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Short Title: Teaching ICA vs ECA

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Abstract

Introduction: There is controversy in minimally invasive colorectal procedures regarding choosing optimal technique between intra-corporeal (ICA) and extra-corporeal anastomosis (ECA). Previous studies recognise the short-term benefits in right hemicolectomy with intra-corporeal approach, however, ICA can result in increased operative difficulty. The aim of this study is to understand attitudes towards teaching ICA in colorectal procedures and how this varies between subspecialty training.

Methods: Active members of General Surgeons Australia were contacted through email to participate in a voluntary, unincitived survey. Demographic details were collected and participants were asked to rate agreement for simulation-based training for increasing adoption of ICA through a Likert scale and when preferences for teaching ICA. Descriptive statistics were completed to describe frequencies and ordinal regression was completed to determine factors for Likert scale question.

Results: There were 43 respondents and most participants recognised that ECA was easier to teach trainees and should be taught first. 53.5% of respondents recognised that simulation-based training would assist the adoption of ICA. Surgeons who routinely close bowel or enteric defects intra-corporeally are 354% more likely to show an interest in simulation-based training for adopting ICA, however, surgeons who are not involved in teaching trainees did not show an interest in simulation-based training.

Conclusion: There is significant agreement that ECA forms the basis to learn ICA and simulation-based training would assist with the uptake of ICA. However, a multimodal approach, including expanding training avenues and providing financial incentives, would be necessary to enhance the adoption of ICA in colorectal surgery.

Main Text

Introduction

Minimally invasive ileocolic and colo-colonic anastomoses can be performed using extra-corporeal (ECA) or intra-corporeal anastomosis (ICA). Both ECA and ICA can be completed using laparoscopic or robotic approaches. Controversy still surrounds the optimal approach, which is a balance of the potential benefits of ICA and the increased technical difficulty. ICA has been shown to improve short-term patient outcomes, with comparable oncological outcomes.¹ Previous studies have demonstrated that there is decreased morbidity and hospital stays when completing ICA in right hemicolectomy, with a decreased surgical site infection rate.²⁻³ This contrasts initial expectations due to an expected increased risk of infection due to exposing the peritoneum to intra-luminal contents.⁴ Many surgeons recognise that increased time to complete ICA and the technical difficulty may limit its uptake. ICA takes anywhere from 13-44 minutes longer than ECA.^{3,5-6}

The aim of this study was to understand attitudes towards teaching ICA, and whether completing colorectal sub-speciality training altered preference to ICA.

Materials and Methods

The University of Sydney Human Research and Ethics Committee (HREC) approved this study in line with the National Statement on Ethical Conduct in Human Research, 2007 (NHMRC) (Approval no: 2022/904). This study has been conducted as per CHERRIES guidelines (see supplementary material). 960 active general surgeons were contacted through the General Surgeons Australia (GSA) emailing list and were invited to complete the survey. Exclusion criteria involved retired surgeons and surgeons who did not perform colorectal procedures. Survey collected demographic data including sex, age, location, experience, fellowship training and colorectal procedure volume as well as preference for ICA or ECA and attitudes towards teaching ICA. Participants were asked to complete a Likert scale to determine agreement with use of simulation-based training to increase likelihood of adopting ICA.

The survey was open from 6th of July 2023 to 5th of September 2023. GSA full financial members were emailed on the 6th of July 2023, with a second follow-up email sent on the 3rd of August 2023. Other results from survey have been published previously.⁷

Statistical analysis was completed using SPSS 28 for Mac (IBM Corp., Armonk, N.Y., USA). Descriptive statistics were utilised to describe demographical data. Descriptive statistics were used to describe frequency and ordinal regression was completed for determining factors that would increase the likelihood of agreement with simulation-based training to adopt ICA.

Results

The total number of respondents to the survey was 43 (4.48% response rate). Descriptive statistics for respondents are shown in Table 1. 53.5% of respondents recognised that simulation-based training would assist the adoption of ICA and further details are seen in Table 2. Table 3 summarises results of ordinal regression showing that surgeons who routinely close bowel or enteric defects intra-corporeally are 354% more likely to have an interest in simulation-based training to adopt ICA. Those who were not involved in hospital-based teaching of trainees were 91% less likely to prefer simulation-based training to increased adoption of ICA, however, this was not statistically significant. 81.3% of respondents believed that ECA should be taught first, and 76.7% of respondents believed that ECA was easier to teach. Interestingly, only surgeons who had completed colorectal subspeciality training believed that ICA should be taught first or easier to teach and further details can be seen in Table 4 and 5.

Discussion

Our previous study has shown that this sample of Australian general surgeons preferred completing ECA and that perceived barriers towards completing ICA was the longer operative time and lack of perceived benefits in patient outcomes.⁷ However, Marchesi et al (2013) has demonstrated that ICA can be completed faster than ECA, if given the opportunity to progress through the learning curve.⁵ This suggests surgeons should consider challenging the automaticity of selecting ECA on all patients, so as to develop skills in ICA. Education and training are imperative to assist with the adoption of ICA. Given a majority of participants find teaching ECA first easier and that ECA should be mastered prior to ICA, training in ECA will serve as a foundation onto which skills in ICA are developed. Simulation-based training has been shown as an effective method to develop skills in laparoscopy and within colorectal surgery.⁸⁻⁹ The surgeons within this study recognise the value of simulation-based training, albeit, this enthusiasm was not shared by surgeons who are not involved in teaching of trainees. However, simulation alone cannot solve lack of training in ICA and colorectal surgical techniques require a multi-modal approach to be taught effectively.¹⁰ Effective learning of advanced laparoscopic skills necessary to perform ICA would require high-fidelity simulator, laparoscopy workshops, mentorship and surgical performance assessment.¹⁰⁻¹¹

When laparoscopic colorectal surgery was first introduced in 1991, it represented a significant advancement over the status quo of open procedures. This innovative technique initially faced cautious scrutiny as surgeons diligently assessed its benefits and efficacy to ensure the highest standards of patient care. There were concerns about the oncological benefits of laparoscopic colorectal cancer procedures.¹² Surgeons at that time also highlighted other issues including lack of perceived remuneration, inadequate access to training & equipment and lack of tactile sensation when operating as barriers to adopting laparoscopic surgery.¹³ Within colorectal procedures, there were also concerns regarding oncological outcomes and port site metastasis when performing laparoscopic procedures.¹⁴⁻¹⁶ The benefit of laparoscopic surgery compared to open in terms of reduced morbidity, mortality, decreased length of stay, improved infection rates and quicker return to normal function took time to be appreciated.¹⁷⁻¹⁹ This does ask the question of whether we are currently in a similar paradigm shift and surgeons are experiencing a similar lagging effect regarding the adoption of ICA. The gradual adoption of ICA among Australian surgeons can be understood through the 'Diffusion of Innovations' theory, which posits that new technologies are adopted at varying rate.²⁰ Factors such as knowledge dissemination, peer influence, and the need for skill acquisition are likely contributing to a natural, albeit delayed, acceptance curve within the Australian medical community.

Currently, in the Australian system, ICA and ECA are not differentiated by the current billing system. To assist with increasing uptake of ICA and its potential benefits, there would need to be a review of the billing system to offer financial incentives to surgeons to complete ICA. However, a cost benefit analysis would be required to determine if this method is appropriate. Additional research should be targeted towards completing auditing colorectal procedure techniques to determine rates of ICA compared to ECA within the Australian system.

A limitation of this study is the small sample size and higher proportion of participants with lower volume in colorectal surgery. However, this would provide insight into how less experienced surgeons would increase adoption of ICA. Additionally, it is unknown how many

emailed surgeons would have met the exclusion criteria; therefore, the true response rate would be expected to be higher than reported.

Conclusion

Adoption of ICA will require a multi-modal approach to help train surgeons including simulation based-training, financial incentives, and progression through the learning curve. Additionally, there is general consensus in this sample that will help to ECA to form a foundation to learn the advanced techniques of ICA.

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Figure Legend

Table 1 - Descriptive statistics of respondents

Table 2 – Results of Likert scale for whether agree with extra simulation-based training for adoption of ICA

Table 3 – Interest in extra simulation-based training to adopt intra-corporeal anastomosis

Table 4 – Frequency of respondents to which technique should be taught first compared by post-fellowship training.

Table 5 – Frequency of respondents to which technique is easier to teach trainees compared by post-fellowship training

Table 1 – Descriptive statistics of respondents

	Frequency (n)	Percentage %
Gender		
Male	33	76.7
Female	8	18.6
Non-binary	1	2.3
Term not listed	1	2.3
Experience		
Fellow <5 years	10	23.3
Fellow >5 years	2	4.7
Consultant < 5 years	7	16.3
Consultant >5 years	24	55.8
Post-Fellowship training		
No	10	23.3
In colorectal	20	46.5
In non-colorectal speciality	13	30.2
Colorectal procedure volume		
<10	7	16.3
10-25	18	41.9
25-50	13	30.2
>50	5	11.6

Type of colorectal resections		
Both elective and emergency	38	88.4
Emergency resections only	5	11.6
Involvement in hospital-based training of trainees		
Yes	40	93.0
No	3	7.0

Table 2 – Results of Likert scale for whether agree with extra simulation-based training for adoption of ICA

Would you be interested in extra simulation-based training would help you adopt intra-corporeal anastomosis into your practice?	Total	Percentage (%)
Strongly disagree	8	18.6
Somewhat disagree	3	7.0
Neither disagree or agree	9	20.9
Somewhat agree	16	37.2
Strongly agree	7	16.3

Table 3 – Interest in extra simulation-based training to adopt intra-corporeal anastomosis

	Current Fellows [†]		Routinely performs suturing of bowel perforations and enteric defects intra-corporeal [‡]		Not involved hospital-based teaching of trainees [§]	
Factor	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Extra-simulation base training	1.424 (0.360, 5.646)	0.614	3.543 (1.025, 12.231)	0.046	0.0892 (0.007, 1.071)	0.057

†: When compared to current consultants

‡: When compared to surgeons who do not routinely close bowel defects intra-corporeal

§: When compared to surgeons who are involved in hospital-based teaching of trainees

Table 4 – Frequency of respondents to which technique should be taught first compared by post-fellowship training.

		ICA	ECA	It does not matter	Total
Post-fellowship training	Not completed	0	7	3	10
	Non-colorectal speciality	0	11	2	13
	Colorectal	1	17	2	20
	Total	1	35	7	43

Table 5 – Frequency of respondents to which technique is easier to teach trainees compared by post-fellowship training

		ICA	ECA	It does not matter	Total
Post-fellowship training	Not completed	0	8	2	10
	Non-colorectal speciality	0	12	1	13
	Colorectal	2	13	5	20
	Total	2	33	8	43