Enhanced recovery pathway for radical prostatectomy: Implementation and evaluation in a universal healthcare system

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Abstract

Introduction: Enhanced recovery pathways are standardized, multidisciplinary, consensus-based tools that provide guidelines for evidence-based decision-making. This study evaluates the impact of the implementation of a clinical care pathway on patient outcomes following radical prostatectomy in a universal healthcare system.

Methods: Medical charts of 200 patients with prostate cancer who underwent open and minimally invasive radical prostatectomy at a single academic hospital from 2009 to 2012 were reviewed. A group of 100 consecutive patients' pre-pathway implementation was compared with 99 consecutive patients' post-pathway implementation. Duration of hospital stay, complications, post-discharge emergency department visits and readmissions were compared between the 2 groups.

Results: Length of hospital stay decreased from a median of 3 (interquartile range [IQR] 4 to 3 days) days in the pre-pathway group to a median of 2 (IQR 3 to 2 days) days in the post-pathway group regardless of surgical approach ($p < 0.0001$). Complication rates, emergency department visits and hospital readmissions were not significantly different in the pre- and post-pathway groups (17% vs. 21%, $p = 0.80$; 12% vs. 12%, $p = 0.95$; and 3% vs. 7%, $p = 0.18$, respectively). These findings were consistent after stratification by surgical approach. Limitations of our study include lack of assessment of patient satisfaction, and the retrospective study design.

Conclusions: The implementation of a standardized, multidisciplinary clinical care pathway for patients undergoing radical prostatectomy improved efficiency without increasing complication rates or hospital readmissions.

Introduction

Since radical prostatectomy (RP) remains one of the primary management options for localized prostate cancer, efforts to improve quality and efficiency of care may have a large impact. Enhanced recovery after surgery pathways (ERPs) are tools that have been implemented internationally to provide guidelines for evidence-based decision-making. The goal is to minimize variability in patient care without compromising the quality of care. Pathways also allow for an easier way to critically evaluate outcomes, to monitor standards and costs, and to improve teamwork by involving all members of the multidisciplinary team.[1] In addition, with the implementation of ERPs, length of hospital stay (LOS) has been gradually reduced over the years.[2-4] With detailed medical and nursing orders, all unnecessary steps, laboratory tests, imaging and medications, which contribute to excessive costs and prolonged LOS, are automatically eliminated. ERPs aim to improve the trajectory of patient recovery by implementing evidence-based approaches to reduce surgical stress, improve physiologic and functional recovery, and decrease complications.[5] While evidence for their role in decreasing LOS and complications is strongest in colorectal surgery,[6] these principles have been successfully applied in multiple procedures, including RP.[7]

A multidisciplinary, consensus-based ERP for RP was implemented at our hospital in 2010 to improve patient recovery and decrease variations in care. The objective of this study was to describe the creation and implementation of the pathway and estimate the impact of its introduction on LOS, morbidity, and readmissions.

Methods

Creation of ERP

As part of a quality improvement initiative, a working group was established in 2008 to implement ERPs for prevalent surgical procedures. In 2007, 73 RPs were performed, account-

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ing for 271 acute bed days (average LOS 3.7 days; 3.8 days for open and 3.7 days for laparoscopic surgery). RPs are the fifth most common procedure performed; therefore it was selected for inclusion in the ERP program. The multidisciplinary ERP group included surgeons, anesthesiologists, nurses, nutritionists, physiotherapists, pharmacists, and a medical librarian to help with literature searches. A full-time nursing pathway coordinator managed the project. The primary goals of each ERP was to improve recovery through early nutrition and ambulation, improved analgesia, avoidance or early removal of drains and tubes, and to align expectations between patients, nurses, and surgeons through education. For each pathway, the team worked with clinical experts, reviewed the literature for best practices in perioperative care and reached consensus on each step of patient care. The team eventually created the ERP, including patient education material, standard medical orders and a customized nursing plan for the preoperative visit and each day of hospital stay. Drafts were presented to 8 attending urologists at our institution for review, and an iterative process of revision was followed until consensus was reached. Discharge target was 2 days.

Pathway

All patients were enrolled in the pathway regardless of operative approach or comorbidities. Patients met with a nurse prior to surgery and were provided with preoperative instructions, and details about the surgery and postoperative course. This was reinforced through a literacy-level appropriate booklet given to patients.[8] Patients were also seen by an internist to be medically optimized for surgery. Routine investigations were performed according to pathway criteria (http://journals.sfu.ca/cuaj/index.php/journal/article/view/2114/1948). Planned criteria-based discharge (tolerating oral intake, pain ≤4/10, ambulating as at baseline, understanding catheter care instructions) was on postoperative day 2, barring unexpected complications. Follow-up appointments and home care instructions were given prior to patient discharge.

Statistical analysis

We retrospectively reviewed charts of 200 consecutive patients undergoing RP between 2009 and 2012. Patients were divided into 2 groups: (1) those who were admitted to hospital prior to pathway implementation and (2) those who were admitted after. There were 100 consecutive patients in each group. The first 50 consecutive patients who were admitted immediately after the pathway was implemented were omitted from study to allow for a period of adaptation. One patient was excluded due to a rare intra-operative complication. The rest of the patients were treated as per pathway protocols.

Standard variables were collected from medical charts. To assess the efficacy and safety of the care plan, we compared the groups by looking specifically at 5 variables: LOS, total blood transfusion rate, postoperative complication rate, post-discharge emergency room (ER) visits, and readmissions within 90 days. The severity of postoperative complications was graded according to the Clavien classification.[9]

Statistical analysis was conducted using Stata server (version 11, StataCorp, College Station, TX). The chi-square test was used to analyze postoperative complication rate, total blood transfusion rate, post-discharge ER visits, and hospital re-admissions. The Mann-Whitney test was used to analyze differences in LOS. An alpha level of <0.05 was considered statistically significant.

Results

We tallied patients' mean age, comorbidities, pathologic stage and grade of disease, and type of surgical approach (Table 1). There were no differences in patients' clinical characteristics and demographics between the pre- and post-ERP implementation groups. However, the use of minimally-invasive RP increased significantly during this time period, from 49% to 78%, with the introduction of a robot-assisted approach.

Prior to pathway implementation, median LOS was 3 days (interquartile range [IQR] 4 to 3 days). After pathway implementation, this was reduced to 2 days (IQR 3 to 2 days) ($p < 0.0001$). In the pre-pathway group, only 24% of patients were discharged on postoperative day 2, whereas in the post-pathway group, 63% of patients were discharged that same day.

When these results were stratified according to type of surgery (open surgery vs. minimally invasive), the median LOS was decreased by 1 day in the post-pathway implementation group for both open and minimally-invasive approaches ($p < 0.01$ and $p = 0.02$, respectively) (Table 2).

With regards to complication rate, there was no significant difference between the pre- and post-pathway implementation groups (17% vs. 21%, $p = 0.80$). Most complications were classified as Clavien I (Table 3). The most common complication was urine leak, and accounted for 50% of the postoperative complications. The second most common complication was anemia requiring blood transfusion, accounting for one-third of complications. The rest of the complications were minor and required no further interventions. All these complications occurred during the initial admission. There were no statistically significant differences between the pre-pathway group and the post-pathway group after stratification according to the surgical approach (Table 2).

There were 12 ER visits in the pre-pathway group, and 12 post-pathway implementation ($p = 0.95$). Most ER vis-

Table 1. Clinical characteristics and demographics of patients pre- and post-pathway implementation

	Pre-pathway		Post-pathway		*p* value
	N	%	N	%	
No. subjects	100		99		
Mean age (SD), years	62.5 (6.31)		61.8 (5.1)		0.51
BMI, kg/m^2					0.28
<30	71	74.0%	78	80.4%	
≥30	25	26.0%	19	19.6%	
Comorbidities					
Hypertension	24	24.0%	20	20.2%	0.35
DM-II	3	3.0%	3	3.0%	0.71
Dyslipidemia	7	7.0%	9	9.1%	0.38
CAD	2	2.0%	3	3.0%	0.75
None	41	41.0%	43	43.4%	
2 of the above conditions	15	15.0%	15	15.2%	
3 of the above conditions	8	8.0%	6	6.1%	
Gleason score					0.45
6	21	21.2%	16	16.3%	
7	65	65.7%	73	74.5%	
8-10	13	13.1%	9	9.2%	
Pathological T-stage					0.13
T2	56	56.6%	65	66.3%	
T3	43	43.4%	33	33.7%	
Pathological N-stage					0.02
N+	2	2.0%	3	3.1%	
N0	49	49.5%	32	33.0%	
Nx	48	48.5%	62	63.9%	
Type of surgery					<0.001
RRP	51	51.0%	22	22.2%	
LP	35	35.0%	0	0.0%	
RALP	14	14.0%	77	77.8%	

SD: standard deviation; BMI: body mass index; DM-II: type 2 diabetes; CAD: coronary artery disease; RRP: radical retropubic prostatectomy; LP: laparoscopic prostatectomy; RALP: robot-assisted laparoscopic radical prostatectomy.

its were for minor complaints that resolved spontaneously (e.g., hematuria, abdominal pain, urinary retention). Overall, 10/24 patients (42%) who visited the ER were readmitted. There was no significant difference in the readmission rates between the 2 groups (p = 0.18) (Table 4).

Discussion

Implementation of ERP was associated with decreased LOS, with no increase in the postoperative complication rate, post-discharge ER visits, or readmissions. These results are

Table 2. Results stratified according to type of surgery-open (n = 73) vs. minimally invasive (n = 126)

	Type of surgery	Pre-ERP	Post-ERP	*p* value
Length of stay – median (IQR)	Open	3 (4 to 3)	2 (3 to 2)	<0.01
	Minimally invasive	3 (4 to 2)	2 (3 to 2)	0.02
In-hospital blood transfusions (%)	Open	7%	11%	0.17
	Minimally invasive	4%	5%	0.50
Postoperative complications (%)	Open	7%	9%	0.79
	Minimally invasive	10%	11%	0.90
No. ER visits	Open	6	3	0.33
	Minimally invasive	6	9	0.74
No. readmissions	Open	2	2	0.90
	Minimally invasive	1	5	0.20

ERP: enhanced recovery after surgery pathways; IQR: interquartile range; ER: emergency room.

Table 3. Postoperative complications – Clavien classification

	Pre-pathway, n (%)	Post-pathway, n (%)
Clavien I	10 (10.0%)	12 (12.1%)
Clavien II	5 (5.0%)	7 (7.1%)
Clavien III	2 (2.0%)	0 (0.0%)

comparable to those of other studies evaluating similar outcomes. In reviewing the literature, we identified 11 other studies looking at the effectiveness of implementing a care plan for patients undergoing RP (Table 5). Of note, all studies reported a decrease in LOS with pathway implementation.

We have grouped the results according to LOS after ERP implementation. The first group included studies conducted in Japan; both studies reported a mean LOS of 15.8 days[10] and 9.9 days.[11] This prolonged LOS is due to multiple factors. In both studies, patients were admitted 1 to 2 days prior to surgery. Also, postoperatively, patients were kept at the hospital until the Foley catheter and/or stitches were removed.[10,11]

Konety[12] and Licht[2] and their respective colleagues both reported a median LOS of 5 days after ERP implementation. They achieved this shortened LOS by admitting patients only on the day of surgery and by advancing clear fluids on a target date rather than waiting until patients pass flatus. In both studies epidural analgesia was used for pain control after the surgery, potentially contributing to the prolonged admission of patients.[2,12]

Litwin[4] and Koch[13] and their respective colleagues had similar strategies with regards to diet and ambulation. However, they were able to discharge their patients earlier than the 2 studies previously mentioned by eliminating the use of epidural analgesia. They reported a mean LOS of 3.6 days. Leibman and colleagues achieved a mean LOS of 2.7 days in their study.[14] Their pathway was designed to use certain recovery end points as goals to achieve prior to patient discharge, rather than to establish a fixed discharge date; they were efficient in further reducing LOS.

Finally, 4 studies, including ours, achieved the shortest LOS found in the literature with a median of 2 days for McLellan and colleagues,[15] Klein and colleagues[3] and the study conducted at our institution, and a mean of 1.7 days for the study conducted by Palmer and colleagues.[16] Strategies encouraging early feeding and ambulation were similar across the studies. In addition, a narcotic-sparing strategy was used in all 4 studies. Pain control after surgery was mainly achieved by using different regimens of acetaminophen, ibuprofen, and ketorolac, with or without opioids for breakthrough pain-control.[3,15,16] These results concord well with previous reports stating that the use of opioid-sparing analgesia in the postoperative period decreased LOS.[17] LOS could be further optimized by using new anesthetic techniques, such as transversus abdominis plane (TAP) blocks.

Table 4. ER visits and readmissions after discharge

	Pre-pathway (n = 100)	Post-pathway (n = 99)	*p* value
ER visits	12	12	0.95
>1 ER visit/patient	2	0	----
Readmissions	3	7	0.18
Cause of readmission			
Hematuria	0	2	----
Lymphocele	2	0	----
Ileus	0	2	----
Stroke	0	1	----
Incarcerated hernia	1	0	----
Pyelonephritis	0	1	----
Glioblastoma	0	1	----

ER: emergency room.

In fact, Dudderidge and colleagues have shown that adding TAP blocks to their pathway led to significant reductions of opiate use, and they were able to manage 7% of their laparoscopic RP as true day cases.[18]

The care plan implemented at our institution was designed for patients undergoing open and minimally invasive RP. When results were stratified according to surgical approach, a median LOS of 2 days was achieved after ERP-implementation in both groups. Our study is the only one found in the literature reporting such a short LOS for patients undergoing both open and minimally invasive surgery within a universal healthcare system. Nine of the 11 studies were conducted on patients undergoing open RP exclusively (Table 5). Okamura and colleagues included patients undergoing open as well as minimally-invasive RP.[10] However, they reported a LOS of 15.8 days, and they did not stratify their results according to surgery type. Parrado and colleagues evaluated pathway implementation for 86 patients undergoing laparoscopic RP, but their results for LOS were not statistically significant.[19] We have shown that with the implementation of our pathway, LOS was significantly reduced. Although our results may not reflect an ideal outcome since, with the advent of minimally invasive surgery, a 1- to 2-night stay is expected, it emphasizes the impact of ERP implementation (regardless of surgical approach) in helping a higher proportion of patients adhere to their target day of discharge. Of interest, since last year, we have stopped performing open RP at our institution, and 100% of the procedures are now being done robotic-assisted. As such, our current ERP has been further revised to discharge patients on postoperative day 1, with the intention to further reduce the LOS by 1 additional day – for a total LOS of 1 day.

Importantly, in the current study, implementation of the ERP did not increase complication rates. These results are comparable to the current literature. Of the 9 studies that reported complication rates, 8 found no statistically signifi-

Table 5. Summary of other studies published on the impact of ERP in patients treated with RP

		LOS (median⁺ or mean*)	Complication rate (%)	Readmission rate (%)	EBL (mL) or transfusion rate (%) or mean number of units of PRBCs transfused (U)
Okamura et al.[10] 2012, n = 2610 RRP+MIS	pre-ERP	18.0⁺	21%	1.9%	85.4%
	post-ERP	15.8⁺	17.9%	2.5%	80.4%
	p value	<0.001	0.048	0.374	0.001
Parrado et al.[19] 2008, n = 86 MIS	pre-ERP	4.8⁺	---	---	1.08 U
	post-ERP	3.9⁺	---	---	0.09 U
	p value	NS	---	---	0.013
Hsu et al.[11] 2008, n = 44 RRP	pre-ERP	11.7⁺	---	---	---
	post-ERP	9.9⁺	---	---	---
	p value	0.0001	---	---	---
McLellan et al.[15] 2006, n = 215 RRP	pre-ERP	4*	13.2%	2.9%	7.4%
	post-ERP	2*	21.8%	0.7%	5.4%
	p value	<0.0001	0.19	0.24	0.77
Leibman et al.[14] 1998, n = 743 RRP	pre-ERP	5.04⁺	5.70%	0%	---
	post-ERP	4.04⁺	5.80%	1.6%	---
	p value	<0.05	NS	0.42	---
Klein et al.[3] 1996, n = 374 RRP	pre-ERP	7*	13.5%	4.7%	---
	post-ERP	2*	7.4%	1.9%	---
	p value	<0.0001	NS	NS	---
Konety et al.[12] 1996, n = 129 RRP	pre-ERP	6.4⁺	12.3%	6.1%	1.8 U
	post-ERP	5.2⁺	12.6%	5.6%	1.2 U
	p value	<0.003	NS	---	<0.01
Litwin et al.[4] 1995, n = 199 RRP	pre-ERP	5⁺	0%	1.3%	---
	post-ERP	3.6⁺	0.7%	1.4%	---
	p value	<0.0001	---	---	---
Palmer et al.[16] 1996, n = 47 RRP	pre-ERP	4.6⁺	20%	0%	1948 mL
	post-ERP	1.7⁺	10%	0%	1204 mL
	p value	<0.005	---	---	<0.005
Licht et al.[2] 1996, n = 272 RRP	pre-ERP	8*	13.50%	---	---
	post-ERP	5*	11.90%	---	---
	p value	<0.0001	NS	---	---
Koch et al.[13] 1994, n = 104 RRP	pre-ERP	5.7	13%	---	2.1 U
	post-ERP	3.6	0%	0%	0.9 U
	p value	<0.0001	---	---	0.0001

ERP: enhanced recovery after surgery pathways; RP: radical prostatectomy; EBL: estimated blood loss; LOS: length of stay; PRBCs: packed red blood cells; RRP: radical retropubic prostatectomy; MIS: minimally invasive surgery; NS: non-significant.

cant difference between pre- and post-pathway implementation groups (Table 5). Okamura and colleagues reported a small decrease in their complication rate, from 21% to 18% ($p = 0.048$) after pathway implementation.[10]

With regards to blood loss, similar to the study by McLellan and colleagues,[15] our study showed no statistically significant difference in blood transfusion rates after pathway implementation. However, other studies reported a significant decrease in estimated intra-operative blood loss or in blood transfusion rates after ERP implementation (Table 5). None of these studies reported on the parameters contributing to these results, so it is difficult to identify whether this improvement was attributed to the pathway itself or other factors.[10,12,13,16,19]

One limitation of our study is the lack of assessment of patient satisfaction within the 2 groups. Furthermore, although all the patients' pre- and post-ERP were included in a consecutive manner, the assignment to pathway was not randomized. However, demographics of patients in the pre- and post-pathway groups were comparable.

Conclusion

With implementation of an ERP, the median LOS was significantly reduced for patients undergoing RP. This goal was achieved safely without compromising the quality of care delivered to patients since complication and readmission rates did not increase. These results are encouraging and

efforts should be made to extend the implementation of such care plans to other urologic procedures.

Competing interests: Dr. Abou-Haidar, Dr. Abourbih, Dr. Braganza, Dr. Al Qaoud, Dr. Lee, Dr. Carli, Dr. Watson, Dr. Aprikian, Dr. Tanguay and Dr. Feldman declare no competing financial or personal interests. Dr. Wassim Kassouf is a recipient of a Research Scholar Award from the FRSQ. This work was partially funded by an investigator initiated research grant from Ethicon Endosurgery Canada.

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