CASE REPORT

EXPERIMENTAL ONCOLOGY

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SURGICAL MANAGEMENT OF METACHRONOUS LIVER METASTASIS AFTER WATCH-AND-WAIT STRATEGY IN RECTAL CANCER PATIENTS WITH COMPLETE RESPONSE: A CASE REPORT

The watch-and-wait (W&W) strategy has become an accepted organ-preserving approach for rectal cancer patients who achieve a clinical complete response (cCR) after total neoadjuvant therapy (TNT). However, the occurrence of metachronous colorectal liver metastases (CRLM) in this setting presents important therapeutic challenges. Evidence regarding the optimal surgical strategy—particularly the role of laparoscopic anatomical resection in centrally located liver segments—remains limited. We report the case of a 54-year-old male with cT3N0M0 rectal adenocarcinoma who achieved cCR following TNT and was subsequently managed with a W&W strategy. During routine surveillance, a solitary metachronous liver metastasis (15 mm) was detected in segment 4b. After a multidisciplinary tumor board review, the patient underwent laparoscopic anatomical segment 4b resection using an intrahepatic Glissonean approach. The postoperative course was uneventful, and the patient was discharged on postoperative day 6. Histopathological examination confirmed metastatic moderately differentiated adenocarcinoma with a microsatellite stable (MSS) phenotype and *KRAS/BRAF* wild-type status. This case demonstrates that laparoscopic anatomical segment 4b resection is a safe and feasible option for carefully selected patients with metachronous CRLM managed within a W&W strategy. The minimally invasive anatomical approach allowed precise vascular control and achievement of oncologically adequate margins in a technically demanding central segment. Larger clinical series are needed to define optimal management strategies and long-term oncologic outcomes in this setting.

Keywords: laparoscopic liver resection, rectal cancer, watch-and-wait strategy, clinical complete response, metachronous liver metastasis, anatomical segment 4b resection.

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Significant progress in rectal cancer surgery was achieved in 1982, when B. Heald introduced the principles of total mesorectal excision (TME) [1]. This technique enabled removal of primary rectal tumors along the embryological plane, with dissection performed within the relatively avascular space between the visceral and parietal fascia, significantly reducing local recurrence rates [1, 2]. TME subsequently became the foundation of modern multimodal rectal cancer (RC) treatment strategies. One of the major advancements in this field has been the implementation of total neoadjuvant therapy (TNT) for the locally advanced distal RC [3]. TNT has been shown to increase rates of clinical complete response (cCR) and improve disease-free survival. The most important advantage of achieving cCR is the potential for organ preservation without compromising quality of life. However, the rate of cCR following TNT is approximately 20%, and reported 5-year overall survival rates may reach up to 95% in selected patients [4]. The watch-and-wait (W&W) strategy for patients achieving cCR after TNT has become increasingly standardized following the results of the OPRA trial [5]. Nevertheless, this approach carries inherent risks, including the local tumor regrowth and distant metastatic progression [6]. The randomized and registry-based data indicate that the local regrowth occurs in approximately 25% of patients within two years, while distant metastases develop in 8%—30% of cases [7]. In parallel, minimally invasive surgery has demonstrated clear advantages over open approaches, including reduced surgical trauma and faster postoperative recovery [8]. Laparoscopic liver resection (LLR), particularly for minor resections, has shown favorable short-term outcomes in specialized centers [8—10]. The studies report a lower morbidity, shorter hospital stay, and earlier return to daily activities compared with open liver surgery [11]. Moreover, randomized data suggest that LLR performed by experienced teams achieves oncologic outcomes comparable to open surgery [12]. However, specific recommendations regarding the optimal surgical approach for metachronous liver metastases in rectal cancer patients managed with a W&W strategy after TNT remain lacking. The aim of this study is to present a clinical case of laparoscopic anatomical resection of a metachronous liver metastasis in a patient with rectal cancer who achieved cCR following TNT.

Case presentation

The surgical procedure was performed by the hepatopancreatobiliary (HPB) team at the National Cancer Institute (Kyiv, Ukraine). The detailed clinical course, including initial diagnosis, TNT, confirmation of the cCR, development of metachronous liver metastasis, multidisciplinary tumor board (MDT) decision-making, and preoperative evaluation, is described below.

A 54-year-old male presented to the National Cancer Institute with a history of rectal cancer previously treated with TNT. During routine follow-up, radiologic evaluation revealed disease progression in the form of a solitary metachronous liver metastasis. At the initial diagnosis in December 2023, the tumor was staged as cT3N0M0 (stage IIA) according to the AJCC TNM classification (8th edition). The diagnosis was established during a routine colonoscopy, which identified a suspicious rectal lesion. Histopathological examination confirmed a well-to-moderately differentiated (G1—G2) rectal adenocarcinoma. Between January and February 2024, the patient underwent a long-course pelvic radiotherapy to a total dose of 50.4 Gy delivered in 28 fractions, with concomitant capecitabine (825 mg/m^2 twice daily). This was followed by eight cycles of FOLFOX-6 chemotherapy initiated in March 2024 as part of TNT. Restaging performed nine weeks after completion of treatment, including high-resolution pelvic MRI, PET-CT, and endoscopic assessment, demonstrated a cCR of the rectal tumor. MRI showed magnetic resonance tumor regression grade (mrTRG) 1 with no residual wall thickening, no restricted diffusion, no residual mass on diffusion-weighted imaging, and no suspicious lymphadenopathy in either the coronal (Fig. 1) or sagittal planes (Fig. 2). The flexible endoscopy confirmed the normalization of the rectal mucosa, characterized by whitening and telangiectasia without a visible residual tumor. According to the international response criteria, these findings were consistent with the complete radiologic and endoscopic response.

The routine follow-up included contrast-enhanced pelvic MRI and CT of the chest, abdomen,

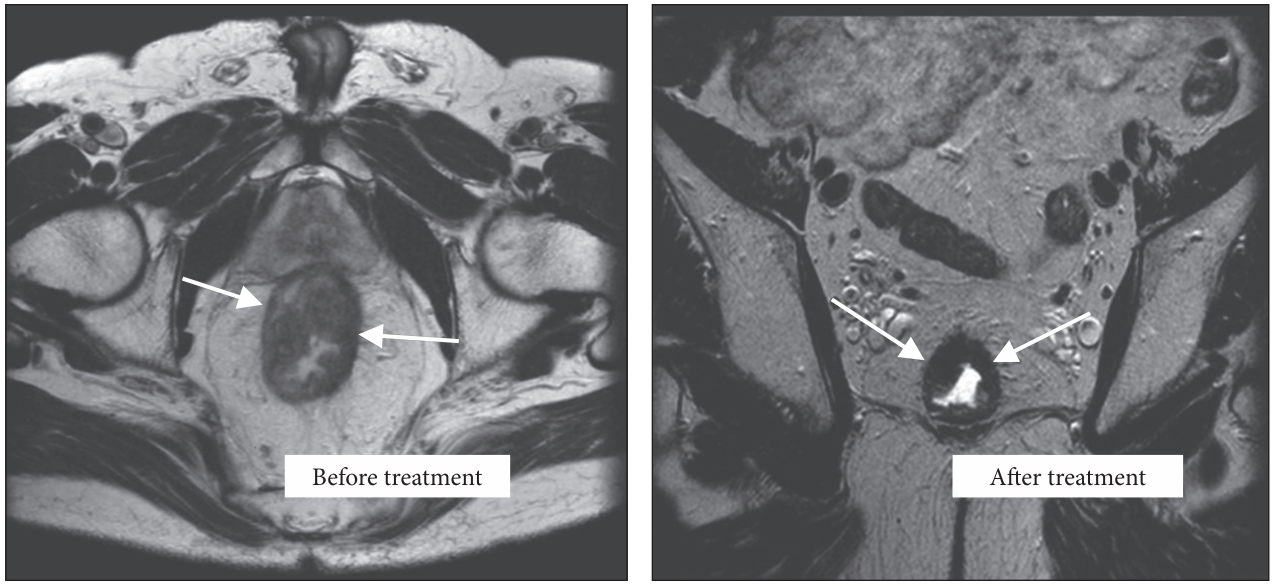

Fig. 1. Axial T2-weighted MRI sequences before and after treatment demonstrating cCR (mrTRG 1)

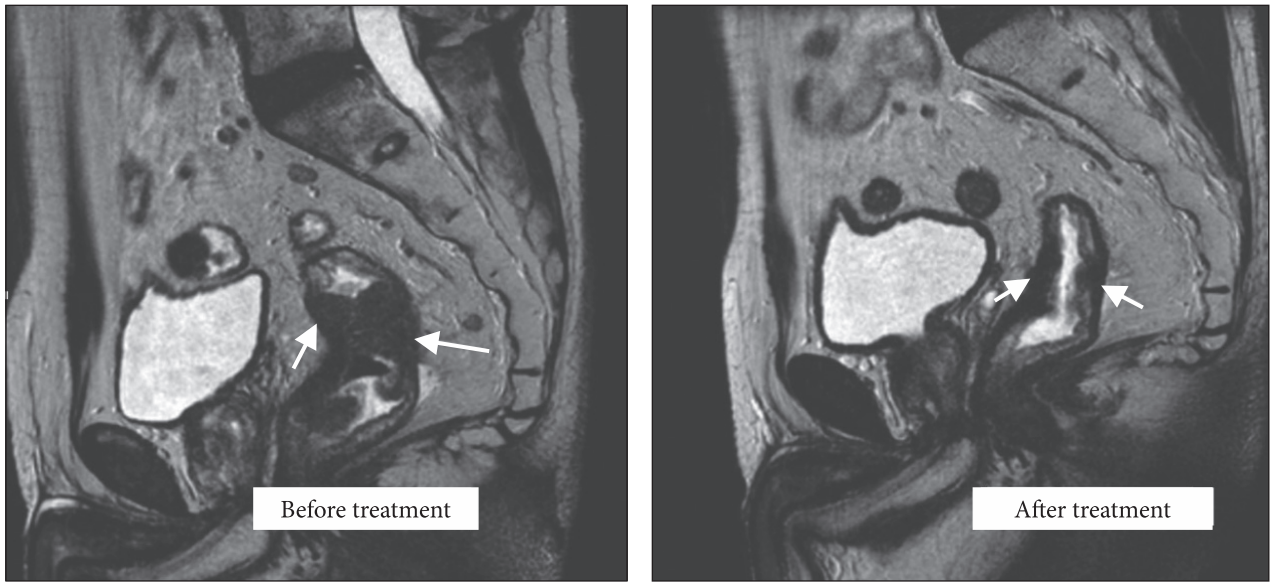

Fig. 2. Sagittal T2-weighted MRI sequences before and after treatment confirming cCR (mrTRG 1)

and pelvis according to international surveillance protocols [13]. In December 2024 CT, the appearance of a new hypodense lesion in segment 4b of the liver was evident. The final lesion localization was confirmed on contrast-enhanced MRI as segment 4b, which determined the operative anatomical strategy (Fig. 3).

The patient underwent a full preoperative evaluation with no comorbidities and was classified as ASA I. Also, there was no relevant drug use, family history (including hereditary cancer syndromes), or psychosocial concerns.

The patient's clinical course followed a clearly defined chronological sequence. In December 2023, he was diagnosed with cT3N0M0 rectal adenocarcinoma. Between January and February 2024, he underwent long-course pelvic radiotherapy (50.4 Gy in 28 fractions) with concomitant capecitabine. From March to July 2024, eight cycles of FOLFOX-6 were administered as part of TNT.

In September 2024, the comprehensive restaging, including high-resolution pelvic MRI, PET-CT, and endoscopic evaluation, confirmed a cCR. A structured W&W surveillance program was subsequently initiated.

In December 2024, a routine follow-up imaging detected a solitary metachronous liver metastasis in segment 4b. After MDT evaluation, surgical

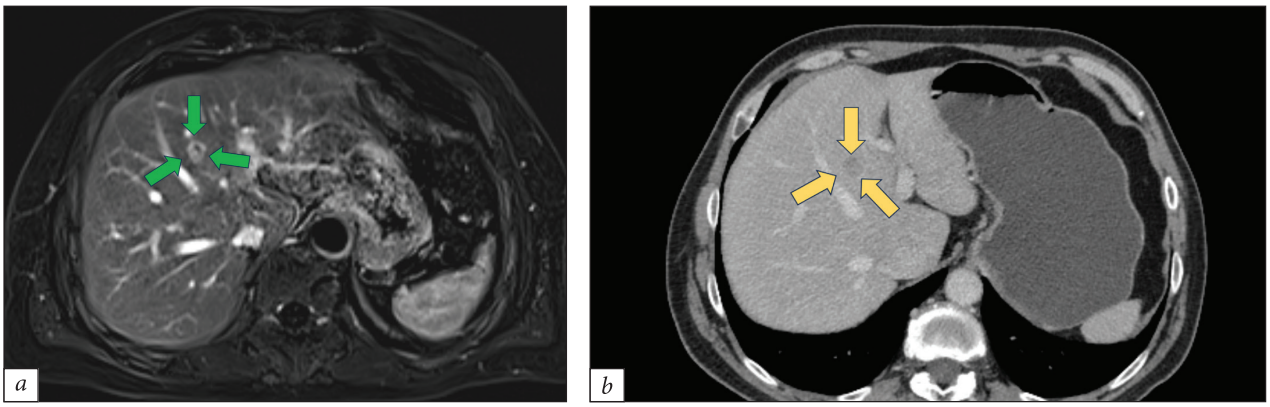

Fig. 3. Contrast-enhanced MRI (*a*) and CT (*b*) performed in December 2024, demonstrating a solitary lesion in segment 4b

treatment was recommended. In January 2025, the patient underwent laparoscopic anatomical segment 4b resection.

Examination results and planning of treatment tactics. The routine laboratory tests revealed no abnormality. The patient's serum carcinoembryonic antigen (CEA) level was elevated at 25.8 ng/mL, while CA 19-9 remained within normal limits. Tumor marker levels did not influence surgical decision-making. Contrast-enhanced abdominal CT and MRI identified a solitary hepatic lesion in segment 4b measuring 15 mm (Fig. 3). Given the confirmed cCR of the primary tumor after TNT, the MDT recommended continuation of the non-operative W&W strategy for the rectal lesion and surgical management of the liver metastasis. The choice of laparoscopic anatomical resection was based on several considerations. The lesion was solitary (15 mm) with no evidence of extrahepatic disease, and the patient had preserved liver function and no comorbidity (ASA I). Due to its central location in segment 4b and proximity to the major vascular structures, an anatomical resection was considered preferable to ensure complete portal territory clearance and adequate oncologic margins. Furthermore, institutional experience in laparoscopic anatomical liver resections supported the minimally invasive approach. Preoperative preparation included standard thromboprophylaxis with subcutaneous low-molecular-weight heparin.

Ligasure Maryland and bipolar/monopolar electrocautery were used as laparoscopic surgical energy devices.

Surgical technique. The patient was positioned in the supine split-leg position, with the surgeon standing between his legs. After placement of a 12 mm umbilical port, pneumoperitoneum was established using carbon dioxide insufflation, and intra-abdominal pressure was maintained below 12 mm Hg. Four trocars were inserted under direct vision (one 12 mm, two 10 mm, and one 5 mm) as shown in Fig. 3. The falciform and coronary ligaments were divided in the cephalad direction to mobilize the liver. Intraoperative ultrasonography was performed to confirm tumor location and assess resection margins. The medial transection line was marked along the right side of the falciform ligament using electrocautery. An intrahepatic Glissonean approach was used to control the segment 4 pedicles. Parenchymal transection was initiated along the right side of the falciform ligament, followed by careful dissection to expose the segment 4 Glissonean pedicle. The subdivisional pedicle to segment 4b was isolated and divided using Hem-o-lok clips (Fig. 4). The resulting demarcation line on the liver surface was used to guide anatomical parenchymal transection. Intermittent inflow control was applied using a 14-Fr Foley catheter tourniquet technique (Huang method). Parenchymal transection was completed using the clamp-crushing technique (Fig. 5).

Operative time was 185 min, estimated blood loss was 200 mL, and total Pringle maneuver duration was 26 min. The patient had no postoperative complications and was discharged on postoperative day 6.

Pathological findings and follow-up. Histopathological examination of the resected liver specimens confirmed moderately differentiated adenocarcinoma. Molecular genetic analysis revealed *MSS, KRAS,* and *BRAF* of the wild type. The patient continued regular follow-up with the attending surgeon and clinical oncologist. Adju-

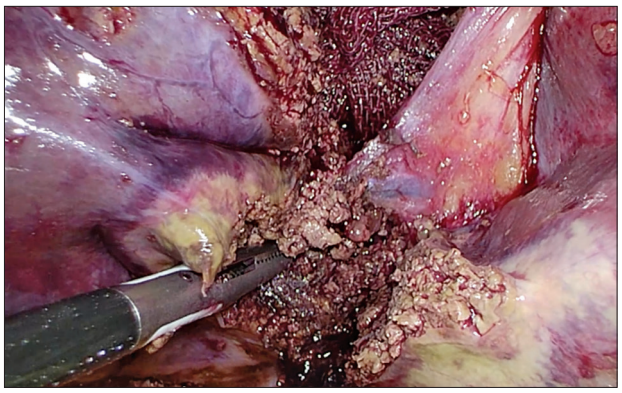

Fig. 4. Intraoperative view of the isolated S4b Glissonean pedicle

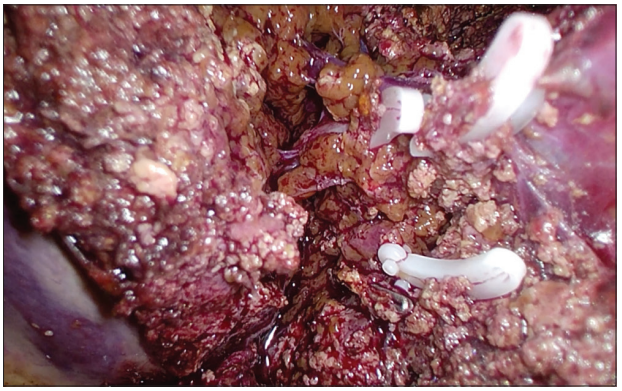

Fig. 5. Parenchymal transection following control of the S4b Glissonean pedicle

vant chemotherapy with the FOLFOX-6 regimen was recommended by the MDT based on the current institutional protocol for the resected metachronous colorectal liver metastases (CRLM), considering the risk of systemic recurrence. A non-operative W&W strategy was adopted for the rectal lesion. The follow-up strategy included clinical evaluation and serum CEA assessment every 3 months over the first two years, with contrast-enhanced CT of the chest and abdomen every 6 months, and pelvic MRI according to the W&W surveillance protocol.

Discussion

This case highlights the importance of multidisciplinary decisions in the course of the W&W strategy in RC patients with cCR experience after TNT. It is recommended to apply state-of-the-art radiologic and endoscopic assessment to ensure robust confirmation of cCR and support decision-making regarding rectal organ preservation [14]. Data regarding the incidence and management of CRLM in patients treated with a W&W strategy remain limited. According to analyses from the International W&W Database (IWWD), distant metastases develop in approximately 8%—30% of patients, particularly among those experiencing local regrowth [6, 7]. Furthermore, long-term data from the OPRA trial confirm that while organ preservation is feasible, distant metastatic progression remains a relevant clinical concern in this population [5]. However, we lack specific surgical recommendations for CRLM, arising in the context of prior organ-preservation strategies, and current management is generally extrapolated from conventional CRLM treatment paradigms. Nevertheless, the development of metastatic disease introduces additional clinical challenges and requires individualized decision-making. The advancement of minimally invasive hepatobiliary surgery has expanded therapeutic options for metastatic liver disease, allowing effective oncologic treatment with reduced surgical trauma. The laparoscopic anatomical resections in CRC patients with liver metastases remain a technically demanding procedure, particularly when targeting lesions are located in central liver segments. Segment 4b, positioned adjacent to key vascular and biliary structures, presents specific challenges due to its anatomical proximity to the left and right hepatic pedicles, the middle hepatic vein, and the gallbladder fossa [15, 16]. Precise anatomical orientation and controlled dissection are therefore critical to avoid vascular injury and ensure oncological safety. However, the foundation of these procedures must be rooted in solid open surgical experience and a thorough understanding of intrahepatic vascular anatomy. Several contemporary studies have demonstrated that LLR achieves oncological outcomes comparable to open liver resection (OLR) in patients with CRLM, with similar overall and disease-free survival rates [17, 18]. In addition, LLR has been associated with reduced intraoperative blood loss, lower postoperative morbidity, and shorter hospital stay compared to OLR in selected patients [17, 19]. Although resections in the central liver segments remain technically demanding due to proximity to major vascular structures, recent series suggest that with appropriate expertise and anatomical approaches, minimally invasive resections

can be performed safely even in these challenging locations [18, 20].

In our case, the laparoscopic anatomical resection of segment 4b was performed successfully, with full control of the segmental Glissonean pedicle and clear exposure of the resection line. The minimally invasive approach allowed achievement of R0 resection with clear gross and microscopic margins, minimal blood loss, and no need for conversion.

This case demonstrates that laparoscopic anatomical segment 4b resection is a safe and feasible option for carefully selected patients with metachronous CRLM managed within a W&W strategy. The minimally invasive anatomical approach allowed precise vascular control and achievement of oncologically adequate margins in a technically demanding central segment. Larger clinical series are needed to define optimal management strategies and long-term oncologic outcomes in this setting.

Limitations

This report represents a single clinical observation and therefore does not allow generalization of outcomes or comparison with alternative surgical strategies. No comparative analysis between the laparoscopic and open approaches in this specific clinical scenario can be made. Long-term oncologic results remain unavailable due to the relatively short follow-up period. Furthermore, evidence guiding management of metachronous CRLM in patients treated with a W&W strategy after TNT is limited, and current decision-making relies largely on extrapolation from conventional CRLM treatment paradigms.

Conflict of interest

The authors declare no conflict of interest.

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ХІРУРГІЧНЕ ЛІКУВАННЯ МЕТАХРОННИХ МЕТАСТАЗІВ У ПЕЧІНКУ ПІСЛЯ WATCH-AND-WAIT СТРАТЕГІЇ В ПАЦІЄНТІВ ІЗ РАКОМ ПРЯМОЇ КИШКИ З ПОВНОЮ КЛІНІЧНОЮ ВІДПОВІДДЮ: КЛІНІЧНИЙ ВИПАДОК

Стратегія watch-and-wait (W&W) стала визнаним органозберігаючим підходом для пацієнтів із раком прямої кишки, які досягли повної клінічної відповіді після тотальної неоад'ювантної терапії (ТНТ). Однак виникнення метахронних колоректальних метастазів у печінку в цій когорті створює важливі терапевтичні виклики. Дані щодо оптимальної хірургічної стратегії, зокрема, ролі лапароскопічної анатомічної резекції центрально розташованих сегментів печінки залишаються обмеженими. Представлено випадок 54-річного чоловіка з аденокарциномою прямої кишки cT3N0M0, який досяг повної клінічної відповіді після проведення ТНТ і надалі перебував під спостереженням за стратегією W&W. Під час рутинного моніторингу виявлено солітарний метахронний метастаз у печінку (15 мм) у сегменті 4b. Після розгляду випадку на мультидисциплінарному онкологічному консиліумі пацієнту виконано лапароскопічну анатомічну резекцію сегмента 4b із застосуванням внутрішньопечінкового гліссонового доступу. Післяопераційний перебіг — без ускладнень, пацієнта виписано на шосту післяопераційну добу. Гістопатологічне дослідження підтвердило метастатичну помірно диференційовану аденокарциному з мікросателітною стабільністю та статусом *KRAS/BRAF* дикого типу. Цей клінічний випадок демонструє, що лапароскопічна анатомічна резекція сегмента 4b є безпечним і виконуваним методом лікування в ретельно відібраних пацієнтів із метахронними колоректальними метастазами в печінку в межах стратегії W&W. Мінімально інвазивний анатомічний підхід забезпечив точний судинний контроль і досягнення онкологічно адекватних країв резекції в технічно складному центральному сегменті. Для визначення оптимальної тактики лікування та оцінки віддалених онкологічних результатів у цій категорії пацієнтів необхідні подальші клінічні дослідження.

Ключові слова: лапароскопічна резекція печінки, рак прямої кишки, watch-and-wait, повна клінічна відповідь, метахронний метастаз у печінку, анатомічна резекція сегмента 4b.