Synchronous resections of primary colorectal tumor and liver metastasis by laparoscopic approach

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Liver metastasis of colorectal cancer is common. Resection of solitary tumors of primary and metastatic colorectal cancer can have a favorable outcome. Open resection of primary colorectal tumor and liver metastasis in one operation or in separate operations is currently common practice. Reports have shown that synchronous resections do not jeopardize short or long-term surgical outcomes and that this is a safe and effective approach in open surgery. The development of laparoscopic colorectal surgery and laparoscopic hepatectomy has made a minimally invasive surgical approach to treating colorectal cancer with liver metastasis feasible. Synchronous resections of primary colorectal tumor and liver metastasis by laparoscopy have recently been reported. The efficacy and safety of laparoscopic colorectal resection and laparoscopic hepatectomy have been proven separately but synchronous resections by laparoscopy are in hot debate. As it has been shown that open resection of primary colorectal tumor and liver metastasis in one operation results in an equally good short-term outcome when compared with that done in separate operations, laparoscopic resection of the same in one single operation seems to be a good option. Recent evidence has shown that this new approach is a safe alternative with a shorter hospital stay. Large scale randomized controlled trials are needed to demonstrate the effectiveness of this minimally invasive approach.

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shown that resection of solitary metastatic tumors of CRC can have a favorable outcome\cite{3}. With the use of sophisticated imaging systems, such as high resolution contrast computed tomography and positron emission tomography, the sensitivity of detection of liver metastases larger than 2 cm is as high as 90%\cite{8,9}. Open resection of primary colorectal tumor and liver metastasis in one operation or in separate operations is currently common practice\cite{4,5}. Improved chemotherapies and biological agents have made many previously unresectable tumors resectable\cite{1}. Reports have shown that synchronous resections do not jeopardize short or long-term surgical outcomes and that this is a safe and effective approach in open surgery\cite{6,7}.

Like laparoscopic hepatectomy, laparoscopic colorectal surgery has become popular in recent years because of its absolute advantage of allowing fast return of bowel motion and a shorter hospital stay\cite{10,11}. More recently, synchronous resections of primary colorectal tumor and liver metastasis by laparoscopy have been reported\cite{12-14}. Since the complication rate of synchronous resections is generally higher, as documented by Slesser et al\cite{15}, careful patient selection is important. Contrast computed tomography and positron emission tomography can provide accurate disease staging. Laparoscopy is not suitable for very bulky tumors. Although major resection by laparoscopy is feasible, the patient would not benefit from a small incision as a relatively large wound must be created for retrieval of the resected tumor.

Approximately 25% of CRC patients have concurrent liver metastasis on presentation. Liver is the most common site of hematogenous dissemination. Contemporary management of CRC calls for multidisciplinary involvement. Positron emission tomography using $\text{F}^{18}$-fluorodeoxyglucose can provide very accurate staging of disease, enabling surgeons to achieve an R0 resection with curative intention\cite{16,17}. Novel chemotherapeutic agents used in target therapy are effective in causing remarkable tumor response\cite{18,19}. Nonetheless, viable cancer cells can still be present after chemotherapy despite extensive tumor necrosis\cite{20} and hence, chemotherapy should not replace resection. After all, resection of primary and metastatic tumors is the best way to maximize patient survival.

**TECHNIQUES**

Laparoscopic synchronous resections of primary colorectal tumor and liver metastasis are normally carried out under general anesthesia. The patient is placed in a supine position with Trendelenburg adjustment. A 12 mm port is created using the open method. Pneumoperitoneum is introduced by insufflation of CO$_2$ and the intra-abdominal pressure is maintained at 12 cm H$_2$O. Another two 12 mm ports and two 5 mm ports are made under direct vision. Standard diagnostic and staging laparoscopy is then conducted. The liver is examined with laparoscopic ultrasound to confirm the extension of the tumor and its relationship to the hepatic vasculature\cite{21}. It is preferred that resection of the colorectal tumor is conducted first to make sure that the primary tumor is resectable before any metastatic tumor is to be resected. Moreover, conducting colorectal resection before hepatic resection can avoid bowel edema, a condition that makes anastomosis difficult, caused by the Pringle maneuver. The colon or rectum is mobilized with an ultrasonic dissector and the mesenteric artery and vein are controlled with clips. For a rectal tumor, the rectum is transected with an endoscopic linear stapler\cite{22}. Intracorporeal colorectal anastomosis is performed with a circular stapler. A laparoscopic anterior resection usually takes 2 h or so\cite{23}. For hepatic resection, the no-touch technique can be used. The area to be transected is marked by diathermy. Transection of the liver parenchyma can be done with a Cavitron ultrasonic surgical aspirator and a Harmonic scalpel. The margin from the lesion is ideally 1 cm and is marked by intraoperative ultrasound. Both the primary and metastatic tumors are retrieved with protection through an incision with size similar to the largest diameter of the tumors\cite{13}. Routine hepatic inflow control may not be necessary. A laparoscopic minor hepatectomy usually takes 2-3 h and a major one usually takes 6-8 h\cite{24}.

**CONSIDERATIONS**

Short-term benefits of laparoscopic surgery for CRC have been proven by randomized controlled trials\cite{25-29}. Emerging evidence also shows that the laparoscopic approach does not compromise patient survival\cite{30,31}. As it has been shown that open resection of primary colorectal tumor and liver metastasis in one operation results in an equally good short-term outcome when compared with that done in separate operations\cite{28}, laparoscopic resection of the same in one single operation seems to be a good option. The obvious advantage of laparoscopic surgery is small surgical incisions. With improvements of laparoscopic equipment, the present high definition feature of most monitoring units provides magnificent magnification of the operation field. The margin of resection is thus not compromised even although the operation is conducted through a very small opening\cite{32,33}.

The risk of hemorrhage is an important concern when conducting hepatic resection on patients who have received chemotherapy treating their primary cancer and the location of liver metastasis can be a challenge in laparoscopic hepatic resection. Careful interpretation of the liver anatomy displayed by preoperative high-resolution imaging and intraoperative ultrasonography helps to avoid injury to the major hepatic vein, enabling safety of laparoscopic hepatic resection in difficult locations\cite{34}. Careful use of the Cavitron ultrasonic surgical aspirator followed by application of clips helps to reduce blood loss. Strict control of the central venous pressure with careful administration of intravenous fluid and an intra-abdominal pressure of 12 to 15 mmHg contributes to minimal oozing of blood during liver transection\cite{24}. The Pringle maneuver can be easily applied to the liver.
hilum in the laparoscopic approach but a routine Pringle maneuver is not encouraged as it tends to cause venous congestion and thus leakage of anastomoses. Both colorectal resection and hepatic resection are complicated operations. Whether combining these two complicated procedures in one laparoscopic surgery will do patients more harm or good is in hot debate. However, synchronous resections of primary colorectal tumor and liver metastasis by laparoscopy are not only feasible but also safe. Therefore, this approach is an alternative to open resection in one or separate operations for selected patients, especially when minimally invasive surgery is desired. Large-scale randomized controlled trials are needed to demonstrate the effectiveness of this minimally invasive approach.

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