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REVIEW ARTICLE

Clinical utility of mean platelet volume in neoplastic diseases

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Keywords:
mean platelet volume; neoplasms; lymphoma; leukemia; multiple myeloma (source: MeSH-NLM).

ABSTRACT

The aim of this review was to evaluate the clinical utility of mean platelet volume (MPV) as an accessible and low-cost prognostic biomarker in patients with solid and hematological neoplasms. A narrative review of the scientific literature published between 2011 and 2025 was conducted. The search was performed in PubMed/MEDLINE, Scopus, SciELO, and Google Scholar using terms related to mean platelet volume and neoplasms. Original articles, systematic reviews, and meta-analyses published in Spanish or English that evaluated MPV as a prognostic or diagnostic marker in cancer were included. Given the heterogeneity of the studies, the results were synthesized narratively and organized according to neoplasm type. MPV showed a significant, although variable, association with oncological prognosis. In solid tumors, such as colorectal, gastric, and breast cancer, as well as pancreatic adenocarcinoma, elevated MPV was associated with greater tumor aggressiveness, metastasis, and poorer survival. In contrast, in renal and bladder carcinoma, low MPV values were associated with more aggressive tumors and poorer survival. The evidence is inconsistent in thyroid cancer, whereas in lung cancer, a low MPV/PLT ratio is associated with higher mortality. In hematological neoplasms, low MPV is generally associated with poorer survival and a higher risk of venous thromboembolism. The main limitations include the lack of standardized cutoff values and the influence of preanalytical factors. In conclusion, MPV is a promising biomarker; however, it requires validation in prospective studies and standardization before clinical implementation.

Utilidad clínica del volumen plaquetario medio en enfermedades neoplásicas

Palabras clave:
volumen plaquetario medio; neoplasias; linfoma; leucemia; mieloma múltiple (fuente: DeCs-BIREME).

RESUMEN

El objetivo de esta revisión fue evaluar la utilidad clínica del volumen plaquetario medio (VPM) como biomarcador accesible y económico para el pronóstico en pacientes con neoplasias sólidas y hematológicas. Se realizó una revisión narrativa de la literatura científica publicada entre 2011 y 2025. La búsqueda se llevó a cabo en PubMed/MEDLINE, Scopus, SciELO y Google Scholar, utilizando términos relacionados con el *mean platelet volumen* y las neoplasias. Se incluyeron artículos originales, revisiones sistemáticas y metaanálisis en español o inglés, que evalúan el VPM como un marcador pronóstico o diagnóstico en cáncer. Dada la heterogeneidad de los estudios, los resultados fueron sintetizados de forma narrativa y organizados según el tipo de neoplasia. El VPM mostró una asociación significativa, aunque variable, con el pronóstico oncológico. En tumores sólidos, como cáncer colorrectal, gástrico, de mama y adenocarcinoma pancreático, un VPM elevado se relaciona con mayor agresividad tumoral, metástasis y menor supervivencia. En contraste, en carcinoma renal y de vejiga, valores bajos de VPM se asocian con tumores más agresivos y menor supervivencia. La evidencia es discordante en cáncer de tiroides, mientras que en cáncer de pulmón un cociente VPM/PLT bajo se vincula con mayor mortalidad. En neoplasias hematológicas, un VPM bajo se asocia generalmente con menor supervivencia y mayor riesgo de tromboembolismo venoso. Entre las principales limitaciones destacan la falta de estandarización en puntos de corte y la influencia de factores preanalíticos. Se concluye que el VPM es un biomarcador prometedor; sin embargo, requiere validación en estudios prospectivos y estandarización para su implementación clínica.

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INTRODUCTION

The search for accessible, low-cost, and reliable biomarkers for cancer prognosis represents an area of growing interest in medical research. In this context, routinely obtained hematological parameters, particularly mean platelet volume (MPV), have been investigated as potential biomarkers capable of reflecting tumor–host interactions. Recent studies have reinforced the relevance of MPV by demonstrating its association with tumor aggressiveness and progression in various types of cancer, highlighting its usefulness as an indirect indicator of platelet activation and of the prothrombotic and inflammatory state of the tumor microenvironment [1].

MPV is a hematological parameter that reflects the average size of platelets and serves as an indirect indicator of platelet reactivity. Larger platelets are generally more metabolically active and have greater thrombotic and proinflammatory potential. MPV is routinely measured using automated hematology analyzers, making it an accessible and low-cost tool for the indirect assessment of platelet function [2].

Clinically, MPV is used as a prognostic and diagnostic marker in various conditions. Elevated values (> 9.5 fL) are associated with inflammatory diseases, prothrombotic states, and endothelial dysfunction [2]. Likewise, MPV may be useful in the differential diagnosis of thrombocytopenia and in the assessment of disorders such as preeclampsia. In the oncological setting, its association with platelet activation processes and tumor progression has been described in some types of cancer [1,3–5].

Despite the growing evidence regarding the usefulness of MPV, limitations remain related to the standardization of cutoff values, preanalytical testing conditions (for example, appropriate use of anticoagulants), and its integration into clinical oncology prognostic algorithms, limiting its use beyond the research setting. Therefore, it is important for the medical community to have access to current scientific evidence regarding the clinical utility of MPV as an accessible biomarker in patients with cancer [6].

This article focused on the clinical use of MPV for prognostic assessment in various neoplasms, including solid tumors of the digestive system, breast, thyroid, lung, among others, as well as lymphoproliferative and myeloproliferative hematological neoplasms. MPV is notable for being a parameter included in routine hematological tests, such as the automated complete blood count, making it accessible and low cost. In addition, its broad availability positions it as a promising biomarker for prognostic assessment in patients with cancer [5,7].

Therefore, the objective of this study was to evaluate the clinical utility of mean platelet volume (MPV) as an accessible and low-cost biomarker for prognosis in patients with solid and hematological neoplasms.

METHODS

Eligibility criteria

Original articles, systematic reviews, and meta-analyses published between 2011 and 2025 in Spanish or English that evaluated the usefulness of MPV as a diagnostic or prognostic marker in solid and hematological neoplasms were included. The selected studies were required to have been published in indexed scientific journals and to provide sufficient information on the relationship between MPV and clinical or prognostic variables in patients with cancer. Publications classified as "medical images" or "photo galleries," as well as articles that did not directly address the relationship between MPV and neoplastic diseases, were excluded.

Information sources

Searches were conducted in the following databases and academic search engines to identify relevant literature: PubMed/MEDLINE, Scopus, SciELO, and Google Scholar. In addition, the reference lists of the included articles and systematic reviews related to the topic were examined to identify additional potentially eligible publications.

Search strategy

The final literature search was conducted in December 2025. The search strategy combined controlled terms (MeSH/DeCS) and free-text terms related to "Mean Platelet Volume" or "Volumen Plaquetario Medio" and neoplasms. Boolean operators (AND, OR) were used to combine the search terms. An example of the search strategy used in the PubMed database was as follows:

(("Mean Platelet Volume"[Mesh] OR "Mean Platelet Volume" OR "Volumen Plaquetario Medio" OR MPV) AND ("Neoplasms" [Mesh] OR cancer OR tumor* OR oncology* OR neoplasm* OR lymphoma* OR leukemia*))*

No language filters other than Spanish and English were applied; however, the publication date range was restricted to 2011–2025.

Study selection process

Study selection was conducted in two phases. Initially, records were identified through literature searches, and duplicate articles were removed. Subsequently, one reviewer (JLHA) screened the titles and abstracts of the records identified in the literature searches to exclude those that were clearly irrelevant. In the second phase, the same reviewer retrieved and assessed the full text of the preselected articles to verify compliance with the eligibility criteria. Studies for which eligibility remained uncertain were reviewed and discussed with a second investigator to minimize the risk of selection bias.

Data collection process

A single reviewer (JLHA) extracted data from the included studies using a standardized template. The information collected included author and year of publication, study design, study population (type of neoplasm and sample size), reported MPV values (effect measures and cutoff values), main outcomes assessed (overall survival, progression-free survival, tumor aggressiveness, treatment response, and thromboembolic events), and relevant conclusions.

Data items

The following outcomes of interest were defined for data collection: 1) the association between MPV and tumor aggressiveness, as measured by vascular invasion, metastasis, and molecular subtypes; 2) the association between MPV and survival, including overall survival (OS) and progression-free survival (PFS); 3) the association between MPV and response to treatments such as chemotherapy; and 4) the association between MPV and the risk of thromboembolic complications. Data on study characteristics, including design and country, as well as characteristics of the included patients, were also collected. Lack of explicit reporting of a significant association for an outcome was assumed to indicate the absence of such an association in that particular study.

Assessment of risk of bias in studies

Given the nature of the evidence collected, which included various study designs such as meta-analyses, systematic reviews, retrospective studies, and prospective studies, no single risk-of-bias assessment tool was applied. However, aspects such as sample size, study design (prospective vs. retrospective), the definition and justification of MPV cutoff values, and control of confounding factors in the analyses were critically considered, as discussed in the corresponding section.

Effect measures

For outcomes synthesized narratively, the reported effect measures included mean differences in MPV between groups, hazard ratios (HRs) for survival outcomes, odds ratios (ORs) or relative risks (RRs) for dichotomous events such as thromboembolism, and correlation coefficients (*r*). When available, confidence intervals and reported *p* values were also recorded.

Synthesis methods

Given the clinical and methodological heterogeneity among the included studies, including different cancer types, variable MPV cutoff values, and diverse outcomes, a quantitative meta-analysis was not considered appropriate or feasible. Instead, a narrative synthesis of the findings was performed. The results were tabulated and organized according to neoplasm type (solid tumors vs. hematological neoplasms) to facilitate comparison and visual presentation of consistent and discordant findings. Potential sources of heterogeneity, such as cancer type and pathophysiological context, were also explored. No formal sensitivity analyses were performed because of the narrative nature of the synthesis.

Assessment of reporting bias

No formal assessment of the risk of bias due to missing results was performed because the synthesis was based on data reported in the retrieved publications.

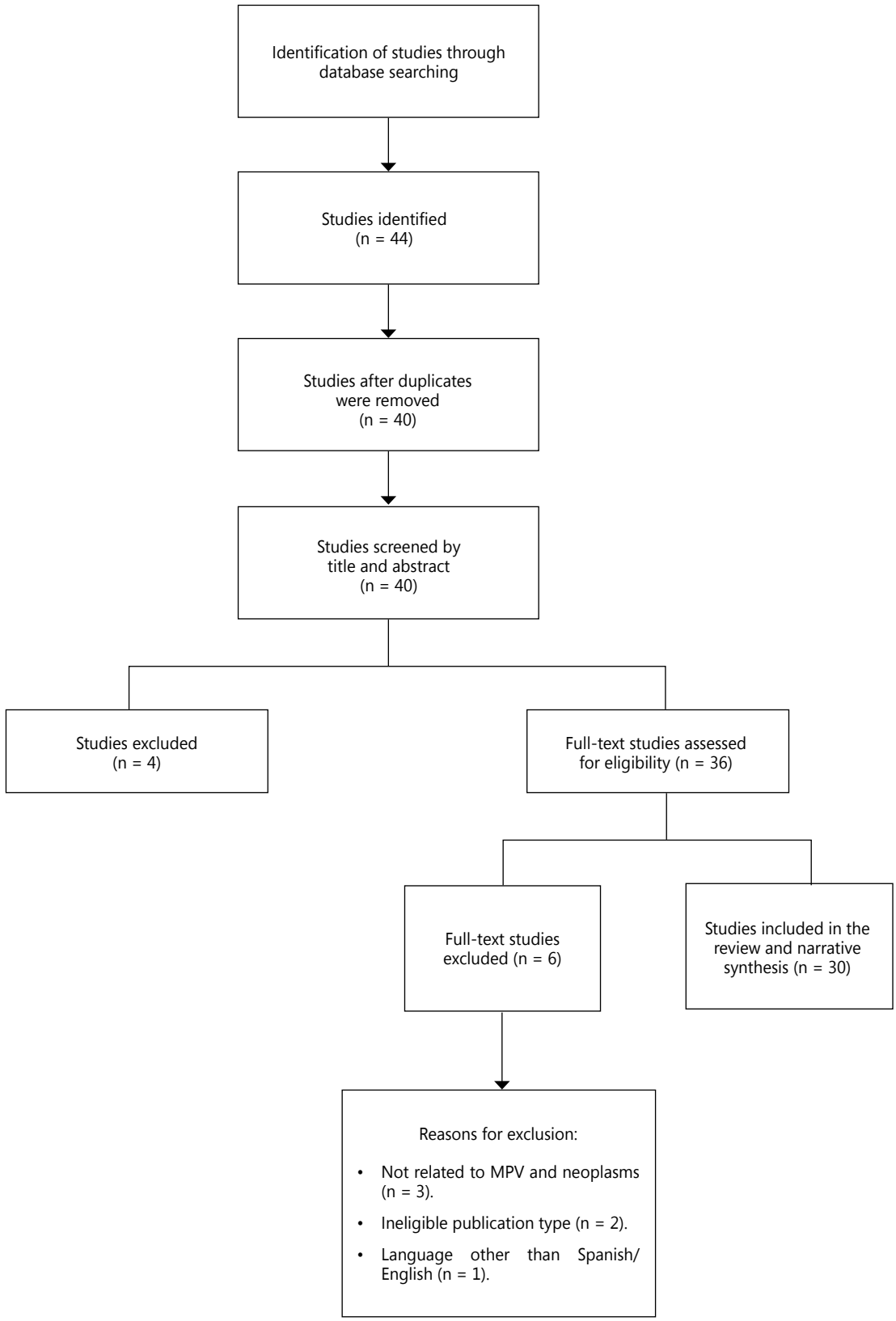
Certainty assessment

No formal assessment of the certainty of the evidence, for example using the GRADE methodology, was performed for each outcome because of the narrative nature of this review. The strength of the conclusions was based on the consistency of findings across multiple studies and on the discussion of the limitations of the available evidence.

RESULTS

Study selection

The PRISMA flow diagram shows the flow of information through the different phases of the review:


Identification of studies through database searching
Studies identified (n = 44)
Studies after duplicates were removed (n = 40)
Studies screened by title and abstract (n = 40)
Studies excluded (n = 4)
Full-text studies assessed for eligibility (n = 36)
Full-text studies excluded (n = 6)
Studies included in the review and narrative synthesis (n = 30)
Reasons for exclusion:
• Not related to MPV and neoplasms (n = 3).
• Ineligible publication type (n = 2).
• Language other than Spanish/ English (n = 1).

Results of individual studies

I. Solid tumors

In oncology, the potential of MPV as a possible biomarker for diagnosis, prognostic assessment, and therapeutic monitoring has been explored in various neoplasms. This index may serve as a diagnostic indicator, as significant variations in its values have been reported across different types of cancer. In solid tumors, such as lung, breast, and colorectal cancer, an increase in MPV is frequently observed. Likewise, its potential prognostic usefulness has been described, since elevated MPV levels have been associated with less favorable clinical outcomes and more advanced tumor stages in neoplasms such as gastric, ovarian, and colorectal cancer [1].

Recent scientific evidence supports the usefulness of MPV as a prognostic indicator in gastrointestinal cancer. In colorectal carcinoma, elevated MPV values have been reported compared with healthy subjects or patients with adenomas, together with an association with vascular invasion and the development of metastases. Notably, reduced MPV levels predict a better therapeutic response to chemotherapy combined with bevacizumab. However, to date, no significant relationship has been demonstrated between MPV and conventional tumor biomarkers such as CEA or CA19-9 [5].

In addition, a systematic review published in 2023 showed heterogeneous findings regarding MPV in colon cancer: while one study reported elevated MPV in patients with colorectal cancer, another observed decreased levels. Nevertheless, a general trend was identified: patients with metastatic disease had significantly higher MPV values, attributed to an exacerbated inflammatory state. Likewise, low MPV levels were associated with longer survival and a better response to chemotherapy in most studies [7].

In gastric cancer, MPV has demonstrated clinical relevance, although the evidence presents some contradictions. On the one hand, multiple studies have reported elevated MPV values in patients compared with healthy individuals, particularly in the preoperative period, with a significant decrease observed after tumor resection [1,5]. Likewise, patients with lower baseline MPV values have been reported to experience a lower incidence of metastasis, a better response to chemotherapy, and longer overall survival (15.5 vs. 9 months).

Similarly, a reduction in MPV after treatment has also been associated with a better prognosis. However, an analysis of eight studies conducted in different countries revealed inconsistent findings. Although most reported elevated MPV levels in gastric cancer, one found decreased levels. In advanced stages, MPV showed a tendency to increase or remained stable, whereas surgery was associated both with reductions and with no change in this parameter. In addition, its relationship with survival was heterogeneous, as both high and low MPV values were associated with shorter survival in different studies [5,7].

MPV has also been proposed as a relevant marker in renal cell carcinoma (RCC) and bladder cancer. Several multicenter studies have shown that reduced MPV values are associated with more aggressive tumors, characterized by sarcomatoid components, histologic necrosis, vascular invasion, and more advanced T stages. This association translates into unfavorable clinical outcomes, including lower 5-year overall survival (50.8% vs. 75.9% in RCC), a higher incidence of cancer-specific death at 10 years (13.1% vs. 6.2%), and reduced survival in muscle-invasive bladder cancer (68.1% vs. 83.1%). Notably, surgical resection has been observed to lead to a significant increase in MPV [5,7].

On the other hand, the evidence regarding MPV in thyroid cancer is inconsistent. A meta-analysis of 10 studies involving 1,305 patients reported a predominant tendency toward elevated MPV values, which were associated with cardiovascular complications and metastasis in some cases [3]. In addition, a specific study in papillary thyroid cancer involving 107 patients found no significant differences in MPV between risk groups according to MACIS/TNM, nor any relationship with tumor focality or invasion. Although a slight trend toward higher MPV in high-risk groups according to MACIS was observed, the effect size was not significant. These findings suggest that MPV lacks independent clinical utility as a prognostic marker in papillary thyroid cancer [8].

With regard to breast cancer, the evidence indicates that MPV may be useful as an indicator of biological aggressiveness. Specific studies have reported that more aggressive molecular subtypes, including HER2-positive and ER/PR-negative tumors, have higher MPV values ($p < 0.05$), with a significant correlation between MPV and HER2 ($r = 0.65$). Notably, MPV did not show a consistent association with histologic grade or tumor stage, suggesting

that it may more accurately reflect molecular aggressiveness than conventional tumor burden [9].

In advanced non-small cell lung cancer (NSCLC), patients were observed to have lower MPV values compared with the control group, while platelet counts were significantly elevated in the same group. This imbalance resulted in a reduced MPV/PLT ratio, which influenced overall survival (OS): patients with a low MPV/PLT ratio had clearly shorter OS (10.3 months vs. 14.5 months, $p = 0.0245$). Multivariable analysis confirmed that a low MPV/PLT ratio is an independent unfavorable prognostic factor for OS [10]. In addition, in patients with unresectable locally advanced NSCLC (stage IIIA/B), MPV, together with platelet count and Eastern Cooperative Oncology Group (ECOG) performance status, were significant independent predictors of survival, with p values < 0.001, 0.008, and 0.034, respectively [11].

MPV may also be useful for differentiating nonfunctioning pancreatic neuroendocrine tumors (pNETs) from pancreatic adenocarcinomas. Preoperative MPV values were significantly lower in patients with pNETs (median, 7.8 fL) than in those with pancreatic adenocarcinoma (median, 8.6 fL; $p = 0.014$) [12].

Likewise, increased MPV has been associated with a more aggressive clinical course in pancreatic cancer. Patients with elevated MPV have a higher frequency of high-grade tumors (G3/4; $p = 0.004$), together with a lower platelet count, elevated bilirubin concentrations, and higher C-reactive protein (CRP) levels. In multivariable analysis, the association between increased MPV and a higher risk of mortality persisted in patients with stage IV metastatic disease, whereas this relationship was not observed in patients with localized or early-stage disease [13].

Finally, in the specific context of pancreatic ductal adenocarcinoma (PDAC), high MPV was associated with the presence of G3/4 tumors ($p = 0.004$) and shorter overall survival in patients with metastases ($p = 0.005$). This association was confirmed as an independent factor of poor prognosis in multivariable analysis ($p = 0.02$) [13].

II. Hematological neoplasms

MPV also shows clinical utility in Hodgkin lymphoma (HL). A study involving 217 patients found that MPV was significantly lower in patients with HL than in controls (8.8 fL vs. 9.7 fL; $p < 0.001$), particularly in advanced stages (8.4 fL vs. 8.9 fL in early stages; $p = 0.033$) [14]. On the other hand, prechemotherapy MPV has shown usefulness as a predictor of thromboembolic risk in patients with HL: those with a baseline MPV ≤ 6.8 fL had a higher incidence of venous thromboembolism (19% vs. 5.5%; $p = 0.0244$). The risk of developing venous thromboembolism (VTE) in these patients was more than twice that of patients with normal or elevated MPV levels [15].

Regarding non-Hodgkin lymphoma (NHL), a retrospective study of 161 patients with diffuse large B-cell lymphoma (DLBCL) treated with R-CHOP demonstrated that patients with a baseline MPV ≤ 9.1 fL (cutoff established by ROC curve analysis) had significantly lower progression-free survival (PFS) than those with higher MPV values (60.6% vs. 84.0%; $p = 0.003$). Similarly, overall survival (OS) was lower in the low-MPV group (70.4% vs. 87.9%; $p = 0.030$). Furthermore, multivariable analysis confirmed that low MPV was associated with shorter PFS (HR = 0.456; $p = 0.010$) and shorter OS (HR = 0.588; $p = 0.045$), independently of factors such as the International Prognostic Index (IPI), disease stage, or lactate dehydrogenase (LDH) levels [16].

Reduced MPV has also been associated with an increased risk of venous thromboembolism (VTE) and mortality in patients with DLBCL. The study by Rupa-Matysek et al. [17] demonstrated that prechemotherapy MPV values were significantly lower in patients who developed VTE. In addition, an MPV above the 10th percentile of the overall population (6.11 fL) was associated with the occurrence of VTE, whereas an MPV > 10th percentile was correlated with longer VTE-free survival and better overall survival (78% vs. 55% at 3.5 years).

Regarding chronic lymphocytic leukemia (CLL), a retrospective review identified, through ROC curve analysis, an MPV cutoff of 10.4 fL for prognostic prediction. Patients with MPV values above this threshold had a significantly longer time to first treatment (TTFT) (36 months) than those with lower MPV values (17.9 months). Multivariable analysis confirmed that low MPV, together with the presence of *del11q* and *del13q* deletions, was independently associated with a shorter TTFT. Finally, among patients treated with ibrutinib, no significant correlation was found between MPV and treatment-related complications, although a trend toward a higher incidence of atrial fibrillation was observed in the low-MPV group [18].

A study of platelet activation in acute lymphoblastic leukemia (ALL) showed that patients had lower values of platelet parameters, including platelet count, MPV, plateletcrit, and platelet distribution width, compared with individuals in complete remission and healthy controls. An increase in the number of immature platelets was also observed. After complete remission was achieved, these parameters returned to normal and became comparable with those of the control group, demonstrating that ALL is associated with platelet dysfunction and that these markers could be useful for assessing treatment effectiveness and disease status [19].

A study published in 2021 evaluated the influence of clinical and laboratory variables on the course and prognosis of acute myeloid leukemia (AML). Patients who achieved first complete remission (CR1) were characterized by younger age, better performance status according to the Eastern Cooperative Oncology Group (ECOG) scale, lower MPV and LDH values, and the use of an intensive induction regimen, compared with those who did not achieve CR1 ($p < 0.05$). Logistic regression analysis showed that MPV, LDH, and initial treatment were significantly associated with achievement of CR1 ($p < 0.05$). Likewise, these findings indicate that, apart from the induction protocol, only MPV had an impact on immediate and long-term clinical outcomes, including complete remission, overall survival (OS), and progression-free survival (PFS) [20].

However, Dr. Cengiz Beyan, in a letter to the editor published in *Leukemia & Lymphoma* in 2021 (21), questioned the findings of the previous study. His criticism focused on the lack of standardization in MPV measurement, a parameter whose clinical validity may be compromised by multiple preanalytical and analytical factors. Beyan argued that MPV increases significantly after blood collection, particularly when ethylenediaminetetraacetic acid (EDTA) is used as the anticoagulant, with increases of up to 45% within 2 hours, and that its value varies according to the time elapsed before measurement, the type of analyzer used, and patient age. Because the study did not provide details regarding the measurement protocol, and given the inherent limitations of its retrospective design, which preclude adequate control of these sources of error, Beyan concluded that the observed differences in MPV may represent artifacts and therefore did not support its usefulness as a prognostic biomarker [21].

Regarding the use of MPV in chronic myeloid leukemia (CML), a study published in 2015 reported two main findings. First, MPV values were significantly higher in patients with CML than in healthy individuals ($p < 0.05$), regardless of whether they had thrombocytosis or a normal platelet count. Second, an inverse correlation between platelet count and MPV was observed in patients with CML and thrombocytosis, as well as in healthy controls. This correlation was not observed in patients with CML whose platelet counts were within the normal range [22].

In addition, Zhuang et al. [23] conducted a retrospective study of 62 patients diagnosed with multiple myeloma (MM) to evaluate the association between MPV and prognosis. The correlation of MPV with various clinical parameters and its impact on survival were analyzed. A prognostic MPV cutoff value of 8.50 fL was also established. The results showed that low MPV values were significantly associated with the IgA isotype ($p = 0.012$), serum creatinine levels > 1.99 mg/dL ($p = 0.025$), and the presence of immunoglobulin heavy-chain (IgH) gene rearrangements ($p = 0.008$). Likewise, patients with MPV below the cutoff value had significantly shorter overall survival (OS) ($p = 0.0397$). In multivariable analysis, low MPV was independently associated with shorter OS, with a 2.44-fold higher risk of death (HR = 2.44; $p = 0.026$).

In cases of febrile neutropenia, a condition affecting approximately 80% of patients with hematological neoplasms and associated with mortality rates of up to 11.2% [24], the relationship between mortality, MPV, and albumin (ALB) has been investigated. A study conducted by Dimitrijević et al. [25] evaluated the MPV/ALB ratio as a potential predictor of mortality in patients with febrile neutropenia. The prospective study determined the MPV/ALB ratio at the time of hospital admission. The predictive ability of this parameter was analyzed using receiver operating characteristic (ROC) curves and compared with the Multinational Association for Supportive Care in Cancer (MASCC) risk index. Patients who died had a significantly lower MPV/ALB ratio than survivors. Using a cutoff value of 0.245, this parameter identified patients at higher risk of mortality with high specificity. Similarly, the MPV/ALB ratio showed better performance than the MASCC index for predicting mortality during an acute episode of febrile neutropenia.

Table 1. Characteristics of the studies included in the review

No.	Title	Authors	Year of publication	Journal	Study type
1	Mean platelet volume: A versatile biomarker in clinical diagnostics and prognostics	Anandani G, Goswami P, Bhankhodia V, Dave R.	2025	Bioinformation	Scoping review
2	Mean platelet volume: its importance in clinical practice	Hernández Y, Castillo D.	2022	Revista Cubana de Hematología, Inmunología y Hemoterapia	Brief original article
3	Is mean platelet volume a predictor of mortality in septic patients? A literature review	Vélez JL.	2018	Revista Médica Herediana	Scoping review
4	Clinical utility of mean platelet volume (MPV) in monitoring diabetes mellitus in patients treated at a private polyclinic	Falcón Rodríguez PA.	2025	Universidad Privada Norbert Wiener, Faculty of Health Sciences (Repository)	Thesis
5	The prognostic value of mean platelet volume in cancer patients	Masternak M, Knap J, Giannopoulos K.	2019	Acta Haematologica Polonica	Scoping review
6	Mean platelet volume analysis needs more standardization	Lance MD, Henskens YMC, Marcus MAE.	2011	Platelets	Letter to the editor
7	Relation of Mean Platelet Volume (MPV) with cancer: A systematic review with a focus on disease outcome on twelve types of cancer	Detopoulou P, Panoutsopoulos GI, Mantoglou M, Michailidis P, Pantazi I, Papadopoulos S, et al.	2023	Current Oncology	Systematic review
8	Mean platelet volume and platelet-to-lymphocyte ratio as prognostic factors in papillary thyroid cancer	Mendoza-Hernández JE, Hurtado-López LM, Basurto-Kuba EOP, Oca-Durán ERM de, Zaldívar-Ramírez FR, Pulido-Cejudo A.	2023	Cirugía y Cirujanos	Original article (retrospective, observational, analytical)
9	Correlation between breast cancer receptors and the Mean Platelet Volume ratio	Sunil H, Mallesh S, Singh V.	2025	Frontiers in Health Informatics	Original article (retrospective, observational, analytical)
10	Prognostic impact of the mean platelet volume/platelet count ratio in terms of survival in advanced non-small cell lung cancer	Inagaki N, Kibata K, Tamaki T, Shimizu T, Nomura S.	2014	Lung Cancer	Original article (retrospective, observational, analytical)
11	Prognostic significance of mean platelet volume on local advanced non-small cell lung cancer managed with chemoradiotherapy	Sakin A, Secmeler S, Arici S, Geredeli C, Yasar N, Demir C, et al.	2019	Nature	Original article (retrospective, observational, analytical)
12	The predictive value of mean platelet volume in differential diagnosis of non-functional pancreatic neuroendocrine tumors from pancreatic adenocarcinomas.	Karaman K, Bostanci EB, Aksoy E, Kurt M, Celep B, Ulas M, et al.	2011	European Journal of Internal Medicine	Original article (retrospective, observational, analytical)
13	Large platelet size is associated with poor outcome in patients with metastatic pancreatic cancer	Lembeck AL, Posch F, Klocker EV, Szkandera J, Schlick K, Stojakovic T, et al.	2019	Clinical Chemistry and Laboratory Medicine	Original article (retrospective, observational, analytical)
14	Are platelet-related parameters predictive of the prognosis of Hodgkin's lymphoma?	Akdeniz A, Mehtap Ö, Karakuş V, Ünal S, Aygün K, Örekici Temel G, et al.	2021	Kocaeli University Research Information System	Original article (retrospective, observational, analytical)
15	Mean platelet volume as a predictive marker for venous thromboembolism in patients treated for Hodgkin lymphoma	Rupa-Matysek J, Gil L, Barańska M, Dytfeld D, Komarnicki M.	2018	Oncotarget	Original article (retrospective, observational, analytical)
16	Mean platelet volume predicts prognosis in patients with diffuse large B-cell lymphoma	Zhou S, Ma Y, Shi Y, Tang L, Zheng Z, Fang F, et al.	2017	Hematological Oncology	Original article (retrospective, observational, analytical)
17	Mean platelet volume as a predictive marker for venous thromboembolism and mortality in patients treated for diffuse large B-cell lymphoma	Rupa-Matysek J, Gil L, Kroll-Balcerzak R, Barańska M, Komarnicki M.	2017	Hematological Oncology	Original article (retrospective, observational, analytical)

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No.	Title	Authors	Year of publication	Journal	Study type
18	Mean platelet volume has prognostic value in chronic lymphocytic leukemia	Masternak M, Puła B, Knap J, Waszczuk-Gajda A, Drozd-Sokołowska J, Wdowiak K, et al.	2020	Cancer Management and Research	Original article (retrospective, observational, analytical)
19	Platelet parameters and expression of platelet membrane glycoprotein in childhood acute lymphoblastic leukemia	Huang Z, Liu WJ, Guo QL, Liu CY.	2015	Genetics and Molecular Research	Original article (prospective, observational, analytical)
20	Mean platelet volume is a predictive and prognostic marker for patients with acute myeloid leukemia: a two-center retrospective analysis	Tığlıoğlu M, Albayrak M, Doğan S, Yılmaz F, Akyol P, Sağlam B, et al.	2021	Leukemia & Lymphoma	Multicenter original article (retrospective, observational, analytical)
21	Mean platelet volume may not be a predictive and prognostic marker in patients with acute myeloid leukemia	Beyan C.	2021	Leukemia & Lymphoma	Letter to the Editor
22	Normal platelet counts mask abnormal thrombopoiesis in patients with chronic myeloid leukemia	Yan K, Ding B, Huang J, Dai Y, Xiong S, Zhai Z.	2015	Oncology Letters	Original article (prospective, observational, analytical)
23	The independent association of mean platelet volume with overall survival in multiple myeloma	Zhuang Q, Xiang L, Xu H, Fang F, Xing C, Liang B, et al.	2016	Oncotarget	Original article (retrospective, observational, analytical)
24	Epidemiology and source of infection in patients with febrile neutropenia: A ten-year longitudinal study	Al-Tawfiq JA, Hinedi K, Khairallah H, Saadeh B, Abbasi S, Noureen M, et al.	2019	Journal of Infection and Public Health	Original article (prospective, observational, analytical)
25	Mean Platelet Volume-to-Albumin Ratio as a Predictor of Mortality in Patients with Febrile Neutropenia: An Observational Study	Dimitrijević J, Calamac M, Durmez O, Stojanović M.	2025	Medicina	Original article (prospective, observational, analytical)
26	Mean platelet volume (MPV): New perspectives for an old marker in the course and prognosis of inflammatory conditions	Korniluk A, Koper-Lenkiewicz OM, Kamińska J, Kemona H, Dymicka-Piekarska V.	2019	Mediators of Inflammation	Scoping review
27	The role of platelets in angiogenesis	Battinelli EM.	2019	Platelets 4th Edition	Book chapter
28	The role of inflammation in hematopoiesis and bone marrow failure: What can we learn from mouse models?	Wang J, Erlacher M, Fernandez-Orth J.	2022	Frontiers in immunology	Scoping review
29	Preoperative platelet distribution width represents a novel prognostic biomarker in patients with nonmetastatic renal cell carcinoma: A retrospective clinical analysis	Xiao R, Yang B, Liu C, Liu L, Ma L.	2022	Frontiers in oncology	Original article (retrospective, observational, analytical)
30	Platelet distribution width correlates with prognosis of gastric cancer	Zhang X, Cui M-M, Fu S, Li L-L, Liu Y-S, Liu Z-P, et al.	2017	Oncotarget	Original article (retrospective, observational, analytical)
31	Elevated preoperative platelet distribution width predicts poor prognosis in Esophageal Squamous Cell Carcinoma	Song Q, Wu J-Z, Wang S, Chen W-H	2019	Nature	Original article (retrospective, observational, analytical)
32	Increased platelet distribution width predicts 3-year recurrence in patients with hepatocellular carcinoma after surgical resection	Li H, Liu J, Yan S, Rao C, Wang L.	2023	Cancer Management and Research	Original article (retrospective, observational, analytical)
33	Verification of reference intervals in routine clinical laboratories: practical challenges and recommendations	Ozarda Y, Higgins V, Adeli K.	2018	Clinical Chemistry and Laboratory Medicine	Opinion article

Table 2. Findings and potential biases of the original articles reviewed

Title	Main findings	Risk or association measure	Potential biases
Mean platelet volume and platelet-to-lymphocyte ratio as prognostic factors in papillary thyroid cancer [8]	No statistically significant relationship was found between MPV and clinical stage (TNM or MACIS) in papillary thyroid cancer	*p = 0.231 (MACIS); p = 0.949 (TNM)*	Retrospective and cross-sectional design, which prevents exclusion of confounders such as comorbidities or medication use
Correlation between breast cancer receptors and the Mean Platelet Volume ratio [9]	A significant correlation exists between higher MPV and more aggressive breast cancer subtypes, particularly HER2-positive disease	$p < 0.05$	Small sample size (n = 30) and retrospective design
Prognostic impact of the mean platelet volume/platelet count ratio in terms of survival in advanced non-small cell lung cancer [10]	A low MPV-to-platelet count ratio is associated with shorter survival in patients with advanced non-small cell lung cancer	$p = 0.0245$	Selection of a control group with chronic inflammatory diseases (COPD/asthma), which may not adequately represent the general population
Prognostic significance of mean platelet volume on local advanced non-small cell lung cancer managed with chemoradiotherapy [11]	Pretreatment MPV ≤ 9 fL is an independent risk factor for shorter survival in patients with locally advanced non-small cell lung cancer treated with chemoradiotherapy	$p = 0.034$	Retrospective design; marked sex imbalance in the sample (95.7% men)
The predictive value of mean platelet volume in differential diagnosis of non-functional pancreatic neuroendocrine tumors from pancreatic adenocarcinomas [12]	Preoperative MPV is significantly lower in nonfunctioning pancreatic neuroendocrine tumors than in pancreatic adenocarcinomas	$p < 0.014$	Small sample size (16 patients); retrospective design
Large platelet size is associated with poor outcome in patients with metastatic pancreatic cancer [13]	Higher MPV is independently associated with poorer overall survival in patients with metastatic ductal pancreatic cancer	*Hazard ratio* (HR) = 1.13; $p = 0.005$	Single-center retrospective design, which may limit external validity and generalizability
Are platelet-related parameters predictive of the prognosis of Hodgkin's lymphoma? [14]	MPV and platelet count have diagnostic value and are associated with staging in Hodgkin lymphoma	$p < 0.05$	Retrospective design; incomplete data and lack of survival analysis for all patients
Mean platelet volume as a predictive marker for venous thromboembolism in patients treated for Hodgkin lymphoma [15]	Prechemotherapy MPV ≤ 6.8 fL is associated with a higher risk of venous thromboembolism in patients with Hodgkin lymphoma	$p = 0.0244$	Possible selection bias due to the retrospective design and exclusive inclusion of Caucasian patients from a single center
Mean platelet volume predicts prognosis in patients with diffuse large B-cell lymphoma [16]	MPV ≤ 9.1 fL is associated with shorter progression-free survival and shorter overall survival compared with MPV > 9.1 fL	$p < 0.05$	Retrospective, single-center design, which may limit the external validity of the findings
Mean platelet volume as a predictive marker for venous thromboembolism and mortality in patients treated for diffuse large B-cell lymphoma [17]	Low MPV (≤ 10th percentile) is an independent risk factor for VTE and is associated with a higher risk of mortality	*Hazard ratio* (HR) = 5.56; $p < 0.001$	Retrospective design, making it difficult to control for unmeasured confounding and potentially limiting causal interpretation of the observed associations.
Mean platelet volume has prognostic value in chronic lymphocytic leukemia [18]	MPV ≤ 10.4 fL is independently associated with an unfavorable prognosis in CLL	$p = 0.0015$	Variability in MPV measurement among the participating centers
Platelet parameters and expression of platelet membrane glycoprotein in childhood acute lymphoblastic leukemia [19]	Pediatric patients with ALL show reduced MPV, among other platelet parameters	$p < 0.05$	Small sample size (19 patients with ALL, 15 in remission, and 15 controls), which may limit statistical power and generalizability
Mean platelet volume is a predictive and prognostic marker for patients with acute myeloid leukemia: a two-center retrospective analysis [20]	High MPV at diagnosis is an independent unfavorable prognostic factor in patients with AML	$p < 0.05$	Potential bias due to the retrospective design and exclusion of patients with acute promyelocytic leukemia
Normal platelet counts mask abnormal thrombopoiesis in patients with chronic myeloid leukemia [22]	In CML, MPV is significantly higher than in healthy controls in patients with either elevated or normal platelet counts	$p < 0.05$	Small sample size (25 patients in the normal platelet count group), which may limit generalizability
The independent association of mean platelet volume with overall survival in multiple myeloma [23]	Low MPV before treatment predicts shorter overall survival in multiple myeloma	*Hazard ratio* (HR) = 2.44; $p = 0.026$	Retrospective design and small sample size (62 patients), which may limit generalizability
Mean Platelet Volume-to-Albumin Ratio as a Predictor of Mortality in Patients with Febrile Neutropenia: An Observational Study [25]	The MPV/albumin ratio is a better predictor of mortality during an episode of febrile neutropenia than the MASCC risk index	$p = 0.0002$	Most participants had solid tumors, limiting the applicability of the findings to patients with hematological neoplasms

* Abbreviations: MPV, mean platelet volume; COPD, chronic obstructive pulmonary disease; RCC, renal cell carcinoma; HR, hazard ratio; CLL, chronic lymphocytic leukemia; ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; CML, chronic myeloid leukemia.

Table 3. Clinical utility of MPV in solid tumors

Cancer type	Main findings	Clinical utility	Comments
Colorectal cancer	Elevated values compared with healthy individuals or patients with adenomas. ↑ MPV correlated with vascular invasion and metastasis. ↓ MPV predicts better response to chemotherapy + bevacizumab	Marker of aggressiveness and treatment response	No correlation with CEA or CA19-9. Heterogeneous findings across studies.
Gastric cancer	High preoperative levels that decrease after surgery. ↓ Baseline MPV associated with fewer metastases, better response to chemotherapy, and ↑ survival (15.5 vs. 9 months)	Prognostic marker and indicator of treatment response	Contradictory evidence: some studies report low MPV. Relationship with survival is inconsistent
Renal cell carcinoma (RCC) and bladder cancer	↓ MPV associated with aggressive tumors (sarcomatoid components, necrosis, vascular invasion) ↓ MPV associated with reduced 5-year overall survival (50.8% vs. 75.9% in RCC)	Marker of tumor aggressiveness and poor prognosis	Surgical resection increases MPV
Thyroid cancer	Meta-analysis (10 studies): elevated MPV, associated with cardiovascular complications and metastasis. Specific study (papillary carcinoma): no significant differences according to risk category (MACIS/TNM)	Clinical utility remains unclear; evidence is inconsistent	Not recommended as an independent marker in papillary thyroid cancer
Breast cancer	↑ MPV in aggressive subtypes (HER2+, ER/PR−). Correlation with HER2 (r = 0.65)	Marker of molecular biological aggressiveness	Not associated with histologic grade or tumor stage; may reflect molecular aggressiveness
Non-small cell lung cancer (NSCLC)	↓ MPV in NSCLC compared with healthy controls ↓ MPV/PLT ratio predicts shorter overall survival (OS)	Potential diagnostic utility in NSCLC; unfavorable prognostic marker for survival	Good predictor of survival in locally advanced stages
Pancreatic cancer	↓ MPV in pancreatic neuroendocrine tumors (pNETs) compared with pancreatic adenocarcinoma. ↑ MPV correlated with high histologic grade, ↓ platelet count, ↑ bilirubin, and ↑ CRP. ↑ MPV associated with higher mortality risk in stage IV metastatic disease	Useful for differentiating pNETs from adenocarcinoma Marker of clinical aggressiveness Predictor of mortality	MPV values obtained preoperatively No association with increased mortality in localized or early-stage disease

***** Abbreviations: MPV, mean platelet volume; RCC, renal cell carcinoma; NSCLC, non-small cell lung cancer; pNETs, pancreatic neuroendocrine tumors; CEA, carcinoembryonic antigen; CRP, C-reactive protein; OS, overall survival.

DISCUSSION

MPV reflects platelet activity and has been proposed as a potential biomarker associated with both prothrombotic and proinflammatory conditions. Significant variations in MPV have been described according to the underlying disease. Elevated values have been reported in cardiovascular disease, stroke, respiratory disorders, chronic kidney disease, intestinal disorders, rheumatic diseases, diabetes, and several types of cancer. Conversely, decreased values have been observed during exacerbations of tuberculosis, ulcerative colitis, systemic lupus erythematosus (SLE), and certain neoplasms. In this context, several studies have concluded that MPV provides valuable information regarding the course and prognosis of various conditions. Nevertheless, for its clinical implementation—as an indicator of inflammatory severity, risk of thrombotic complications, disease progression, or treatment response—reference values must be standardized [26].

This review confirms that MPV is a parameter with prognostic relevance across a broad range of solid and hematological neoplasms. However, its clinical interpretation should be contextualized according to tumor type, because the direction of the association (high vs. low MPV) and its prognostic implications vary substantially.

In colorectal, gastric, and breast cancer, as well as pancreatic adenocarcinoma, elevated MPV is consistently associated with greater tumor aggressiveness, the presence of metastases, and

Table 4. Clinical utility of MPV in hematological neoplasms

Cancer type	Main findings	Clinical utility	Comments
Hodgkin lymphoma (HL)	MPV significantly lower in patients (8.8 fL) than in controls (9.7 fL). Lower in advanced stages (8.4 fL). Prechemotherapy MPV ≤ 6.8 fL predicts a higher risk of VTE	Diagnostic marker and predictor of thromboembolic risk	Patients with baseline MPV ≤ 6.8 fL had a 19% incidence of VTE vs. 5.5% in patients with higher MPV
Diffuse large B-cell lymphoma (DLBCL)	Baseline MPV ≤ 9.1 fL associated with shorter progression-free survival (60.6% vs. 84.0%) and shorter overall survival (70.4% vs. 87.9%).	Independent prognostic factor for survival	Confirmed by multivariable analysis (HR for PFS = 0.456; HR for OS = 0.588).
	Lower prechemotherapy MPV in patients who developed VTE.	Predictor of venous thromboembolism and mortality	Overall survival at 3.5 years: 78% for MPV > 10th percentile vs. 55% for MPV ≤ 10th percentile
	MPV ≤ 10th percentile (6.11 fL) associated with VTE and shorter overall survival		
Chronic lymphocytic leukemia (CLL)	MPV > 10.4 fL associated with longer time to first treatment (TTFT) (36 vs. 17.9 months)	Predictor of time to first treatment	Trend toward higher incidence of atrial fibrillation with ibrutinib in the low-MPV group
Acute lymphoblastic leukemia (ALL)	Platelet parameters (PLT, MPV, PCT, PDW) significantly lower in active ALL	Assessment of platelet dysfunction and treatment response	All parameters normalize after complete remission
Acute myeloid leukemia (AML)	↓ MPV associated with first complete remission (CR1)	Favorable predictor of remission and survival	Clinical validity is compromised by preanalytical and analytical factors
	In the long term,↓ MPV is positively associated with complete remission, overall survival, and progression-free survival		
Chronic myeloid leukemia (CML)	↑ MPV in CML compared with healthy individuals	Potential diagnostic utility in CML	Association is maintained in patients with thrombocytosis or normal platelet counts
Multiple myeloma	↓ MPV associated with IgA isotype, ↑ serum creatinine, and IgH rearrangements	Correlation with clinical parameters and predictor of poor survival	↓ MPV is associated with a 2.44-fold higher risk of mortality
	MPV < 8.5 fL associated with shorter overall survival		
Febrile neutropenia	MPV/ALB ratio significantly lower in patients who died	Predictor of mortality in patients with febrile neutropenia.	MPV/ALB ratio showed better performance than the MASCC index for predicting mortality during an acute episode of febrile neutropenia
	MPV/ALB ratio < 0.245 shows high specificity for identifying patients at greater risk of mortality		

***** Abbreviations: MPV, mean platelet volume; HR, hazard ratio; HL, Hodgkin lymphoma; VTE, venous thromboembolism; DLBCL, diffuse large B-cell lymphoma; CLL, chronic lymphocytic leukemia; ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; CML, chronic myeloid leukemia; PFS, progression-free survival; ALB, albumin.

poorer prognosis. This relationship may be explained by the role of platelets in processes such as angiogenesis, tissue invasion, and the establishment of a microenvironment favorable to metastasis. Larger platelets, reflected by higher MPV, are more metabolically active and release greater amounts of growth factors and proangiogenic cytokines that promote tumor progression [27]. Likewise, increased platelet volume may reflect enhanced platelet production and activation, phenomena commonly associated with cancer [1].

In contrast, in renal and bladder carcinoma, low MPV correlates with features of greater tumor aggressiveness and poorer survival. Similarly, a low MPV/PLT ratio is associated with shorter survival in patients with non-small cell lung cancer. These findings suggest that the interaction between tumors and the hematopoietic system is complex and tissue-specific. In these settings, low MPV may reflect severe bone marrow impairment related to chronic inflammation or cytokine-mediated effects, resulting in smaller and dysfunctional platelets [28].

The available evidence in thyroid cancer is inconsistent, suggesting that the usefulness of MPV may be limited in this setting or influenced by specific histologic subtypes. The lack of correlation with established staging systems such as TNM and MACIS indicates that MPV should not be used as a prognostic marker in papillary thyroid cancer, the most common subtype.

In lymphoproliferative diseases, the findings are more consistent. Low MPV may serve as a predictor of poor prognosis in lymphomas, including Hodgkin and non-Hodgkin lymphoma, as well as in chronic lymphocytic leukemia. This finding is clinically relevant because it remains an independent prognostic factor even after adjustment for prognostic indices such as the IPI. In addition, the association between low MPV and a higher risk of venous thromboembolism in patients with Hodgkin lymphoma and DLBCL increases the practical usefulness of this marker by potentially identifying patients who may benefit from prophylactic antithrombotic strategies [15–18].

In myeloproliferative neoplasms, the findings are heterogeneous. In AML, low MPV predicted complete remission and was associated with better survival [20]. This association may be related to the fact that larger platelets, reflected by higher MPV, exhibit increased metabolic activity and release abundant substances that promote angiogenesis, thereby contributing to cancer progression. In contrast, in multiple myeloma, low MPV values predicted a higher risk of mortality [23]. In this disease, the presence of smaller platelets and increased mortality may share the same underlying mechanism: bone marrow dysfunction that impairs the production of young, larger platelets.

Despite the promising findings described above, the clinical application of MPV remains challenging and requires further research for validation in routine practice [26]. Lance et al. [6] described several barriers to the routine implementation of MPV as a prognostic parameter in oncology. Similarly, Beyan [21] argued against the use of MPV as a prognostic marker. These limitations include:

a) There is no international standardization; the reference range is broad, and results vary according to analyzer manufacturer and measurement method (impedance vs. optical), making interlaboratory comparisons difficult.
b) MPV values may change after blood collection—for example, they may increase in tubes containing ethylenediaminetetraacetic acid (EDTA)—leading to inaccurate results if samples are not processed promptly.
c) It is difficult to determine whether a value is abnormal for a specific individual because platelet size is heterogeneous and varies according to age, sex, and platelet count, with which it is inversely correlated.

Based on the above, MPV alone is insufficient for establishing a definitive diagnosis. In addition, its value for prognostication in individual patients remains uncertain. Therefore, it should be recommended only as a complementary tool rather than as a standalone test.

Another widely available and low-cost platelet index, platelet distribution width (PDW), could be used together with MPV to assess prognosis in patients with cancer. PDW, a parameter that reflects variability in platelet size, has shown prognostic usefulness in nonmetastatic renal cell carcinoma [28], gastric cancer [29], and esophageal squamous cell carcinoma [30], as well as for predicting recurrence in hepatocellular carcinoma [31].

Finally, the limitations of this review include methodological heterogeneity among the studies analyzed, particularly regarding MPV cutoff values, sample sizes, and study designs. In addition, most of the available evidence comes from retrospective studies, highlighting the need for prospective research to validate these findings and standardize cutoff values and reference ranges for implementation in clinical practice.

Despite these limitations, the accessibility, low cost, and reproducibility of MPV make it a valuable ancillary test. Its integration into existing prognostic models could improve risk stratification in patients with cancer, thereby optimizing therapeutic decision-making and surveillance for complications such as thromboembolism.

Conclusions

MPV has gained clinical relevance as an easily accessible and low-cost prognostic indicator in oncology. This parameter, routinely obtained from the automated complete blood count, provides valuable information on platelet production, destruction, and activity. Current evidence supports its ability to predict the progression of various neoplasms, the risk of thromboembolic events, overall survival, and even the risk of complications following chemotherapy. Its integration into clinical practice guidelines as a prognostic marker in the management of patients with cancer depends on standardization of reference intervals, mitigation of preanalytical interferences, and its combined use with other ancillary tests and clinical variables.

In this regard, implementation of standardized MPV reference intervals in clinical laboratories is recommended. To facilitate this process, guidelines

such as EP28-A3c from the Clinical and Laboratory Standards Institute (CLSI) specify minimum sample sizes according to the methodology used to ensure adequate statistical precision, including 90% confidence intervals, as well as recommendations for sample collection and statistical analysis [33]. Likewise, there is a need for prospective studies to validate the usefulness of MPV for prognostic assessment in routine clinical practice.

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