

ROLE OF LAPAROSCOPY IN MANAGEMENT OF COLORECTAL CARCINOMA

Essay
Submitted for Partial Fulfillment of Master Degree
In
General Surgery

By
Wael Salah Abd EL_Ghany
M.B.B.CH

Supervised by

Prof. Dr. Awad Hasan EL-Kayal

Professor of General Surgery
Faculty of Medicine
Ain Shams University

Dr. Mohammed Ahmed Amer

Lecturer of General Surgery
Faculty of Medicine
Ain shams University

Faculty of Medicine
Ain shams University
2009

Acknowledgement

First and foremost, I feel always indebted to ALLAH, the most kind and the most merciful, who guided and aided me to bring this essay to light.

It gives me the greatest proud and glory to express my deepest gratitude and sincerest thanks to Prof. Dr. **Awad Hasan EL-Kayal**, Professor of General Surgery, Faculty of Medicine, Ain Shams University. It was a privilege to work under his supervision. He made achievement of this essay from fantasy to reality and from shadow to light possible. God bless him and his useful knowledge and give him-as he gave me-best of the best.

Very special thanks and very great proud should be offered to Dr. **Mohammed Ahmed Amer**, Lecturer of General Surgery, Faculty of Medicine, Ain Shams University, for his effective and useful guideness and support through this essay.

**To whom
I am indebted**

Contents

Chapter	Content	Page
Chapter 1	Introduction and Aim of the Essay	1
Chapter 2	Embryology and Surgical Anatomy of the Colon	4
Chapter 3	Pathology of Colorectal Carcinoma	19
Chapter 4	Laparoscopic Management of Colorectal Carcinoma	36
Chapter 5	Advantages, Disadvantages and Complications of Laparoscopic Management of Colorectal Carcinoma	145
Chapter 6	Summary and Conclusion	158
Chapter 7	References	161
Chapter 8	Arabic summary	

Tables

Table	Page
Table 1: Stages and prognosis for colorectal cancers	32
Table 2: Specific instruments recommended for diagnostic	44
Table 3: Specific instruments recommended for laparoscopic	53
Table 4: Specific instruments recommended for laparoscopic	68
Table 5: Specific instruments recommended for laparoscopic	93
Table 6: Specific instruments recommended for laparoscopic	115
Table 7: Specific instruments recommended for laparoscopic	133

Figures

Figure	Page
Fig. 1. Diagram of the growth of the embryonic midgut	4
Fig. 2. Diagram of stages in development of the anus	7
Fig. 3. At the start of a laparoscopy, the liver to the right	9
Fig. 4. Peering above the right portion of the liver	10
Fig. 5. By lifting up the lower edge of the liver	10
Fig. 6. Just below the liver in a thin patient	10
Fig. 7. Just to the left of the falciform ligament	11
Fig. 8. By lifting up segments II and III of the liver	12
Fig. 9. The splenic flexure may be seen by lifting the omentum	12
Fig. 10. Just inferior to the splenic flexure	13
Fig. 11. By retracting the small bowel to the right side	13
Fig. 12. During the surgical mobilization of the sigmoid colon	13
Fig. 13. During a surgical dissection of the origin of the inferior	14
Fig. 14. With a patient in the Trendelenburg position	15
Fig. 15. Major vessels of the right colon may be appreciated	15
Fig. 16. As the right colon is mobilized, the retroperitoneal structures	15
Fig. 17. Vessels of the transverse colon and major structures	15
Fig. 18. In the left inguinal region, the relationships	16
Fig. 19. A broad view of the pelvis is seen during laparoscopy	17
Fig. 20. Lifting up on the right uterine adnexa permits	17
Fig. 21. After complete mobilization of the rectum	17
Fig. 22. Diagrammatic representation of two forms of	21
Fig. 23. Polyps of colon as revealed by colonoscopy	21
Fig. 24. Hyperplastic polyp; high-power view showing	21
Fig. 25. Peutz-Jeghers polyp; low-power view showing	28
Fig. 26. A, Pedunculated adenoma showing a fibrovascular	28
Fig. 27. A- Familial adenomatous polyposis in an 18-year-old	28
Fig. 28. Endoscopic image for colon cancer identified in sigmoid	33
Fig. 29. Carcinoma of the caecum	33

Fig. 30. Carcinoma of the descending colon	33
Fig. 31. Positions of the surgical team and equipment	44
Fig. 32. Cannula positions for the diagnostic laparoscopy	45
Fig. 33. A laparoscopic ultrasound probe can be readily used	47
Fig. 34. "Rtmning" of the small bowel begins with appropriate	48
Fig. 35. Running the bowel using the "hand-over-hand" technique	49
Fig. 36. Diagnostic laparoscopy nearly always affords an excellent	49
Fig. 37. Positions of the equipment and the surgical team	53
Fig. 38. The surgeon assumes a position between the legs	54
Fig. 39. Positions of the cannulae for the right colectomy	55
Fig. 40. Good visualization of the right mesocolon is achieved	55
Fig. 41. Definitive identification of the ileocolic pedicle	56
Fig. 42. Various approaches to the right colon mobilization	56
Fig. 43. The surgeon's first step in the dissection is to mark	57
Fig. 44. From between the legs, the surgeon dissects	58
Fig. 45. The origins of the ileocolic artery and vein	58
Fig. 46. Anatomic variations of the origin of the ileocolic vessels	58
Fig. 47. Dissection of the ventral side of the superior mesenteric	59
Fig. 48. Accessory middle colic or right colic veins are clipped	60
Fig. 49. The peritoneum is incised along the base of the ileal	60
Fig. 50. The right mesocolon is dissected away from	61
Fig. 51. The venous anatomy between the hepatic flexure	62
Fig. 52. With earlier steps accomplished, the hepatocolic ligament	62
Fig. 53. Finally, the tumor-bearing segment of the right colon	62
Fig. 54. After drawing out the right colon using a wound protector	63
Fig. 55. Appearance of the abdomen after the completion	63
Fig. 56. Positions of the equipment and the surgical team	68
Fig. 57. Positions of the cannulae for laparoscopic sigmoid colectomy	70
Fig. 58. Active positioning using gravity produces optimum exposure	72
Fig. 59. The uterus can be suspended to the abdominal wall	73
Fig. 60. Initial dissection starts with an incision of the sigmoid	74
Fig. 61. The dissection behind the IMA involves preservation	74

Fig. 62. Radical lymphadenectomy involves exposure	75
Fig. 63. The IMA is divided 1—2cm distal to its origin	75
Fig. 64. The IMV is divided in a safe area between	77
Fig. 65. An avascular plane exists between Toldt's fascia	77
Fig. 66. Lateral dissection then proceeds after the previous	79
Fig. 67. The dissection of the upper rectum should proceed	79
Fig. 68. After upper rectal mobilization, area of mesorectal	80
Fig. 69. Distal bowel division is performed through	80
Fig. 70. Proximal bowel division is performed after dividing	81
Fig. 71. Medial to lateral dissection beneath the left mesocolon	82
Fig. 72. Specimen extraction at the suprapubic site	83
Fig. 73. After specimen extraction, the proximal colon is drawn out	85
Fig. 74. The anvil and center rod of the circular stapler	85
Fig. 75. The bowel is reintroduced into the abdominal cavity	85
Fig. 76. Reestablishment of the pneumoperitoneum	86
Fig. 77. The anastomosis is then done under laparoscopic	86
Fig. 78. After firing the stapler, the anastomosis is checked	86
Fig. 79. Positions of the equipment and the surgical team	91
Fig. 80. Positions of the equipment and the surgical team	91
Fig. 81. Positions of the equipment and the surgical team	92
Fig. 82. Positions of the cannulae for laparoscopic total abdominal	93
Fig. 83. Dissection is commenced at the sacral promontory	95
Fig. 84. Dissection is continued superiorly beneath the IMA	95
Fig. 85. After creating a peritoneal window to the left	95
Fig. 86. The left colic artery and vein are ligated separately	97
Fig. 87. The left mesocolon is dissected away from	97
Fig. 88. The mesorectum is divided sharply	97
Fig. 89. The rectum is next divided from the right side	98
Fig. 90. The colon is reflected medially and dissection of the lateral	100
Fig. 91. Separation of the omentum from the colon	100
Fig. 92. Splenic flexure mobilization may be expedited	100
Fig. 93. Phase III begins with an incision just below	102

Fig. 94. After mobilizing the pedicle, it is ligated	102
Fig. 95. The ileal and right colonic mesenteric attachments	102
Fig. 96. Just cephalad to the ligated ileocolic pedicle	104
Fig. 97. The ligation of the middle colic vessels may be safer	104
Fig. 98. Attachments of the ileum just medial to the base	106
Fig. 99. The last lateral adhesions of the right colon are incised	106
Fig. 100. The hepatocolic ligament is divided from medial to lateral	106
Fig. 101. The entire colon may then be pulled out	107
Fig. 102. After removing the entire colon	108
Fig. 103. After passing the circular stapler up to the top	108
Fig. 104. A standard double-stapled technique is used	108
Fig. 105. Mesenteric vascular connections between the left colic	110
Fig. 106. Positions of the equipment and the surgical team	115
Fig. 107. Positions of the cannulae for the laparoscopic anterior	116
Fig. 108. Dissecting plane from the medial or lateral sides	118
Fig. 109. In the medial approach, the superior rectal	118
Fig. 110. It is always an option to perform dissection laterally	118
Fig. 111. Once the adventitious tunica of the inferior mesenteric	121
Fig. 112. Next, the inferior mesenteric vein and the left colic artery	122
Fig. 113. The rectal dissection starts from the right side	122
Fig. 114. With careful traction and countertraction by the surgeon	123
Fig. 115. Next, the peritoneal reflection is incised	124
Fig. 116. The lateral ligaments are placed under tension	124
Fig. 117. With tension applied to the left side of the rectum	125
Fig. 118. An endoscopic linear stapler is introduced	126
Fig. 119. A transanally introduced circular stapler	126
Fig. 120. The double-stapled anastomosis is performed	127
Fig. 121. After resection, the staples should be evaluated	127
Fig. 122. Positions of the equipment and the surgical team	132
Fig. 123. Positions of the cannulae for the laparoscopic APR	133
Fig. 124. Initial dissection involves incising the peritoneum	135
Fig. 125. The IMA is divided using a LigaSure 5mm device	135

Fig. 126. Dissection is then continued medial to lateral	135
Fig. 127. When the ureter cannot be easily identified	136
Fig. 128. The IMV is ligated only if the ureter is identified	137
Fig. 129. Lateral attachments of the sigmoid colon	138
Fig. 130. Using triangulating tension, the sigmoid mesocolon	138
Fig. 131. Proximal resection line is next incised with an endoscopic	138
Fig. 132. Posterior mobilization is initiated next at the sacral	139
Fig. 133. As the posterior rectal mobilization proceeds	140
Fig. 134. At the level of the lateral stalks, the pelvic plexus	141
Fig. 135. It may be highly useful to use the surgeon's	141
Fig. 136. Just as in the rectal mobilization	143

List of Abbreviations

APC	Adenomatous polyposis coli
APR	Abdominoperineal resection
CD	Chron's disease
CDS	Complicated Diverticulosis of the Sigmoid
HLA	Human leucocytes antigen
UC	Ulcerative Colitis
NHMRC	National Health and Medical Research Council
AJCC	The American Joint Committee on Cancer
HALS	Hand-assisted Laparoscopic Surgery
LAC	Laparoscopic-assisted Colectomy
OC	Open Colectomy
TME	Total Mesorectal Excision
COLOR	Colon Carcinoma Laparoscopic or Open Resection

Introduction

Laparoscopy has improved the surgical treatment of various diseases due to its limited surgical trauma and has developed as an interesting therapeutic alternative for open colorectal surgery. The applicability of laparoscopy to colorectal diseases continues to expand. Laparoscopic approach should be mainly considered for patients with benign conditions, For colorectal cancer, results from randomized trials so far have been favorable.¹

Laparoscopic colectomy for benign colorectal diseases was associated with significantly less disability than was laparotomy in terms of length of hospitalization as well as return to baseline partial and full activity and employment.²

Laparoscopic rectopexy improves rectal dyschezia and fecal incontinence as does the laparotomic approach, with the same risk of operative complications, but with shorter hospital stay and lower incidence of postoperative serious constipation. The recurrence rate is virtually the same. Laparoscopic rectopexy therefore is considered the first surgical choice in patients with complete rectal prolapse with fecal incontinence.³

Laparoscopic-assisted ileocectomy for primary Crohn's disease of the terminal ileum and/or cecum is safe and successful in most cases. Laparoscopic surgery for Crohn's disease should be considered as the preferred operative approach for primary resections. The total hospital charges were significantly less in favor of the laparoscopic group, despite the longer operative time and increased cost of surgical equipment, and can no longer be an argument for those who oppose a laparoscopic approach in this patient population.⁴

The reversal of Hartmann procedure can be difficult due tendency of Hartmann segment to become densely adherent deep in the pelvis. The laparoscopic reversal has made this major operation easier, safe and practical. As a majority of these patients is in the elderly age group, it has the advantage of early mobilization, less pain, short hospital stay and return to normal life.⁵

Laparoscopic colorectal surgery for advanced colorectal carcinoma is controversial because of the technical difficulties in lymph node dissection.⁶ On the other hand, in stage IV colorectal cancer, patients who underwent palliative laparoscopic surgery, the laparoscopic surgery might facilitate effective palliation in selected patients, with the avoidance of a major laparotomy.⁷

There are three basic roles of laparoscopic surgery for patients with colorectal cancer. First, although infrequently needed prior to therapy, diagnostic or staging laparoscopy may be valuable in certain colorectal cancer patients. Second, the laparoscopic approach may offer several attractive features for the palliative management of patients with incurable colorectal cancer. Finally, although this issue is the most controversial, there are theoretic but unproved advantages of using laparoscopic techniques for curative colorectal cancer therapy. The concerted efforts of surgical oncologists and their colleagues must prove this theory in well constructed trials.⁸

Aim of the Essay

The aim of this essay is to evaluate the role of laparoscopy in surgery of colorectal carcinoma and the demonstrable decrease in the conversion and complication rates with increasing experiences.

Embryogenesis

Normal Development

During herniation of the intestines into the umbilical cord (**Fig. 1**), a slight local enlargement of the portion posterior to the superior mesenteric artery marks the site of the future cecum. Growth and differentiation of this postarterial limb lags behind that of the proximal prearterial limb when the intestines return to the abdomen. ⁹

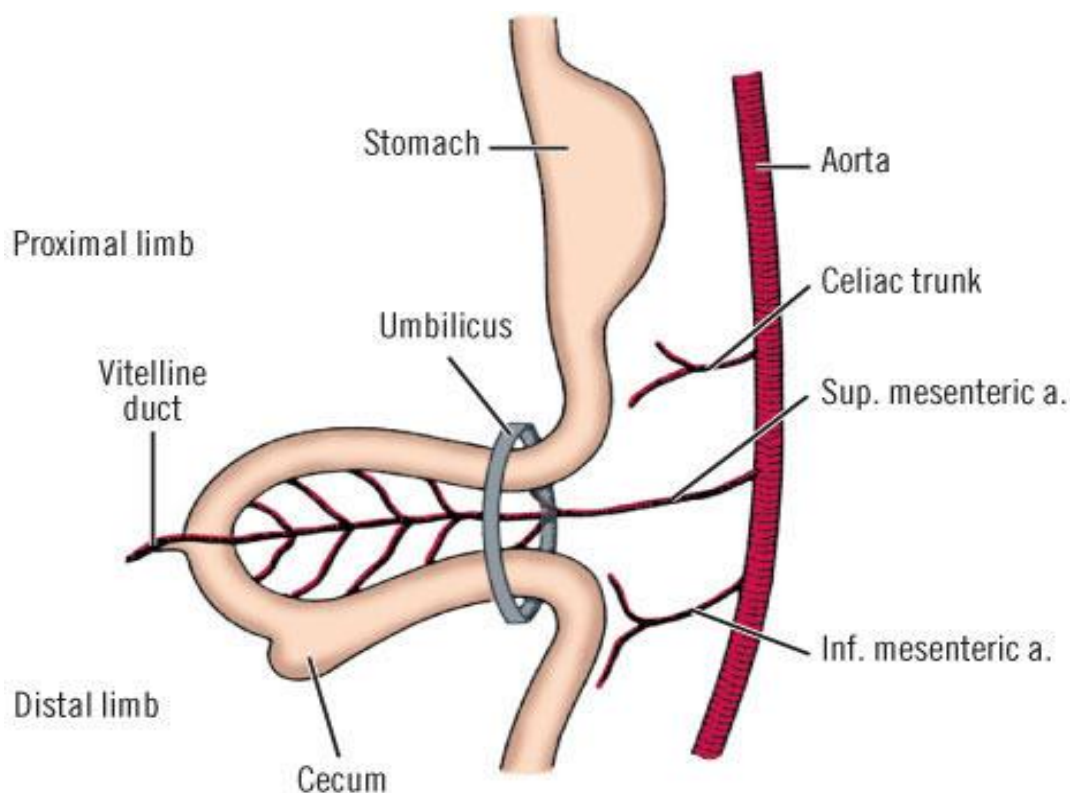


Fig. 1. Diagram of the growth of the embryonic midgut into the umbilical cord. Fifth week of gestation. The distal limb shows a swelling at the site of the cecum. The three great arteries supplying the stomach and intestines are remnants of the earlier vitelline arteries. ⁹

Goblet cells and epithelial cells with a striate border may be found in the colon by the eleventh week. During the third month, villi and glands appear. The villi reach their maximum development in the fourth month and gradually shorten and disappear with the enlargement of the colon in the seventh and eighth months. ⁹

Langman and Rowland¹⁰ reported that the estimated total number of lymphoid follicles in the large intestine is between 12,761 and 18,432. The average follicular density is 18.4 per cm² in the cecum, 15.0 per cm² in the colon, and 25.4 per cm² in the rectum. Previously reported numbers were very low; perhaps these new numbers will remind the physician about the diagnosis of lymphoid hyperplasia.

The circular layer of muscularis externa appears caudally in the ninth week and spreads cranially. Ganglion cells of the myenteric plexus of Auerbach reach the colon in the seventh week, and innervation appears to be complete by the twelfth week.⁹ The first longitudinal muscle fibers are present at the anal canal in the tenth week. Above the sigmoid colon, the longitudinal fibers extend cranially only along the mesenteric border of the colon, reaching the cecum in the eleventh week. By the fourth month, the entire colon is covered, but growth of the muscle coat does not keep up with increasing colon diameter. By the fourth month, the longitudinal muscle coat becomes separated into three bands, the taeniae coli. Meconium gradually fills the colon and the lower ileum until birth.

The colon is produced by both the midgut and the hindgut. The midgut is responsible for the genesis of the cecum, the ascending colon, and the proximal $\frac{2}{3}$ of the transverse colon. The hindgut is responsible for the remainder of the colon, the rectum, and the proximal part of the anus. To be more specific, the distal $\frac{1}{3}$ of the transverse colon, the descending colon, the sigmoid colon, the rectum and the proximal part of the anal canal develop from the hindgut.

The distal part of the surgical anal canal is not related embryologically to the hindgut. It most likely originates from the anal pit, which is of ectodermal origin. As O'Rahilly and Müller¹¹ wrote, "the anal canal is probably derived from the cloaca." To be more anatomically correct but still speculative about the embryology of the anorectum, we present this information by Rowe et al.¹² about the cloacal region.

In the fifth week, the embryonic cloaca is an endodermal sac receiving the hindgut dorsally and the allantoic stalk ventrally. The cloaca (**Fig. 2A, B**) is separated from the outside by a thin cloacal membrane (proctodeum), which occupies the embryo's ventral surface between the tail and the body stalk. During the sixth week, a septum of mesoderm divides the cloaca into a ventral urogenital sinus and a dorsal rectum (**Fig. 2C**). This mesodermic septum fuses with the cloacal membrane in the seventh week to form the perineal body. The cloacal membrane is divided into a larger, ventral urogenital membrane and a smaller, dorsal anal membrane. Externally, the anal membrane becomes slightly depressed, forming the anal dimple.⁹

By the eighth week, the anal membrane ruptures, leaving no trace of itself (**Fig. 2D**). The pectinate line in the adult is often considered to be at the level of the anal membrane, but little evidence exists to either support or contradict this view. Whatever the exact line of demarcation, the rectum and the upper anal canal are endodermal and are supplied by the inferior mesenteric artery, while the lower anal canal is ectodermal and is supplied by branches of the internal iliac artery.⁹

On either side of the anal membrane, the somatic mesoderm forms a pair of anal tubercles. These tubercles fuse dorsally into a horseshoe-shaped structure. By the tenth week, the ventral tips of the horseshoe fuse with the perineal body. Striated muscle in this horseshoe-shaped structure will later become the superficial portion of the external anal sphincter. The anal sphincter will form at the normal location even if the rectum should end blindly or should open at another site.⁹

The superior mesenteric artery (SMA) and the inferior mesenteric artery (IMA) provide the blood supply of the entire colon. In the surgical anal canal, the branches of the internal pudendal artery participate.⁹