Minimally Invasive Concepts in Treating Synchronous Liver Metastases Rectal Cancer Patients: Report of Six Cases

Hao Zhang, Yinghu Jin, Rui Huang and Guiyu Wang
Department of Colorectal surgery, the second affiliated Hospital of Harbin Medical university, Harbin, China

ABSTRACT

Background: Rectal cancer patients with synchronous liver metastases (SLM) is common in clinical practice. However, the application of conventional natural orifice specimen extraction surgery (NOSES) and NOSES with specimen extraction via stoma/hepatectomy incision in the special population is rarely explored.

Case report: Six SLM rectal cancer patients were treated with simultaneous surgical resection and the specimens were extracted via anal/stoma/hepatectomy incision. Respectively, intraoperative and postoperative data, anal function 3 months after surgery and long-term prognosis were reviewed.

Results: Intraoperative and postoperative data and anal function were reliable for the six cases. Only one patient died of brain and bone metastases at 84 months after surgery and the other five patients were alive at their last follow-up.

Conclusions: Simultaneous surgical resection with the concept of conventional NOSES and NOSES with specimen extraction via stoma/hepatectomy incision is safety for SLM rectal patients.

Introduction

Globally, colorectal cancer (CRC) occupies a considerable challenge to human health because of its high incidence and mortality rate [1]. When be confirmed as colorectal cancer for the first time, about 15–25% patients were found to be accompanied by simultaneous liver metastases, and would be associated with unfavorable prognosis [2]. To date, surgical resection of the colorectal primary lesion and liver metastases is considered as the most effective therapeutic modality for patients with colorectal cancer synchronous liver metastases (SLM), which is related to the greatest possibility of being cured [3].

With the constantly updated and modified medical knowledge broadening our horizons, the concept of minimally invasive surgery has invaded the colorectal surgical field and literature on the point is spawning in recent years. Natural orifice specimen extraction surgery (NOSES), which applies laparoscopic instruments, soft endoscopy or transanal endoscopic microsurgery to perform specimen extraction through natural orifice, as one of the most representative approach, has been widely accepted due to its incomparable superiority such as rapid bowel function recovery, less pain and better cosmetic and psychological outcomes [4, 5].

Recently, thanks to the conventional NOSES concept, a new minimally invasive surgical method has been utilized in clinical practice, which extracted specimen using pre-established incision, therefore effectively reducing the number of incisions and surgical trauma for patients. However, the application of conventional NOSES and NOSES with specimen extraction via stoma/hepatectomy incision has been rarely reported in the treatment of SLM rectal patients.

Therefore, in this paper, we herein report six cases of rectal cancer patients under simultaneous surgical resection with the concept of NOSES to determine to safety and feasibility of the proposed minimally invasive concepts in treating SLM rectal cancer patients.

Case report

From 2013 to 2021, six patients have been reviewed. The basic information of the six patients was shown in Table 1. Before surgery, case 1 (FOLFIRI + cetuximab, four cycles) and case 4 (FOLFOX + bevacizumab, four cycles) received neo-adjuvant chemotherapy. What is more, 14 patients with conventional laparoscopic surgery (Table S1) at the same time were used to make further comparison to determine the safety and potential benefits of NOSES approach. All patients have been discussed by a multidisciplinary treatment team and the consensus was that simultaneous surgical resection for rectal and liver specimens should be performed to guarantee a reliable prognosis for them.

CONTACT
Rui Huang huangrui2019@163.com; Guiyu Wang guiwyang@163.com Department of Colorectal Surgery, the Second Affiliated Hospital of Harbin Medical University, 157 Baojian Road, Harbin, Heilongjiang, China

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In terms of liver metastases, case 1 and case 4 received open surgery and laparoscopic partial hepatectomy were performed for case 2, case 3, case 5, and case 6. There are three ways for the specimen extraction approach. For case 1 and case 4, the rectal and liver specimens were extracted from the hepatectomy incision. For case 2, case 3, and case 5, the specimens were extracted from the anal. For case 6, the specimens were extracted from the stoma incision. The approach with the anal was taken for the example.

To begin with, the rectal and liver lesions were determined (Figure 1a, b). Then, complete resection was performed for liver metastases at 1.5–2 cm away from the tumor to ensure a negative edge (Figure 1c). The liver specimens were put into a collection bag and placed in the right side of abdominal cavity.

Standard procedures including low ligation of the inferior mesenteric vessel (Figure 1d), dissection of the lymph nodes and mobilization of the bowel were performed for the patient. The distal rectum below the tumor was transected and the intestine ends were sterilized with povidone gauze. Then, a disposable sterile protective cover was inserted into the abdominal cavity via the 12 mm trocar, with one end positioned in the opened rectal stump, and the other end pulled out of the anus, and then the anvil was introduced into the abdominal cavity through the protective cover (Figure 1e). An incision was made above the tumor in the proximal colon wall, and the anvil was introduced into the colon through the incision. The proximal colon was closed using linear cutter-straight, leaving the anvil head extracted from the bowel lumen.

The collection bag including liver specimens was placed into the protective cover, and extracted gently through the rectum with oval forceps holding one end of the bag (Figure 1f). Subsequently, the isolated rectal specimen was also inserted into the protective cover and extracted from the pelvic cavity (Figure 1g). A linear stapler was used to close the rectal stump and the additional rectal section was

| Table 1 | Basic information of patients. |
| --- | --- |
| **Cases 1** | **Cases 2** | **Cases 3** | **Cases 4** | **Cases 5** | **Cases 6** |
| Gender | Male | Male | Male | Male | Male | Male |
| Age (years) | 42 | 70 | 50 | 51 | 66 | 45 |
| BMI (kg/m²) | 25.5 | 24.5 | 22.3 | 24.3 | 25.1 | 17.3 |
| CEA | Positive | Positive | Positive | Positive | Positive | Positive |
| ASA grade | II | III | III | III | III | II |
| Rectal tumor size (cm) | 4 | 4 | 4 | 3 | 5 | 6 |
| The largest Liver tumor size (cm) | 3 | 3 | 3 | 4 | 3 | 2 |
| Number of liver metastasis | 1 | 3 | 1 | 1 | 2 | 1 |
| T stage | T4a | T3 | T3 | T3 | T3 | T3 |
| N stage | N0 | N1a | N1b | N1b | N2a | N1c |
| Preoperative treatment | Yes | No | No | Yes | No | No |

Figure 1. (a) Primary lesion in rectum. (b) Liver metastasis. (c) Resection of liver lesion. (d) Low ligation of the inferior mesenteric vessel. (e) Introducing the protective cover. (f) Extraction of the rectal specimen. (g) Extraction of the liver specimen. (h) Performance of the colorectal anastomosis. (i) The display of the abdominal wall.
placed into a specimen pouch and extracted via the 12 mm trocar. Finally, an end-to-end colorectal anastomosis was completed (Figure 1h).

### Postoperative outcomes

The operative time ranged from 210 mins to 490 mins (median time: 372.5 mins), and intraoperative blood loss ranged from 50ml to 200ml (median blood loss: 50ml). All patients had their first postoperative flatus at 2–4 days after surgery. The mean number of lymph node examined was 13.2. Pathological data was moderately differentiated adenocarcinoma in all cases. All liver metastases were confirmed pathologically (Table 2). Moreover, no significant difference could be found regarding operative time, blood loss, time to first flatus, postoperative hospital stays and harvested lymph node between NOSES and conventional laparoscopic surgery (Table S2). Compared to conventional laparoscopic surgery, patients with NOSES posed lower pain scores on days 1 and 3 after surgery (Figure 2). The anal function of the six patients has been assessed at 3 months after surgery and the Wexner score was 9.17 ± 0.98, with no obvious difference being found compared to conventional laparoscopic surgery (Figure 3).

### Follow up

One patient (case 1) died of brain and bone metastases at 84 months after surgery. The other five patients were alive at the last follow-up (follow-up time, case 2: 6 months; case 3: 9 months; case 4: 10 months; cases 5: 14 months; case 6: 5 months).

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**Table 2 Intraoperative and postoperative data.**

| Cases 1 | Cases 2 | Cases 3 | Cases 4 | Cases 5 | Cases 6 |
|---------|---------|---------|---------|---------|---------|
| Specimen extraction approach | Hepatectomy incision | Anal | Anal | Hepatectomy incision | Stoma |
| Type of liver resection | Segmentectomy | Segmentectomy | Segmentectomy | Segmentectomy | Segmentectomy | Wedge resection |
| Operative time (min) | 370 | 490 | 210 | 375 | 430 | 265 |
| Blood loss (ml) | 50 | 50 | 50 | 50 | 200 | 50 |
| Time to first flatus (day) | 4 | 2 | 3 | 3 | 2 | 2 |
| Postoperative hospital stays | 16 | 8 | 13 | 12 | 11 | 7 |
| Tumor grade | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate |
| Harvested lymph node | 10 | 14 | 12 | 13 | 12 | 15 |
| Histology type | Adenocarcinoma | Adenocarcinoma | Adenocarcinoma | Adenocarcinoma | Adenocarcinoma | Adenocarcinoma |
| Perioperative death | No | No | No | No | No | No |

Figure 2. VAS scores on days 1, 3, and 5 after surgery.

Figure 3. Anal function three months after surgery.
Discussion

Thanks to the improvement in the anesthetic and surgical techniques, the safety of major operative approach including hepatectomies and pelvis have been increased. Several recent studies suggested stage IV rectal cancer patients receiving simultaneous resection posed reliable postoperative prognosis [3].

Although the clinical superiority of NOSES has been determined in recent years [4, 5], the performance of NOSES in stage IV patients is still in the exploratory stage. This paper analyzed the outcomes of six patients undergoing simultaneous surgical resection with the conventional NOSES and NOSES with specimen extraction via stoma/hepatectomy incision and revealed that the proposed minimally invasive concept was reliable in terms of short-term outcomes and prognosis.

Because the surgical resection should be performed in the peritoneal cavity with an anvil inserted into the abdominal cavity, whether the novel surgical method could comply with the tumor-free operation and aseptic principles is still an opening question. Adequate preoperative bowel preparation and the application of iodine-volt gauze under laparoscope were required to practice the aseptic principle. Besides, the extraction of specimen was performed with the protection of a protective cover to avoid wound infection and tumor planting [6, 7]. Hence, if the specimen and the abdominal cavity were fully disinfected and protected by some necessary measures, the risk of infection and tumor seeding would not be increased during the performance of NOSES. Moreover, regarding the concept of conventional NOSES and NOSES with specimen extraction via stoma/hepatectomy incision, no added technical difficulty and changed oncological principle existed in the procedure. That is to say, there is no technical obstacles for clinicians to perform a radical resection compared with conventional method in clinical practice.

The potential benefit of the NOSES concept for SLM rectal cancer patients mainly due to the reduction of abdominal wall trauma. Simultaneous resection of rectal lesion and liver metastases would leave two inevitable auxiliary incisions on the abdominal wall for specimen removal, largely increasing the possibility of postoperative incision complications. While with the application of the proposed technique, the rectal and liver specimens were extracted through anus or a pre-established incision, therefore reducing the auxiliary trauma, which was related to fewer wound-related complications and less postoperative pain. Moreover, patients with NOSES could have better cosmetic outcomes and it would be conducive to postoperative psychological rehabilitation, which is also of eminent significance in treating cancer patients.

However, only six patients were in the study and the proposed results need to be further confirmed by further large-scale research. This article demonstrated the feasibility of NOSES for rectal cancer patients with liver metastasis, and provided a new perspective on the concept of minimally invasive surgery for the benefit of more stage IV patients.

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