


## Relationship Between Colorectal Carcinoma and Adenoma Detection Rate by Colonoscopy

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### Abstract

**Introduction:** In recent years, the incidence of colorectal cancer has declined dramatically. Screening programs, based on endoscopic resection of polypoid precancerous lesions, have fulfilled a fundamental role in this improvement.

**Methods:** The present work took the form of a retrospective observational study of a set of patients who had undergone endoscopic resection of colonic polypoid lesions between January 2007 and December 2012. We analyzed the rate of polyps per colonoscopy, number of patients, follow-up time, and relationship with later cancer appearance.

**Results:** The study population was composed of 841 patients, including 357 women (42.4%) and 484 men (57.65%), with a sum of 7007 colorectal polyps and a mean follow-up of  $66 \pm 21.84$  months. During the follow-up period, 12 patients were diagnosed with colorectal cancer; these patients were not significantly different relative to the remaining patients in terms of rate of polyps per colonoscopy, number of advanced adenomas ( $Z=0.11$ ,  $P=0.91$ ), and total adenomatous polyps ( $Z=1.84$ ,  $P=0.07$ ). Nevertheless, we could see that patients without colorectal cancer had a lower rate of advanced adenoma polyps per colonoscopy ( $Z=4.61$ ,  $P<0.001$ ) and a lower raw number of polyps ( $Z=7.09$ ,  $P<0.001$ ).

**Conclusion:** When comparing rates by number of patients, number of colonoscopic explorations, and follow-up time, the advanced adenoma rate was found to be higher in patients who later developed colorectal carcinoma. We conclude that perhaps the recommended follow-up intervals should be shortened slightly, paying special attention to follow-up in those patients who have AAs in the initial colonoscopy.

**Keywords:** Colonoscopy, Colorectal adenoma, Endoscopic polypectomy, Colorectal carcinoma

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## Introduction

The incidence of colon and rectal cancer has decreased in recent years in Western and developed countries; since 1999, the percentual increase has been 6.7% in men and 5.1% in women (1, 2). In Europe, the annual incidence of colorectal carcinoma (CRC) is 35-55 per 100,000 inhabitants, with an average patient age of 65-71 years. CRC is the second leading cause of death from cancer in Europe among both sexes (3). In the previous year, the annual incidence of CRC in Spain was 77 per 100,000 inhabitants, with a total of 325,494 cases reported (4).

About 75% of CRCs are diagnosed via screening programs in the asymptomatic population, who lack all risk factors other than age (5). The rest occur in those with a family or personal history of CRC, presenting adenomatous polyps in colonoscopy or having polyposis syndromes. Despite the high prevalence, mortality related to CRC has experienced a significant decline from 1990 to 2007 (6). This is mainly due to two factors: the implementation of screening programs, and the prevention of CRC through early diagnosis and endoscopic resection of polypoid lesions. Unlike other types of cancer (e.g., breast, lung, and prostate), CRC originates from a premalignant lesion (adenomatous polyp), which can be eradicated to prevent cancer development (7).

In this study, we present a series of patients who underwent endoscopic polypectomy with a periodic follow-up by means of colonoscopy. In our analysis, we attempted to determine the relationship between the polypoid lesions found (adenomatous polyps/advanced adenoma) and the development of CRC.

## Material and Methods

The present work was a retrospective, descriptive, observational study, with its known limitations. The study was performed on patients who underwent colonoscopic polypectomy between January 1, 2007, and December 31, 2012, belonging to the area of influence of our hospital (Prince of Asturias University Hospital, Alcalá de Henares, Madrid, Spain). Among this population, all patients who had been followed-up on for at least 3 years were eligible for inclusion. All colonoscopies were performed by physicians specialized in the digestive system. The exclusion criteria were: a history of inflammatory bowel disease (Crohn's disease, ulcerative colitis, or indeterminate colitis), previous CRC, polyposis, presence of serrated polyps, previous surgery, or incomplete/poorly prepared colonoscopy (Boston scale less than or equal to 6 points).

For each patient, we analyzed the gender and the reason for colonoscopy as qualitative variables, while quantitative variables included age, date of the first colonoscopy, number of total colonoscopies performed during follow-up, date of subsequent

colonoscopies, total follow-up time, the interval of follow-up, number of total polyps resected, number of adenomas excised, number of resected advanced adenomas (AAs) and number of resected hyperplastic polyps (in each colonoscopy and in total), and number of CRCs found after the end of the three years of follow-up.

The main variable of the study was the number of AAs found in the sample. An advanced adenoma is a polyp that fulfills at least one of the following three characteristics: size equal to or greater than 10 mm, high-grade dysplasia, or a villous component in the structure. The detection of three or more adenomatous polyps in one exploration was compared with that of presenting an advanced adenoma during the study period.

## Statistical Methodology

The arithmetic mean and the median of the quantitative variables was used as statistical centralization parameters. As dispersion measures, the standard deviation was chosen for quantitative variables; for variables such as the follow-up interval, the range, minimum, and maximum were also reported. For the description of each qualitative variable, the absolute and relative frequencies were calculated.

All comparisons were made for two independent samples. For continuous quantitative variables, when comparing two independent samples, the student t-test was used; the classic test was applied if homogeneous variances could be assumed, and the Welch test was used otherwise. For dichotomous qualitative variables, when comparing two independent samples, the Chi-square with Yates continuity correction was used. In the case of small sample sizes, Fisher's exact test was utilized.

In situations in which the comparison of samples alluded to rates (according to the number of patients, follow-up time, or the number of colonoscopies), the Poisson comparison test was used, approximated by the normal when possible with its corresponding correction for continuity.

All data were recorded through spreadsheets of the Microsoft Excel® 2010 program. The statistical analysis was subsequently performed using IBM SPSS Statistics 24.0. Significance levels were established at 0.1%, 1%, and 5%, expressed as  $P < 0.001$ ,  $P < 0.01$ , and  $P < 0.05$ , respectively.

## Results

A total of 3198 patients were analyzed. After applying the inclusion and exclusion criteria, 2357 patients were discarded, leaving 841 subjects to study, of which 357 were women (42.4%) and 484 were men (57.6%). The average age was  $59.3 \pm 10.3$  years. A total of 3079 colonoscopies were performed during the study, of which 1220 (39.6%) were performed on women and 1859 (60.4%) on men. The average

number of colonoscopies per patient was  $3.7 \pm 1.3$ . The mean follow-up of the series was  $66 \pm 21.84$  months.

The reasons for requesting a colonoscopy included a family history of CRC (23.5%), rectal bleeding (22.4%), alteration of intestinal rhythm (18.6%), anemia (10.5%), abdominal pain (9.4%), and others (15.6%). A total of 7007 colorectal polyps were analyzed, of which 4575 (65.3%) were resected in men and 2432 (34.7%) in women. In men, 1605 adenomatous polyps, 463 AAs, and 2507 hyperplastic polyps were described. In women, 880 adenomatous polyps, 207 AAs, and 1345 hyperplastic polyps were detected. During the follow-up, 12 cases of CRC were diagnosed, including six patients of each gender.

In a deeper analysis, we obtained the ratios of total polyps per colonoscopy, AAs per colonoscopy, adenomas per colonoscopy, and hyperplastic polyps per colonoscopy, as well as their measures of centralization (mean and median) and dispersion (standard deviation). In addition, we also calculated the rate of polyps, hyperplastic polyps, adenomas, AAs, and CRC according to gender. The time intervals between each one of the patients' colonoscopies were tabulated, as well as the time of appearance of AA or CRC, according to the case.

The total number of AAs was evaluated against the total number of adenomas per gender, calculating the mean for each of them. The relationship between the follow-up time (months between the first and last colonoscopy) and the number of colonoscopies performed was also analyzed, as well as the presence or absence of CRC during the follow-up in relation to (i) the number of colonoscopies, (ii) the follow-up time (measured in months), and (iii) the gender. Finally, the relationship between the number of AAs and the total number of adenomas within the patients who developed CRC during the follow-up was analyzed, as well as their relationship with the time of follow-up, number of colonoscopies, and sex.

Next, the relationship between the appearance of CRC and the presence of AA was studied, as well as its possible usefulness in colonoscopic follow-up. The Poisson comparison was used for two independent samples (comparison of rates), using the normal Z approach when necessary, reflecting the

rates of total polyps as AA in relation to the number of colonoscopies, as this scale is most reflective of the greater or lesser relative presence of polyps.

We found statistically significant differences both for the presence of AAs ( $Z=4.46$ ,  $P<0.001$ ) and for the total number of polyps (AA and other adenomas) ( $Z=7.24$ ,  $P<0.001$ ) when comparing their rates per number of colonoscopies performed in each gender group. We also obtained significant differences when analyzing the relationship between the development of CRC and the AA rate by colonoscopy ( $Z=5.06$ ,  $P<0.001$ ). However, we did not find any statistically significant difference when analyzing the relationship between the development of CRC and the rate of total adenomatous polyps per colonoscopy ( $Z=1.01$ ,  $P=0.31$ ) (Table 1).

In our work, we found significant differences between men and women; there was a greater number of AAs in men and there were significant differences in relation to sex when the CRC developed during the follow-up of AA ( $P=0.003$  in men and  $P<0.001$  in women). However, these differences were not found while trying to establish a relationship with the total number of adenomatous polyps ( $P=0.10$  in men and  $P<0.93$  in women). In addition, men had a higher number of total polyps.

A statistically significant relationship was found between the presence of AAs and CRC. AAs were more common when CRC developed than when CRC development was not observed both in men and women. Although there was a higher rate of AAs in men than in women, this was only in general. Thus, among the patients who developed CRC, there was no statistical difference for the rates of AAs ( $Z=0.11$ ,  $P=0.91$ ) and total adenomatous polyps ( $Z=1.84$  and  $P=0.07$ ) per colonoscopy. However, it was noted that patients without the development of CRC during the follow-up had lower rates of AAs ( $Z=4.61$  and  $P<0.001$ ) and polyps ( $Z=7.09$  and  $P<0.001$ ) in general per colonoscopy (Table 2).

We also wanted to study the relationship between AA lesions in the initial colonoscopy and the presence of AA in follow-up colonoscopies, for which we divided the patients into two groups (Table 3). These groups were comprised of patients who

**Table 1:** Relationship between sex, CRC, advanced adenomas and total adenomas.

	Men	Women	Total
Patients	484	357	841
Follow-up (months)	32926	22512	55438
Number colonoscopies	1859	1220	3079
Advanced adenomas	469 (0.25)	213 (0.17)	682 (0.22)
Total adenomas	2976 (1.60)	1558 (1.28)	4534 (1.47)
	CRC	No CRC	Total
Patients	12	829	841
Follow-up (months)	572	54866	55438
Number colonoscopies	32	3047	3079
Advanced adenomas	21 (0.66)	661 (0.22)	682 (0.22)
Total adenomas	54 (1.69)	4480 (1.47)	4534 (1.47)

CRC: Colorectal carcinoma; AA: advanced adenomas

**Table 2:** Relationship between sex, advanced adenomas, total adenomas in patients with CRC.

<b>CRC</b>	<b>Men</b>	<b>Women</b>	<b>Total</b>
Patients	6	6	12
Follow-up (months)	258	314	572
Number colonoscopies	16	16	32
Advanced adenomas	11 (0.69)	10 (0.63)	21 (0.66)
Total adenomas	34 (2.13)	20 (1.25)	54 (1.69)
<b>No CRC</b>	<b>Men</b>	<b>Women</b>	<b>Total</b>
Patients	478	351	829
Follow-up (months)	32668	22198	54866
Number colonoscopies	1843	1204	3047
Advanced adenomas	458 (0.25)	203 (0.17)	661 (0.22)
Total adenomas	2942 (1.60)	1538 (1.28)	4480 (1.47)

CRC: Colorectal carcinoma

**Table 3:** Relationship between patients with AA.

	<b>Patients (First colonoscopy)</b>	<b>AA in follow-up</b>	<b>Ratio Patient/AA</b>	<b>P</b>
Patients with AA	293	112	0.38	<0.001
Patients without AA	548	84	0.15	
Total AA	841	196	0.23	
Men with AA	181	82	0.45	<0.001
Men without AA	303	49	0.16	
Total men	484	131	0.27	
Women with AA	112	30	0.27	<0.001
Women without AA	245	35	0.14	
Total women	357	65	0.18	

CRC: Colorectal carcinoma; AA: advanced adenomas

presented an AA in the first colonoscopy and those patients who did not. In the first group, 293 patients were diagnosed (181 men and 112 women; 34.8% of the total). Of these, 70 patients (8.3%; 48 men and 22 women) presented AAs in the follow-up. The remaining 548 patients (65.1%) did not present AAs or had low-risk adenomas or hyperplastic polyps. In this first group, 474 AAs were resected after follow-up (70.7%). In the second group, we found 548 patients (303 men and 245 women; 65.1% of the total). Of these, 64 patients (7.6%) presented AAs in the follow-up colonoscopies.

A total of 670 AAs were diagnosed in the 841 patients, which corresponds to an AA rate per patient of 0.79. Of the 670 AAs, 474 (70.7%) were diagnosed in the first or baseline colonoscopy. The remaining 196 AAs (29.3%) were diagnosed in the follow-up colonoscopies. For the group of men, we calculated an Odds Ratio (OR) of 2.76 (95% CI: 1.70-4.48); in this same group, the Poisson comparison of the rates of AAs showed significant differences ( $Z=5.93$  and  $P<0.001$ ). For the group of women, we obtained an OR of 1.82 (95% CI: 0.99-3.32), which was close to statistical significance. As in men, with respect to the Poisson comparison of AA rate, we found statistically significant differences ( $Z=2.53$  and  $P=0.011$ ). Finally, in the total number of patients, we observed an OR of 2.37 (95% CI (1.63-3.45) for the appearance of AAs in the follow-up colonoscopies based on having presented AA in the baseline colonoscopy, and statistical significance was also seen with respect to

the Poisson comparison of the rates of AAs ( $Z=6.53$  and  $P<0.001$ ). Thus, we found statistically significant differences in relation to the presence of AA found in the first exploration, concluding that the presence of one or more AAs in the baseline colonoscopy was related to the development of single or several new AAs in the follow-up colonoscopies; this relationship was clearly demonstrated in men and was probable in women.

Finally, we analyzed the follow-up intervals in patients who developed CRC. In our study, 3079 colonoscopies for 841 patients were included. Precisely 72.7% of the colonoscopies ( $n=2238$ ) were repeated during follow-up based on the findings found in the first colonoscopy (baseline colonoscopy). In this section, we could not assess the fulfillment of the intervals between the baseline colonoscopy and the following ones since criteria were not followed uniformly when choosing the moment of repetition, leaving that decision in each doctor's hands.

Of the 12 cases of CRC diagnosed during follow-up, 6 occurred in women and 6 in men. The mean time of appearance of CRC after baseline colonoscopy was  $47.5\pm 26.77$  months, finding the earliest CRC nine months after the first colonoscopy and the latest one 111 months after that baseline colonoscopy. When we calculated these same results based on the number of colonoscopies performed until the appearance of CRC, we found that the mean value time between colonoscopies was  $31.7\pm 16.14$  months (range: 9-60 months).



Regarding the rest of the patients in the sample, who did not develop CRC, we found that the average interval between colonoscopies was  $29.98 \pm 14.93$  months with a minimum value of 5.5 and a maximum of 82.1. Using the student t-test for independent samples, in this case for homogeneous variances ( $P=0.30$ ), we found that there were no significant differences between the follow-up intervals between the group of 12 patients who developed CRC during follow-up and the rest of the sample ( $P=0.69$ ).

## Discussion

At the beginning of the 20th century, there was a major concern about the origin of CRC. The hypothesis that CRC originates from adenomatous mucosae was established and derived from the works published by Lockhart-Hummery and Dukes (8). Despite this, it will not be until 1984 that Morson hypothesized that CRC is derived from polyps, thus establishing the adenoma-carcinoma sequence for the first time (9-11).

Subsequently, and thanks to the development of the colonoscopy in the mid-70s (8), Wolff and Shinja were able to remove polypoid lesions for the first time by colonoscopy (12). In 1993, and as a consequence of the National Polyp Study, the adenoma-carcinoma hypothesis was proven. Currently, the adenoma-carcinoma sequence described for adenomatous polyps is regulated by mutations in the APC gene, though it appears that other polyps such as serrated polyps do not follow this pathway but rather are based on a different sequence revolving around mutations in the BRAF gene (13).

The first studies were conducted in the United States by Mandel, Bond, and Church (14) and later in Europe by Hardcastle and Kronborg (15, 16). In these studies, asymptomatic patients underwent a fecal occult blood test. If the result was positive, they entered a group of patients who underwent a colonoscopy to rule out lesions with hemorrhagic potential such as polyps or tumors. With these studies, the authors demonstrated that the screening programs had a significant impact on minimizing the incidence and mortality of colorectal cancer; specifically, mortality was reduced by 33% in the United States and by between 13-15% in Europe (8, 17, 18).

However, it was not until 1997 when screening colonoscopy was introduced in the guidelines first by Fletcher and Winawer and then by the American Cancer Society (ACS) (8). These guidelines classified individuals at high and low risk of developing CRC based on the number of polyps resected in the colonoscopy, as well as their size and histopathology (particularly the presence of dysplasia). Currently, the European Society of Gastrointestinal Endoscopy (ESGE) and American Gastrointestinal Association (AGA) guidelines are implemented.

Over time, follow-up recommendations for

colorectal polyps have varied according to different authors and societies. Since 2006, following the recommendations of the ACS and the United States Multi Society Task Force (USMSTF), patients were stratified after colonoscopy into two groups, the first in which colonoscopy should be performed in an interval between 5 and 10 years and a second group with a 3-year recommendation (19, 20). It was in 2012 when the follow-up guidelines for colorectal adenomas underwent an update and the European Guide for Endoscopic Quality of Screening and the European Society of Gastrointestinal Endoscopy (ESGE) added a third more restrictive group in which colonoscopy was to be repeated after only 1 year.

The National Polyp Study (NPS) has been the reference study for the elaboration of our work. The NPS was a multicenter study that aimed to assess the risk of development of CRC and the performance of colonoscopy intervals based on the findings of the former. Our work deals with a retrospective series of patients who underwent endoscopic polypectomy in a single hospital center, facilitating an evaluation of the profitability of colonoscopy and an analysis of the proper time interval of follow-up colonoscopy in accordance with the risk of CRC. As described by O'Brien et al., the exclusion criteria of the NPS were patients who presented a personal history of CRC, inflammatory bowel disease, or familial polyposis (21). The mean age of the patients in the NPS was  $62 \pm 11$  years, which is similar to that of ours ( $59.2 \pm 10.28$  years). In the NPS, a higher frequency of adenomas was observed in men (61.6%) compared with women (38.4%), corresponding with our rate of 66% for men and 34% for women.

Another data analyzed was the percentage of patients who presented a single adenoma in the baseline colonoscopy versus those patients who presented multiple adenomas (three or more). In the NPS, it was observed that 59.4% of the patients presented a single adenoma in the baseline colonoscopy, while in 40.5% of the patients more than one adenomatous polyp was excised (22-24). We have seen that this percentage was different in the Barreda series of 684 patients, in which 1057 polyps were studied (25). In that study, the percentage of patients with a single resected polyp vs. multiple polyps was 70% vs. 30%. In our series, we found that 174 patients (20.6%) had a single adenoma in the baseline colonoscopy compared with 459 patients (54.5%) who were diagnosed with at least three or more adenomatous polyps. In the NPS,  $1.8 \pm 1.4$  adenomatous polyps were described per patient. In our study, this value was clearly higher, with  $4.6 \pm 5.6$  adenomas per patient.

The NPS showed a 66.5% proportion of adenomatous polyps and an 11.2% proportion of hyperplastic polyps, with the remaining 33.3% corresponding to polyps of another histology or fragments of normal colonic mucosa (21, 22). We

described 35.46% hyperplastic polyps and 64.46% adenomatous polyps (including AAs).

Focusing on the histology of the adenoma, we observed a greater number of tubular adenomas and tubulovillous adenomas compared with the figures described in the NPS. In our study, we found a 92.1% proportion of tubular adenomas (58.9% of all excised polyps), 7.1% tubulovillous adenomas (4.6% of all excised polyps), and 0.83% villous adenomas (0.5% of all excised polyps). Authors such as Bacchuddi described similar relationships, i.e., 87% tubular adenomas, 8% tubulovillous adenomas, and 5% villous adenomas (26).

Considering the size, we found that in our study, a greater number of small polyps ( $\leq 5$  mm) were removed when compared with the NPS data (22, 23). In the NPS, 37.6% of small polyps were resected, compared with 82.28% in our series. This may be because the NPS was a study performed between the 80s and 90s, where the resolution of the colonoscopy equipment was less precise and the smaller lesions went unnoticed. On the contrary, we observed that the percentage of polyps of medium (6-9 mm) and large ( $\geq 10$  mm) was lower in our series. It is possible that the previous extirpation of lesions of small size averted the development of lesions of greater size in the follow-up. This matter is explored further when comparing the rate of failed polyps in the baseline colonoscopy.

Finally, in relation to the distribution of the excised polyps, we found a distribution similar to that previously described in the NPS. We only observed a smaller number of polyps in the sigmoid colon (22.5% vs. 43% described in the NPS), whereas a higher number of polyps were present in the rectum relative to the NPS (19.9% vs. 8.1%). Regarding size, we observed, as in the NPS, that resected polypoid lesions proximal to the splenic angle were smaller than those distal to this point ( $4.28 \pm 3.64$  and  $4.40 \pm 4.25$  mm, respectively). As in most studies, we observed a proportional relationship between size and hairy histology with an ulterior finding of high-grade dysplasia.

In our study, we did not observe a specific pattern of follow-up recommendations for colorectal adenomas by different physicians, though there was a tendency to produce intervals for the repetition of the colonoscopy closer to the time of the baseline colonoscopy than guidelines suggest. We wanted to take advantage of this situation to study the efficacy of this practice as well as its relationship with the appearance of CRCs. Despite the recommendations of the different guidelines (both European and American), 30% of the total colonoscopies of the screening programs are related to the follow-up (27). In our work, from a total of 3079 colonoscopies, 2238 were follow-up colonoscopies, assuming 72.7% of the total.

The mean time of repetition of the colonoscopy was  $30 \pm 15.06$  months (2.5 years). Our work presents

a mean follow-up per patient of  $65.9 \pm 21.84$  months (approximately 5.5 years). Authors such as Macrae and Williams followed 330 patients who underwent polypectomy by colonoscopy for 3.6 years (28). Aubert et al. followed 123 patients for 10 years while Faber and Hedberg followed 383 patients for an average of 4 years (29). In relation to the number of patients at follow-up time, we believe that our work represents one of the largest series of patients undergoing endoscopic polypectomy.

When comparing the appearance of AAs in the follow-up colonoscopies based on having presented AA in the baseline colonoscopy, we found an OR of 2.37 (95% CI: 1.63-3.45). Avila et al. established an equally significant association between the possibility of developing new AAs in colonoscopy after three years in those patients who already had one (OR=1.96; 95% CI: 1.147-3.349) (19). Avila et al. divided patients into two groups: follow-up at three and five years both in the group that had AA in the first colonoscopy and in the group in which AA was not found. In our retrospective study, given the variability of the follow-up intervals, we decided to evaluate the same association by studying the behavior in both men and women, without taking into account the time of completion of the second exploration and found a statistically significant association in those patients who presented an AA in the initial colonoscopy. Coinciding with what is described in the literature, we observed a greater total number of polyps (including AAs) in men. However, Heisser et al. proposed that after performing a colonoscopy without the presence of polyps, it could be repeated 10 years later without increasing the risk of AAs or CRC (30).

A failed polyp, as defined by Taek, is one undiagnosed (and therefore not excised) in the first colonoscopy but found and excised in the follow-up colonoscopy; we compared the rate of failed polyps in our series (3.06% for men and 2.18% for women; overall=2.69%) with the results described and accepted in the literature, ranging from 15 to 24% (31). Polyps of flat morphology, adenomas, and AAs (of smaller size) have a higher rate of failure in the detection of the first colonoscopy than pedunculated lesions. The diagnostic rate of CRC at 3-5 years after performing a colonoscopy (with the removal of all visualized polypoid lesions) has been described between 0.5-5%. These tumors would arise from inadvertent lesions in the colonoscopy, which could suggest shorter intervals between colonoscopies than those recommended by the guidelines.

Authors such as Ratuapli et al. suggest that repeating follow-up colonoscopies earlier than the recommended may increase the healthcare costs, while delaying the follow-up may lead to an increased rate of CRC development (32). In our study, we observed that the average interval between colonoscopies was  $31.7 \pm 16.14$  months in those patients who ended up developing CRC, with a statistically

similar timeframe of 29.98±14.93 months being seen in those who did not develop CRC. If we had carried out the next exploration after a year and a half, we would have lost only one of the patients in our sample in the diagnosis. The latest updates to the recommendations, published in 2018, recommend discontinuing follow-up colonoscopies in patients older than 80 years (or older than 75 years with considerable morbidity) or deferring it by 10 years in those who have undergone less than 3 polypoid lesion removals, with none of them being AAs (33, 34).

## Conclusion

Patients who presented an AA in the first colonoscopy had a greater risk of presenting new AAs in the following examinations than those patients who did not present an AA in the baseline colonoscopy. The rate of AAs was higher in patients who developed CRC when considering it according to the number of patients, number of colonoscopies performed, and time of follow-up. There were no significant differences between the patients who developed CRC and those who did not with respect to the total number of adenomatous polyps found. Men who did not develop CRC during the follow-up period had a higher number of AAs and adenomatous polyps than women. However, there were no significant differences between men and women who developed

CRC in relation to the number of AAs found. Finally, the physicians showed low adherence to the follow-up recommendations after endoscopic polypectomy established by the international societies, maintaining a tendency to perform a second colonoscopy earlier than advised.

Performing follow-up colonoscopies earlier than the recommendations may increase the healthcare costs, while delaying the follow-up may lead to an increased rate of CRC development. In our study, we observed that the average time between colonoscopies was similar between those who did and did not develop CRC. If we had carried out the next exploration after a year and a half, we would have lost only one of the patients in our sample in the diagnosis.

Despite the low rate of CRC development observed, we believe that perhaps the recommended follow-up intervals should be shortened slightly, paying special attention to follow-up in those patients who have AAs in the initial colonoscopy. Notably, according to the distribution obtained in our series of patients with CRC, the realization of a colonoscopy between 24 and 36 months after the first one would only have led to a delayed diagnosis in three of the twelve CRC patients (25%).

**Conflicts of interests:** None declared.

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