

# Laparoscopic Intraoperative Location of Colorectal Tumors

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**ABSTRACT:** With the application of various examination methods, many incipient colon tumors are found. With the lack of hand tactility and direct touch, the tumor localization is one of the difficulties in laparoscopic surgery. This study is to summarize and analyze the common location methods currently used in laparoscopic colorectal surgery for your choice according to needs.

**Key words:** Laparoscope; Colorectal tumor; Intraoperative location; Lesion location

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## Introduction

With the progress of medical science and the application of various examination methods, many small colon tumors can be detected. However, inaccurate colonoscopy location shows some errors in surgery<sup>[1,2]</sup>. In laparotomy surgery, the location of colon tumors is not difficult because of direct hand tactility and touch. While in laparoscopic surgery, the most frequently encountered problem is the intraoperative location of colonic lesions. In laparoscopic surgery, some colon tumors can not be directly touched by hands but only can be indirectly located by instruments. Laparoscopic surgery encounters the problem of difficult location, especially in the cases with smooth serosal surface on the lesion and the cases without obvious changes<sup>[3]</sup>. To solve the problem, this paper proposed many assisted location methods.

## 1 Fiber colonoscope assisted location

After routine preoperative preparations, the patient took the lithotomic position under general anesthesia. The artificial pneumoperitoneum was established and laparoscope and auxiliary instruments were inserted from the appropriate position according to the preoperative diagnosis of lesions. The intestinal forceps was used to examine whether the colon was with tumor and whether the tumor infiltrated the intestinal serosa. Fiber colonoscope was inserted through anus to locate the lesion for the patient whose lesion cannot be defined. Intraoperative location was conducted immediately with colonoscopy light as the marker<sup>[4]</sup>. Generally, titanium clip or suture marker on the corresponding intestinal wall was used. The colonoscope was used to suck the gas in the marked colon and then was exited or maintained to assist surgery<sup>[5]</sup>. Then, surgeons went to the next surgical procedure. For lower position rectum and sigmoid colon tumors, sigmoidoscope intraoperative

location was used<sup>[6]</sup>.

This method can accurately locate lesions through dual-endoscope with internal intestinal view and external intestinal view. It can avoid injury of laparotomy, and resect lesions safely and thoroughly and enhance pathological diagnosis accuracy. However, laparoscopic view should be darkened and pneumoperitoneum pressure should be reduced in the application of fiber colonoscope assisted location. In addition, the inflation of fiber colonoscope would influence observation and operation under laparoscope. Thus, the requirement was higher for surgeons. Contacting staff in Endoscopy Room in advance and making enteroscopy preparations is good for improving the operation.

## 2 Metal clip marker method

1 day before the operation, the patient took cathartic orally to clean bowels and had routine fiber colonoscopy. The superior border and the inferior border of the lesion were marked with titanium clip through fiber colonoscope. At the same time, the distance between the lesion and the anal verge was recorded according to colonoscope. The patient took the horizontal position and took the abdomen film. Marks were made on body surface according to the coordinate position of the titanium clip on the X-ray film<sup>[7,8]</sup>. Pneumoperitoneum was established under general anesthesia. Puncture holes were built according to needs and laparoscopic instruments were inserted. Mesenteric border was marked with titanium clip as the parenteral marker according to the vertical project points from the body surface marker to colon in abdominal cavity. The lesion of intestinal canal and mesentery were dissociated and the subordinate mesentery was divided with ultrasonic scalpel. Assisted surgical incision was cut at the corresponding part. The lesion intestine was pulled out and the intestinal canal was carefully touched for further defining the lesion part. Then the lesion part was resected and intestinal anastomosis was conducted in vitro.

The body surface location on lower abdomen and minimal incision operation technique through X-ray was simple, safe<sup>[9]</sup> and effective without other equipment. The titanium clip was in

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clavate high-density shadow and the inflated intestinal canal was in low-density shadow under X-ray. Thus, tumors and laparoscopic abdominal puncture holes were located according to colon direction. However, the transverse colon of some patients was lengthy and dissociative; The titanium clip shadow will change under different positions, which led to the errored lesion location.

### 3 Macroparticle activated carbon marker method

Marking time was less than 5 days before operation. Tumor part was found according to routine fiber colonoscopic operation. The patient took the supine position and 20~40ml 0.9% sodium chloride solution was injected into the intestinal cavity adjacent to the tumor through the forceps hole of the fiber colonoscope. The retained part of 0.9% sodium chloride solution was the rear side of the colon and the right front of water was the abdominal side of the colon. The target part to inject macroparticle activated carbon was the colonic mucosa at the abdominal side. 1ml normal saline was injected under the mucosa of the target part with the local injection needle to make the mucosa form swell rash. Then 0.3~0.5ml macroparticle activated carbon was injected into the swollen colonic mucosa at 2 points or more points according to the needs<sup>[10]</sup>. After routine preoperative preparations, artificial pneumoperitoneum was established under general anesthesia. The laparoscopic instruments were inserted to explore. Stained lesion intestinal wall and enlarged lymph nodes can be found and resected by routine surgery<sup>[11]</sup>.

The application of macroparticle activated carbon had obvious locating function in laparoscopic colorectal cancer surgery. Lesion part can be easily found without any auxiliary measures. This method was beneficial for distinguishing normal tissues at both sides of the tumor and ensuring there was no tumor infiltration at the stump. This method was simple and economic and saves operation time<sup>[12]</sup>. Compared with other stains, macroparticle activated carbon had obvious advantages, such as excellent adsorption capacity, extremely high lymphatic system tropism and tissue penetration, longer tissue retention and no obvious adverse reaction<sup>[13]</sup>. Toluidine blue, isosulfan blue, hematoxylin and eosin were of short tissue retention, bad staining strength and higher requirement on operation time management. Like macroparticle activated carbon, India ink was long in staining time and clear in ink operation. However, India ink was weak in lymphatic system tropism and easy to cause local complications, such as cellulitis, fat necrosis, inflammatory pseudotumor, abscess and localized peritonitis<sup>[14]</sup>.

### 4 Laparoscopic ultrasound (LUS)

Laparoscopic instruments were inserted to explore under routine general anesthesia. If the lesion was hard to define under laparoscopic view, laparoscopic ultrasound detector was inserted. LUS high-frequency probe was closely contacted with the intestinal wall. The laparoscopic ultrasound detector could directly provide high-definition image, display lesion part, find locally infiltrated depth, check enlarged lymph node and scan hepatic metastasis according to needs<sup>[15]</sup>. Sutured or marked with titanium clip at the lesion part. The next operation method and resection range were determined according to the ultrasound description.

The laparoscopic ultrasound was swift, convenient, reliable time-saving and repeatable<sup>[16, 17]</sup>. LUS high-frequency probe directly contacted the intestinal mucosa to provide high-definition image. A 5-layer high-low-high-low-high echo structure of the intestinal wall was clearly displayed when the colon and the rectum were examined. The 5 layers represent mucosal interface, mucosa, submucosa, muscularis propria and serosa<sup>[18]</sup>. LUS could find minimal lesions which were smaller than 5mm in deep liver. Compared with external ultrasound, CT, MRI and other imaging methods, LUS was more sensitive. Thus, LUS was beneficial for finding early hepatic metastasis and making treatment prognosis. However, LUS was high in cost and difficult in operation under laparoscope. Doctors in Ultrasonography Department are needed to make judgment. When the intestinal canal is flatulent, the ultrasound display is unclear and scan cannot be conducted. And it can make relevant preoperative preparations well.

### 5 Hand-assisted laparoscopic surgery

If preoperative preparation was insufficient, temporary intraoperative location was difficult or intraoperative lesion and ambient conditions were complex, adhesion or infiltration were serious, totally laparoscope was hard to finish separately, hand-assisted laparoscopic surgery, HALS is used for locating laparoscopic colorectal tumors. Hand-assisted incisions and other surgical incisions were determined according to lesions and operational needs. Generally, the hand-assisted incision of right hemicolectomy was transrectus incision at right lower abdomen and the hand-assisted incision of left hemicolectomy, sigmoidectomy and proctectomy was transrectus incision at left lower abdomen. Abdominal wall was incised layer by layer and 'Lapdisk' or Hand-port was inserted. Lapdisk was tightened in the abdominal cavity with the left hand and CO<sub>2</sub> was injected<sup>[19]</sup>. The tumor was located under the guide of the left hand for assisting laparoscopic operation.

Surgeons can sense the thickness and softness of intestinal canal and tumors and lymph nodes in the intestinal cavity with hand touch in hand-assisted laparoscopic surgery. The hand enter-

ing the abdominal cavity can effectively assist pull, exposure and hemostasis, which makes the surgery safer and quicker<sup>[20]</sup>. Hand-assisted laparoscopic surgery expands the range of laparoscopic colorectal surgery<sup>[21]</sup>. At the same time, the hand-assisted laparoscopic surgery had many shortcomings. The hand-assisted incision increased the injury to the abdominal wall and the hand occupies certain space in the abdominal cavity. In rectal surgery, the hand would influence the operation of laparoscopic instruments in pelvic cavity. In addition, excessive hand operation in the abdominal cavity would increase abdominal adhesion<sup>[22]</sup>. HALS must be equipped with a leakage protector. At present, these devices are expensive, which increases medical cost and patient burden and influences the development of HALS technology.

## 6 Conclusion

There are many location methods for colorectal cancer, which one have different advantages and disadvantages. Surgeons can select the aforementioned methods according to their own conditions and patients' conditions. So far, the methods for temporary intraoperative location are a few and are largely restricted. Those methods increase the injury to patients and medical costs. Better methods are to be developed and researched.

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## 腹腔镜手术中结直肠肿瘤的术中定位

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**摘要** 随着各种检查方法的应用,许多结肠的早期肿瘤被发现,但腹腔镜手术中,由于缺乏手的触感,不能直接触摸到肿瘤,从而使这些肿瘤的定位成为腹腔镜手术中的困难之一,目前术用的术中定位很多,主要有纤维结肠镜辅助、金属夹标记、染料标记法、术中腹腔镜超声探查、手助腹腔镜技术等等,本文就目前在腹腔镜结直肠手术中常用的这些定位方法加以总结、分析,以供大家根据需要进行选择应用。

**关键词** 腹腔镜 结直肠肿瘤 术中定位 病变定位

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