

Congress Abstract

Three-Dimensional Liver Master Model as a Tool for Lesion-By-Lesion Correlation of Radiological Data, Intraoperative Findings, and Histological Examination in Colorectal Cancer Metastases

D.V. Nesterov^{1,4}, V.V. Nesterova¹, I.A. Burovik^{1,2}, S.S. Bagnenko^{1,3}, P.V. Balakhnin¹, A.V. Kulish¹, A.S. Shmelev¹, V.I. Malkevich¹, E.V. Zagaynov^{1,4}, I.I. Yarmolyuk¹, A.A. Grushko¹, A.A. Stefanenkova¹

¹Federal State Budgetary Institution "N.N. Petrov National Medical Research Center of Oncology" of the Ministry of Health of the Russian Federation, St. Petersburg, Russia

²Federal State Budgetary Educational Institution of Higher Education "Saint Petersburg State University," St. Petersburg, Russia

³Federal State Budgetary Educational Institution of Higher Education "Saint Petersburg State Pediatric Medical University" of the Ministry of Health of the Russian Federation, St. Petersburg, Russia

⁴Federal State Budgetary Educational Institution of Higher Education "North-Western State Medical University named after I.I. Mechnikov" of the Ministry of Health of the Russian Federation, St. Petersburg, Russia

Proceedings of International Scientific and Practical Conference "ONCO FUTURE KAZAKHSTAN 2026: Precision Oncology Theranostics, Artificial Intelligence," September 24-26, 2026, Astana, Kazakhstan

Corresponding author's email:
nestlera@mail.ru

Copyright: By the author(s).

License: A non-exclusive license by the publisher. Published by Australasia Publishing Group LLP (Astana, Kazakhstan) on behalf National Research Oncology Center.

Open Access: This article is an open access article distributed under the terms and conditions of the CC-BY Creative Commons Attribution license
<https://creativecommons.org/licenses/by/4.0>



Introduction: The extent of surgery for colorectal cancer (CRC) liver metastases is currently planned on a lesion-by-lesion basis, making lesion-by-lesion assessment of the diagnostic efficacy of radiological methods important. Such studies are few in number: they are labor-intensive, and lesions detected by different methods are difficult to correlate with each other. Typically, the correspondence between radiological findings and histological conclusions is established by liver segment or anatomical landmarks, which is unreliable in cases of multiple lesions.

Objective: To develop a methodology for lesion-by-lesion correlation of radiological data, intraoperative findings, and histological examination based on a three-dimensional liver master model.

Materials and Methods: A single-center study at the N.N. Petrov National Medical Research Center of Oncology included 18 patients with CRC liver metastases who underwent intravenous contrast-enhanced CT, CT-arteriohepaticography (CT-AHG), MRI with hepatobiliary contrast agent, and MR-arteriohepaticography (MR-AHG) 1–7 days prior to liver resection. Using 3D Slicer software, a master model—a three-dimensional reconstruction of the liver with numbered lesions—was constructed from CT data. Lesions detected by at least one imaging method, including those only visible prior to chemotherapy, were mapped onto the model. The lesion number linked the label on images, the surgeon's finding on intraoperative ultrasound (IOUS), and the gross specimen. Correspondence between model lesions and the gross specimen was established by a consensus of the radiologist, surgeon, and pathologist based on location relative to the capsule, resection margin, and vessels.

Results: In 18 patients, 147 lesions were mapped on the master models: median 5.5 per patient (range 1–27). Sixteen patients had more than one lesion. A total of 111 lesions were histologically verified (median 3.5 per patient), of which 103 were metastases; 36 non-resected lesions were excluded from accuracy calculations. The model enabled independent correlation of the four imaging methods: sensitivity was 77.7% for CT, 69.9% for CT-AHG, 56.3% for MRI, and 50.5% for MR-AHG; with combined assessment (at least one method), sensitivity was 90.3%: 93 of 103

metastases were detected, while 10 were missed by all methods. No additional lesions were identified on the gross specimen outside the master model.

Conclusion: When performing liver resection for CRC metastases, the master model provides a unified coordinate system from preoperative images to the gross specimen and continuous lesion numbering. This enables rigorous lesion-by-lesion verification in cases of multiple lesions, where segmental correspondence alone is insufficient.

Keywords: Colorectal Cancer; Liver Metastases; Three-Dimensional Modeling; Master Model; Preoperative Planning