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Title:
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Date:
2020-07-01

Citation:
Suhardja, T. S., Das, A., Rajkomar, A. K. S., Smart, P., Heriot, A. G. & Warrier, S. K. (2020). How to do a complete mesocolic excision and central vascular ligation. ANZ Journal of Surgery, 90 (7-8), pp.1469-1471. https://doi.org/10.1111/ans.16064.

Persistent Link:
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Title Page

How to do a Complete Mesocolic Excision and Central Vascular Ligation

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No conflict of interest.

No competing financial interests.

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/ans.16064

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How to do a Complete Mesocolic Excision and Central Vascular Ligation

T.S. Suhardja, A. Das, A. Rajkumar, P. Smart, A.G. Heriot, S. Warrier

Introduction

The last few decades have seen an evolution in the surgical management of colorectal cancer. The concept of total mesorectal excision (TME) championed by Heald et al.[1] has shown that good quality surgery improved the outcome for rectal cancer. TME is nowadays accepted as gold standard for rectal cancer surgery. More recently, advances in the quality of cancer care and shifts in multidisciplinary care have raised the overall standard of care for colorectal cancer patients. However, surgical quality of right-sided colon cancer as per National Comprehensive Cancer Network (NCCN) guideline only describes the need for negative margins and a minimum of 12 lymph nodes to be examined to establish N stage [2].

Following the embryological planes similar to the principles of TME, Hohenberger et al. in 2009 [3] introduced the concept of Complete Mesocolic Excision (CME) as curative treatment for colon cancer. Proponents to CME and central vessel ligation (CVL) suggest that the technique improves lymph node harvest and provide a more accurate nodal staging. Potential benefits of performing extended lymphadenectomy are complete removal of the tumour-bearing lymph nodes and removal of potential 'skip' lymph node metastasis.

Eastern centres have adopted this model as a standard of care for clinically stage II or III colon cancer. The uptake of this operative principle in western centres has been limited to high volume centres. This is related to concerns over increased safety profile of such cases, relating to variable anatomy of the superior mesenteric vein (SMV), dissection around head of pancreas, and lymphatics- concerns associated with major vascular injury, pancreatic injury and chylous ascites. Another reason is also the notion that there is a lack of evidence to instigate a paradigm shift in the management of colon cancer.

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Our centre is an early adopter of CME and CVL in Australia. We describe an approach for CME and CVL utilising a robotic platform. We describe the steps in detail focusing on an SMV first approach. A supplementary video is provided.

Methods

Patients are preoperatively staged according to the AJCC manual for colon cancer, and discussed at a multidisciplinary meeting. Patients receive routine preoperative mechanical bowel preparation with oral antibiotics. The operations follow the oncological principle of CME and CVL with en-bloc resection of any adjacent organ involved and high central vascular ligation.

Surgical Technique

Patient positioning

The patient is positioned lithotomy with both arms tucked. We use the da Vinci® Surgical System (Intuitive Surgical, Sunnyvale, CA, USA) and an Airseal (SurgiQuest Inc., Milford, CT). Robotic ports and instruments are positioned as described in Figure 1, with patient cart docked towards the patient's right hip.

SMV-first approach

The procedure commences with exposure of the medial aspect of ascending colon mesentery, with retraction of the small intestine to the left of the superior mesenteric vein (SMV). The ileocolic (ILC) vascular pedicle can be predictably identified with anterior upward traction of the ascending colon mesentery close to the caecum. In line with the falciform ligament as a guide, just inferior to the third part of the duodenum is a segment of mesentery overlying the SMV. The peritoneum is opened longitudinally to expose the medial aspect of the SMV. Nearly always the SMV lies to the anatomical right of the superior mesenteric artery (SMA).

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There are few midline branches of the SMV that are worth noting. The ileocolic artery can be seen sometimes traversing anteriorly over it (see below). Further proximally the middle colic vein is seen. The right branch of the middle colic artery is also seen proximally over it. See Figure 1.

Dissection of SMV superiorly will expose the gastrocolic trunk of Henle (GCT), which provides branching of its right-sided tributaries consisting of the superior right colic vein (SRCV), accessory right colic vein (ARCV), right gastroepiploic vein (RGEV), anterior superior (inferior) pancreaticoduodenal vein (ASPDV). Occasionally the middle colic vein can be seen anteriorly as a tributary. There is tremendous variation in the venous anatomy as described by Peltrini et al. (2019) [4]. The duodenum will be easily identified in the superior and posterior aspect of the GCT and SMV dissection. The dissection can be continued superiorly to include the proximal dissection of the pancreas. Colonic branches of the GCT can be ligated at its origin. See Figure 1.

Ileocolic pedicle can be positively identified with the continued inferior dissection of SMV under the GCT. Note the variation of ILC artery when performing a high vascular ligation. As described by Negoi et al. (2018) [5], ILC artery courses almost equally anterior to (42.6%) or posterior (57.4%) to the SMV; unlike the right colic artery, which more predictably courses anterior (89.4%) to the SMV rather than posterior to it (10.6%).

Middle dissection

Following proximal ligation of the ILC pedicle, a medial to lateral colonic mobilisation along embryological planes is followed. The white line of Toldt laterally, and the hepatic flexure superiorly are used as dissecting guides. It is imperative not to break the window above the ileocolic pedicle. The medial border of the dissection is the middle colic pedicle, the pancreatic head, and posteriorly the SMV at the pancreatic isthmus. A combination of supracolic compartment dissection will then complete the hepatic flexure mobilisation. This dissection commences medially with dissection of the gastrocolic ligament to enter the lesser

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sac, meeting our previous infracolic compartment dissection of SMV, duodenum, and pancreas medially, then followed laterally along embryological plane.

In more radical cases an en-bloc omentectomy can be performed with the proximal ligation of the gastroepiploic vein.

Lateral dissection and anastomosis

Lateral and inferior dissection of the caecum and ascending colon can then be performed subsequently to complete the dissection.

Our preference is to perform an intracorporeal anastomosis with a robotic platform. This is done using an intracorporeal (ICA) stapled anastomosis. The mesentery is divided using advanced bipolar energy. Transection of the ileum and transverse colon is performed with a robotic stapled. ICG selectively at this point to ensure vascularity. Additional ileal mesenteric resection can be performed to complement the CME.

A 3.0 Vicryl suture is used as a holding suture, and following this an enterotomy and colotomy are performed to allow the blue Da Vinci SureForm 60 stapler for the isoperistaltic ICA common channel. The remaining otomy is closed with 3.0 V-Loc sutures and buried with 3.0 Vicryl sutures.

Conclusion:

We describe our technique for CME and CVL in Australasia. This is the first such technical description from an Australian centre.

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Figure 1. A. Robotic port placements for CME and CVL, B. Right branch of middle colic artery (RMCA) seen overlying the GCT, which is shown here with its Right Colic Vein (RCV) tributary, C. ICV is inferior to the ICA, which is shown here coursing posterior to the SMV, D. Colonic tributary (RCV) of GCT can be ligated, sparing the non-colonic tributaries i.e. ASPDV (seen here) and GEV (not shown here).

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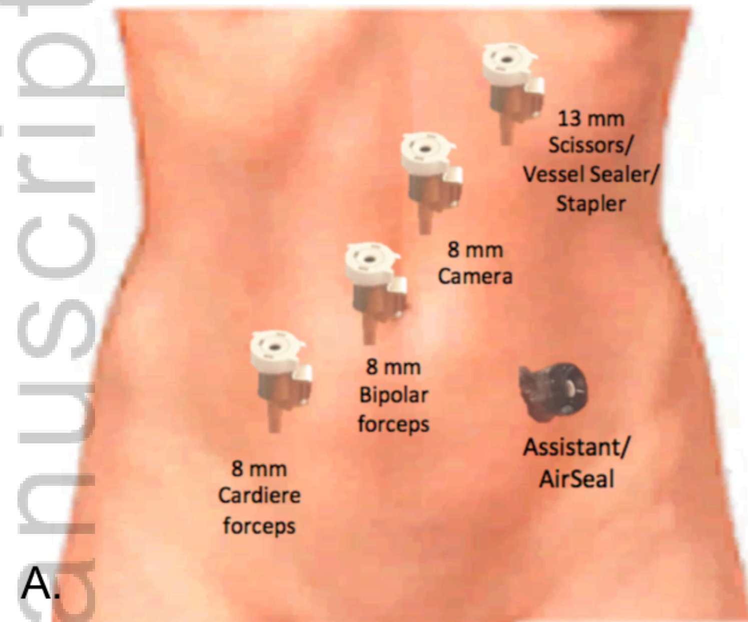

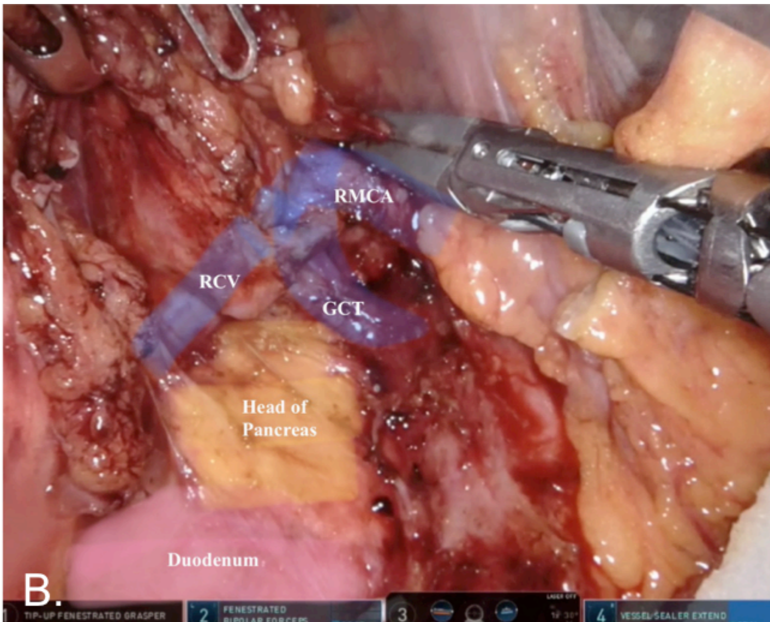

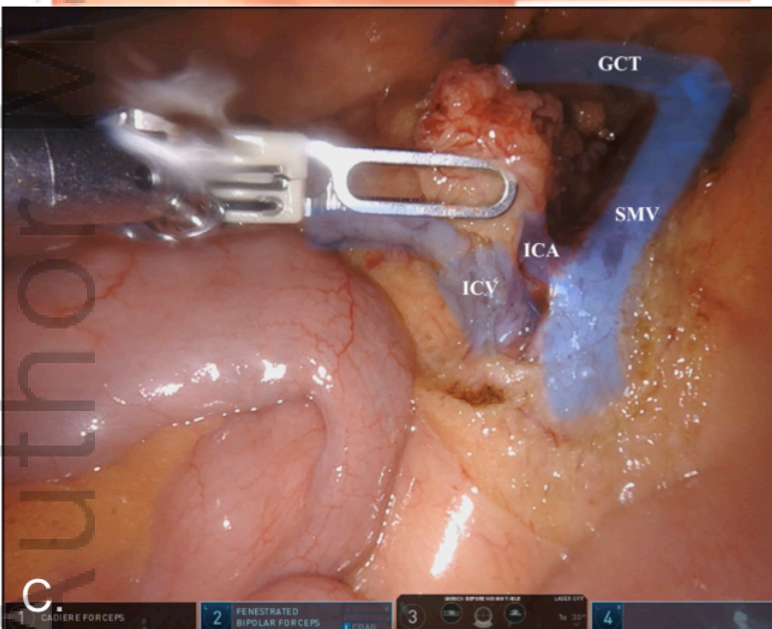

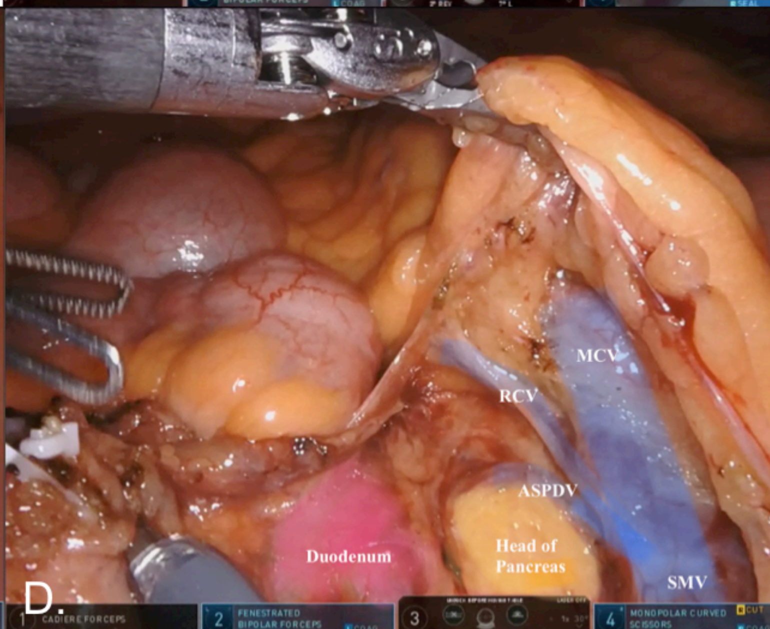

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