INTRODUCTION

Colorectal cancer, also called colon cancer or bowel cancer, includes cancerous growths in the colon, rectum and appendix. It is the third commonest form of cancer and the second leading cause of cancer-related deaths in the western world. It is equally prevalent in men and women, and usually occurs in later life (aged 60-70yrs). It causes 655,000 deaths worldwide per year. The incidence and mortality of colorectal cancer have remain approximately static for the past 40yrs, although there are recent trends showing slight declines regarding both in the UK and the US. The decrease in mortality may reflect a tendency towards earlier diagnosis that is most probably due to increased awareness of people and large national screening programs in many countries ***(WHO, 2006)***.

Colorectal cancer is considered the only commonly curable visceral malignancy. In the United Kingdom, half of the patients presenting with the disease are treated with a reasonable expectation of cure. Approximately half of these can expect to be alive at 5yrs. Surgery remains the mainstay of treatment. The cure and survival rates are directly related to the standard of surgery. Early diagnosis makes it more likely that the tumor can be completely resected and thereby improves the chance of cure ***(John, 2002)***.

The history of modern sigmoid and rectal cancer resections dates back to 1884, when Czerny described the first abdominoperineal resection (APR). In 1885, Kraske pioneered the trans-sacral approach of rectal resection and anastomosis. In 1908, Miles improved on the APR by understanding that there was a "zone of upward spread". He emphasized the importance of performing a wide perineal excision, including removal of the pelvic contents of the rectum, the abdominal attachments of the rectum with a high arterial ligation, and the iliac lymph nodes. Operative mortality in Miles' first series, however, exceeded 42% ***(Miles, 1908)***.

During the last two decades, William Heald popularized the total mesorectal excision. This surgical approach to rectal cancers appreciates the subtle fascial planes along with the lymphatic and neural anatomy of the pelvis. Heald described a "zone of downward spread "within the mesorectum that requires proper excision in order to reduce local recurrence. Local excision of small rectal cancers, having been employed for a hundred years in selected patients, is being combined with other therapies to maximize local control with a minimally invasive approach ***(Heald et al., 1998)***. Anterior resections were introduced by ***Guillem, (1997)*** to provide a better way of removing the tumor bearing area with still giving the patient a better life style without colostomies.

The use of laparoscopy in colorectal resection, especially in malignancy, has been debatable for a long time. Many studies are trying to prove its efficacy and make it a routine to use laparoscopy in such procedures.

Open colorectal procedures has always been considered the cornerstone operations for colorectal malignancy. But since the first laparoscopic cholecystectomy performed in 1985, advances in minimally invasive techniques and equipment have permitted safe and more advanced operations to be performed starting from laparoscopic appendectomy and up to laparoscopic liver, pancreatic and colorectal resection. First laparoscopic colectomy was performed on 1991 ***(Jacobs et al., 1991).*** Apart from perforation and obstructing carcinoma, there are no uniformly accepted specific contra-indications ***(John, 2002)***.

Laparoscopic colorectal resections are considered amongst the most complex of laparoscopic cases. Resection requires mobilization of a bulky structure, working in more than one quadrant of the abdomen, obtaining control of multiple large blood vessels, extraction of a large specimen, and creation of a safe anastomosis. For cancer, oncologic principles must be applied with the additional requirements of adequate distal and proximal margins, appropriate lymphadenectomy, proximal ligation of the vascular pedicle(s) and avoidance of handling and perforation of the tumor ***(SAGES, 2006)***.

This led to the fact that laparoscopic approach progress is limited as it needs a high degree of laparoscopic skills, expensive equipment, and a longer operating time. Its learning curve is steep. Above all, its oncological safety is still uncertain when it comes to tumor spillage, early recurrence and adequacy of resection ***(Boller et al., 2007).***

But still when compared to open technique, laparoscopic colectomy has shown to be associated with decreased postoperative pain, faster return of bowel function, earlier resumption of oral intake, shorter hospital stay, lower complications rate and better cosmetic outcome ***(Murray et al., 2006)***.

While abdominoperineal resection is the gold standard in management of low rectal tumor, the low anterior resection with sphincter preservation has been rise to be the major challenge for surgeons.

Methods of sphincter preservation were developed more than a century ago. Combining these techniques with adequate anterior resection has permitted the resurrection of sphincter-saving procedures that are currently being applied in the therapy of cancer at every level of the rectum. Although Miles' abdominoperineal resection still remains the "gold standard" for the treatment of low rectal neoplasms, restorative resection may now be possible with equivalent oncologic disease control and survival. Further, current trends also suggest that the abdominoperineal resection is being used less frequently in the treatment of most rectal cancers and is being replaced with sphincter-preserving techniques that afford excellent functional results. In this review, the pertinent anorectal anatomy, current issues, and sphincter-saving surgical techniques presently available for the treatment of distal cancers of the rectum are presented ***(Murray et al., 2006)***.

While Adjuvant therapy, believed by some to be of no benefit for colorectal cancer as recently as 10 years ago, now offers thousands of patients considerable hope after surgical resection. The first effective adjuvant regimen—combined fluorouracil (5-FU) and levamisole—described in 1989 .Patients with locally advanced (Dukes stages B2, B3, and C; TNM stages II and III) large bowel cancer have a significantly increased risk of relapse after surgical resection alone, and in patients with stage III disease (node positive), the risk of death from cancer is as high as 70% during the five years after surgical resection.8 Because of the high risk of relapse after surgery alone, therapies that may be added to surgery to prevent clinical metastatic disease have attracted great interest ***(Murray et al., 2006)***.

This approach to post-resection treatment, called adjuvant therapy, is aimed at destroying microscopic metastatic disease and, ideally, at preventing death from metastatic cancer.

Adjuvant therapies for colon cancers are quite distinct from those developed to treat rectal cancers. Radiation therapy, for example, is almost always a major part of adjuvant programs for rectal cancer (tumors below the peritoneal reflection) ***(Murray et al., 2006)***.

AIM OF THE WORK

Recently there are significant advances in the management of colorectal cancer attributed mainly to advances in surgical techniques, investigation and preoperative and postoperative therapy.

This review addresses some of these advances and their impact on prognosis of colorectal cancer.

ANATOMY

Anatomy of the Colon, Rectum and Anus:

Although much of our fundamental understanding of the anatomy of the colon, rectum, and anus comes from the efforts of researchers of the 19th and early 20th centuries, comprehensive observations of this region had been made as early as 1543 by Andreas Vesalius through anatomic dissections. 1 However, anatomy of this region, especially that of the rectum and anal canal, is so intrinsically related to its physiology that much can be appreciated only in the living. Thus, it is a region in which the surgeon has an advantage over the anatomist through in vivo dissection, physiologic investigation, and endoscopic examination. However, anatomy of the pelvis is also challenging to the surgeon: the pelvis is a narrow space, packed with intestinal, urologic, gynecologic, vascular, and neural structures, all confined within a rigid and deep osseous-muscular cage. Therefore, detailed anatomy of this region is difficult to learn in the setting of an operating room and it demands not only observations in vivo, but historical reviews, anatomy laboratory studies, including dissections of humans and animals, with in depth descriptions and drawings and sometimes associated with physiologic evaluation. Based on these studies, some controversial concepts of the anatomy, especially of the rectum and anal canal, have been actually changed. In addition, virtual reality models have been designed to improve visualization of three dimensional structures and more properly teach anatomy, pathology, and surgery of the anorectum and pelvic floor ***(Dobson et al., 2003).***

Anal Canal Structure, Anus, and Anal Verge:

The anal canal is anatomically peculiar and has a complex physiology, which accounts for its crucial role in continence and, in addition, its susceptibility to a variety of diseases. The anus or anal orifice is an anteroposterior cutaneous slit, that along with the anal canal remains virtually closed at rest, as a result of tonic circumferential contraction of the sphincters and the presence of anal cushions. The edge of the anal orifice, the anal verge or margin (anocutaneous line of Hilton), marks the lowermost edge of the anal canal and is sometimes the level of reference for measurements taken during sigmoidoscopy. Others favor the dentate line as a landmark because it is more precise. The difference between the anal verge and the dentate line is usually 1-2cm. The epithelium distal to the anal verge acquires hair follicles, glands, including apocrine glands, and other features of normal skin, and is the source of perianal hidradenitis suppurativa, inflammation of the apocrine glands ***(Dobson et al., 2003).***

Anatomic Versus Surgical Anal Canal

Two definitions are found describing the anal canal (Figure 1-1). The “anatomic” or “embryologic” anal canal is only 2.0 cm long, extending from the anal verge to the dentate line, the level that corresponds to the proctodeal membrane. The “surgical” or “functional” anal canal is longer, extending for approximately 4.0 cm (in men) from the anal verge to the anorectal ring (levator ani). This “long anal canal” concept was first introduced by Milligan and Morgan and has been considered, despite not being proximally marked by any apparent epithelial or developmental boundary, useful both as a physiologic and surgical parameter. The anorectal ring is at the level of the distal end of the ampullary part of the rectum and forms the anorectal angle, and the beginning of a region of higher intraluminal pressure. Therefore, this definition correlates with digital, manometric, and sonographic examinations *(Milligan et al., 1998)*.

Anatomic Relations of the Anal Canal

Posteriorly, the anal canal is related to the coccyx and anteriorly to the perineal body and the lowest part of the posterior vaginal wall in the female, and to the urethra in the male. The ischium and the ischiorectal fossa are situated on either side. The fossa ischiorectal contains fat and the inferior rectal vessels and nerves, which cross it to enter the wall of the anal canal.

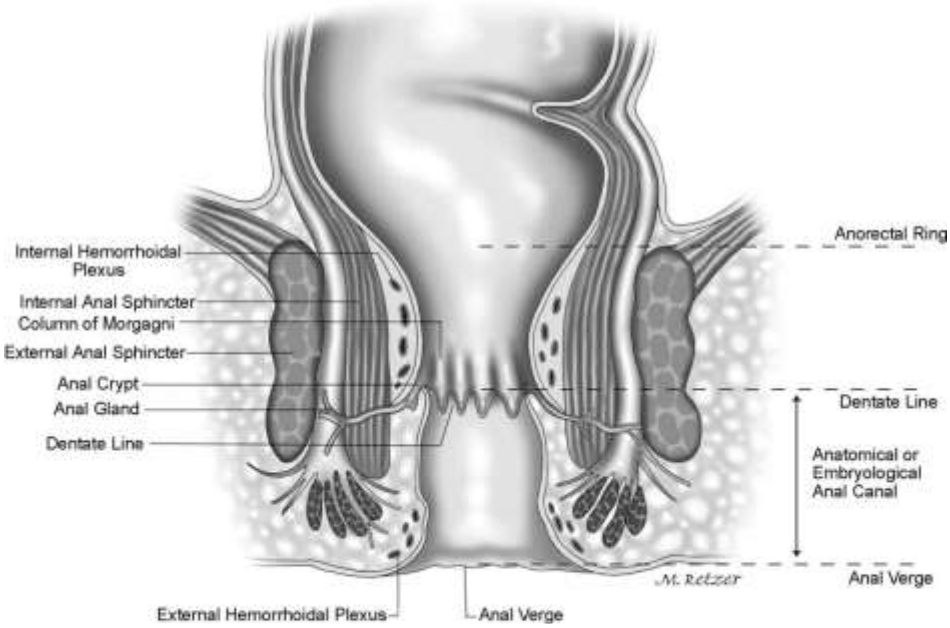

FIGURE 1-1. Anal canal [J.M.N. Jorge and A. Habr-Gama]

Muscles of the Anal Canal.

The muscular component of the mechanism of continence can be stratified into three functional groups: lateral compression from the pubococcygeus, circumferential closure from the internal and external anal sphincter, and angulation from the puborectalis (Figure 1-2). The internal and external anal sphincters, and the conjoined longitudinal are intrinsically related to the anal canal, and will be addressed here. **Milligan et al., 1998**

Internal Anal Sphincter.

The internal anal sphincter represents the distal 2.5- to 4.0 cm condensation of the circular muscle layer of the rectum. As a consequence of both intrinsic myogenic and extrinsic autonomic neurogenic properties, the internal anal sphincter is a smooth muscle in a state of continuous maximal contraction, and represents a natural barrier to the involuntary loss of stool and gas. The lower rounded edge of the internal anal sphincter can be felt on physical examination, about 1.2 cm distal to the dentate line. The groove between the internal and external anal sphincter, the intersphincteric sulcus, can be visualized or easily palpated. Endosonographically, the internal anal sphincter is a 2 to 3 mm thick circular band and shows a uniform hypoechogenicity.

External Anal Sphincter.

The external anal sphincter is the elliptical cylinder of striated muscle that envelops the entire length of the inner tube of smooth muscle, but it ends slightly more distal than the internal anal sphincter. The external anal sphincter was initially described as encompassing three divisions: subcutaneous, superficial, and deep Goligher et al.11 described the external anal sphincter as a simple, continuous sheet that forms, along with the puborectalis and levator ani, one funnel-shaped skeletal muscle. The deepest part of the external anal sphincter is intimately related to the puborectalis muscle, which can actually be considered a component of both the levator ani and the external anal sphincter muscle complexes. Others considered the external anal sphincter as being subdivided into two parts, deep (deep sphincter and puborectalis) and superficial (subcutaneous and superficial sphincter).6,12,13 Shafik14 proposed the three U-shaped loop system, but clinical experience has not supported this schema.

The external anal sphincter is more likely to be one muscle unit, attached by the anococcygeal ligament posteriorly to the coccyx, and anteriorly to the perineal body, not divided into layers or laminae. Nevertheless, differences in the arrangement of the external anal sphincter have been described between the sexes. In the male, the upper half of the external anal sphincter is enveloped anteriorly by the conjoined longitudinal muscle, whereas the lower half is crossed by it. In the female, the entire external anal sphincter is encapsulated by a mixture of fibers derived from both longitudinal and internal anal sphincter muscles. Endosonographically, the puborectalis and the external anal sphincter, despite their mixed linear echogenicity, are both predominantly hyperechogenic, with a mean thickness of 6 mm (range, 5–8 mm). Distinction is made by position, shape, and topography. Recently, both anal endosonography and endocoil magnetic resonance imaging have been used to detail the anal sphincter complex in living, healthy subjects. These tests provide a three-dimensional mapping of the anal sphincter; they help to study the differences in the arrangement of the external anal sphincter between the sexes and uncover sphincter disruption or defect during vaginal deliveries. In addition, there is some degree of "anatomical asymmetry" of the external anal sphincter, which accounts for both radial and longitudinal "functional asymmetry" observed during anal manometry. **Jorge et al., 2000.**

The automatic continence mechanism is formed by the resting tone, maintained by the internal anal sphincter, magnified by voluntary, reflex, and resting external anal sphincter contractile activities. In response to conditions of threatened incontinence, such as increased intraabdominal pressure and rectal distension, the external anal sphincter and puborectalis reflexively and voluntarily contract further to prevent fecal leakage. Because of muscular fatigue, maximal voluntary contraction of the external anal sphincter can be sustained for only 30–60