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Diagnostic value of peritoneal lavage fluid cytology findings of peritoneal invasion in patients with gastric cancer

Moein Moghadam Ahmadi [1], Fatemeh Nejatifar [2], Habib Eslami Kenarsari [3], Saeed Soroush [4], Amineh Hojati [5]*

[1] Clinical Research Development Unit of Poursina Hospital, Guilan University of Medical Sciences, Rasht, Iran

[2] Department of Hematology and Medical Oncology, Guilan University of Medical Sciences, Rasht, Iran

[3] Clinical Research Development Unit of Poursina Hospital, Razi Hospital, Guilan University of Medical, Sciences, Rasht, Iran

[4] Student Research Committee, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran

[5] Gastrointestinal and Liver Disease Research Center, Guilan University of Medical Science, Rasht, Iran

Abstract

Introduction: Currently, patients diagnosed with gastric cancer typically undergo surgical or laparoscopic examination to assess the presence of metastasis.

Methods: This study involved 35 candidates for gastric adenocarcinoma surgery, consisting of 21 males and 14 females from medical centers in Rasht, Iran, in 2021. Patients reported initial complaints such as abdominal pain, nausea, weight loss, loss of appetite, and anemia. All data was analyzed using SPSS version 21.

Results: Peritoneal lavage cytology results indicated 14 positive cases and 21 negative cases for peritoneal metastasis, while laparoscopic examination during surgery showed 12 positive cases and 23 negative cases. There was concordance between the two methods in 23 cases regarding the presence or absence of peritoneal metastasis, while 12 cases showed inconsistency. Specifically, five cases had negative peritoneal lavage cytology and positive laparoscopic examination, and seven had positive peritoneal lavage cytology and negative laparoscopic examination. Although peritoneal lavage cytology aligned with intraoperative findings regarding patient feasibility.

Conclusion: The study illustrated that solely on peritoneal lavage cytology results is not enough for determining peritoneal invasion in patients with gastric cancer.

Keywords: Gastric Cancer, Peritoneal Lavage, Laparoscopy, Cytology

Corresponding Authors: Amineh Hojati

✉ Email: amineh_hojati@yahoo.com

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Introduction

Gastric cancer is a significant global health concern, accounting for a substantial proportion of cancer-related morbidity and mortality. It is the fifth most common cancer worldwide and the third leading cause of cancer-related deaths (1). The incidence of gastric cancer varies across different regions, with higher rates observed in Eastern Asia, Eastern Europe, and parts of South America (2). Several risk factors contribute to the development of gastric cancer, including Helicobacter pylori infection, a family history of gastric cancer, smoking, and an everyday diet (3). Peritoneal involvement in cancer is usually manifested by abdominal distension, changes in bowel habits, feeling full after eating, and pain secondary to ascites accumulation (4,5). The value of peritoneal lavage cytology in stomach, colon, and pancreatic cancers has always been one of the topics of interest for study, and the relationship between positive peritoneal lavage cytology and worsening prognosis has been confirmed (6).

One critical aspect of managing gastric cancer is accurately assessing the presence of peritoneal invasion, as it significantly impacts prognosis and treatment decisions (7). Currently, surgical or laparoscopic examination is commonly used to investigate the presence of peritoneal metastasis in patients diagnosed with gastric cancer. However, these methods can be invasive and may carry certain risks. Therefore, there is a need for less invasive diagnostic approaches that can provide reliable information about peritoneal invasion in gastric cancer patients (8–11). Peritoneal lavage cytology involves collecting and examining fluid samples from the peritoneal cavity and has emerged as a potential diagnostic tool for peritoneal invasion in gastric cancer (12,13). This study aimed to evaluate the diagnostic value of peritoneal lavage fluid cytology findings in determining peritoneal invasion in patients with gastric cancer.

Methods

In this cross-sectional study, a total number of 35 patients diagnosed with gastric cancer, including those undergoing chemotherapy and those not receiving chemotherapy, were recruited from medical centers in Rasht, Iran, in 2021. Eligibility for inclusion in the study was determined based on CT scan findings, following the guidelines outlined by the National Comprehensive Cancer Network (NCCN). Specifically, patients with minimum involvement of the submucosa (T1b, T2, T3, T4a, and T4b), as indicated by the T score corresponding to tumor growth rate through the stomach wall, were considered suitable candidates for laparoscopy. Patients were provided with detailed information about the study and asked to complete a consent form. Demographical data and clinical characteristics of the patients were recorded. Diagnostic peritoneal lavage was performed immediately before the laparoscopy. The peritoneal lavage fluid was collected, and cytological evaluation was applied to identify the malignant cells' presence or absence. Subsequently, laparoscopy was performed on each patient, and tissue samples were obtained for pathological examination to diagnose peritoneal metastasis. Patients with liver and other organ metastasis were excluded from the study. All data was analyzed using SPSS version 21 and reported by numbers and percentages.

Results

According to the results, about 60% of the patients were males, and most were aged 70-80 (table 1). About 17, 5, 4, and 6 patients had pain, early saturation, vomiting, weight loss, anemia, or stomachache, respectively. Out of three detected tumors, 23 were located distal, 10 were proximal, and two were located in the stomach's body, of which 11, 1, and 5 were well, moderate, and poorly differentiated, respectively. About 16 patients had no lymph node involvement, 11 had one reactive lymph node, 7 had two, and one had three lymph nodes. Cytology results were positive in 14 samples while the laparoscopy findings were positive for 12. About 16 findings were not in agreement with laparoscopy and cytology findings, in which seven samples were diagnosed as positive for gastric cancer by cytology missed from laparoscopy findings; and five samples were diagnosed as positive by laparoscopy findings not confirmed by cytology examination. Only seven samples were confirmed as positive by both laparoscopy and cytology findings. According to our results, the cytology and diagnostic laparotomy agreement rate was 65.7% (Table 2).

Table 1. Demographical findings of the patients with gastric cancer.

variables		Frequency n (%)
Gander	Male	21 (60.00)
	female	14 (40.00)
Age	< 50 year	3 (8.50)
	50-60 year	5 (14.28)
	60-70 year	7 (20.00)
	70-80 year	12 (34.2)
	>80 year	8 (22.8)

Table 2. Diagnostic value of peritoneal lavage fluid cytology in identifying peritoneal invasion compared to intraoperative findings as the gold standard.

Variables	Value	Confidence interval
Sensitivity	0.58	0.0-35.78
Specificity	0.69	0.0-49.9
Positive news value	0.5	0.0-2.7
Negative news value	0.76	0.0-.94
Positive agreement	1.87	1.2-28.88
Negative agreement	0.6	0.0-36.8

Discussion

The value of peritoneal lavage cytology in determining the prognosis of stomach, colon, and pancreatic cancers has been studied before, and the relationship between positive peritoneal lavage cytology and poor prognosis has been confirmed. Also, this method has been used to determine the recurrence of abdominal cancers, which has yielded beneficial results (14). The study's findings indicate that cytology and laparoscopy findings showed some discrepancies, with positive results in both modalities for a limited number of samples. The agreement rate between cytology and diagnostic laparotomy was reported as 65.7%.

Higaki et al. reported that the outcomes of gastric cancer patients with positive peritoneal lavage cytology findings vary due to the diversity of cancer cells. This study aimed to establish diagnostic criteria for curative resections based on peritoneal lavage cytology. The presence of specific cytological features, such as signet ring cells, cell clusters, and isolated cancer cells, predicted poor prognoses. Patients with these high-risk positive peritoneal lavage cytology findings criteria had significantly worse survival rates, even without macroscopic peritoneal metastasis (15). The evaluation of cytological examination of peritoneal fluid in patients with gastrointestinal cancers, including stomach and cardia cancer, showed low sensitivity, specificity, positive predictive value, and negative predictive value, which indicated that peritoneal lavage fluid cytology is not reliable for determining operability in gastrointestinal cancer cases. Therefore, alternative indicators should be explored for accurate diagnosis.

In a study conducted by Abolghasemi Fakhri et al., the sensitivity, specificity, positive predictive value, and negative predictive value of the cytological examination of peritoneal lavage fluid in comparison with the findings during the operation as a diagnostic standard were 59%, 57%, 52%, and 64%, respectively (16). In another study by To et al. (12) to evaluate the diagnostic power of peritoneal fluid cytology in diagnosing peritoneal involvement in 65 patients with gastric cancer, the sensitivity was reported as 51.1%, and there were no false positive cases (6). A study by Wilkimir et al. on 40 patients with gastric or esophageal cancer illustrated that positive cases in laparoscopy were significantly more than positive cases in cytology, and false negative cytology was reported in 45% of cases. They reported that diagnostic laparoscopy in these patients was sufficient to confirm or reject peritoneal involvement, and there was no need for cytological examination of peritoneal lavage fluid (17).

Mozhir et al. studied 27 patients with gastric adenocarcinoma. They performed diagnostic peritoneal lavage before laparoscopy, and a lavage fluid sample was taken for cytology. A successful diagnosis was reported in 22 patients with peritoneal lavage, of which 54.5% had a positive cytology result. Compared with the cytology results of diagnostic laparoscopy samples, the sensitivity of diagnostic peritoneal lavage was calculated to be 100%, and its specificity was 92%. Compared with the results of direct vision with laparoscopy, the sensitivity and specificity of diagnostic peritoneal lavage were reported as 54.5% and 100%, respectively. They reported that in patients with gastric cancer with metastasis, it is possible to

predict the presence of metastasis only based on the cytological findings of peritoneal lavage (18).

Based on the studies, the presence of cancer-free cells in the peritoneal cavity during surgery can predict the outcome of patients. However, whether or not it is helpful for the operability of these patients is still not agreed upon (19,20). Benevolo et al. demonstrated that the immunohistochemical method exhibited a 14% higher rate of detecting free cancer cells than cytology. Additionally, when considering patients identified solely through the immunohistochemical method, they observed comparable rates of recurrence and distant survival compared to the group of patients with a positive cytological examination (21). Other studies have also confirmed these findings, reporting an incidence of free cancer cells ranging from 21.4% to 30% (22–24). The existence of free cancer cells in the peritoneal lavage of patients with gastric cancer carries significant negative implications for their prognosis. The survival advantage of radical surgery in individuals with free cancer cells in the peritoneal lavage is limited, indicating the importance of including peritoneal lavage examination in the preoperative assessment for appropriate surgical planning. The presence of free cancer cells is closely associated with the stage and type of gastric cancer, and their identification can contribute to better categorization of patients. This approach aids in identifying individuals who would benefit the most from aggressive surgical interventions, ultimately leading to improved long-term survival rates.

Conclusion

Based on the findings of the current study, the examination of peritoneal lavage fluid cytology in patients with gastric cancer is consistent with the intraoperative findings of whether the patient is operable or inoperable. However, these results are not significant enough to rely on peritoneal lavage fluid cytology to determine the patients' operability alone.

Conflict of interests

The authors declare that they have no competing interests.

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Consent

This study was approved by the ethics committee of the Guilan University of Medical Sciences [IR.GUMS.REC.1399.537].

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None.

Authors contributions

MMA, **FN**, **HEK** and **SS** did this research, data collection, analysis and wrote the manuscript, **AH** guidance and assisted in data collection and analysis of the results.

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