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DYNAMIC MANUSCRIPT

Surgical techniques for advanced transverse colon cancer using the pincer approach of the transverse mesocolon

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Abstract

Background Laparoscopic surgery for colorectal cancer, not only early cancer but also advanced cancer, has become standardized by some randomized controlled studies. However, cases involving advanced transverse colon cancer were excluded from these studies due to the technical difficulty of the surgery. Hence, laparoscopic surgery for advanced transverse colon cancer is still a theme that we need to overcome. To solve these issues, it is necessary to establish a standardized approach and surgical technique.

Surgical techniques The advantage of our method, which approaches from both sides of the transverse mesocolon, is that it is easier to achieve hemostasis when active bleeding occurs because this approach provides space for ligating and sealing. This allows the surgeon to perform lymphadenectomy around the superior mesenteric artery and vein.

Conclusions We introduced the usefulness of the "Pincer approach of the transverse mesocolon" to standardize laparoscopic surgery for advanced transverse colon cancer.

Keywords Laparoscopic surgery · Colon cancer · Transverse colon cancer · Pincer approach

Laparoscopic surgery for colorectal cancer, not only early cancer but also advanced cancer, has become standardized and is now widely and safely used [1–7]. However, cases involving advanced transverse colon cancer were excluded from these studies due to the technical difficulty of the surgery. This is because it involves very difficult procedures such as dislodgement of the liver and spleen curvatures, avoiding damage to the duodenum/pancreas/weak veins with abundant blood flow, dissection focusing on the superior mesenteric artery and vein, etc. Hence, surgery for advanced transverse colon cancer is still a theme that we need to overcome.

Actually, some studies have compared the results of laparoscopic surgery to those of open surgery for advanced transverse colon cancer [8, 9]. Although the number of cases in which laparoscopic surgery has been performed for advanced transverse colon cancer has gradually increased, this surgery is only performed by experienced surgeons. To solve these issues, it is necessary to establish a standardized approach and surgical technique. Several methods of performing a safe operation for advanced transverse colon cancer have been reported. Most colorectal surgeons use a medial to lateral approach, because it is easier to detect the superior mesenteric vein and artery after detecting the ileocecal vessels. On the other hand, some colorectal surgeons use a cranial approach, which is able to detect feeding vessels, prior to the mobilization of the mesocolon as a non-touch isolation technique [10]. However, in both methods, it is necessary to take care to avoid injuring the fragile veins (which have numerous variations) that drain to the superior mesenteric vein.

The advantage of our method, which approaches from both sides of the transverse mesocolon is that it is easier

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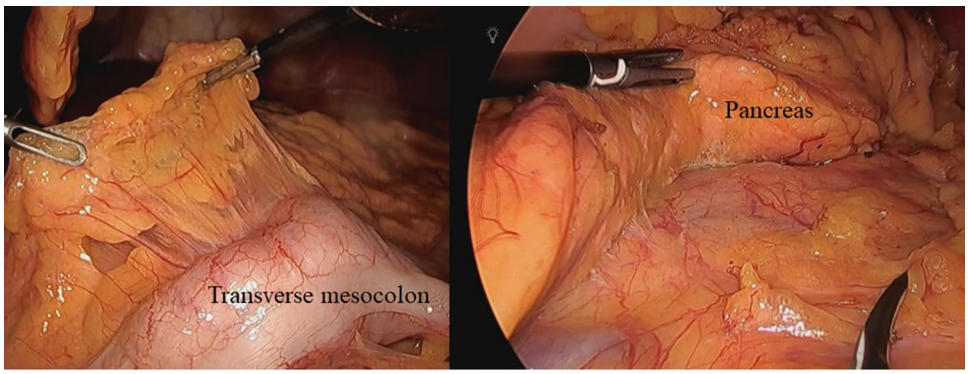
to achieve hemostasis when active bleeding occurs because this approach provides space for ligating and sealing. This allows the surgeon to perform lymphadenectomy around the superior mesenteric artery and vein. We present our own approach with the aim of standardizing laparoscopic surgery for advanced transverse colon cancer.

Surgical techniques

We have proposed a method of interweaving operations which carries out both from the cranial side and caudal side during laparoscopic surgery for transverse colon cancer. This means surgeon look up from the dorsal side by setting the transverse mesocolon to the cranial side and look down from the ventral side by setting the transverse mesocolon to the cranial side as the "Pincer method of the transverse mesocolon." Since the body position needs to be changed many times and involves many surgical fields, the surgical procedure was organized by dividing the position of the surgeon into four stations.

The surgeon first stands on the right side of the patient (station 1) with the left side of the head up, then releases the bursa omentalis to completely remove the greater omentum. Subsequently, the fascia in front of the pancreas and anterior lobe of the transverse mesocolon are cut open along the inferior border of the pancreas towards the spleen curvature (Fig. 1). Here, the transverse mesocolon is moved to the cranial side with the right side of the head in a lower position. An incision is made from the dorsal side of the inferior mesenteric vein of the descending mesocolon and sufficient medial approach is carried out with this as the opening to dislodge the spleen curvature (Fig. 2). In this scene, it is easy to get into the dorsal side



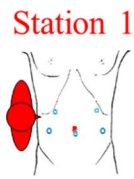
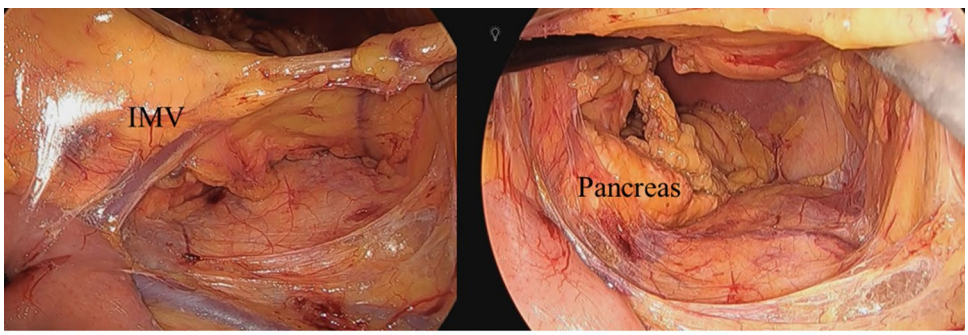


Fig. 1 The surgeon first stands on the right side of the patient with the left side of the head up. The bursa omentalis is released completely and the greater omentum is removed from the transverse colon. Subsequently, the fascia in front of the pancreas and anterior lobe of the transverse mesocolon are cut open along the inferior border of the pancreas towards the spleen curvature



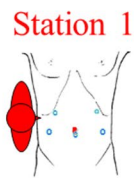


Fig. 2 The transverse mesocolon is moved to the cranial side with the right side of the head in a lower position. An incision is made from the dorsal side of the inferior mesenteric vein (IMV) of the descending mesocolon and sufficient medial approach is carried out with this as the opening to dislodge the spleen curvature. *IMA* inferior mesenteric vein

of the pancreas, but our approach is preceded by peeling of the lower border of the pancreas, and we believe that the rapid identification of the pancreas will lead to safe surgery.

Here, the surgeon moves to the left side of the patient (station 2). With the right side of the head up, the greater omentum is removed towards the hepatic flexure and the liver and colon ligaments are dissected within a possible range. Next, the fascia in front of the pancreas is dissected towards the right side along the inferior border of the pancreas and the middle colic blood vessel is identified. Next, with the left side of the head at a low position, modified medial approach, which means commencing from dissection of the thin peritoneum that can be seen through the duodenum is carried out to complete dislodgement of the hepatic flexure (Fig. 3). The advantage of this approach is to prevent injury to the duodenum and pancreas.

Next, the surgeon stands between the legs of the patient to carry out lymphadenectomy around root of the middle colic artery and vein (station 3). When the transverse

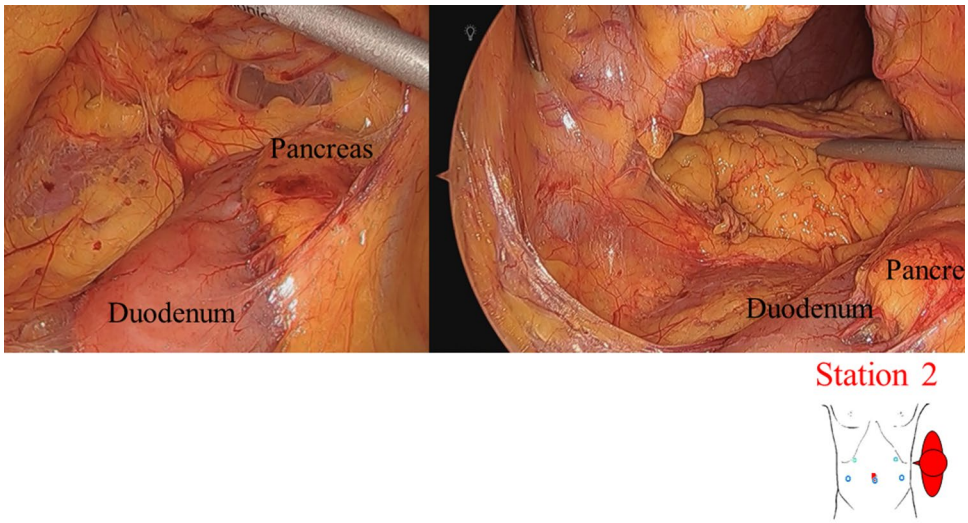


Fig. 3 With the left side of the head at a low position, modified medial approach, which means commencing from dissection of the thin peritoneum that can be seen through the duodenum is carried out to complete dislodgement of the hepatic flexure

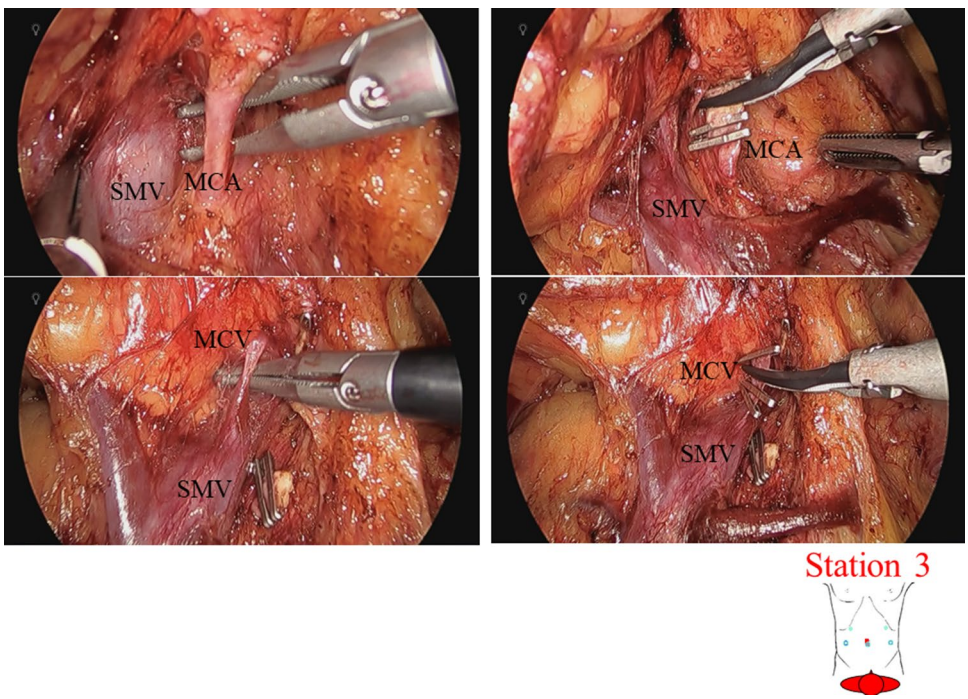


Fig. 4 Dissection is carried out towards the cranial side while confirming the superior mesenteric artery (SMA) and superior mesenteric vein (SMV) along with the branches thereof. The dissected tissues are treated at the middle colic vein and the root of the middle colic artery, with the dissected tissue on the dissected side. *SMA* superior mesenteric artery, *SMV* superior mesenteric vein, *MCA* middle colic artery, *MCV* middle colic vein

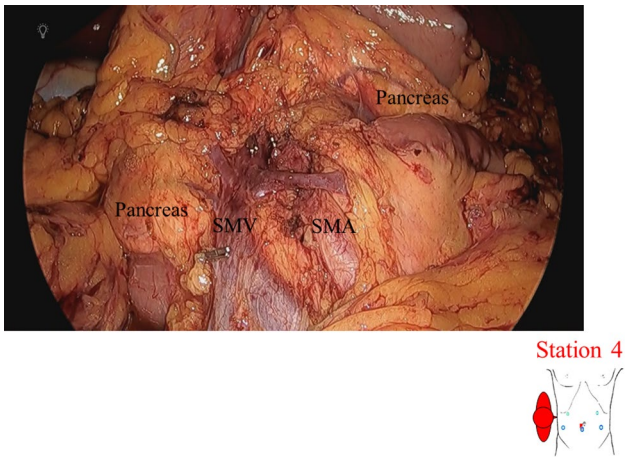


Fig. 5 Finally, the surgeon returns to the right side of the patient and moves the transverse mesocolon on the caudal side, confirms this from the ventral side, and treats the accessory middle colic blood vessel if there are, to complete the dissection. *SMA* superior mesenteric artery, *SMV* superior mesenteric vein

mesocolon is pulled to the cranial and ventral side, the running of the superior mesenteric artery and vein and middle colic blood vessel, as well as the position of the duodenum and pancreas may be clearly understood from the operations so far. Dissection is carried out towards the cranial side while confirming the superior mesenteric artery and vein along with the branches thereof. The dissected tissues are treated at the middle colic vein and the root of the middle colic artery, with the dissected tissue on the dissected side (Fig. 4).

Finally, the surgeon returns to the right side of the patient (station 4) and moves the transverse mesocolon on the caudal side, confirms this from the ventral side, and treats the accessory middle colic blood vessel if there are, to complete the dissection (Fig. 5).

Conclusions

We introduced the usefulness of the "Pincer approach of the transverse mesocolon" which involves approaching from both the ventral and dorsal sides while appropriately moving the transverse mesocolon to the caudal side and cranial side and oncological safety for advanced transverse colon cancer.

Author contributions HE participated in treatment of these patients, literature search, drafting the manuscript, making the video. IN participated in treatment of these patients and helped to do data analysis. MH helped to do data analysis. SM, MK, KT, HS, and SM participated in treatment of these patients. HO participated in treatment planning of these patients. All authors read and approved the final manuscript.

Compliance with ethical standards

Disclosures Drs. Hiroyuki Egi, Ikki Nakashima, Minoru Hattori, Shoichiro Mukai, Masatoshi Kochi, Kazuhiro Taguchi, Haruki Sada, Yusuke Sumi, Hideki Ohdan have no conflicts of interest or financial ties to disclose.

Ethical standard Patients were given written informed consent prior to surgery. This study was conducted in accordance with the Helsinki Declaration Guidelines with the approval of the Ethics Committee of Hiroshima University Hospital.

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