**Name of Journal:** *World Journal of Clinical Cases*

**Manuscript NO:** 88460

**Manuscript Type:** ORIGINAL ARTICLE

***Case Control Study***

**Colorectal resections for malignancy: A pilot study comparing conventional *vs* freehand robot-assisted laparoscopic colectomy**

Cawich SO *et al*. Laparoscopic colectomy

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**Received:** September 26, 2023

**Revised:** December 6, 2023

**Accepted:** December 29, 2023

**Published online:**

**Abstract**

BACKGROUND

Laparoscopic colectomy is widely accepted as a safe operation for colorectal cancer, but we have experienced resistance to the introduction of the FreeHand® robotic camera holder to augment laparoscopic colorectal surgery.

AIM

To compare the initial results between conventional and FreeHand® robot-assisted laparoscopic colectomy in Trinidad and Tobago.

METHODS

This was a prospective study of outcomes fromall laparoscopic colectomies performed for colorectal carcinoma from November 29, 2021 to May 30, 2022. The following data were recorded: Operating time, conversions, estimated blood loss, hospitalization, morbidity, surgical resection margins and number of nodes harvested. All data were entered into an excel database and the data were analyzed using SPSS ver 20.0.

RESULTS

There were 23 patients undergoing colectomies for malignant disease: 8 (35%) FreeHand®-assisted and 15 (65%) conventional laparoscopic colectomies. There were no conversions. Operating time was significantly lower in patients undergoing robot-assisted laparoscopic colectomy (95.13 ± 9.22 *vs* 105.67 ± 11.48 min; *P* = 0.045). Otherwise, there was no difference in estimated blood loss, nodal harvest, hospitalization, morbidity or mortality.

CONCLUSION

The FreeHand® robot for colectomies is safe, provides some advantages over conventional laparoscopy and does not compromise oncologic standards in the resource-poor Caribbean setting.

**Key Words:** Laparoscopic; Colectomy; Robot; Surgery; Minimally invasive

Cawich SO, Plummer JM, Griffith S, Naraynsingh V. Colorectal resections for malignancy: A pilot study comparing conventional *vs* freehand robot-assisted laparoscopic colectomy. *World J Clin Cases* 2023; In press

**Core Tip:** The FreeHand® single arm robot is a viable option to conventional laparoscopy for colorectal surgery. The Free hand robot is safe for colectomy and does not compromise oncologic standards in the resource-poor Caribbean setting.

**INTRODUCTION**

There is level 1 data in support of a laparoscopic approach to colorectal surgery[1-12]. During a laparoscopic colectomy, the surgeon uses both hands to control operating instruments, while a separate camera person controls the laparoscope. Due to staff shortages at our institution, and compounded by the concern of crowding in the operating room during the 2021 pandemic, camera persons were unavailable and this impaired our ability to perform laparoscopic surgery. In response, the FreeHand® (Freehand 2010 Ltd., Guildford, Surrey, United Kingdom) robotic camera holder was introduced to our facility at the Port of Spain General Hospital in Trinidad and Tobago to augment laparoscopic colorectal surgery.

The FreeHand® robot is a single robotic arm that is docked at the operating bed rail and is used to control the laparoscope. The operating surgeon is in direct control of the robotic arm *via* a head-mounted radiofrequency communicator that responds to the surgeon’s head movements. The robot controls are intuitive as they respond to the direction in which the surgeon’s head moves, mirroring the direction of vision. The requirement for a human camera person is now obviated because the surgeon can control operating instruments in both hands and simultaneously control the laparoscope using head movements. The advantage is an accurate and stable view of the operating field, eliminating human error by the camera person[13].

The first FreeHand® robot-assisted colorectal operation in the Caribbean was performed by Cawich *et al*[13] on November 29, 2021. This was greeted with resistance from established laparoscopic surgeons who touted that this would prolong operation times, increase complication rates and compromise oncologic standards. Therefore, this pilot study sought to compare the initial results between conventional and FreeHand robot-assisted laparoscopic colectomy in Trinidad and Tobago. The primary outcomes of this pilot study were to compare total operating times, number of conversions to open surgery and conversions to a human camera person. The secondary endpoints were to compare post-operative outcomes: Total duration of hospitalization, post-operative morbidity and oncologic standards (node harvest, resection margins) between the techniques.

**MATERIALS AND METHODS**

In this study an independent researcher observed all laparoscopic colectomies performed in patients who had confirmed diagnoses of colorectal carcinoma over a six-month period from November 29, 2021 to May 30, 2022. This was an observational study and no change in treatment protocols were required for the purposes of this study. The attending surgeon decided which patients would be offered conventional laparoscopy or resections using the Freehand® (Freehand 2010 Ltd., Guildford, Surrey, United Kingdom) robotic camera holder, many times based on availability of the robot. When the robot was utilized, the attending surgeon solely made the decision on setup of the operating room and positioning of the robot.

The study was approved by the local institutional review board, and each patient gave their consent to have an observer present in order to be included in the study. We only included patients who had operations performed by attending surgeons and those who had operations for colorectal malignancies. We excluded patients below the age of 18, those who had rectal operations, other procedures at the same sitting, emergent operations and those who did not consent to participate.

The independent observer recorded the following data: Robot docking time (time for draping, lens fixation and positioning), total operating time (time from first skin incision to closure of last incision inclusive of robot docking time), conversions to open surgery, conversions to a human camera operator, estimated blood loss and intra-operative complications. After discharge, all patient records were retrieved for detailed analysis and the following data extracted: Total duration of hospitalization, post-operative complications and mortality.

Histopathologic data were also collected since a secondary outcome of this study was to compare oncologic standards. Current guidelines[14-28] stipulate that an oncologically adequate surgical procedure is a curative colectomy with complete removal of the cancer bearing segment of colon[14-17], resection margins ≥ 10 cm from the primary[14,18,19] and ≥ 12 regional lymph nodes[14,20-28]. Therefore, a colectomy was only considered oncologically adequate in our study if there were resection margins ≥ 10 cm and ≥ 12 nodes harvested in the specimen.

All data were entered into an excel database and the data were compared using SPSS 20.0. Continuous variables were compared using the Mann-Whiney test and Fisher’s exact test was used to compare categorical data. A *P* < 0.05 was considered significant.

**RESULTS**

Over the study period, data were collected from 23 patients undergoing laparoscopic colectomies for malignant disease. Eight (35%) patients underwent robot assisted colectomies and 15 (65%) had conventional laparoscopic colectomies. All procedures were performed by attending surgeons with significant experience in laparoscopic colectomies. There were no conversions to open surgery in this cohort.

The conventional laparoscopy group (15) was comprised of 8 (53%) men and 7 (47%) women at an age of 57.9 ± 8.43 years (mean ± SD). In this group, the procedures were right (6), left (2) and sigmoid colectomies (7).

In the robot group (8), there were 5 (63%) males and 3 (37%) females at an age of 59.9 ± 6.90 years (mean ± SD). In this group, the procedures were right (5), left (1) and sigmoid colectomies (2). The robot docking time was 5.9 ± 1.25 min (mean ± SD). No conversions to a human camera holder were recorded.

Overall, there was no mortality and only one (4%) patient experienced a superficial surgical site infection requiring opening of the wound and therapeutic antibiotics. The outcomes in both groups are compared in Table 1. The only parameter that achieved statistical significance was the total operating time, which was shorter in the robot-assisted colectomy group (95 min *vs* 105 min; *P* = 0.0455).

**DISCUSSION**

Open surgeons resisted the introduction of laparoscopic resections for colorectal carcinoma in the Anglophone Caribbean[11], similar to the experience reported across the globe. Now that laparoscopic colectomy has become widely accepted, we have witnessed conventional laparoscopic surgeons mounting aggressive resistance to single incision laparoscopic[12] and robot-assisted laparoscopic[13] colectomy. Specifically, conventional laparoscopic surgeons in the Caribbean suggested that operators would be distracted by the robotic controls and this would lead to increased complication rates, prolonged operating times and compromised oncologic standards. Often, established surgeons have gained sufficient reputation that their utterances are often believed, despite the lack of supporting evidence or data. Therefore, we carried out this study to provide objective data for evidence-based decisions.

We have shown that use of the FreeHand® robot does not increase blood loss, morbidity or mortality, when compared to conventional laparoscopy. Additionally, oncologic standards are not compromised as there were equivalent resection margins and adequate nodal harvest. In fact, post-operative morbidity, mortality and hospitalization recorded in this study were comparable to published data on laparoscopic colectomies from the Anglophone Caribbean[9,11,29].

In this study, only one parameter attained statistical significance – the mean total operating time was 10 min shorter when the FreeHand® robot was utilized. Interestingly, this was also shorter than the mean time to perform a conventional laparoscopic colectomy in Caribbean literature[9,11,29] that was reported to span from a minimum of 150 min[9] to a maximum of 175 min[29]. We theorized that the surgeon’s ability to control vision and reduced communication time between the camera person and the surgeon may have contributed to this effect. This was well-stated by Ballantyne *et al*[30] who wrote: “*inexperienced or bored camera-holders move the camera frequently and rotate it away from the horizon.*” We suggest that a distinct advantage of this technology is the surgeon having full control of their vision.

This robot had one arm that held the scope in response to directions from the surgeon using an infrared communicator. More sophisticated platforms such as the DaVinci (Intuitive Surgical Inc, Sunnyvale, California, United States) robots have additional operating arms to facilitate specialized instruments and increased functionality[31-34], but these would come at significantly greater cost. Most Caribbean nations could not afford these advanced systems as most were low and middle income countries[13]. Up to this time of publication, there were no DaVinci platforms in any nation in the Anglophone Caribbean. Nevertheless, the FreeHand® robot balanced cost while providing some advantages over conventional minimally invasive surgery.

Since we only evaluated short-term outcomes, we cannot comment on long-term outcomes, but we anticipate that they would be similar to those from conventional minimally invasive colectomy, that is supported by good quality data[1-8,35].

This study had few limitations: Firstly, it evaluated outcomes when colectomies were performed by experienced laparoscopic surgeons who were beyond their learning curves for laparoscopic colectomies. Therefore, these results may not be extrapolated to those by community surgeons.

Secondly, the case numbers were small in this pilot study, reducing the power of our observations. This was largely based on the availability of cases/equipment in this resource poor region.

Finally, the cases chosen for robot-assisted colectomy were not blinded. Case selections were made solely by the attending surgeons, and this may have introduced selection bias.

**CONCLUSION**

Using this technology to complete colectomy is safe and does not compromise oncologic standards in the resource-poor Caribbean setting.

**ARTICLE HIGHLIGHTS**

***Research background***

There is limited experience with robotics in surgery in the English-speaking Caribbean, although the laparoscopic approach to colorectal surgery is widely accepted for colorectal cancer. We recount our experience since the FreeHand robotic camera holder was introduced to the Caribbean in 2021.

***Research motivation***

In the English-speaking Caribbean, we experienced resistance to the introduction of the FreeHand® robotic camera holder to augment laparoscopic colorectal surgery. Therefore, we attempted to collect data to compare the initial results between conventional and FreeHand® robot-assisted laparoscopic colectomy in Trinidad and Tobago.

***Research objectives***

The aim of this study was to collect objective outcome data to compare robot-assisted and conventional laparoscopic colorectal resections for malignancy. The objectives were achieved and show that there is some advantage that requires further research in the future.

***Research methods***

A prospective study was carried out to collect data on the outcomes fromall laparoscopic colectomies performed for colorectal carcinoma over a six-month period in Trinidad and Tobago. An independent observer recorded operating times, conversions, estimated blood loss, hospitalization, morbidity, surgical resection margins and number of nodes harvested. SPSS version 20 was used to analyze all data.

***Research results***

Of 23 colectomies performed for malignant disease, 8 (35%) were performed with the FreeHand® robot and 15 (65%) by conventional laparoscopy. There were no conversions. Operating time was significantly lower in patients undergoing robot-assisted laparoscopic colectomy (95.13 ± 9.22 *vs* 105.67 ± 11.48 min; *P* = 0.045). Otherwise, there was no difference in estimated blood loss, nodal harvest, hospitalization, morbidity or mortality.

***Research conclusions***

We have demonstrated that the FreeHand® robot for colectomies is safe, provides some advantages over conventional laparoscopy and does not compromise oncologic standards.

***Research perspectives***

This preliminary study suggests that operating time can significantly be reduced with the use of the FreeHand robot. This will guide future research. If larger studies confirm this finding, there will be significant implications for cost-savings in this setting. This will have significant positive implications for use of technology in low and middle income nations.

**REFERENCES**

1 **Lacy AM**, García-Valdecasas JC, Delgado S, Castells A, Taurá P, Piqué JM, Visa J. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomised trial. *Lancet* 2002; **359**: 2224-2229 [PMID: 12103285 DOI: 10.1016/S0140-6736(02)09290-5]

2 **Clinical Outcomes of Surgical Therapy Study Group**, Nelson H, Sargent DJ, Wieand HS, Fleshman J, Anvari M, Stryker SJ, Beart RW Jr, Hellinger M, Flanagan R Jr, Peters W, Ota D. A comparison of laparoscopically assisted and open colectomy for colon cancer. *N Engl J Med* 2004; **350**: 2050-2059 [PMID: 15141043 DOI: 10.1056/NEJMoa032651]

3 **Veldkamp R**, Kuhry E, Hop WC, Jeekel J, Kazemier G, Bonjer HJ, Haglind E, Påhlman L, Cuesta MA, Msika S, Morino M, Lacy AM; COlon cancer Laparoscopic or Open Resection Study Group (COLOR). Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. *Lancet Oncol* 2005; **6**: 477-484 [PMID: 15992696 DOI: 10.1016/S1470-2045(05)70221-7]

4 **Guillou PJ**, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, Heath RM, Brown JM; MRC CLASICC trial group. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet* 2005; **365**: 1718-1726 [PMID: 15894098 DOI: 10.1016/S0140-6736(05)66545-2]

5 **Weeks JC,** Nelson H, Gelber S, Sargent D, Schroeder G, Clinical Outcomes of Surgical Therapy (COST) Study Group. Short term quality of life outcomes following laparoscopic assisted colectomy vs open colectomy for colon cancer: a randomized trial. *JAMA* 2002; **287**: 321e8 [DOI: 10.1001/jama.287.3.321]

6 **Janson M**, Lindholm E, Anderberg B, Haglind E. Randomized trial of health-related quality of life after open and laparoscopic surgery for colon cancer. *Surg Endosc* 2007; **21**: 747-753 [PMID: 17342556 DOI: 10.1007/s00464-007-9217-9]

7 **Jackson TD**, Kaplan GG, Arena G, Page JH, Rogers SO Jr. Laparoscopic versus open resection for colorectal cancer: a metaanalysis of oncologic outcomes. *J Am Coll Surg* 2007; **204**: 439-446 [PMID: 17324779 DOI: 10.1016/j.jamcollsurg.2006.12.008]

8 **Jayne DG**, Guillou PJ, Thorpe H, Quirke P, Copeland J, Smith AM, Heath RM, Brown JM; UK MRC CLASICC Trial Group. Randomized trial of laparoscopic-assisted resection of colorectal carcinoma: 3-year results of the UK MRC CLASICC Trial Group. *J Clin Oncol* 2007; **25**: 3061-3068 [PMID: 17634484 DOI: 10.1200/JCO.2006.09.7758]

9 **Plummer JM**, Mitchell DI, Arthurs M, Leake PA, Deans-Minott J, Cawich SO, Martin A. Laparoscopic colectomy for colonic neoplasms in a developing country. *Int J Surg* 2011; **9**: 382-385 [PMID: 21419240 DOI: 10.1016/j.ijsu.2011.03.002]

10 **Cooperman AM**, Katz V, Zimmon D, Botero G. Laparoscopic colon resection: a case report. *J Laparoendosc Surg* 1991; **1**: 221-224 [PMID: 1834273 DOI: 10.1089/Lps.1991.1.221]

11 **Cawich SO**, Pooran S, Amow B, Ali E, Mohammed F, Mencia M, Ramsewak S, Hariharan S, Naraynsingh V. Impact of a medical university on laparoscopic surgery in a service-oriented public hospital in the Caribbean. *Risk Manag Healthc Policy* 2016; **9**: 253-260 [PMID: 27895521 DOI: 10.2147/rmhp.s89724]

12 **Cawich SO**, FaSiOen P, Singh Y, Francis W, Mohanty SK, Naraynsingh V, Dapri G. Single incision laparoscopic surgery from a caribbean perspective. *Int J Surg* 2019; **72S**: 13-18 [PMID: 31132463 DOI: 10.1016/j.ijsu.2019.05.009]

13 **Cawich SO**, Arulampalam T, Senasi R, Naraynsingh V. Robot-Assisted Minimally Invasive Surgery: First Report from the Caribbean. *Cureus* 2021; **13**: e18739 [PMID: 34790488 DOI: 10.7759/cureus.18739]

14 **Xynos E**, Gouvas N, Triantopoulou C, Tekkis P, Vini L, Tzardi M, Boukovinas I, Androulakis N, Athanasiadis A, Christodoulou C, Chrysou E, Dervenis C, Emmanouilidis C, Georgiou P, Katopodi O, Kountourakis P, Makatsoris T, Papakostas P, Papamichael D, Pentheroudakis G, Pilpilidis I, Sgouros J, Vassiliou V, Xynogalos S, Ziras N, Karachaliou N, Zoras O, Agalianos C, Souglakos J; [the Executive Team on behalf of the Hellenic Society of Medical Oncology (HeSMO)]. Clinical practice guidelines for the surgical management of colon cancer: a consensus statement of the Hellenic and Cypriot Colorectal Cancer Study Group by the HeSMO. *Ann Gastroenterol* 2016; **29**: 3-17 [PMID: 26752945 DOI: 10.20524/aog.2016.0003]

15 **Cohen AM**. Surgical considerations in patients with cancer of the colon and rectum. *Semin Oncol* 1991; **18**: 381-387 [PMID: 1713712]

16 **Hohenberger W**, Weber K, Matzel K, Papadopoulos T, Merkel S. Standardized surgery for colonic cancer: complete mesocolic excision and central ligation--technical notes and outcome. *Colorectal Dis* 2009; **11**: 354-64; discussion 364-5 [PMID: 19016817 DOI: 10.1111/j.1463-1318.2008.01735.x]

17 **West NP**, Hohenberger W, Weber K, Perrakis A, Finan PJ, Quirke P. Complete mesocolic excision with central vascular ligation produces an oncologically superior specimen compared with standard surgery for carcinoma of the colon. *J Clin Oncol* 2010; **28**: 272-278 [PMID: 19949013 DOI: 10.1200/JCO.2009.24.1448]

18 **Tan KY**, Kawamura YJ, Mizokami K, Sasaki J, Tsujinaka S, Maeda T, Nobuki M, Konishi F. Distribution of the first metastatic lymph node in colon cancer and its clinical significance. *Colorectal Dis* 2010; **12**: 44-47 [PMID: 19438890 DOI: 10.1111/j.1463-1318.2009.01924.x]

19 **Toyota S**, Ohta H, Anazawa S. Rationale for extent of lymph node dissection for right colon cancer. *Dis Colon Rectum* 1995; **38**: 705-711 [PMID: 7607029 DOI: 10.1007/BF02048026]

20 **Compton CC**, Greene FL. The staging of colorectal cancer: 2004 and beyond. *CA Cancer J Clin* 2004; **54**: 295-308 [PMID: 15537574 DOI: 10.3322/canjclin.54.6.295]

21 **Joseph NE**, Sigurdson ER, Hanlon AL, Wang H, Mayer RJ, MacDonald JS, Catalano PJ, Haller DG. Accuracy of determining nodal negativity in colorectal cancer on the basis of the number of nodes retrieved on resection. *Ann Surg Oncol* 2003; **10**: 213-218 [PMID: 12679304 DOI: 10.1245/aso.2003.03.059]

22 **Le Voyer TE**, Sigurdson ER, Hanlon AL, Mayer RJ, Macdonald JS, Catalano PJ, Haller DG. Colon cancer survival is associated with increasing number of lymph nodes analyzed: a secondary survey of intergroup trial INT-0089. *J Clin Oncol* 2003; **21**: 2912-2919 [PMID: 12885809 DOI: 10.1200/jco.2003.05.062]

23 **Berger AC**, Sigurdson ER, LeVoyer T, Hanlon A, Mayer RJ, Macdonald JS, Catalano PJ, Haller DG. Colon cancer survival is associated with decreasing ratio of metastatic to examined lymph nodes. *J Clin Oncol* 2005; **23**: 8706-8712 [PMID: 16314630 DOI: 10.1200/jco.2005.02.8852]

24 **Chang YJ**, Chang YJ, Chen LJ, Chung KP, Lai MS. Evaluation of lymph nodes in patients with colon cancer undergoing colon resection: a population-based study. *World J Surg* 2012; **36**: 1906-1914 [PMID: 22484567 DOI: 10.1007/s00268-012-1568-2]

25 **Hanna NN**, Onukwugha E, Choti MA, Davidoff AJ, Zuckerman IH, Hsu VD, Mullins CD. Comparative analysis of various prognostic nodal factors, adjuvant chemotherapy and survival among stage III colon cancer patients over 65 years: an analysis using surveillance, epidemiology and end results (SEER)-Medicare data. *Colorectal Dis* 2012; **14**: 48-55 [PMID: 21689262 DOI: 10.1111/j.1463-1318.2011.02545.x]

26 **Johnson PM**, Porter GA, Ricciardi R, Baxter NN. Increasing negative lymph node count is independently associated with improved long-term survival in stage IIIB and IIIC colon cancer. *J Clin Oncol* 2006; **24**: 3570-3575 [PMID: 16877723 DOI: 10.1200/jco.2006.06.8866]

27 **Vather R**, Sammour T, Kahokehr A, Connolly AB, Hill AG. Lymph node evaluation and long-term survival in Stage II and Stage III colon cancer: a national study. *Ann Surg Oncol* 2009; **16**: 585-593 [PMID: 19116751 DOI: 10.1245/s10434-008-0265-8]

28 **Wong SL**, Ji H, Hollenbeck BK, Morris AM, Baser O, Birkmeyer JD. Hospital lymph node examination rates and survival after resection for colon cancer. *JAMA* 2007; **298**: 2149-2154 [PMID: 18000198 DOI: 10.1001/jama.298.18.2149]

29 **Leake PA**, Pitzul K, Roberts PO, Plummer JM. Comparative analysis of open and laparoscopic colectomy for malignancy in a developing country. *World J Gastrointest Surg* 2013; **5**: 294-299 [PMID: 24520427 DOI: 10.4240/wjgs.v5.i11.294]

30 **Ballantyne GH,** Merola P, Weber A, Wasielewski A. Robotic solutions to the pitfalls of laparoscopic colectomy. *Osp Ital Chir* 2001; **7**: 405–412 [DOI: 10.1097/00129689-200202000-00008]

31 **Trastulli S**, Coratti A, Guarino S, Piagnerelli R, Annecchiarico M, Coratti F, Di Marino M, Ricci F, Desiderio J, Cirocchi R, Parisi A. Robotic right colectomy with intracorporeal anastomosis compared with laparoscopic right colectomy with extracorporeal and intracorporeal anastomosis: a retrospective multicentre study. *Surg Endosc* 2015; **29**: 1512-1521 [PMID: 25303905 DOI: 10.1007/s00464-014-3835-9]

32 **Alkan Härtwig E**, Aust S, Heuser I. HPA system activity in alexithymia: a cortisol awakening response study. *Psychoneuroendocrinology* 2013; **38**: 2121-2126 [PMID: 23627992 DOI: 10.1016/j.psyneuen.2013.03.023]

33 **Leiviskä J**, Sundvall J, Jauhiainen M, Laatikainen T. [Apolipoprotein A-I and B in laboratory diagnostics of dyslipidemia--what benefits do we gain compared with cholesterol measurements?]. *Duodecim* 2014; **130**: 2331-2337 [PMID: 25558595 DOI: 10.4103/0972-9941.147678]

34 **Lujan HJ**, Plasencia G, Rivera BX, Molano A, Fagenson A, Jane LA, Holguin D. Advantages of Robotic Right Colectomy With Intracorporeal Anastomosis. *Surg Laparosc Endosc Percutan Tech* 2018; **28**: 36-41 [PMID: 28319493 DOI: 10.1097/SLE.0000000000000384]

35 **Bonjer HJ**, Hop WC, Nelson H, Sargent DJ, Lacy AM, Castells A, Guillou PJ, Thorpe H, Brown J, Delgado S, Kuhrij E, Haglind E, Påhlman L; Transatlantic Laparoscopically Assisted vs Open Colectomy Trials Study Group. Laparoscopically assisted vs open colectomy for colon cancer: a meta-analysis. *Arch Surg* 2007; **142**: 298-303 [PMID: 17372057 DOI: 10.1001/archsurg.142.3.298]

**Footnotes**

**Institutional review board statement:** This study was approved by the local institutional review board at the University of the West Indies (CREC-SA.1615/06/2022). A copy of the approval document will be provided upon request

**Informed consent statement:** All study participants or their legal guardian provided informed written consent about personal and medical data collection prior to study enrolment.

**Conflict-of-interest statement:** There are no conflicts of interest for any of the authors of this study.

**Data sharing statement:** All data are kept by the corresponding author and can be released upon reasonable request.

**STROBE statement:** The authors have read the STROBE Statement—checklist of items, and the manuscript was prepared and revised according to the STROBE Statement—checklist of items.

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**Provenance and peer review:** Invited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review started:** September 26, 2023

**First decision:** December 5, 2023

**Article in press:**

**Specialty type:** Medicine, research and experimental

**Country/Territory of origin:** Trinidad and Tobago

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): 0

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Qin J, China **S-Editor:** Fan JR **L-Editor:** A **P-Editor:**

**Table 1 Comparison of patients undergoing laparoscopic colectomy for colorectal carcinoma (mean ± SD)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Conventional** | **Robot** | ***P* value** |
| Robot docking time in minutes | - | 5.9 ± 1.25 | - |
| Total operating time in minutes | 105.67 ± 11.48 | 95.13 ± 9.22 | 0.0455a |
| Conversions to open surgery (*n*) | 0 | 0 | - |
| Conversions to human camera operator | - | 0 | - |
| Estimated blood loss in mL | 62 ± 27.89 | 96.25 ± 93.80 | 0.71884 |
| Number of nodes harvested  | 13 ± 2.24 | 13.13 ± 2.70 | 1 |
| Proximal resection margin in cm | 20.5 ± 5.78 | 20.75 ± 7.11 | 0.95216 |
| Distal resection margin in cm | 18.87 ± 6.71 | 16.88 ± 3.48 | 0.69654 |
| Duration of hospitalization in days | 3.73 ± 0.88 | 3.13 ± 1.36 | 0.12852 |
| Post-operative major morbidity  | 0 | 0 | 1 |
| Post-operative minor morbidity  | 1 | 0 | 1 |
| Mortality | 0 | 0 | - |

a*P* < 0.05.