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Research Abstracts

Differences in Objective Performance Indicators During Robotic Right Colectomy in Obese and Non-Obese Patient Populations

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Introduction: Despite the perception of increased procedural complexity in obese patients, a lack of objective data prohibits precise characterization of any potential differences in surgical techniques required during procedures on obese patients. Objective performance indicators (OPIs), machine learning-enabled metrics calculated from robotic systems data, provide objective data regarding surgeon movements and robotic arm kinematics. In this study, we identified differences in OPIs during robotic right colectomy (RRC) between obese and non-obese patients.

Methods: Endoscopic video synchronized to robotic systems data was captured during 25 RRCs. Nine obese (BMI ≥ 30) and 16 non-obese (BMI < 30) patients were included in this study. Videos were annotated to delineate individual surgical steps. OPIs during the following steps were analyzed: mesenteric dissection, ligation and division of vascular pedicle, mobilization of ascending colon, and preparation of proximal and distal bowel. Comparisons were made using the T-test/Wilcoxon Sum-Rank test as appropriate.

Results: Indications for surgery, which included adenoma, cancer, and inflammatory bowel disease, did not differ significantly between the two groups. OPIs analyses revealed significant differences between obese and non-obese patients. Across all steps, surgeons exhibited greater 3rd arm path length and moving time in obese patients. Step-specific analyses revealed the following in obese patients: slower primary non-dominant arm acceleration during medial to lateral mobilization of the ascending colon, longer 3rd arm moving time during lateral to medial mobilization of the ascending colon, and longer energy activation duration during mesenteric dissection. Using OPI analyses, we identified significant differences in surgeon movements when operating on obese versus non-obese patients.

Conclusions: This study assessed the impact of a patient attribute (obesity) on surgeon movements and robotic arm kinematics. It is the first study to identify step-specific OPIs that differ during RRC across patient populations. To draw more robust conclusions, further studies involving larger patient samples are needed.

Examples of OPI differences between obese and non-obese patients during RRC steps

OPIs	Obese median [IQR]	Non-obese median [IQR]	p value
All steps 3rd arm path length [m]	0.63 [0.10 - 1.73]	0.32 [0.02 - 0.98]	**0.020**
All steps 3rd arm moving time [sec]	30.45 [5.71 - 66.17]	15.00 [1.31 - 41.23]	**0.011**
Medial to lateral ascending colon mobilization Non-dominant arm acceleration [m/sec^2]	0.36 [0.25 - 0.45]	0.46 [0.35 - 0.59]	**0.032**
Lateral to medial ascending colon mobilization 3rd arm moving time [sec]	44.81 [20.20 - 108.91]	21.08 [3.35 - 47.81]	**0.042**
Mesenteric dissection Energy activation duration [sec]	0.78 [0.53 - 1.04]	0.53 [0.33 - 0.78]	**0.041**

OPIs = objective performance indicators, RRC = robotic right colectomy, IQR = interquartile range, sec = seconds, m = meters, m/sec^2 = meters per second squared