



International Science Group

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**XXXI International scientific and practical conference
«Frontiers of modern knowledge: integration of theory
and practice»**

**August 4–7, 2026
Sofia, Bulgaria**

ISBN - 979-8-90600-154-2

DOI – 10.46299/ISG.2026.1.31

FRONTIERS OF MODERN KNOWLEDGE: INTEGRATION OF THEORY AND PRACTICE

Proceedings of the XXXI International Scientific and Practical Conference

Sofia, Bulgaria
August 4–7, 2026

UDC 01.1

The 31th International scientific and practical conference “Frontiers of modern knowledge: integration of theory and practice” (August 4–7, 2026) Sofia, Bulgaria. International Science Group. 2026. 96 p.

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THE ROLE OF SYNERGISTIC USE OF MINIMALLY INVASIVE TECHNIQUES IN THE STAGING OF LOCALLY ADVANCED AND METASTATIC COLORECTAL CANCER

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Introduction and relevance of the problem

Colorectal cancer (CRC) is one of the most common malignancies worldwide. According to estimates by the International Agency for Research on Cancer (IARC), approximately 1.9 million new CRC cases and more than 900,000 deaths occur worldwide each year, ranking it third in incidence and second in cancer-related mortality globally [1].

A major challenge in many healthcare systems is the high rate of advanced-stage disease at presentation. A significant percentage of patients seek specialized medical care for the first time only when the tumor process is locally advanced (stage III) or in the presence of clinically manifested distant metastasis (stage IV). The traditional diagnostic algorithm, based on routine non-invasive imaging methods (CT, MRI, PET-CT), has objective physical and spatial limitations. A major limitation of current imaging modalities is their inability to reliably detect lesions smaller than 10 mm. Computed tomography demonstrates low sensitivity (7–28%) for such lesions, leading to the underdiagnosis of occult peritoneal carcinomatosis. Positron emission tomography (PET-CT) has a high rate of false-negative results in mucinous tumor subtypes due to their low metabolic activity [2].

Conversely, radiological assessment may overestimate thoracic metastatic disease because reactive lymphadenopathy and benign pulmonary granulomas can be misinterpreted as M1 disease. This dictates the necessity of utilizing minimally invasive surgical techniques for the definitive in vivo verification of the extent of the malignant process. Staging laparoscopy, combined with modern imaging methods, improves the accuracy of disease staging, allows for the timely detection of occult peritoneal metastases, and optimizes the choice of treatment strategy [3].

Objective of the study

To improve the diagnostic accuracy of locally advanced and metastatic colorectal cancer by developing a staging algorithm that integrates conventional non-invasive imaging with minimally invasive techniques, including diagnostic laparoscopy, video-

assisted thoracoscopic surgery (VATS), and mediastinoscopy, to enable precise disease staging and individualized treatment planning.

Materials and Methods

This study was based on a combined retrospective and prospective analysis of 140 patients with morphologically confirmed colorectal cancer (CRC) ($n = 140$; mean age, 64.5 ± 10.4 years) who were classified as having clinical stage T3–T4 disease. Histopathological examination identified conventional adenocarcinoma in 75.0% of patients (105/140), whereas the remaining 25.0% (35/140) had prognostically unfavorable histological subtypes, including mucinous adenocarcinoma and signet-ring cell carcinoma.

Patients were stratified into three groups according to the staging strategy employed.

Group I ($n = 45$): the reference group, in which disease staging was performed exclusively using conventional non-invasive imaging modalities, including computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography-computed tomography (PET-CT). Radiological findings alone determined the presence or absence of metastatic disease.

Group II ($n = 67$) comprised patients with suspected peritoneal carcinomatosis or distant metastatic disease who underwent one targeted minimally invasive staging procedure—diagnostic laparoscopy, video-assisted thoracoscopic surgery (VATS), or mediastinoscopy—following conventional imaging.

Group III ($n = 28$): patients with multiple indeterminate lesions who underwent a multimodal staging approach combining two or more minimally invasive procedures, such as diagnostic laparoscopy together with VATS.

The male-to-female ratio was 1.4:1, which is consistent with the global epidemiological distribution of colorectal cancer (Table 1).

Table 1. Gender structure of CRC patients

Study group	Men (Abs. value)	Men (%)	Women (Abs. value)	Women (%)
Overall cohort (N=140)	81	57.9	59	42.1
Group I (n=45)	26	57.8	19	42.2
Group II (n=67)	39	58.2	28	41.8
Group III (n=28)	16	57.1	12	42.9

Results

Comparison of radiological staging with subsequent histopathological verification showed that conventional imaging substantially underestimated disease burden. Conventional imaging modalities failed to detect 51.4% of liver micrometastases: non-invasive imaging identified 34 cases, whereas the combined use of minimally invasive procedures increased the number of confirmed cases to 70. Similarly, CT and MRI failed to identify 47.0% of cases of occult peritoneal carcinomatosis, detecting only 9

cases compared with 17 morphologically confirmed cases identified following minimally invasive assessment.

The radiological Peritoneal Cancer Index (rPCI) consistently underestimated the true extent of peritoneal disease. During direct intraoperative assessment, the median surgical PCI (sPCI) was 11, which was significantly higher than the preoperative radiological estimate (median rPCI = 4; $p < 0.001$).

Diagnostic laparoscopy. The incorporation of diagnostic laparoscopy, including intraoperative PCI assessment and peritoneal lavage, detected 76.7% of clinically occult cases of peritoneal carcinomatosis. This staging strategy reduced the absolute risk of unnecessary exploratory laparotomy by 40%. Diagnostic laparoscopy demonstrated a sensitivity of 92–98% and a specificity of approximately 99% for the detection of peritoneal metastases. Histological subtype independently predicted peritoneal dissemination, with mucinous adenocarcinoma being associated with a 2.5-fold higher likelihood of detecting peritoneal implants (odds ratio [OR] = 2.472). Identification of extensive occult peritoneal carcinomatosis (PCI > 20) enabled timely referral of patients for systemic palliative chemotherapy, thereby avoiding non-therapeutic laparotomy.

Video-assisted thoracoscopic surgery (VATS) and mediastinoscopy. Radiological assessment alone resulted in false-positive findings in up to 18.2% of patients, primarily because reactive lymphadenopathy and benign fibrotic pulmonary nodules were misclassified as metastatic disease. For differential diagnosis, VATS demonstrated a sensitivity of 96–99% and a specificity of 99%, while cervical mediastinoscopy achieved a sensitivity of 75% and a specificity of 98% for the assessment of mediastinal lymphadenopathy. Histopathological confirmation of benign mediastinal lesions resulted in downstaging, allowing these patients to remain eligible for radical surgical treatment, including extended D3 lymph node dissection. Immunohistochemical analysis using the CK20(+)/CDX2(+)/CK7(–) marker profile accurately confirmed the colorectal origin of metastatic lesions in all examined cases.

Clinical Effectiveness of the Diagnostic Algorithm

The combined diagnostic algorithm (Group III) achieved an overall diagnostic accuracy of 96.4%, with a specificity of 98.2%. Integrating conventional imaging with minimally invasive staging techniques resulted in disease stage reclassification and changed the initial treatment strategy in 42.1% of patients (odds ratio [OR] = 3.85, $p < 0.01$). Accurate verification of metastatic (M) status enabled individualized treatment planning and was associated with improved overall survival (OS) and prolonged disease-free survival (DFS) (hazard ratio [HR] = 0.64, 95% confidence interval (CI): 0.48–0.85; $p = 0.032$).

Conclusions

Conventional non-invasive imaging modalities demonstrate limited sensitivity for detecting small peritoneal implants, failing to identify up to 47.0% of cases of occult peritoneal carcinomatosis. In addition, they overestimate mediastinal metastatic involvement by misclassifying reactive lymphadenopathy as metastatic disease in up to 18.2% of cases.

Incorporating diagnostic laparoscopy into the staging algorithm for locally advanced colorectal cancer enables detection of 76.7% of clinically occult peritoneal carcinomatosis and reduces the incidence of unnecessary exploratory laparotomy by 40%.

Video-assisted thoracoscopic surgery (VATS) and mediastinoscopy provide reliable histopathological verification of indeterminate thoracic lesions, preventing false-positive diagnoses of metastatic disease (downstaging) and allowing eligible patients to undergo radical surgical treatment.

A multimodal staging algorithm integrating conventional imaging with minimally invasive techniques changed the initial treatment strategy in 42.1% of patients. Accurate disease staging and individualized treatment planning were associated with improved overall survival (HR = 0.64).

References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74(3):229-263. doi:10.3322/caac.21834.
2. Szadkowska MA, Pałucki J, Cieszanowski A. Diagnosis and treatment of peritoneal carcinomatosis – a comprehensive overview. *Pol J Radiol.* 2023;88:e89-e97. doi:10.5114/pjr.2023.125027.
3. Rijsemus CJV, Kok NFM, Aalbers AGJ, et al. Staging peritoneal metastases in colorectal cancer: The correlation between MRI, surgical and histopathological peritoneal cancer index. *Eur J Surg Oncol.* 2024;50(12):108611. doi:10.1016/j.ejso.2024.108611.