Development of a Canadian Colorectal Robotic Surgery Program: the First Three Years

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INTRODUCTION

Although robotic colorectal surgery is prevalent in many American centres, Canadian uptake has been limited. The aim of this study is to describe the experiences and results of the first three years of a novel colorectal robotic surgery program at a tertiary centre, the University of Alberta Hospital in Edmonton, Canada. This is the first colorectal robotic program in Western Canada.

METHODS

Phase One: First Three Years of a Robotic Colorectal Surgery Program

We analyzed a prospective database of all robotic procedures performed at the University of Alberta Hospital by three surgeons from November 19, 2018 to November 17, 2021 (Table 1). Patients were split into quarters based on cases numbers. The Welch ANOVA test was used to compare OR times (OT) throughout the learning curve, and the Kruskal-Wallis test was used to analyze change in median hospital stay (HS) in the same period.

Phase Two: Comparison of Pelvic Procedures between Robotics Program and Historic Procedures

We analyzed all patients from November 19, 2018 to November 17, 2021 who underwent low anterior resection (LAR) or abdominoperineal resection (APR) with a robotic (Table 2), laparoscopic, or open approach. We compared this group to patients who underwent LAR or APR from 2014 – 2018 at the same centre via laparoscopic (n=57) or open (n=129) approach.

Table 1. Demographics of all robotic colorectal patients from Nov 2018 – 2021

Variable	Statistics (n=136)
Age in years	
N (Nmiss)	136 (0)
Mean ± SD	60.0 ± 13.8
Range	20 - 83
Median (Q1-Q3)	62 (54 – 70)
Gender	
Female	51 (37.5)
Male	85 (62.5)
BMI	
N (Nmiss)	136 (0)
Mean ± SD	27.7 ± 6.0
Range	17.2 – 53.6
Median (Q1-Q3)	27 (23.3 – 31.7)
ASA	
I	5 (3.7)
II	79 (58.0)
III	52 (38.2)
IV	0 (0)

Table 2. Demographics of LAR/APR robotic colorectal patients from Nov 2018 – 2021

Variable	Statistics (n=92)
Age in years	
N (Nmiss)	92 (0)
Mean ± SD	61.3 ± 11.7
Range	21 - 83
Median (Q1-Q3)	56 - 70
Gender	
Female	31 (33.7%)
Male	61 (66.3%)
BMI	
N (Nmiss)	92 (0)
Mean ± SD	28.0 ± 6.2
Range	18.3 – 53.6
Median (Q1-Q3)	23.2 - 32
ASA	
I	3 (3.3%)
II	49 (53.3%)
III	40 (43.5%)
IV	0 (0%)
Procedure	
LAR	60 (65.2%)
APR	32 (34.8%)

RESULTS

Phase One: First Three Years of a Robotic Colorectal Surgery Program

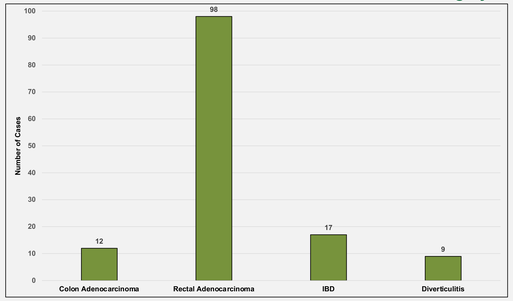


Figure 1. Robot cases by indication November 2018 – 2021

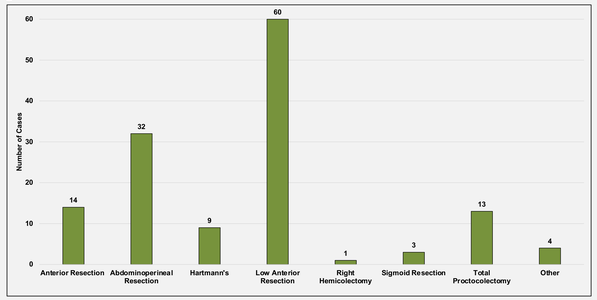


Figure 2. Robot cases by procedure November 2018 – 2021

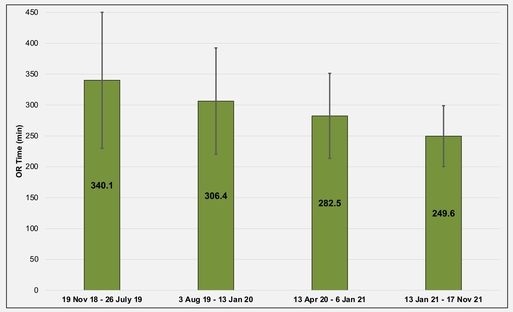


Figure 3. Robot cases by mean (±SD) OR Time (minutes) per quarter from November 2018 – 2021 (p<0.0001, Welch's ANOVA)

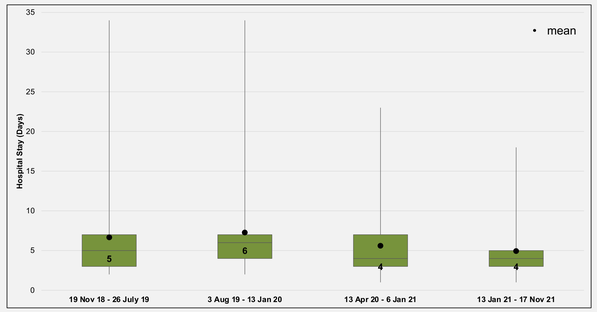


Figure 4. Robot cases by median hospital stay (days) per quarter from November 2018 – 2021 (p=0.0811, Kruskal-Wallis)

Phase Two: Comparison of Pelvic Procedures between Robotics Program and Historic Procedures

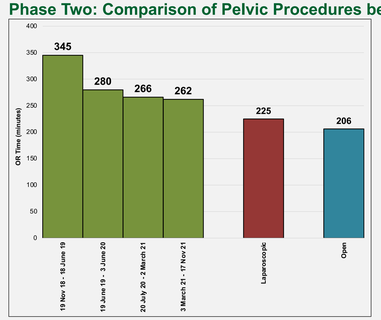


Figure 5. Mean OR time of robot LAR/APR cases per quarter from Nov 2018 - 2021 compared with historic laparoscopic/open cases (2014-2018)

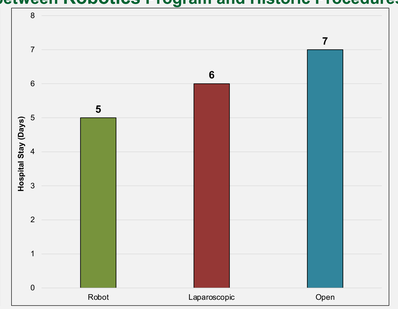


Figure 6. Median hospital stay of robot LAR/APR cases from Nov 2018 - 2021 compared with historic laparoscopic/open cases (2014-2018)

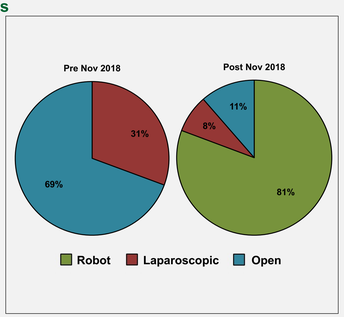


Figure 7. LAR/APR case distribution pre- and post-initiation of robot program

DISCUSSION

Phase One: First Three Years of a Robotic Colorectal Surgery Program

- Main indication for robotic surgery was rectal adenocarcinoma.
- Majority of robotic procedures were LAR and APR.
- Significant decreased in mean OR time for all robotic procedures with time, demonstrating learning curve despite onboarding of third surgeon in mid 2021.
- Median hospital stay decreased overtime, however, not statistically significant.

Phase Two: Comparison of Pelvic Procedures between Robotics Program and Historic Procedures

- Mean OR time for LAR/APR robotic cases decreases with learning curve, approaching lap and open OR time.
- Median HS for robotic cases decreased compared to historic lap/open cases.
- Case distribution post-initiation demonstrated 89% minimally invasive cases, compared to 31% prior to Nov 2018.
- Readmission rate was lower for robotic cases (7.5%) compared to lap (8.8%) and open (15.5%). Conversion rate pre-initiation was 5%, compared to 3% post-initiation (of this, lap to open [2%] and robot to open [1%]).
- Decreased HS and conversion rate in keeping with other robotic programs.

Limitations

- OR time, hospital stay, readmissions, and conversions as primary outcomes of robotic surgery are limited. Future studies will analyze other outcomes, including post-operative pain, complication rate, patient quality of life, as well as cost-effectiveness.

CONCLUSION

Developing a robotic colorectal program with similar post-operative outcomes to previous laparoscopic and open cases is feasible in the Canadian context. There is a significant decrease of OT with surgeon experience. Robotic surgery resulted in decreased HS and readmission rates compared to open/laparoscopic pelvic procedures. Post-initiation, 89% of pelvic procedures were minimally invasive, compared to 31% prior to 2018. Future studies will analyse additional outcomes related to robotic surgery.

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