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Colorectal polyposis: clinical presentation and surgical treatment

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Introduction

Conditions that increase the risk of CRC include age, a personal and family history of colorectal cancer (CRC) and chronic inflammatory bowel disease, but the main prerequisite for developing cancer is the presence of adenoma [1]. The risk of malignancy in an adenoma depends on its size, grade of dysplasia and number present [2]. Conditions characterised by multiple adenomas are therefore at high risk of developing carcinoma of the large bowel. The most common polyposis disorders include familial adenomatous polyposis (FAP) and the multiple colorectal adenomas (MCRAs) syndromes. This article aims to review the clinical, genetic and treatment aspects of FAP and MCRAs.

Clinical aspects

Familial adenomatous polyposis (FAP)

FAP is an inherited autosomal dominant disease caused by germline mutation in the tumour-suppressor adenomatous polyposis coli (APC) gene, which is located on chromosome 5q21 [3]. FAP affects both sexes equally, occurs in one to two of *22 000* live births and accounts for fewer than 1% of CRC. Most patients with FAP have a positive family history, but approximately 20–30% are due to *de novo* mutation [4]. The diagnosis of FAP relies on the number of adenomas and the family history. Individuals with 100 or more adenomatous polyps or those with fewer than 100 who have a family history of FAP are clinically diagnosed as FAP. First degree relatives of FAP patients should undergo genetic counselling and colonoscopy in early puberty to look for adenomas. The risk of CRC is virtually 100% after 40 years of age in APC mutation carriers [4].

Although colorectal adenomas dominate the clinical phenotype, FAP should be considered a systemic disease. Many FAP patients show extracolonic manifestations, which can contribute to morbidity and mortality. The most frequent extracolonic manifestations include fundic polyps of the stomach, adenomas of duodenum and rarely of the small bowel, desmoid tumours, skin lesions (lipoma, fibroma and epidermoid cysts); osteomas, dental abnormalities, congenital hypertrophy of the retinal pigment epithelium (CHRPE), hepatoblastoma and cancer of the thyroid gland, biliary system and brain [5]. It also known that there is a correlation between the genotype and phenotype. APC gene mutations between codons 1250 and 1463 are associated with more severe forms of FAP [6].

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Multiple colorectal adenomas (MCRAs)

A new type of colorectal adenomatous polyposis has been recently defined, which is characterised by more than ten and fewer than one hundred polyps in the large bowel. It often develops after the fourth or fifth decade of life [7] and in contrast with FAP, it may affect the proximal more than the distal part of the colon [7]. Based on the colonic phenotype, this form of polyposis has recently been defined as the condition known as multiple colorectal adenomas (MCRA). The number of polyps is around 30 and the age at presentation of polyposis in MCRA is 48–53 years [8,9]. The genetic background includes (i) the AFAP (Attenuated FAP), which is the attenuated phenotype of classical FAP with a germline mutation on the APC gene, (ii) the MAP (MYH associated polyposis) whose genetic background is a germline biallelic mutation on the MutYH gene and (iii) when no mutations are found, the polyposis is named wild type MCRA (wt MRCA).

In AFAP polyposis, the disease is mild, with fewer than 100 polyps and is evident usually in the third decade of life. The typical extracolonic manifestations seen in FAP can be present. It accounts for 10–15% of cases of MCRA [10,11]. The percentage of APC mutations found in the series of MCRA increases if more restrictive criteria are applied such as a high number of polyps or family history of polyposis [12,13]. The number of polyps in AFAP has been reported to be 20–50 and the age at presentation of polyposis to be 37–38 years [7,10].

In MAP polyposis, the disease is inherited in a recessive manner and the genetic defect disrupts the base excision repair system that is involved in restoring DNA after oxidative damage [14]. The MAP is responsible in 24–35% of cases of MCRAs [12,15]. The colonic phenotype of MAP and AFAP is often undistinguishable. Rarely, MutYH mutations can be responsible of more severe phenotypes, which is similar to classical FAP. Extracolonic manifestations of MAP are rare [16,17]. The median number of polyps is 36–53 and the median age at presentation 44–46 years, [10,15,18]. In the wt MCRAs, the number of reported polyps is highly variable and depends on the inclusion criteria. Often the adenoma number is lower and the age of diagnosis is older than those reported in AFAP or MAP. Overall, wt MCRAs account for half of all MRCA cases [8,12]. The number of polyps ranges from 27 to 33 and the median age at presentation 50–53 years, respectively [10,12].

Treatment

Familial adenomatous polyposis (FAP)

There is general agreement that patients with FAP should undergo prophylactic colectomy. The surgical options include total colectomy with ileo-rectal anastomosis (IRA) and restorative proctocolectomy (RPC) with an ileo-pouch anal anastomosis (IAA) or in cases with very low rectal cancer conventional proctocolectomy with a permanent an ileostomy. There are no guidelines for the timing of surgery. Considering that the risk of cancer becomes clinically significant after 18–20 years of age and increases over time [4,5], surgery is usually planned after the legal age, unless large polyps or severe dysplasia are found before that time.

Total colectomy with ileo-rectal anastomosis

Compared with restorative proctocolectomy, the advantages of colectomy with IRA are related to the sparing of the rectum. Consequently, patients have better bowel function, quality of life, sexual function and fertility. Moreover, the laparoscopic approach may offer additional advantages because a stepwise approach, which includes an initial colectomy with IRA which can be followed if necessary by RPC in patients with uncontrollable or large rectal polyps developing during follow up [19]. Colectomy with IRA is usually performed in cases with a small number of polyps in the rectum and in patients compliant with a proctoscopic follow-up. Its main disadvantage is related to the risk of rectal cancer, which becomes 50% by the age of 50 years, with an overall cumulative risk of 28.8% after 25 years of follow-up [20].

Proctocolectomy

Restorative proctocolectomy is considered by some surgeons to be the gold standard surgery for patients with FAP [21,22]. The colon and rectum are removed, a reservoir or 'pouch' is constructed from the terminalileum and this is then joined to the anal canal by an ileoanal anastomosis. The pouch can be hand sewn and anastomosed with the anal canal after a mucosectomy of the anorectal stump,or it can be stapled. In this circumstance a stapled anastomosis is performed between the pouch and the top of the anal canal leaving a short segment of mucosa which some believe is beneficial for continence and bowel function [22]. A covering ileostomy was originally considered mandatory (two-stage procedure), but many surgeons may avoid this in selected patients (one-stage procedure). The laparoscopic approach is increasingly used. Advocates of a two-stage procedure point to the risk of anastomotic leakage (5–24%) [23] and the beneficial effect of diversion in the immediate postoperative period when transient incontinence is possible.

Proctocolectomy with permanent ileostomy

This option is limited to the rare patient with a carcinoma at the level of the anorectal junction. It has the clear advantage of eliminating the risk of colorectal cancer, but it still leaves the small bowel and duodenum where carcinoma can occur. Perineal wound infection may result in a persistent sinus [24].

Laparoscopic approach

The main advantages of the laparoscopic approach in colorectal surgery are safety, trauma reduction, improved short-term outcome, less intraoperative blood loss, postoperative pain and immunosuppression, a reduced incidence of small bowel obstruction and incisional hernia formation, and shorter hospital stay. In addition, the cosmetic benefits are relevant in this young population [19]. Another question is the development of desmoid tumours after surgery. They affect approximately 68–83% of patients and in a recent study, open surgery was shown to be an independent risk factor for postoperative desmoid tumour formation [25]. Moreover, the advantages of minimally invasive surgery is supported by fast-track rehabilitation [26].

Laparoscopic surgery for FAP may be performed through multiple ports with a midline or Pfannenstiel incision to permit a mini-laparotomy. Alternatively it can be carried out through a single port. Some surgeons advocate a hand-assisted technique using a hand-port. This has a shorter learning curve because some

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manoeuvres are similar to those used in open surgery [27]. The first single-incision laparoscopic restorative proctocolectomy was reported in 2010 and, in a recent study Costedio *et al.* [28]. showed that this can be safely performed with short-term results comparable to conventional laparoscopy with a significant reduction in the operation time and blood loss. A recent Cochrane Review [29] has however, shown no advantage of laparoscopic over open RPC.

Post-operative management and follow-up

Patients having either colectomy with IRA or RPC require lifetime endoscopic surveillance of the rectum or ileal pouch. Because of the extracolonic manifestations of FAP, patients should also be followed for polyps of the upper gastrointestinal tract and desmoids, which are an important cause of morbidity and mortality [30].

In a series of 206 patients undergoing RPC for FAP the cumulative incidence of adenoma formation in the anorectal stump after a manual ileoanal anastomosis with mucosectomy was 22.6% compared with 51.1% after a stapled anastomosis. There was however only once case of cancer in the entire series [31]. If adenoma formation occurs in the anal transitional zone, a transanal mucosectomy with advancement of the pouch to the dentate line may be possible [32]. In patients having RPC, there is the additional risk of pouch adenoma formation, which increases with the duration of follow-up 7–16% at 5 years to 75% at 15 years. In patients with established malignancy at the original surgery, follow-up is the same as for patients with sporadic colorectal cancer.

After colectomy with IRA, endoscopic surveillance of the rectal stump is recommended at 6–12 monthly intervals, with it being more frequent in patients with large numbers of adenomas [33]. Scattered polyps smaller than 5 mm can be safely observed or removed with biopsy forceps. In cases of severe dysplasia or villous adenoma formation not endoscopically or transanally removable, proctectomy is required.

Multiple colorectal adenomas (MCRA)

The indications for the treatment of patients with MCRAs depend on the symptoms and the risk of invasive colonic carcinoma. Even if patients with MCRAs are genetically heterogeneous, they share a high risk of colonic carcinoma. The risk of malignancy does not reach 100%, as for FAP, so prophylactic colectomy is not the standard of treatment for these patients. Furthermore, part of the colon can be spared from the polyposis, and prevention of invasive carcinoma in some cases can be obtained by right or left colectomy rather than total colectomy. In other cases, repeated polypectomies in patients who are compliant to several endoscopic treatments can be considered adequate treatment as long as all high-risk polyps can be removed.

There are no strong data to drive treatment and the surveillance of MCRAs patients. In the absence of guidelines, recommendations obtained from other inherited diseases (e.g. FAP or Lynch syndrome) are incorporated in follow up for MRCA patients.

Efficient treatment and surveillance is mainly based on the risk of cancer that is related to the disease. If not all the MRCA patients develop carcinoma, it is important to identify risk factors that can be used to stratify patients who are at different risk levels. Unfortunately, data on MCRA from the available literature are often collected for only a portion of the MCRA cases, those with APC or MutYH mutations, and little attention has been given to the majority of MRCA patients, the wild type cases. Moreover, data on follow-up are often lacking and cancer incidence is recorded only at patient enrolment. In addition, the very few papers on treatment do not mention surgical or endoscopic related severe complications for MCRA management. The relationship between the polyposis genotype and the risk of invasive cancer is summarised in Table 1.

The cancer incidence is greater in patients with AFAP or MAP, but this does not mean that this can be used as a criterion for treatment. In a retrospective study [8] of 80 MCRA patients, the incidence of invasive carcinoma was not associated with age, gender, number of colorectal polyps and mutations. The authors' conclusion was that the results of genetic testing could not be used to decide on the management of MCRA patients. This conclusion is supported by other studies on MCRA [10,12]. In contrast with that by Urso *et al.* [8], Knudsen *et al.* [9] found a borderline statistically significant association ($P = 0.05$) between the number of polyps and the presence of invasive carcinoma. This difficulty to correlate the number of adenomas with the cancer risk in MCRA may be explained by the difficulty in the accurate counting the polyps during endoscopy, when there are more than 20 or 30.

In an attempt to obtain data useful for clinical practice, Urso *et al.* [8] compared gender, age, number of polyps and result of genetic testing with the type of treatment received by MCRAs patients at a mean follow up of 74 months [median 43, (1–468) months] from the diagnosis of polyposis. The treatment was divided into three groups of total colectomy irrespective of whether tor not the rectum was spared ($n = 37$), segmental colectomy ($n = 16$) and endoscopic polypectomy ($n = 47$). When only patients without carcinoma are

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Table 1 Colorectal cancer risk reported in series of MCRA patients.

Author/year	Patients, N°	Genotypes APC/MutYH/wt *n*	Cancer incidence APC/MutYH/wt %	Comment
Sieber/2003 [34]	152	0/6/146*	0/50/14	3–100 polyps
Morak/2010 [17]	33	0/33/0	Not tested/33/0	Only APC negative patients
Knudsen/2010 [9]	196	69/not tested/127	11/not tested/38	MutYH not tested
Ponz de Leon/2013 [10]	82	10/30/42	30/46/45	North Italian series
Urso/2013 [8]	80	4/19/57	43 (whole series)	No significant difference in the cancer incidence between genotypes
Filipe/2009 [12]	52	6/18/28	67/67/39	
Nielsen/2005 [15]	170	Not tested/40/130	Not tested/65/45	APC not tested

MCRA, multiple colorectal adenomas; APC, adenomatous polyposis coli; wt, wild type for APC and MutYH.
*Six cases of MutYH mono allelic mutations.

considered (obviously all cancer patients received surgery), only the number of polyps was significantly associated with the type of treatment in both univariate and multivariate analysis.

The study by Knudsen *et al.* [9] is the only other report on the treatment of MCRAs patients. Of 196 who were enrolled in twelve polyposis registers, 64% had undergone surgery (25% segmental resection) at a median of 105 months. Considering that MutYH mutations were not looked for in this study and that 40% of patients had an APC mutation, two observations made by Knudsen *et al.* [9] are of special interest. First, as in the series reported by Urso *et al.* [8], a high percentage (36%) of patients can be managed by the endoscopic approach. In many patients with MCRA, surgery can be avoided for long time, even up to an 8 year median. These results are in agreement with data collected from a large series of MCRA patients from Northern Italy [10] in which half were managed by an endoscopic approach. The second important data from the Knudsen study [9] is the management of the rectum. Only 5 (6%) out 82 patients who had a colectomy with ileorectal anastomosis underwent a subsequent proctectomy during follow up. The rectum is at the 'centre' of any discussion of bowel function and quality of life also because proctectomy is related to more complications than colectomy with ileorectal anastomosis [35]. In FAP there is no consensus on the use of prophylactic surgery in MCRA cases, but considering the MCRA is less aggressive than FAP, if the rectum is spared or contains only a few rectal adenomas, it is reasonable to avoid proctectomy. In a follow up study [20] after colectomy with IRA in a small group of MAP patients, management of the rectum by standard endoscopic surveillance in patients with rectal sparing was without any problem at a median follow up of 5 years [36].

With few data on the characteristics of MCRA patients and their treatment, it is opportune briefly to summarise the pros and cons of surgery and endoscopy in the management of colonic polyposis. Removal of the colon with polyposis at a premalignant stage prevents the significant morbidity and mortality associated with advanced colorectal cancer. The diagnosis of invasive carcinoma during surveillance is a failure of management. On the other hand total colectomy whether open or laparoscopic-assisted, has a complication rate of 20%, a reoperation rate of 5–7% and a perioperative mortality of 1–2% [37]. Endoscopic polypectomy has a lower complication rate (bleeding 0.3–0.6%, delayed bleeding 2%, perforation 0.3–0.4%) [38–41] but for MCRA, endoscopic procedures have to be repeated several times, which is likely to increase the overall morbidity. When, during endoscopic management, an early invasive carcinoma with more than just the most superficial submucosal invasion (T1, American Joint Committee on Cancer, AJCC) [42], the probability of nodal metastasis is 6–13% [43,44] with the risk being independent of tumour size [44]. This means that a small, but not negligible percentage of patients under surveillance, who are managed without colectomy will have an AJCC stage III tumour [42]. The natural limit of endoscopy in excluding long-term cancer burden for patients with large numbers of adenomas may be an indication for prophylactic colectomy in patients at low operative risk in whom a 'clean colon' is difficult to achieve. In the retrospective analysis by Urso *et al.* [8], the authors calculated a receiver operating characteristic (ROC) curve that showed that surgery was more likely in patients with more than 25 polyps.

Chemoprevention plays a small role in the management of MCRA. Aspirin, celecoxib and calcium may reduce the recurrence of adenomas and incidence of

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advanced adenomas in individuals with an increased risk of CRC [45]. COX-2 inhibitors have been used in FAP to reduce the number of adenomas, especially in the duodenum and there is some evidence that aspirin can reduce the incidence of CRC in the general population. There is no evidence that the administration of non-steroidal anti-inflammatory drugs (NSAID) or calcium is an effective treatment in patients with MCRA. NSAID and calcium could be important, combined with standard endoscopic surveillance, following colectomy with ileorectal anastomosis in reducing the rectal polyp burden [45].

The treatment of large bowel polyposis mainly depends on the assessment of the cancer risk. In classical FAP this is approximately 100% over adult life and owing to this, prophylactic colectomy is widely accepted. There is, however, still debate about whether the rectum should or should not be retained. The decision depends on the severity of rectal polyposis, the likely compliance of the patient with endoscopic follow up, and the type of mutation.

There is no standard management for patients with MCRAs, with or without APC or MutYH mutations and there are no treatment guidelines. Management is tailored according to the number, size, and distribution of adenomas, the severity of dysplasia, age of the patient and operation risk. Compliance with repeated endoscopic procedures is an additional factor to be considered in the decision-making process.

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Conflicts of interest

None.

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