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CLINICAL AND PATHOGENETIC SIGNIFICANCE OF HEMATOLOGICAL MARKERS AND SYSTEMIC INFLAMMATION INDICES IN THE EARLY DIAGNOSIS OF POSTPARTUM COMPLICATIONS

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Abstract

Physiological postpartum changes complicate early diagnosis of infection after cesarean section. This narrative review of six publications assessed the diagnostic potential of monocyte distribution width (MDW) and systemic inflammatory indices. MDW showed promising performance in nonobstetric sepsis studies, while neutrophil-to-lymphocyte and platelet-to-lymphocyte ratios were associated with post-cesarean infection. However, diagnostic accuracy varied, and evidence supporting their combined use in obstetric populations remains insufficient. Prospective studies are needed to establish obstetric-specific thresholds and determine their added value beyond routine clinical assessment.

Keywords: cesarean section, postpartum infection, surgical site infection, endometritis, monocyte distribution width, MDW, neutrophil-to-lymphocyte ratio

Background

Early recognition of infectious complications after cesarean section, particularly surgical site infection and endometritis, remains challenging because physiological postpartum changes and the inflammatory response to surgery can overlap with infection-related hematological abnormalities. In a longitudinal study of 24,318 pregnant women, the pregnancy-specific white blood cell reference interval was 5.7–15.0 × 10^9/L, with increased neutrophil and monocyte counts and reduced lymphocyte counts. Leukocyte counts increased further immediately after childbirth, returning to predelivery levels by approximately seven days and prepregnancy levels by day 21. These changes highlight the importance of population- and time-specific interpretation of laboratory results.

Complete-blood-count-derived inflammatory indices, including the neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), monocyte-to-lymphocyte ratio (MLR), and systemic immune-inflammation index (SII), are candidate tools for perioperative risk assessment. Monocyte distribution width (MDW), which quantifies heterogeneity in circulating monocyte volume, may provide complementary information about cellular activation. Unlike calculated indices, MDW requires a compatible hematology analyzer and is not universally available with routine blood counts.

Objective

To critically evaluate the diagnostic and prognostic potential of MDW and systemic inflammatory indices for infectious complications after cesarean section, and to identify the methodological requirements for assessing their combined use in the early postoperative period.

Materials and methods

A focused narrative review was undertaken using six selected publications within the 2019–2026 period, including obstetric hematological reference-interval research, cesarean-specific observational studies, a prospective emergency-department study, and systematic reviews with meta-analyses. Evidence was examined according to study population, timing of blood sampling, infection definition, diagnostic thresholds, discrimination, sensitivity, specificity, and applicability to postpartum women. Findings from nonobstetric populations were considered indirect evidence rather than validated estimates of post-cesarean diagnostic performance.

Results

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MDW reflects the standard deviation of monocyte volumes and may increase during infection-associated activation and morphological change. However, monocytes also respond to tissue damage, so increased MDW should not be interpreted as a pathogen-specific response. A 2025 meta-analysis reported pooled sensitivity of 80% (95% CI, 75–85%) and specificity of 76% (95% CI, 66–83%) for sepsis detection across nine emergency-department studies. Substantial heterogeneity was associated with diagnostic criteria, thresholds, and sample anticoagulants. Importantly, the review excluded pregnant women, limiting direct extrapolation to obstetric practice.

In a prospective study of 402 emergency-department patients, MDW achieved an area under the receiver operating characteristic curve (AUC) of 0.753 for infection with systemic inflammatory response syndrome and 0.722 for Sepsis-3. Combining MDW with white blood cell count increased AUC to 0.784 for infection-associated systemic inflammation but did not improve Sepsis-3 discrimination, illustrating that biomarker combinations do not invariably enhance diagnostic performance.

For NLR, a meta-analysis of 12 studies involving 4,375 surgical patients reported pooled sensitivity of 77%, specificity of 78%, and AUC of 0.84. Evidence certainty was rated low, and performance varied by surgical setting and sampling time; these pooled estimates should therefore not be presented as cesarean-specific accuracy. In a cesarean-specific case-control study comparing 113 infected patients with 224 controls, NLR and PLR measured 6–24 hours postoperatively were independently associated with infection, although NLR discrimination was modest (AUC, 0.67). A subsequent retrospective emergency-cesarean study reported an AUC of 0.854, sensitivity of 79.1%, and specificity of 88.4% for a model combining preoperative NLR, PLR, and maternal body mass index. This model did not include MDW and requires prospective external validation.

Taken together, these studies provide a rationale for investigating complementary cellular biomarkers, but they do not establish the clinical utility of a combined MDW–NLR–PLR–MLR–SII panel after cesarean section. Future evaluation should standardize sampling times, analyzer and specimen conditions, and outcome definitions, while accounting for obstetric physiology and perioperative clinical characteristics.

Conclusion

MDW and systemic inflammatory indices are promising adjunctive research markers rather than established standalone tests for post-cesarean infection. Prospective multicenter studies are needed to determine obstetric-specific thresholds and assess whether combined models improve discrimination, calibration, and clinical decision-making beyond routine assessment. Their ability to distinguish physiological postoperative inflammation from infection, or improve maternal outcomes, remains to be demonstrated.

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