Laparoscopic, Endoscopic and Robotic Surgery 8 (2025) 178–184

Contents lists available at ScienceDirect

Laparoscopic, Endoscopic and Robotic Surgery

journal homepage: www.keaipublishing.com/en/journals/laparoscopic-endoscopic-and-robotic-surgery

Comparison of outcomes in robot-assisted colon cancer surgery using Da Vinci Xi, Hugo™ RAS, and Versius®: The COMPAR-CRC multiplatform study

Corrado Pedrazzani [a,b,*], Giulia Turri [b], Michele Genna [c], Alessandro Valdegamberi [b], Andrea Ballarin [c], Ernesto De Giulio [b], Ruben Sciortino [b], Simone Priolo [d], Callisto Marco Bravi [e], Andrea Ruzzenente [b,f]

[a] Department of Engineering for Innovation Medicine, Division of General and Hepatobiliary Surgery, University of Verona, Verona, Italy
[b] Unit of General and Hepatobiliary Surgery, University of Verona Hospital Trust, Italy
[c] Division of General Surgery, University of Verona Hospital Trust, Verona, Italy
[d] Unit of Intensive Care and Anesthesia, University of Verona Hospital Trust, Verona, Italy
[e] Azienda Ospedaliera Universitaria Integrata Verona, Verona, Italy
[f] Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, Section of General and Hepatobiliary Surgery, University of Verona Hospital Trust, University of Verona, Italy

ARTICLE INFO

Article history:
Received 11 August 2025
Received in revised form
20 September 2025
Accepted 13 October 2025
Available online 16 October 2025

Keywords:
Colon cancer
Robot-assisted surgery
Versius robotic system
Hugo robotic-assisted surgery system
Da Vinci Xi platform

ABSTRACT

Objective: Since the introduction of the Da Vinci® robotic system, robot-assisted colon resection has gained popularity because of its the potential technical advantages. Recently, two new CE-marked platforms have become available in Europe: Hugo™ RAS and Versius®. We present the first prospective case series comparing these three robotic systems.

Methods: This exploratory, prospective study enrolled 45 consecutive adult patients undergoing robotic colon resection between February and December 2024, as part of the COMPAR trial. Two experienced colorectal surgeons performed all procedures across two surgical units. Each robotic platform was used in 15 cases. The primary outcomes were conversion to laparoscopy or open surgery and intra-operative complications. The secondary outcomes included post-operative recovery, oncological results, and platform-specific technical parameters.

Results: The mean age was 66.8 years and 68.9% of patients underwent surgery for colon cancer. No conversions occurred in the Da Vinci group, whereas 2 and 3 conversions to laparoscopy were recorded with Hugo™ RAS and Versius®, respectively. One intra-operative instrument malfunction occurred with Hugo™ RAS, and one surgical complication was reported in each group. No significant differences emerged in post-operative recovery or oncological outcomes. Versius® cases required more frequent use of laparoscopic energy devices ($p < 0.001$). Hugo™ RAS was associated with a longer total operating room time ($p = 0.022$) and longer incision length ($p = 0.005$).

Conclusion: Robotic colorectal surgery with all three platforms is feasible when performed by expert surgeons. While early outcomes are encouraging, larger comparative trials are needed to confirm differences in recovery and oncological efficacy.

1. Introduction

Minimally invasive surgery (MIS) has become the standard of care in colorectal surgery, with laparoscopic surgery still the most commonly used technique.[1–7] However, laparoscopic surgery remains technically challenging due to several limitations, including

* Corresponding author: Division of General and Hepatobiliary Surgery, University of Verona, Verona, Italy.
E-mail address: corrado.pedrazzani@univr.it (C. Pedrazzani).

https://doi.org/10.1016/j.lers.2025.10.001

limited instrument mobility, lack of direct camera control, two-dimensional imaging, and poor ergonomics for the surgeon.

Robot-assisted surgery was developed to overcome these challenges, with the Da Vinci robotic surgical system leading the way. It has helped to expand the use of MIS, with lower conversion rates, and shorter learning curves.[8–11] More recently, new robotic platforms have been introduced, including the Hugo™ robotic-assisted surgery (RAS) system (Medtronic, Dublin, Ireland; Minneapolis, MN, USA) and the Versius® robotic surgical system (Cambridge Medical Robotics Surgical, UK). Both systems have received CE mark approval and are currently being used in gastrointestinal surgery in Europe.

These newer systems share similar goals with the Da Vinci platform, such as improving the precision and overall quality of MIS through high-definition 3D vision, assisted instruments, and digital integration. However, they also differ in important ways. The Hugo™ RAS and Versius® systems have only recently entered clinical use, more than twenty years after the launch of Da Vinci. Their designs include open consoles and modular robotic arms, which may offer greater flexibility in the operating room and aim to lower costs. However, their instruments are still limited, as energy devices and staplers are not yet available. The operating room setup and trocar placement are also still being optimized, particularly for multi-quadrant procedures such as colorectal surgery. Moreover, the learning curve required to achieve proficiency with these systems has yet to be clearly defined.

The CMR Versius® system received CE mark approval in 2019 and has been shown to be feasible in urology,[12] gynecology,[13] general[14] and gastrointestinal surgery,[15–17] as well as thoracic surgery.[18] However, clinical experience remains limited, and it has mostly been used for low- to moderate-complexity procedures. The Medtronic Hugo™ RAS system was approved for general surgery in 2022 and has been used in multiple specialties, including urology,[19,20] gynecology,[21] and general surgery.[22–26]

This prospective study presents the first case series comparing the performance of the CMR Versius®, Medtronic Hugo™ RAS, and Intuitive daVinci Xi platforms in robot-assisted colectomy.

2. Methods

2.1. Study design

This study is a part of the prospective post-market trial *Comparison of Outcomes of Multiple Platforms for Assisted Robotic Surgery (COMPAR)* promoted by the Azienda Ospedaliera Universitaria Integrata of Verona as a project encompassing various procedures and specialties. The COMPAR-CRC was designed to evaluate the performance of the three robotic platforms in the context of colorectal surgery. The study was carried out at the Division of General and Hepatobiliary Surgery and at the Division of General Surgery, University of Verona Hospital Trust, from February to December 2024. The inclusion criteria were elective robot-assisted left- and right-sided colectomies in adult patients with an American Society of Anesthesiologists (ASA) score I–III and a BMI $\leq$35 kg/m^2. Accepted indications included colon neoplasia and diverticular disease. The allowed procedures were right colectomy, left colectomy, and sigmoid resection. The exclusion criteria were rectal location of the disease, BMI >35 kg/m^2, ASA class > III, inflammatory bowel disease, or refusal to provide informed consent. All consecutive patients treated at the two units were evaluated for inclusion. Patients were assigned to one of the available robotic platforms on the basis of availability. Informed consent was obtained from all patients, and the study was approved by the local ethics committee (Prot. No. 98CET – COMPAR-CRC).

The primary endpoints were the rate of conversion to laparoscopic or open surgery and the incidence of intraoperative complications. The secondary endpoints included short-term postoperative outcomes, oncological adequacy of the resected specimen, and total and phase-specific procedure times.

2.2. Training for surgical platforms

All surgeries were performed by two experienced surgeons (C.P. and M.G.) proficient in both laparoscopic and robotic colorectal surgery. Console surgeons, assistant surgeons, and scrub nurses received dedicated training on the Medtronic Hugo™ RAS and CMR Versius® robotic platforms. All surgeries were conducted with all 4 robotic arms of the three platforms and at least one assistant trocar.

The CMR Versius® Surgical System training program was conducted onsite and included an online theoretical module, simulator-based training for console surgeons, and a dry lab session where the entire surgical team practiced instrument handling, trocar placement, and system setup. All surgical procedures were supported by a CMR clinical engineer to assist with trocar placement and robotic arm positioning. A proctor surgeon was present for the first four cases.

Training for the Hugo™ RAS system took place at a specialized training center. It included an onsite theoretical course, followed by dry lab sessions, simulator-based training, and wet lab practice. For all Hugo™ RAS cases, a Medtronic specialist was present to assist with trocar placement and robotic arm positioning.

The Da Vinci Xi platform was already routine clinical use prior to the start of the study, and both operating and assistant surgeons were already certified on the system.

2.3. Management of colon neoplasia

The standard preoperative work-up for patients undergoing surgery for neoplasia included contrast-enhanced computed tomography (CT) of the chest and abdomen, a complete colonoscopy, blood tests, and evaluation of tumor markers. Surgical management followed consistent oncologic principles regardless of the robotic platform. The primary objective was to achieve complete tumor removal (R0 resection). The extent of resection was based on the patient's clinical status, tumor location, and disease stage. Anatomical resections with high ligation of the vessels at their origin were preferred to ensure adequate lymph node yield. Right colectomy was performed through a bottom-to-up approach according to the principles of complete mesocolic excision with D3 lymphadenectomy, or through a medial-to-lateral approach, depending on the surgical team's preference. Pathological evaluation of the specimens was performed according to the 8th edition of the American Joint Committee on Cancer and the Union for International Cancer Control criteria.

2.4. Management of diverticular disease

All patients undergoing surgery for complicated diverticular disease received a complete colonoscopy in combination with either contrast-enhanced abdominal CT or CT colonography. The extent of resection and level of vessel ligation were based on preoperative and intraoperative findings, as well as surgeon preference.

2.5. Data collection and statistical analysis

All demographic, clinical, and perioperative data were prospectively collected by a dedicated member of the surgical team. Conversion was defined as the inability to complete all intended

steps robotically. Intraoperative complications were defined as any unintended adverse event occurring during the surgical procedure that resulted in a deviation from the planned operative course, with or without immediate clinical consequences. Postoperative morbidity was defined as any deviation from the expected postoperative course and was graded according to the Clavien–Dindo classification.[27] Pain control was assessed 6 hours after surgery and daily up to postoperative day 5 or until hospital discharge, using the Numeric Rating Scale from 0 to 10. Length of stay was defined as the number of days from the day of surgery to discharge. Mortality, morbidity, and readmission rates were recorded. All patients were followed for a minimum of 90 days.

This study was designed as a feasibility pilot study, and no formal sample size calculation was performed because of its exploratory nature. The protocol planned to enroll 45 patients, with 15 randomly assigned to each platform based on availability. All the data were deidentified and stored in a secure, password-protected Research Electronic Data Capture database.

Descriptive statistics are reported as medians with interquartile ranges (IQRs) for continuous variables and as absolute frequencies and percentages for categorical variables. Categorical data were compared via the chi-square test or chi-square trend. Continuous data were analyzed via the Kruskal–Wallis test. A p value < 0.05 was considered statistically significant. All the statistical analyses were performed via SPSS software, version 23.0 (IBM Corporation, Armonk, NY).

3. Results

3.1. Cohort-under study

A total of 45 patients were enrolled as expected. No significant differences in baseline characteristics were observed among the groups (Table 1). The surgical data are summarized in Table 2. The groups were generally comparable in terms of the extent and characteristics of surgery.

3.2. Primary outcomes

The primary outcomes are summarized in Table 2. With respect to conversions, no switches to open surgery were required in any group. However, 2 patients in the Hugo™ RAS group and 3 in the Versius® group required conversion to laparoscopy; no conversions occurred in the Da Vinci Xi group ($p = 0.207$). Specifically, 2 cases in the Versius® group and 1 case in the Hugo™ RAS group were converted due to technical difficulties in completing the dissection with the robotic platform. In another case in the Hugo™ RAS group, the dissection was completed robotically, but the procedure was converted to laparoscopy for anastomosis creation due to prolonged operative time. In the remaining case of Versius®, conversion was preferred because of the large tumor size, the patient's refusal of blood transfusion for religious reasons, and the development of hypercarbia.

With respect to intraoperative complications, one surgery-related complication occurred in each group: a superficial splenic capsule tear with Da Vinci Xi, a bladder injury with Hugo™ RAS, and severe hypercarbia with Versius®. All the intra-operative complications were promptly managed robotically. The patient who developed hypercarbia also required conversion to laparoscopy because of previously reported tumor- and patient-related factors. Additionally, one instrument malfunction was reported in the Hugo™ RAS group ($p = 0.760$). The failure did not cause any harm to the patient but led to an increase in the operative time, which eventually resolved with the replacement of the instrument.

3.3. Secondary outcomes

The secondary outcomes are summarized in Tables 2 and 3. No significant differences were observed among the groups in terms of surgical time, oncologic adequacy of resection, postoperative complications, length of stay, and pain control (Fig. 1). However, differences were observed in the total incision length and the frequency of laparoscopic and robotic energy device use. The total incision length, including both the minilaparotomy and trocar sites, was significantly greater in the Hugo™ RAS group than in the Versius® and Da Vinci Xi (median [IQR]: 12.2 [2.2] mm, compared with 9.5 [2.25] mm and 10 [1.25] mm, respectively; $p = 0.005$). The use of a laparoscopic energy device was significantly more common in the Versius® group than in the Hugo™ RAS and Da Vinci Xi groups (80.0% vs. 33.3% vs. 0.0%, respectively; $p < 0.001$). In contrast, robotic advanced energy devices were used only in the

Table 1
Demographic and clinical characteristics of the cohort under study

	Da Vinci *(n = 15)*	Hugo™ RAS *(n = 15)*	Versius® *(n = 15)*	*p* value
Age, median (IQR), y	66 (17.5)	70 (20)	73 (14)	0.465
Gender, *n* (%)				0.177
Male	4 (26.7)	9 (60.0)	6 (40.0)	
Female	11 (73.3)	6 (40.0)	9 (60.0)	
BMI, median (IQR), kg/m^2	24.2 (6.25)	25.9 (5.3)	25.7 (2.05)	0.518
Charlson comorbidity index, median (IQR)	4 (2)	5 (4.5)	4 (3)	0.614
ASA physical status class, *n* (%)				0.211
I	2 (13.3)	0 (0.0)	0 (0.0)	
II	12 (80.0)	11 (73.3)	13 (86.7)	
III	1 (6.7)	4 (26.7)	2 (13.3)	
Previous abdominal surgery, *n* (%)	8 (53.3)	7 (46.7)	8 (53.3)	0.915
Indication for surgery, *n* (%)				0.902
Colon cancer	10 (66.7)	11 (73.3)	10 (66.7)	
Diverticular disease	5 (33.3)	4 (26.7)	5 (33.3)	
Tumor location, *n* (%)				0.552
Right colon	7 (70.0)	7 (63.6)	8 (80.0)	
Left colon	3 (30.0)	4 (36.4)	2 (20.0)	
Pre-operative TNM staging, *n* (%)				0.181
I	7 (70.0)	6 (54.5)	3 (30.0)	
II	1 (10.0)	2 (18.2)	3 (30.0)	
III	1 (10.0)	3 (27.3)	3 (30.0)	
IV	1 (10.0)	0 (0.0)	1 (10.0)	

Table 2
Surgical data and intraoperative outcomes for the cohort under study

	Da Vinci (*n* = 15)	Hugo™ RAS (*n* = 15)	Versius® (*n* = 15)	*p value*
Conversion to laparoscopy, *n* (%)	0 (0.0)	2 (13.3)	3 (20.0)	0.207
Conversion to open, *n* (%)	0 (0.0)	0 (0.0)	0 (0.0)	–
Intra-operative complications, *n* (%)	1 (6.7)	2 (13.3)	1 (6.7)	0.760
Total duration of case, median (IQR), min	366 (82.5)	417.5 (33.5)	375 (93)	0.022
Duration of surgery, median (IQR), min	236 (64)	284.5 (66)	257 (56)	0.084
Extent of surgery, *n* (%)				0.780
Right hemicolectomy	7 (46.7)[a]	7 (46.7)	8 (53.3)	
Left hemicolectomy	1 (6.7)	2 (13.3)	1 (6.7)	
Sigmoid resection	7 (46.7)	6 (40.0)	6 (40.0)	
Associated resections, *n* (%)	0 (0.0)	2 (13.3)	1 (6.7)	0.343
Laparoscopic advanced energy device, *n* (%)	0 (0.0)	5 (33.3)	12 (80.0)	<0.001
Robotic advanced energy device, *n* (%)	8 (53.3)	0 (0.0)	0 (0.0)	<0.001
Mini-laparotomy, *n* (%)				0.254
Suprapubic	15 (100)	12 (80.0)	14 (93.3)	
Transumbilical	0 (0.0)	2 (13.3)	0 (0.0)	
Other	0 (0.0)	1 (6.7)	1 (6.7)	
Length of minilaparotomy, median (IQR), mm	5 (1.5)	6 (1.5)	6 (1.0)	0.149
Total length of incisions, median (IQR), mm	10 (1.25)	12 (2.2)	9.5 (2.25)	0.005
Type of anastomosis, *n* (%)				
Intracorporeal	15 (100.0)	14 (93.3)	15 (100.0)	0.360
Mechanical	15 (100.0)	15 (100.0)	15 (100.0)	–
Drain placement, *n* (%)	2 (13.3)	3 (20.0)	1 (6.7)	0.562
Estimated blood loss, median (IQR), mL	60 (80)	150 (160)	50 (50)	0.324

[a] Right hemicolectomy includes one right extended hemicolectomy.

Table 3
Post-operative secondary outcome data for the cohort under study

	Da Vinci (*n* = 15)	Hugo™ RAS (*n* = 15)	Versius® (*n* = 15)	*p value*
Post-operative complications, *n* (%)	6 (40.0)	4 (26.7)	6 (40.0)	0.678
No complications	9 (60.0)	11 (73.3)	9 (60.0)	0.793
Clavien–Dindo I–II	3 (20.0)	4 (26.7)	4 (26.7)	
Clavien–Dindo ≥ III	3 (20.0)	0 (0.0)	2 (13.3)	
Surgical complications, *n* (%)				
Anastomotic leak	1 (6.7)	0 (0.0)	1 (6.7)	0.593
PPOI	0 (0.0)	2 (13.3)	1 (6.7)	0.343
SSI	2 (13.3)	0 (0.0)	1 (6.7)	0.343
Redo surgery, *n* (%)	2 (13.3)	0 (0.0)	2 (13.3)	0.334
Readmission (30 days), *n* (%)	1 (6.7)	0 (0.0)	0 (0.0)	0.360
Mortality (90 days), *n* (%)	1 (6.7)	0 (0.0)	0 (0.0)	0.360
Length of stay, median (IQR), d	5 (2)	4 (3)	4 (3)	0.765
Number of harvested lymph-nodes, median (IQR)	22 (5.5)	23 (7)	27 (8.25)	0.464
R0 resection, *n* (%)	10 (100)	11 (100)	10 (100)	–

PPOI, prolonged postoperative ileus. SSI, surgical site infection.

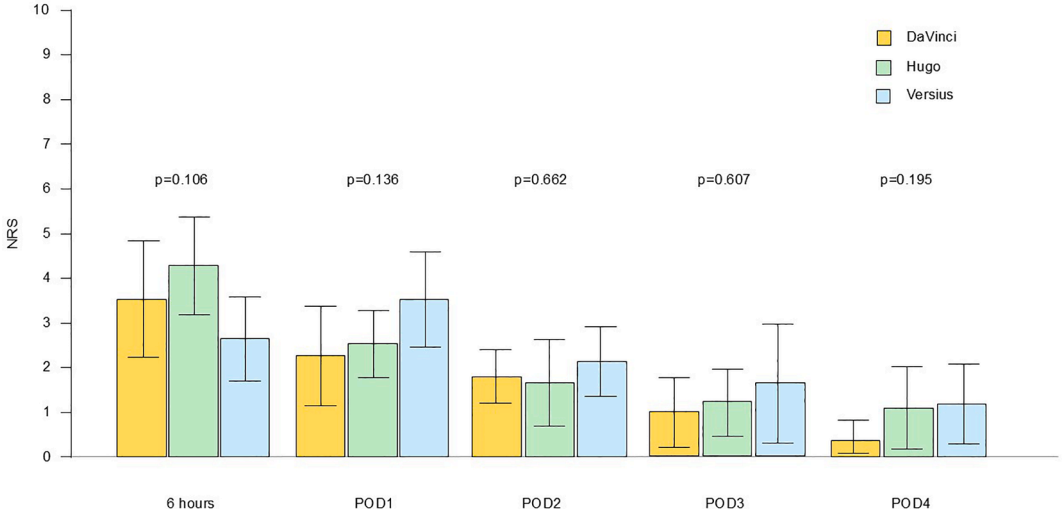


Fig. 1 Graphical presentation of highest mean post-operative pain according to robotic platform
NRS: numeric rating scale.

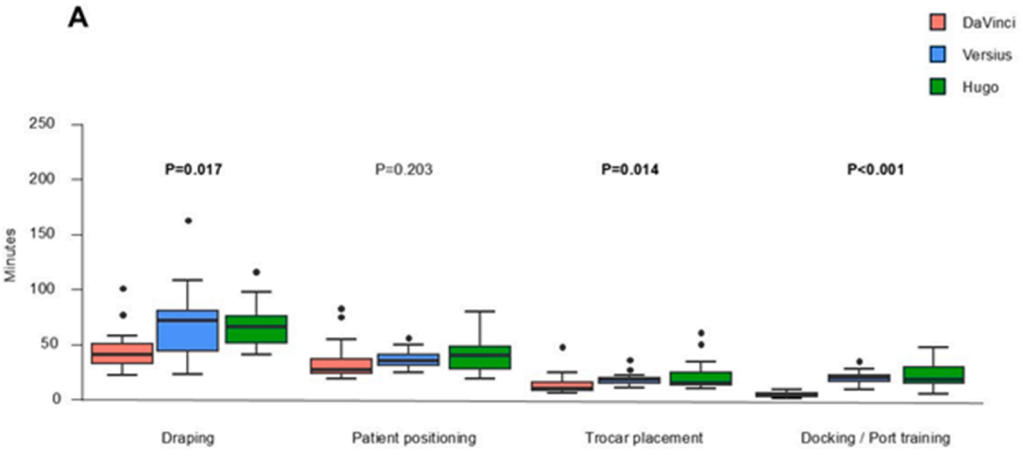
Da Vinci Xi group (8/15 cases), as they were not available on the other platforms ($p < 0.001$). The estimated blood loss was greater in the Hugo™ RAS group, although the difference did not reach statistical significance (median [IQR]: 60 [80] mL with Da Vinci Xi vs. 150 [160] mL with Hugo™ RAS vs. 50 [50] mL with Versius®; $p = 0.324$).

The total operating room time was longer with the Hugo™ RAS and Versius® systems than with the Da Vinci Xi platform (median [IQR]: 366 [82.5] min vs. 417.5 [33.5] min vs. 375 [93] min, respectively; $p = 0.022$). Fig. 2 illustrates the timeline of all procedural phases by study group. As shown in the figure, draping ($p = 0.017$), trocar placement ($p = 0.014$), docking/port training ($p < 0.001$), and undocking/robot disengagement ($p = 0.002$) were longer with Versius® and Hugo™ RAS than with Da Vinci Xi.

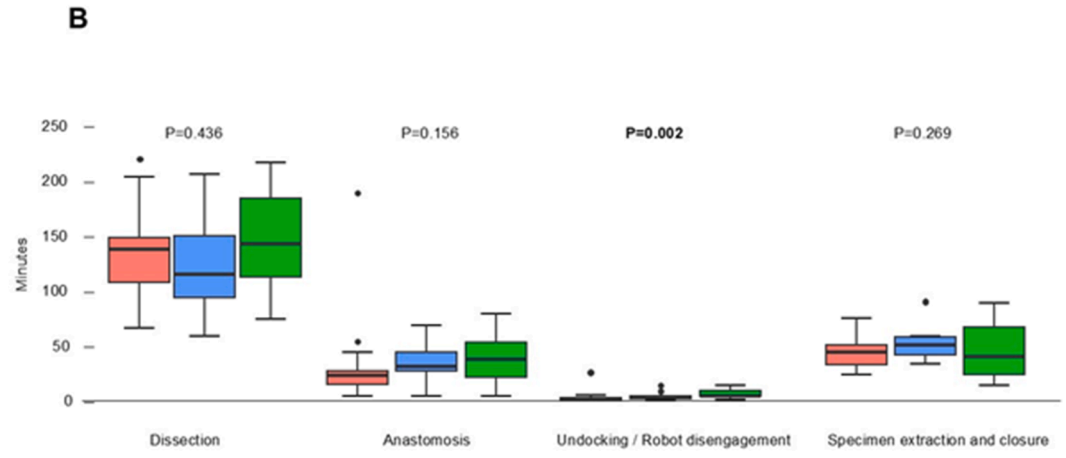
4. Discussion

To the best of our knowledge, this is the first prospective series comparing the performance of three available robotic platforms for colon resection. Although experiences with the Hugo™ RAS[20–23] and Versius®[12,14,15] systems have started to accumulate, there are no reports directly comparing their performance and the feasibility of training on all three systems.

The prospective trial *COMPAR* was designed to assess the feasibility of colonic resection with the two new CE-marked platforms. Specifically, the primary aim of this study was to assess the completion rate of surgical resection with new platforms in terms of conversion rates and intraoperative complications. Notably, two console surgeons conducted all the surgeries, and



	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
DaVinci	41 (17.5)	27 (13)	10 (7)	5 (3)
Versius	72 (36.5)	35 (9.5)	18 (4.5)	20 (6)
Hugo	66 (24)	40 (21)	15 (12)	18 (14.5)



	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
DaVinci	139 (40.5)	24 (12.5)	2 (2.5)	45 (18.5)
Versius	116 (56)	32 (17)	4 (2)	52 (16)
Hugo	144 (72.25)	39 (31.75)	5.5 (5)	41.5 (43.25)

Fig. 2 Graphical representation of the procedural steps according to the robotic platform
A, Boxplots showing the duration of draping, patient positioning, trocar placement, and docking/port training. B, Boxplots showing the durations of dissection, anastomosis, undocking/robot disengagement, and specimen extraction and closure.

they were selected because they were already experienced in minimally invasive colorectal surgery. Both previously performed at least 50 robotic colorectal resections with the Da Vinci Xi platform and hundreds of laparoscopic colorectal resections. In addition, bedside assistants and scrub nurses were also experienced in laparoscopic and robotic surgery with the Da Vinci Xi system. Console surgeons, bedside assistants, and scrub nurses received specific training on Hugo™ RAS and Versius® with theoretical modules and dry or wet lab sessions. The experience of the surgical team was confirmed by the null conversion rate with the Da Vinci Xi. However, 2 conversions to laparoscopy occurred with Hugo™ RAS (13.3%), and 3 conversions occurred with Versius® (20.0%). The reasons for conversion included technical difficulties in completing the dissection in one case with Hugo™ RAS (6.7%) and 2 with Versius® (13.3%). In the remaining cases, conversion was required for patient- or tumor-related issues. Given the small sample size of the study, even one case of conversion resulted in a seemingly high conversion rate. However, we acknowledge the exploratory nature of the study as well as the limited experience of the surgeons with the new platforms. The learning curve effect may explain the higher conversion rate and longer operating times. Nonetheless, no conversion to open surgery was needed, which is in line with previous experiences with Hugo™ RAS[22,26] and Versius®.[15,17]

Considering intra-operative complications, no major complications occurred, and only one instrument malfunction was reported with Hugo™ RAS, requiring increased operative time and instrument replacement. Instrument malfunction did not affect patient safety, and the case was completed with intracorporeal laparoscopic anastomosis due to the prolonged time under anesthesia. One mild non-platform-related complication occurred in each group: a superficial splenic capsule tear with Da Vinci Xi, a bladder injury with Hugo™ RAS, and severe hypercarbia with Versius®.

The secondary outcomes of the study included short-term postoperative outcomes, the oncological adequacy of the resected specimen, and total and phase-specific procedure times. No significant differences were found in terms of postoperative recovery or oncological parameters. The platforms did not influence the surgical technique of the experienced minimally invasive console surgeons, allowing for adequate oncological resections. However, surgeries conducted with the new platform required more operating room time ($p = 0.022$). When looking at the different steps of the procedures, we should highlight longer durations of platform-related steps. Given the multi-modular nature of both Hugo™ RAS and Versius®, draping took approximately 20 minutes longer than Da Vinci Xi. Similarly, trocar placement, docking/port training, and undocking/robot disengagement were lengthier with the new platforms because of the absence of a standardized port set-up and the multi-modular arms.

Finally, some differences emerged regarding the total length of the incisions and the use of advanced energy devices. Considering the length of the incisions, the standard set-up with Da Vinci Xi requires 8 mm trocars for the robotic arms, one of which can be replaced with a 12 mm trocar when the robotic stapler is used. Conversely, a laparoscopic stapler can be deployed through a 12 mm assistant trocar. For Hugo™ RAS, any robotic arm can hold the dedicated Karl Storz TIPCAM®1 S 3D endoscope through an 11 mm trocar, whereas robotic instruments require 8 mm trocars. The Versius® platform does not require specific robotic trocars, and a 10 mm endoscope camera and 5 mm instruments are inserted into standard laparoscopic trocars. In addition to the differences in trocar size, the number of assistant trocars also influenced the total length of the incisions. In fact, all surgeries performed with Versius® required only one assistant trocar, whereas 2/15 (13.3%) with Da Vinci Xi and 7/15 (46.7%) with Hugo™ RAS involved two or more. Finally, while monopolar and bipolar devices were present in all the platforms, robotic advanced energy devices, robotic staplers, and indocyanine green camera were available only in the Da Vinci Xi. Consequently, laparoscopic advanced energy devices were utilized in 5/15 (33.3%) cases with Hugo™ RAS and 12/15 (80.0%) with Versius®. The type of trocars, robotic instruments, and the use of advanced energy instruments may also affect the total costs of the procedures, which will be evaluated in a further analysis.

Our study has several limitations that can be explained mainly by the small sample size. Given the exploratory nature of the study, the number of cases was limited by the availability of the platform and the robotic kits. Therefore, no formal sample size calculation was possible, and the conclusions should be interpreted with caution. Similarly, patients were assigned to the platforms depending on the system's availability. Despite the strict inclusion criteria, some degree of variability between groups could have been introduced by the absence of randomization, even if baseline characteristics did not differ significantly. Additionally, even though the surgical teams were experienced in laparoscopic and robotic surgery, none had previous exposure to Hugo™ RAS or Versius®. It is reasonable to believe that some cases of conversion and the increase in operating time could be ascribed to the surgeons' learning curve with the new platforms.

Nonetheless, our study also has several strengths. First, this is the first case series comparing Da Vinci Xi, Versius® and Hugo™ RAS in a single center. Most published experiences refer to centers that transitioned from Da Vinci to other platforms and did not compare parallel groups.[14,17,20,21,26] Second, as the first experience with the new platforms, we applied strict selection criteria to recruit a homogeneous group of patients with moderate surgical difficulty. For these reasons, we excluded patients with rectal cancer, a BMI >35 kg/m^2, an ASA > III, or inflammatory bowel disease. Finally, despite the surgical teams still being in their learning phase with the new platforms, no conversion to open surgery or major intraoperative complications occurred.

5. Conclusions

Robot-assisted colectomies with Versius® and Hugo™ RAS are feasible when performed by expert minimally invasive surgeons. However, larger randomized trials should be planned to compare oncological and recovery outcomes.

Ethics approval

Approval was granted by the Local Ethics Committee "Area Sud Ovest Veneto" (Prot. No. 98CET – COMPAR-CRC). Informed consent was obtained from all individual participants included in the study.

CRediT authorship contribution statement

Corrado Pedrazzani: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Giulia Turri:** Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Data curation, Conceptualization. **Michele Genna:** Writing – review & editing, Supervision, Project administration, Investigation. **Alessandro Valdegamberi:** Writing – review & editing, Writing – original draft, Validation, Investigation. **Andrea Ballarin:** Writing – review & editing, Supervision, Resources, Project administration, Investigation. **Ernesto De Giulio:** Writing – review & editing, Methodology, Investigation, Data

curation. **Ruben Sciortino:** Writing – original draft, Project administration, Formal analysis, Data curation. **Simone Priolo:** Writing – review & editing, Resources, Project administration, Investigation. **Callisto Marco Bravi:** Writing – review & editing, Supervision, Project administration, Investigation, Conceptualization. **Andrea Ruzzenente:** Writing – review & editing, Validation, Supervision, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Allaix ME, Rebecchi F, Fichera A. The landmark series: minimally invasive (laparoscopic and robotic) colorectal cancer surgery. *Ann Surg Oncol*. 2020;27(10):3704–3715.
2. Heikkinen T, Msika S, Desvignes G, et al. Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. *Lancet Oncol*. 2005;6(7):477–484.
3. Lacy AM, Delgado S, Castells A, et al. The long-term results of a randomized clinical trial of laparoscopy-assisted versus open surgery for colon cancer. *Ann Surg*. 2008;248(1):1–7.
4. Clinical Outcomes of Surgical Therapy Study Group, Nelson H, Sargent DJ, et al. A comparison of laparoscopically assisted and open colectomy for Colon cancer. *N Engl J Med*. 2004;350(20):2050–2059.
5. Green BL, Marshall HC, Collinson F, et al. Long-term follow-up of the medical research council CLASICC trial of conventional versus laparoscopically assisted resection in colorectal cancer. *Br J Surg*. 2013;100(1):75–82.
6. Fleshman J, Sargent DJ, Green E, et al. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-Year data from the COST study group trial. *Ann Surg*. 2007;246(4):655–664.
7. Jayne DG, Guillou PJ, Thorpe H, et al. Randomized trial of laparoscopic-assisted resection of colorectal carcinoma: 3-year results of the UK MRC CLASICC trial group. *J Clin Oncol*. 2007;25(21):3061–3068.
8. Keller DS, Jenkins CN. Safety with innovation in Colon and rectal robotic surgery. *Clin Colon Rectal Surg*. 2021;34(5):273–279.
9. Cuk P, Kjær MD, Mogensen CB, Nielsen MF, Pedersen AK, Ellebæk MB. Short-term outcomes in robot-assisted compared to laparoscopic colon cancer resections: a systematic review and meta-analysis. *Surg Endosc*. 2022;36(1):32–46.
10. Solaini L, Bocchino A, Avanzolini A, Annunziata D, Cavaliere D, Ercolani G. Robotic versus laparoscopic left colectomy: a systematic review and meta-analysis. *Int J Colorectal Dis*. 2022;37(7):1497–1507.
11. Park JS, Kang H, Park SY, et al. Long-term oncologic after robotic versus laparoscopic right colectomy: a prospective randomized study. *Surg Endosc*. 2019;33(9):2975–2981.
12. De Maria M, Meneghetti I, Mosillo L, Collins JW, Catalano C. Versius robotic surgical system: case series of 18 robot-assisted radical prostatectomies. *BJU Int*. 2024;133(2):197–205.
13. Uccella S, Galli L, Casprini C, et al. Robotic-assisted surgical staging with sentinel node biopsy for apparently early-stage endometrial cancer using the modular multi-arm surgical robot system versius® (Cambridge Medical Robots): a case series. *Gynecol Obstet Invest*. 2025;90(4):319–327.
14. Dixon F, Qureshi A, Vitish-Sharma P, Khanna A, Keeler BD. Implementation of robotic hernia surgery using the versius® system. *J Robot Surg*. 2023;17(2):565–569.
15. Collins D, Paterson HM, Skipworth RJE, Speake D. Implementation of the versius robotic surgical system for colorectal cancer surgery: first clinical experience. *Colorectal Dis*. 2021;23(5):1233–1238.
16. Gussago S, Balaphas A, Liot E, et al. Applicability and results of the versius surgical robotic system in colorectal surgery: a systematic review of the literature. *J Robot Surg*. 2025;19(1):1–8.
17. Puntambekar SP, Rajesh KN, Goel A, et al. Colorectal cancer surgery: by Cambridge medical robotics versius surgical robot System—A single-institution study. Our experience. *J Robot Surg*. 2022;16(3):587–596.
18. Fra S, Caballero-Silva U, Cabañero-Sánchez A, et al. Implementation of the versius robotic surgical system for thoracic surgery: first clinical evaluation of feasibility and performance. *Eur J Cardio Thorac Surg*. 2024;66(2):ezae286.
19. Marino F, Moretto S, Rossi F, et al. Robot-assisted Radical Prostatectomy with the Hugo RAS and Da Vinci Surgical Robotic Systems: a Systematic Review and Meta-analysis of Comparative Studies. *Eur Urol Focus*. 2025;11(2):312–322.
20. Antonelli A, Veccia A, Malandra S, et al. Outcomes of Da Vinci® versus Hugo RAS® radical prostatectomy: focus on postoperative course, pathological findings, and patients' health-related quality of life after 100 consecutive cases (the COMPAR-P prospective trial). *Minerva Urol Nephrol*. 2024;76(5):596–605.
21. Yagur Y, Martino MA, Sarofim M, et al. Implementation and outcomes in benign gynecological surgery with HUGO™ RAS system 12 months initial experience. *J Robot Surg*. 2024;18(1):350.
22. Belyaev O, Fahlbusch T, Slobodkin I, Uhl W. Major colorectal surgery with Hugo™ RAS: initial experience of a German center and a review of the literature. *Updates Surg*. 2024;76(5):1705–1714.
23. Bianchi P Pietro, Salaj A, Rocco B, Formisano G. First worldwide report on hugo RAS™ surgical platform in right and left colectomy. *Updates Surg*. 2023;75(3):775–780.
24. Violante T, Rottoli M, Colpaert J, et al. A right colectomy case study: transitioning to the Hugo RAS system with a novel 3-ports technique in experienced robotic colorectal practice. *Langenbecks Arch Surg*. 2024;409(1):368.
25. Rottoli M, Violante T, Calini G, Cardelli S, Novelli M, Poggioli G. A multi-docking strategy for robotic LAR and deep pelvic surgery with the Hugo RAS system: experience from a tertiary referral center. *Int J Colorectal Dis*. 2024;39(1):154.
26. Gangemi A, Bernante P, Rottoli M, Pasquali F, Poggioli G. Surgery of the alimentary tract for benign and malignant disease with the novel robotic platform HUGOTM RAS. A first world report of safety and feasibility. *Int J Med Robot*. 2023;19(4):e2544.
27. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004;240(2):205–213.