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ORIGINAL ARTICLE

Introducing an enhanced recovery programme to an established totally intracorporeal robot-assisted radical cystectomy service

Justin W. Collins[1], Christofer Adding[1], Abolfazl Hosseini[1], Tommy Nyberg[2], Giovannalberto Pini[1], Linda Dey[1] and Peter N. Wiklund [1]

[1]*Department of Urology, Karolinska University Hospital, Stockholm, Sweden, and* [2]*Division of Clinical Cancer Epidemiology, Department of Oncology-Pathology, Karolinska Institutet, Stockholm, Sweden*

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Abstract

Objective: The aim of this study was to assess the effect of introducing an enhanced recovery programme (ERP) to an established robot-assisted radical cystectomy (RARC) service. *Materials and methods:* Data were prospectively collected on 221 consecutive patients undergoing totally intracorporeal RARC between December 2003 and May 2014. The ERP was specifically designed to support an evolving RARC service, where increasing proportions of patients requiring radical cystectomy underwent RARC. Patient demographics and outcomes before and after implementation of the ERP were compared. The primary endpoint was length of stay (LOS). Secondary outcomes included age, American Society of Anesthesiologists (ASA) score, preoperative staging, operative time, complications and readmissions. Differences in outcomes between patients before and after implementation of ERP were tested with the Jonckheere–Terpstra trend test and quantile regression with backward selection. *Results:* Following implementation of the ERP, the demographics of the patients ($n = 135$) changed, with median age increasing from 66 to 70 years ($p < 0.01$), higher ASA grade ($p < 0.001$), higher preoperative stage cancer (pT ≥ 2, $p < 0.05$) and increased likelihood of undergoing an ileal conduit diversion ($p < 0.001$). Median LOS before ERP was 9 days [interquartile range (IQR) 8–13 days] and after ERP was 8 days (IQR 6–10 days) ($p < 0.001$). ASA grade and neoadjuvant chemotherapy also affected LOS ($p < 0.05$ and $p < 0.01$, respectively). There was no significant difference in 30 day complication rates, readmission rates or 90 day mortality, with 59% experiencing complications before ERP implementation and 57% after implementation. The majority of complications were low grade. *Conclusions:* Patient demographics changed as the RARC service evolved from selected patients to a general service. Despite worsening demographics, LOS decreased following ERP implementation. This evidence-based ERP safely standardized perioperative care, resulting in decreased LOS and decreased variability in LOS.

Keywords:

Bladder cancer, enhanced recovery programme, robot-assisted radical cystectomy, totally intracorporeal RARC

History

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Introduction

Radical cystectomy is complex multistep surgery. The authors have previously reported a standardized approach to robot-assisted radical cystectomy (RARC) surgery and described how standardization can improve surgical outcomes [1]. A didactic approach can help to identify "hazard steps" within multistep surgery, reduce complication rates and shorten learning curves [1,2]. Standardization of care can be extended to include all aspects of patient management during radical cystectomy. Radical cystectomy is associated with significant surgical morbidity and lengthy inpatient stay irrespective of the surgical approach. Prolonged hospitalization is associated with early complication rates (within the first 30 days) [3]. There is increasing evidence that RARC minimizes the surgical insult, with several meta-analyses concluding that RARC compared to open radical cystectomy decreases blood loss and reduces overall complication rates, resulting in reduced transfusion rates, shorter time to normal diet and reduced length of stay in hospital (LOS) [4–6]. A totally intracorporeal approach has been shown to be associated with further reductions in complication rates [7]. The number of centres offering RARC continues to grow [8].

RARC with a totally intracorporeal approach was first performed at Karolinska in 2003, with early cases being carefully selected [1]. Following growing evidence that RARC is oncologically equivalent to open surgery [1,9] and several studies concluding that it is safe and advantageous for elderly patients requiring radical cystectomy [10,11], the proportion of patients offered RARC has gradually increased since 2012 (Figure 1). However, surgical technique is only one aspect that affects the surgical stress response in patients, with other critical aspects including patient age, comorbidity and tumour biology [12]. It was recognized that increasing the proportion of patients undergoing RARC, moving from a selected patient cohort to a more general service, would

Correspondence: Prof. Peter Wiklund, Department of Urology, Karolinska University Hospital, SE-171 76 Stockholm, Sweden. Tel: +46 8 517 728 54. Fax: +46 8 517 735 99. E-mail: peter.wiklund@ki.se

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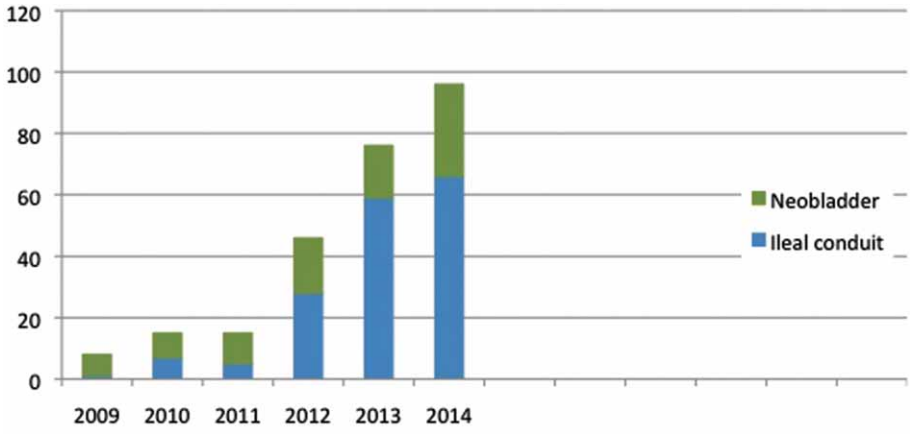

Figure 1. Year-on-year numbers of patients undergoing totally intracorporeal robot-assisted radical cystectomy at Karolinska.

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result in negative changes to patient demographics. Therefore, to support the evolving RARC service, a review of the literature was performed to establish the current best evidence for perioperative management of patients undergoing radical cystectomy.

Enhanced recovery programmes (ERPs) are standardized multimodal care pathways that aim to minimize the stress response by optimizing perioperative management from diagnosis, through treatment, to return to normal function, while minimizing the physiological and psychological effects of elective surgery. ERPs were first introduced in colorectal surgery by Wilmore et al. in 2000 [13]. A totally intracorporeal RARC approach aligns itself with the original stated principles of the ERP, that minimally invasive surgery is preferential to minimize the stress response perioperatively and to aid quicker patient recovery [13]. However, there is a lack of data on ERPs in RARC. Much of the evidence base for ERPs still comes from the management of patients in colorectal care, with evidence for use in radical cystectomy being limited in comparison [14,15].

This study describes the authors' experience with the implementation of an ERP in totally intracorporeal RARC and assesses whether the evolving demographics for patients undergoing totally intracorporeal RARC have affected outcome measures such as LOS, complications and readmissions.

Materials and methods

Between December 2003 and May 2014, 221 patients underwent totally intracorporeal RARC. Surgery was performed in a designated centre by one of three console surgeons (PW, AH or CA). All patient data and outcome measures were prospectively collected. Patient demographics, indications for surgery and urinary diversion type are summarized in Table 1. Outcome measures included LOS, complication

Table 1. Patient demographics, indications for surgery and treatment details of patients undergoing totally intracorporeal robot-assisted radical cystectomy (RARC).

	Before implementation of ERP	After implementation of ERP	Statistical significance
No. of patients	86	135	
Male to female ratio	71:15	101:34	NS
Age (years)	66 (59–71)	70 (63–74)	$p < 0.01$
ASA grade			$p < 0.001$
1	26 (30)	16 (12)	
2	41 (48)	54 (40)	
3	18 (21)	63 (47)	NS
4	1 (1)	2 (1)	
BMI (kg/m^2)	26 (23–27)	26 (24–29)	
Preoperative staging			$p < 0.05$
CIS	3 (3)	3 (2)	
Ta	4 (5)	5 (4)	
T1	25 (29)	29 (21)	
T2	45 (52)	67 (50)	
T3	8 (9)	26 (19)	
T4	1 (1)	5 (4)	
Received neoadjuvant chemotherapy[a]	27/85 (32)	52/135 (39)	NS
Neobladder to ileal conduit ratio	48:38	38:97	$p < 0.001$

Data are shown as *n*, median (interquartile range) or *n* (%).
[a] Missing data = 1.
ERP = enhanced recovery programme; ASA = American Society of Anesthesiologists; BMI = Body mass index; CIS = Carcinoma *in situ*; NS = Not significant.

Table 2. List of components in Karolinska's enhanced recovery programme (ERP) for robot-assisted radical cystectomy (RARC).

An ERP after totally intracorporeal RARC focusing on reduced bowel preparation, early feeding and mobilization and analgesic regimens

Outpatient assessment
1. Preoperative counselling and education, verbal and written information offered on operation and urinary diversion options.

Preparation for surgery
1. Preoperative medical optimization.
2. Seen by stoma nurse specialist. Advice on stoma and/or neobladder care.
3. Cardiopulmonary exercise testing if indicated.
4. Advice and support for cessation of smoking and/or alcohol consumption.
5. Social issues addressed and discharge planning.

Day before radical cystectomy
1. No bowel preparation.
2. Carbohydrate loading (Nutricia preOp®) 4 × 250 ml [19].

Day of radical cystectomy: Day 1
1. Solids up to 6 h and clear fluids up to 2 h preoperatively, including 2 × 250 ml Nutricia preOp® carbohydrate loading [19].
2. Avoidance of long-acting sedatives.
3. Thrombosis prophylaxis. Compression stockings and low molecular weight heparin.
4. Antimicrobial prophylaxis and skin preparation with chlorhexidine–alcohol.
5. Standard anaesthetic protocol to attenuate surgical stress response – intraoperative maintenance of haemodynamic control, central and peripheral oxygenation, muscle relaxation, optimized depth of anaesthesia with spinal and appropriate analgesia avoiding opiates with peripheral action.
6. Totally intracorporeal RARC approach [8].
7. Goal-directed fluid management with judicious use of fluid restriction and vasopressors [26].
8. Prevention of hypothermia (Bair Hugger®).
9. Removal of nasogastric tube in recovery.

Day 2–4
1. Prophylactic metoclopramide for prevention of postoperative nausea and vomiting.
2. Chewing gum [18].
3. Unrestricted diet.
4. Drain fluid routinely sent for creatinine on day 2 and drain removed on day 2 if drain fluid indicates serum creatinine levels.
5. Thrombosis prophylaxis. Compression stockings and low molecular weight heparin.
6. Regular analgesia: paracetamol and Targiniq® (oxycodone hydrochloride and naloxone hydrochloride dihydrate) with oxybutinin.
7. Early mobilization with 100 m × 3.
8. Daily nutritional supplements (Fortisip®) with nutrition goal 900 kcal/day.
9. Fluid/electrolyte (30 ml/kg/day).
10. Encourage self-care (catheter care/flushing if neobladder and stoma bag care if ileal conduit).

Day 4 onwards
1. Continue as previously. Increase daily nutritional goal to 1500 kcal/day.
2. Discharge home when criteria met:
—Pain adequately controlled
—Independently mobile
—Competent with neobladder or stoma care
—Bowels opened.

Postdischarge
1. Stents out on day 10 (no stentogram).
2. Removal of clips on day 10.
3. Contact with specialist nurse via telephone.
4. Audit cycle of compliance and outcomes.

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rates within the first 30 days (Clavien–Dindo classification) and readmissions.

The ERP was introduced at Karolinska Institutet, Stockholm, in October 2012. The fundamentals of this ERP were based on current best evidence from publications in urology [16–19] and colorectal surgery [20,21] at that time. The authors also took into account their own experience of RARC following audits of their results and associated complications [1]. The Enhanced Recovery After Surgery (ERAS) Society guidelines, published in 2013, identified 22 aspects of optimal perioperative care [14], of which, through an independent review, the authors had incorporated 21 at the time of implementation, with only current guidance on epidural analgesia [14] not having been applied, as it was not considered necessary for patients undergoing totally intracorporeal robotic cystectomy. A full description of the Karolinska ERP and timings can be seen in Table 2.

The Jonckheere–Terpstra test was used to assess trends in the various characteristics and outcomes between the periods before and after implementation of the ERP. LOS was visualized using the Kaplan–Meier estimator, and the corresponding log-rank test was used to test for differences. Logistic regression and quantile regression with backward selection (inclusion criterion: $p < 0.05$) were used to estimate odds ratios and median differences with 95% confidence intervals (CIs) for the associations between various potential predictors, and complication rates and LOS, respectively. Predictors assessed included ERP, age, American Society of Anesthesiologists (ASA) grade, preoperative tumour staging, surgeon's operative experience (measured as cumulative number of cases), neoadjuvant chemotherapy, BCG therapy, operative time and urinary diversion type. All tests were performed two-sided at the 5% significance level. Missing values were removed for each calculation.

Limitations of this study include the potential effect of the surgeons' learning curve on outcomes. It is recognized that early cases can have worse outcomes and there is evidence that approximately 30 cases are needed to "pass" the learning curve for RARC [22]. However, studies have shown that the learning curve for additional surgeons at a centre with an established RARC service is significantly reduced [2]. To further assess the potential effect of the institution's learning curve on LOS, subanalysis was performed on the complete series having removed the first 30 cases.

Results

Following implementation, all patients were successfully entered into the ERP, which is applied to all patients undergoing totally intracorporeal RARC, irrespective of their age, cancer stage or comorbidities.

Since the implementation of the ERP, the patient demographics have significantly changed, with the median age of patients increasing from 66 to 70 years ($p < 0.01$), and patients having a higher ASA grade ($p < 0.001$) and being more likely to have bulky disease or muscle-invasive cancer on preoperative staging ($p < 0.05$). Patients are also more likely to undergo an ileal conduit urinary diversion

Table 3. Patient outcomes with patients categorized into two groups: group A, before implementation of the enhanced recovery programme (ERP); and group B, after implementation of ERP.

	Before implementation of ERP (group A)	After implementation of ERP (group B)	Statistical significance
LOS (days) for all patients	9 (8–13)	8 (6–10)	$p < 0.001$
LOS (days) for ileal conduit	9 (9–22)	8 (6–10)	$p < 0.001$
LOS (days) for neobladder	9 (8–12)	7 (6–10)	$p < 0.01$
Overall LOS			$p < 0.01$
1–10 days	53/86 (62)	107/135 (79)	
11–20 days	19/86 (22)	21/135 (16)	
21–30 days	9/86 (10)	4/135 (3)	
31–40 days	2/86 (2)	3/135 (2)	
≥ 40 days	3/86 (3)	0/135 (0)	
Clavien 30 day complication rate for all patients			NS
None	35 (41)	58 (43)	
Clavien 1–2	30 (35)	51 (38)	
Clavien ≥ 3	21 (24)	26 (19)	
Clavien 30 day complication rate for ileal conduit			$P < 0.05$
None	12 (32)	48 (49)	
Clavien 1–2	13 (34)	32 (33)	
Clavien ≥ 3	13 (34)	17 (18)	
Clavien 30 day complication rate for neobladder			NS
None	23 (48)	10 (26)	
Clavien 1–2	17 (35)	19 (50)	
Clavien ≥ 3	8 (17)	9 (24)	
Readmission rate	25 (29)	44 (33)	NS
90 day mortality rate	2 (2)	3 (3)	NS

Data are shown as median (interquartile range) or *n* (%).
LOS = Length of stay; NS = Not significant.

($p < 0.001$). Of the 221 patients in the study, 214 had transitional cell carcinoma, five squamous cell carcinoma, one adenocarcinoma and one a neuroendocrine tumour.

Patient outcomes, before (group A) and after implementation (group B), are summarized in Table 3, including subgroup analysis depending on urinary diversion type. Median LOS before implementation of the ERP was 9 days [interquartile range (IQR) 8–13 days, range 4–142 days] and after implementation was 8 days (IQR 6–10 days, range 4–38 days) ($p < 0.001$) (Figure 2). In the most recent 50 patients, median LOS was further reduced to 7 days (IQR 6–10 days).

In the multivariable quantile regression, LOS was found to be lower after ERP (median difference –2 days,

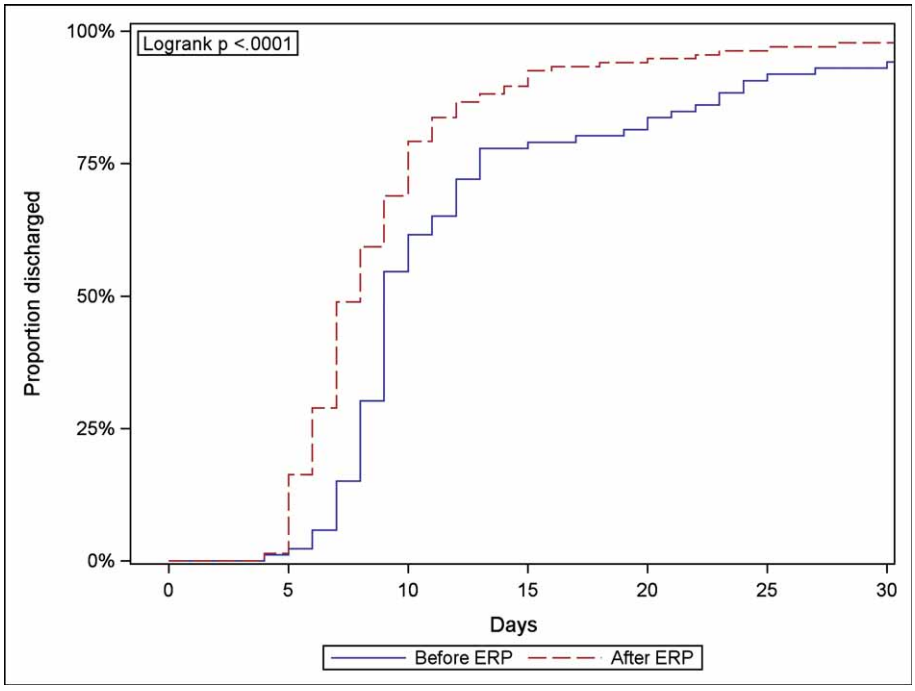

Figure 2. Kaplan–Meier plot demonstrating the relationship between the length of stay before and after implementation of the enhanced recovery programme (ERP).

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95% CI –3.1 to –0.9 days, $p < 0.001$). LOS was also lower with neoadjuvant chemotherapy (median difference –1 day, 95% CI –1.8 to –0.2 days, $p < 0.01$), whereas LOS was found to increase with increasing ASA classification ($p < 0.05$). With ASA 1 as reference, ASA 2 had a median difference of +1 day (95% CI –0.2 to +2.2 days) and combined ASA 3 and 4 had a median difference of + 2 days (95% CI +0.4 to +3.6 days).

There was no difference between groups A and B in readmission rates or 90 day mortality. Overall, high-grade complications (Clavien ≥ 3) within 30 days decreased from 25% before ERP to 19% after implementation (difference not significant). There was no significant change in overall complication rates within 30 days, with 59% of patients experiencing some form of complication before ERP implementation and 57% after implementation. The majority of complications experienced were low grade (Clavien 1–2), comprising 59% of all complications before ERP implementation and 66% after implementation. Patient outcomes are summarized in Table 3.

To assess the potential effect of the institution's learning curve on LOS, the first 30 cases were removed from group A. The median LOS remained 9 days (IQR 8–12 days) before ERP. A statistically significant difference in LOS remained between group A minus the first 30 cases and group B (Figure 3) $p = 0.001$.

Discussion

This study describes the safe implementation of an ERP to an established RARC service, which has supported service development and represents a significant change in patient management. The key elements of the ERP (shown in Table 2) include preoperative patient education, optimization of nutrition, totally intracorporeal RARC, standardized anaesthetic, analgesic and antiemetic regimens, and early mobilization. Multiple aspects of ERPs developed in colorectal surgery management have successfully been adopted into ERPs for radical cystectomy [13,14]. However, it is recognized that there are significant differences between open colorectal pelvic surgery and open radical cystectomy; for example, a continent urinary diversion will result in urine absorption by the small bowel used to form the neobladder, contributing to postoperative ileus rates. It is probable that the surgical stress response from a totally intracorporeal RARC also differs significantly from open radical cystectomy for multiple reasons, including reduced pain from smaller incisions, requiring lower narcotic administration and allowing early ambulation; reduced bowel manipulation, resulting in earlier return of bowel function; as well as the potential benefits from a closed abdomen resulting in decreased fluid shifts [8]. In contrast, there are increased transfusion rates and higher complication rates in open radical cystectomy, all contributing to increased LOS compared to RARC [4].

However, RARC is not currently the standard of care and recent guidelines on ERP for radical cystectomy suggest that minimally invasive approaches should be considered only in research settings [14]. Thus, for many reasons, the evidence for ERPs in RARC is currently very limited.

Karolinska has been performing totally intracorporeal RARC since 2003 and an ERP was introduced in October 2012. The ERP was one of several stepwise improvements to the service that have occurred since the introduction of RARC. Other improvements include increased use of neoadjuvant chemotherapy, more radical extended pelvic lymph-node dissections and ongoing refinements to the surgical technique [1]. Since 2012 there has been a steady increase in the proportion of patients undergoing RARC (Figure 1). This has resulted in significant changes in demographics (Table 1), with patients now more likely to have T3/T4 bladder tumours ($p < 0.05$) and more likely to be older with increased comorbidities ($p < 0.001$).

The rates of complications, readmission and 90 day mortality at Karolinska are consistent with other published series and meta-analyses of open and robotic radial cystectomy [4,5,23,24]. While there was no statistically significant reduction in overall complication rates in this series, there appears to be a trend towards a reduction in major complications following implementation of the ERP, with a decrease from 24% to 19% (Table 3), and there was also a significant decrease in complication rates within the ileal conduit patients ($p < 0.05$). This occurred despite the disadvantageous changes in patient demographics including older patients, higher ASA grades and more advanced clinical staging. Although it is understood that radical cystectomy is associated with high surgical morbidity and associated complication rates irrespective of approach, it is also recognized that many complications are related to the age and comorbidities of the patients. A multi-institution study published in 2014 found age, female gender, ASA grade, preoperative transfusion of more than 4 units and operative time longer than 6 h to be individual predictors of increased complication rates (all $p < 0.05$) [12]. In the present study series, it was found that as the RARC service evolved and included a higher proportion of the patients who were listed for radical cystectomy, the median age of patients ($p < 0.01$) and ASA grade ($p < 0.001$) increased, yet the overall complication rates remained stable. Implementation of the ERP was also associated with a significant decrease in LOS despite this older patient group having more comorbidities and advanced preoperative tumour staging. Minimally invasive approaches aim to minimize the overall trauma of the operation, and recent evidence has shown that the lower complication rates associated with RARC compared to open radical cystectomy make this complex operation more accessible to elderly patients and those with increased comorbidities [4,5,10,11].

ERPs are based on several fundamental principles, of which minimizing trauma and initiating an early return to normal activities and the natural state of physiology are key, and a totally intracorporeal RARC approach is very much in keeping with these underlying principles. The ERP reported herein includes the vast majority of the current ERAS guidelines [14] and continues to evolve. The one element in the ERAS guidelines that was not included is the epidural. In the authors' experience, a perioperative spinal anaesthetic and local anaesthetic to the wounds suffices, and patients can be mobilized more quickly after surgery if a postoperative epidural is avoided. Additional improvements currently under review include the optimization of "goal-directed"

perioperative fluid management [25]. A recent double-blind randomized controlled trial (RCT) concluded that restricted deferred hydration combined with pre-emptive norepinephrine infusion reduces postoperative complications and hospitalization time, decreases transfusion rates and is associated with improved functional outcomes [25,26]. There are also likely to be future improvements in perioperative analgesia regimens, as the side-effects of pharmacological agents are better understood. There is increasing evidence that μ-opioid receptor antagonists such as alvimopan accelerate the rate of gastrointestinal recovery, shorten LOS and reduce the incidence of postoperative ileus in patients following radical cystectomy and urinary diversion [27]. The authors currently use Targiniq® (oxycodone hydrochloride and naloxone hydrochloride dihydrate) to prevent the peripheral effect of opiates on the incidence of postoperative ileus.

A key aspect of an ERP is patient education, making sure that patients understand the process and self-manage care where appropriate. Involvement and empowerment of the patient are crucial to achieving a successful ERP. Future potential developments include improved patient education with videos, which have been shown to help patients psychologically to prepare for major surgery [28]. The readmission rates at Karolinska are high, particularly for neobladder patients, and similar findings have consistently been reported in other RARC series [4]. The application of telemedicine to improve contact with the surgical team and specialist nurses after discharge may help to prevent unnecessary readmissions. In this series, six patients were readmitted, investigated and subsequently found to have no significant underlying problem that required either surgical or pharmacological intervention. Previous telemedicine studies have shown that remote monitoring of patients in their homes, supplemented with direct audiovisual contact with hospital staff, resulted in significant reductions in readmissions [29]. Whether a similar effect can be achieved with RARC patients requires further study.

There are limitations to the analysis reported in this study. It is not possible to adjust fully for the effects of the surgical learning curve, particularly early in the series. However, there is evidence that the number of cases needed to pass the learning curve for RARC is approximately 30 [22], with other studies indicating that the learning curve of the senior surgeon in a high-volume centre can significantly shorten subsequent surgeons' learning curves for RARC [2]. Even after adjusting for the department's overall learning curve by removing the first 30 cases (Figure 3), the positive effect of the ERP on LOS remains ($p = 0.001$). It can also be seen that the Kaplan–Meier curves separate early and remain separated, indicating a benefit on LOS that affects all patients receiving RARC with an ERP. There are other recognized confounding variables in this series, including changing patient demographics and the introduction of additional new surgeons. However, on quantile regression analysis of the complete series, ASA grade was found to be associated with LOS, with ASA 1 patients staying on average 2 days less than patients with ASA 3–4. Given the increased proportion of ASA 3–4 patients after implementation of the ERP, this provides further evidence for the benefit of the ERP on LOS. While changing patient demographics are necessary to grow a service, they are more likely to have a negative effect on LOS. This article has reported a consecutive case series from one centre, which represents the outcome results of all the surgeons involved. There were three main surgeons performing RARC in this series, commencing at various times (PW 2003, AH 2009, CA 2013), indicating further that LOS improvements were not solely dependent on surgeon performance and rather represent a cumulative effect from the defined changes to patient care. There was also evidence for decreased variability in LOS following implementation of the

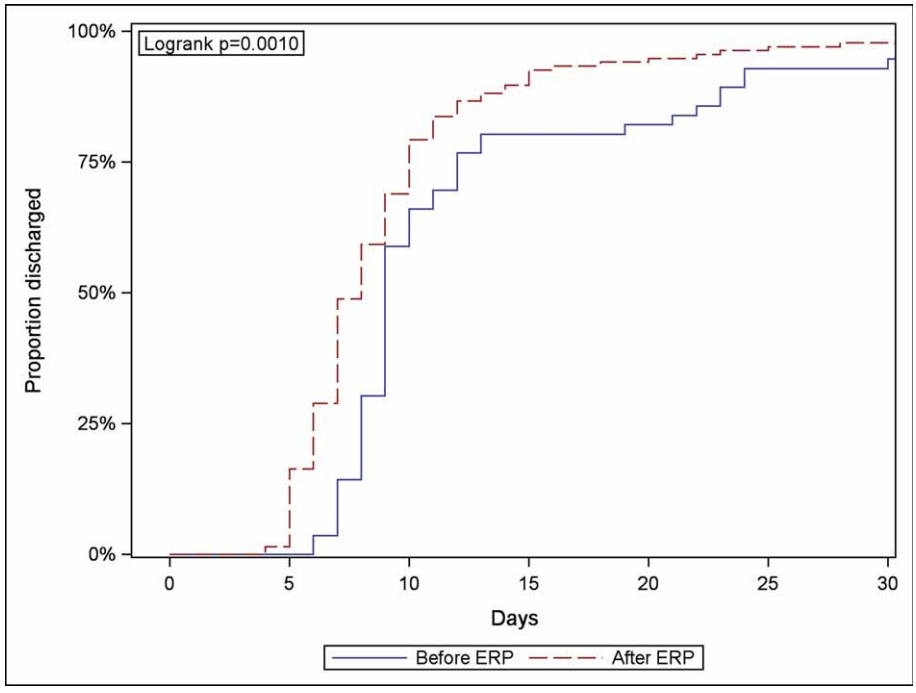

Figure 3. Kaplan–Meier plot comparing the relationship between the length of stay before implementation of the enhanced recovery programme (ERP) (minus the first 30 cases in the series to minimize the effects of the learning curve) and after ERP implementation.

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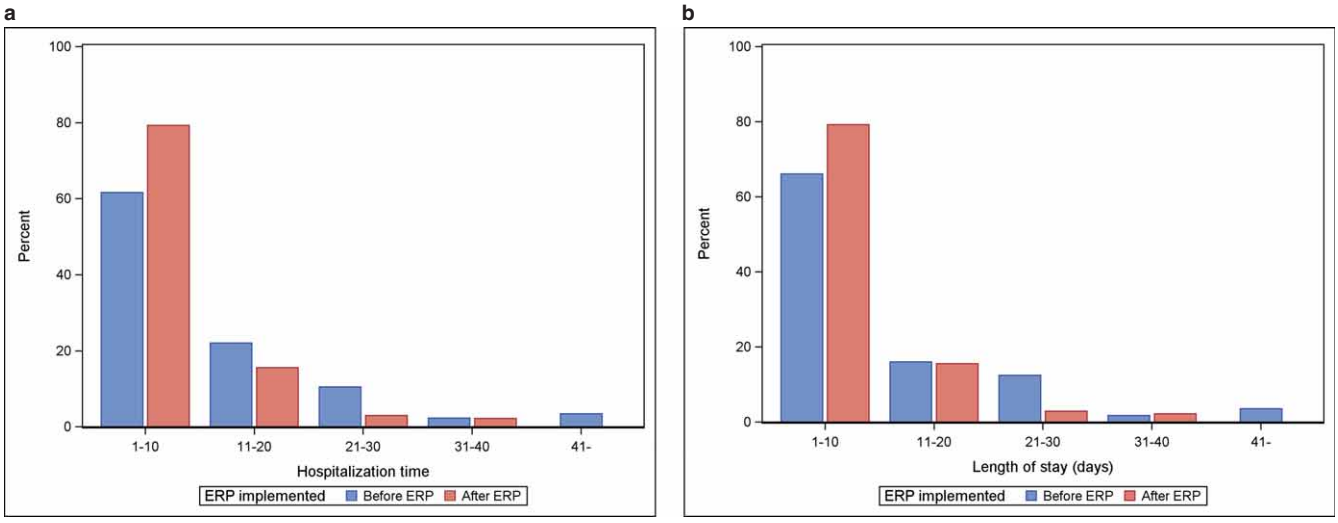

Figure 4. (a) Variability in length of stay before and after implementation of the enhanced recovery programme (ERP); (b) variability in length of stay before and after ERP implementation minus the first 30 cases in the robot-assisted radical cystectomy series.

ERP, with the percentage of patients discharged within 10 days increasing from 62% to 79% ($p < 0.01$). In the most recent 50 patients, median LOS was further reduced to 7 days (IQR 6–10 days). Various statistical analysis methods were used in this study, with the aim of identifying which aspects of patient demographics and care were associated with the reduction in LOS and/or complications. Although receiving neoadjuvant chemotherapy was associated with a reduced LOS ($p < 0.01$), this is likely to be due to healthier patients being offered neoadjuvant chemotherapy treatment. An overall improvement in LOS was seen after implementation of the ERP ($p < 0.001$) (Figures 2,3,4), with the general trend towards reducing LOS ongoing, indicating that this is likely to be due to a combination of effects incorporated in the totally intracorporeal RARC service with ERP.

There is currently sparse evidence in the literature on ERPs in robotic surgery and this is an area of surgical management that will benefit from further study. ERPs are not well suited to RCTs owing to the multiple aspects of care and current evidence supporting their implementation [30]. However, prospective multicentre data collection using a centralized database would probably help to clarify the benefits of various aspects, such as the impact of a totally intracorporeal approach, the optimal perioperative nutritional support, the optimal perioperative fluid balance [22,26] and postoperative analgesia regimens. The next logical step is to assess the potential of a standard ERP designed specifically for RARC and implemented by multiple institutions. Once an ERP in RARC has been standardized and validated, delivering predictable outcomes, then areas of potential improvement can be identified more easily and, with a collaborative approach, new elements can be introduced to the ERP, resulting in continuous incremental improvement.

In conclusion, the ERP is a safe approach promoting standardization of perioperative care, resulting in decreased LOS and decreased variability in LOS with no negative effect on complication or readmission rates. This assessment of patients undergoing RARC at a tertiary referral hospital highlights changing patient demographics, confirming that more elderly patients with associated increased comorbidities are undergoing RARC. Despite the potential negative impact on results of these changing patient demographics, early recovery after totally intracorporeal RARC was enhanced following the introduction of an ERP.

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