

# Discrepancy between gastroenterologists' and general surgeons' perspectives on repeat endoscopy in colorectal cancer

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This work was presented at Digestive Disease Week (American Society for Gastrointestinal Endoscopy), May 16–19, 2015.

Accepted for publication  
Feb. 23, 2015

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DOI: 10.1503/cjs.005115

**Background:** A myriad of localization options are available to endoscopists for colorectal cancer (CRC); however, little is known about the use of such techniques and their relation to repeat endoscopy before CRC surgery. We examined the localization practices of gastroenterologists and compared their perceptions toward repeat endoscopy to those of general surgeons.

**Methods:** We distributed a survey to practising gastroenterologists through a provincial repository. Univariate analysis was performed using the  $\chi^2$  test.

**Results:** Gastroenterologists ( $n = 69$ ) reported using anatomical landmarks (91.3%), tattooing (82.6%) and image capture (73.9%) for tumour localization. The majority said they would tattoo lesions that could not be removed by colonoscopy (91.3%), high-risk polyps (95.7%) and large lesions (84.1%). They were equally likely to tattoo lesions planned for laparoscopic (91.3%) or open (88.4%) resection. Rectal lesions were less likely to be tattooed (20.3%) than left-sided (89.9%) or right-sided (85.5%) lesions. Only 1.4% agreed that repeat endoscopy is the standard of care, whereas 38.9% ( $n = 68$ ) of general surgeons agreed ( $p < 0.001$ ). General surgeons were more likely to agree that an incomplete initial colonoscopy was an indication for repeat endoscopy ( $p = 0.040$ ). Further, 56% of general surgeons indicated that the findings of repeat endoscopy often lead to changes in the operative plan.

**Conclusion:** Discrepancies exist between gastroenterologists and general surgeons with regards to perceptions toward repeat endoscopy and its indications. This is especially significant given that repeat endoscopy often leads to change in surgical management. Further research is needed to formulate practice recommendations that guide the use of repeat endoscopy, tattoo localization and quality reporting.

**Contexte :** De nombreuses options de repérage s'offrent aux endoscopistes dans les cas de cancer colorectal; on en sait cependant peu sur l'utilisation de ces techniques et leur lien avec les endoscopies répétées avant les interventions chirurgicales de traitement de ce cancer. Nous avons étudié les pratiques de repérage employées par des gastroentérologues et comparé leurs perceptions des endoscopies répétées à celles des chirurgiens généralistes.

**Méthodes :** Nous avons réalisé un sondage auprès de gastroentérologues en exercice figurant dans un répertoire provincial. Une analyse unidimensionnelle a été effectuée à l'aide du test  $\chi^2$ .

**Résultats :** Les gastroentérologues ( $n = 69$ ) ont dit recourir à des repères anatomiques (91,3 %), au tatouage (82,6 %) et à des images (73,9 %) pour repérer les tumeurs. La majorité a dit tatouer les lésions ne pouvant être éliminées par coloscopie (91,3 %), les polypes à haut risque (95,7 %) et les lésions de grande taille (84,1 %). Ils étaient tout aussi susceptibles de tatouer les lésions devant être éliminées par résection laparoscopique (91,3 %) ou effractive (88,4 %). Ils étaient cependant moins susceptibles de tatouer les lésions rectales (20,3 %) que les lésions du côté gauche (89,9 %) ou du côté droit (85,5 %). Seul 1,4 % des gastroentérologues était d'avis que l'endoscopie répétée constitue une norme en matière de soins, contrairement à 38,9 % des chirurgiens généralistes ( $n = 68$ ;  $p < 0,001$ ). Les chirurgiens généralistes étaient plus nombreux à penser qu'une coloscopie initiale incomplète était susceptible d'être associée à des endoscopies répétées ( $p = 0,040$ ). En outre, 56 % d'entre eux ont indiqué que les résultats d'endoscopies répétées menaient souvent à des changements sur le plan chirurgical.

**Conclusion :** Il existe des divergences entre les perceptions des gastroentérologues et des chirurgiens généralistes quant aux endoscopies répétées et à leur indication. Ces divergences sont particulièrement pertinentes, étant donné que les endoscopies répétées entraînent souvent des changements aux interventions chirurgicales qui sont pratiquées ultérieurement. Des recherches approfondies seront nécessaires pour formuler des recommandations liées aux pratiques et orienter le recours aux endoscopies répétées et au repérage des lésions par tatouage ainsi que la production de rapports sur la qualité.

**C**olorectal cancer (CRC) is the third most commonly diagnosed cancer in Canada. In 2014, an estimated 24 300 individuals will have CRC diagnosed and an estimated 9300 will die of the disease.<sup>1</sup> Colonoscopy is considered the gold standard for detection of CRC, with a specificity of 90.0% and a sensitivity of 95.0%.<sup>2</sup> Over the past decade, the rise of minimally invasive surgical (MIS) techniques has made endoscopic lesion localization critical to surgical planning. However, little is known about the localization practices of gastroenterologists and general surgeons.

Although colonoscopy demonstrates excellent detection rates for both malignancies and adenomas, its ability to provide precise localization information is less clear. In the literature, estimates of the error rate in tumour localization vary from as low as 4% to as high as 21%.<sup>3–10</sup> These errors can have a dramatic impact on surgical management, especially in laparoscopic cases where the surgeon lacks the tactile ability to palpate the colon for the lesion. This may result in conversion from a laparoscopic to open approach, intraoperative colonoscopies and removal of incorrect segments of colon. To help surgical planning and prevent such complications, surgeons often perform repeat colonoscopy before CRC surgery to verify lesion location.

In a recent study by Al Abbasi and colleagues,<sup>11</sup> the repeat endoscopy rate at a large tertiary academic centre before CRC surgery was estimated to be up to 40.5%. Factors associated with preoperative repeat endoscopy by the operating surgeon were left-sided colonic neoplasms, planned laparoscopic resection and failure to tattoo the lesion on the initial colonoscopy.<sup>11</sup> However, to our knowledge, no studies have assessed the perceptions of gastroenterologists toward repeat endoscopy and its indications.

When a lesion is detected by colonoscopy, endoscopists have a myriad of localization techniques at their disposal. They include use of anatomic landmarks, distance from the anal verge, image capture if the lesion is near an identifiable landmark, hemoclips and tattooing. No formal protocols exist to guide endoscopists in choosing the appropriate localization technique, and little is known about current use of these practices as they relate to repeat endoscopy before CRC surgery. Localization based on anatomic landmarks is often reported in the vast majority of polypectomies;<sup>12</sup> however, this technique has been associated with error rates as high as 21%.<sup>3–10</sup> Less clear is the practice of colonoscopic image capture, with studies demonstrating varied utilization rates.<sup>12,13</sup> Moreover, there is a paucity of literature assessing the use of hemoclips in colonoscopy. Tattoo localization is considered the most accurate localization technique, and lack of tattoo localization is the most cited reason for repeat endoscopy by the operating surgeon.<sup>11,14</sup> Nevertheless, the rate of tattooing remains quite low — between 0% and 23%.<sup>15,16</sup> Furthermore, while tattoo localization is

often recommended for colonic lesions suspicious for malignancy,<sup>17</sup> the use of tattooing in different clinical scenarios remains unclear.

Given the limited evidence available on the localization practices of endoscopists, including the use of tattoo localization, the primary objective of our study was to identify the colonoscopic localization practices of gastroenterologists and to clarify the role of tattoo localization in this setting. The secondary objective was to assess the attitudes and perceptions of gastroenterologists toward repeat endoscopy and to compare their perceptions to those of general surgeons identified by a recent survey.

## METHODS

### *Instrument design*

We developed a preliminary questionnaire based on a Medline literature review to ascertain the current localization practices and attitudes of gastroenterologists toward repeat endoscopy before CRC surgery. The preliminary survey was reviewed by a focus group consisting of 2 academic gastroenterologists, a community gastroenterologist, a gastroenterology resident and a practising general surgeon.

The final questionnaire comprised 16 questions that addressed demographic items, general localization practices, tattoo localization practices and indications for repeat endoscopy as well as attitudes and perceptions toward repeat endoscopy. The survey evaluated the frequency of 5 localization techniques used over the previous 12 months using a 5-point Likert scale (with possible responses being never, rarely, sometimes, frequently and always). Tattoo localization practices under 10 clinical scenarios were assessed using the same 5-point Likert scale. The 5 most common indications for repeat endoscopy were ranked from most to least frequent.<sup>11</sup>

### *Data collection and analysis*

We disseminated the questionnaire in an online, electronic format using QuestionPro. Participants were identified and recruited via the membership directory of the Ontario Association of Gastroenterology (OAG) and among attendees of the 17th Annual OAG Conference. We performed statistical analyses using SPSS Statistics software version 21.0 (IBM Corp.).

We compared attitudes and perceptions of gastroenterologists toward preoperative repeat endoscopy and its perceived indications with those of practising general surgeons.<sup>18</sup> Univariate group comparisons for categorical data were achieved using the  $\chi^2$  test. We considered results to be significant for all comparisons at  $p < 0.05$ . The University Health Network Research Ethics Board approved our study protocol.

## RESULTS

Of the 184 active members of the OAG, 69 practising gastroenterologists completed the survey, along with 3 trainees. Trainees were excluded from the statistical analysis, resulting in a response rate of 38%. The characteristics of participants excluding trainees are presented in Table 1. The majority of respondents were men (89.9%), had more than 20 years of practice experience (43.5%) and worked in an urban setting (92.8%). Most respondents were employed in a teaching hospital (60.9%); only 8.7% worked in private clinics. All respondents performed colonoscopies. Colonoscopy volume was widely distributed; whereas the majority of respondents performed between 50 and 100 colonoscopies per month (60.9%), 27.5% performed less than 50 colonoscopies per month.

### *Localization practices*

On average,  $56.5\% \pm 11.5\%$  of respondents routinely shared colonoscopic images and/or videos with the consulting surgeon when referring patients for CRC surgery. The frequency of various localization techniques when a lesion was detected by colonoscopy is highlighted in Table 2. Most respondents used anatomical landmarks ( $91.3\% \pm 10.9\%$ ), followed by tattooing ( $82.6\% \pm 11.3\%$ ), image capture ( $73.9\% \pm 11.5\%$ ) and distance measured from the anal verge ( $71.0\% \pm 11.5\%$ ). No participants reported the use of hemoclips for localization.

Tattoo localization practices are highlighted in Table 3. The majority of respondents indicated they would tattoo lesions that could not be removed by colonoscopy ( $92.8\% \pm 10.9\%$ ), polyps with high-risk features ( $95.7\% \pm 10.7\%$ ) and large lesions suspicious for malignancy ( $84.1\% \pm 11.3\%$ ). In addition,  $76.8\% \pm 11.5\%$  indicated they would tattoo polyps with features that may require follow-up colonoscopy. Only  $2.9\% \pm 5.0\%$  indicated they would tattoo polyps smaller than 1 cm. The vast majority of respondents would routinely tattoo a lesion regardless of surgical approach ( $91.3\% \pm 10.9\%$  for laparoscopic surgery;  $88.4\% \pm 11.1\%$  for open surgical resection). With respect to tumour location, respondents said they would be likely to tattoo left-sided ( $89.9\% \pm 11.0\%$ ) and right-sided malignancies ( $85.5\% \pm 11.2\%$ ). Only  $20.3\% \pm 8.2\%$  said they would be likely to tattoo a rectal lesion.

### *Repeat colonoscopy prior to CRC surgery*

Table 4 summarizes the perceived indications for preoperative repeat endoscopy specified by gastroenterologists as well as general surgeons. Gastroenterologists (80.6%) were more likely than general surgeons (56.6%) to identify preoperative planning or tattoo localization by the operating surgeon as the primary indication for repeat endoscopy ( $p < 0.001$ ). General surgeons were more likely

than gastroenterologists to agree that an incomplete initial colonoscopy was an indication for repeat endoscopy (14.9% v. 6.9%;  $p = 0.040$ ).

Most (63 [91.3%]) gastroenterologists agreed that tattoo localization of a malignancy on the initial colonoscopy is the standard of care. Only 1 (1.4%) gastroenterologist agreed that repeat colonoscopy by the general surgeon before CRC surgery is the standard of care, whereas 68 (38.9%) general surgeons agreed ( $p < 0.001$ ). The majority of gastroenterologists (48 [69.6%]) and general surgeons (105 [60.0%]) disagreed with the statement, "Repeat colonoscopy prior to surgery has minimal impact on total cost of care" ( $p = 0.15$ ). A total of 104 (59.4%) general surgeons agreed that "Repeat colonoscopy prior to surgery has minimal impact on time to definitive surgery," whereas

**Table 1. Characteristics of study participants**

Variable	No. (%)
Sex, n = 69	
Male	62 (89.9)
Female	7 (10.1)
Years in practice	
< 5	13 (18.8)
6–20	26 (37.7)
> 20	30 (43.5)
Practice location	
Urban	64 (92.8)
Rural	5 (7.2)
Practice setting	
Community hospital	21 (30.4)
Teaching hospital	42 (60.9)
Private clinic	6 (8.7)
No. of colonoscopies performed, average per mo	
< 50	19 (27.5)
50–69	11 (15.9)
70–89	20 (29.0)
90–100	11 (15.9)
> 100	8 (11.6)
No. of CRCs diagnosed on colonoscopy in past 12 mo	
< 5	10 (14.5)
5–10	37 (53.6)
> 10	22 (31.9)
CRC = colorectal cancer.	

**Table 2. Localization practices for lesions detected by colonoscopy for gastroenterologists**

Localization technique	Frequency; no (%)	
	Infrequently/never	Frequently/always
Colonoscopy tip measured from anal verge	20 (29.0)	49 (71.0)
Anatomical landmark	6 (8.7)	63 (91.3)
Image capture	18 (26.1)	51 (73.9)
Tattoo localization	12 (17.4)	57 (82.6)
Hemoclips	69 (100.0)	0

only 28 (40.6%) gastroenterologists agreed ( $p = 0.003$ ). Further, 84 (56%) of the general surgeons surveyed indicated that the findings of repeat endoscopy often lead to changes in the operative plan. With regard to conducting repeat endoscopy before CRC surgery in the previous 12 months, 46 (26.9%) never performed repeat endoscopy, 73 (42.7%) in less than 50% of CRC cases, 24 (14.0%) in 51%–75% of cases and 28 (16.4%) performed repeat endoscopy in more than 75% of cases.

## DISCUSSION

Our study demonstrates that for lesions detected by colonoscopy, gastroenterologists most frequently use anatomical landmarks (91.3%) for tumour localization. This is followed by tattooing (82.6%), image capture (73.9%) and colonoscopy tip measured from the anal verge (71.0%). Use of hemoclips was not reported by any of the respondents in this study. The frequent use of anatomical landmarks corroborates recent findings by Beaulieu and colleagues,<sup>12</sup> who demonstrated a 99.1% anatomical location-based reporting rate.<sup>12</sup> Despite these results, use of anatomical landmarks compared with intraoperative location has been associated with localization error rates as high as 21%, thus leading many to recommend tattoo localization instead.<sup>7,9</sup>

**Table 3. Likelihood of gastroenterologists to perform tattoo localization under various clinical conditions**

Clinical setting	No. (%)
<b>Colorectal lesion features</b>	
Lesion that cannot be removed with colonoscopy	64 (92.8)
Polyp with high-risk features that may require resection	66 (95.7)
Polyp with features that may require follow-up colonoscopy	53 (76.8)
Large lesion highly suspicious for malignancy	58 (84.1)
Small polyp (< 1 cm)	2 (2.9)
<b>Surgical approach</b>	
Referring suspicious lesion for laparoscopic resection	63 (91.3)
Referring suspicious lesion for open resection	61 (88.4)
<b>Malignancy location</b>	
Left side	62 (89.9)
Right side	59 (85.5)
Rectum	14 (20.3)

Given that lack of tattoo localization was cited as one of the most common indications for repeat endoscopy by general surgeons,<sup>18</sup> the results of our study are an important contribution to further understanding this practice by gastroenterologists. For lesions detected at colonoscopy in the previous 12 months, 74% of respondents said they frequently localized the lesion by tattooing. This result is similar to those of Conaghan and colleagues,<sup>17</sup> who demonstrated a tattoo localization rate of 65.1% in 85 patients who underwent laparoscopic resection for colorectal tumours. However, in their study, 31% of patients were tattooed at a repeat endoscopy, a procedure that is both costly and has associated risks.<sup>17</sup> Respondents in our study were very likely to tattoo lesions that could not be removed by colonoscopy (92.8%), polyps with high-risk features (95.7%) and polyps with features that may require follow-up colonoscopy (76.8%). These findings are in contrast to those of a recent study by Zafar and colleagues,<sup>16</sup> who examined tattoo localization in 165 patients with polyps and reported a tattoo rate of only 23%. Our study demonstrates a tattoo rate of only 2.9% for polyps smaller than 1 cm and much higher rates for polyps with high-risk features. To our knowledge, this is the first study to explicitly assess tattooing practices based on polyp features.

There is a paucity of literature evaluating tattoo rates with respect to tumour location. Most of the respondents in our study said they would tattoo right-sided (85.5%) and left-sided malignancies (89.9%), whereas only 20.3% said they would tattoo rectal lesions. Keller and colleagues<sup>15</sup> demonstrated an even lower rectal tattoo rate of 4.1% in 49 patients with rectal polyps that were later diagnosed as neoplastic. This discrepancy in tattooing of rectal lesions may best be explained by the clinical scenarios addressed: whereas Keller and colleagues assessed only tattooing of polyps, our study assessed the likelihood of tattooing rectal lesions suspicious for malignancy. Interestingly, our study demonstrates that gastroenterologists are likely to tattoo malignancies in the right colon despite evidence that right-sided lesions close to known anatomical landmarks, such as the ileocecal junction or appendiceal

**Table 4. Primary indication for repeat endoscopy before colorectal cancer surgery identified by gastroenterologists and general surgeons**

Primary indication	Group; no. (%)		
	Gastroenterologists	General surgeons*	p-value
Preoperative planning or tattoo localization by surgeon	56 (81.2)	99 (65.1)	< 0.001
Lack of information provided by initial colonoscopy report	7 (10.1)	24 (15.8)	0.26
Incomplete initial colonoscopy	5 (7.2)	26 (17.1)	0.040
Repeated therapeutic attempt	1 (1.4)	3 (2.0)	0.79

\*Based on a recent survey of practising general surgeons in Ontario.<sup>18</sup>

orifice, may not require tattoo localization.<sup>19</sup> The finding that gastroenterologists are likely to tattoo left-sided lesions and lesions that will be referred for laparoscopic surgery (91.3%) builds on recent work by Al Abbasi and colleagues,<sup>11</sup> who showed a significant increase in the rate of repeat endoscopy before CRC surgery for left-sided lesions and planned laparoscopic surgery.

The preoperative repeat endoscopy rate at a large tertiary care centre has been estimated to be 40.5%, with the most common reasons for repeat endoscopy including tattooing of the lesion or preoperative planning in more than 80% of cases.<sup>11</sup> Given the relatively high cost of colonoscopy in Canada<sup>20</sup> and the adverse potential risk of perforation with colonoscopy,<sup>21</sup> recent efforts have been made to elucidate general surgeons' perspectives on repeating colonoscopy.<sup>18</sup>

Our study builds on previous work by our group by assessing and comparing the attitudes and perceptions of gastroenterologists with those of general surgeons. Our study confirmed that the majority of both gastroenterologists and general surgeons identify preoperative planning or tattoo localization by the operating surgeon as the primary indication for repeat endoscopy. Furthermore, we found that general surgeons were more likely than gastroenterologists to believe that preoperative repeat endoscopy is the standard of care ( $p < 0.001$ ). Only 1.4% of gastroenterologists agreed that repeat endoscopy should be the standard of care. This difference is likely explained by our finding that the majority of general surgeons frequently alter their surgical plans based on the results of the repeat colonoscopy. The featured discrepancies between the opinions of gastroenterologists and general surgeons emphasize the misconceptions that exist with regards to this costly practice. Our finding that 56% of general surgeons agree that repeat colonoscopy often leads to change in surgical management underlines the importance of accurate localization and reporting of this information among endoscopists. This finding is supported by a recent study by Saleh and colleagues,<sup>22</sup> who demonstrated that repeat endoscopy was protective against localization error, with a sensitivity greater than 80% in detecting errors. These conflicting perceptions are likely secondary to the lack of standardized protocols that guide endoscopists with respect to the indications for repeat endoscopy and the indications for tattooing. Additionally, the lack of standardized documentation and reporting of localization information compounds this problem.

### **Limitations**

The findings of the present study should be interpreted within the context of the following limitations. First, the results may have been influenced by recall bias. To minimize this possibility, we used Likert

scales and ranges rather than soliciting discrete values from respondents. Second, although respondents included gastroenterologists from across the province of Ontario, the results may not be generalizable to other gastroenterology groups. Finally, the results are based on self-reporting by clinicians, and thus we were unable to calculate precise rates of tumour localization practices.

### **CONCLUSION**

The present study confirms that anatomic landmarks are the most commonly used localization technique by gastroenterologists for lesions detected by colonoscopy. Moreover, gastroenterologists frequently use tattoo localization for high-risk polyps, large lesions suspicious for malignancy, and left- and right-sided malignancies. However, discrepancies exist between gastroenterologists and general surgeons with regards to perceptions toward repeat endoscopy and its indications. Such discrepancies highlight the importance of developing standardized guidelines for tattooing, repeat endoscopy and reporting of localization information among endoscopists. This is especially important given that general surgeons report frequent changes in the operative plan as a result of new information learned at repeat endoscopy. Further research is needed to formulate practice recommendations that guide the use of repeat endoscopy and tattoo localization with the aim of improving quality of patient care while minimizing cost.

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**Competing interests:** None declared.

**Contributors:** T.D. Jackson, A. Okrainec, P.G. Rossos and F.A. Quereshy designed the study. A. Azin and M.C. Jimenez acquired the data, which A. Azin, M.C. Jimenez and M.C. Cleghorn analyzed. A. Azin, M.C. Jimenez and M.C. Cleghorn wrote the article, which T.D. Jackson, A. Okrainec, P.G. Rossos and F.A. Quereshy reviewed. All authors approved the final version of the manuscript for publication.

### **References**

- Canadian Cancer Society's Advisory Committee on Cancer Statistics. Canadian Cancer Statistics 2014. Toronto, ON: Canadian Cancer Society; 2014.
- Zauber AG, Lansdorp-Vogelaar I, Knudsen AB, et al. Evaluating test strategies for colorectal cancer screening: a decision analysis for the U.S. preventive services task force. *Ann Intern Med* 2008;149:659-69.
- Stanciu C, Trifan A, Khder SA. Accuracy of colonoscopy in localizing colonic cancer. *Rev Med Chir Soc Med Nat Iasi* 2007;111:39-43.
- Vaziri K, Choxi SC, Orkin BA. Accuracy of colonoscopic localization. *Surg Endosc* 2010;24:2502-5.

5. Louis MA, Nandipati K, Astorga R, et al. Correlation between pre-operative endoscopic and intraoperative findings in localizing colorectal lesions. *World J Surg* 2010;34:1587-91.
6. Vignati P, Welch JP, Cohen JL. Endoscopic localization of colon cancers. *Surg Endosc* 1994;8:1085-7.
7. Lee J, Voytovich A, Pennoyer W, et al. Accuracy of colon tumor localization: computed tomography scanning as a complement to colonoscopy. *World J Gastrointest Surg* 2010;2:22-5.
8. Cho YB, Lee WY, Yun HR, et al. Tumor localization for laparoscopic colorectal surgery. *World J Surg* 2007;31:1491-5.
9. Piscatelli N, Hyman N, Osler T. Localizing colorectal cancer by colonoscopy. *Arch Surg* 2005;140:932-5.
10. Borda F, Jimenez FJ, Borda A, et al. Endoscopic localization of colorectal cancer: study of its accuracy and possible error factors. *Rev Esp Enferm Dig* 2012;104:512-7.
11. Al Abbasi T, Saleh F, Jackson TD, et al. Preoperative re-endoscopy in colorectal cancer patients: an institutional experience and analysis of influencing factors. *Surg Endosc* 2014;28:2808-14.
12. Beaulieu D, Barkun A, Martel M. Quality audit of colonoscopy reports amongst patients screened or surveilled for colorectal neoplasia. *World J Gastroenterol* 2012;18:3551-7.
13. Singh H, Kaita L, Taylor G, et al. Practice and documentation of performance of colonoscopy in a central Canadian health region. *Can J Gastroenterol Hepatol* 2014;28:185-90.
14. Beretvas RI, Ponsky J. Endoscopic marking: an adjunct to laparoscopic gastrointestinal surgery. *Surg Endosc* 2001;15:1202-3.
15. Keller D, Jaffe J, Philp MM, et al. Should all endoscopically excised rectal polyps be tattooed? A plea for localization. *Surg Endosc* 2012;26:3101-5.
16. Zafar A, Mustafa M, Chapman M. Colorectal polyps: When should we tattoo? *Surg Endosc* 2012;26:3264-6.
17. Conaghan PJ, Maxwell-Armstrong CA, Garrioch MV, et al. Leaving a mark: the frequency and accuracy of tattooing prior to laparoscopic colorectal surgery. *Colorectal Dis* 2011;13:1184-7.
18. Jimenez MC, Azin A, Saleh F, et al. Preoperative repeat endoscopy for colorectal cancer: attitudes, perceptions and practices of general surgeons. Poster session presented at the meeting of the Society of Gastrointestinal and Endoscopic Surgeons, Salt Lake City, Utah, April 2014.
19. Kim SH, Milsom JW, Church JM, et al. Perioperative tumor localization for laparoscopic colorectal surgery. *Surg Endosc* 1997;11:1013-6.
20. Sharara N, Adam V, Crott R, et al. The costs of colonoscopy in a Canadian hospital using a microcosting approach. *Can J Gastroenterol* 2008;22:565-70.
21. Araghizadeh FY, Timmcke AE, Opelka FG, et al. Colonoscopic perforations. *Dis Colon Rectum* 2001;44:713-6.
22. Saleh F, Abbasi TA, Cleghorn M, et al. Preoperative endoscopy localization error rate in patients with colorectal cancer. *Surg Endosc* 2015;29:2569-75.

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