

# Minimally Invasive Surgical Approaches to Colon Cancer



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## KEYWORDS

- Colon cancer • Minimally invasive surgery • Laparoscopic colectomy
- Single incision laparoscopic surgery • Robotic colectomy

## KEY POINTS

- Colon cancer remains the most common abdominal visceral malignancy affecting both men and women in America.
- Open colectomy has been the standard of care for colon cancer patients the past 100 years; however, although highly effective, the major trauma associated with it has a significant morbidity rate and represents a large operation for patients to recover from.
- Minimally invasive colon surgery is an option, and surgeons aim to continue to make it simpler, more reproducible, and easier to teach and learn.
- Juxtaposing the current state of minimally invasive colorectal surgery for colon cancer with open surgery offers insights to future directions.

## INTRODUCTION

Colon cancer remains the most common abdominal visceral malignancy affecting both men and women in America. It remains one of the top 3 carcinomas for both new diagnosis and mortality in the United States. More than a million Americans are estimated to be living with colon cancer.<sup>1</sup> Over the past several decades, national statistics revealed a reduction in both the incidence and death rates with improved 5-year survival.<sup>1</sup> These outcomes can be attributed in large part to better screening methods but also to advancements in care.

The mainstay treatment of colon cancer patients remains surgery. Open colectomy has been the standard of care for the past 100 years. Although highly effective, the major trauma associated with it has a significant morbidity rate and represents a large operation for patients to recover from. The laparoscopic revolution started in 1987 with the first report of a laparoscopic cholecystectomy. The patient benefits were

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immediately obvious. Patients recover quicker, have less postoperative pain, are in the hospital for shorter periods of time, and are back to their normal quality of life much sooner. Due to the obvious success of laparoscopic cholecystectomy, a flood of intra-abdominal procedures were performed laparoscopically. The first laparoscopic colectomy was performed in November 1991, in the same month by Jacobs and colleagues<sup>2</sup> and by Fowler and White.<sup>3</sup> At that time, based on the experience of adoption of laparoscopic cholecystectomy, the common belief was that more than 70% of colon procedures would be done in a laparoscopic fashion by the mid-1990s. The real challenges with minimally invasive surgery (MIS) in a multiquadrant approach, however, represented serious difficulties for surgeons. On top of this, rather than operating for a benign disease, a majority of colon surgeries were done for cancer and mishaps in this regard could prove fatal to patients. This fear was born from early reports of port site recurrences. Although this ultimately proved a technical issue based on poor operative technique, it resulted in the quick initiation of a moratorium on laparoscopy for colon cancer outside of the trial period. It took more than a decade for these trials to be completed. This significantly retarded the growth of laparoscopic colorectal surgery. To this day, the adoption of minimally invasive colorectal surgery, although improving, has remained low. In 2007, 3 years after the report of the major Clinical Outcomes of Surgical Therapy (COST) trial, still less than 15% of elective colectomies were performed laparoscopically in the United States.<sup>4</sup> The last largely published data in 2012 showed the best adoption at 59%, but in many areas it is still in the 40% range.<sup>5</sup> In contrast, in the authors' unit, 95% of the cases are performed in a minimally invasive fashion.

The learning curve for laparoscopic colectomy remains steep. The need to retract multiple organs, identify complex anatomy, and control large vessels makes the operation a difficult one. As understanding of the problems and challenges of laparoscopic colectomy have improved, however, the ability to teach this has also improved. A focus on the key principles of the steps of the operation, the anatomy, and the ability to retract and expose proper tissue planes has facilitated the performance and adoption of this approach. This should make minimally invasive colon surgery simpler, more reproducible, and easier to teach and learn. The purpose of this review is to describe the current state of minimally invasive colorectal surgery for colon cancer and to compare this with open surgery and offer insights to future directions.

## **EVOLUTION OF MINIMALLY INVASIVE SURGICAL TECHNIQUES IN COLON CANCER**

Over the past 25 years, new options and challenges have presented themselves to general and colorectal surgeons in addressing colon cancer in a minimally invasive fashion. In the early 1990s, multiport laparoscopic colectomy was introduced. Advantages of MIS were realized and patients had shorter hospital stays, less postoperative pain, and lower infection rates. The obvious decrease in abdominal wall trauma led to improved patient recovery. In the mid-2000s, single port surgery was first introduced. As an offshoot notes, technology improved to allow for development of an operation with minimal visible scar and parietal trauma. The first single-incision laparoscopic surgery (SILS) colectomy was performed in 2008 by Geisler and colleagues at the Cleveland Clinic.<sup>6</sup> Their experience suggested that this was safe and could be performed with improved cosmesis, pain control, and recovery.<sup>6,7</sup> The challenge of this approach was due to all the instrumentation run through the abdominal incision in parallel, causing a great number of collisions at the operative field. The development of both flexible-tip laparoscopes and angled instrumentation addressed these problems, as shown in many studies, with excellent results. A major criticism for this technique,

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