

Survey: Italian Robotic Colorectal Surgery

2

Maria Michela Di Nuzzo, Roberto Peltrini,
Michele D'Ambra, Graziano Ceccarelli, Umberto Bracale,
and Francesco Corcione

2.1 Introduction

Robotic platforms are currently the latest step in the development of technological innovations applied to surgery. They allow natural wristed movements within a narrow space and provide a surgeon-controlled three-dimensional field, reducing tremor and integrating fluorescence optical outputs [1]. The use of robotic platforms was introduced in the early 2000s, when Weber [2] performed the first robotic colectomy. Ten years later, the use of robotic technologies had become frequent in colorectal surgery, especially among Korean and Italian surgeons.

Despite the initial learning curve, the complete lack of tactile sensation and the prolonged operative time due to the robot docking time, the majority of colorectal surgeons stated they prefer this robotic approach owing to its maneuverability in narrow confined spaces and superior advantages in nerve visibility and preservation [3]. To date, robotic technologies have been applied for both malignant and benign colorectal diseases, such as inflammatory bowel disease, colonic diverticulum or pelvic organ prolapse. The international ROLARR trial (ISRCTN80500123) [4, 5] and the South Korean COLRAR trial (NCT01423214) reported the superiority of robotic over laparoscopic surgery for rectal cancer especially in terms of conversion

M. M. Di Nuzzo (✉) · R. Peltrini · M. D'Ambra · F. Corcione
Department of Public Health, University of Naples Federico II, Naples, Italy
e-mail: mariamichela.dinuzzo@outlook.it; roberto.peltrini@gmail.com; michele.dambra@unina.it; francesco.corcione@unina.it

G. Ceccarelli
General and Robotic Surgery Unit, San Giovanni Battista Hospital, Foligno (Perugia), Italy
e-mail: g.cecca2003@libero.it

U. Bracale
Department of Surgical Science, School of Surgical Science and Advanced Diagnostic and Therapeutic Technology, University of Naples Federico II, Naples, Italy
e-mail: umbertobracale@gmail.com

to open surgery, quality of pathological specimens and some short-term postoperative outcomes. However, the spread of the robotic approach in colorectal surgery is still inadequate in Italy. For this reason, we decided to perform a survey in order to have a picture of the current national situation.

2.2 Methods

The study steering committee used remote brainstorming to develop the questionnaire, which was shared on Google Form (Google LLC, Mountain View, California US). It includes 41 questions, mostly closed-ended. All questions were set as mandatory fields and concern the type of institution (public hospital, university hospital, private center, other), general information about the institution and specific questions for each type of robotic colorectal procedure. The estimated mean time to complete the survey was about 15 min.

The link (<https://forms.gle/DbfVDYCEztXGPrCv9>) was circulated as an email invitation to the chiefs of all Italian colorectal surgery departments equipped with a robotic platform. Baseline information on the respondents and the names and locations of the surgical units were stored through the questionnaire. Three members of the steering committee (U.B., R.P., and M.M.D.N.) downloaded the survey results and shared them with the other members.

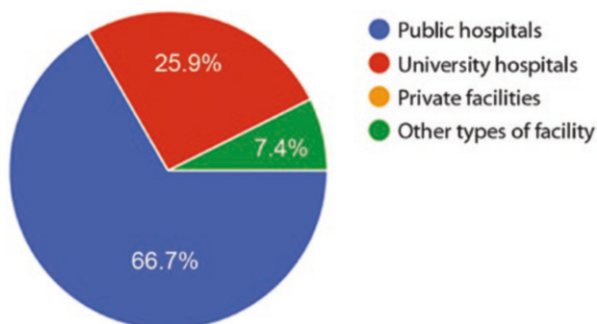
Categorical variables were reported using counts and percentages for the preliminary results.

2.3 Preliminary Results

A total of 27 Italian centers took part in the survey. Characteristics of the departments are: 66.7% public hospitals, 25.9% university hospitals and 7.4% other types of medical facility (Fig. 2.1). A total of 88.9% of the surgeons work in institutions with more than 200 beds and in general surgery units with more than 20 beds.

In 23.1% of the included centers, the robotic platform has been present for at least 15 years, so all surgeons are experienced in robotic surgery. About 40.7% of centers have more than three surgeons using the robot for colorectal disease. About

Fig. 2.1 Types of facility included in the survey



70.4% of the survey participants had performed laparoscopic colorectal resections before approaching robotics.

Moreover, the analysis showed that survey respondents proposed robotic surgery as follows:

- to all patients with colorectal diseases in 22.2% of cases;
- only to patients selected by well-defined criteria in 44.4% of cases;
- only to patients selected at the discretion of first surgeon in 33.3% of cases.

Specifically, the selection criteria were:

- 48.1% patient's disease + BMI + surgeon expertise
- 29.6% patient's disease + surgeon expertise
- 22.2% patient's disease.

The surgeons were asked to rate the usefulness of the robotic approach in colorectal surgery in relation to the disease to be treated. The results, reported in Fig. 2.2, show that most of the “remarkably useful” responses were related to diseases of the rectum and right colon.

Robotic surgeons were asked what was the least complex procedure to be performed in the early stages of the learning curve. More than 50% reported right hemicolectomy as the easiest intervention to be performed during the learning process. By contrast, 74.5% of surgeons stated that rectal resection surgery with total mesocolic excision is the most complex procedure and therefore to be avoided in the early stages of the learning curve. A total of 81.5% of respondents reported agreement to shorten the learning curve by means of dedicated robotics courses, tutoring activities and attending dedicated high-volume robotic colorectal surgical units.

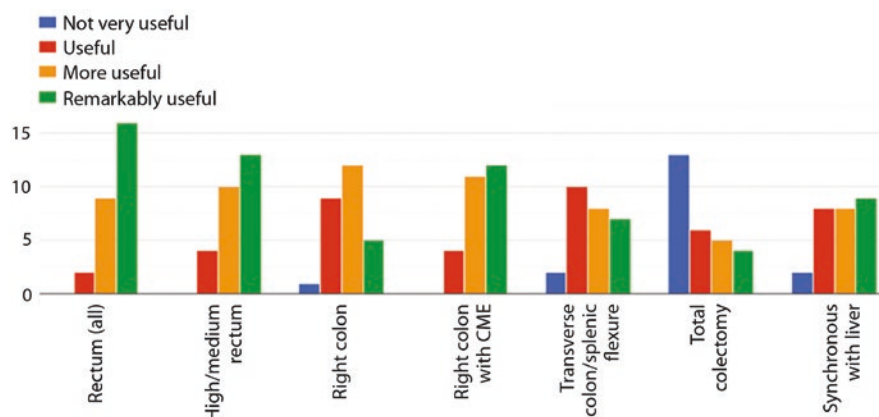


Fig. 2.2 Importance of robotic approach in relation to the colorectal disease

Fewer than 33.3% of surgeons have direct experience of robotic platforms other than the da Vinci system (e.g., CRM Versius or Hinotori). Currently, 96.2% of respondents believe that 3D-robotic vision is better than laparoscopic vision, and 77.4% of them also consider 4K laparoscopic vision inferior to robotic vision.

Analysis of the rate of robotic colorectal procedures performed over one year yielded the following results:

- in 8 centers the robotic approach is less than 20%
- in 13 centers the robotic approach is between 20% and 50%
- in 3 centers the robotic approach is between 50% and 80%
- in 3 centers the robotic approach is used in more than 80% of cases.

About 50% of the responding centers propose robotic surgery as the first approach for both right and left hemicolectomy and for anterior rectal resection in 10% to 50% of cases. For over 50% of respondents the main advantages of the robotic approach are evident during right hemicolectomy. In over 80% of centers, the anastomosis is performed intracorporeally during right robotic hemicolectomy.

The rate of conversion to open or laparoscopic surgery is:

- less than 5% in 19 centers (70.4%)
- between 5% and 20% in 7 centers (25.9%)
- between 20% to 50% in 1 center (3.7%).

The main causes for surgical conversion include different conditions, such as visceral adhesions, obesity, incorrect patient selection, or inadequate surgeon experience. The conversion rate is shown in Fig. 2.3.

In 20 centers, intraoperative use of indocyanine green (ICG) fluorescence imaging was reported both for right hemicolectomy and left colon or rectum surgery, while in 6 centers its use was limited to left colectomy and rectal anterior resection (74.1% vs. 22.2%) (Fig. 2.4).

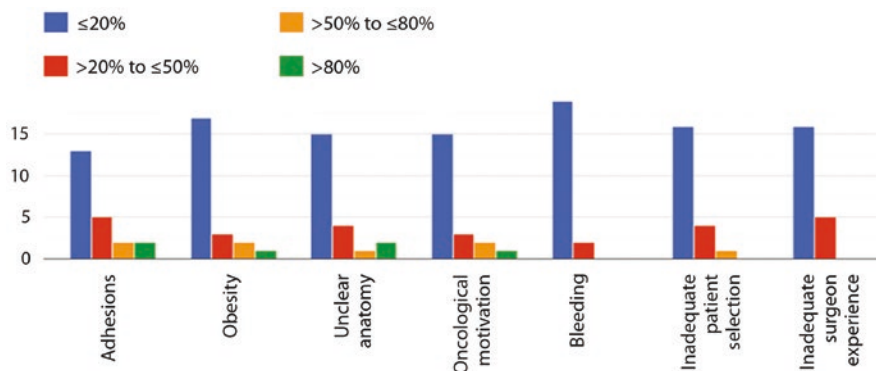
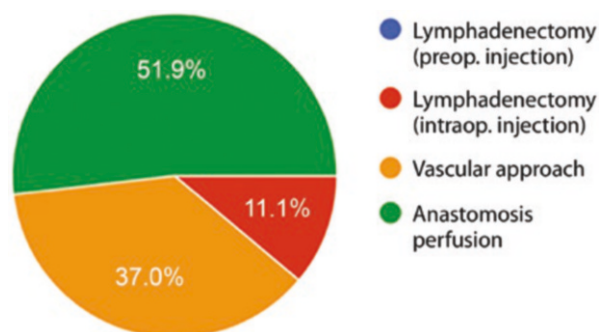


Fig. 2.3 Main causes of conversion of colorectal robotic surgery to open or laparoscopic surgery

Fig. 2.4 Indocyanine green fluorescence uses in colorectal robotic surgery



Lastly, in about 60% of the centers included in the survey the use of robotic surgery decreased during the Covid-19 pandemic, as happened for most elective surgeries.

2.4 Discussion

Analysis of the preliminary data shows that the majority of respondents work in high-volume laparoscopic colorectal centers using a robotic approach for more than 15 years.

They reported that right hemicolectomy could be the easiest procedure to be done during the early learning process. In the same way, for over 80% of the surgeons right colectomy could be the most suitable for a robotic approach because of the advantages of the robotic platform during intracorporeal anastomosis. This finding is consistent with the results of a recent Italian systematic review and meta-analysis, which reported a higher rate of intracorporeal anastomosis in robotic right colectomy than in the laparoscopic group [6, 7].

Despite the common opinion that the robotic platform is very useful for rectal surgery [3], over 50% of respondents reported that the benefits of robotics are also evident in right hemicolectomy. This finding is consistent with the results that only 8/27 centers (29.6%) propose robotic rectal resection as a first approach.

The intraoperative use of ICG fluorescence imaging optimizes intraoperative vision of anatomical structures by improving blood and lymphatic flow [8]. In accordance with the spread of this technology, all centers included in this survey use ICG fluorescence and apply it during robotic colorectal surgery to detect lymph nodes and to test perfusion of the anastomosis.

As is well known, the Covid-19 pandemic had a negative impact on colorectal surgery, increasing the time to diagnosis and treatment [9]. Also the use of robotic platforms has been negatively affected. This is in line with other experiences in Italy, as reported in a recent national survey [10], which found that the use of the robotic approach decreased during the pandemic as well as all minimally invasive approaches.

Another important finding of our survey is the unanimous agreement that the robotic platform needs to be implemented through a standardized training program. So, similarly to the Fundamentals of Robotic Surgery (FRS) in the USA and the European Academy of Robotic Colorectal Surgery (EARCS) in Europe, we hope that also in Italy an academy of robotic surgery will be set up in order to standardize education and training programs.

Survey Collaborative Group

Massimo Basti, Paolo Pietro Bianchi, Luigi Bonanni, Alberto Brolese, Valerio Caracino, Davide Cavaliere, Graziano Ceccarelli, Fabrizio Cimino, Mariagrazia Coluzzi, Andrea Coratti, Diego Cuccurullo, Carlo De Nisco, Giovanni De Palma, Michele De Rosa, Paolo Delrio, Antonio Di Cintio, Giorgio Ercolani, Marco Farsi, Giampaolo Formisano, Niccolò Furbetta, Antonio Giuliani, Giuseppe Giuliani, Gian Luca Grazi, Mario Guerrieri, Elio Jovine, Raffaele Lombardi, Daniele Marrelli, Michele Masetti, Andrea Mazzari, Marco Milone, Eugenio Miranda, Luca Morelli, Andrea Oddi, Monica Ortenzi, Ugo Pace, Daniele Paradies, Alessandro Pasculli, Graziano Pernazza, Angela Pezzolla, Felice Pirozzi, Alfonso Recordare, Franco Roviello, Stefano Scabini, Antonio Sciuto, Domenico Soriero, Ernesto Tartaglia, Giovanni Tebala, Mario Testini, Irene Urciuoli, Roberto Vicentini, Giovanni Viel.

References

1. Addison P, Agnew JL, Martz J. Robotic colorectal surgery. *Surg Clin North Am.* 2020;100(2):337–60.
2. Weber PA, Merola S, Wasielewski A, Ballantyne GH. Telerobotic-assisted laparoscopic right and sigmoid colectomies for benign disease. *Dis Colon Rectum.* 2002;45(12):1689–94; discussion 1695–6.
3. Nasir I, Mureb A, Aliozo CC, et al. State of the art in robotic rectal surgery: marginal gains worth the pain? *Updates Surg.* 2021;73(3):1073–9.
4. Corrigan N, Marshall H, Croft J, Copeland J, Jayne D, Brown J. Exploring and adjusting for potential learning effects in ROLARR: a randomised controlled trial comparing robotic-assisted vs. standard laparoscopic surgery for rectal cancer resection. *Trials.* 2018;19(1):339.
5. Jayne D, Pigazzi A, Marshall H, et al. Robotic-assisted surgery compared with laparoscopic resection surgery for rectal cancer: the ROLARR RCT. Southampton: NIHR Journals Library; 2019.
6. Bracale U, Merola G, Cabras F, et al. The use of barbed suture for intracorporeal mechanical anastomosis during a totally laparoscopic right colectomy: is it safe? A retrospective nonrandomized comparative multicenter study. *Surg Innov.* 2018;25(3):267–73.
7. Solaini L, Bazzocchi F, Cavaliere D, et al. Robotic versus laparoscopic right colectomy: an updated systematic review and meta-analysis. *Surg Endosc.* 2018;32(3):1104–10.
8. Peltrini R, Podda M, Castiglioni S, et al. Intraoperative use of indocyanine green fluorescence imaging in rectal cancer surgery: the state of the art. *World J Gastroenterol.* 2021;27(38):6374–86.
9. Peltrini R, Imperatore N, Di Nuzzo MM, et al. Effects of the first and second wave of the COVID-19 pandemic on patients with colorectal cancer: what has really changed in the outcomes? *Br J Surg.* 2021;108(11):e365–6.
10. Bracale U, Podda M, Castiglioni S, et al. Changes in surgical behaviors during the Covid-19 pandemic. The SICE CLOUD19 Study. *Updates Surg.* 2021;73(2):731–44.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits any noncommercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if you modified the licensed material. You do not have permission under this license to share adapted material derived from this chapter or parts of it.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

