Prevention of Port Site Hernia after Laparoscopic-assisted colectomy

Kazuteru Watanabe, Departments of Gastroenterological Surgery, Yokohama City University postgraduate School of Medicine, Yokohama, Japan
Shouichi Fujii, Yokohama City University Medical Center, Gastroenterological Center
Hirokazu Suwa, Yokohama City University Medical Center, Gastroenterological Center
Jun Watanabe, Yokohama City University Medical Center, Gastroenterological Center
Kenji Tatsumi, Yokohama City University Medical Center, Gastroenterological Center
Shigeru Yamagishi, Yokohama City University Medical Center, Gastroenterological Center
Mitsuyoshi Ota, Yokohama City University Medical Center, Gastroenterological Center
Chikara Kunisaki, Yokohama City University Medical Center, Gastroenterological Center
Yasushi Ichikawa, Yokohama City University Medical Center, Gastroenterological Center
Itaru Endo, Yokohama City University Medical Center, Gastroenterological Center

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Abstract

Background Although laparoscopic colorectal cancer resection is becoming increasingly popular, port site hernia (PSH) has remained a problem. It worsens satisfaction and the quality of life. No studies have specifically investigated the use of a GraNeeTM Needle and R-MedTM Plug system (the GraNee Needle system) in this surgical procedure. Thus, the aim of the present study was to determine the incidence of PSH using a grasping needle in a cohort of patients undergoing laparoscopic colorectal cancer resection in comparison with standard closure.

Methods We enrolled 672 consecutive patients with colorectal cancer who underwent laparoscopic colorectal resection between June 1993 and December 2008. The GraNee Needle system was introduced into the operation from April 2001 (GraNee Group ; N=388). Prior to this, standard closure was carried out via the defect through the skin wound once the pneumoperitoneum has been released and the port removed (Standard closure group ; N=221). Patient and tumor characteristics, and complication details were extracted from case records retrospectively and used to identify patients who developed PSH.

Results The median follow-up periods of standard closure group and Granee Needle group were 52.4 (12-167) and 38.3 (12-128) months, respectively. There were two incidences of PSH in the standard group (1.0 %) and none in the GraNee Needle group.

Conclusion No hernias were identified at any of the trocar sites when the GraNee Needle system was used. This method is quick, safe and provides adequate closure of the fascia and peritoneum which can be confirmed by intraperitoneal inspection.

KEYWORDS: Laparoscopic colorectal cancer resection, port site hernia, trocar
INTRODUCTION

Laparoscopic colorectal cancer resection has become increasingly popular since its introduction over 10 years ago (1). The main benefits have been in terms of fewer postoperative complications, decreased length of hospital stay, faster return of gut function, and reduced surgical infection without adverse effects on oncological outcome in colorectal cancer (2-4).

A potential complication of any laparoscopic procedure is the development of a port site hernia (PSH). PSH is surely infrequent in the complications of laparoscopic surgery, but it worsens satisfaction and the quality of life of the patients. Several methods and instruments are available to help close the trocar sites. The GraNee™ Needle and R-Med™ Plug system (the GraNee Needle system) is one of these devices. However, few studies have investigated PSH (5, 6) in laparoscopic colorectal cancer resection.

The aim of the present study, therefore, was to determine the incidence of PSH using the GraNee Needle system in a cohort of patients undergoing laparoscopic colorectal cancer resection, when compared with standard closure.

PATIENTS AND METHODS
Study design

We enrolled 672 consecutive patients with colorectal cancer who underwent laparoscopic colorectal resection between June 1993 and December 2008. The Granee Needle system was introduced into the operation from April 2001. Prior to this, standard closure was carried out via the defect through the skin wound once the pneumoperitoneum has been released and the port removed. Usually, the fascial edges are grasped with a Kocher clamp and the fascia and the peritoneum are sutured together with a simple or figure-of-eight 1-0 Vicryl suture.

Patients were divided into two groups based on the port site closure method: standard closure group (n=221) and the GraNee Needle group (n=388). Patient and tumor characteristics, and complication details were extracted from case records retrospectively and used to identify those patients who developed PSH.

The standard follow-up time for all patients after laparoscopic colorectal cancer resection was four weeks after hospital discharge. Subsequent follow-up was at 4-6 month intervals in the first year and then annually. Patients who were converted to an open procedure (n=37) and those who failed to attend for postoperative follow-up for a year (n=26) were excluded from the analysis. Thus, final study population is 609.
**Trocar Insertion and wound closure**

Under general anesthesia, the operation is performed under pneumoperitoneum. The patient is placed in the lithotomy position at 15 degrees Trendelenburg. A 5 port technique is employed in this procedure. Trocar placement is shown in Figure 1. A 12 mm trocar is inserted beside the navel as a scope port. Four additional trocars (5 mm x 1, 12 mm x 3) are placed superior and inferior to the lesion and serve as the working ports. One port site beside the navel is enlarged, and the specimen is extracted through it. At the end of the procedure, the three working port sites (12mm) were closed.

**GraNee™ Needle and R-Med™ Plug system (Figure 2)**

The GraNee™ Needle and R-Med™ Plug system (R-MED, Inc, Oregon, OH) consists of the pilot guide and the suture passer. To close the port incision, the suture passer is used to push suture material through the pilot guide, fascia, muscle, and peritoneum into the abdomen. The suture (1-0 Vicryl) is then released and dropped inside the peritoneal cavity and only the suture passer pulled back out of the abdomen. The empty suture passer is inserted through the opposite side of the pilot guide to again pick up the suture. This is then pulled up through the peritoneum, muscle, fascia, and guide, and the pilot
guide is removed. At the end of the operation, the suture is tied with a simple suture after removing the trocar. The procedure takes a few minutes by a port.

**Statistical analysis**

All results were expressed as the mean ± SD. Differences were determined by the Student’s *t*-test, chi-square test and the Kaplan-Meyer life table analysis with Breslow-Gehan-Wilcoxon test. SPSS version 11.01J for Windows was used for statistical analysis (SPSS, Chicago, IL), and a two-tailed *p*-value <0.05 was regarded as significant.

**RESULTS**

The median follow-up time for patients in the standard group and GraNee needle group were 52.4 (range 12-167) and 38.3 (range 12-96) months, respectively. Table 1 shows the characteristics of participating patients. Age, gender, BMI, ASA grade and indication of the operation didn’t significantly differ between the two groups. The rate of anterior resection in the GraNee needle group was higher than that in the standard group. The length of operation time was similar.

Table 2 shows the type of complications that occurred in both groups of patients. Two PSHs occurred in the standard group, an incidence of 1.0 %, but
no PSH was identified at any of the trocar sites in the GraNee needle group. The demographics of patients with PSH were as follows. First case is a 53-year-old man who underwent laparoscopic assisted anterior resection. 6 days after surgery, he suffered a severe pain at the site of the right lateral 12-mm port, which was diagnosed as PSH. At surgical repair the hernia was again found at the point where the trocar had pierced the fascia. The sac was dissected and the defect closed with a simple closure. The hernia orifice was 3cm, and the hernia content was small intestine. After that, he underwent two times of operations for the small bowel obstruction. Second case is a 74-year-old man who underwent laparoscopic assisted sigmoidectomy. 19 days after surgery, he re-presented with an abdominal pain, which was diagnosed as PSH. At the time of surgery, the hernia was found to be at the point at which the 12-mm laparoscopic port had pierced the fascia. The hernia orifice was 2.5cm, and the hernia content was small intestine. The sac was dissected and the defect closed with a simple closure. The patient made an uneventful recovery.

DISCUSSION

The current study identified a 0.3 % minimum prevalence of PSH, which is in agreement with previous reports (7) of an incidence of 0.02-6%, average 1 %, of PSH after laparoscopic surgery. Patients with PSH usually present within two weeks of surgery, although some cases have been reported years after the
initial surgery\(^{(8)}\). All patients in this study attended for postoperative follow-up for more than 12 months. This follow-up period was considered to be necessary and sufficient to detect PSH.

The development of unremitting pain, fever, or other gastrointestinal complaints after laparoscopic surgery requires immediate investigation. The spectrum of symptoms ranges from no indications to pain due to omental infarction or small bowel obstruction. The contents of these hernias are usually small bowel or omentum. PSH should be suspected in all patients with bowel obstruction up to one year after laparoscopic surgery. A computed tomography (CT) scan can be helpful in making the diagnosis\(^{(9)}\). Our 2 PSH cases were diagnosed by CT, too.

Risk factors related to PSH can be divided into clinical and technical aspects\(^{(10-12)}\). Clinical factors include male gender, advanced age, poor nutrition, anemia, diabetes, renal failure, treatment with steroids, advanced malignancy, and obesity. Technical factors include use of a sharp-bladed trocar-tip, a large trocar size, open laparoscopy, stretching the port-site during manipulation, the technique used for closure, properties of the suture materials used for closure, and location of the incision. Some reports suggest that pathogenesis is mainly due to technical factors rather than host factors, ie; most assert that use of a large trocar size, a bladed trocar-tip, and leaving the fascial defect open may
lead to the development of PSH\textsuperscript{(13,14)}. Therefore, every attempt should be made to close the fascia and the peritoneum.

Trocars used for laparoscopic surgery usually range between 5–15 mm in size. Although the current consensus is not uniform about the management of port sites less than 10 mm, sites larger than this should be closed if at all possible. The ideal method of closure should be quick, easy to perform without enlarging the skin incision, safe, inexpensive, and provide adequate closure of the fascia and peritoneum. Standard suture techniques can be difficult and frustrating to apply, often involving blind closure of the fascial defect. However, several methods and instruments are available to help close trocar sites.

The GraNee\textsuperscript{TM} Needle and R-Med\textsuperscript{TM} Plug system is one such method and used for PSH prevention, but few reports are available on the efficacy of PSH prevention. The procedure is straightforward and takes little time. Our original adaptation of laparoscopic colorectal cancer resection was for early cancer, but this has since been extended to include progressive cancer. This explains why there were many progressive and difficult cases in the GraNee needle group compared with the standard group. Nevertheless, the length of operation time was similar between the GraNee needle group and the standard group. Moreover, no incidences of PHS occurred in the GraNee needle group, and
closure of the fascial defect using this technique was neither difficult nor frustrating.

Maintenance of the pneumoperitoneum during closure keeps the anterior abdominal wall away from the bowel, reducing the likelihood of iatrogenic injury\(^{(15)}\). The GraNee\(^{TM}\) Needle system also provides easy assessment of adequate closure and allows the potential for intraperitoneal inspection of the closed port site via remaining lateral ports, further ensuring that the bowel is not implicated in the repair. It is advisable to view the peritoneal side of each wound during fascial closure via the laparoscope.

In conclusion, no hernias were identified at any of the trocar sites using the GraNee\(^{TM}\) Needle and R-Med\(^{TM}\) Plug system. This method is quick, safe and provides adequate closure of the fascia and peritoneum which can be confirmed by intraperitoneal inspection. These benefits could expand to other laparoscopic procedures.

**REFERENCES**


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Table 1. Patient characteristics

<table>
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<tr>
<th>characteristics</th>
<th>Standard group</th>
<th>Needleless group</th>
<th>P value</th>
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<tr>
<td>No. of patients</td>
<td>221</td>
<td>388</td>
<td></td>
</tr>
<tr>
<td>Median follow-up period (Months, range)</td>
<td>52.4(12-167)</td>
<td>38.3(12-128)</td>
<td>&lt;0.01</td>
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<tr>
<td>Age (years, ±SD)</td>
<td>64.2±11.0</td>
<td>64.5±10.1</td>
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<tr>
<td>Gender (M/F)</td>
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<tr>
<td>male</td>
<td>123</td>
<td>214</td>
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<tr>
<td>female</td>
<td>98</td>
<td>170</td>
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<tr>
<td>BMI</td>
<td>22.7±5.5</td>
<td>22.8±3.6</td>
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<tr>
<td>Carcinoid</td>
<td>2</td>
<td>9</td>
<td>2.5</td>
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<tr>
<td>Operation time (minutes, ±SD)</td>
<td>253.4±97.9</td>
<td>227.1±70.8</td>
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<td>Bleeding (ml, ±SD)</td>
<td>107.2±106.8</td>
<td>84.2±115.4</td>
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### Table 2. Patient complications in the standard group and GraNee Needle group

Table 2. Complications compared with the standard group and the GraNee Needle group

<table>
<thead>
<tr>
<th></th>
<th>Total (n=609)</th>
<th>Standard group (n=221)</th>
<th>GraNee Needle group (n=388)</th>
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</thead>
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<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
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<tr>
<td>Port site hernia</td>
<td>2 (0.3)</td>
<td>2 (1.0)</td>
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<td>leakage</td>
<td>32 (5.3)</td>
<td>13 (5.9)</td>
<td>19 (4.9)</td>
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<td>ileus</td>
<td>10 (1.6)</td>
<td>3 (1.4)</td>
<td>7 (1.8)</td>
<td>0.691</td>
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<tr>
<td>Surgical site infection</td>
<td>64 (10.0)</td>
<td>18 (8.1)</td>
<td>43 (11.1)</td>
<td>0.267</td>
</tr>
</tbody>
</table>
Figure Legends

Fig. 1. Trocar placement and median incision

Fig. 1 Trocar placement and median incision

Right-sided lesion

Left-sided lesion
Fig. 2. Granee\textsuperscript{TM} Needle and R-Med\textsuperscript{TM} Plug system.