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ORIGINAL ARTICLE

Colorectal Robotic Surgery in a Closed Community Hospital. Initial Experience

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ABSTRACT

Background: *The introduction of the Da Vinci system has revolutionized the field of minimally invasive surgery. With this system, the surgeon has control of the 3D camera, and the instruments are highly skilled and ergonomically comfortable, shortening the surgical learning curve.*

Objective: *To describe our initial experience with robotic colorectal surgery in a closed community hospital in the Ciudad Autónoma de Buenos Aires.*

Material and Methods: *Retrospective descriptive study based on a prospective database of robotic colorectal surgeries performed by the same surgical team from May 2016 to April 2019.*

Results: *Forty-one patients were operated, 13 of them were right colectomies, 17 left colectomies, and 11 rectal surgeries. The average surgical time was 170 minutes (90-330), the hospital stay 4 days (3-30), the conversion rate 7.31% (3/41 patients), and the anastomotic dehiscence rate 9.7% (4/41 patients). Overall morbidity was 19.5% (8/41 patients).*

Conclusion: *We have reviewed the initial results of our experience in robotic colorectal surgery in a small number of cases, but enough to evaluate the safety and reproducibility of the method at the beginning of a learning curve.*

Key Words: *Robotic Colorectal Surgery; Da Vinci System; Minimally Invasive Surgery*

INTRODUCTION

The introduction of the Da Vinci robotic surgery system has revolutionized the field of minimally invasive surgery. With this system, the surgeon has control of the high-definition 3D camera with stereoscopic vision, and performs movements with highly skilled and precise instruments, gaining ergonomic comfort, and shortening the surgical learning curve.[1,2]

The robotic system was mainly designed to perform precise movements, meticulous dissections, and complex intracavitary sutures. The greatest benefit is obtained in tight spaces, as in rectal cancer surgery in the pelvis minor, where a thorough total excision of the mesorectum can be achieved.

The objective of this preliminary presentation is to describe our initial experience with robotic colorectal surgery, in a closed community hospital, in the Ciudad Autónoma de Buenos Aires.

DESIGN

Retrospective, descriptive study based on 41 consecutive robotic colorectal surgeries performed by the same surgical team between May 2016 and April 2019.

MATERIAL AND METHODS

The prospective data collection included affiliation data, age, BMI, type of surgery, ASA classification, surgical time, intraoperative bleeding, need for conversion, and hospital stay. In the case of oncologic surgeries, we also analyzed histological tumor type, surgical margins, and TNM. Complications were divided into early (within 30 postoperative days) and late (beyond 30 days).

The initial model of the Da Vinci system was launched in 1999 and had several improvements, until reaching the "XI" version that has the best performance.

The Da Vinci system consists of a console and a robot that has four interactive arms connected to the console controlled by the surgeon. One of the arms carries the endoscopic camera, which has two lenses that provide a 3D image with high-definition stereoscopic vision. The other three arms are used to adapt the instruments.

The hospital has a four-armed Da Vinci (Intuitive Surgical System) SI. In all surgeries, both colectomy and low and ultra low anterior resections, the principles of conventional surgery were maintained.

Three surgeons participated in this robotic surgery program, all of them with extensive experience in conventional and laparoscopic surgery. The surgical team completed more than 25 hours simulation hours on the robot

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console, then experimental robotic surgery was performed on pigs, completing the robotic surgery Education, Simulation and Innovation (CESI) program at Hartford Hospital, Connecticut, USA. It also included attending the operating room in different robotic surgeries. Finally, and as part of the learning curve, they carried out observation of cases by Dr. Gustavo Plascencia, and Dr. Henry Lujan, from Jackson Hospital, Miami, USA.

Instrumentalist nurses and anesthesiologists started this series with previous experience in assembling the robot and the operating room.

All patients were previously evaluated for inclusion in the robotic surgery protocol.

Surgical technique: In all surgeries, three 8-mm trocars and two 12-mm trocars were placed for the endocamera and the stapler instruments (figures 1 to 4).

RESULTS

A total of 41 patients underwent surgery, 23 (52%) patients were male. The rest of the demographic data are shown in Table 1.

The pathologies treated were mainly tumors of the right and left colon in 68% of cases. They were:

- 13 right colectomies: 6 moderately differentiated adenocarcinomas; 2 carcinoid tumors of the ileocecal valve, and 5 villous adenomas with Tis (tumor in situ).
- 17 left colectomies: 2 diverticular stenosis, 14 moderately differentiated adenocarcinomas, 1 sigmoid polyp previously excised by endoscopy.
- 11 rectal surgeries: 3 Dixon operations for 2 adenocarcinomas of the upper rectum and 1 villous adenoma of the rectum; 6 low resections for 3 tumors of the middle rectum and 3 villous adenomas; 1 ultra-low anterior resection for a tumor of the lower rectum, 1 rectopexy for rectal prolapse (Table 2).

Oncological results

Thirty-eight patients presented oncologic pathology. Of these, 9 had Tis on villous adenomas, and 44.7% had T3 tumors. The total percentage of positive nodes was 31.5%. One of the cases, corresponding to an ultralow rectal tumor presented compromised distal margin (2.6% of the oncology patients) (Table 3).

Surgical Results

Eight patients had immediate postoperative complications (19.5%). There were 3 anastomotic dehiscences (2 of the colonic stump of side to side ileotransverse anastomoses, and 1 from colorectal anastomosis in a low rectal tumor).

Figure 1: Placement of trocars.

Figure 2: Robot assemby in left colectomy.

The conversion rate was 7.3% (3/41 patients); 1 case of bleeding during mobilization of the splenic flexure, 1 case of a bulky middle rectum tumor in a male with a narrow pelvis, and 1 case of sustained hypercapnia that could not be reversed during surgery (Table 4).

DISCUSSION

The first report of robotic surgery was published by Cardieré et al. in 2001[20], They performed three transanal resections for rectal tumor. Later in 2002, Weber et al.[21] published the first robot-assisted colectomy, and numerous publications followed from that year to present.

The benefit of robotic surgery is based on the 3-D steroscopic field of view that improves the visualization of small structures. This facilitates the dissection of the lower mesenteric vessels at its root, and the mobilization of all aspects of the rectum in the pelvis minor. In this way, the pelvic autonomic nerves are precisely preserved during dissection, obtaining better functional results. Besides, the robot facilitates the mesorectal total excision for

ultra-low resections, the achievement of an adequate distal margin, and the colorectal anastomosis.[12-14]

By improving the precision of surgical gestures, favorable results are obtained in terms of postoperative pain, hospital stay, and recovery of intestinal function and initiation of the oral route.[10,11,15] Another great benefit of robotic surgery is the ductility and safety during the realization of intracorporeal anastomoses, mainly right colectomies with ileotransverse anastomosis.[2,13,16,17]

In 2009, Pigazzi et al. reported the local recurrence for rectal cancer comparing laparoscopic surgery with robotic surgery. It was 5.5% and 0%, respectively, with a mean follow-up of 18.7 months for laparoscopy and 29.2 months for robotic surgery.[13,22]

Subsequently, Kwak et al. in 2011, shows that there is no significant difference in local and distant recurrence at a mean follow-up of 17 months in the robotic surgery group and 13 months in the laparoscopic group.[23]

We present initial results in robotic colorectal surgery in a small number of cases, but sufficient to evaluate the safety and reproducibility of the method at the beginning of a learning curve.[8] The first impression we had was that each surgeon adapted easily and rapidly to the management of the console, reproducing the steps of the laparoscopic colorectal technique. It is to be highlighted the speed, safety and comfort with which the intracorporeal suture and the dissection of both, the splenic flexure and the pelvis minor are performed.[17,18,25,26]

Our complications are within the expectations for an initial experience.[10,24,27]

The limitations of this study are based in its retrospective nature, and the small sample of patients, typical of an initial learning curve.

Undoubtedly, the biggest drawback of robotic surgery is its cost. The cost analysis study by Baek and Kim[16] in 154 patients undergoing robotic surgery vs. 150 patients undergoing laparoscopic surgery reported a 1.5-fold increase in the robotic group (U$S 14,647 vs. U$S 9,970, respectively; P=0.0001). Currently the ROLARR (Robotic versus Laparoscopic Resection for Rectal Cancer), multicenter, controlled, randomized, non-blind study for the curative treatment of rectal cancer, analyzes the rate of conversion, circumferential margin compromise, local recurrence at 3 years, disease-free period, morbidity, mortality, overall survival, quality of life, and cost-effectiveness of both approaches. Although the final results do not show greater benefits of robotic surgery on cancer patients, we must wait a longer period of time for adaptation of surgeons to this new technology, and analyze the new results that will be published.[6,22,28-31]

Robotic surgery is expensive, so it requires a careful evaluation, and it is worth highlighting the safety and

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION (N=41)

Median age (range) years	65 (27-84)
Male gender	23 (52%)
Median BMI (range)	26 (16-44.7)
ASA I	15 (36.5%)
ASA II	24 (58.5%)
ASA III	2 (4.8%)
ASA II (N° Y %)	24 (58,53)
ASA III (N° Y %)	2 (4,87)

TABLE 2: PATHOLOGIES TREATED IN THIS SERIES

Diagnosis	No (%)
Rigth colon tumor	13 (31,7)
Superior rectum tumor	3 (7,3)
Middle rectum tumor	6 (14,6)
Lower rectum tumor	1 (2,4)
Rectal prolapse	1 (2,4)
Sigmoid colon tumor	15 (36,5)
Diverticular disease	2 (4,8)
Total	41 (100)

TABLE 3: ONCOLOGIC RESULTS

Variable	
n	38
Tis: n (%)	9 (23.6)
T1: n (%)	2 (5.2)
T2: n (%)	10 (26.3)
T3: n (%)	17 (44.7)
N+: n (%)	12 (31.5)
Total lymph nodes (median and range)	14.6 (2-33)
Distal margin involvement	1 (2.6)

TABLE 4: SURGICAL RESULTS

Variable	
n	41
Hospital stay, median (range)	4 (3-30) days
Operative time, median (range)	170 (90-330) min
Blood loss, median (range)	50 (10-500) ml
Conversion, No (%)	3 (7.3)
Complications, No (%)	
Anastomotic dehiscence	4 (9.7)
Pulmonary embolism	3 (7.3)
Wound dehiscence	1 (2.4)
Morbidity, No (%)	8 (19.5)
Mortality, No (%)	1 (2.4)

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comfort for the surgeon in all the steps of the surgical procedure.[12,15]

CONCLUSION

Robotic surgery is a feasible technique in our surgical environment.

The satisfactory results obtained in our initial experience encourage us to deepen the development of the robotic surgery program in our hospital.

New clinical studies to consolidate these conclusions are mandatory, being necessary the evaluation of the long term oncologic results.

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