Endoscopic Tattoo of the Colon might be Standardized to Locate Tumors Intraoperatively

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Abstract

Background. Small colonic lesions which are identified during endoscopy are usually difficult to locate intraoperatively. Endoscopic tattoo of the colon seems the most efficient method, however it does fail in some cases to identify the lesion peroperatively. We studied this method to evaluate its efficacy. Methods. Nineteen patients were tattooed during colonoscopy with “India ink” (drawing ink Rotring®). These patients had lesions in which difficulties were anticipated when retracing them again during colorectal surgery. Seventeen patients underwent colonic surgery. One patient underwent laparoscopic polypectomy and the other TEM (Transanal Endoscopic Microsurgery). Results. The visibility of the “India ink” peroperatively and afterwards during histological examination were evaluated. The tattoos were visible in 68.4 % patients intraoperatively. Histopathological macroscopic examination of the specimens showed ink in 73.6 % patients. In 31.5 % patients the tattoo could not be recognised peroperatively. Conclusions. Endoscopy assisted tattooing of the colon has been reported to be a safe method to landmark lesions in the colon. In the majority of our patients the tattoo was obvious during surgery. Endoscopic tattoo seems an efficient technique in identifying small colonic lesions intraoperatively.

Key words
Colorectal lesions - endoscopic tattoo - laparoscopy - Rotring® ink - budget - standardization - histology - lymphnodes

Introduction

Precise localization of lesions within the colon is essential in a number of clinical circumstances, particularly when surgical resection is required or the lesion after polypectomy needs to be reinspected at a later date.

Landmarking soft colorectal lesions during colonoscopy for surgical recognition during (laparoscopic) operation is a topic for surgeons. The laparoscopist does not have the ability of palpating the colon between the fingers during exploration. Even in conventional surgery, intra-operative localization of small nonpalpable soft tumours or polypectomy sites has been reported to be a difficult problem. There are many different methods to help the surgeon to find these lesions intraoperatively. Most of the methods which have been reported seem insufficient in recognizing the lesions (1).

Distance estimation for instance is a method which roughly gives the location of a lesion, due to the distensi-
bility characteristics of the colon and the fact that during colonoscopy air is inflated which also will lead to distension of the colon. Another well-known method is peroperative endoscopy which is time consuming and needs the attendance of an additional endoscopist. In laparoscopic surgery, palpation of colonic tumour is impossible and the location of these tumours must be defined preoperatively. Large soft lesions are not well palpable.

Colonic tattoo with “India ink” is a method reported in 1975 by Ponsky and King (2). The safety and the efficacy of this method was reported in other studies (3,4). We evaluated the efficacy of this method with a low-budget tattoo ink (Rotring®) in identifying soft colorectal lesions.

Methods

It is our practice to inject a permanent surgical marker during the initial colonoscopy if a lesion cannot be removed or if an endoscopically removed polyp has clinical features that may require surgical resection or surveillance colonoscopy.

Between September 2001 and March 2003, 19 patients underwent surgery for small lesions, such as colonic polyps. During colonoscopy these patients were prospectively marked with a low budget, easily available “India ink” (Rotring®). The “India ink” suspension was first filtered by a 5 micron filter, then produced in ampulla, sterilised (15 min. 121 °C) and used. The “ink” was not diluted prior to its submucosal injection of 1 cc proximal or distal of the lesion, with a sclerosing needle (Cobra Medical®). India ink is a black drawing ink made with carbon particles. India ink (Rotring®) is available from any stationary store for drawing-materials.

Patients were operated for both premalignant and malignant diseases of the colon and rectum (13 adenocarcinomas, 6 adenomas).

Seventeen patients underwent surgical intervention: 8 low anterior resection, 3 left hemicolecctomy, 3 sigmoid resection, 1 rectosigmoid resection, 1 transverse colon resection, 1 subtotal colectomy. One patient underwent laparoscopic polypectomy and another patient a TEM. We evaluated these patients regarding the visibility and safety of the tattooing during operation and in histopathological investigation.

The local ethical committee approved the study.

Results

None of the patients developed fever, abdominal pain or tenderness after tattooing the colon. The tattoo was visible in 13 patients (68.4 %) intra-operatively (Table I). During post-operative examination of the specimens, the tattoo was visible in 14 (73.6 %) patients macroscopically. The mean time-interval between injection of the ink and subsequent operation was 3 weeks (range 1-8 weeks).

In one patient who underwent laparoscopic polypectomy no “India ink” could be identified at histopathology, although the tattooing was clearly visible during the operation near the resected area. This finding could be due to the fact that the tattooing had been injected distal of the lesion. In 6 patients (31.5 %) the “India ink” was not recognised during surgery. The lesion was easily found by

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* tumour in the small pelvis, difficult to inspect, bimanually per rectum palpable

Table I Visibility of the colonic lesions intra- and post-operatively
Endoscopic tattoo of the colon

Palpation in two patients. In another patient, the lesion was difficult to detect, due to the location in the small pelvis. The fourth patient had a colonic lesion with adhesions to the spleen, after previous surgery. TEM was performed in a patient with a rectal lesion and the lesion was obvious. The tattoo was not reported by the surgeon. In the sixth patient it was necessary to perform an intraoperative endoscopy in order to locate the lesion.

In 5 patients there were minimal or no lymph nodes in the specimens during postoperative examination. In the remaining 14 patients, the lymph nodes were examined and the “India ink” particles were microscopically visible in 5 of the patients (35.7 %). In one patient the tattoo was also macroscopically visible in the lymph nodes. No signs of inflammatory reaction, granulomas or other complications were recognised during surgery.

Pathological examination showed adenocarcinoma in 13 patients. In 6 of them, this was recognised preoperatively either as premalignant lesion or highly suspected lesion. The diameter of the ink particles was approximately 0.1 micron and they were present in the stromal interstitium and in macrophages especially in the adjacent lymph nodes. However, no inflammatory reaction was present in the vicinity of the ink particles (Figs.1,2).

Discussion

Small colorectal lesions are difficult to locate during colorectal surgery. Endoscopic measurement during preoperative colonoscopy usually gives a rough estimation. The colon is a distensible organ and the inflated air together with the endoscope can lead to misinterpretation easily.

Frager et al (5) reported six patients in whom reliance on preoperative colonoscopic tumour localisation had led to errors of the diagnosis and therapy. Three patients required a relaparotomy because the tumour had been left in place during the first colorectal surgery.

Intraoperative colonoscopy is a difficult investigation for endoscopists. Poor operative exposure due to bowel distension is another disadvantage for the surgeon (1). Endoscopically placed mucosal clips were tried in the past. However, clips fall off in an average of 10 days, and laparoscopic recognition therefore seems inadequate (1).

Laparoscopic clips applied to the serosal surface of the bowel under the guidance of intraoperative colonoscopy is less attractive to the surgeon because the clips tend to dislodge from the serosa (1). Moreover, the clips are too small to be recognised easily. This method is time consuming.
and needs the cooperation of the surgeon and the gastroenterologist.

The safety of “India ink” has previously been reported in several studies. Botoman et al. (6) described the only case of a clinical complication. A patient underwent snare biopsy of a sigmoid cancer with cauterisation followed by “India ink” tattooing of the lesion. However, these findings could well be attributed to the cauterisation procedure and not to a possible complication of “India ink”.

Histopathological complications have been reported in the literature, such as local reactions like fat necrosis with inflammatory pseudotumour formation, colonic abscess with localised peritonitis, and chronic inflammation (7-9). In another study in which “India ink” was used in 195 patients no complications were recognized (3).

“India ink” is a permanent dye. Ponsky and King who first described the use of this method, reported a patient in whom the ink was visible after 22 years.

In our pilot - study with Rotring® India Ink we did not encounter any clinical or histopathological complications. Rotring® India Ink is easily available at very low prices (100 cc: • 12,00).

The presence of “India ink” during surgery helped in targeting lesions in the majority of our patients. Quick identification during surgery saves time.

In six patients the tattoo in the colon was not visible, but in five patients the lesion could be detected with other means, further intraoperative colonoscopy being not necessary. In one patient it was necessary to perform an intraoperative colonoscopy in order to retrace the lesion. Unfortunately, we marked the lesion with a single injection of 1 cc. A second injection of 1 cc given contralaterally would have probably allowed to recognize the tattooing.

Since the colonoscopist cannot know which portion of the bowel is the superior aspect, multiple injections should be made circumferentially in the wall around a lesion to prevent a single injection site from being located in a “sanctuary” site, which is hidden from the eyes of the surgeon when the abdomen is opened.

Obviously endoscopic tattooing of the colon mucosa outperforms the other alternatives in identifying a colorectal lesion (10).

Safety in performance has been reported in many studies. It is important to sterilise the ink before its use in order to avoid infection. India ink itself is not conducive for culture on media (11). The absence of inflammatory reactions even after 10 years as reported by King et al. is reassuring (3). We looked very carefully for secondary inflammation due to ink in the mucosa and lymph nodes but we did not find any adverse reaction at the histopathological examination.

Conclusion

Endoscopic tattooing of the colon seems a safe and effective low-budget method to landmark small lesions in the colon. In our patients we did not encounter any adverse reactions to the “India ink” clinically or histopathologically.

In the presented series the tattoo was clearly visible during surgery in the majority of patients. The use of endoscopic tattoo is an essential and efficient technique to help identifying small lesions intraoperatively, still underused and undervalued in many hospitals. We recommend the use of this method as a standard method of marking small lesions during colonoscopy when a planned colorectal surgical intervention is anticipated.

Injecting a second shot contralaterally may help in decreasing the percentage of undetected tattoos during surgery. The surgeon should be informed whether the injections are proximal or distal to the lesions.

References