Streamlining Recovery: Harnessing Robotic Surgery for Shorter Hospital Stays in Low Rectal Cancer Patients Undergoing Ultralow Anterior Resection

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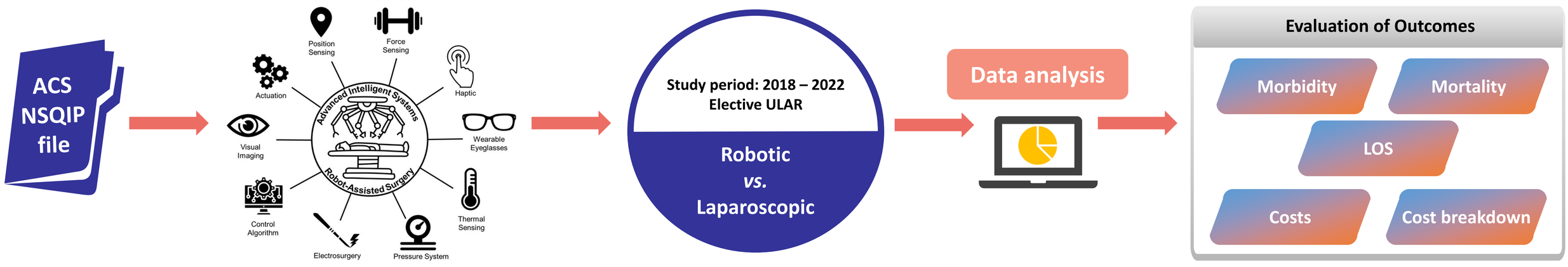
INTRODUCTION

- In Singapore, colorectal cancer (CRC) is the most commonly diagnosed malignancy. Low rectal cancer is a subtype of CRC that develops in the lower two-thirds of the rectum. It is more challenging to treat low rectal cancer due to its location and proximity to vital organs and structures.
- Ultralow anterior resection (ULAR) is a surgical procedure involving the removal of the rectum and reattaching of the colon to the anus. In recent years, low rectal cancer surgery has favored minimally invasive techniques, such as laparoscopic and robotic ULAR.
- There is an ongoing debate regarding the cost-effectiveness of robotic versus laparoscopic ULAR.
- This study aimed to compare the clinical outcomes and costs of robotic versus laparoscopic ULAR for low rectal cancer using data from the American College of Surgeons – National Surgical Quality Improvement Program (ACS-NSQIP).

METHODOLOGY



RESULTS

Table 1. Comparison of patient demographics, surgical and clinicopathologic characteristics

Variable	Laparoscopic n (%)	Robotic n (%)	P-value
Total case	66	66	
Age (year)			
Median [IQR]	67.70 [60.13, 72.86]	65.93 [60.10, 71.99]	0.649
Gender			
Female	27 (40.9)	23 (34.8)	0.590
Male	39 (59.1)	43 (65.2)	
ASA classification			
1	0 (0.0)	0 (0.0)	1.000
2	49 (74.2)	49 (74.2)	
3	17 (25.8)	17 (25.8)	
BMI (kg/m²)			
Median [IQR]	22.80 [21.09, 25.76]	22.91 [19.95, 25.10]	0.317
< 27.5	57 (86.4)	62 (93.9)	0.243
≥ 27.5	9 (13.6)	4 (6.1)	
Hypertension requiring medication			
No	32 (48.5)	37 (56.1)	0.486
Yes	34 (51.5)	29 (43.9)	
Diabetes mellitus			
No	49 (74.2)	49 (74.2)	1.000
Yes	17 (25.8)	17 (25.8)	
Preoperative bleeding disorder			
No	65 (98.5)	66 (100.0)	1.000
Yes	1 (1.5)	0 (0.0)	
Preoperative immunosuppressive therapy			
No	66 (100.0)	65 (98.5)	1.000
Yes	0 (0.0)	1 (1.5)	
Preoperative sepsis			
No	66 (100.0)	65 (98.5)	1.000
Yes	0 (0.0)	1 (1.5)	
Preoperative chemoradiation therapy			
No	29 (43.9)	27 (40.9)	0.860
Yes	37 (56.1)	39 (59.1)	
Operative duration (min)			
Median [IQR]	355.00 [266.25, 468.75]	405.00 [320.00, 487.50]	0.089
TNM staging			
I	22 (33.3)	16 (24.2)	0.386
II	20 (30.3)	20 (30.3)	
III	22 (33.3)	24 (36.4)	
IV	2 (3.0)	6 (9.1)	

There was no significant difference between the laparoscopic and robotic groups in terms of comorbidity profile, preoperative variables, serum albumin level, preoperative chemoradiation therapy, and TNM staging.

Table 2. Comparison of postoperative outcomes and surgical complications

Variable	Laparoscopic (n = 66) n (%)	Robotic (n = 66) n (%)	P-value
Required transfusion within 72 h	4 (6.1)	2 (3.0)	0.676
Required dialysis	0 (0.0)	1 (1.5)	1.000
Venous thrombosis requiring therapy	0 (0.0)	0 (0.0)	NA
30-day readmission	10 (15.2)	19 (28.8)	0.093
30-day return to theatre	1 (1.5)	3 (4.5)	0.612
30-day mortality	0 (0.0)	0 (0.0)	NA
Length of stay (days)			
Median [IQR]	**6.00 [5.00, 8.75]**	**5.00 [4.00, 7.00]**	**0.005**
≤ 7	**43 (65.2)**	**54 (81.8)**	**0.049**
> 7	**23 (34.8)**	**12 (18.2)**	
Postoperative complications	18 (27.3)	22 (33.3)	0.570
Superficial incisional SSI	3 (4.5)	1 (1.5)	0.612
Deep incisional SSI	0 (0.0)	1 (1.5)	1.000
Oran/space SSI	4 (6.1)	7 (10.6)	0.529
Pneumonia	1 (1.5)	1 (1.5)	1.000
Pulmonary embolism	0 (0.0)	0 (0.0)	NA
Unplanned intubation	0 (0.0)	1 (1.5)	1.000
Renal insufficiency	2 (3.0)	1 (1.5)	1.000
UTI	2 (3.0)	1 (1.5)	1.000
Stroke/CVA	0 (0.0)	0 (0.0)	NA
Myocardial infarction	0 (0.0)	1 (1.5)	1.000
Cardiac Arrest Requiring CPR	0 (0.0)	0 (0.0)	NA
Clostridium difficile infection	0 (0.0)	0 (0.0)	NA
Anastomotic leak	3 (4.5)	4 (6.1)	1.000
Sepsis	3 (4.5)	4 (6.1)	1.000

- **No significant differences in postoperative outcomes and mortality rates. The robotic group had a significantly shorter median LOS.**
- **A prolonged LOS > 7 days occurred in 18.2% of robotic patients, compared to 34.8% of laparoscopic patients.**

- **The total inpatient hospitalization cost was comparable between both groups.**
- **The robotic group incurred higher surgical costs, but substantially lower costs for ward accommodation, daily medical treatment, and nonclinical services.**

The robotic ULAR approach leads to a quicker and smoother recovery for patients without compromising safety or quality of care as well as cost savings for the healthcare system, as shorter hospital LOS translates to reduced hospitalization costs and increased bed availability.

Table 3. Comparison of inpatient hospitalization costs

Hospitalization Costs (S$)	Laparoscopic (n = 66)	Robotic (n = 66)	% difference	P-value
Total inpatient cost per case	26,810.36 (8,406.13)	27,151.59 (5,265.55)	1.3% increase	0.780
Cost breakdown				
Surgical cost	9,450.95 (2,724.98)	10,899.11 (2,482.12)	15.3% increase	0.002
Ward accommodation	3,738.72 (2,372.86)	3,240.32 (1,942.37)	13.3% decrease	0.042
Daily treatment				
Medical	1,964.83 (1,276.37)	1,522.14 (723.04)	22.5% decrease	0.016
Nursing	1,676.09 (759.94)	1,643.38 (511.46)	2.0% decrease	0.772
Professional attendance	50.67 (78.11)	64.23 (146.20)	26.8% increase	0.507
Investigation				
Radiology	169.50 (237.33)	126.56 (219.85)	25.3% decrease	0.283
Laboratory	2,126.95 (838.27)	2,011.94 (663.71)	5.4% decrease	0.384
Specialized	613.85 (627.27)	709.49 (1,277.64)	15.6% increase	0.586
Rehabilitation	261.23 (195.68)	246.38 (228.36)	5.7% decrease	0.689
Consumables	5,761.32 (1,463.27)	5,955.58 (1,390.17)	3.4% increase	0.436
Pharmacy	586.30 (611.11)	445.36 (334.66)	24.0% decrease	0.103
Nonclinical	390.71 (387.84)	258.93 (173.21)	33.7% decrease	0.013

Cost data were presented as mean (SD) in 2022 Singapore dollars (S$), adjusted for inflation. 1 Singapore dollar (S$) = 0.731 US dollar (US$).

CONCLUSION

This study provides valuable insights into the cost comparison between robotic and laparoscopic ULAR for low rectal cancer in Singapore. Despite higher surgical costs, robotic ULAR was associated with a shorter hospital LOS. Our findings contribute to the ongoing debate regarding the cost-effectiveness of the robotic surgical approach and assist healthcare providers and policymakers in making informed decisions about resource allocation and reimbursement policies.