

Robotic Colorectal Surgery using Senhance® Robotic Platform: Single Center Experience with First 13 Cases

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Abstract. Until recently, robotic surgery has been associated only with da Vinci robotic system. A novel Senhance® robotic system (TransEnterix Surgical Inc., Morrisville, NC, USA) has been introduced almost 5 years ago. Published reports on experience in colorectal surgery using this robotic platform is very limited. We present a prospective analysis of first 13 robotic colorectal surgeries in Klaipėda University Hospital, Klaipėda, Lithuania. 13 patients underwent various colorectal resections: 10 for colorectal cancer and 3 for colonic polyps. 7 were men and 6 women, age range 32–77 years, on an average 56 years. Among 10 patients with colorectal cancer, 3 had stage I, 3 stage II, 3 stage III and 1 stage IV colorectal cancer. 2 patients were operated for unremovable ascending colon adenomas and 1 underwent prophylactic subtotal colectomy with ileorectal anastomosis for familial adenomatous polyposis. Complication occurred in 1 case (7.7%). This patient underwent robotic abdominoperineal resection for low rectal cancer, developed postoperative bleeding from perineal wound on day 7 and had to be taken to operative room for oversuturing the bleeding vessel. Operative time was on an average 3 hours 50 minutes, ranging from 2 hours and 55 minutes to 6 hours and 10 minutes. In-hospital stay ranged from 5 to 16 days, on an average 7 days.

Conclusion. Our experience with different types of robotic colorectal resections allows us to state that Senhance® robotic system is feasible and safe for colorectal surgery, and wider implementation of this system in our specialty worldwide is simply a question of time.

Key words: Robotic surgery, colorectal surgery, minimally invasive surgery.

Robotinė kolorektinė chirurgija naudojant *Senhance*® robotinę sistemą: vieno centro 13 pirmųjų operacijų patirtis

Santrauka. Dar visai neseniai robotinė chirurgija buvo asocijuojama tik su *da Vinci* robotine sistema. Beveik prieš penkerius metus įdiegta *Senhance*® robotinė sistema (TransEnterix Surgical Inc., Morrisville, NC, USA). Kol kas yra labai nedaug mokslinių duomenų apie šios robotinės sistemos panaudojimą kolorektinėje chirurgijoje.

Šiuo straipsniu pristatoma Klaipėdos universitetinėje ligoninėje atliktų pirmųjų 13 įvairių kolorektinių operacijų, naudojant *Senhance*® robotinę sistemą, perspektyvioji analizė. Iš 13 operuotų pacientų dešimt buvo operuoti dėl storosios žarnos vėžio, trys – dėl storosios žarnos polipų. Operuoti septyni vyrai ir šešios moterys, jų amžius – 32–77 m. (amžiaus vidurkis – 56 m.). Iš 10 pacientų, operuotų dėl storosios žarnos vėžio, trys pacientai sirgo I stadijos vėžiu, trys – II stadijos vėžiu, trys – III stadijos vėžiu, vienas – IV stadijos vėžiu. Du pacientai operuoti dėl endoskopiškai nepašalinamų kylančiosios gaubtinės storosios žarnos dalies adenomų, vienam atlikta subtotalinė kolektomija su ileorektostomija dėl šeiminės adenominės polipozės. Komplikavosi vienos pacientės (7,7 %) pooperacinė eiga. Šiai pacientei septintą pooperacinę parą pradėjo kraujuoti iš tarpvietės pjūvio, todėl operacinėje persiūta kraujuojanti kraujagyslė. Vidutinė operacijų trukmė – 3 val. ir 50 min., t. y. nuo 2 val. ir 55 min. iki 6 val. ir 10 min. Hospitalizacijos trukmė – nuo 5 iki 16 dienų (vidutiniškai – 7 dienos).

Išvada. Įgyta patirtis, atlikus įvairių robotinių kolorektinių operacijų, leidžia teigti, kad *Senhance*® robotinė sistema yra saugi ir tinka kolorektinei chirurgijai. Platesnis šios robotinės sistemos pritaikymas chirurgijoje visame pasaulyje, galima manyti, yra tik laiko klausimas.

Reikšminiai žodžiai: robotinė chirurgija, kolorektinė chirurgija, mažai invazinė chirurgija.

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Introduction

The possibility of performing minimally invasive (laparoscopic) colorectal surgery, including colon cancer, has been demonstrated more than a quarter of a century ago [1]. Since then and already quite a while ago, we learned about the safety of laparoscopic surgery for colon cancer [2–4]. There have been a number of trials in favor of laparoscopic rectal cancer surgery, though two relatively recent non-inferiority trials have put certain doubt on laparoscopic rectal cancer surgery in comparison with the open approach [5–6]. Robotic colorectal surgery has long traditions as well, using da Vinci robotic system, which has been the only option for performing robotic surgery for years. The first robotic operation has been performed on a human in 1997 [7]. It seems to be reasonable to expect that robotic approach which has technological privileges including improved view and articulating instruments would help to perform surgeries in narrow spaces such as pelvis in rectal cancer surgery. There was a lot expected from ROLLARR randomized clinical trial [8] to give a solid background for this new type of surgery applied for rectal cancer, to demonstrate its superiority compared to conventional laparoscopy at least in terms of risk of conversion, but neither this nor secondary rectal cancer specific endpoints of this trial did show any difference between the two groups. The proof is still to be provided in future.

Robotic surgery using Senhance® robotic system (TransEnterix Surgical Inc., Morrisville, NC, USA) has been started in Klaipėda university hospital in Lithuania on November 19, 2018. In fact, first two robotic surgeries (first not only in Lithuania and in the Baltic countries as well) were colorectal resections for colon and rectal tumors. Since the first single center series on colorectal surgery using this robotic system in the world [9] there have been just a couple more, and we hope that this article on our first experience in Klaipėda will add to the evidence of feasibility of this robotic system for colorectal surgery.

Patients and methods

Prior to the start of robotic surgery with Senhance® robotic system in Klaipėda University Hospital, our team (divided into two separate groups) consisting of two surgeons, two gynecologists, two urologists, three scrub nurses and two anesthesiologists went to the Senhance® training center in Milan, Italy. Training consisting of introduction to this robotic platform and a hands-on two day dry lab training with third day wet lab, performing various surgical procedures with this system on pigs, having a proctor who had large experience with this kind of surgery on humans.

November 19, 2018 to April 1, 2019 more than 100 procedures using Senhance® robotic platform have been performed in general and colorectal surgery, gynecology and urology. Among them, 13 patients underwent various colorectal resections: 10 for colorectal cancer and 3 for colonic polyps. 7 were men and 6 women, age range 32–77 years, on an average 56 years. Among 10 patients with colorectal cancer, 3 had stage I, 3 stage II, 3 stage III and 1 stage IV colorectal cancer. 2 patients were operated for unremovable ascending colon adenomas and 1 underwent prophylactic subtotal colectomy with ileorectal anastomosis for familial adenomatous polyposis. All selected patients would otherwise undergo laparoscopic surgery. Informed consent was obtained in each case. Robotic surgery was started in each case like a typical laparoscopic case, inserting the first trocar just below the umbilicus, creating pneumoperitoneum and investigating the abdominal cavity. Other trocars were inserted depending on the type of surgery which was planned to be performed, trying to put two working port of the robotic arms a bit further away from the operation field in comparison to laparoscopic approach. After all the trocars were in place, robotic arms were docked. In all cases performed, so far we used only 3 robotic arms. For the right hemicolectomy, all the three robotic arms were on the left side of the patient. For sigmoid and rectal resections, one robotic arm was on the right side and two on the left side. While performing subtotal colectomy, we used the same position of the robotic arms as

for the latter surgery, but we had to re-dock the arms several times during this more complex multi-quadrant procedure. In the cases of right hemicolectomy, both ligation of the vessels and anastomosis were performed after making a 5 to 6 cm transumbilical incision and exteriorizing the surgical specimen. In cases of sigmoid and rectal resections, ligation of vessels was performed laparoscopically after mobilizing the inferior mesenteric artery and vein using *Echelon 60* stapling device. In case of prophylactic subtotal colectomy for familial adenomatous polyposis, colon was mobilized close to serosa using *Lotus* robotic energy source. After sigmoid resection or anterior rectal resection with partial mesorectal excision (PTME) anastomosis was performed laparoscopically using *Ethicon 29* or *33* circular stapling device. After TaTME, manual colo-anal side to end anastomosis was performed.

Results

From 13 operations performed, complication occurred in 1 case (7.7%). This patient underwent robotic abdominoperineal resection for low rectal cancer, developed postoperative bleeding from perineal wound on day 7 and had to be taken to operative room for oversuturing the bleeding vessel. Operative time was on an average 3 hours 50 minutes, ranging from 2 hours and 55 minutes for right hemicolectomy to 6 hours and 10 minutes for subtotal colectomy with ileorectal anastomosis. In rectal cancer cases, neither distal nor circumferential margins were compromised. Both patients who underwent TaTME were after long course radiochemotherapy – one underwent TaTME 8 weeks after neoadjuvant treatment and no response, the second one had a recurrence after complete response being in a ‘watch and wait’ group. In-hospital stay ranged from 5 to 16 days, on an average 7 days. More detailed information about our 13 patients is delineated in Table 1.

Table 1. Data on 13 robotic procedures

Case	Patient characteristics (sex, age)	Procedure	Final histology	Lymph node harvest
1	F, 58	Anterior rectal resection with partial TME	pT1N0	15
2	F, 77	Right hemicolectomy	Adenoma with high grade dysplasia	n/a
3	M, 54	Anterior resection with partial TME (Hartman procedure)	Liver and peritoneal metastasis	19 (5 mts)
4	M, 54	Right hemicolectomy	pT2No	22
5	F, 52	Abdominoperineal resection	pT2N0	10
6	F, 68	Right hemicolectomy	pT3N0	16
7	F, 67	Sigmoid resection	pT4N1	12 (2 mts)
8	F, 48	Right hemicolectomy	pT3N0	26
9	M, 32	Subtotal colectomy	Multiple colonic adenomas	n/a
10	M, 72	Right hemicolectomy	pT3N1	23 (3 mts)
11	M, 50	TaTME	ypT2N2	16 (4 mts)
12	M, 51	Right hemicolectomy	Adenoma	n/a
13	M, 46	TaTME	ypT3N0	10

Discussion

Senhance® robotic system has first been used in gynecological surgery and report about this experience has been published in 2015 [10]. Spinelli et al. [9] was the first to report experience in colorectal surgery with Senhance®, which showed it to be feasible for this type of surgery as well. From 45 colorectal resections performed by his group, 2/3 were performed for colorectal cancer. There were only 4 conversions, which included 3 to laparoscopy and only 1 to open surgery. Major complications (Calvien-Dindo III) occurred only in 2 cases. Other important experience comes from Siegen in Germany [11], where 116 abdominal robotic surgeries were performed over a period of 6 months in 2016. They started colorectal resections with sigmoid colectomy for diverticular disease only after gaining experience with 100 less complicated general surgical procedures. FDA approval for this robotic platform came in 2018, and first published article on US experience included only 2 colorectal resections [12]. Of course, our experience is very limited as well, but so far we didn't have major complications and there was no need for conversion. Even starting other abdominal procedures at the same time and not having a possibility to get larger experience with the platform with more simple general surgical procedures, we performed a variety of different and complicated colorectal procedures, and after this experience, only our right hemicolectomy seems to be closer to more or less routine procedure for us. This was the reason for longer duration of the operating time. Our pathological specimens were adequate and in no case oncologic safety was compromised among 10 patients undergoing robotic surgery for cancer.

Conclusion

Our experience with different types of robotic colorectal resections allows us to state that Senhance® robotic system is feasible and safe for colorectal surgery, and wider implementation of this system in our specialty worldwide is simply a question of time.

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