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ORIGINAL ARTICLE

Using a modified Delphi process to explore international surgeon-reported benefits of robotic-assisted surgery to perform abdominal rectopexy

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Abstract

Background Robotic-assisted surgery (RAS) offers improved visualisation and dexterity compared to laparoscopy. As a result, RAS is considered an attractive option for performing rectopexy, particularly in the confines of the lower pelvis. The aim of this study was to explore the benefits of RAS in rectopexy by analysing the views of a group of surgeons will have published on robotic rectopexy.

Methods A three-round Delphi process was performed. Combined qualitative, Likert scale and binary responses were utilised in rounds one and two with binary responses seeking overall consensus in round two and three. Particular areas that were studied included: clinical aspects of patient selection, technical aspects of using RAS to perform rectopexy, ergonomic factors, training, and consideration of the 'learning-curve'. Consensus was defined as agreement > 80% among participants. Potential experienced RAS rectopexy surgeons were identified using PubMed where authors of studies reporting outcomes from RAS rectopexy were searched and invited.

Results Twenty surgeons participated from the following countries: France, Germany, Ireland, Italy, Netherlands, Switzerland, UK, and USA. Participants had median operative experience of 75 (range 20–450) rectopexies (all techniques) and 11(range 0–300) robotic-rectopexies for all indications. All participants agreed that patient-reported functional outcomes and improved quality-of-life were the most important outcomes following rectopexy. Participants agreed the most significant benefits offered by RAS for rectopexy were improved precision due to better visualisation (80%), improved dexterity (90%) and improved overall accuracy e.g., for suture placement (90%). Ninety percent agreed that the superior ergonomics of RAS rectopexy improved their performance on several steps of the operation, in particular: mesh fixation (85%) and rectovaginal dissection (80%). Consensus on the learning curve for RAS abdominal rectopexy was not achieved: forty-five percent ($n = 9$) reported the learning curve as 11–20 cases and 55% ($n = 11$) as 21–30 cases.

Conclusions A panel of surgeons who had published on RAS view that it positively improves performance of rectopexy in terms of technical skills, improved dexterity and visualisation and ergonomics.

Keywords Rectopexy · Robotic · Ergonomics · Laparoscopy · Rectal prolapse · Dexterity

Introduction

Many operative approaches have been described for the correction of rectal prolapse the aim of which are to restore anatomical anatomy and improve the associated symptoms with the minimum associated surgical morbidity. Robotic-assisted surgery (RAS) offers improved visualisation and dexterity compared to laparoscopic-assisted surgery and has been commenced for performing abdominal rectopexy [1–5]. Robotic-assisted rectopexy surgery is especially helpful in the confines of the lower-pelvis, where there are limitations from the bony anatomy. While acceptable and equivalent

International Robotic Rectopexy Delphi Group Details are listed in Acknowledgement.

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outcomes for RAS have been reported, clinical superiority of robotic-rectopexy to the perceived gold standard of laparoscopic rectopexy has not been demonstrated the technical advantages of robotic platforms, superior ergonomics, and improved dexterity may contribute to a more favourable operative experience for the surgeon [6–10].

However, those who utilise a robotic approach believe that the improved dexterity and precision does in fact offer significant benefits to laparoscopy including more precise dissection and potential improved nerve preservation, shorter operative-time, and improved ergonomics for surgeons. It could also be postulated that robotic-rectopexy may be associated with improved functional outcomes similar to what has been observed in robotic rectal cancer surgery although to date clinical studies have not confirmed this [11, 12]. As only a few, small studies on robotic-rectopexy have been published, it is clear that research in this area can be challenging due to the small proportion of patients who proceed to surgery following unsuccessful non-surgical management strategies and the heterogeneity of disorders of the pelvic floor for which rectopexy is performed [11, 13–15]. Thus, there is an opportunity to explore the consensus opinions of experienced surgeons in robotic-assisted rectopexy on the perceived advantages in specific areas of technical performance, opinions on the learning curve and barriers to its practice and training.

The Delphi process is a well-established methodology that aims to establish a consensus view among experts [16, 17]. It involves a multi-staged self-completed questionnaire process and allows for reflection among participants. Participants may nuance or reconsider their opinion based on the anonymised opinions of others. Due to current lack of consensus in published literature on the benefits of RAS-rectopexy, the aim of this project was to report the perceived benefits of RAS-rectopexy by an international panel of colorectal surgeons, experienced in the performance of RAS and other rectopexy techniques, utilising Delphi methodology.

Materials and methods

Participant identification and selection

Potential experienced robotic-assisted rectopexy surgeons were identified using a broad literature search of PubMed. The following search terms were utilised: "robotic", "robotic assisted surgery", "rectopexy". All forms of robotic-assisted rectopexy (sutured, mesh, resection) were considered as were all indications for surgery e.g., full thickness rectal prolapse, rectocele. The final search was performed on 10th January 2021 for articles published in the English language from 01/01/2000 to this date suitable for review to identify authors of studies reporting outcomes from robotic-assisted rectopexy for all indications. Those who were duplicate authors or who had no email contact listed were removed from the list and the remaining authors were then invited via email to participate. As these authors were colorectal surgeons publishing literature on robotic-assisted rectopexy, the assumption was made that they had expertise. They were therefore considered a potential expert 'panellist' and those who consented to participate formed the expert panel for the Delphi process. Initially, a steering group convened to generate broad themes relevant to the discussion on the clinical utility of RAS to perform abdominal rectopexy. A digital survey was then generated and disseminated using Google Forms (Mountain View, CA, USA) (Fig. 1 and Table 1).

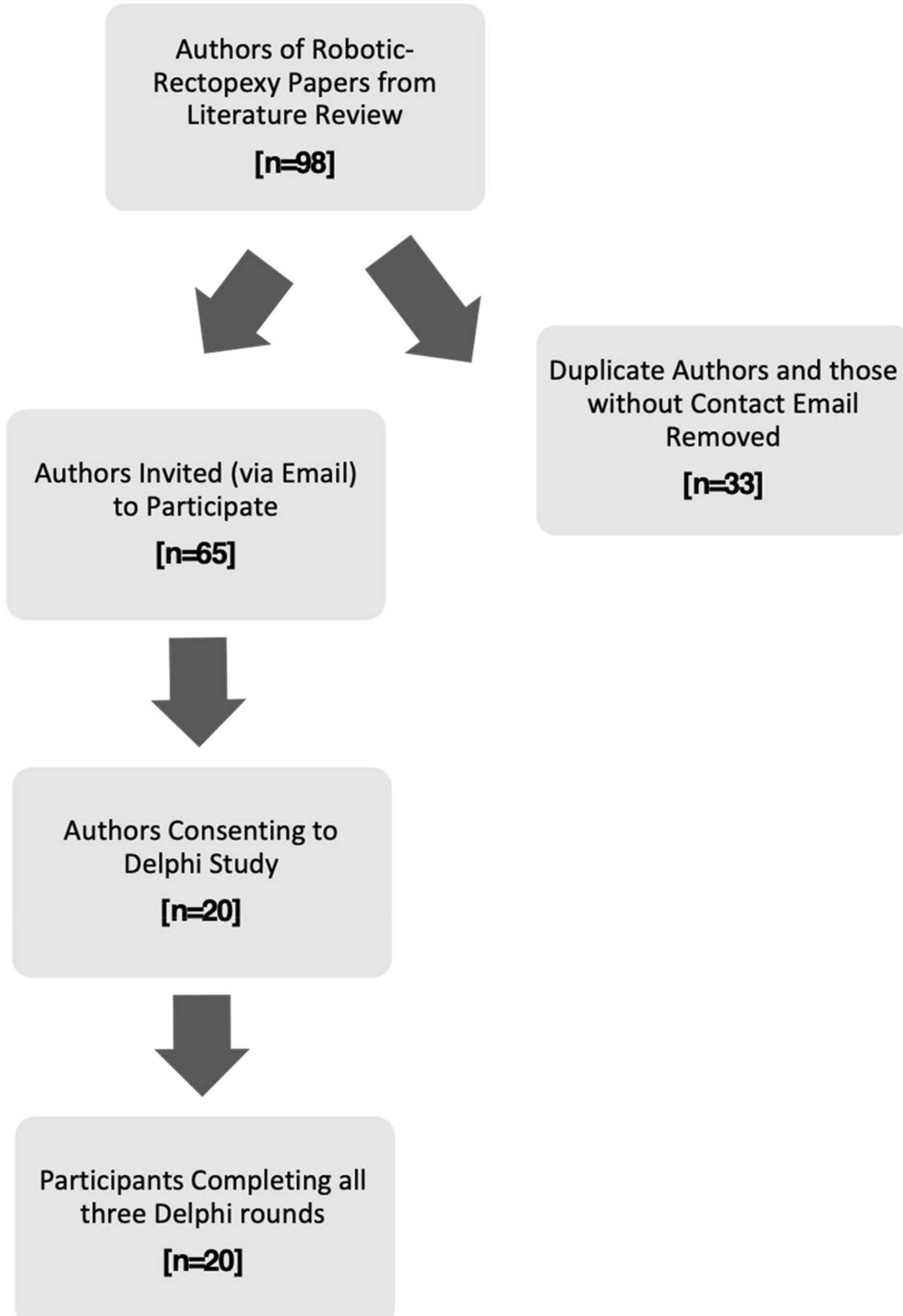
Delphi methodology

Delphi methodology refers to a systematic approach involving collecting, evaluation and compiling expert opinion on a certain topic [18]. The principal features of this Delphi process involved:

1. Anonymity (self-administered questionnaires utilised to maintain anonymity)
2. Iteration (completion of digital questionnaires over a series of rounds)
3. Controlled feedback (removal of statements reaching consensus from subsequent rounds)
4. Statistical accumulation of the group response

Three rounds were planned and performed, and each round was open over a two-week period, beginning in March 2021 and finishing in May 2021. There was 1 week of data analysis between Delphi rounds. Expert panellists were reminded via email after 1 week to submit their response. The first round focused on idea generation to allow the panellists to generate anonymous concepts without being influenced by other panel members' answers. In particular, panellists were asked to generate ideas under the umbrella of a number of overarching themes, including clinical aspects of patient selection, technical aspects of using robotic-assisted surgery (RAS) to perform rectopexy, ergonomic factors, resources, training, and consideration of the 'learning-curve'. These umbrella themes were selected by performing a literature search on rectopexy surgery and agreed upon by the steering group, encompassing the most common topics of comparison and outcome measures between robotic and laparoscopic colorectal surgery; particularly in research papers discussing abdominal rectopexy surgery. Three rounds were deemed sufficient to balance maximum return with minimal participant dropout [19]. Consensus was defined as agreement > 80% among experts. This is in keeping with the majority of previously published Delphi studies, where consensus is often defined as > 70–80% [20–22].

Fig. 1 Participant selection



Non-consensus or 'divergence' was defined as > 33% disagreement among panel members (Table 2).

The responses from round one were collected and a qualitative analysis of the data was performed, as outlined by *Sekai* et al. [23]. Initial open coding was performed on the responses to round one, whereby the data were sorted, and descriptive labels and colours were assigned for small segments of text. Axial coding was then applied to analyse and group statements. The categories generated from the axial coding process were compiled into a list of statements for presentation in round two. These statements were organised into a series of Likert scale style statements, with experts now getting the opportunity to consider other panel members' responses. They were then asked to rank each statement to stratify the different aspects of each theme in order of importance with some binary statements also included. Finally, in round three, the responses from round two were organised into

Table 1 Characteristics of included experts

Sex	
Male	14
Female	6
Qualification	
Consultant	18
Senior Specialist Trainee	2
Country of Practice	
Italy	4
France	3
Netherlands	3
United Kingdom	3
United States of America	3
Ireland	2
Germany	1
Switzerland	1
Number of Rectopexies Performed	
< 100	10
100–199	3
200–299	1
300–399	4
≥ 400	2
Number of robotic-assisted rectopexies performed	
< 10	10
11–199	7
200–299	2
≥ 300	1
Median number of rectopexies performed	
Median total rectopexies performed	75 (range 20–450)
Median robotic-assisted rectopexies performed	11 (range 0–300)

Table 2 Round one: qualitative analysis

Themes	Subthemes
Technical considerations	Mobilisation and dissection suturing Mesh considerations
Patient factors	Patient selection Patient outcomes
Resources and training	
Ergonomics	
Advantages and disadvantages	

a binary agreement style of questions (agree/disagree) to explore a consensus view among the panellists, allowing panellists an opportunity to re-evaluate their answers. Two authors cross-checked responses from each round (CF/TK).

Data analysis

Basic data analysis and presentation of final Delphi consensus statements was performed using Microsoft Excel (Microsoft Corp, Redmond, WA, USA). Furthermore, panellist demographics including sex, level of qualification (consultant, senior specialist trainee) and country of practice were recorded and summarised. Panellists were also asked to report on the number of overall rectopexy procedures that they had performed as well as the number of RAS rectopexies as an objective measure of operative experience among the panel.

Results

A total of 98 authors were identified from published papers. When accounting for duplicate authors and removing those who had no contact information listed, 65 authors were emailed and invited to participate in the Delphi study. Twenty surgeons consented to take part (in keeping with recommendations for the inclusion of 10 to 50 ‘panellists’[24] and a 100% response was achieved for all three rounds. Panellists were from the following countries: Italy [$n=4$], France [$n=3$], Netherlands [$n=3$], UK [$n=3$], USA [$n=3$], Ireland [$n=2$], Germany [$n=1$] and Switzerland [$n=1$]. There were 14 male and 6 female general/colorectal surgeons, 18 of whom were consultant surgeons and 2 of whom were senior specialist trainees. The panel of experts had a median operative experience of 75 rectopexies (range 20–450) and 11 robotic-assisted rectopexies (range 0–300). Four panellists had only performed abdominal or laparoscopic rectopexies and no robotic rectopexies (Fig. 2).

Technical considerations

This expert group agreed that dissection down to the pelvic floor (100%), rectovaginal septum dissection (85%) and placement of the mesh (90%) are the most important technical considerations when performing rectopexy. The experts also agreed that the most significant benefits offered by the robotic-assisted approach to rectopexy are improved precision when performing the above steps due to better visualisation (80%), improved dexterity (90%) and improved overall accuracy e.g., for suture placement (90%).

When performing rectopexy with mesh; avoiding damage to other structures (95%), including avoiding nerve injury (95%) and preserving bowel integrity (100%) as well as avoiding excessive tension with mesh fixation (85%) were agreed to be the most important technical considerations. More than half of the panel (61.1%) felt that the use of mesh confers a risk when performing rectopexy. While not divergent by definition, there was no agreement reached regarding

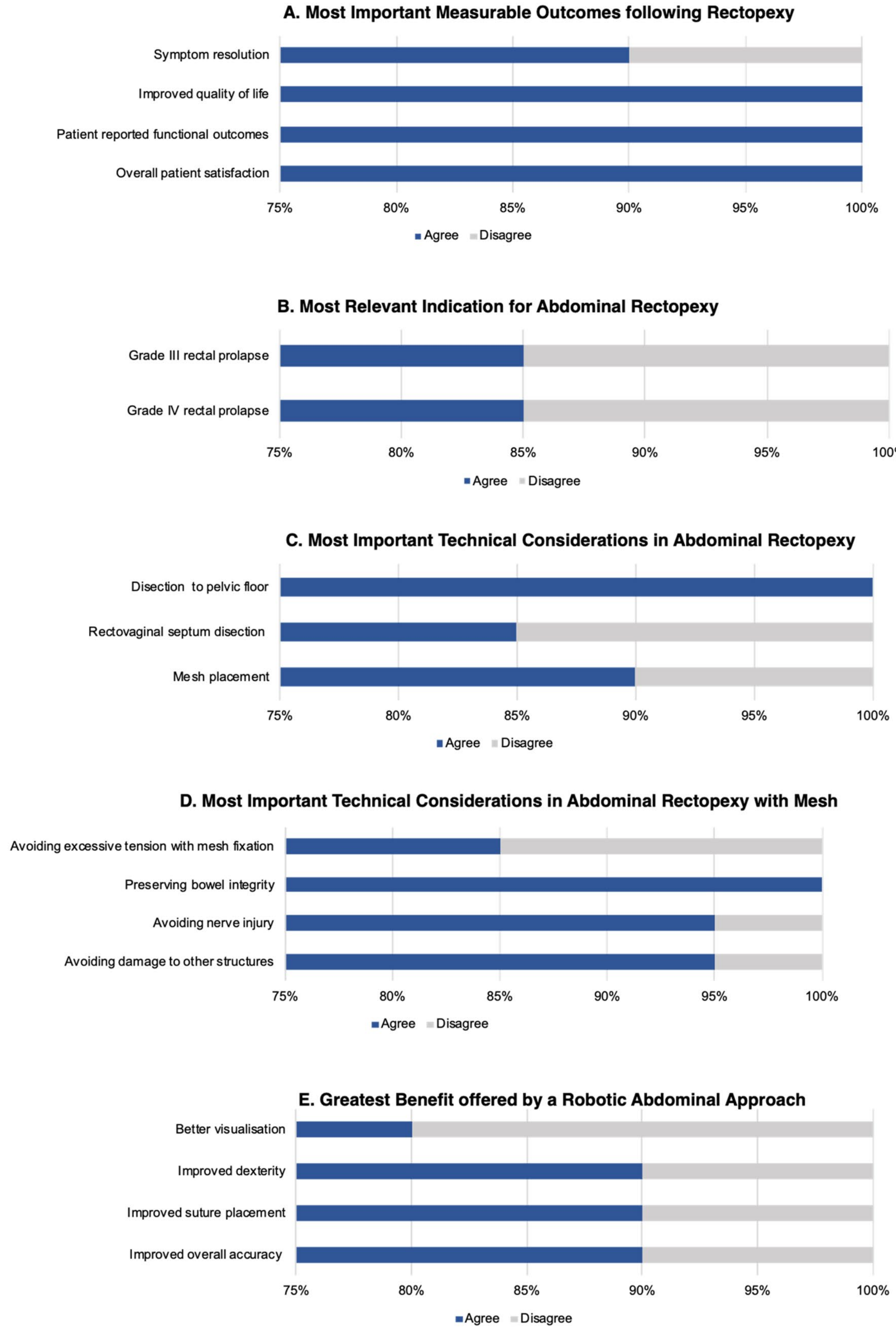


Fig. 2 Statements reaching consensus regarding the use of robotic-assisted surgery to perform rectopexy

choice of mesh for primary rectopexy or re-do rectopexy, with 60% and 65% of experts, respectively opting for a biologic mesh.

Patient factors

Exploring the clinical aspects of patient selection, the expert group deemed that Grade III or IV rectal prolapse[24] (85%) was the most important and appropriate indication guiding patient selection for abdominal rectopexy. There was a 50:50 split between the panel members regarding whether increased body mass index had an impact on patient selection. Consensus was not reached on the most commonly used tool to guide patient selection of patients for rectopexy [The Oxford Rectal Prolapse Grading System (75%), Wexner Constipation Score/Cleveland Clinic Incontinence Score [25] (50%) reported as the most common tools used].

Exploring the most important patient-reported outcomes and the single most important measure of 'success' following rectopexy, all panellists agreed that assessment of quality of life (100%) and patient-reported functional outcomes (100%) were the most important outcomes to assess following rectopexy followed by symptom resolution (90%). The most important specific patient-reported outcomes were also agreed to be overall patient satisfaction (100%), improved quality of life (95%), and complete or near-complete symptom resolution (95%). There was no consensus regarding the single most important measure *of success* following rectopexy, however, the most popular measures of success chosen were all patient-reported outcome measures such as satisfaction with bowel control, improved quality of life, and symptom reduction (75%). The group agreed (80%) that the best time to measure 'success' i.e., clinically assess the expected outcome of surgery was no sooner than 6–12 months postoperatively.

Resources and training

According to the expert group, cost (85%) and availability or access (80%) to robotic-assisted surgical systems were the biggest barriers to using the robotic-assisted approach for surgery in general. Interestingly, the panel did not agree that set up challenges including time required for docking were barriers to using the robotic-assisted approach (70% disagreement). Regarding the learning curve, the panel reached consensus that experienced proctors (90%), availability/access to a robotic surgical system (80%) and sufficient volume of cases (80%) were the most important factors affecting the 'learning curve'. In relation to robotic-assisted rectopexy in particular, familiarity with dissection (100%), familiarity with suturing (80%) and volume of cases (95%) were the most important considerations in relation to the 'learning curve'. Consensus on the learning curve was not reached, with 45% of the panel reporting the 'learning curve' as 11–20 cases and 55% of the panel reporting the 'learning curve' as 21–30 cases.

Ergonomics

Ninety percent of the panellists agreed that the superior ergonomics of robotic-assisted rectopexy has improved their performance of several steps of the operation, in particular with mesh fixation (85%) and rectovaginal dissection (80%). In addition, 77.8% of the panel agreed (not reaching consensus) that the robotic-assisted approach impacted on surgeon musculoskeletal health with 77.8% reporting that the positive impact on musculoskeletal health would make them more likely to use the robotic-assisted approach than a laparoscopic approach. Most of the panellists 0.83.3%. Agreed that robotic-assisted surgery impacts on surgeon fatigue with 72.2% of the group reporting that this positive impact on surgeon fatigue may translate to better clinical and patient outcomes.

Discussion

This study reports consensus opinion from an expert panel that using RAS to perform abdominal rectopexy may confer benefits in terms of technical considerations, namely due to better visualisation, improved dexterity, and improved overall accuracy of surgical technique. The panellists agreed that the superior ergonomics of RAS-rectopexy may potentially benefit several steps of the operation, in particular mesh fixation and rectovaginal dissection. Cost and availability of/access to robotic surgical systems were reported as the biggest barriers to utilising RAS to perform rectopexy. While clear consensus (> 80% agreement) on a 10-case range for the learning curve for RAS-rectopexy was not reached, all experts agreed it is in the range between 11 and 30 cases.

In current practice, the benefits of minimally invasive surgery are realised in rectopexy including improved pain control, shorter length of stay and shorter return of bowel function with comparable recurrence rates. As a result, surgical societies have recommended laparoscopy as the gold standard where resources and expertise are available [26–31]. Robotic surgery is a more recent minimally invasive approach applied to rectopexy and to date there have been few high-quality studies comparing the techniques [13, 32–35]. Overall, studies have demonstrated comparable recurrence rates and similar or lower morbidity profiles. Patient- reported outcomes measures (PROMs) and quality of life, considered the most important outcome measure following rectopexy by this expert panel, were also comparable [11]. Limitations in study design, heterogeneity in prolapse morphology, grades included, and limited accrual are reported in this research area. Timing of assessment of 'success' is also important with the assessment of functional outcomes at 6–12 months postoperatively considered the most reliable indicator of long-term function [8, 10, 36]. In this study, a consensus view from experienced surgeons on perceived benefits of robotic-assisted over laparoscopy, that are difficult to objectively measure in clinical studies, include how instrument articulation and improved visualisation can benefit specific technical performance of crucial steps in the procedure. While this is a subjective measure, it appears to be consistent by those who regularly perform robotic-assisted rectopexy.

For mesh repairs, biological mesh was favoured, due to material strength in suturing with increased ability for articulation. The use of mesh for rectopexy has been controversial with clear practice guidelines from the Pelvic Floor Society, European Society of Coloproctology and American Society of Colon and Rectal Surgeons on the most appropriate quality assured approach to undertake [26–28]. However, numerous research papers looking at functional results following abdominopelvic rectopexy have not reported increased complications in mesh cohorts [35, 37–39] largely in relation to laparoscopic ventral mesh rectopexy but also including studies focusing on robotic-assisted rectopexy [40]. In a systematic review, mesh related complications were reported in 0.96% ($n = 12$) of 1242 patients who had undergone laparoscopic ventral mesh rectopexy [41]. In this study, panellists reported that technical performance of mesh placement is easier to perform using a robotic surgery platform. This may be due to the articulation and improved visualisation offered which are particularly useful to overcome the resistance of suture placement in strong biological mesh material and also for identifying the pelvic floor anchorage point deep in the pelvis.

There are a number of barriers to robotic surgery in current surgical practice that are also relevant to RAS rectopexy [42]. Cost, access to both robotic surgical systems and experienced proctors were reported as the most significant barriers by our expert panel. There are several published studies reporting longer operative time using the robotic-assisted approach in surgery [9, 43–45]. Prolonged operative duration relates to the 'learning curve' for the surgeon and longer set-up times [46]. Operative time between RAS and laparoscopy is less significant with experience of both the surgeon and the operating theatre team [32, 47]. The initial prolonged operative time does not appear to adversely impact patient perioperative outcomes [48]. Longer operative times in RAS compared to laparoscopy appear less common in RAS rectopexy compared to other RAS colorectal procedures [49, 50]. This may be explained by the fact that suturing time can be improved using RAS compared to laparoscopy.

Consensus on a 10-case range learning curve was not reached with 45% of the panel reporting the 'learning curve' as 11–20 cases and 55% of the panel reporting the 'learning curve' as 21–30 cases. Previously, the 'learning curve' for robotic-assisted surgery in general has been reported to be 15–25 cases [46] which falls in the range of 11–30 cases reported by the panel as the expected learning curve for RAS-rectopexy. Defining a 'learning curve' for a procedure is complex, with limited validated quality standards [51]. Familiarity with minimally invasive surgery and dissection and suturing as well as a sufficient volume of RAS cases were felt to be the most important considerations for obtaining proficiency (overcoming the 'learning curve') in RAS-rectopexy.

The majority of this panel agreed that RAS positively impacted on surgeon musculoskeletal health. A consensus was also reached that the robotic-assisted approach positively impacts on surgeon fatigue. The majority of the panel felt that this impact on surgeon fatigue could translate to better patient outcomes. While in the literature this is not yet proven to have any clinical significance in literature, it is postulated that with advancing technology and improvement in surgical ergonomics, RAS has the potential to improve surgical performance [52–55]. Previous studies have demonstrated that muscle fatigue and discomfort have a negative impact on surgical performance, and RAS has the potential to positively impact on surgical performance versus a laparoscopic approach [53, 56–58].

There are a number of limitations to this study. The most significant is the selection criteria for the panellists. Despite publishing on robotic rectopexy, ten of the panel had personally performed less than 10 procedures and 4 had never performed one. This lack of practical experience by many of the panel may affect the validity of some of the results. Furthermore, the response rate to our email of invitation was only 31%, allowing for respondent bias and skewed representation on the topic of robotic-rectopexy. We also did not distinguish between the surgical indications for rectopexy. The Delphi technique can be time consuming, as in this study; where completion of rounds required eight weeks, allowing for one week of data analysis between rounds. This downside has also been reported by other researchers using the Delphi technique [59]. Despite these limitations this study provides insights from a panel of surgeons who are at least aware of the literature on the technical benefits that it can offer when performing rectopexy including ergonomic benefits for surgeons while to date studies have not demonstrated clearly what the specific clinical benefits of RAS rectopexy are compared to laparoscopy for example. Furthermore, a guide range for the potential learning curve for this procedure is suggested by the combined experience of the panel.

Conclusions

A panel of International surgeons who have published on RAS view that it positively impacts on the technical performance of rectopexy mostly due to improved dexterity and visualisation and ergonomics, which has the potential to offer improved patient outcomes. However this has yet to be consistently demonstrated in clinical trials. The learning curve for RAS-rectopexy in their opinion is within 11–30 cases and is mostly influenced by access to experienced proctors and sufficient availability of /access to a robotic surgical system resulting in a sufficient volume of cases. RAS is also perceived to offer ergonomic benefit to the operating surgeon.

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Declarations

Conflict of interest The authors have no conflict of interest to declare.

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