Accuracy of colonoscopy in determining colorectal cancer localization

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Abstract

Aim: A precise preoperative localization of colorectal cancer (CRC) is very important in order to provide an adequate medical treatment. Our aim was to determine the accuracy of colonoscopy localization compared to the gold standard of intra-operative localization in Albanian patients.

Methods: This was a prospective study carried out at the University Clinic of Gastrohepatology, University Hospital Center "Mother Teresa" in Tirana, Albania. Consecutive patients diagnosed with CRC by colonoscopy and confirmed by histopathology, for which they underwent subsequent surgical resection at the University Clinics of Surgery, during January 2011- September 2016 were included in this study. The difference between the locations described by the two modalities was determined for each tumor. Overall accuracy and accuracy for all colonic segments of colonoscopy was calculated. The weighted Kappa coefficient was calculated, along with its 95% confidence interval, to estimate the agreement between the two modalities.

Results: Colonoscopy and surgery were concordant in 205/241 of the cases (85.1%) and discordant in 36/241 (14.9%) of the cases. Of these, 20 cases (8.3%) differed by one colonic segment, and 16 (6.6%) differed by two colonic segments. The difference noticed in the left colon lesions were higher than those found in the right colon (11.2% vs. 3.7%, respectively). The agreement between colonoscopy and surgery was substantial with a weighted Kappa coefficient of 0.709 (95%CI=0.639-0.778; P<0.001).

Conclusion: Colonoscopy localization inaccuracy is to be considered. Our findings indicate that discrepancies are more prevalent in the left than the right side of the colon.

Keywords: accuracy, colonoscopic localization, colorectal cancer, surgery.

Introduction

Colorectal cancer (CRC) is the third most common cancer in both males and females; an estimated 97,220 cases of colon cancer and 43,030 cases of rectal cancer will be diagnosed in the USA during 2018 (1). Actually, colonoscopy is considered the optimal investigation for the CRC diagnosis and localization within the colonic segments (2,3).

A precise preoperative localization of CRC is very important in order to provide an adequate surgical treatment and an efficient utilization of neoadjuvant chemo-radiation (4).

Several studies have reported that localization errors lead to changes in the operative modalities in 4%-11% of the cases (5,6).

Finally, with the advent of laparoscopic resection in Albania, a procedure which offers the benefits of a minimally invasive surgery, identifying the precise location of CRC is crucial (7).

In one study (8), the reported removal of incorrect colonic segment by laparoscopic surgeons was estimated at 6.5%.

According to the literature, the accuracy of colonoscopy in CRC localization varies widely, with a reported wrong localization ranging from 4% to 34% (2,9-13).

The aim of our study was to determine the accuracy of colonoscopy localization compared to the gold standard of intra-operative localization in Albanian patients.

Methods

This was a prospective study carried out at the University Clinic of Gastrohepatology, University Hospital Center "Mother Teresa" in Tirana, Albania. Consecutive patients diagnosed with CRC by colonoscopy and confirmed by histopathology, for which they underwent subsequent surgical resection at the University Clinics of Surgery, during January 2011- September 2016, were included in this study. Colonoscopies were performed by experienced endoscopists in our Endoscopy Unit, and not in the screening settings; all the patients were symptomatic. Patients were excluded if they were undergoing neoadjuvant chemo-radiation, had a previously colon resection, or had inflammatory bowel disease. In order to standardize reporting, cancer localization during colonoscopy, and surgical intervention, was classified according to the colonic segments: cecum, ascending colon, hepatic flexure, transverse colon, splenic flexure, descending colon, sigmoid colon, rectosigmoid and rectum. Intra-operative lesion localization was considered as the gold standard. The difference between the locations described by the two modalities was determined for each tumor. Overall accuracy of colonoscopy was calculated. This was also calculated for each colonic segment.

A $P \leq 0.05$ was considered to be statistically significant. The weighted Kappa coefficient was calculated, along with its 95% confidence interval, to estimate the agreement between the two modalities. All statistical analyses were performed using IBM SPSS, version 20.0.

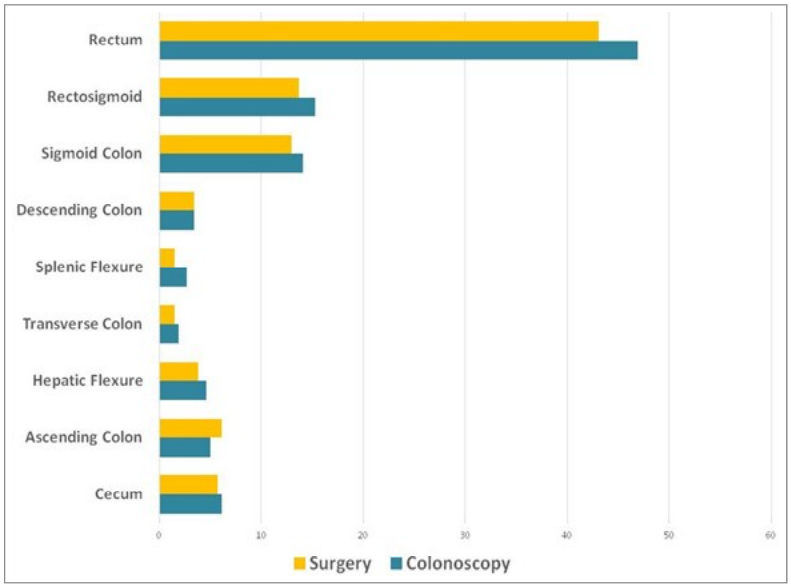
Results

There were 262 patients diagnosed with CRC by colonoscopy and confirmed histologically as colorectal adenocarcinomas. We had a slight male predominance of 147 patients (56.1%) vs. 115 (43.9%) females. Mean age was 62.68±11.03 years. Of these, 241 patients underwent surgical resection, whereas further 21 cases were excluded since no surgical intervention took place due to advanced stage disease. Location of CRC during colonoscopy and surgery is presented in Table 1 and Figure 1. A different description of location between colonoscopy and surgery was found in 14.9% (n=36) of the cases (Table 2). Of these, 20 cases (8.3%) differed by one colonic segment, and 16 (6.6%) differed by two colonic segments. When dividing the colon into right (cecum, ascending colon, hepatic flexure, and transverse colon) and left

Table 1. Colorectal cancer location according to colonoscopy and surgery

Colonic Segment	Colonoscopy (%)	Surgery (%)
Cecum	16 (6.1)	15 (5.7)
Ascending colon	13 (5)	16 (6.1)
Hepatic flexure	12 (4.6)	10 (3.8)
Transverse colon	5 (1.9)	4 (1.5)
Splenic flexure	7 (2.7)	4 (1.5)
Descending colon	9 (3.4)	9 (3.4)
Sigmoid colon	37 (14.1)	34 (13)
Rektosigmoid colon	40 (15.3)	36 (13.7)
Rectum	123 (46.9)	113 (43.1)
Total	262	241 (92)
Missing		21 (8)
Total	262	262

Figure 1. Colorectal cancer location in colonoscopy and surgery



(splenic flexure, descending colon, sigmoid colon, rectosigmoid and rectum), the difference noticed in the left colon lesions were higher than those found in the right colon (11.2% vs. 3.7%, respectively).

Table 2. Correlation between colonoscopy and surgery of CRC localization

Colonoscopy	SURGERY									
	Cecum	Ascending	Hepatic flexure	Transverse	Splenic flexure	Descending	Sigmoid	Rectosigmoid	Rectum	Total
Cecum	15	1	0	0	0	0	0	0	0	16
Ascending	0	10	3	0	0	0	0	0	0	13
Hepatic flexure	0	4	7	0	0	0	0	0	0	11
Transverse	0	1	0	4	0	0	0	0	0	5
Splenic flexure	0	0	0	0	4	2	0	0	0	6
Descending	0	0	0	0	0	7	1	0	0	8
Sigmoid	0	0	0	0	0	0	28	4	1	33
Rectosigmoid	0	0	0	0	0	0	3	26	8	37
Rectum	0	0	0	0	0	0	2	6	104	112
Total	15	16	10	4	4	9	34	36	113	241

There were 24 (9.9%) cases of discordant localization described in sigmoid, rectosigmoid and rectum. In these 24 cases, all the lesions were found in one of these three segments.

The overall accuracy of colonoscopy was 85.1%. Regarding the colonic segments, the accuracy for cecum, ascending, hepatic flexure, transverse, splenic flexure, descending, sigmoid, rectosigmoid and rectum localization were respectively: 99.59%, 96.27%, 97.10%, 98.76%, 99.17%, 98.34%, 94.19%, 90.04%, and 90.46%. The agreement between colonoscopy and surgery was substantial with a weighted Kappa coefficient of 0.709 (95%CI=0.639-0.778, P<0.001) (14).

Discussion

Accurate preoperative CRC localization is very important in order to ensure optimal pre-operative surgical treatment, especially in the widespread of laparoscopic surgery. This intervention offers to the patient the benefits minimally invasive surgery but has the disadvantage of losing the intraoperative tactile sensation (3,15).

Although, sometimes it can be challenging to determine the precise location of the tumor, it would be reasonable to suppose that some anatomical areas provide more reliable landmarks during colonoscopy e.g., ileocecal valve or hepatic flexure (13). Nevertheless, in our study and others, all the colonic segments were susceptible to localization inaccuracy. There is a wide variability in published papers regarding tumor localization error ranging from 4% (9) to 34% of cases (16), with the highest rates in earlier studies. However, even recent studies report a considerable rate of erroneous colonoscopic localization. A retrospective 2017 study (16,17), found mislocalization in 33% of cases; 2 multi- centers prospective (2014,2017) studies conducted in UK reported an error rate of 19% (18,19).

Finally, a meta-analysis conducted by Sergio et al, in 2016 with a total of 3221 patients included found a 15.4% error rate (4). This rate was lower when tattoo was used (9.5%).

Our study showed that the localization of CRC was inaccurate in 14.9% of patients. The majority of these misallocations occurred within one colonic segment (8.3%) and 6.6% in two colonic segments. Our results are within the range of previously reported data. The highest accuracy was found in cecum localization 99.59%. The localization of left colon lesions was associated with increased discordance rate when compared to right colon lesions (11.2% vs 3.7%). The literature shows controversial results regarding the distribution of

wrong localization rate among the colonic segments; some studies reported that left- sided lesions were more difficult to localize properly (12,13), while others reported that right- sided lesions were harder to accurately localized (11,20).

In our study 66.7% (24/36) of cases with erroneous localization were described in sigmoid, rectosigmoid and rectum. In these 24 cases, all the lesions were found in one of these three segments. This is probably due to the lack of distinct colonoscopy landmarks in this area. In such circumstances, communication between endoscopists and surgeons is of paramount importance. As stated before, incorrectly localized lesions can lead to changes in surgical plan and/or treatment strategy. Discordance in rectum rectosigmoid and sigmoid segments is of particularly relevant importance because patients with stage II or III rectal cancer are treated preoperatively with neoadjuvant chemo-radiation in contrast to more proximal cancers (5). By the other hand, low anterior resection is associated with higher morbidity than sigmoid resection (21). In both cases, inappropriate use of adjuvant therapy or resection of the wrong colonic segments can occur. In rectum, the precise distance from anal dentate line is important in regard to distal resection margin, while in colon, inaccurate localization may lead to wrong colonic segment resection. Johnstone et al. reported that 6.3% of incorrectly localized lesions required on-table changes in planned surgery (18). From the same group, Moug et al. found that 5.2% of cases with localization error resulted in altered surgical management (19). When analyzing factors influencing CRC localization at colonoscopy, they found that both cecal intubation and use of scope guide were significant factors associated with precise CRC anatomic location (19).

Other studies (22) found gastroenterology training along with incomplete colonoscopy as important factors associated with incorrect localization. Different techniques have been used to minimize preoperative localization errors. Tattooing during colonoscopy improved the accuracy up to 98% (23), while with intraoperative colonoscopy localization accuracy reached 100% (24). Clips has also been used to facilitate localization (25,26). Others have used magnetic endoscopic imaging (27) and CT colonography (2) to aid in tumor localization.

In conclusion, in our series including Albanian patients, the colonoscopy procedure regarding tumor localization is to be considered reasonably accurate. The error rate is higher in the left than the right side of colon. Discrepancies are more prevalent in rectum, rectosigmoid and sigmoid. Efforts should be made to better communicate and establish an agreement between endoscopists and surgeons regarding the definitions of anatomic colonic segments, particularly on lesions located in these three segments.

Conflicts of interest: None declared.

References

1. American Cancer Society. Cancer Facts & Figures 2018. Atlanta, Ga: American Cancer Society; 2018.

2. Cho YB, Lee WY, Yun HR, Lee WS, Yun SH, Chun HK. Tumor localization for laparoscopic colorectal surgery. World J Surg 2007;31:1491-5.

3. Lee J, Voytovich A, Pennoyer W, Thurston K, Kozol RA. Accuracy of colon tumor localization: computed tomography scanning as a complement to colonoscopy. World J Gastrointest Surg 2010;2:22-5.

4. Acuna SA, Elmi M, Shah PS, Coburn NG, Quereshy FA. Preoperative localization of colorectal cancer: a systematic review and meta-analysis. Surg Endosc 2016;31:2366-79.

5. Piscatelli N, Hyman N, Osler T. Localizing colorectal cancer by colonoscopy. Arch Surg 2005;140:932-5.

6. Kim JH, Kim WH, Kim TL, Kim NK, Lee KY, Kim MJ, et al. Incomplete colonoscopy in patients with occlusive colorectal cancer: usefulness of CT colonography according to tumor location. Yonsei Med J 2007;48:934-41.

7. Holzman MD, Eubanks S. Laparoscopic colectomy. Prospects and problems. Gastrointest Endosc Clin N Am 1997;7:525-39.

8. Wexner SD, Cohen SM, Ulrich A, Reissman P. Laparoscopic colorectal surgery – are we being honestwith our patients? Disease Colon Rectum 1995;38:723-7.

9. Vaziri K, Choxi SC and Orkin BA. Accuracy of colonoscopic localization. Surg Endosc 2010;24:2502-5.

10. Feuerlein S, Grimm LJ, Davenport MS, Haystead CM, Miller CM, Neville AM, et al. Can the localization of primary colonic tumors be improved by staging CT without specific bowel preparation comparedto optical colonoscopy? Eur J Radiol 2011;81:2538-42.

11. Vignati P, Welch JP, Cohen JL. Endoscopiclocalization of colon cancers. Surg Endosc 1994;8:1085-7.

12. Louis MA, Nandipati K, Astorga R, Mandava A, Rousseau CP, Mandava N. Correlation between preoperative endoscopic and intraoperative findings in localizing colorectal lesions. World J Surg 2010;34:1587-91.

13. Borda F, Jiménez FJ, Borda A, Urman J, Goni S, Ostiz M, et al. Endoscopic localization of colorectal cancer: study of its accuracy and possible error factors. Rev Esp Enferm Dig 2012;104:512-7.

14. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1997;33:159-74.

15. Clinical Outcomes of Surgical Therapy Study Group. A comparison of laparoscopically assisted and open colectomy for colon cancer. N Engl J Med 2004;350:2050-9.

16. Tabibian N, Michaletz PA, Schwartz JT, Heiser MC, Dixon WB, Smith JL, et al. Use of an endoscopically placed clip can avoid diagnostic errors in colonoscopy. Gastrointest Endosc 1988;34:262-4.

17. Blum-Guzman JP, Wanderley de Melo S. Location of colorectal cancer: colonoscopy versus surgery. Yield of colonoscopy in predicting actual location. Endosc Int Open 2017;5:E642-5.

18. Johnstone MS, Moug SJ, West of Scotland Surgical Research Network. The accuracy of colonoscopic localisation of colorectal tumours: a prospective, multi-centred observational study. Scott Med J 2014;59:85-90.

19. Moug SJ, Fountas S, Johnstone MS, Bryce AS, Renwick A, Chisholm LJ, et al. Analysis of lesion localisation at colonoscopy: outcomes from a multi-centre U.K. study. Surg Endosc 2017;31:2959-67.

20. Lam DT, Kwong KH, Lam CW, Leong HT, Kwok SP. How useful is colonoscopy in locating colorectal lesions? Surg Endosc 1998;12:839-41.

21. Chatwin NA, Ribordy M, Givel JC. Clinical outcomes and quality of life after lowanterior resection for rectal cancer. Eur J Surg 2002;168:297-301.

22. Yap R, Ianno D, Burgess A. Colonoscopic localization accuracy for colorectal resections in the laparoscopic era. Am J Surg 2016;212:258-63.

23. Park JW, Sohn DK, Hong CW, Han KS, Choi DH, Chang HJ, et al. The usefulness of preoperative colonoscopic tattooing using a saline test injection method with prepackaged sterile India ink for localization in laparoscopic colorectal surgery. Surg Endosc 2008;22:501-5.

24. Cai Z, Pan R, Ma J, Zheng M. Tumor localization for Laparoscopic Colorectal Resection Without Endoscopic Tattooing. Surg Laparosc Endosc Percutan Tech 2016;26:230-5.

25. Lee J, Voytovich A, Pennoyer W, Thurston K, Kozol RA. Accuracy of colon tumor localization: Computed tomography scanning as a complement to colonoscopy. World J Gastrointest Surg 2010;2:22-5.

26. Montorsi M, Opocher E, Santambrogio R, Bianchi P, Faranda C, Arcidiacono P, et al. Original technique for small colorectal tumor localization during laparoscopic surgery. Dis Colon Rectum 1999;42:819-22.

27. Cheung HY, Chung CC, Kwok SY, Tsang WW, Li MK. Improvement in colonoscopy performance with adjunctive magnetic endoscope imaging: a randomized controlled trial. Endoscopy 2006;38:214-7.