

No Interval Cancers in Endoscopic Practice

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ABSTRACT: Colonoscopy is long time the most preferred method for CRC screening along with diagnosis and treatment for a range of colon diseases. Based on its difficulty in visualizing precursor CRC lesions, mostly those located on the right colon, this method can be subject of improvement. The colonoscopy quality can be influenced by many factors such as colon preparation, retraction time, the colonoscopists medical training and knowledges as well as the performance of endoscopy equipment. The bad quality of colonoscopy will result in the emergence of interval cancers defined, based on the author, as cancers that appear at 3-5 years up to 10 years from the colonoscopy procedure. Interval cancers have predominantly incriminated both the colonoscopy quality and the clinician competences and less the tumor biology. Subsequently there were set quality indicators of colonoscopy in order to raise the quality of the exploration. Among the important indicators, proving their utility in studies, the ADR (adenoma detection rate) is most commonly used along with PDR (polyp detection rate) and APC (adenoma per colonoscopy). Following the purpose of obtaining a higher colonoscopy quality the medical units should keep in check all indicators. Furthermore, there should be an active involvement in an additional training of non-conforming medical personnel or even restrain of practice, given the medical legal actions that have interval cancers as a main cause.

KEYWORDS: Colonoscopy, quality indicators, interval cancer, ADR, PDR, APC

Introduction

Colonoscopy is long time the most preferred method for CRC screening.

Although colonoscopy proved its efficiency in lowering the CRC incidence and mortality rate, recently limitations of colonoscopy were described in premalignant lesions identification, mainly for those located on the right colon.

This outcome is due to interval cancers emergence, which are diagnosed for patients who went under colonoscopy screening in the past.

Published studies carried from 2006 and up to the present show a CRC interval prevalence ranging from 0.09% to 9%, which highlights a significant variation between studies.

The variation is caused by multiple factors: [1] differences between study types, retrospective or prospective, [2] different definitions of interval CRC, appearing at 3-5 years in some studies and 10 years in others, [3] the types of operated data, both administrative and clinical data, [4] type of studied populations, screening vs. diagnosis indication, [5] different specialties of the endoscopists.

Regardless of being described multiple factors in the appearance of interval CRC (missed lesions, different tumor pathogenesis, incomplete resected lesions during previous colonoscopies), there is a tendency in incriminating the colonoscopy quality and the

clinician specialties which has led to a growth in medical legal implications.

Apart from that even the most experienced colonoscopists miss a great number of preneoplastic lesions [1].

Based on a review analyzing six studies there was shown a rate of 22% for missed polyps of any size [2].

By comparison, another study carried on CT colonography efficiency for visualization of polyps bigger than 1cm reported a lesions missing rate of 12% [3].

Additionally, the colonoscopy quality is influenced by the patient who should accept the preparation and apply it as indicated by the doctor [4-6].

Most important indicators of quality, according to the guides in force, will be described in the present review.

However, is the clinicians duty to periodically evaluate their own performances as well as improving the colonoscopy quality by all means necessary for the patient well being.

Interval Cancers

Interval Cancers represent a recent issue in the medical practice [7-10].

These are cancers developed from missed premalignant lesions during previous colonoscopies [11].

Studies have shown that 4-5% of CRC evolve from the prior mentioned cause [7,8].

Moreover, recent studies emphasize a rise of interval cancer incidence between 0.09-9% [9,10].

This variation is determined by multiple factors: [1] differences between study types, retrospective or prospective, [2] lack of an unanimous accepted definition, appearing at 3-5 years in some studies and 10 years in others, [3] the types of operated data, both administrative and clinical data, [4] differences among indications of colonoscopy procedure, aimed for screening or diagnosis [5] diverse specialties of the medical practitioners [12].

Most of the studies carried in the past were limited by the deficit of information. Except for the missed lesions during colonoscopies, which will further be explained, there are other factors that seem to be responsible for the interval CRC development [1].

Arain et al. proved that the link between MSI and CIMP presence in association with CRC of proximal colon was significantly stronger than the association with CRC of left colon [13].

Sawhney et al. likewise proved that MSI would associate with interval CRC 3.7 times more frequently than with a non-interval cancer [14,15].

Yet, according to Shaukat el al, BRAF mutation is not characteristic for interval CRC [16].

As a current interest in nowadays studies is the serrated pathway for carcinogenesis of CRC, implying the higher potential of malignant transformation for adenomatous serrated polyp in comparison with conventional adenomas [15,17].

Adenomatous serrated polyps are mainly located along ascendant colon, having MSI and phenotype CIMP [15].

The New Hampshire Colonoscopy Registry study suggests a raise in the identification of serrated polyps by 30% while the retraction time was prolonged by 9 minutes [18].

Between Conform National Polyp Study and other studies is accentuated the contribution of colonoscopy to the lowering of CRC incidence [19], but at the same time the lowering of mortality rate by CRC ranged only within 37%-67% [4,5,20].

Quality Indicators for Colonoscopy

Quality indicators for colonoscopy are as follow:

1. Preprocedure quality indicators
2. Intraprocedure quality indicators
3. Postprocedure quality indicators [21]

Preprocedure quality indicators

1. Determining a precise indication for which the colonoscopy is carried. Currently there are well established indications for performing colonoscopies which are published in treatment guidelines [22].

In case of performing a colonoscopy for polyp monitoring or even CRC screening with moderate risk it is highly required specific documentation of former same type procedures along with the date on which they were effectuated and histopathology results, in case the patient history form exists.

The aim of this regulation is to diminish the number of colonoscopies made without a clear indication [23-25].

2. The informative consent must be signed by the patient each time the colonoscopy is made and it has the aim of informing the patient about all risks associated with the colonoscopy procedure [21].

3. Frequency of regular checkups and post-op and post polypectomy colonoscopy.

Commonly, colonoscopy it is recommended every 10 years for patients over 50 years old without any additional risk factors following CRC diagnosis [26-28].

A German study has pointed out how for a period of 20 years, a negative colonoscopy can be associated as a protection factor against CRC [29].

In the Unites States the medical specialists lean towards an interval of 5 years for patients under moderated risk of developing CRC [30].

Usually, in actual practice post polypectomy colonoscopies are performed more frequently, contrary to the guideline indications [30].

When it comes to 2cm size sessile polyps which can be removed with piecemeal method, it is indicated that the first follow-up colonoscopy be appointed at a time distance of 3-6 months, postdated by a second one after one year [31].

And for patients having hyperplastic polyposis syndrome the colonoscopy is required once at 1-2 years [26].

Not the least, in case of colon bleeding after following a negative colonoscopy the patients are recommended to be submitted to another examination under a shorter time table than the initial one.

4. Colonoscopy assessment for ulcerative colitis and Chron disease.

Despite the rarity of CRC cases emerged on an inflammatory disease, colonoscopy assessment is indicated in 2-3 years for patients

having the history disease of 10-20 years, without primary sclerosing cholangitis and severe intestinal damage [32].

Patients with longer disease activity or additional risk factors in CRC development (family history), might need shorter intervals between colonoscopies.

Intraprocedural Quality indicators

A qualitative colonoscopy is achieved only when all segments of the colon are intubated, thus the entire mucosa can be visualized without being necessary further explorations.

5. The quality of colon preparation. The colon is believed to be well prepared as long as it allows lesion visualization, and polyps bigger than 5mm [33].

Inadequate preparation is associated with ADR (adenoma detection rate) and PDR (polyp detection rate) being under quality standards [34-37].

As documented in a recent report there is an association between high quality bowel preparation, even the intermediary one with a significant high ADR [38].

On the overall, both intermediate and high preparations are predominantly similar [39].

Along a retrospective study carried among 133 patients, who went under inadequate preparation for the first colonoscopy, it was reviewed a miss rate adenomas of 48% in comparison with the colonoscopy re-effectuated under proper preparation [40].

Consequently, whenever the colonoscopy is performed for CRC screening and has a preparation that fails to allow an accurate identification of polyps bigger than 5mm, a re-evaluation should be suggested in less than a year.

A significant important factor in quality preparation is represented by the use of split-doses which must be administrated the day of the examination and have half or one third of the dosage [41].

It is best to drink the whole container rapidly rather than sipping small amounts continuously [42].

Usually the second split-dose has to be consumed 4-5 hours before the actual colonoscopy in the same fashion as the first dose, but no longer than 2-3 hours since the beginning of the first sip. In some cases the entire dosage must be swallowed on the course of a day but only if the colonoscopy will be performed that same day, in the afternoon [43].

A large proportion of assessments have implied that fragmentary dosage preparation aim towards a better bowel preparation having a high ADR [44].

6. The caecum intubation with landmarks photography (documentation) for each procedure. In order to have a qualitative colonoscopy the caecum intubation is essential, thus the colonoscopist has to make the necessary documentation by each exploration carried, by the photographs taken of the ileocaecal valve and appendicular orifice [45].

In addition, whenever there are anatomical variations of the caecum or the ileocaecal valve does not have the classic lipomatous aspect it is imposed to proceed toward the terminal ileum [46].

If the impossibility to complete the colonoscopy unfolds, based on poor preparation or some existing stenosis, the photo documentation is important to back-up the decision to abandon the examination [21].

Hence, a completed colonoscopy represents an important quality indicator, being strongly correlated with the risk of CRC development [7].

Fact also highlighted in a New Zealand study that showed that 9 of 17 patients were diagnosed with interval CRC after incomplete colonoscopies effectuated [47].

7. ADR (adenoma detection rate). ADR is most commonly known as the main indicator of quality in colonoscopy and it represents percentage of the total number of colonoscopies performed during which at least one adenoma was visualized [48].

By 2002 it was established that for subjects over 50 years old going under their first screening colonoscopy it should be a minimum of 25% for men and 15% for women adenoma detection rate [49].

Later, the value was risen by 30% for men and 20% for women, by The American Society for Gastrointestinal Endoscopy/American College of Gastroenterology Task Force Quality in Endoscopy [50].

Still, there are studies suggesting that ADR should have higher values by even reaching 40% and 50% [51-53].

The growth in ADR values is due to factors such as smoking, obesity, race but most important, patients gender and age [54-56].

Only by performing a high number of procedures can assure a correct calculated value of ADR. Do et al. might be necessary at least 500 colonoscopies [57].

Screening intervals are also established based on ADR, such as endoscopists with high ADR usually have shorter time intervals between two colonoscopies because of the large number of preneoplastic lesions detected.

On the contrary, endoscopists with low ADR recommend colonoscopic re-evaluation for a bigger time interval [58].

Between 2000-2004 a Polish study was carried on approximately 45 000 patients to evaluate the risk of interval CRC development and it concluded that endoscopists with $ADR < 20\%$ exposed patients on a number 10 times higher than those with $ADR > 20\%$ [59].

Also, Kaminski et al. implies that endoscopists with ADR under 11% expose patients to a 11 times higher risk of interval CRC development than those with $ADR > 20\%$.

The correct ADR calculation has its limitations regarding an ultimate strong bond needed with the histopathology department which is translated into supplementary work taken by the endoscopists [58].

Addition to that, it was shown that endoscopists fail to carefully examine the rest of the mucosa after the discovery of a possible adenoma lesion.

As an alternative there were introduced Polyp Detection Rate (PDR) and Adenomas Per Colonoscopy (APC) into calculations.

In hindsight PDR sums up the percentage of patients older than 50 years to whom at least one polyp was resected during a screening colonoscopy without further histopathology history database requirement [60-63].

Multiple studies have forwarded a correlation coefficient bigger than 0.8, along with conversion as a result of the best suited correlation between PDR and ADR [60,64-67].

But nonetheless, we should take into consideration a recent retrospective study that emphasizes the better correlation of ADR and PDR for the proximal colon [66].

Based on a retrospective analyses of 3367 colonoscopies carried by 20 different endoscopists, Francis et al. had figured a 0.64 correlation coefficient [68], while Baxter et al. figured the link between low prevalent interval CRC and a high rate of PDR [69].

Arguably the main setback of PDR is that endoscopists can artificially raise the index number by performing biopsies on normal tissue or by resecting small hyperplastic lesions which were in no need for that [48].

Total number of documented adenomas in reference to the entire number of colonoscopies

are shown through APC quality indicator, which gradually became used in clinical practice [70,71].

By offering pertinent information on the correlation with interval cancers, APC can be used complementary to ADR, or even replace it. Also, APC has a lower tendency of artificially being influenced, contrary to ADR and PDR [48].

Thus, as an alternative to APC, it was introduced the numbering of documented adenomas after the first lesion visualization or resected, leading to a continuously attention of the endoscopists while avoiding the first lesion mirage [65].

Along with this improvement, there is an effort put into introducing the advanced ADR in current evaluation, which quantifies lesions bigger than 10mm with adenoma histology or high-grade dysplasia, also the serrated detection rate and ADR based on colon segment [72,73].

Future aims propose higher quality of endoscopic images, implying a polyp management through "resect and discard" approach, that will allow endoscopists to anticipate the histology type relying on the macroscopic aspect of the masses, without the need for submission of the resected tissue to anatomic pathology department [71,74].

Throughout many studies it was demonstrated that gastroenterologists obtain by far higher quality indicators in comparison with doctors from other specialties that practice colonoscopy [75-79].

8. Medium time of withdraw and measurement of its frequency by endoscopists.

The importance in quality monitoring of colonoscopy is likewise represented by the withdraw time as second indicator and consists in the time spent by the endoscopists in the withdrawal of the endoscope from caecum up to the anorectal junction [48].

It is to no value for endoscopists with ADR above average, mostly aiming to correct those with index below standard [80].

Regardless of the prior demonstrated link between the withdraw time and endoscopy quality [48] there are multiple studies suggesting a lack of correlation of ADR value and withdrawal time [81,82].

Barclay et al. assessed through their study that colonoscopies with medium time of withdraw of six minutes had significantly a higher rate of neoplastic lesions detection in contrast to those performed in less than six minutes, 28.3% vs. 11.8% [35,51].

Lately, a research on 8000 colonoscopies brought up that for a 9 minutes withdrawal time the ADR value was 33.6%, while for a less than 6 minutes withdrawal time the ADR value was 23.8% [83].

As long as there is an understanding and willingness for improvement in preneoplastic lesions discovery the results can become even more spectacular following peculiar educational and training sessions.

One study prone to improve the overall outcome is the Barclay et al. research, imposing a two minute withdrawal time for each segment of the colon which showed a direct effect on the increase of ADR rate, up to 50% for endoscopists participating in the study, unlike the ADR of those not partaking [84].

On the other hand, another research conducted in Peru was unable to prove a growth of PDR after setting a withdrawal time higher than six minutes [85].

Besides the Peru study, two more studies failed to conclude the relation between withdrawal time and endoscopy quality [81,82].

9. Frequency of the attempt of endoscopic polypectomy for polyps bigger than 2cm.

All gastroenterologists must be qualified to perform endoscopic polypectomy along with biopsy sampling, therefore any step taking into recommending another gastroenterologist to the patient, due to incapacity of polyp visualization should be frowned upon.

Exceptions must be made in case of large sized polyps or when it comes to slim accessible positions, for which polypectomy should not be encouraged to be realized by not well trained endoscopists [79,86].

Postprocedural quality indicators

10. Incidence of perforation and postpolypectomy bleeding

Although it has a slim occurrence (less than 1:1000 in screening colonoscopies), perforation is known as a severe colonoscopy complication with a 5% fatal rate [87-89].

Amid the factors implied in perforation, most common are as it follows: poor bowel preparation, severe diverticular disease, severe intestinal inflammatory diseases and ischemia.

Plus, whenever a resistance occurs against advancing with the procedure it is upon the endoscopist to stop the investigation.

Discovered perforations during the colonoscopy could be mended by using metallic clips.

Unlike cold resection techniques, polyp resection is generally undertaken with electrocautery with risk perforation implications [90,91].

For postpolypectomy most frequent complication is the bleeding [87,89,92,93], yet its occurrence rate is just at 1% [87,88,92,93].

This 1% bleeding occurrence rate can rise up to 10% for polyp resection bigger than 2cm [31,92-95].

The internal bleeding might happen throughout the investigation or afterwards, [96,97] and in most cases can be solved with the help of the electrocautery [98].

Submucosa infiltration reduces the possible bleeding risks emerging during EMR performance and also evaluates the degree of lesions infiltration because of its utility of sessile polyp raise.

In prophylaxis adrenalin administration in dilution is preferred at the base of sessile or pedunculated polyps and detachable loops implantation for gross pedunculated polyps [99,100].

11. Postpolypectomy fbleeding frequency in need of surgical intervention

In 90% of the cases postpolypectomy bleedings can be resolved within the endoscopy by adrenalin administration, electro-coagulation or hemostatic clip [101,102].

Among adverse events related with the examination it is excluded the bleeding surfaced during the entire period of hospital admission.

Lastly, in terms of a long distance bleeding, colonoscopy can be taken into consideration without any further preparation, but in most cases the bleedings stop spontaneously [102].

12. Proper recommendations for repeated colonoscopy dependent on histopathology results of samples obtained by previous colonoscopy.

Current guidelines suggest patients confronted with medium risk CRC development should undergo colonoscopy screening every 10 years [26-28,103].

Grounded on the number, size and histological structure of the detected polyps in prior colonoscopies, the monitoring intervals should be applied as it follows: 5-10 years for 1-2 tubular adenomas, smaller than 1cm, 5 years for history of advanced adenomas, 3 years for patients with three small adenomas, large adenomas, villous adenoma or even with high-grade dysplasia [30].

Inexperienced endoscopists with low ADR [11] should be aware of the possibility of

missing lesions during colonoscopy, [104] especially the non polypoid ones.

Numerous reviews brought into attention stronger links between non polypoid lesions and interval CRC placed in proximal colon, with the mention that this link remains arguable [105-108].

Nonetheless, colonoscopy abuse must be avoided [30], particularly colonoscopies conducted for polypectomies that can arise bigger issues.

Accordingly to Robertson et al. assessment, incomplete polyp resection constitutes 26% of

the total interval CRC documented, mainly within colon segments who went under polypectomies [109].

Emergence of interval CRC at 5 years has a rate of 0.17% for colonoscopies without polypectomy and 1.5% for those with polypectomy, as demonstrated in Liberman et al. research.

A brief synthesis of the main types of ADR enhancing techniques and devices is presented in Fig.1.

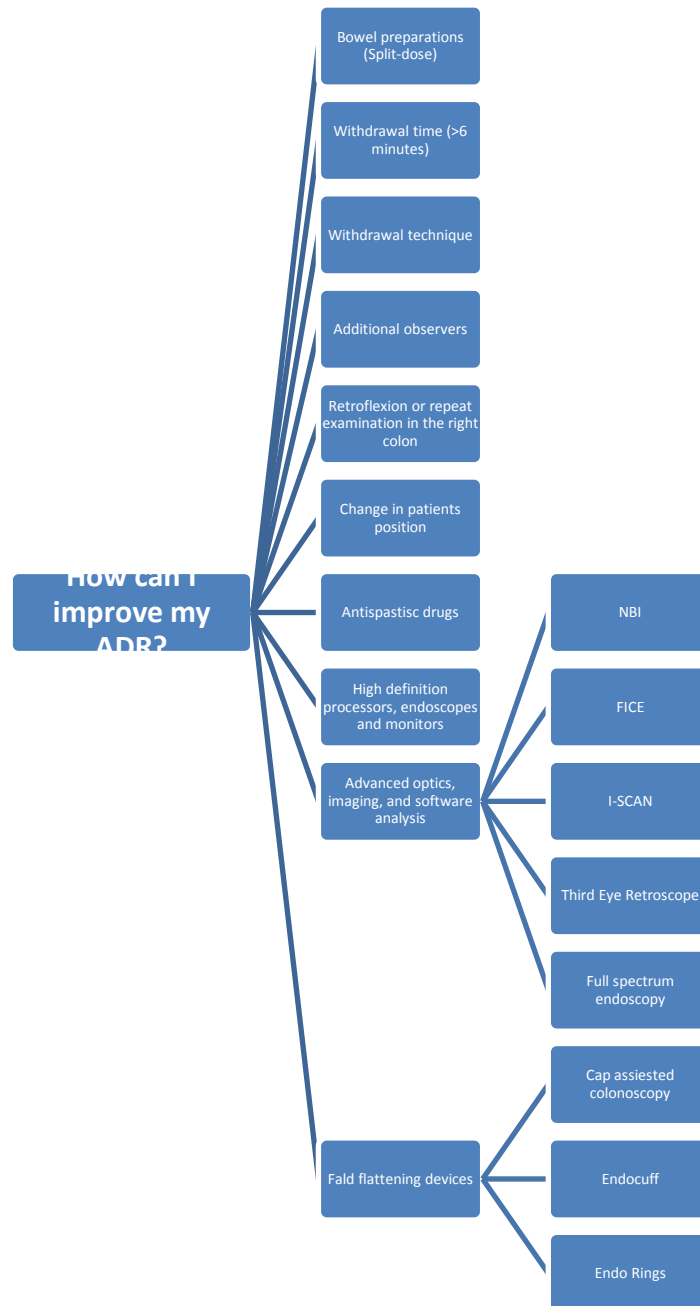


Fig.1. A graphical representation of the main classes of ADR enhancing techniques available

Other factors impacting the colonoscopy quality

1. Additional observers

The wrong focusing of endoscopists, known as "inattention blindness" phenomena, refers to lesion missing even if the lesion is in the visual spectrum of the endoscopist. The mentioned issue can be solved with the help of an additional observer such as an experienced assistant, another gastroenterologist etc. The improvement of colonoscopy quality with additional observers was the main subject for various studies [48], one of which pointed out a significantly higher ADR (37%) in colonoscopies performed with additional observers than those performed only by gastroenterologists (23%) [110]. Furthermore, other studies carried on 500 patients have shown PDR and APC enhancement when assistants were involved during the procedure [36]. But the effect of additional observers is exclusively and strongly marked at inexperienced endoscopists [111].

2. Retroflexion or repeated right colon examination

On account of critical preparation, different tumor biology for right colon tumors, prominent folds and numerous lesions with risk of malignant development, there must be a peculiar attention towards ascending colon examination [48]. Following the sole purpose of improving examination quality and diminishing interval CRC risk development, ascending colon retroflexion was recommended complementary to colonoscopy examination [48]. Hewett and Rex attained a lesion missing rate of 9.8% subsequently to the colonoscopy completion with retroflexion examination of right colon, this result was contingent upon 1000 patients referred for screening [112]. Same outcomes are testified in other two studies but with the use of a second examination called forward view of right colon [113]. Whether is the retroflexion or the forward view examination, it is implied a second procedure for the right colon for previous lesions detected [114,115].

3. Positioning change of the Patient

Older research, relying on ADR, consider the colon examination carried in specific positions for each segment a more accurate assessment than the one in left lateral decubitus (ADR 37% vs 23%) [116]. On the other hand, recent research found no significant difference between the two examination methods, having 41.8% ADR for patients with positioning change and

37.9% ADR for those examined in left lateral decubitus [117]. However, if high rigor is considered then this factor should be taken into account.

4. Drugs and medications

Due to colon peristalsis, certain lesions can be overlooked while performing the colonoscopy. Although past data affirmed no ADR improvement following antispasmodic medications [118,119], new data from a Japanese study affirm an ADR enhancement in patients who were administered L-menthol spray in the caecum, in contrast to the ADR of patients in group control (69.2-42.6%). Thus, double-blind studies, obtaining similar results, are required for an accurate result confirmation [120].

5. Endoscopic equipment quality and its accessories

a) High-definition and Enhanced Imaging Technologies

In spite of the high quality images obtained in high-definition (HD), reviews show only a 3.5% ADR improvement for HD examination in comparison with the classic one [93]. Enhanced Imaging Technologies were developed by endoscopic equipment producers in order to upgrade the polyp rate of detection, as well to facilitate neoplastic lesion differentiation [48]. Nowadays there are three such systems. Olympus offers NBI (narrow-band imaging), a virtual technique of chromoendoscopy which was recently introduced in the clinical practice. NBI relies on a basic light examination using a short wavelength (blue and green light) facilitating a softer tissue penetrating, together with a better evaluation of mucosa and vascular patterns. Both I-scan (Pentax) and FICE (Fujinon), are real time chromoendoscopy virtual techniques that were developed based on processing algorithms applied on images obtained under white light [121]. Up to this point, the results of chromoendoscopy techniques efficiency evaluated in recent studies are highly arguable [122-125]. In addition, studies that have proven a superior ADR for examinations made through these techniques, were subject of a series of limitations such as prolonged withdrawal time in contrast to the control group examined in HD [126] or low ADR in control group [101]. Still, chromoendoscopy has certified its efficiency in neoplasia detection occurred on the basis of intestinal inflammatory diseases [127,128].

6. The third eye retroscope

The third eye retroscope is a system developed by Avantis Medical Systems and is a mini endoscope that is inserted into the colonoscope's working channel and allows retrograde visualization of the colon. Although there are few studies certifying its efficiency, a new study sampled on 300 patients exposed to Third Eye exam has identified up to 16% more colon adenomatous lesions than the standard colonoscopy [129]. A further study sampling a bigger number of subjects resulted in a higher ADR value of 22.6% after the Third eye procedure [130]. The setbacks this technique implies are related to the cost, aspiration drop and the constant need of removal whenever a polyp must be resected [131].

7. Full Spectrum endoscopy

Full Spectrum endoscopy represents a new edoscopic system that allows a 330 degree mucosa evaluation throughout three lenses placed in front and on both sides. Gralnek et al [132] concluded that adenoma miss rate is only at 7.6% in FUSE exam, while in standard colonoscopy it is at 41.7%. It is to be mentioned that the withdrawal time for FUSE examination was significantly longer.

8. Fold Flattening devices

Cap assisted colonoscopy is a method that stands in attaching a translucent cap that creates a better visualizing of the colonic lumen by colon fold flattening [133-135]. Thus, a suggestive higher ADR for cap assisted exam is differentiating from the ADR group control (69% vs 56%) in a research conducted on 420 patients. On the contrary, a study conducted on 1000 patients highlights a superior ADR standard colonoscopy to the cap assisted exam (37.5% vs 30.5%) [136]. Endocuff is a rubber accessory attached to the top of the endoscope, having a set of flexible wings that contribute to fold flattening, therefore making possible the mucosa visualizing from their back during the endoscope withdraw. In previous studies the endocuff using appears to improve ADR only for inexperienced edoscopists with a low ADR [137]. Moreover, EndoRings (EndoAid, Israel) and balloon assisted colonoscopy function based on a similar principle [138]. When it comes to the balloon assisted colonoscopy remarkable differences were noted for PDR values in contrast with classic colonoscopy (91.7% vs 45.8%). This study is limited in terms of being realized on a colonic model with stimutaed polyps [139,140].

Correction of poor performance

1. Identification of endoscopists with low levels of performance combined with further training followed by the cut of the right of colonoscopy practice if there is no improvement after retraining [141].
2. Implementing the split-dose preparation model [80,142].
3. Informing and educating the endoscopists on the large spectrum of precancerous lesions as well as the importance of their detection [80,142].
4. Imposed withdraw time, longer than six minutes, associated with an adequate colonic distension [99,143].
5. Proximal colon intubation performed two times.
6. Usage of additional observers and fold flattening devices for inexperienced endoscopists with low ADR.
7. Purchase of last generation edoscopic equipment that allow HD visualizing [144].

Medicolegal issues

The emergence of interval cancers or postprocedure complication might lead to legal actions taken against medical personnel. This stresses the importance of well informing patients on the colonoscopy limitations, the complications they are exposed to, even more when we refer to interventional procedures. All procedures should be performed only after the informed consent is signed by the patient. Furthermore, data processing regarding the colonoscopy quality, caecum intubation, colon preparation, the withdrawal time and registration/photography of possible abnormality registration, should also be considered [145,146].

Conclusions

Colonoscopy has long proven to be efficient by its ability of lowering CRC mortality rates, thus is considered the go to method for screening.

Its efficiency is not only dependable on the doctor's training, but also on the willingness of the patient to cooperate regarding the acceptance of the procedure and the proper colon preparation.

According to the higher rates of missing lesions for doctors of other specialties, gastroenterologists are validated as the better endoscopists.

The key to performing quality procedures comes from the continuous monitoring of the main quality indicators (ADR, PDR, APC) carried through auto evaluation, also the objective assessment of sanitary units.

Nevertheless, implementation of stricter regulations on the colon preparation method, withdrawal time, right colon re-examination, use of antispasmodic medications etc., are long due in order to achieve a more qualitative examination.

Conflict-of-interest statement

No potential conflicts of interest. No financial support.

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