Past, Present and Future in Colorectal Surgery

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Colorectal cancer is a major health issue all over the world and, during the last century has seen great improvements in colorectal cancer management.

The interest for rectal pathology has been established even from Hippocrates' era (1,2). In the 19th century, the management of rectal cancer was based on a colostomy, first time described in 1776 by Jean Zulema Amussat. In 1826 Jacques Lisfranc successfully performed the first resection for rectal cancer, removing only a few centimeters of the distal rectum, procedure published in 1833 (3).

In 1908 in Lancet, Sir Ernest Miles published a new method of performing abdomino-perineal excision for carcinoma of the rectum and the terminal segment of the pelvic colon, considered "one of the most formidable operations in surgery" with a mortality of 41.6% (4). Too much conservatism in the removal of the organ associated with a high rate of local recurrence were the arguments for a new technique (5).

In 1917 Arthur D. Bevan published a paper which described the posterior approach to the rectum by complete division of the anal sphincters in the midline and coccygectomy, technique that later was recognized as Bevan procedure (6).

William Bashall Gabriel (1893–1975) proposed a 1-stage procedure called "perineo-abdominal excision of the rectum" and in 1934 Martin Kirschner first imagined a technique that allowed two surgical teams to work at the same time. A combined lithotomy-Trendelenburg position enabled Lloyd-Davies in 1939 to perform the first synchronous combined radical abdomino-perineal resection using adjustable leg support (3).

In 1930 Dukes describes the possible dissemination pathways for cancer of the rectum and a new classification of

rectal cancer is proposed, which represents a modification of the clinical classification into A, B, and C stages (7). In 1977 the first TNM staging Cancer Manual was elaborated by the American Joint Committee on Cancer (AJCC) and is used until present time in patient management (8).

J. C. Goligher in 1937 in the book "Surgery of the Anus, Rectum and Colon", gives information about causes, treatment of colorectal cancer and the new techniques used at that moment (9).

In 1948 in *Annals of Surgery*, Claude F. Dixon, first describes the anterior resection for malignant lesions of the upper part of the rectum and lower part of the sigmoid with a resectability rate of 80% for tumors higher than 10 cm from the dentate line and 44% for tumors at 8 cm, with a mortality rate of 5.9% (10).

In 1982 Krause described the abdominoperineal excision of the rectum presenting details of both perineal and abdominal approaches, but this intervention was associated with a high rate of urinary tract complication, of up to 25% (11).

An important step in the treatment of rectal cancer is achieved in 1986, when Heald publishes the survival results after total mesorectal excision in rectal cancer (12) and in 1988 when he describes the "Holy plane in rectal surgery", showing that local recurrences are the most important reflection of surgical technique in rectal cancer (13). A total mesorectal excision (TME) is performed by dissection of the mesorectum down to the plane of the levator ani, with its removal that must be made with an intact mesorectal fascia, based on a sharp dissection. In Heald's first series of 112 patients, the rate of local recurrence was 2 %, as compared to 20 % in conventional rectal resection (12–17).

In 1986, Philip Quirke, first shows through histopathological studies that in rectal adenocarcinoma, local recurrence is mainly due to lateral spread of the tumour, aspect that was underestimated before (18).

Neoadjuvant radiotherapy treatment efficiency was first proven in 1997 when the results from the Swedish trial were published, showing

a recurrence rate of 11% for patients with short course radiotherapy, compared to 27% in patients with upfront surgery (19). In 2001 in the Danish trial, the local recurrence rate was reported to be 5% in the radiotherapy group, compared to 11% in the surgery group (20).

TME associated with neoadjuvant chemoradiotherapy represents a major progress in rectal cancer in the last decades. In 1994 TME was introduced in Stockholm and after a training project, the permanent stoma rate was reduced from 60.3% to 26.5% ($P<0.001$), five-year local recurrence rates decreased from 21.9% to 8.2% ($P<0.001$) and five-year cancer-specific survival rates increased from 66.0% to 77.3% ($P<0.001$) (21).

Based upon the necessity of a multidisciplinary approach for patients with rectal cancer in March 2003, in England was launched the first English National Multidisciplinary Team- Total Mesorectal Excision (MDT-TME) Development Program, which was the first MDT program. Through education and development of colorectal MDTs, the project proposed to improve survival and quality of life of patients with rectal cancer. The core members of each MDT (Radiologists, Oncologists, Colorectal Surgeons, Pathologists and Colorectal Nurses) were involved in the multidisciplinary management of patients in all phases of the treatment (22).

According to the concept of TME for rectal cancer, a concept of complete mesocolic excision (CME) for colonic cancer was proposed. It consists of the separation of the mesocolon from the parietal plane and true central ligation of the supplying arteries and draining veins at their roots. The technique is associated with a reduced 5-year local recurrence from 6.5% to 3.6% and an increased 5-year survival rate from 82.1% to 89.1% (23). The Toldt fascial plane allows a dissection for a precise conduction of CME, using a correct technique (24,25).

A wait-and-watch strategy for patients with rectal cancer and complete clinical response after neoadjuvant radio-chemotherapy was proposed by the Habr-Gama in her studies with organ preservation in selected cases. This is quite a bold approach and may

be considered when radical surgery is not immediately performed and an attentive screening for local relapse is conducted. A strict follow-up program may yield a rate of up to 70% of patients without surgery during surveillance. Thus, similar oncological outcomes may be obtained both through this strategy and through surgery only, with the benefit of avoiding mortality and morbidity associated to rectal surgery (26–33). However, this approach needs more study.

A minimally invasive approach for rectal cancer surgery may be performed through laparoscopy, robotic surgery, NOTES (natural orifice transluminal endoscopic surgery), or TAMIS (transanal minimally invasive surgery) with high-quality local excision in selected cases.

TaTME (transanal TME) represents a valuable alternative to standard, transabdominal TME, in obese male patients with distal, locally advanced rectal cancer and seems to revolutionize the practice of rectal cancer surgery in these cases (34–39).

In early-stage rectal cancer (cT1-3N0M0), organ preservation is possible with TEM (transanal endoscopic microsurgery) or TEO (transanal endoscopic operation) in approximately two-thirds of patients, with good long-term oncological outcomes and quality of life (40).

Robotic assisted surgery for rectal cancer is associated with an acceptable morbidity and a low rate of positive circumferential resection margins. An European consensus in order to validate the TME robotic technique was published in 2018 (41,42). Both laparoscopic and robotic TME, were proven feasible and the results in terms of oncological outcomes are similar to open surgery, but provide short-term benefits. Robotic surgery allows by means of a better visualization, an improved nerve sparing and a direct entry in the dissection plane (43).

New biomarkers are necessary in order to predict colorectal cancer survival, and among these, the immune system plays a very important role. Although TNM staging is considered to be the most important prognostic factor, immunologic criteria seem to have a prognostic

value that was proven to be superior and independent of the TNM staging system. Team of Franck Pages and Jerome Galon has shown that local immune reaction and the presence of high levels of infiltrating memory cells are correlated with the absence of signs of early metastatic invasion, a less advanced pathological stage and increased survival. The immunological data (type, density, and location of immune cells within the tumor) are better predictors of patient survival than the histopathological findings used in staging colorectal cancer (44–49). In 2018 in Lancet was published the international validation for the Immunoscore as prognostic marker in colorectal cancer (50). In rectal cancer the prognostic value of immune infiltration was proved based on a diagnostic biopsy analysis, with a better response to neoadjuvant treatment in patients with high levels of infiltration (51,52).

Surgery will continue to be influenced by technology and innovation. No matter the choice of surgical approach, the oncological radicality of colorectal cancer surgery has to represent the gold standard in patient management (53).

Conflict of Interest

The author declare no conflicts of interests.

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