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Expert consensus on a train-the-trainer curriculum for robotic colorectal surgery

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Abstract

Aim Robotic techniques are being increasingly used in colorectal surgery. There is, however, a lack of training opportunities and structured training programmes. Robotic surgery has specific problems and challenges for trainers and trainees. Ergonomics, specific skills and user–machine interfaces are different from those in traditional laparoscopic surgery. The aim of this study was to establish expert consensus on the requirements for a robotic train-the-trainer curriculum amongst robotic surgeons and trainers.

Method This is a modified Delphi-type study involving 14 experts in robotic surgery teaching. A reiterating 19-item questionnaire was sent out to the same group and agreement levels analysed. A consensus of 0.8 or higher was considered to be high-level agreement.

Results Response rates were 93–100% and most items reached high levels of agreement within three rounds. Specific requirements for a robotic faculty development curriculum included maximizing dual-console teaching, theatre team training, nontechnical skills training, patient safety, user–machine interface training and telementoring.

Conclusion A clear need for the development of a train-the-trainer curriculum has been identified. Further research is needed to assess feasibility, effectiveness and clinical impact of a robotic train-the-trainer curriculum.

Keywords Robotic surgery, training, trainer, Delphi

What does this paper add to the literature?
Although evidence of the effectiveness of colorectal robotic surgery remains uncertain, its adoption is rapidly increasing in Europe. One of the limitations in achieving optimal outcomes after the adoption of this new approach is receiving a structured training, which at the same time depends on having a properly trained faculty. There is an urgent need to establish a colorectal robotic surgery train-the-trainer curriculum. This paper presents an expert consensus, based on a modified Delphi technique, on the requirements for a robotic surgery train-the-trainer curriculum.

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Introduction

Minimally invasive procedures have changed the face of abdominal surgery over the last three decades [1]. In the last few years, robotically assisted techniques have

also increasingly been used for resections of the colon and rectum [2,3]. Robotic techniques were developed to overcome some of the limitations of conventional laparoscopic instruments by providing increased range and precision of instrument movements, a stable camera position with magnified three-dimensional imaging and avoidance of the fulcrum effect [4–6].

Although evidence of the effectiveness of colorectal robotic surgery is still evolving and its benefits are unclear [7,8] it has been rapidly adopted in recent years. Despite current evidence that unregulated adoption of novel surgical techniques may lead to poor patient outcomes, there is still a lack of training opportunities and structured training programmes. The training domain was primarily covered by industry with little or no external control. There are a few exceptions, such as the European Academy of Robotic Colorectal Surgery (EARCS) [9] or the European Association of Urology/Robotic Urology Section (EAU/ERUS) which have implemented structured, validated and competency-driven training programmes in robotic surgery. The success of such programmes depends on the educational quality of the faculty and it has been shown in the English National Training Programme in Laparoscopic Colorectal Surgery (Lapco) that developing the faculty through structured train-the-trainer (TTT) courses has a significant impact on the quality of the training delivered [10,11]. Although robotic surgery is a minimally invasive technique, it poses its own problems and challenges for trainers and trainees. Ergonomics, specific skills and user–machine interfaces are different from those in traditional laparoscopic surgery, and hence teaching techniques may differ.

The aim of this study was to establish expert consensus on the requirements for a robotic TTT curriculum amongst robotic surgeons and trainers.

Method

For this study, a modified Delphi technique was used by sending out a structured, reiterating questionnaire to a group of expert robotic surgeons and trainers from several European countries [12,13].

Experts were selected based on their expertise in training and in robotic surgery. Surgeons participating in the Delphi process (Table 1) had been involved in at least 50 robotic colorectal surgery cases and in training in colorectal surgery. The surgical expertise of LBS was in the field of robotic upper gastrointestinal surgery.

A 19-item questionnaire was developed based on published peer-reviewed literature on educational principles in laparoscopic and robotic colorectal surgery and on two brainstorming sessions with the whole group.

Table 1 Participating surgeons for Delphi robotic colorectal process.

Name	Country
Sergio Alfieri	Italy
Thomas Becker	Germany
Michael Bergmann	Austria
Ugo Boggi	Italy
Nuno Figueiredo	Portugal
Ismail Gogenur	Denmark
Marcos Gómez Ruiz	Spain
Danilo Miskovic	UK
Amjad Parvaiz	UK
Johan Pratschke	Germany
Taz Qureshi	UK
Lars Bo Svendsen	Denmark
Paris Tekkis	UK
Carlos Vaz	Portugal

The questionnaire was developed and agreed by the participating surgeons during the brainstorming sessions after a review of the literature. All the educational tools that could be useful for a TTT course in robotic colorectal surgery were considered and potential new ones were added to the questionnaire. Some questions required a simple yes/no answer, others a Likert-type scale. Respondents were also given the opportunity to add comments on individual items.

The questionnaire was sent out electronically using Google Docs forms. Responses were collected automatically in an Excel sheet (Microsoft Excel for Mac version 15). Items that reached consensus in the first round were removed and the remaining items were sent again. Results of the consensus at each round were displayed as histograms so that the participants could reflect on the results before selecting a response in the next round. After three rounds the consensus views included in the final guidance needed to reach a minimum agreement level of 0.8.

Cronbach's α [14] was chosen as the statistical method for quantifying the consensus among the expert panel. A Cronbach's α of 0.80 was chosen as an acceptable measure of consensus.

Results

The project was conducted between December 2016 and February 2017.

The response rate for the first and second rounds was 100% (14/14) and for the third round 93% (13/14).

The results of the different survey rounds can be seen in Table 2. Increasing levels of agreement could be

observed in all items, but it was impossible to reach consensus for some. These included questions on how many trainees a proctor should train per year to become proficient and some of the content of a TTT course.

Below is a summary of the agreed items according to three main categories. Agreement levels are indicated in brackets.

On the curriculum

Experts agreed that there is a need for a TTT course in robotic colorectal surgery (100%, Round 1). All prospective trainers should attend such a course (100%, Round 1). They should also undergo an assessment or exam as part of the TTT curriculum (80%, Round 2). Prospective trainers should be familiar with the current evidence for robotic training, nontechnical skills, patient safety and benefits and the disadvantages of different training methods and modalities (dry and wet lab, animal and cadaver models, virtual reality training, e-learning and modular training, theatre team training) (80–100%, Rounds 1–3).

On desired trainer abilities

Trainers completing the TTT course should employ a modular teaching approach, whereby the procedure is broken down into several standardized steps (93%, Round 1) and follow mutually agreed guidelines on content (93%, Round 1). They should be able to establish a training contract and set ground rules together with the trainee before starting with the teaching (100%, Round 1). They should be familiar with techniques to give trainees real-time feedback during the

Table 2 Questionnaire items and levels of agreement at each round.

Item	Question	Round 1	Round 2	Round 3
1	Do you agree there is a need for a TTT course in robotic colorectal surgery?	1.0*	–	–
2	Ideally, should all trainers attend a TTT course before they are certified to be trainers?	1.0*	–	–
3	Should all trainers undergo an assessment/exam before they are certified to be trainers?	0.79†	0.80*†	–
4	Should TRAINEES follow the same guidelines to training that have been defined in your specialty-specific robotic curriculum?	0.93*	–	–
5	Should TRAINERS follow the same guidelines to training that have been defined in your specialty-specific robotic curriculum?	0.93*	–	–
6	Which aspects of training described in a robotic curriculum should trainers be familiar with and be aware of the current evidence for?			
	e-learning curriculum	0.86*	–	–
	Basic robotic training	0.79	1.0*	–
	Dry lab training	0.86*	–	–
	Virtual reality simulation training	0.71	0.69	0.8
	Wet lab training	0.86*	–	–
	Cadaver training	0.51	0.62	0.8
	Theatre team training	0.86*	–	–
	Nontechnical skills training (NOTS)	0.79	1.0*	–
	Patient safety	0.93*	–	–
	Modular training approach (index procedure)	0.71	0.85*	–
	All the above	0.5	0.42	–
7	Should trainers teach trainees with a modular approach to multi-step surgery, breaking the surgery down into standardized predefined steps, even if the whole procedure is taught in one setting?	0.93*	–	–
8	Does real-time feedback delivered from the trainer to the trainee improve the learning process?	1.0*	–	–
9	Should a description of the process and benefits of 'real-time feedback' from the trainer to the trainee be part of the TTT course?	0.93*	–	–
10	Do different trainees require different levels of information depending on their skills and personality?	0.86*	–	–
11	Should the trainers establish an 'educational contract' and agreement on 'ground rules' with their trainee before they commence training?	0.93*	–	–

Table 2 (Continued).

Item	Question	Round 1	Round 2	Round 3
12	Which aspects of training should be included in a TTT course?			
	e-learning curriculum content description	0.71	0.69	0.9
	'Buttonology'	0.86*	–	–
	Dry lab training	1.0*	–	–
	Virtual reality	0.64	0.62	0.7
	Wet lab training	0.93*	–	–
	Theatre team training	0.93*	–	–
	Nontechnical skills training	0.79	0.92*	–
	Patient safety	0.86*	–	–
	Maximizing dual-console teaching	0.79	1.0*	–
	All the above	0.5	0.35	–
13	What are the important principles/content in a successful TTT course that aims to optimize training for robotic colorectal surgery?			
	PowerPoint presentations on relevant curriculum based subject areas	0.71	0.69	0.4
	Lectures on teaching style	0.71	0.69	0.8
	Principles of proctoring and mentoring	0.79	0.92*	–
	Role play with experienced trainers	0.57	0.46	1.0
	Role play with other doctors	0.43	0.23	0.4
	Access to training facilities	0.93*	–	0.7
	Access to wet lab models	0.79	0.69	0.8
	Access to theatre team training simulation models	0.71	0.69	0.6
	NOTS role play	0.57	0.15	0.5
	Patient safety role play	0.50	0.23	0.6
	Course review and evaluation on completion of training exercises	0.79	0.85*	–
	Principles of real-time feedback	0.93*	–	–
	Guided group discussions‡		0.23	0.4
	Principles of video review‡		0.54	0.9
	Formal assessment‡		0.23	0.9
14	Important subject areas to be covered in educational content of the TTT course include			
	Conscious competency	0.85*	–	–
	Taking over in theatre	1.0*	–	–
	Performance-enhancing instruction	0.93*	–	–
	Dual-task interference	0.85*	–	–
	Optimizing communications	0.85*	–	–
	Optimizing the training environment	0.93*	–	–
	Reflection on training	0.78	0.92*	–
	Dealing with difficult trainees	0.93*	–	–
	Optimizing feedback to the trainee	0.93*	–	–
	All the above	0.64	–	–
15	Practical training exercises should include the following topic areas			
	Performance-enhancing instruction	0.93*	–	–
	Dual-task interference	0.64	0.54	0.6
	Verbal instruction	0.79	1.0*	–
	Reverse screen exercise	0.57	0.7	0.8
	Physical instruction	0.93*	–	–
	Technical skills training example	0.93*	–	–
16	Should trainers be evaluated during the TTT course?	0.93*	–	–
17	How many trainees should a proctor train per year to become proficient?			
	1–5	0.36	0.15	0.1
	6–10	0.43	0.38	0.4
	> 10	0.07	0	0.1
	Number not important, quality is important‡	–	0.38	0.3

Table 2 (Continued).

Item	Question	Round 1	Round 2	Round 3
18	Considering the differences in training between observation with subjective feedback compared with competency-based training and objective scoring metrics: how important is 'competency based training' to confirm adequate training standards on a scale of 1 to 5?			
	1	–	–	–
	2	–	0.16†	–
	3	0.21†	0.16†	0.1†
	4	0.5†	0.31†	0.4†
	5	0.29†	0.38†	0.5†
19	On completion of the TTT course trainers should receive…			
	Personalized feedback	0.93*	–	–
	Certificate of attendance	1.0*	–	–
	USB with teaching material	0.86*	–	–
	All the above	0.79	–	–

*Question removed as agreement ≥ 0.8.
†Cronbach's α.
‡New question introduced based on previous comments.

training (93%, Round 1). They should be able to adapt content and pace according to the trainees' individual abilities and personalities (86%, Round 1).

On the content of a TTT course

The course should provide topics covering dry and wet lab teaching techniques, maximizing dual-console teaching, theatre team training, nontechnical skills training, the use of e-learning, patient safety and user–machine interface training (86–100%, Rounds 1–3). There was no consensus on the value of virtual reality (70%, Round 3). In addition, the course will provide information on how to access training facilities, optimizing video review and feedback, formal assessment methods and basic principles of proctoring and mentoring (80–100%, Rounds 1–3). Important subject areas to be covered in the educational content of the TTT course include: taking over in theatre, performance-enhancing instruction, optimizing the training environment, dealing with difficult trainees, optimizing feedback to the trainee, reflection on training, conscious competency, optimizing communications (85–100%, Rounds 1–3). Practical training exercises should include the following topic areas: verbal instruction, performance-enhancing instruction, physical instruction, technical skills training example, reverse screen exercise (80–100%, Rounds 1–3). There was no consensus on the value of dual-task interference after three rounds.

Discussion

This is the first study to explore expert opinion for a TTT curriculum in robotic colorectal surgery. The expert panel underlined the need for such a course and several specific requirements have been detailed in the summary consensus statement.

We believe that the purpose and need for this study is timely, since robotic surgery has become a standard method of rectal resection in many hospitals. With further adoption of the technique, future training will be provided to junior surgeons as part of their in-house training. However, currently, most training is happening as part of proctorships and international collaborative groups. Standardization of technique and teaching methods and materials is more relevant now than when robotic surgery becomes fully established. A TTT curriculum can also provide a future platform to bring teaching surgeons together and thus promote surgical quality standards.

There was good consensus reached in many areas of training including the view that a TTT course is beneficial and necessary to provide a higher standard of training. A standardized approach is an important part of optimizing training in robotic colorectal surgery. The expert panel recognizes the role of TTT courses and endorses this guidance on further standardization of training curriculums. The experts are all experienced trainers and it is likely that their opinions have been formed not only by previous personal experience but also the structured TTT training they received themselves in areas other than robotics. Hence it is not surprising that many of the items highlighted are also present in other TTT courses [10,11]. Generic teaching skills, such as giving feedback, taking over when appropriate and lecturing styles, are basic concepts that are taught in many TTT-style courses. What this study highlights are the certain specific skills required to be effective in robotic training. These include

maximizing dual-console teaching, theatre team training, nontechnical skills training, the use of e-learning and patient safety. Because of the specificities of robotic colorectal surgery, user–machine interface training and telementoring will play an important role in this training.

It was interesting to observe that the experts could not come to an agreement on the usefulness of virtual reality training despite current investments and research in this area.

Robotic surgery has become a standard method of rectal resection in an increasing number of institutions. In-house training is subsequently provided. We acknowledge the fact that this in-house training will become the main means of teaching in robotic surgery as with any other technique. This may lead to considerable variation of the technique. Teaching guidelines might now even be of higher relevance than in the establishment phase of robotic surgery, when most of the robotic surgeons underwent standard training programmes mostly organized by industry.

With further acceptance of the robotic approach in the future it will most likely not be feasible for all robotic trainees to participate in training courses, but it might still be possible to bring the teachers together and establish teaching guidelines and thus promote and ensure surgical standards. International societies should support this effort.

This study has several limitations. It has sampled a small number of experts, and it was not considered if a larger expert group would have found additional items for discussion. However, the experts were from various countries with different healthcare systems and training curricula, and it is unlikely that a larger group would have changed these outcomes substantially. In addition, this is merely an exploratory study to describe the specific features of a robotic TTT course for colorectal surgeons. It is not clear if the items considered to be important by the expert group are practical when applied in a real setting.

Further research should focus on evaluating practical TTT courses specifically designed for robotic colorectal surgery trainers in terms of feasibility, effectiveness and impact on clinical outcomes.

Conflicts of interest

The principal investigators declare no financial and other competing interests for the publication of this manuscript. MG and CV are proctors for Intuitive Surgical and for EARCS. AP is a proctor for EARCS which is funded by Intuitive Surgical.

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