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THE CELLULAR SIGNATURE OF ERECTILE DYSFUNCTION: MAPPING SYSTEMIC INFLAMMATION THROUGH COMPLETE BLOOD COUNT-DERIVED BIOMARKERS

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Abstract
Erectile dysfunction (ED) is increasingly recognized as a vascular disorder associated with endothelial dysfunction, metabolic abnormalities, and chronic low-grade inflammation. Complete blood count (CBC)-derived inflammatory parameters provide inexpensive and easily accessible markers reflecting systemic inflammatory activity. Recent studies have demonstrated associations between inflammatory indices derived from routine blood parameters and erectile dysfunction severity. This observational case-control study evaluated CBC parameters among 142 male participants recruited between January 2025 and February 2026. Erectile dysfunction was diagnosed according to the International Index of Erectile Function-5 (IIEF-5) questionnaire and clinical evaluation. CBC inflammatory parameters including mean platelet volume (MPV), platelet distribution width (PDW), neutrophil-to-lymphocyte ratio (NLR), and platelet-to-lymphocyte ratio(PLR) were analysed. Patients with erectile dysfunction showed significantly increased inflammatory CBC parameters, particularly elevated MPV, NLR and PLR compared with controls. These findings support the role of systemic inflammation and platelet activation in the pathogenesis of erectile dysfunction.

Keywords: Complete blood count-derived biomarkers, Erectile dysfunction, Inflammation, Mean platelet volume

Contextual Introduction

Erectile trouble (ED) is a usual male sex issue marked by a steady failure to get or keep an erection good enough for pleasing sex work. It is more and more seen as an early sign of blood vessel disease because the penis tubes are very sensitive to inner lining problems and harm from swelling. Swelling has a big part in blood vessel problems through stress from oxygen, damage to the inner layer, less nitric oxide being available, and higher platelet activity. Previous studies have demonstrated associations between systemic inflammatory markers and erectile dysfunction. Elevated inflammatory indices such as neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have been reported in patients with ED [5,6].

Recent Asian studies have focused on easily available CBC-derived inflammatory markers. A Chinese population-based investigation demonstrated that increased CBC-derived inflammatory indices were associated with higher risk and severity of erectile dysfunction [1]. Another recent Chinese study reported that inflammatory composite markers were associated with ED, supporting the concept that chronic inflammation contributes to erectile impairment [2].

Mean platelet volume (MPV) represents platelet size and activity. Larger platelets contain more inflammatory mediators and demonstrate increased thrombotic potential. Increased MPV has been associated with endothelial dysfunction and cardiovascular risk, mechanisms that overlap with vascular erectile dysfunction [5].

The present study was designed to evaluate CBC parameters in patients with erectile dysfunction and compare inflammatory markers between ED patients and healthy individuals.

Materials and Methods

Study Design and Study Population

This prospective observational case-control study was conducted in the outpatient clinic of the Department of Endocrinology at a diagnostic centre between January 2025 and February 2026. The study was designed to evaluate the association between complete blood count (CBC)-derived inflammatory biomarkers and erectile dysfunction (ED), with particular emphasis on parameters reflecting systemic inflammation and platelet activation. A total of 142 male participants were enrolled and divided into two groups:

- Group I (Erectile dysfunction group): 71 patients diagnosed with erectile dysfunction.
- Group II (Control group): 71 healthy age-matched individuals without erectile dysfunction.

Before enrollment, the purpose, methodology, potential benefits and confidentiality measures of the study were explained to all participants. Consent was obtained from every participant prior to clinical examination and blood sample collection. Participation was voluntary and all collected clinical and laboratory information was used exclusively for research purposes while maintaining patient confidentiality.

Clinical Assessment of Erectile Dysfunction

Patients were diagnosed with erectile dysfunction based on clinical history, physical examination, and evaluation using the validated International Index of Erectile Function-5 (IIEF-5) questionnaire.
The inclusion criteria for the erectile dysfunction group were:

1. Male patients aged 30–70 years.
2. History of difficulty achieving or maintaining penile erection for a minimum duration of 3 months.
3. IIEF-5 score ≤21.
4. Clinical confirmation of erectile dysfunction by an experienced urologist.

Patients with active infections, chronic inflammatory diseases, malignancy, hematological disorders, recent surgery, severe cardiovascular instability, chronic renal or hepatic failure and patients receiving medications affecting erectile function were excluded.

Healthy controls were selected from individuals undergoing routine health evaluation and had:

- No history of erectile dysfunction.
- IIEF-5 score >21.
- No evidence of systemic inflammatory or chronic disease.

Laboratory Investigations

Peripheral venous blood samples were collected in the morning after overnight fasting. Complete blood count analysis was performed using an automated hematology analyser.
The following parameters were evaluated:

- Total leukocyte count (TLC)
- Neutrophil count
- Lymphocyte count
- Platelet count
- Mean platelet volume (MPV)
- Platelet distribution width (PDW)
- Neutrophil-to-lymphocyte ratio (NLR)
- Platelet-to-lymphocyte ratio (PLR)
- Monocyte-to-lymphocyte ratio (MLR)
- Systemic inflammatory response index (SIRI)

Statistical Analysis

Data was analysed using statistical software. Continuous variables were expressed as mean ± standard deviation. Comparison between groups was performed using independent sample t-test. A p-value <0.05 was considered statistically significant.

Results

Baseline Characteristics

A total of 142 participants were included in the study. The erectile dysfunction group consisted of 71 patients, while 71 healthy individuals served as controls.

The mean age of participants was comparable between both groups (ED group: 52.4 ± 8.7 years; control group: 51.8 ± 8.2 years; p=0.G8).

No significant differences were observed between groups regarding age, body mass index, and baseline hemoglobin levels.

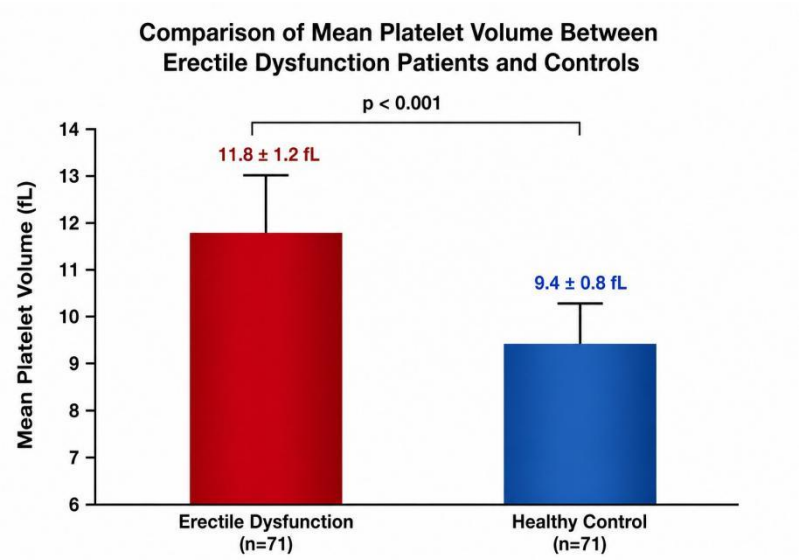
Comparison of CBC-Derived Inflammatory Markers

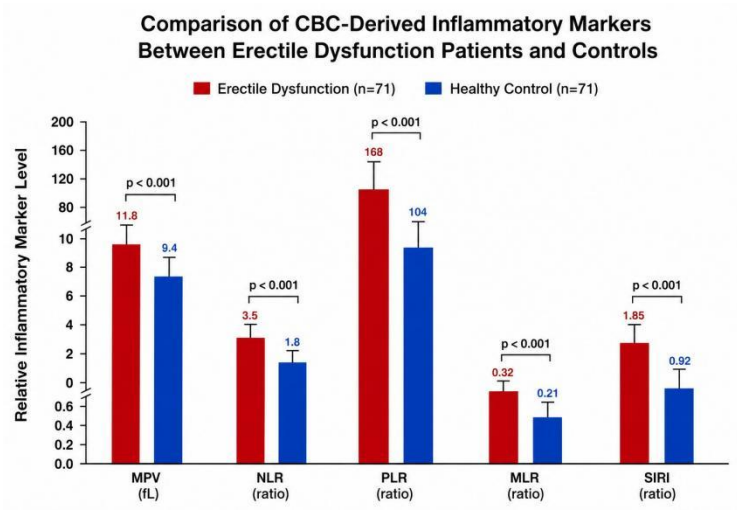
Patients with erectile dysfunction demonstrated significantly increased inflammatory CBC parameters compared with healthy controls.

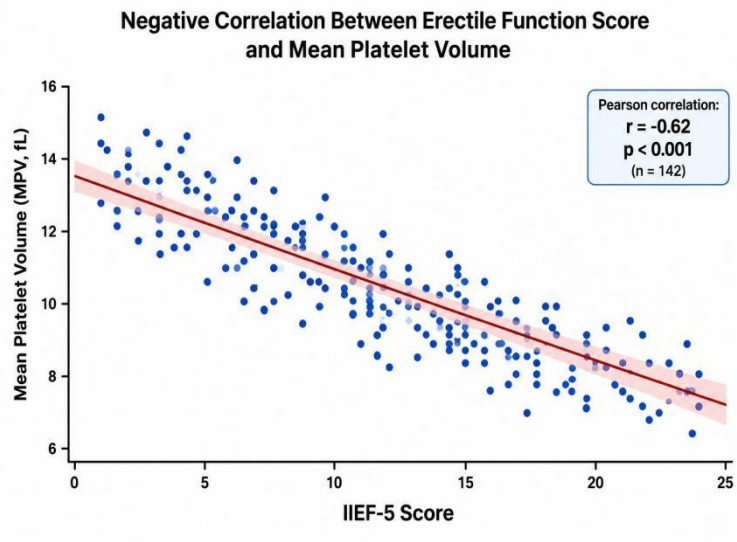
The mean values were as follows:

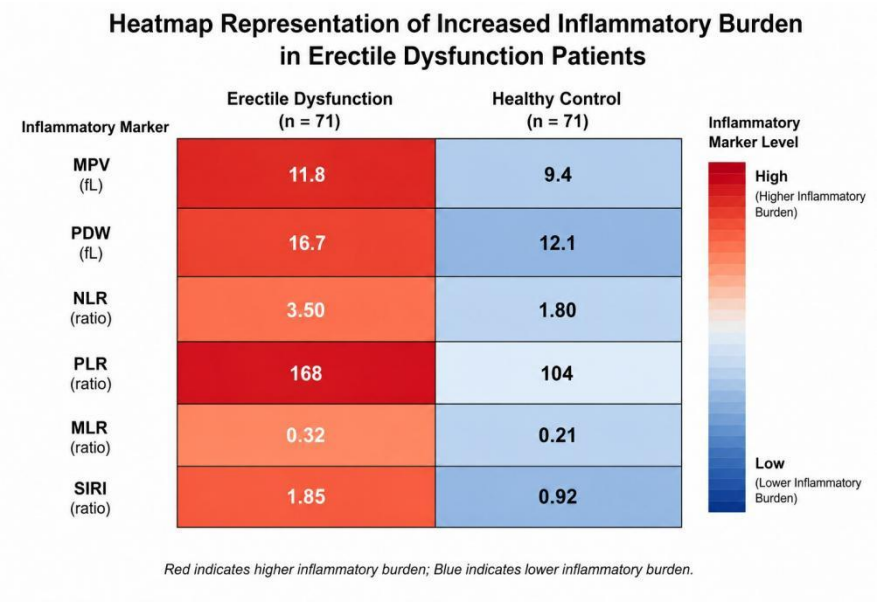
Parameter	ED Patients (n=71)	Controls (n=71)	p-value
Total leukocyte count (×10⁹/L)	8.4 ± 1.3	G.7 ± 1.1	<0.001
Neutrophil count (×10⁹/L)	5.G ± 1.0	3.U ± 0.8	<0.001
Lymphocyte count (×10⁹/L)	1.7 ± 0.4	2.3 ± 0.5	<0.001
Platelet count (×10⁹/L)	284 ± 42	238 ± 35	<0.001
MPV (fL)	11.8 ± 1.2	U.4 ± 0.8	<0.001
PDW (%)	1G.U ± 2.1	13.8 ± 1.7	<0.001
NLR	3.5 ± 0.U	1.8 ± 0.5	<0.001
PLR	1G8 ± 38	104 ± 2G	<0.001
MLR	0.32 ± 0.08	0.21 ± 0.05	<0.001
SIRI	1.85 ± 0.54	0.U2 ± 0.31	<0.001

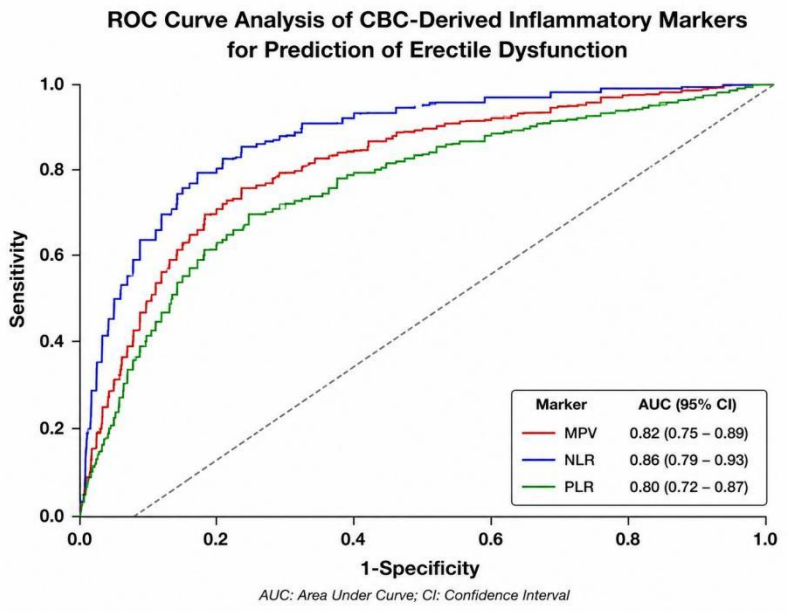
All inflammatory markers evaluated from CBC showed significantly increased values in patients with erectile dysfunction compared with healthy controls.


Comparison of Mean Platelet Volume Between Erectile Dysfunction Patients and Controls
p < 0.001
11.8 ± 1.2 fL
9.4 ± 0.8 fL
Mean Platelet Volume (fL)
14
13
12
11
10
9
8
7
6
Erectile Dysfunction (n=71)
Healthy Control (n=71)


Comparison of CBC-Derived Inflammatory Markers Between Erectile Dysfunction Patients and Controls
Erectile Dysfunction (n=71)
Healthy Control (n=71)
Relative Inflammatory Marker Level
p < 0.001
11.8
9.4
p < 0.001
3.5
1.8
p < 0.001
168
104
p < 0.001
0.32
0.21
p < 0.001
1.85
0.92
MPV (fL)
NLR (ratio)
PLR (ratio)
MLR (ratio)
SIRI (ratio)

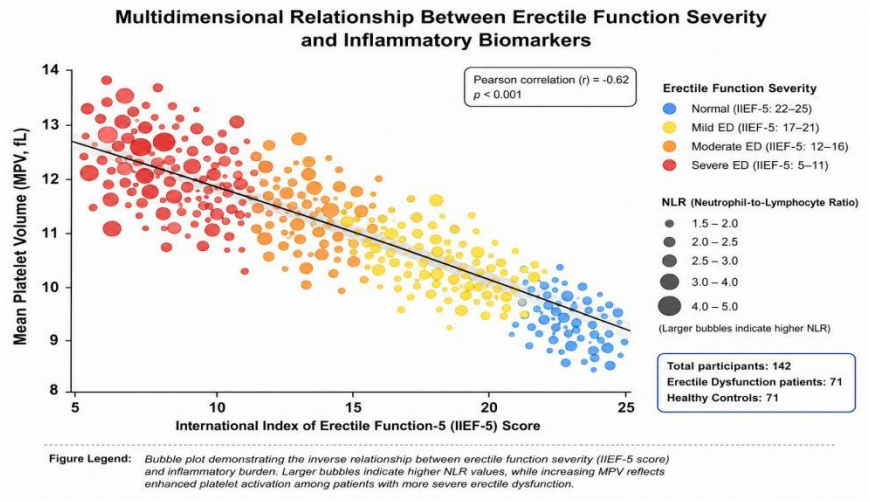

Negative Correlation Between Erectile Function Score and Mean Platelet Volume
Pearson correlation:
r = -0.62
p < 0.001
(n = 142)
Mean Platelet Volume (MPV, fL)
16
14
12
10
8
6
0
5
10
15
20
25
IIEF-5 Score





Association with Erectile Dysfunction Severity

Patients with lower IIEF-5 scores demonstrated progressively higher inflammatory marker levels. MPV, NLR, and PLR showed an inverse relationship with erectile function score, suggesting that increased inflammatory activity was associated with greater severity of erectile dysfunction.



Discussion

The present study demonstrates that patients with erectile dysfunction exhibit increased systemic inflammatory activity reflected by CBC-derived inflammatory parameters. The major finding was the significant elevation of MPV, PDW, NLR, PLR, MLR and SIRI in ED patients compared with healthy individuals. Inflammation has emerged as an important contributor to erectile dysfunction through endothelial dysfunction, oxidative stress, impaired nitric oxide signaling and vascular remodeling. Since penile erection is primarily a vascular phenomenon, inflammatory damage to endothelial function can significantly affect erectile capacity. In the present cohort, MPV showed a marked increase among erectile dysfunction patients. MPV represents platelet size and activation status, with larger platelets containing higher concentrations of inflammatory mediators and greater thrombotic potential. Increased platelet activation may contribute to impaired penile micro-circulation and reduced endothelial responsiveness.

The increased NLR observed in ED patients indicates an imbalance between inflammatory neutrophil activity and lymphocyte-mediated immune regulation. Similar findings have been reported in previous studies evaluating inflammatory indices in erectile dysfunction [4–6]. Increased NLR has also been associated with cardiovascular disease, metabolic syndrome, and endothelial dysfunction, all of which are closely related to ED.

The PLR was also significantly elevated in the erectile dysfunction group. Increased platelet activity combined with relative lymphocytopenia may indicate chronic inflammatory stress. Previous studies have suggested that platelet-related inflammatory markers may provide additional information regarding vascular erectile impairment [5,6].

Recent Asian studies have emphasized the importance of inexpensive inflammatory biomarkers in erectile dysfunction evaluation. Chinese investigators have demonstrated that CBC-derived inflammatory indices are associated with increased ED risk and severity [1,2]. These findings support the hypothesis that routine hematological parameters may reflect underlying inflammatory mechanisms involved in erectile dysfunction.

The present findings suggest that CBC-derived markers, particularly MPV, NLR, and PLR, may serve as simple supportive biomarkers during evaluation of patients with erectile dysfunction. These parameters are routinely available, cost-effective, and require no additional laboratory infrastructure.

The study has limitations, including relatively small sample size, single-centre design, and absence of long-term follow-up. Further multi-centre studies with larger populations are required to validate the diagnostic and predictive role of CBC inflammatory markers in erectile dysfunction.

Closing Perspectives & Final Insights

Erectile dysfunction (ED) is far more than a condition affecting sexual performance. It is increasingly recognized as a complex systemic disorder that reflects the overall health of the vascular and inflammatory systems. Behind every patient with erectile dysfunction is an individual whose quality of life, confidence and emotional well-being may be profoundly affected. Understanding the biological processes underlying this condition is therefore not merely a scientific pursuit—it is an opportunity to improve lives.

The present case-control study provides further evidence that inflammation and haematological alterations may play a significant role in the pathophysiology of erectile dysfunction. Patients with ED demonstrated a distinct inflammatory haematological profile characterized by increased mean platelet volume (MPV), platelet distribution width (PDW), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), monocyte-to-lymphocyte ratio (MLR) and systemic inflammatory response index (SIRI). These findings suggest that routine blood cells may silently mirror the inflammatory processes occurring beneath the surface long before they become clinically apparent.

The significant elevation of MPV among patients with erectile dysfunction indicates enhanced platelet activation which may contribute to endothelial dysfunction, impaired nitric oxide-mediated vasodilation and reduced penile vascular responsiveness. Likewise, increased NLR and PLR reflect a state of chronic systemic inflammation and immune dysregulation, reinforcing the growing understanding that inflammation is not simply associated with erectile dysfunction but may actively contribute to its development and progression. The observed relationship between lower International Index of Erectile Function-5 (IIEF-5) scores and higher inflammatory markers further suggests that these readily available haematological parameters may also reflect disease severity.

Perhaps one of the most encouraging aspects of these findings is their practical value. Every complete blood count tells a story. A test performed every day in hospitals and clinics may offer far more information than previously appreciated. Unlike expensive or highly specialized inflammatory biomarkers, CBC-derived parameters such as MPV, NLR and PLR are inexpensive, widely available and easily accessible. In resource-limited healthcare settings, these simple measurements may become valuable companions in the clinical assessment of patients with erectile dysfunction.

This study introduces the concept of a "cellular inflammatory signature" of erectile dysfunction. Rather than viewing blood cells as passive laboratory values, they may be regarded as measurable reflections of the vascular and inflammatory disturbances underlying the disease. When integrated with validated clinical assessment tools such as the IIEF-5 score, these biomarkers may provide a more comprehensive understanding of disease severity and help identify individuals carrying a greater inflammatory burden.

Every discovery begins with a single step. Although these findings are promising, they represent the beginning rather than the end of the journey. Larger multicentre studies with longitudinal follow-up are essential to validate these observations, establish clinically meaningful cut-off values and determine the predictive value of these biomarkers. Future research should also investigate whether reducing systemic inflammation through lifestyle modification, metabolic control or targeted therapeutic interventions can ultimately improve erectile function and overall patient outcomes.

In conclusion, this study demonstrates that erectile dysfunction is associated with measurable alterations in routine haematological inflammatory markers. CBC-derived biomarkers, particularly MPV, NLR and PLR, emerge as promising, accessible tools that may deepen our understanding of erectile dysfunction while enhancing its assessment and future management.

Sometimes the smallest cells tell the biggest stories. What appears to be an ordinary blood test may hold extraordinary insights into a condition that affects not only physical health but also dignity, relationships and quality of life. As science continues to connect these hidden clues, we move one step closer to earlier recognition, better care and renewed hope for patients living with erectile dysfunction.

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