1.1.

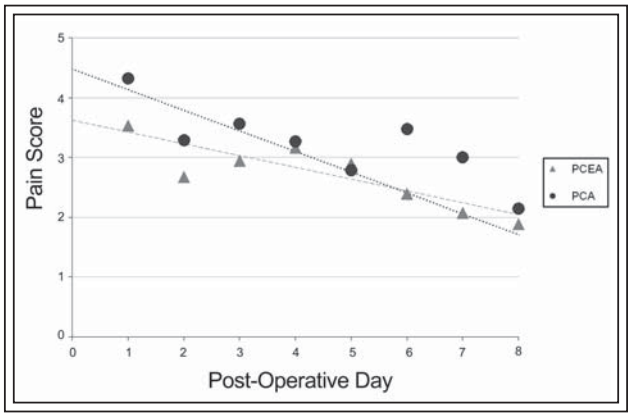

Figure 1. Mean pain scores with activity (/10) and modeled regression fit for PCEA and PCA groups.

TABLE 1. **Characteristics of patients who underwent radical cystectomy with PCEA versus IV PCA**

	PCEA (n = 73)	IV PCA (n = 58)	p value
Mean age (years)	68.5	65.1	0.10
Mean BMI (kg/m^2)	25.9	28.6	0.13
Mean preoperative time (hours)	1.22	1.05	0.003
Mean operative time (hours)	6.1	5.8	0.33
Mean operative PRBC transfused (units)	2.7	2.9	0.65
Mean postoperative PRBC transfused (units)	0.6	1.0	0.21

BMI = body mass index; IV = intravenous; PCA = patient-controlled analgesia; PCEA = patient controlled epidural analgesia; PRBC = packed red blood cells

Results

A total of 140 patients who had a cystectomy during the study period were identified. Of these patients, four patients with no information about pain and five patients who only had a partial cystectomy were excluded, leaving 131 patients who were included in the study. Eight of the study patients had a total exenterative procedure, 14 patients had creation of a neobladder, and two patients had an additional bowel resection. Table 1 shows patient and operation characteristics for the 73 patients who received PCEA and the 58 patients who received IV PCA.

The use of each analgesic modality was stable over the years reviewed (data not shown). The mean daily postoperative pain scores for each modality are shown in Table 2. Postoperative pain scores of 5 or higher were reported by eight patients in the PCEA group and 11 patients in the IV PCA group, which was not significantly different. Using a mixed model analysis, there were no significant differences between the two groups for pain scores at rest (p = 0.11). The rate of decrease in pain scores at rest was not significantly different for the two groups (0.38). For pain scores with activity, however, there was a significant difference between the two groups (p = 0.02). There was a strong interaction effect (p = 0.03) indicating that the lower scores for patients in the PCEA group occurred largely in the early postoperative period, Figure 1.

An average of 10 minutes more peri-induction time (p = 0.003) and 0.5 days more follow up time with pain service (p = 0.03) was required in patients who received PCEA compared with those who received IV PCA. No differences in patient mobilization were detected between groups, and half the patients from both groups were sitting and walking on the first postoperative day. The mean day for patients to start eating solid food was postoperative day 3.5 for the PCA group and postoperative day 2.7 for the PCEA

TABLE 2. **Mean daily postoperative pain scores after radical cystectomy with PCEA or IV PCA***

Postoperative Day	Pain score at rest		Pain score during activity	
	PCEA	IV PCA	PCEA	IV PCA
1	1.71	2.19	3.54	4.32
2	0.94	1.29	2.68	3.29
3	1.30	1.48	2.95	3.57
4	1.50	2.13	3.17	3.27
5	1.28	1.29	2.90	2.79
6	1.24	1.89	2.39	3.47
7	0.42	1.07	2.08	3.00

IV = intravenous; PCA = patient controlled analgesia; PCEA = patient controlled epidural analgesia
*Pain scores are from 0 to 10

TABLE 3. **Side effects after radical cystectomy with PCEA versus IV PCA***

Side effect	PCEA (n = 73)	IV PCA (n = 58)
Hypotension	2 (2.7)	0
Hallucinations/delirium	6 (8.2)	4 (6.9)
Nausea	11 (15.1)	9 (15.5)
Pruritis	5 (6.8)	3 (5.2)
Sedation	0	2 (3.4)

IV = intravenous; PCA = patient controlled analgesia; PCEA = patient controlled epidural analgesia
*Side effects expressed as number of patients (%)

group (p = 0.09). The median length of hospital stay was 9 days for both groups (p = 0.65). Side effects are shown in Table 3. Hypotension was seen specific to PCEA, while sedation was only seen with PCA. Patient reported overall satisfaction (with postoperative pain management) responses (yes or no) were available for 94 patients. A total of 84% of patients in the PCEA group and 80% of patients in the IV PCA group reported being satisfied.

Discussion

Epidural analgesia is often used as part of a care plan for patients undergoing radical cystectomy,[7,8] but there is little direct evidence supporting this use. Published data supports several aspects of perioperative management in radical cystectomy patients, including early removal of the nasogastric tube[10] and early institution of an oral diet.[8] Other than a couple of studies on radical prostatectomy patients,[5,6] we did not find any relevant published studies in the English language that compared epidural versus intravenous analgesia in radical cystectomy patients. In our current study, we utilized the fact that our anesthesia group does not have a standardized policy about the use of epidurals, in order to determine the efficacy of epidural analgesia, albeit in a nonrandomized fashion.

Postoperative pain management is a very important factor in the recovery course of patients, impacting patient mobility, return to physiologic bowel function, and overall satisfaction. This study demonstrates that among patients who have undergone radical cystectomy, epidural analgesia provides superior pain relief during activity, with minimal side effects. Its effectiveness was most pronounced in the period where patients began to be mobile and to eat solid food. There appears to be no benefit in continuing the epidural anesthesia for longer than 4 days.

None of the tested secondary outcomes were significantly different between the two groups, although there was a trend (p = 0.09) for earlier advancement to a solid diet in the PCEA group. Earlier advancement to a solid diet has been associated with earlier hospital discharge.[8] In a larger cohort, we suspect that this would have achieved statistical significance as had been found in the non-urologic literature.[10]

In contrast to previous data in the urologic literature,[5] our results indicate that epidural analgesia takes more anesthetic time to implement. Although this may reflect the academic and teaching environment of our hospital, the overall 10 minute difference is of no clinical significance for a procedure with an average length of 6 hours.

Despite improved pain scores with PCEA, overall patient satisfaction did not differ between the two groups. This highlights that multidimensional, complex factors influence patient satisfaction. Future studies to assess the level of patient satisfaction with analgesic technique are needed, especially since the cost of epidural analgesia is estimated to be three times that of PCA.[12]

There are some study limitations. The study was underpowered to determine differences in resolution of ileus. Due to the retrospective nature of the study, the rationale for the choice of analgesic modality was not available. Choice of analgesia may have been affected by patient comorbidities not accounted for in this study, likely in combination with anesthesiologist preference. Hence, unrecognized confounders, as with all nonrandomized studies, may be present and relevant. In addition, pain score data was not collected on weekends, which meant the data was not complete. However, interobserver variability was likely low, since most of the pain score data was likely collected by the same nurse.

Conclusion

Our findings suggest that compared with IV PCA, PCEA for radical cystectomy patients can result in lower immediate postoperative pain during activity, with a trend to earlier progress to eating solid foods, but no shortening of hospital stay. Further research about the use of analgesic modalities for radical cystectomy is needed to evaluate patient satisfaction and cost effectiveness. □

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