Outcomes of Sleeve Gastrectomy Procedure in Robotic vs. Standard Laparoscopic Settings

Jeremiah Hyslip, MS3; Richard Perugini, MD; Philip Cohen, MD
University of Massachusetts Medical School

Background

Robotic surgery is becoming more prevalent in medicine with the advent of new technology and increased resources[1]. The robotic platform offers an advantage in ergonomics. Each robotic instrument allows articulation and rotation, as compared with standard laparoscopic instruments that allow only rotation. This significantly increases the degrees of freedom, making movements more precise and comfortable for the surgeon[2]. The Intuitive robotic platform also utilizes true 3D vision, which is an improvement over the standard laparoscopic 2D vision[3,4]. These gains from the robotic platform should be weighed against the loss of haptic feedback, or the information that can be gained from proprioception[5]. Specifically, a surgeon may learn characteristics of a tissue, such as degree of inflammation, fibrosis, or the amount of tension a tissue is experiencing, by their sense of touch. This sense is completely lost when moving from laparoscopic surgery to robotic surgery. Surgeons need to utilize visual cues to substitute for this loss of touch.



The Da Vinci Xi Surgical System
https://www.ccmhhealth.com/davinci-surgical-system/

Learning Curves

The ability to acquire technical prowess in a new endeavor, such as robotic surgery, may be dependent on the baseline technical skill and experience of the surgeon[6,7]. One would expect that an experienced laparoscopic surgeon who is well beyond their learning curve would have a shorter learning curve for robotics than a novice attempting to learn the operation itself as well as the intricacies of the robotic approach[8,9]. Alternatively, a surgeon may also be too advanced in age and experience, so that acquisition of technical skill is hindered by their age or prior experience.

	Non-Robotic	Robotic	p-value
Procedure time (min)	82.97	90.44	0.153
Average Length of Stay	1.186 days	1.232 days	0.534
6 month weight loss	20.58%	20.55%	0.986
6 hour Hct drop	3.58%	1.31%	0.011
<30 day readmission	3.98%	7.14%	0.313
<6 month readmission	3.91%	10.71%	0.052

Table 1. Comparison of several outcome measures between robotic and non-robotic groups

Results

The average procedure time for robotic cases was 7.57 minutes longer than for non-robotic cases, although this difference was not significant (p=0.153). There was no difference in average length of stay or percentage weight loss at six months post-op.
The average percent hematocrit drop was significantly lower in the robotic group (1.31% vs 3.58%, p=0.011).
The 30 day readmission rate was higher in the robotic group, though this was not significant (7.14% vs 3.98%, p=0.313). The 6-month readmission rate was higher in the robotic group (10.71% vs 3.91%, p=0.052).

Methods

Data for all patients who underwent a sleeve gastrectomy procedure at UMass Memorial Medical Center in 2019 were pulled from EPIC and the UMass MBSAQIP registry. The patients were sorted into two groups, based on whether or not their operation was performed using the DaVinci robot system. Data such as time of operation, post-op length of stay, six-month weight loss, <30 day readmission rate, <30 day reoperation, and post-op hematocrit drops were all collected. Additionally, long-term outcome metrics such as resolution or development of GERD or type 2 diabetes mellitus were measured. Two-tailed t-tests and z-tests were run on Excel to check for statistical differences between proportions, and p-values were subsequently generated.

	Non-Robotic	Robotic	p-value
Developed GERD	14.2%	13.8%	0.479
GERD resolved	38.5%	44.4%	0.304
Developed Diabetes	0.8%	0.0%	0.281
Diabetes Resolved	70.7%	55.0%	0.209

Table 2. Comparison of chronic outcomes between robotic and non-robotic groups

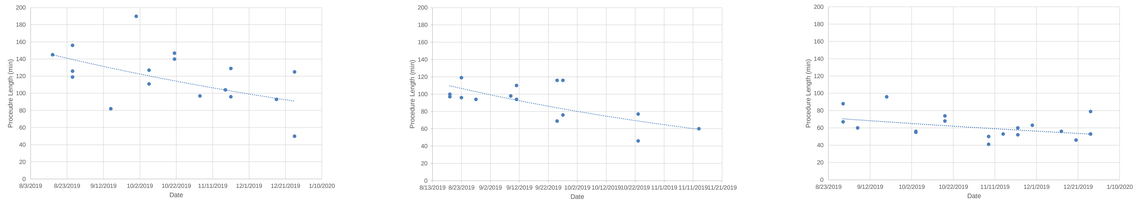


Figure 1. Learning curves for three different surgeons at UMass Memorial from Aug 2019 to Dec 2019. Learning curve is based on operative time. The surgeon in the rightmost poster was the only one with prior experience in robotic surgery.

Discussion

Overall, there were not many significant differences in outcomes between patients who had undergone robotic and non-robotic sleeve gastrectomies. Percentage weight loss, the most relevant outcome of sleeve gastrectomy, was almost identical between the two groups. Other metrics of quality for sleeve gastrectomy including resolution of preoperative GERD, development of de novo GERD, and remission of diabetes were equivalent. This indicates that use of the robotic platform does not lead to a reduction in quality.

A decrease in the 6 hour Hct drop may imply an improvement in postoperative hemorrhage with the use of the robotic platform.

An increase in 6 month hospital readmission rate will require further investigation. These patients were admitted for reasons such as dysphagia, PE, and nausea with vomiting.

Limitations and Future Directions

The major limitation to this study was the relatively small sample size of robotic cases (n=56) compared to non-robotic cases (n=226). While we were able to achieve some statistically significant results, there were not enough data to construct meaningful learning curves. In addition, length of operation is a relatively rudimentary way of assessing learning curve, as well as being vulnerable to confounders. Finally, it is difficult to decipher how much of the procedure was performed by the attending surgeon, a fellow, or a surgical resident. With a larger sample, we plan to construct learning curves based on variables such as weight loss, Hct drop, and readmission rates.

This study will be continued in the coming months. We plan to have a larger robotic sample, by which we can obtain more thorough conclusions and better assess learning curves. Furthermore, we plan to obtain a collection of technical metrics from Intuitive Inc., the manufacturer of the Da Vinci Xi, which may give us further insight on the acquisition of expertise on the robotic platform. Our goal is to better define the learning curve, and to associate certain metrics with better outcomes.

Contact Information

Jeremiah Hyslip
University of Massachusetts Medical School
Email: Jeremiah.Hyslip@umassmed.edu
Phone: 413-530-1661

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Acknowledgements

Thanks to Dr. Richard Perugini and Dr. Philip Cohen
for their oversight and consultation with this project

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