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ASSOCIATION OF MEAN PLATELET VOLUME WITH RESPONSE TO NEOADJUVANT CHEMOTHERAPY IN RECTAL CANCER PATIENTS

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ABSTRACT
Rectal cancer is one of the most common malignant neoplasms in humans and ranks as the second most frequent cancer of the large intestine. The management of rectal cancer requires a multidisciplinary approach, including surgery, chemotherapy, and radiotherapy administered either before or after surgery to improve the chances of cure. Mean Platelet Volume (MPV) reflects platelet size and is associated with platelet production and activation. Platelet activation plays a crucial role in the development and progression of malignancy. This study aimed to determine the relationship between Mean Platelet Volume (MPV) and the response to neoadjuvant chemotherapy in patients with rectal cancer, as assessed using the Response Evaluation Criteria in Solid Tumors (RECIST). This study was an analytical study with a cross-sectional design, in which several variables were measured simultaneously at a single point in time. Data were collected from outpatients attending the Digestive Surgery Clinic at Adam Malik General Hospital, Medan. A total of 81 patients who met the study inclusion criteria were enrolled using a consecutive sampling method. Data were analyzed using the Shapiro–Wilk test to assess the normality of data distribution. One-way ANOVA or the Kruskal–Wallis test was used to analyze differences between qualitative variables, as appropriate. Receiver Operating Characteristic (ROC) analysis was performed to determine the diagnostic performance of Mean Platelet Volume (MPV). A total of 81 patients were included in this study, with the majority being female (n = 41). The mean age of the study subjects was 53.9 years. Tumors were most commonly located in the proximal rectum (33 patients), and the predominant histopathological differentiation was well differentiated, observed in 53 patients. Most patients with low MPV values (<8.6 fL) demonstrated a better response to chemotherapy, characterized by partial response and stable disease, whereas patients with high MPV values (⩾8.6 fL) more frequently experienced progressive disease. There was no statistically significant association between Mean Platelet Volume (MPV) and response to neoadjuvant chemotherapy in patients with rectal cancer, as assessed using the RECIST criteria (p = 0.075). However, clinically, patients with lower MPV values tended to demonstrate a better therapeutic response compared with those with higher MPV values.

Keywords: mean platelet volume; RECIST; rectal cancer

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INTRODUCTION

The rectum is the most distal portion of the large intestine, bound by the sigmoid colon proximally and converging into the anal canal distally. This segment of the intestine derives its name from Latin intestinum rectum meaning “straight intestine,” describing its course compared to the tortuous appearance of the rest of the gastrointestinal (GI) tract. Coursing within the pelvis, the rectum is the most posterior visceral organ in the pelvic cavity with differing anatomical relationships to male and female structures. (Wang et al., 2023)

Rectal cancer is the second most common type of cancer of the large intestine after proximal colon cancer, accounting for approximately 28% of cases. Therefore, in many epidemiological studies, rectal cancer is often analyzed as part of colorectal cancer (CRC). Globally, CRC represents a major public health problem with a high prevalence, particularly in developed countries. It is the third most common cancer in men and the second most common in women, with a lifetime risk of approximately 4.7–5%. In the United States, CRC is reported to be the third leading cause of cancer-related mortality in both men and women. The incidence of colorectal cancer (CRC) varies geographically; however, its occurrence pattern is generally similar between men and women. CRC is more prevalent in developed countries, with the highest incidence reported in Australia and New Zealand (44.8 per 100,000 in men and 32.2 per 100,000 in women), while the lowest incidence has been observed in Western Africa (4.5 and 3.8 per 100,000, respectively). In the United States, approximately 136,830 new cases of CRC are diagnosed annually, of which around 40,000 are rectal cancer. Although the overall incidence of CRC has declined by approximately 3% per year over the past decade due to advances in early detection and treatment, the incidence of rectal cancer among individuals younger than 50 years has increased by 1.8% annually. (Araghi et al., 2019)

Most rectal cancers are sporadic, with approximately 70% of cases occurring in individuals without a clear hereditary background and typically diagnosed after the age of 50 years. About 10% of cases exhibit a well-defined genetic inheritance pattern, conferring an increased cancer risk in individuals younger than 50 years, while the remaining 20% occur in familial clusters without an identifiable genetic syndrome. Environmental and lifestyle factors play a substantial role in the development of rectal cancer, although their patterns differ from those observed in colon cancer. Consumption of red and processed meat, alcohol intake, obesity, and cigarette smoking have been associated with an increased risk of rectal cancer, with stronger associations reported in some studies compared with colon cancer. Conversely, several protective factors have been identified, including diets rich in fiber, fruits, and vegetables, resistant starch, fish consumption, and supplementation with folate, vitamin B6, calcium, vitamin D, and magnesium. Evidence also suggests that milk and dairy product intake is associated with a reduced risk of colon cancer but does not appear to have a significant protective effect against rectal cancer. Physical activity demonstrates a stronger protective effect against colon cancer than rectal cancer, whereas magnesium intake has been shown to reduce the risk of both cancers in women. (Yu et al., 2019; Yang et al., 2019)

Platelets play a crucial role in the haemostatic process by preventing blood loss when vascular injury occurs. Larger platelets are metabolically and enzymatically more active and represent an activated platelet population, releasing substantial amounts of pro-thrombotic and pro-inflammatory mediators that contribute to thrombus formation. Platelet size is quantified by mean platelet volume (MPV). Previous studies have demonstrated that elevated preoperative MPV levels are significantly associated with advanced tumor stage and poorer survival outcomes, suggesting that MPV may serve as a valuable, non-invasive biomarker for early diagnosis and prognosis in patients with cancer. (Anandani et al., 2025) Recently, increasing attention has been directed toward the evaluation of mean platelet volume (MPV) in patients with cancer. Neoplastic transformation is closely associated with chronic inflammatory processes, which may also influence platelet parameters. Studies investigating MPV in rectal cancer have reported inconsistent results. Some studies have found no significant differences in MPV between patients with rectal cancer and healthy individuals, or between patients with and without metastatic disease. In contrast, other studies have demonstrated significantly higher MPV levels in patients with rectal cancer compared with healthy controls. A significant reduction in MPV levels has also been observed following surgical resection of colorectal tumors, suggesting that MPV may serve as an independent prognostic factor for patient survival. (Li et al., 2017)

In the context of rectal cancer, assessment of response to neoadjuvant therapy, including chemotherapy and radiotherapy, is essential for determining subsequent treatment strategies.

Although RECIST version 1.1 provides a systematic framework for response evaluation, its application in rectal cancer has notable limitations, particularly due to the difficulty in distinguishing residual tumor tissue from post-therapy fibrosis on imaging studies. Therefore, a multimodal approach integrating clinical assessment, endoscopy, and advanced imaging modalities, such as magnetic resonance imaging (MRI) with diffusion-weighted imaging (DWI), is employed to improve the accuracy of response evaluation. (Masi et al., 2019) Recent studies have demonstrated that the use of multiparametric magnetic resonance imaging (mpMRI) in combination with RECIST version 1.1 can improve the accuracy of tumor response assessment in patients with rectal cancer undergoing neoadjuvant therapy. A study by El-Sharawy et al. emphasized the importance of this integrated approach in enabling more personalized treatment planning and more precise clinical decision-making. However, it should be noted that despite its promising potential, more standardized and consistent criteria for imaging interpretation are still required to ensure the reliability and reproducibility of response assessment. (Lambregts et al., 2019). This study aimed to investigate the relationship between Mean Platelet Volume and the response to neoadjuvant chemotherapy in rectal cancer patients at Adam Malik Hospital, Medan.

METHOD

This study was an observational analytical study with a cross-sectional design, in which multiple variables were measured at a single point in time. The study was conducted at the Sub-Installation of Clinical Pathology, Faculty of Medicine, Universitas Sumatera Utara / Adam Malik General Hospital, in collaboration with the Department of Surgery, Digestive Division, during the period from May to October 2025. Samples were collected using a consecutive sampling technique from all patients who met the inclusion criteria at the Digestive Surgery Outpatient Clinic of Adam Malik General Hospital. A total of 81 respondents were included in this study. Subject characteristics were presented in tabular form and described narratively. The relationship between Mean Platelet Volume (MPV) and response to neoadjuvant chemotherapy in patients with rectal cancer was analyzed using one-way analysis of variance (ANOVA) or, alternatively, the Kruskal–Wallis test, as appropriate. Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the diagnostic performance of MPV and to determine the optimal cut-off value. A p-value of <0.05 was considered statistically significant.

The inclusion criteria comprised patients diagnosed with rectal cancer who were scheduled to undergo neoadjuvant chemotherapy by a digestive surgery specialist, patients aged >18 years, patients with stage II–III rectal cancer, and those who provided written informed consent either personally or through a family member. This study was conducted after obtaining ethical approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara, Medan, with approval number 646/KEPK/USU/2025.

RESULT

Table 1.
Demographic Characteristics of Patients with Rectal Cancer

Variabel	Nilai
Age, years	53,9 ± 14,2
Sex	
Male	40 (49,4%)
Female	41 (50,6%)
Tumor location	
Distal	20 (24,7%)
Medial	28 (34,5%)
Proximal	33 (40,7%)
Tumor Differentiation	
Poorly-differentiated	8 (9,9%)
Moderately-differentiated	20 (24,7%)
Well-differentiated	53 (65,4%)

Variabel	Nilai
Stadium	
IIa	11 (13,6%)
IIb	9 (11,1%)
IIc	3 (3,7%)
IIIa	10 (12,3%)
IIIb	36 (44,4%)
IIIc	12 (14,8%)

This study included 81 patients, with a relatively balanced sex distribution comprising 41 females and 40 males. The mean age of the subjects was 53.9 ± 14.2 years. Tumors were most frequently located in the proximal rectum (40.7%). Based on histopathological differentiation, the majority of tumors were well differentiated (65.4%), and most patients were classified as stage IIIB (44.4%). Prior to the initiation of neoadjuvant chemotherapy, Mean Platelet Volume (MPV) was assessed in patients with rectal cancer. In this study, the mean MPV was 8.98 fL with a standard deviation of 1.05 fL. These findings are further summarized in Table 2.

Table 2.
Mean Platelet Volume (MPV) Values in Patients with Rectal Cancer

Variable	Mean Value
Mean Platelet Volume, fL Platelet, fL	8,98 ± 1,05

At the end of neoadjuvant chemotherapy, patients with colorectal cancer were evaluated according to the RECIST criteria. A total of 30 patients (37%) were classified as having Progressive Disease (PD), while the remaining 17 patients (21% of the total study population) were classified into other response categories.

Table 3.
Assessment of Response to Neoadjuvant Chemotherapy Using RECIST Criteria

Variable	Value
Chemotherapy Response	
Complete Response (CR)	17 (21%)
Partial Response (PR)	17 (21%)
Stable Disease (SD)	17 (21%)
Progressive Disease (PD)	30 (37%)

To compare Mean Platelet Volume (MPV) across chemotherapy response groups, the Kruskal–Wallis test was performed due to non-normal data distribution. The Kruskal–Wallis analysis demonstrated no statistically significant differences among the groups.

Table 4.
Comparison of Mean Platelet Volume (MPV) Across Chemotherapy Response Groups

Variable	MPV Value	*p-value*
RECIST Criteria		
Complete Response (CR)	9,22 ± 0,69	0,075*
Partial Response (PR)	8,77 ± 0,73	
Stable Disease (SD)	9,36 ± 1,48	
Progressive Disease (PD)	8,80 ± 0,97	

*Kruskas-Wallis test

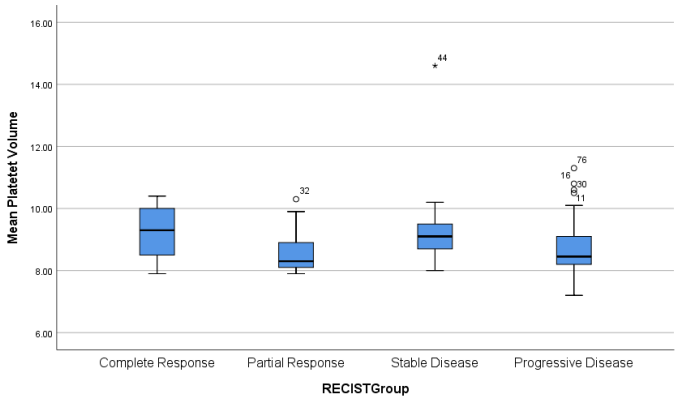

Figure 1. Boxplot of Mean Platelet Volume (MPV) According to RECIST Criteria

To assess the association between Mean Platelet Volume (MPV) values (using a cut-off of <8.6 fL and ≥8.6 fL) and chemotherapy response as defined by the RECIST criteria, a chi-square test was performed, as both variables were categorical.

Table 5.
Association Between Mean Platelet Volume (MPV) (Cut-off <8.6 fL and ≥8.6 fL) and Chemotherapy Response According to RECIST Criteria

Variable	Proggressive Disease	Partial Response	Complete Response	Stable Disease	*Value*	*p*
n = 81	30	17	17	17		
MPV ≤8.6 fL	18 (48.6%)	10 (27 %)	5 (13,5 %)	4 (10,8 %)	8.838	0.032*
MPV >8.6 fL	12 (27,3 %)	7 (15,9%)	12 (27,3 %)	13 (29,5 %)		

*Chi-square test

Based on Table 1, the association between MPV values categorized using a cut-off of <8.6 fL and ≥8.6 fL and chemotherapy response according to the RECIST criteria was analyzed in a total of 81 subjects. In the group with MPV <8.6 fL, the distribution of chemotherapy response consisted of 18 subjects (48.6%) with progressive disease, 10 subjects (27.0%) with partial response, 5 subjects (13.5%) with complete response, and 4 subjects (10.8%) with stable disease. Meanwhile, in the group with MPV ≥8.6 fL, 12 subjects (27.3%) were classified as progressive disease, 7 subjects (15.9%) showed partial response, 12 subjects (27.3%) achieved complete response, and 13 subjects (29.5%) were categorized as stable disease. The association between MPV categories and RECIST response was analyzed using the chi-square test, yielding a chi-square value of 8.838 with a p-value of 0.032.

DISCUSSION

The mean MPV value in this study was 8.98 fL, which is consistent with the ranges reported in other gastrointestinal cancer populations. Wu et al. reported MPV values in patients with colorectal cancer ranging from approximately 8 to 10 fL, while Chang et al. similarly demonstrated that MPV values in colorectal cancer patients typically range between 8 and 9 fL. Relatively elevated MPV values in cancer patients are often interpreted as indicators of platelet activation secondary to the chronic inflammatory processes accompanying tumor development. (Wu et al., 2019; Chang et al., 2019; Vasudeva et al., 2019). In addition, larger platelets tend to be more reactive and exhibit greater pro-coagulant capacity. In the context of rectal cancer, platelet activation may also contribute to the formation of a microthrombotic environment, which could theoretically affect the distribution and delivery of chemotherapeutic agents to tumor tissue. (Conroy et al., 2021) Therefore, MPV has been considered a potential biomarker that may reflect tumor biological characteristics and the likelihood of therapeutic response. However, in the present study, although MPV values were within a range that theoretically suggests platelet activation, the association between MPV and response to chemotherapy did not reach statistical significance.

In this study, therapeutic response was predominantly characterized by the Progressive Disease (PD) group, accounting for 37% of cases, while Complete Response (CR), Partial Response (PR), and Stable Disease (SD) each accounted for 21%. The relatively high proportion of PD suggests that patients presenting to this tertiary care center may have more aggressive tumor biological characteristics or present at a more advanced stage of disease. This condition may contribute to greater variability in response to neoadjuvant chemotherapy. In contemporary guidelines for rectal cancer management, response to neoadjuvant chemotherapy is recognized as a critical indicator that correlates with surgical success and long-term outcomes. Therefore, the identification of predictive biomarkers such as MPV holds substantial clinical significance. Kruskal–Wallis analysis demonstrated no statistically significant differences in MPV values across chemotherapy response groups ($p = 0.075$). Although the difference was not statistically significant, a trend was observed in which MPV values tended to be slightly higher in the Complete Response (CR) and Stable Disease (SD) groups compared with the Partial Response (PR) and Progressive Disease (PD) groups;

however, this difference was insufficient to establish a meaningful association.

Several possible explanations for the lack of a statistically significant association include:
1. High biological variability of MPV: MPV is influenced by multiple factors, including acute infections, medication use, chronic inflammatory conditions, comorbidities, and variations in laboratory measurement techniques, which may contribute to inconsistent associations between MPV and therapeutic response. (Korniluk et al., 2019)
2. MPV may not function as a direct predictive biomarker: In several studies, MPV has been more frequently reported as a prognostic rather than a predictive biomarker. This suggests that MPV may better reflect tumor aggressiveness or long-term survival outcomes rather than short-term response to chemotherapy. (Li et al., 2017)
3. The possibility that chemotherapy response is more strongly influenced by tumor molecular factors should also be considered. Molecular characteristics such as KRAS, NRAS, and BRAF expression, mismatch repair (MMR) status, p53 mutations, and the degree of tumor immune infiltration are known to play important roles in determining treatment response. Consequently, simple hematological parameters such as MPV may not be sufficient to capture the biological complexity underlying chemotherapy response. (Lian et al., 2023)

Several previous studies have reported elevated MPV levels in various gastrointestinal malignancies, reflecting inflammatory and platelet activation processes associated with tumor progression. However, the consistency of findings regarding the role of MPV as a predictive biomarker for chemotherapy response remains variable. Li et al. (2017) reported that MPV was elevated in a subset of patients with colorectal cancer and that higher MPV levels were associated with tumor progression, poor differentiation, and worse survival outcomes. In contrast, Chang et al. (2019) reported findings opposite to several other studies, demonstrating lower MPV values in patients with colorectal cancer, with lower MPV being associated with poorer prognosis. However, the study by Li et al. (2017) also demonstrated that MPV was not associated with response to neoadjuvant chemotherapy. These inconsistent findings across previous studies suggest that MPV may not be sufficiently sensitive to reflect the tumor biological changes that determine chemotherapy response. (Li et al., 2017; Chang et al., 2019; Wu et al., 2019; Zhang et al., 2023)

Although this study did not demonstrate a statistically significant association between MPV and response to neoadjuvant chemotherapy, these findings still provide several important clinical implications. First, the results reinforce that MPV should not be used as a standalone predictive biomarker for determining chemotherapy response in patients with rectal cancer. Nevertheless, the observed tendency toward higher MPV values in patients with poorer treatment response suggests that MPV remains relevant as an indicator of systemic inflammatory activity and potential tumor aggressiveness. Accordingly, MPV may be more appropriately positioned as an adjunctive prognostic biomarker reflecting inflammatory burden or tumor biological activity rather than as a primary predictive parameter for therapeutic response. These findings also highlight the need for a composite biomarker approach, such as combining MPV with other inflammatory indices including platelet distribution width (PDW), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), or even tumor-specific molecular parameters. Such a multimodal approach may better capture the complexity of the biological response to chemotherapy and allow for more accurate prediction. Overall, this study emphasizes that MPV should be interpreted with caution and integrated with other clinical and laboratory information to optimize its relevance in clinical decision-making.Based on the analysis presented in Table 4.6, a statistically significant association was observed between MPV categories (MPV < 8.6 fL and MPV ≥ 8.6 fL) and chemotherapy response assessed using the RECIST criteria among the 81 study subjects ($p = 0.032$). The chi-square test yielded a chi-square value of 8.838, indicating a significant difference in the distribution of treatment responses between the low-MPV and high-MPV groups. These findings support the hypothesis that MPV is associated with differences in clinical outcomes following chemotherapy.

The importance of MPV as a hematological parameter in oncology has been widely discussed in the literature. MPV represents the average platelet volume and reflects the degree of platelet activation and heterogeneity within the circulation. Activated platelets play a role in various immunological and inflammatory processes within the tumor microenvironment, including angiogenesis and tumor cell proliferation through the release of growth factors such as platelet-derived growth factor (PDGF) and vascular endothelial growth factor (VEGF). These associations indicate that MPV is not merely a simple hematological marker but also reflects tumor biological dynamics and the potential response to systemic therapies such as chemotherapy. This concept is supported by evidence suggesting that MPV may function as a prognostic and, in certain contexts, a predictive biomarker in aggressive malignancies. (Zhang et al., 2023; Detopoulou et al., 2023)

In the group with MPV < 8.6 fL, the proportion of subjects experiencing progressive disease was higher (18 subjects; 48.6%) compared with the group with MPV ≥ 8.6 fL (12 subjects; 27.3%). Conversely, the MPV ≥ 8.6 fL group showed higher proportions of complete response (27.3%) and stable disease (29.5%). This distribution pattern suggests that subjects with higher MPV values tended to have more favorable responses to chemotherapy compared with those with lower MPV values. A similar trend of poorer outcomes in low-MPV groups has been reported in retrospective studies involving patients with colorectal and esophageal cancers, in which lower MPV values were associated with worse prognostic outcomes following systemic therapy. (Zhang et al., 2023; Liu et al., 2022)

Physiologically, a higher MPV generally reflects larger and relatively younger platelets, which may contribute to more effective vascular responses and a more adaptive immune response to tumor-related insults and the toxic effects of chemotherapy. In contrast, lower MPV values are often associated with increased platelet consumption due to intense chronic inflammation or immune dysfunction, which may impair the effectiveness of systemic therapeutic strategies. This concept is consistent with findings from several cancer studies showing that MPV values change in response to systemic inflammatory conditions and are associated with various clinical prognostic parameters in solid tumors. (Zhang H et al., 2023)

The strength of this study lies in the use of a routinely available, inexpensive, and widely accessible laboratory parameter—Mean Platelet Volume (MPV)—as a potential predictive biomarker for chemotherapy response. Nevertheless, several limitations should be acknowledged, including the retrospective nature of some supporting studies, methodological variability in determining MPV cut-off values, and the potential influence of uncontrolled clinical confounders. To further substantiate these findings, prospective studies with larger and more heterogeneous populations are required to establish the clinical validity of MPV as a robust indicator of chemotherapy response. Overall, the significant association observed between MPV categories and chemotherapy response according to the RECIST criteria in this study supports the potential role of MPV as a hematological biomarker for predicting chemotherapy effectiveness in cancer patients, thereby opening opportunities for integrating this simple parameter into future clinical decision-making. (Detopoulou et al., 2023)

CONCLUSION

This study demonstrated that Mean Platelet Volume (MPV) was not significantly associated with response to neoadjuvant chemotherapy in patients with rectal cancer when analyzed as a continuous variable. Nevertheless, when MPV was classified according to a specific cut-off value, a trend toward differential therapeutic responses was observed, with patients in certain MPV categories exhibiting distinct chemotherapy response patterns based on the RECIST criteria. These findings indicate that MPV cannot yet be considered a standalone predictive biomarker for neoadjuvant chemotherapy response in rectal cancer. However, MPV may serve as an adjunctive parameter reflecting systemic inflammatory status and tumor biological activity.

REFERENCES

Anandani, G., Goswami, P., Bhankhodia, V. and Dave, R. (2025) 'Mean platelet volume: A versatile biomarker in clinical diagnostics and prognostics', Bioinformation, 21(4), pp. 783–788. doi:10.6026/973206300210783.

Araghi, M., Soerjomataram, I., Jenkins, M., Brierley, J., Morris, E., Bray, F. et al. (2019) 'Global trends in colorectal cancer mortality: projections to the year 2035', International Journal of Cancer, 144(12), pp. 2992–3000. doi:10.1002/ijc.32055.

Chang, J., Lin, G., Ye, M., Tong, D., Zhao, J., Zhu, D. et al. (2019) 'Decreased mean platelet volume predicts poor prognosis in metastatic colorectal cancer patients treated with first-line chemotherapy', BMC Cancer, 19(1), p. 15. doi:10.1186/s12885-018-5252-2.

Conroy, T., Bosset, J.F., Etienne, P.L., Rio, E., François, É., Mesgouez-Nebout, N. et al. (2021) 'Neoadjuvant chemotherapy with FOLFIRINOX and preoperative chemoradiotherapy for patients with locally advanced rectal cancer (UNICANCER-PRODIGE 23): a multicentre, randomised, open-label, phase 3 trial', The Lancet Oncology, 22(5), pp. 702–715. doi:10.1016/S1470-2045(21)00079-6.

Detopoulou, P., Panoutsopoulos, G.I., Mantoglou, M. et al. (2023) 'Relation of mean platelet volume (MPV) with cancer: a systematic review with a focus on disease outcome on twelve types of cancer', Current Oncology, 30(3), pp. 3391–3420. doi:10.3390/curroncol30030258.

Korniluk, A., Koper-Lenkiewicz, O.M., Kamińska, J., Kemona, H. and Dymicka-Piekarska, V. (2019) 'Mean platelet volume (MPV): new perspectives for an old marker in the course and prognosis of inflammatory conditions, Mediators of Inflammation. doi:10.1155/2019/9213074.

Lambregts, D.M.J., Beets, G.L., Maas, M., Kessels, A.G.H., Bakers, F.C.H., Cappendijk, V.C. et al. (2019) 'Response evaluation after neoadjuvant treatment for rectal cancer using modern MR imaging: a pictorial review', Insights into Imaging, 10(1), p. 15. doi:10.1186/s13244-019-0696-0.

Li, N., Yu, Z., Zhang, X., Liu, T., Sun, Y.X., Wang, R.T. et al. (2017) 'Elevated mean platelet volume predicts poor prognosis in colorectal cancer', Scientific Reports, 7(1), p. 10261. doi:10.1038/s41598-017-11053-y.

Lian, S.Y., Tan, L.X., Liu, X.Z., Yang, L.J., Li, N.N., Feng, Q. et al. (2023) 'KRAS, NRAS, BRAF signatures, and MMR status in colorectal cancer patients in North China', Medicine (Baltimore), 102(9), e33115. doi:10.1097/MD.0000000000033115.

Masi, G., Salvatore, L., Boni, L., Loupakis, F., Cremolini, C., Fornaro, L. et al. (2019) 'Analysis of response evaluation criteria in solid tumors reduction ratio of primary chemotherapy in unresectable advanced or recurrent colorectal cancer', Oncology Letters, 18(2), pp. 1933–1940. doi:10.3892/ol.2019.10496.

Vasudeva, K. and Munshi, A. (2019) 'Genetics of platelet traits in ischaemic stroke: focus on mean platelet volume and platelet count', International Journal of Neuroscience, 129(5), pp. 511–522. doi:10.1080/00207454.2018.1538991.

Wang, Y.H.W. and Wiseman, J. (2025) 'Anatomy, abdomen and pelvis, rectum', in StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing.

volume/platelet count ratio in colorectal cancer: a retrospective clinical study', BMC Cancer, 19(1), p. 314. doi:10.1186/s12885-019-5504-9.

Yang J, Huang Y, Feng Y, Li H, Feng T, Chen J, et al. Associations of genetic variations in mismatch repair genes MSH3 and PMS1 with acute adverse events and survival in patients with rectal cancer receiving postoperative chemoradiotherapy. Cancer Res Treat. 2019;51(3):1198–206. doi:10.4143/crt.2018.466.

Yu H, Hemminki A, Sundquist K, Hemminki K. Familial associations of colon and rectal cancers with other cancers. Dis Colon Rectum. 2019;62(2):189–95. doi:10.1097/DCR.0000000000001251.

Zhang, H., Lin, F. and Wang, Z. (2023) 'Mean platelet volume/platelet count ratio in combination with tumor markers in colorectal cancer: a retrospective clinical study', BMC Cancer, 23(1), p. 124. doi:10.1186/s12885-023-10621-8.