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# Laparoscopic Right Colectomy with Complete Mesocolic Excision and Central Vascular Ligation

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## Abstract

Colorectal cancer continues to be a very important health problem today, representing 10% of all cancers worldwide, and responsible for 9.4% of cancer mortality around the world. Laparoscopic surgery has shown to offer benefits compared to open surgery, which are already widely known. As shown by various publications (COLOR, COLOR II, and CLASSIC among others). Right colectomy has historically been considered an intermediate complexity procedure, not standardized, and generally performed by residents and less experienced general surgeons. This has led to the fact that the morbidity and mortality related to it and the oncological results over the years have not been ideal. In the last 30 years, the development of laparoscopic colon surgery has been exponential, despite the initial reluctance of many surgeons to use it in oncological pathology, due to publications from the early 1990s that reported worse oncological results using this approach. Since Hogenberger's publication in 2009 on the standardization of colon cancer surgery, central vascular ligation, and complete excision of the mesocolon, the surgical community's view of this technique has changed substantially. Today these concepts are the cornerstone of colon cancer surgery.

**Objective:** We present our way of performing standardized step by step laparoscopic right colectomy with central vascular ligation and complete excision of the mesocolon, and revision of the literature. Secondarily, we present the short-term and oncological outcomes of our series of 238 laparoscopic right colectomies, of which 206 were for malignant pathology.

**Keywords:** Oncologists; Radiotherapists; Endoscopists; Imaging specialists; Pathologists

## Introduction

We have created a multidisciplinary team within our hospital that is almost exclusively dedicated to colorectal surgery, with a significant focus on oncological surgery. This is a colo-rectal surgery ERAS TEAM, which includes five anaesthesiologists, three surgeons, a nurse who specializes in nutrition, a nurse who specializes in the handling of ostomies, and a chief nurse, who is our true star, and is in charge of educating the patients and their families, as well as ensuring continuity of the healthcare process. They also participate in the care of our patients and in the tumor committee, where we make individualized therapeutic decisions for each patient. The team includes oncologists, radiotherapists, endoscopists, imaging specialists, and pathologists. In the year two thousand and seventeen we launched our ERAS program for colorectal surgery. It entails a step-by-step standardized procedure that includes intracorporeal sutures. As I mentioned before, we have been teaching and performing colorectal laparoscopic surgery in a standardized and repetitive way for a number of years. This allows us to cross the river by stepping steadily on each Stone, which prevents us from falling into the water. We have achieved optimal operative times, reduced surgical morbidity and mortality, and have had a positive impact on oncologic outcomes. Al these measures involve not only the surgeon, but all of the healthcare team. Always keeping the patient and their family at the center of our attention, we provide horizontal care over time and across spaces, with communication among different specialists to ensure the highest quality and excellence of care based on the best scientific evidence. Referring specifically to right colectomy, it all changed in two thousand and

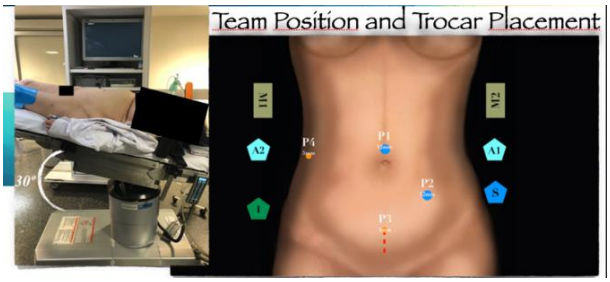
nine, following Hohemberg´s publishing of two key concepts in colonic surgery: complete mesocolonic excision and central vascular ligation. These follow the precepts that Heald described for rectal surgery in nineteen eightytwo, giving special emphasis to the mesocolic dissection following embryologic planes, ensuring an en-bloc resection of the mesocolon, with no disruption of its folds. There is an historic confrontation between Eastern and western concepts of oncologic surgery. On one side they state that oncological radicality lies in extended lymphadenectomies (D3), while on the other the focus is set on the indemnity of the mesocolic folds (CME). However, these are not actually opposite standpoints but complementary approaches that allow a safer procedure from an oncological point of view. When talking about CME we refer to respecting embryological vascular planes that will guide our dissection, without violating the peritoneal folds of the mesocolon. To this concept, we add CVL (Central Vascular Ligation), which tries to ensure a complete lymphnode harvest by performing the vascular transection close to the superior mesenteric vessels. Finally, we must ensure the lateral oncologic margins within the colon wall (at least 10cm from the tumor´s macroscopic margin on each side) and the pericolic lymph node harvest. The embryologic planes that must guide our oncologic dissection during the right colectomy procedure are: right Toldt´s fascia, Fredet´s fascia and the fascia of Treitz. The pathologist´s audit of the surgical specimen gives us information about the quality of the surgery. Garcia Granero and collaborators propose that the right colectomy specimen must be shaped as a sail, the boom being the ileocolic vessels, the mast being the surgical trunk of Guillot, and the cloth of the sail represented by the right mesocolon including the duodenal window. When aiming for oncologic radicality in right colectomy we therefore must include CME and D3 lymphadenectomy. This includes dissection following embryological planes, and ligation of the superior right colic vessels, as well as the right branch of the middle colic vessels, at their origin. To make it clear what we mean when we talk about the different levels of lymphadenectomy in right colectomy, we present the different definitions: D1 lymphadenectomy includes pericolic lymph nodes located at least ten cm proximally and distally from the tumour. D2 lymphadenectomy adds intermediate lymph nodes, in relation to the duodenal window of the right mesocolon. D3 lymphadenectomy adds central lymph nodes, in relation to Guillot Trunk, along the superior mesenteric vessels. When we are discussing an extended lymphadenectomy, we must remember it has precise indications, needing a thorough preoperative diagnosis, and a trained surgical team, with an acceptable rate of surgical morbidity and mortality.

## How do we do it? – (Pictures 1-15)

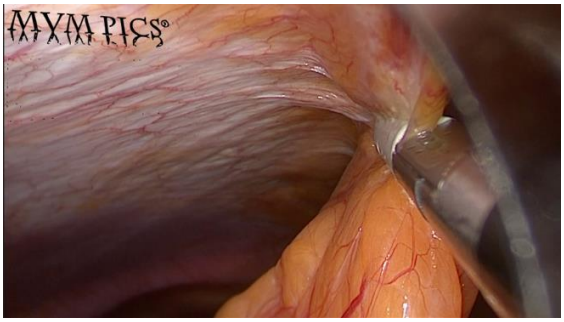
The patient is set in a 30-degree Trendelemburg position and sided to the left, making the small bowel fall into the upper left quadrant of the abdomen, and allowing for a great exposition of the right side of the abdominal cavity.

The surgeon stands at the patient´s left side, at his left flank. We use four laparoscopic ports: a 12mm umbilical port for the camera, a 12mm port on the left flank for the surgeon´s right hand, a five mm suprapubic port for the surgeon´s left hand and another five mm port at the right hypochondrium for the assistant.

We create a pneumoperitoneum of ten to twelve mm of mercury, therefore avoiding the side effects of the CO2-related lowering of the patient´s body temperature, and abdominal hypertension (Picture 1). We begin the procedure by dividing the falciform ligament, maneuver that will allow us to position the transverse colon and greater omentum above the liver, gaining space in the inframescolic space (Picture 2). Here we can see the medial approach for the blunt dissection of Todt´s fascia, below and posterior to the ileocolic vessels (Picture 3). Once the ileocolic vessels are completely dissected, we clip and section the ileocolic vein at its origin (Picture 4). Then we proceed to clip and section the ileocolic artery at its origin, and continue the dissection of the Fascia of Fredet before the duodenum and the pancreatic head (Picture 5). Next step is the clipping and sectioning of the superior right colic artery at its origin, and completing the dissection of Fredet´s Fascia (Picture 6). We now complete Henle´s Trunk´s dissection and clip the superior right colic vein at its origin (Picture 7). We identify and divide the right Branch of the middle colic vessels (Picture 8). Afterwards, we continued with the section of the greater omentum (Picture 9) and then divided the gastrocolic ligament and the right gastroepiploic vessels are identified (Picture 10). Next step is the division of the parietocolic ligament, completing the mobilization of the distal ileum and right colon (Picture 11). Once the mobilization is completed, we perform the section of the distal ileum and transverse colon (Picture 12). In Picture 13, we show the final view of the dissection once we finish with the mobilization and resection of the specimen. The clips on the central vascular ligation can be seen on the superior mesenteric vessels. We once again perform an Indocyanine green angiography to evaluate ileum and colonic perfusion (Picture 14). And then make an intracorporeal, side-to-side, isoperistaltic, anastomosis. We then finish by closing the enterotomy manually in two planes (Picture 15). (You can watch the entire video on the websurg website, https://websurg.com/es/doi/vd01en6305/).




**Picture 1**

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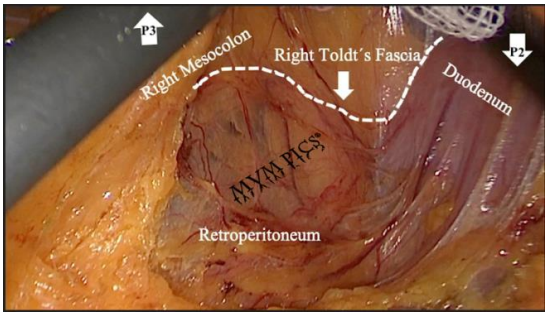


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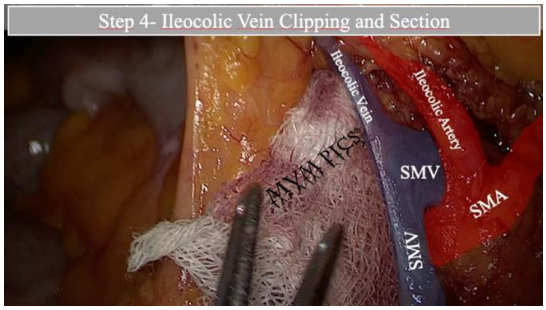


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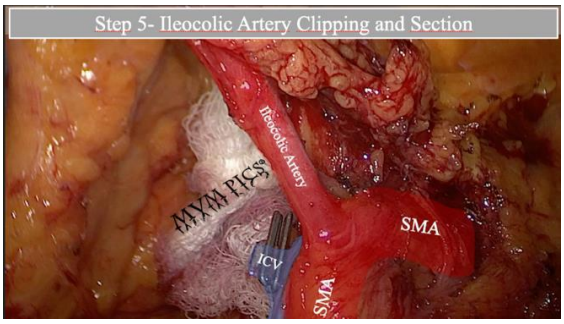


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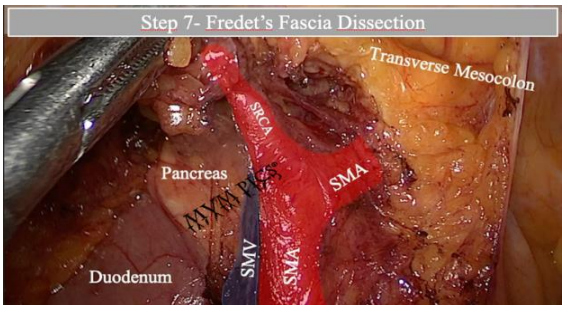


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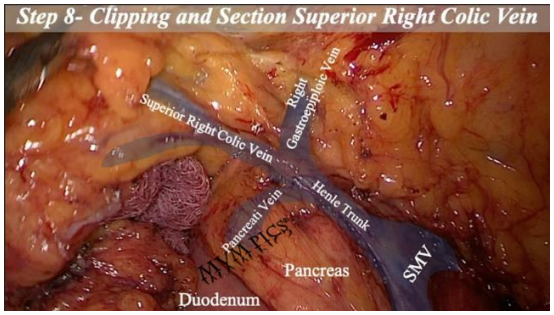


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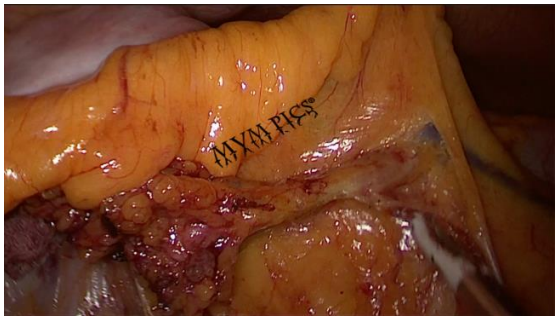


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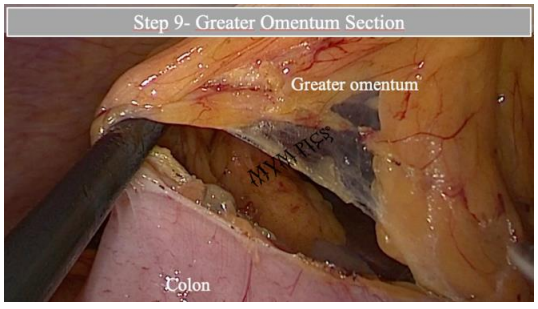


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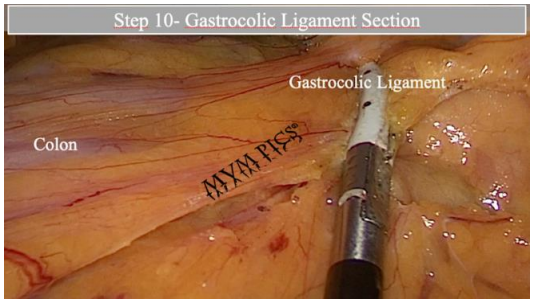


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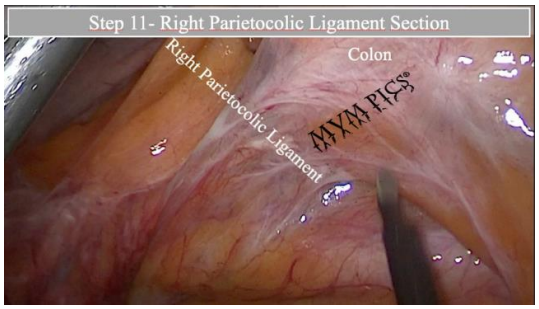


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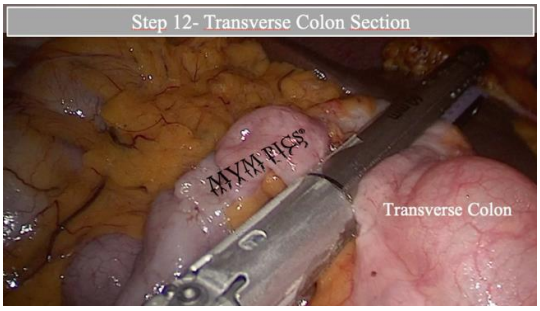


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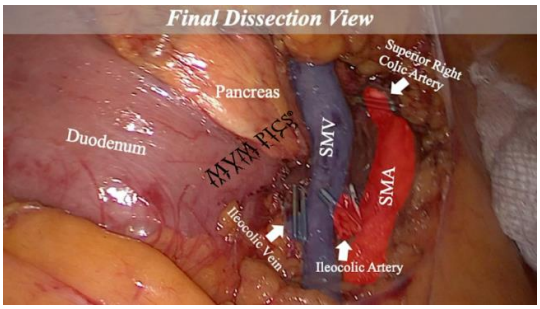
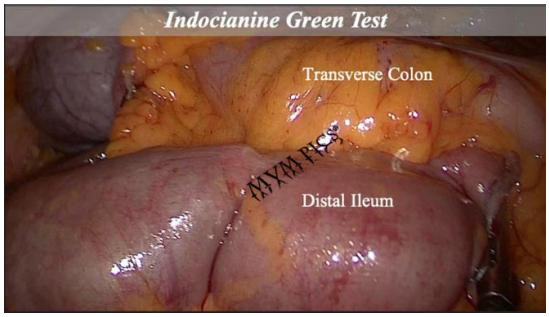
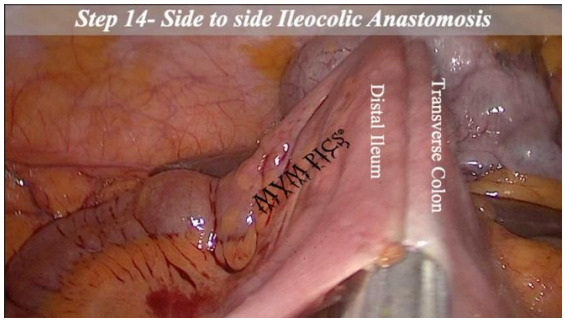



**Picture 13**




**Picture 14**




**Picture 15**

## Material and Methods

A total of 238 medical records of patients who underwent surgery over a period of 14 years (2008-2022) were analyzed. Of these, the last 146 were included in an ERAS multimodal rehabilitation protocol. The IBM SPSS Statistics version 25 program was used for analyzing the variables.

## Results

Our case series includes two-hundred and thirty-eight patients, one hundred and thirty-four women, and one-hundred and four men, with an average age of 65 years. Hospital stay was in average 4 days. Anastomotic leak rate is 7,5%, and we have achieved a lower rate of 4,7% by applying the ERAS multimodal rehabilitation protocols and performing intracorporeal anastomoses. Over 85% or our patients are intervened due to malignant tumors. Operative mortality in our series is 1,9% (Table 1).

***Table 1:*** *Operative mortality in our series.*

| | | |
|---|---|---|
| **Age** | Media 65 | Rango 22 - 90 |
| **Sex** | 104 pacientes (43,8% Masculino) | 134 pacientes (56,2% Femenino) |
| **Surgical Time** | Media 114 min | Rango 50 -240 min |
| **LOS** | Media 4 Días | Rango 2 - 35 Días |
| **Anastomotic Leaks** | Media 7.5 % | |
| | 10.7 % | EC mechanic |
| | 10 % | EC manual |
| | 4,7 % | IC mechanic |
| **30 days mortality** | 1,9 % | |
| **Oncologic patients** | 206 | 86,5 % |

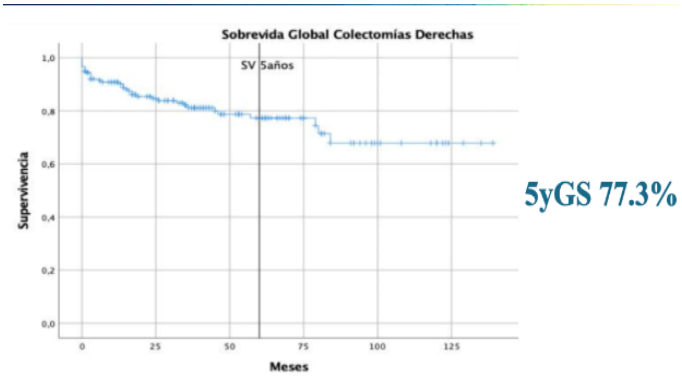
A 72% of the patient presented with locally advanced tumors, and nearly 40% had lymph node metastasis. Two-thirds of the patients presented at Stages II and III (Table 2).

***Table 2:*** *Two-thirds of the patients presented at Stages II and III.*

| | | |
|---|---|---|
| **LN Harvest** | 16,75 (average) | Range 3 – 55 |
| T3 y T4 72% | | N+ 39,7 % |

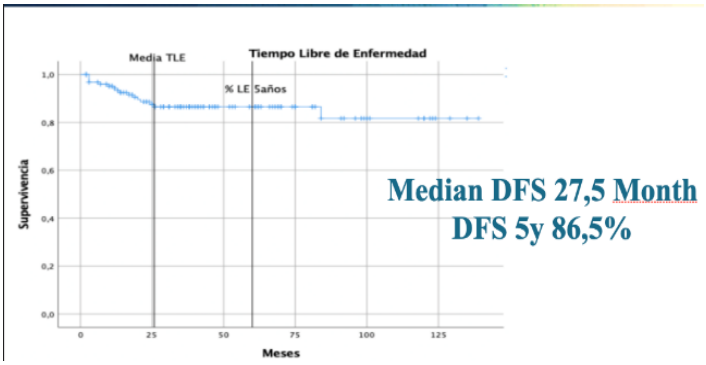
| pTNM | |
|---|---|
| 0 | 6,3% |
| I | 18,6% |
| II | 33,7% |
| III | 31,7% |
| IV | 9,7% |

Kaplan Meier survival curves show an overall five-year survival rate of 77,3% in our series (Graph 1).



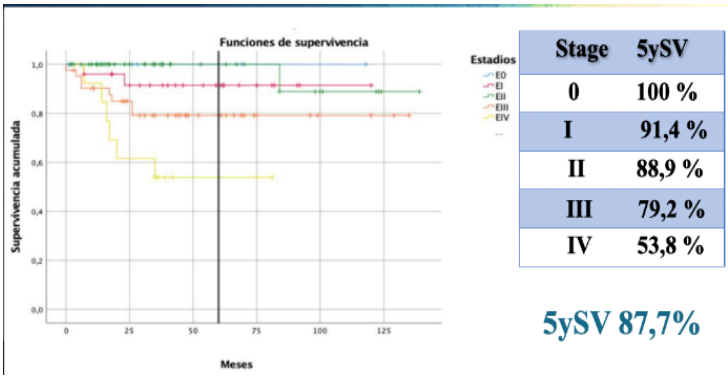

***Graph 1:*** *Kaplan-Meier Global Survaival curves and 5y GS.*

Disease free survival rates for patients who had recurrences were 27, 5 months, and 86, 5% of patients were disease free five years after surgery (Graph 2).




***Graph 2:*** *Kaplan-Meier Disease Free Survival curves and 5y DFS.*

The survival rate of patients in stage cero is one 100%, 91, 4% for stage I, 88, 9% for stage II, 79, 2% for stage III and 53, 8% percent for stage IV. The global survival rate is 88, 7% (Graph 3) [1-19].




| Stage | 5ySV |
|---|---|
| 0 | 100 % |
| I | 91,4 % |
| II | 88,9 % |
| III | 79,2 % |
| IV | 53,8 % |

***Graph 3:*** *Kaplan-Meier Stage Survival curves and 5y Sv.*

## Conclusions

Without a doubt, if we want to consider the laparoscopic right colectomy as the gold standard for this procedure, we must work together as a team and in a standardized manner. This will allow us to navigate through still water, and if the waters are turbulent, we will always have a tutor who can get us through. This way this scenario won´t happen, we won´t end up in the water, and most importantly: the patient won´t drown. Lastly, to perform a secure laparoscopic right colectomy it is of the utmost importance to have a standardized step-by-step technique and a program that involves the whole healthcare process. We must have a highly trained team and the possibility of intraoperative tutoring by experienced surgeons (at least at the beginning). Training and simulation are two non-negotiable tools for the surgeon and his team. Recording of data and a permanent audit are also essential to allow continuous improvement, and to offer the highest quality of healthcare.

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