INTRODUCTION

Colorectal cancer is one of the predominant types of cancer and the fourth leading cause of cancer-associated deaths worldwide ***(World Health Organization, 2013).***

In numbers, 600000 patients died of colorectal cancer in 2008, and disability-adjusted life-years lost from colorectal cancer were 300 per 100000 patients, which was estimated to be 7% of the total cancer burden worldwide ***(Soerjomataram, 2012)***.

Most colorectal cancers are due to old age and lifestyle factors with only a small number of cases due to underlying genetic disorders. Some risk factors include diet, obesity, smoking, and lack of physical activity. Dietary factors that increase the risk include red and processed meat as well as alcohol ***(World cancer report, 2014).***

Another risk factor is inflammatory bowel disease, which includes Crohn's disease and ulcerative colitis. Some of the inherited genetic disorders that can cause colorectal cancer include familial adenomatous polyposis and hereditary non-polyposis colon cancer; however, these represent less than 5% of cases. It typically starts as a benign tumor, often in the form of a polyp, which over time becomes cancerous ***(World cancer report, 2014).***

The symptoms and signs of colorectal cancer depend on the location of the tumor in the bowel, and whether it has spread elsewhere in the body (metastasis). The classic warning signs include: worsening constipation, blood in the stool, decrease in stool caliber (thickness), loss of appetite, loss of weight, and nausea or vomiting in someone over 50 years old. While rectal bleeding or anemia are high-risk features in those over the age of 50, other commonly described symptoms including weight loss and change in bowel habit are typically only concerning if associated with bleeding ***(Astin, 2011).***

Colorectal cancer may be diagnosed by obtaining a sample of the colon during a sigmoidoscopy or colonoscopy. This is then followed by medical imaging to determine if the disease has spread. During colonoscopy, small polyps may be removed if found. If a large polyp or tumor is found, a biopsy may be performed to check if it is cancerous ***(National Cancer Institute, 2014).***

Screening is effective for preventing and decreasing deaths from colorectal cancer. Screening is recommended starting from the age of 50 to 75 ***(Preventive Service Task Force, 2014)***.

As successful outcomes have been obtained in operations like cholecystectomy, appendectomy and hernia repair by the laparoscopic technique, the procedures have become accepted worldwide. The growing experience in laparoscopic surgery expanded the indications and more complicated operations were successfully done with this technique. Even the laparoscopic colon operations have been started in the surgical treatment of not only benign but also malignant colonic diseases ***(Leung et al., 2007).***

When colorectal cancer is caught early, surgery can be curative. However, when it is detected at later stages (metastases are present), this is less likely and treatment is often directed more as a palliative treatment ***(Cunningham et al., 2010)***.

For people with localized cancer, the preferred treatment is complete surgical removal with the attempt of achieving a cure. This can either be done by an open laparotomy or sometimes laparoscopically. If there are only a few metastases in the liver or lungs they may also be removed. Sometimes chemotherapy is used before surgery to downstage the cancer before attempting to remove it ***(Cunningham et al., 2010)***.

Use of laparoscopic techniques to treat colonic diseases, both benign and malignant, is by either the standard laparoscopic surgery (SLS) where mobilization of the bowel is accomplished with laparoscopic tools only, and a minilaparotomy is created for the purpose of specimen extraction and anastomosis (when appropriate). or hand-assisted laparoscopic surgery (HALS) which involves creation of a small incision at the beginning of the operation through which a hand is inserted to assist in dissection of the bowel, and through which specimen extraction and anastomosis are performed ***(Ringley et al., 2007).***

Various controlled prospective trials have demonstrated that laparoscopic surgery for colon cancer has short-term benefits such as less postoperative pain, shorter hospital stay and earlier return to social life than with conventional open surgery. However, criticism concerning the oncologic stability of laparoscopic surgery for colorectal cancer has continued due to port-site recurrences and incomplete lymph node dissection. Nevertheless, the long term oncologic stability of laparoscopic surgery for colon cancer has been established and laparoscopic surgery is now an accepted alternative to conventional open surgery for colon cancer ***(Kim et al., 2009)***.

Aim of the Work

The aim of this study is to evaluate the role of laparoscopy in management of colorectal cancer.

ANATOMY OF COLON AND RECTUM

The gastrointestinal tract terminates at the colon, which is involved in absorption of water and electrolytes, mucus secretion, and the propagation and storage of fecal material ***(Skandalakis et al., 2004).***

The colon measures approximately150–180 cm in length and comprises nearly a fifth of the total intestinal length. It begins just distal to the terminal ileum at the ileocecal valve and extends to the dentate line, which includes the proximal two-thirds of the anal canal. Surgically, the colon terminates at the level of the levator ani muscles ***(Skandalakis et al., 2004).***

Its diameter can be substantially augmented by distension, it gradually decreases from 7.5 cm at the cecum to 2.5 cm at the sigmoid. Anatomic differences between the small and large intestines include position, caliber, degree of fixation, and, in the colon, the presence of three distinct characteristics: the taeniae coli, the haustra, and the appendices epiploicae. The three taeniae coli, anterior (taenia libera), posteromedial (taenia mesocolica), and posterolateral (taenia omentalis), represent bands of the outer longitudinal coat of muscle that traverse the colon from the base of the appendix to the rectosigmoid junction,where they merge ***(Jorge, 2013).***

The haustra or haustral sacculations are outpouchings of bowel wall between the taeniae; they are caused by the relative shortness of the taeniae, about one-sixth shorter than the length of the bowel wall. The haustra are separated by the plicae semilunares or crescentic folds of the bowel wall, which give the colon its characteristic radiographic appearance when filled with air or barium. The appendices epiploicae are small appendages of fat that protrude from the serosal aspect of the colon. The colon can be subdivided into the cecum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum ***(Yee, 2007)***.

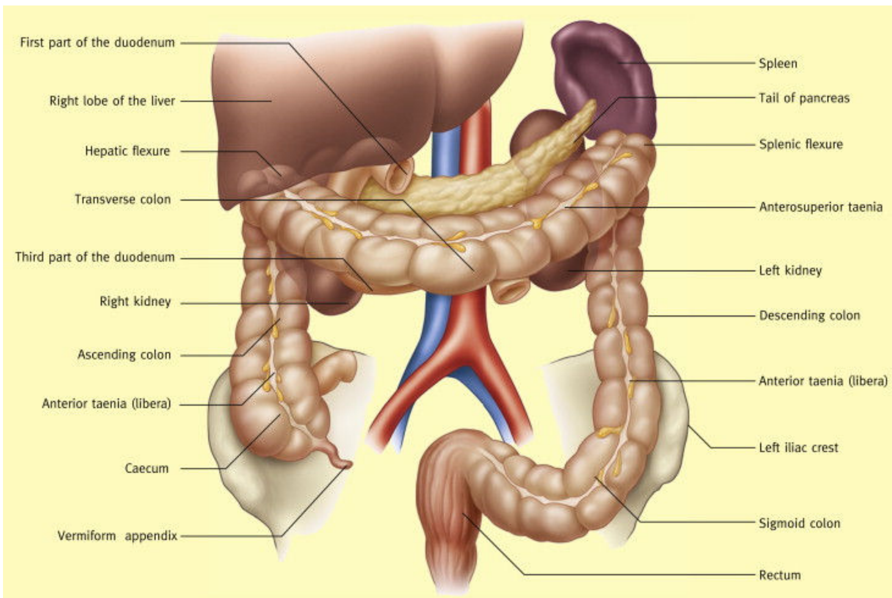

Fig. (1): The large bowel ***(Yee, 2007)***.

Cecum and Appendix:

The cecum is the sacculated segment of the large bowel that projects downward as a 6- to 8-cm blind pouch below the entrance of the ileum. It is usually situated in the right iliac fossa, the cecum is almost entirely, or at least in its lower half, invested with peritoneum. The ileum terminates in the posteromedial aspect of the cecum ***(Gray, 2009)***.

A circular sphincter, the ileocecal sphincter, originates from a slight thickening of the muscular layer of the terminal ileum. A competent ileocecal valve is related to the critical closed-loop type of colonic obstruction. Instead of preventing reflux of colonic contents into the ileum, the ileocecal valve regulates ileal emptying. The ileocecal sphincter seems to relax in response to the entrance of food into the stomach ***(Skandalakis et al., 2004).***

As in the gastroesophageal junction, extrasphincteric factors such as the ileocecal angulation apparently have a role in the prevention of reflux from the colon to the ileum ***(Bannister, 1999).***

The vermiform appendix is an elongated diverticulum that arises from the posteromedial aspect of the cecum about 3.0 cm below the ileocecal junction. Its length varies from 2 to 20 cm (mean, 8–10 cm), and it is approximately 5 mm in diameter. Because of its great mobility,it may occupy avariety of positions, possibly at different times in the same individual ***(Jorge, 2013)***.

It has been estimated that in 85–95% of cases, the appendix lies posteromedial on the cecum toward the ileum,but other positions include retrocecal, pelvic, subcecal, pre-ileal and retroileal. The confluence of the three taeniae is a useful guide in locating the base of the appendix ***(Yee, 2007)***.

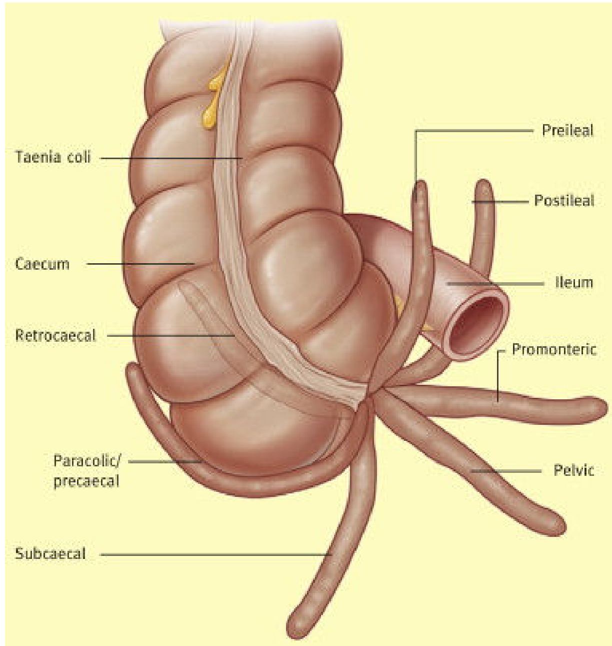

Fig. (2): The appendix and its various positions ***(Yee, 2007)***.

Ascending colon:

The ascending colon is approximately 15 cm long. It ascends, from the level of the ileocecal junction to the right colic or hepatic flexure, laterally to the psoas muscle and anteriorly to the iliacus, the quadratus lumborum, and the lower pole of the right kidney ***(Moore and Agur, 1995)***.

The ascending colon is covered with peritoneum anteriorly and on both sides. The ascending colon is devoid of peritoneum, which is instead replaced by an areolar tissue (fascia of Toldt). In the lateral peritoneal reflection, this process is represented by the white line of Toldt, which is more evident at the descending-sigmoid junction ***(Bannister, 1999)***.

This line serves as a guide for the surgeon when the ascending, descending, or sigmoid colon is mobilized. At the visceral surface of the right lobe of the liver and lateral to the gallbladder, the ascending colon turns sharply medially and slightly caudad and ventrally to form the right colic (hepatic) flexure ***(Jorge, 2013).***

Transverse colon:

The transverse colon is approximately 45 cm long, the longest segment of the large bowel. It crosses the abdomen, with an inferior curve immediately caudad to the greater curvature of the stomach. The transverse colon is relatively fixed at each flexure, and, in between, it is suspended by a 10- to 15-cm wide area which provides variable mobility. The transverse colon is completely invested with peritoneum, but the greater omentum is fused on its anterosuperior aspect ***(Skandalakis et al., 2004).***

Left colic flexure is the junction of the transverse colon and descending colon in the left hypochondriac region; it is related to the lower part of the spleen and pancreatic tail above and medially with the front of the left kidney. It is so acute that the end of the transverse colon usually overlaps the front of the descending colon. The left flexure is above and on a more posterior plane than the right flexure and is attached to the diaphragm with the tenth and the eleventh ribs by the phrenicocolic ligament, which lies below the anterolateral pole of the spleen ***(Bannister, 1999).***

Descending colon:

The descending colon courses downward from the splenic flexure to the brim of the true pelvis, a distance of approximately 25 cm ***(Jorge, 2013)***.

The descending colon descends through the left hypochondriac and lumbar regions, at first following the lower part of the lateral border of the left kidney and then descending in the angle between the psoas major and quadratus lumborum to the iliac crest ***(Bannister, 1999).***

The caudal portion of the descending colon just distal to the iliac crest sits in the left iliac fossa and is often referred to as the iliac colon. Similar to the ascending colon, the descending colon does not have a true mesentery. Its mesocolon attaches medially to connective tissue anterior to the aorta and follows the course of the inferior mesenteric vein and mesocolic marginal vessels of the descending colon ***(Charnsangavej et al., 1993).***

Crossing behind it are the following left structures: subcostal vessels and nerve, ilio-hypogastric and ilio-inguinal nerves, fourth lumbar artery (usually). The descending colon is narrower and more dorsally situated than the ascending colon ***(Charnsangavej et al., 1993).***

Sigmoid colon

The “S”-shaped sigmoid colon measures on average 40 cm, extending from the pelvic brim to approximately the third sacral vertebrae and is often tortuous and redundant ***(Moore and Agur, 1995)***.

The loop first descends in contact with the left pelvic wall, then crosses the pelvic cavity between the rectum and the bladder in males, rectum and uterus in females, and may reach the right pelvic wall; finally it turns back to the midline level with the third piece of the sacrum. Where it bends backwards and ends in the rectum ***(Bannister, 1999).***

It is entirely encased by peritoneum and is freely suspended by the sigmoid mesocolon, which diminishes in length from the centre towards its end, where it disappears. The sigmoid mesocolon root has aV-shaped attachment along the external iliac vessels, iliac bifurcation, and third segment of the sacrum ***(Moore and Agur, 1995)***.

Its relations laterally, are the left external iliac vessels the obturator nerve, ovary or ductus deferens and the lateral pelvic wall; posteriorly the left internal iliac vessels, ureter, piriformis and sacral plexus; inferiorly to the bladder in males or uterus and bladder in females; superiorly and to the right it is in contact with terminal coils of the ileum ***(Bannister, 1999).***

RECTUM:

The rectum measures 12 cm on average and continues caudally from the sigmoid colon within the sacrococcygeal curve to terminate at the anal canal.The proximal one-third of the rectum is retroperitoneal and relatively fixed. The rectum lacks haustra as the longitudinal taenia coli terminate at the rectosigmoid junction and continues as a circular smooth muscle layer ***(Gray, 2009)***.

One to four prominent semilunar plicae referred to as the rectal valves of Houston are seen in most individuals. They may vary in size, number, and location. Typically, there are three total folds in the left superior, right middle, and left inferior rectum and are on average located 4–7 cm, 8–10 cm, and 10–12 cm from the anal verge ***(Skandalakis et al., 2004)***.

These valves may serve as anatomic landmarks for localizing lesions within the rectum. The middle valve indicates the level of the abdominal-peritoneal reflection anteriorly and denotes the lower and middle third of the rectum ***(Yee, 2007)***.

The rectum also deviates in three lateral curves; the upper is convex to the right, the middle (the most prominent) bulges to the left and the lower is convex to the right. Both ends of the rectum are in the median plane ***(Bannister, 1999).***

The rectum differs from the sigmoid colon in having no sacculations, appendices epiploicae or mesentery; the taeniae blend about 5 cm. above the rectosigmoid junction, forming two wide muscular bands which descend, anterior and posterior, in the rectal wall ***(Bannister, 1999).***

Only the anterior and lateral surfaces of the proximal one-third rectum are covered by peritoneum, which is reflected anteriorly to form the rectovesicle and rectovaginal recess in males and females, respectively. In both sexes, the peritoneum reflects laterally to form pararectal fossae, allowing for lateral rectal distension ***(Gray, 2009).***

Anatomic Relations of the Rectum:

The rectum occupies the sacral concavity and ends 2–3 cm anteroinferiorly from the tip of the coccyx. At this point, it angulates backward sharply to pass through the levators and becomes the anal canal ***(Yee, 2007)***.

Anteriorly, in women, the rectum is closely related to the uterine cervix and posterior vaginal wall; in men, it lies behind the bladder, vas deferens, seminal vesicles, and prostate. Posterior to the rectum lie the median sacral vessels and the roots of the sacral nerve plexus ***(Skandalakis et al., 2004).***

The parietal endopelvic fascia lines the walls and floor of the pelvis and continues on the internal organs as a visceral pelvic fascia. The lateral ligaments or stalks of the rectum are distal condensations of the pelvic fascia that form a roughly triangular structure with a base on the lateral pelvic wall and an apex attached to the lateral aspect of the rectum. The lateral stalks are comprised essentially of connective tissue and nerves, and the middle rectal artery does not traverse them. Branches, however, course through in approximately 25% of cases ***(Jorge, 2013).***

The presacral fascia is a thickened part of the parietal endopelvic fascia that covers the concavity of the sacrum and coccyx, nerves, the middle sacral artery, and presacral veins. The rectosacral fascia is an anteroinferiorly directed thick fascial reflection from the presacral fascia at the S-4 level to the fascia propria of the rectum just above the anorectal ring ***(Moore and Agur, 1995)***.

The rectosacral fascia, classically known as the fascia of Waldeyer, is an important landmark during posterior rectal dissection. The visceral pelvic fascia of Denonvilliers is a tough fascial investment that separates the extraperitoneal rectum anteriorly from the prostate and seminal vesicles or vagina ***(Jorge, 2013)***.

Arterial supply:

The arterial supply of Large Intestine:

The superior and inferior mesenteric arteries nourish the entire large intestine, and the limit between the two territories is the junction between the proximal two-thirds and the distal third of the transverse colon. This represents the embryologic division between the midgut and the hindgut ***(Yee, 2007)***.

The superior mesenteric artery originates from the aorta behind the superior border of the pancreas at L-1 and supplies the cecum, appendix, ascending colon, and most of the transverse colon ***(Charnsangavej et al., 1993)***.

From its right side arises the colic branches: middle, right, and ileocolic arteries. The ileocolic, the most constant of these vessels, bifurcates into a superior or ascending branch,