The Effectiveness of a Criteria-Led Discharge Initiative on the Length of Stay of Patients Who Underwent a Robotic-Assisted Laparoscopic Prostatectomy

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Abstract

Objectives To determine the impact of a criteria-led discharge initiative (CLD) on the hospital length of stay of patients undergoing a robotic-assisted laparoscopic prostatectomy (RALP).

Methods This is a cohort study of prospectively collected data completed at a major tertiary hospital from December 2017 to August 2020. The CLD initiative consists of 4 criteria: clinical haemodynamic stability (heart rate < 100 beats/minute, systolic blood pressure > 100mmHg), a drain output of less than 50 mL, flatulence or bowel movement, and the ability to tolerate an oral diet. The primary outcome was hospital length of stay for patients before and after the introduction of CLD.

Results One hundred men undergoing RALP before the implementation of the CLD initiative were compared to 118 men undergoing RALP following the implementation of CLD. The patients had similar baseline demographic features. There was a significant difference found in hospital LOS with the pre-CLD group LOS (mean = 1.8 days, SE = 0.12) being longer than the LOS in the post-CLD group (mean = 1.4 days, SE = 0.09, $P = 0.015$). There were no significant between-group differences in the proportion of patients discharged on the first postoperative day and the 30-day readmission rate.

Conclusion Within our study population, we have demonstrated that the introduction of CLD was associated with reduced hospital LOS with no increase in adverse events. These findings support the need for the development of CLD in other conditions.

Introduction

Prostate cancer is the most commonly diagnosed cancer among males in Australia and has the highest cancer treatment cost for males with an annual expenditure of AUD684 million in 2015–2016[1]. Notably, this is near twice the reported expenditure on prostate cancer compared with 2008–2009 (AUD 349 million). Most of this reported expenditure is from the costs associated with hospital-admitted patient services. Radical prostatectomy

Key Words

Criteria-led discharge, robotic-assisted radical prostatectomy, clinical protocol, length of stay, patient safety

Competing Interests

None declared.

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remains the most common form of surgery performed for prostate cancer, with this operation being completed using an open, laparoscopic, or robotic-assisted approach. Increasingly, there has been a movement towards robotic-assisted laparoscopic prostatectomy (RALP), justification being that expenditure may be offset by the incremental improvement in clinical outcomes, reduced complications, and shorter hospital length of stay (LOS)[2].

In recent years, the European Association of Urology has recommended research based protocolised perioperative care in the management of urological patients[3]. Criteria-led discharge (CLD) is considered as one of the protocolised perioperative care initiatives that may contribute to improving bed availability/capacity through more streamlined/standardised patient discharge. CLD in surgical patients dates back to 1992, and refers to the discharge of patients by nursing, midwife, allied health, and junior medical staff who have the necessary knowledge, skills, and competencies to review patients and initiate inpatient discharge[4]. This removes the need for the patient to wait for the lead clinician to approve discharge. The criteria for patient discharge are predetermined medical, nursing, and therapy parameters according to clinical guidelines or best practices for particular conditions. Currently, there is a paucity of literature on the use of CLD with the treatment of prostate cancer.

The purpose of this study was to assess the impact of the introduction of a CLD initiative on LOS and readmission rates for men undergoing RALP in our centre.

Methods

This prospective cohort study was completed at a high-volume RALP (> 100/year), public hospital in New South Wales, Australia from December 2017 to August 2020. The study hospital is a training hospital with several surgeons experienced in robotic surgery performing the RALP with operative console time split with the fellow/trainees. Patient data were collected prospectively and entered into a secure electronic database. Ethics approval for this project was obtained from the Nepean Hospital Human Research and Ethics committee in September 2017 (approval number: Study 17–53 A).

Operative setting

A transperitoneal, non-Retzius-sparing RALP, using a 4-arm, da Vinci Si dual-console Surgical System (Intuitive Surgical Inc., Sunnyvale, CA) was performed on all patients. All operations were performed under general anaesthetic without epidural anaesthetic. A 6-port placement for RALP was used with a standard retrograde approach used for development of the retropubic space, opening of the endopelvic fascia, ligation of the dorsal venous complex (DVC), bladder neck incision, seminal vesicle dissection, and finally the vesicourethral anastomosis, which was performed with a posterior reconstruction and a continuous unidirectional barbed suture. Pneumoperitoneum pressure was standardised throughout the series with pressure of < 15 mmHg via an AirSeal system (AirSeal, ConMed, Utica, NY) used during the procedure, and only changes to pressures up to 20 mmHg occurred during surgical management of the DVC. The decision for a lymph node dissection was made on a case-by-case basis in accordance with the European Association of Urology Guidelines on Prostate Cancer[5]. If a lymph node dissection was undertaken, the lymph nodes overlying the external iliac artery/vein, the nodes within the obturator fossa located cranially and caudally to the obturator nerve, and if possible, the nodes medial and lateral to the internal iliac artery were removed. Whenever possible, a nerve sparing approach was used. Bupivacaine 0.5% 10 mL local anaesthetic is infiltrated into the incisional port sites at the completion of the operation. A suction pelvic drain was typically placed routinely at the completion of the operation. Following the surgery patients were transferred to the postoperative recovery area prior to transfer to the ward. Postoperative analgesia routine included regular non-opioid analgesia charted for every patient, with opioid analgesia used only for breakthrough pain relief. On the ward, patients are reviewed by the operative team twice daily: in the morning (07:00–08:00) and in the afternoon (16:00–17:00) ward rounds.

Criteria-led discharge initiative

An initiative to protocolise discharge for patients undergoing robotic prostatectomy was proposed in 2017 and was fully implemented for all patient undergoing RALP on December 9. Before the development of the CLD initiative, a literature review was undertaken and identified predetermined clinical factors that were supported by previous research and agreed upon departmentally. The CLD initiative consisted of 4 criteria patients had to meet before discharge: a drain output of less than 50 mL, being hemodynamically stable (heart rate < 100 beats/minute, systolic blood pressure > 100 mmHg), having passed flatus or opened their bowels, and the ability to tolerate an oral diet[6]. The CLD initiative was used as an adjunct to the ward round. The discharge readiness of patients would be assessed throughout the day by ward staff who would then initiate patient discharge.

Data collection

Data were collected on demographic, perioperative, and pathological variables. Demographic variables included age, body mass index (BMI), preoperative haemoglobin (Hb), and prostate volume. Perioperative variables included console time, blood loss, nerve sparing (non, unilateral, bilateral) lymph node dissection, Clavien-Dindo score, length of stay, and 30-day readmission.

Pathological variables data were collected including prostate specific antigen (PSA), T-stage, and ISUP grade group classification. Patients were excluded from this study if they underwent a prostatectomy via other approaches (open or laparoscopic) or sustained a complication of Clavien-Dindo ≥ 3. These patients were excluded as they were unlikely to be suitable for CLD, and a CLD initiative would therefore not be expected to reduce their LOS, and they would require more complex discharge planning.

Study endpoints

The primary outcome was LOS, which was recorded as time of discharge following RALP. Secondary outcome measures were the proportion of patients discharged on the first postoperative day and the 30-day readmission rate.

Statistical analysis

Descriptive statistics was reported as mean values and portions for categorical variables. Assessment of categorical variables was completed using the Fisher exact test and recorded as a percentage and with *P*-values to indicate statistical significance. Continuous variables were assessed using an independent student t test, if normally distributed. A two-sided *P*-values of ≤ 0.05 was considered significant. There were no assumptions made for missing values. Additional multivariable sensitivity analyses with linear regression were conducted considering the baseline characteristics that were collected and have been shown to be associated with increased hospital LOS (age, BMI, prostate volume, lymph node dissection) and were imbalanced between groups (console time, final pathology [ISUP grade, clinical t-stage]) as given by a $P < 0.10$[7,8]. Statistical analysis was completed using SPSS statistics v27.0 software (IBM Corp, Armonk NY).

Results

Study population

In total, 218 men were included in this study, with 100 men undergoing RALP before the CLD initiative (December 2017 to January 2019), and 118 men undergoing RALP after introduction of the CLD (February 2019 to August 2020). Fourteen patients developed complications during their inpatient admission and were excluded from final analysis. Demographic and outcome data were available for all patients (Table 1). The mean age of patients was 62 years, and there was no significant difference between the 2 groups in the age, BMI, prostate volume, PSA, and preoperative haemoglobin of the study cohort.

There were statistically significant differences between the groups with the mean total console time being 161 minutes (SD 58.25) in the pre-CLD group compared with 191 minutes (SD 55.75) in the post-CLD group; $P < 0.0001$, the proportion of patients with final pathology of pT3 disease in the pre-CLD group 40/100

TABLE 1.

Baseline characteristic of undergoing RALP in the time period before and after the introduction of CLD*

	Pre-CLD (n = 100)	Post-CLD (n = 118)	*P* value
Age (years)	63.2 ± 7.8	63.5 ± 6.83	0.71
BMI (kg/m²)	29.0 ± 5.1	28.5 ± 4.8	0.66
Haemoglobin (g/L)	146.6 ± 17.32	146.3 ± 15.27	0.86
Prostate volume (cm^3)	42.7 ± 24.8	38.6 ± 20.13	0.32
PSA (micrograms/L)	8 ± 5.22	7.8 ± 4.22	0.72
Total console time (minutes)	161 ± 58.25	191 ± 55.75	< 0.0001
Estimated blood loss (mL)	461 ± 310.15	390 ± 315.09	0.14
Nerve sparing, n (%)			
Non-nerve sparing	39 (39)	46 (39)	0.83
Unilateral nerve sparing	32 (32)	34 (29)	
Bilateral nerve sparing	29 (29)	38 (32)	
Lymph node dissection, n (%)			
Yes	23 (23)	28 (24)	1.0
No	77 (77)	90 (76)	
Final pathological data, n (%)			
pT2 disease	60 (57)	47 (37)	0.004
pT3 disease	40 (38)	71 (56)	
Final pathology ISUP grade group, Gleason pattern, n (%)			
1 (3 + 3)	3 (3)	2 (2)	0.56
2 (3 + 4)	45 (45)	68 (58)	0.07
3 (4 + 3)	24 (24)	33 (28)	0.51
4 (4 + 4)	17 (17)	7 (6)	0.01
5 (4 + 5, 5 + 4, 5 + 5)	11 (11)	8 (7)	0.28
Clavien-Dindo classification, n (%)			
1–2	8 (8)	5 (4)	0.25
3	7 (7)	6 (5)	
4	0 (0)	1 (1)	

**Unless otherwise stated values presented are means with standard deviation.*

BMI: body mass index; CLD: criteria-led discharge; ISUP: The International Society of Urological Pathology; PSA: prostate specific antigen; RALP: robotic-assisted laparoscopic prostatectomy; SD: standard deviation.

patients (37.7%) compared with 71/118 patients (56.3%) the post-CLD group; $P < 0.004$, and the proportion of patients with final pathology of ISUP grade group of 4 in the pre-CLD group 17/100 patients (17%) and 7/118 patients (6%) in the post-CLD group, $P = 0.01$. There were no statistically significant differences between the 2 groups in estimated blood loss, proportion of patients undergoing nerve sparing or lymph node dissection.

Outcomes

There was a significant difference found in hospital length of stay with pre-CLD group LOS (mean = 1.8 days, SE = 0.12) being longer than the post-CLD group LOS (mean = 1.4 days, SE = 0.09, $P = 0.015$) (Table 2). Numerically, a lower proportion of patients were discharged on the first postoperative day in the pre-CLD group (55/100 patients, 55%) compared with the post-CLD group (79/118 patients, 67%); however, this result was not statistically significant (odds ratio = 0.60, 95% CI = 0.34 to 1.05, $P = 0.09$). There was no significant difference between the 2 groups for 30-day readmission rates, with a total of 11 (11%) and 10 (9%) patients readmitted in the pre-CLD and post-CLD group, respectively (Table 2).

Discussion

Statement of principal findings

In this cohort study, we found a significantly shorter average LOS for men undergoing RALP after the introduction of CLD compared with those who underwent RALP before CLD. There were no significant between-group differences in the proportion of patients discharged on the first postoperative day and the 30-day readmission rate.

Relationship to previous studies

To our knowledge, no previous studies have specifically assessed the effect of CLD in patients undergoing radical prostatectomy for prostate cancer. Several studies have demonstrated a clinical benefit in Enhanced Recovery After Surgery (ERAS) protocols in patients undergoing radical prostatectomy that used a broad "bundle of care" approach with a wide variety of perioperative interventions being collectively implemented at the same time[9]. However, our results are consistent with a recent systematic review of surgical patients that reported reduced hospital LOS and no increase in patient readmission or complication rates with CLD[4]. Notably, a randomised control trial of 131 patients undergoing various surgical procedures in Queensland, Australia, reported that a higher proportion of patients were discharged on time in the CLD-initiated discharge group compared with the usual care group, with a similar mean patient satisfaction score between groups[10]. Similarly, a retrospective study conducted in Leicester, United Kingdom, reported a significantly higher number of patients successfully discharged on the day of surgery after laparoscopic cholecystectomy or laparoscopic inguinal hernia repair in a CLD-initiated discharge compared with a usual care group, with no significant difference between the discharge groups in readmission rates or in the number of patients seeking primary care attention following discharge[11]. Finally, a prospective cohort study from Adelaide, Australia of 83 children with uncomplicated appendicitis reported a 29.2% reduction in median postoperative length of stay (19.6 hours versus 27.7 hours; $P < 0.001$), no significant difference in complication rates, and an annual direct cost savings of approximately AUD77 057 in patients managed with CLD protocol compared with historical-usual-care control group. Overall, our study does support the hypothesis that CLD maybe associated with reduced hospital LOS, with no increase in adverse patient events and the potential to reduced hospital costs.

In our study, we saw an approximate 22% reduction in average hospital LOS following the implementation of CLD. This is within the range of the expected effect previously reported in studies that looked at the impact of CLD on hospital LOS[12]. The reasons why CLD has such an effect on hospital LOS were explored in an interesting multicentre, cohort study of 1071 patients undergoing a variety of "abdominal surgeries" within hospitals in Australia and New Zealand, this study included 207 patients categorised as "renal/urology"[13]. This study

TABLE 2.

Comparison of study outcomes in the time period before and after the introduction of CLD

	Pre-CLD (n = 100)	Post-CLD (n = 118)	Mean difference (95% CI)	*P* value
Hospital Length of Stay (days), mean ±SD	1.8 ± 1.24	1.4 ± 0.97	0.4 (0.07–0.66)	0.02
			Odds ratio (95% CI)	
Proportion of patients discharged on the first postoperative day, n (%)	55 (55)	79 (67)	0.60 (0.34–1.05)	0.09
30-day readmission rate, n (%)	11 (11)	10 (9)	1.33 (0.53–3.37)	0.65

CI: confidence intervals; CLD: criteria-led discharge; SD: standard deviation.

reported 30% of patients remained in hospital following fulfilment of CLD checklist and that if a CLD were to be fully implemented the hospital LOS would be reduced by 0.8 days ($P < 0.001$). Of patients remaining in the hospital following completion of all criteria in the CLD checklist, approximately two-thirds were reported as being unnecessarily kept in hospital for illegitimate reasons, the main reasons being awaiting removal of lines/drains, surgeon waiting for patient bowels to open, awaiting a test result or consult, and "no specific reason documented." The authors suggest that CLD leads to improved standardisation in discharge practices, improved patient flow through inpatient facilities, and ultimately improved access to hospital beds. However, patient decision-making needs to be considered, as many patients do not feel ready when confronted with early discharge[14]. Additional preoperative education may be used to offset this.

In 2016, the National Hospital Cost Data Collection found that the average cost for a bed in an Australian public hospital was $1901 per day. An initiative that can reduce the length of stay of patients without increasing complications would represent an important cost-saving method for the public health care system, especially with the use of high-cost technologies in the treatment of prostate cancer. An activity-based funding model was implemented by the Australian government in which a set price is generated for each patient, based on the approximate cost of treatment. This method is used to reduce cost by incentivising the identification of inefficient hospital practices by allowing hospitals to keep any financial surplus.

Hospital LOS is an important driving factor in the cost of patients having a RALP. Previous studies have reported that predictive factors for increased hospital LOS after RALP were patient age, increased medical comorbidities, BMI, smoking, prostate volume, operative time, need for pelvic lymph node dissection, and the development of a postoperative complication[7,8]. Of note, most of these predictive factors are unmodifiable factors. More recently, possibly influenced by COVID-19 limiting hospital bed access, several authors have demonstrated the feasibility of "outpatient" or "day-surgery" RALP[15–17]. However, this approach may not be easily generalisable as these procedures were performed in highly selected patient populations in extremely high-volume centres with an intense level of perioperative coordination and multi-disciplinary care. Nonetheless, these studies at the very least are an important "proof-of-concept" that demonstrate significant improvements can still be made in hospital LOS following RALP.

Limitations

Because of the before and after nature of the study design, we cannot exclude a simple temporal effect on hospital LOS. However, causality is supported by the statistically significant strength of the association in our primary outcome and by the between-group differences at baseline, and in particular, the increased operative time and higher grade/stage pathology at baseline in the post-CLD group compared with the pre-CLD, which are predictive factors that have been associated with increased hospital LOS[7,18]. Another limitation of our study is that we did not collect data on the use of other cointerventions that may be associated increased hospital LOS such as analgesia and antiemetics used perioperatively. Poorly controlled pain is known to be associated with a slower time to mobilise and can lead to an increased length of stay[19,20]. Additionally, while drain output is included in our CLD protocol we recognise that many centres do not routinely leave a drain following RALP, and we have moved to only leaving an abdominal drain in selective patients.

Conclusion

Within our study population, we have demonstrated that the introduction of CLD was associated with reduced hospital LOS and no increase in 30-day readmission rates in patients undergoing a RALP for prostate cancer. CLD is a low-cost, pragmatic, and relatively easy-to-implement initiative that does not appear to negatively impact patient safety. This could also lead to improved bed availability and decreased costs to the health care system. These findings support the investigation of CLD in other urological procedures.

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