CASE REPORT PEER REVIEWED | OPEN ACCESS

Tunnel hepatectomy: A review of the parenchymal-sparing technique in colorectal liver metastasis and operative video

Alexandre de Hemptinne, Mike Salavracos, Laurent Coubeau

ABSTRACT

Introduction: Surgery of colorectal liver metastases (CRLM) has evolved over the past decades from an interest mainly focused on oncological margins to a new surgical policy known as parenchymal sparing hepatectomy (PSH). Contrary to anatomical resection (AR), this new approach combines the well-known issue of curative resections (R0 resections) in tumor removal with a new doctrine, reducing the unnecessary sacrifice of healthy parenchyma as much as possible (salvageability).

Case Report: We report the case of a 60-year-old man diagnosed with rectal adenocarcinoma accompanied by seven synchronous bilobar liver metastases, including two closely situated metastases. The first was located in liver segment VIII, whereas the second was positioned between segments VIII and IV, just beneath the middle hepatic vein (MHV). In order to resect these two lesions without sacrificing the middle hepatic vein and preserving as much hepatic parenchyma as possible, we have chosen a conservative resection approach, the tunnel hepatectomy (TH).

Conclusion: Parenchymal sparing hepatectomy is the recommended approach in CRLM disease. Beyond the need to ensure healthy oncological margins, every surgeon should pay special attention to preserving hepatic parenchyma. Therefore, 3D modeling of the liver and its lesions appear to be a great assistance before any sophisticated surgical intervention to ensure the most conservative surgery possible. And for patients with deep liver metastases having complex relationships, TH seems to be a suitable technique.

Keywords: Colorectal liver metastases, Parenchymal sparing hepatectomy, 3D liver modeling, Tunnel hepatectomy

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INTRODUCTION

At time of diagnosis, 10–25% of patients with colorectal cancer present synchronous liver metastases [1]. Over the past few decades, the survival rates for these patients have substantially increased, attributed to more effective chemotherapy, expanded surgical criteria, and advancements in surgical techniques. Notably, patients with initially unresectable colorectal liver metastases (CRLM) can undergo tumor downsizing through various chemotherapies, making these metastases subsequently resectable. Studies indicate a 33% 5-year survival and a 23% 10-year survival rate for such patients after surgery, slightly lower than resectable CRLM patients but significantly higher than those who do not undergo surgery [2]. Moreover, the number of CRLM is no longer an excluding factor; the only condition for resectability is the ability to remove all metastases while maintaining an adequate residual functional hepatic volume.

Emerging literature has demonstrated the benefits of PSH in CRLM disease instead of anatomical resection (AR). First, minor resections, the so-called cherry-picking surgery, have the advantage of enabling iterative interventions in case of intrahepatic recurrence, an

unfortunate situation that affects 40% of patients after CRLM surgery [3, 4]. Second, PSH has the obvious benefit of preventing post-hepatectomy liver failure and, consequently, increasing liver tolerance to interval chemotherapy [5]. Finally, PSH decreases the morbidity and mortality and, contrary to popular belief, does not change the oncological outcome [6, 7].

For all of these reasons, PSH appears as the gold standard of treatment in CRLM disease. In this article, we present, with video support, one of several techniques of parenchymal sparing liver surgery; the tunnel hepatectomy also known as Liver Tunnel [8].

CASE REPORT

We present the case of a 60-year-old man who has been diagnosed with rectal adenocarcinoma and seven bilobar synchronous liver metastases discovered in a context of rectal bleeding. After neoadjuvant therapy, the patient was considered eligible for a liver-first approach before surgery of his primary rectal cancer.

Two of these metastases were located in close proximity to each other. The first (4 cm) was found in liver segment VIII and the second (1 cm) between segments VIII and IV, just below the middle hepatic vein (MHV). Because of the critical location and the small size of the second metastasis, 3D modeling was performed prior to surgery to facilitate the detection of the second lesion through intraoperative ultrasound (Figure 1).

Owing to the proximity of the two lesions, we decided to perform the second wedge resection inside the first one. In other words, we performed a tunnel hepatectomy (TH) by carrying out the second liver resection within the confines of the first wedge resection (Figure 2). And considering the vascular involvement of the MHV discovered intraoperatively, our decision was to perform a tangential resection of this vein following by its reconstruction rather than its detachment.

The remaining five metastases were subcapsular, and as such, they could be removed through superficial resections.

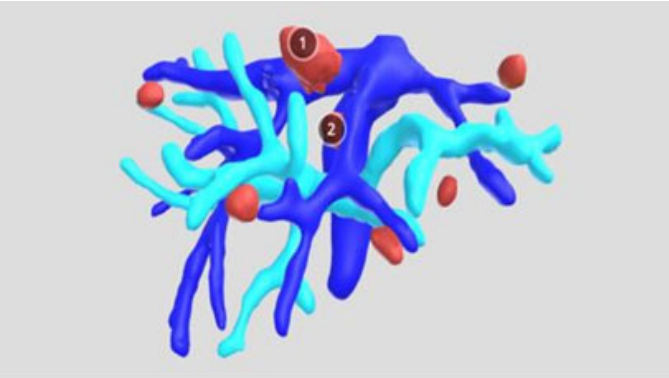

Figure 1: 3D liver modeling before surgery.

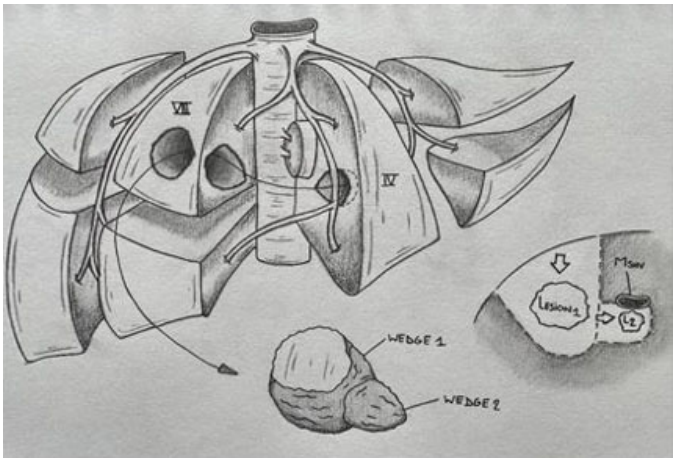

Figure 2: Combined resection of both lesions with partial resection of the MHV.

This TH gave us the opportunity to preserve healthy parenchyma as well as the MHV: a technique from the parenchyma-sparing policy. We provided an annotated surgical video (Video 1) to describe this surgical procedure.

Thereafter, the anatomopathological analysis of all resection pieces confirmed clean oncological margins (R0) and the patient could leave after five days of uneventful hospitalization. A follow-up computed tomography (CT) scan performed three months after surgery did not show early recurrence and indicated good patency of the MHV, no congested area or vascular thrombosis.

Video 1: Tunnel hepatectomy spanning segments IV and VIII.

URL: https://www.ijcrisurgery.com/archive/article-full-text/100133Z12AH2024#video1

Access Video on other devices

DISCUSSION

Tunnel hepatectomy can be technically challenging but this approach has proven to be safe and feasible. In 2019, Torzili et al. conducted a prospective intention-to-treat validation study on 20 consecutive patients who underwent Liver Tunnel for deep liver tumors having complex relationships. There was no in-hospital 90-day mortality and overall morbidity occurred in 50% of patients with major morbidity in 10% of them. All complications were managed conservatively and after a median 15-month follow-up, two instances of local recurrences were observed [8]. These results were concordant with the systematic review of the literature regarding parenchymal-sparing hepatectomy performed by Moris et al. in 2017. After analyzing data on parenchymal versus non-parenchymal-sparing hepatic resections for CRLM on 2505 patients, they showed that PSH had a comparable safety and efficacy profile compared with AR and did not compromise oncologic outcomes [9].

In our patient, one lesion was attached right below the MHV. This proximity necessitated a tangential resection of this vessel followed by its reconstruction with a direct running suture. Indeed, given the absence of observed communicating veins (CV) on intraoperative ultrasound between the hepatic veins, no collateral circulation could justify the sacrifice of the MHV. Sacrificing this vein would have compromised the venous outflow of segments IV, V, and VIII and, by this way, would have reduced the residual functional hepatic volume.

Based on a reviewed cohort of 135 patients with colorectal liver metastases involving hepatic veins close to the caval-confluence, in 2018, an analysis was conducted by Torzili et al. on how to manage these lesions. They have demonstrated that hepatic vein-sparing was feasible in most patients with colorectal liver metastases-hepatic vein contacts. Moreover, resection and direct suture seemed to be a safe, predictable, and oncologically adequate technique for lesions with a contact/involvement in a third to two-thirds of hepatic vein circumference [10].

In our case, considering the vascular involvement of the MHV over a third of its circumference, we decided to perform a partial resection and a direct suture. As soon as this technique proves to be safe, we believe that tangential resection of the MHV should be prioritized instead of vascular detachment to reduce the risk of R1 vascular resection.

CONCLUSION

Our opinion is that every liver surgeon should prioritize parenchymal sparing approach once oncological margins are secured. Parenchymal sparing hepatectomy can be safely carried also for CRLM situated deeply if preoperative identification of the lesions was done accurately. And for these centrally located lesions with complex tumor-vessel relationship, TH appears to be a safe and effective alternative to AR. This approach, by reducing the resection volume and sparing the liver vessels, expands the pool of eligible patients for surgery and maximizes the chances of iterative interventions in the case of metastatic recurrence.

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Author Contributions

Alexandre de Hemptinne – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Mike Salavracos – Design of the work, Acquisition of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Laurent Coubeau – Conception of the work, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Conflict of Interest
Authors declare no conflict of interest.

Data Availability
All relevant data are within the paper and its Supporting Information files.