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Original Research Paper

General Medicine

DIFFERENTIATING ANEMIA OF CHRONIC DISEASE FROM IRON DEFICIENCY ANEMIA IN WOMEN WITH HEAVY MENSTRUAL BLEEDING: A CROSS-SECTIONAL STUDY USING ACCESSIBLE HEMATOLOGICAL AND BIOCHEMICAL MARKERS AT A TERTIARY CARE INDIAN HOSPITAL

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ABSTRACT

Background: Diagnosing iron deficiency anemia (IDA) vs. anemia of chronic disease (ACD) in women with heavy menstrual bleeding (HMB) is challenging in resource-limited settings. Ferritin, while widely used, is unreliable when inflammation is present. **Objective:** To validate a cost-effective algorithm using iron profile, C-reactive protein (CRP), peripheral blood film (PBF), haptoglobin, and Coombs test to distinguish IDA, ACD, and mixed anemia in women with HMB. **Methods:** Cross-sectional analysis of 120 women with HMB and anemia (Hb < 12 g/dL) at a tertiary center in Rajasthan. CBC, iron studies, CRP, haptoglobin, Coombs test, and PBF were evaluated. Subtypes classified using biochemical and morphological criteria. **Results:** IDA occurred in 65%, ACD in 10%, and mixed anemia in 25%. Ferritin was lowest in IDA (M = 15.2 μg/L), highest in ACD (M = 145.1 μg/L), intermediate in mixed anemia (M = 98.7 μg/L). CRP was normal in IDA, elevated in ACD and mixed anemia. Microcytic hypochromic morphology was found in IDA and mixed anemia, normocytic normochromic cells in ACD. The algorithm demonstrated strong reliability for practical care. **Conclusion:** A diagnostic approach incorporating CRP, iron indices, and PBF offers reliable, affordable subtype differentiation in women with HMB, supporting individualized management in resource-limited settings.

KEYWORDS : Iron deficiency anemia, anemia of chronic disease, heavy menstrual bleeding, diagnostic algorithm, CRP, ferritin, peripheral blood film

INTRODUCTION

Anemia is a major cause of morbidity among Indian women of reproductive age, especially those with heavy menstrual bleeding (HMB) (Camaschella, 2015). While iron deficiency anemia (IDA) is most frequent, anemia of chronic disease (ACD) is under-recognized and often confounds diagnosis and treatment (Weiss & Goodnough, 2005; Girelli et al., 2016). Ferritin, the primary iron marker, increases in inflammatory states—masking underlying deficiency (Means, 2003). Cost-effective, practical diagnostic strategies are scarce but sorely needed in such contexts.

This study evaluates a diagnostic algorithm using accessible laboratory markers for distinguishing anemia subtypes in women with HMB.

MATERIALS AND METHODS

Study Design And Population

Hospital-based, cross-sectional study from May to October 2025, Sardar Patel Medical College and PBM Hospital, Bikaner, Rajasthan, India. Women aged 18–50 years with HMB (≥3 months) and anemia (Hb < 12 g/dL) were included. Exclusion: chronic renal/liver disease, GI bleeding, recent iron therapy or transfusion, confirmed hemoglobinopathy.

Evaluations

- Detailed menstrual and chronic disease history
- **Laboratory:** CBC, serum iron, ferritin, TIBC, transferrin saturation, CRP, haptoglobin, Coombs test
- **Morphology:** PBF; hemoglobin electrophoresis as indicated

Diagnostic Classification

Data Analysis

SPSS v23.0 was used. Means (SD) for continuous variables. Group differences by ANOVA; significance at $p<0.05$.

Ethics

Institutional Ethics Committee approval; written consent obtained.

RESULTS AND OBSERVATIONS

1. Distribution Of Anemia Subtypes Among 120 Women:

- **IDA:** 65% (n=78)
- **ACD:** 10% (n=12)
- **Mixed Anemia:** 25% (n=30)

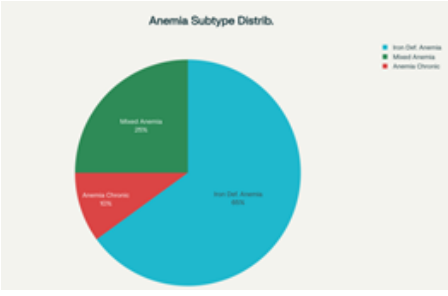

Figure 1: Pie Chart of anemia subtype distribution among study participants.

Parameter	IDA	ACD	Mixed Anemia
Ferritin	Low (<30 μg/L)	Normal/High (>100 μg/L)	Normal/High, microcytosis
CRP	<5 mg/L	>10 mg/L	>10 mg/L
TIBC	High (>360 μg/dL)	Low (<250 μg/dL)	Low
PBF	Microcytic hypochromic	Normocytic normochromic	Microcytic hypochromic
Hemolysis markers	Ruled out	Ruled out	Ruled out

2. Laboratory Marker Comparison

Parameter	IDA (M ± SD)	ACD (M ± SD)	Mixed (M ± SD)	p-value
Hb (g/dL)	10.1 ± 1.1	8.5 ± 0.9	9.0 ± 1.2	<0.01

MCV (fL)	75.2 ± 4.5	88.4 ± 3.1	78.5 ± 5.2	<0.001
Ferritin (μg/L)	15.2 ± 7.1	145.1 ± 35.8	98.7 ± 25.8	<0.001
TIBC (μg/dL)	385 ± 55	220 ± 35	250 ± 40	<0.001
CRP (mg/L)	<5.0	28.1 ± 8.4	22.5 ± 7.2	<0.001

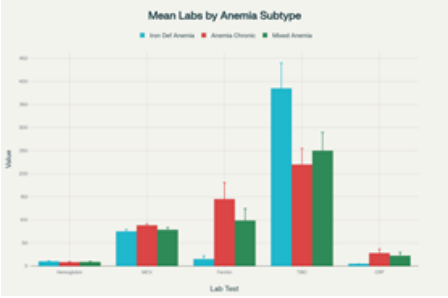

Figure 2: Bar graph comparing mean laboratory values (±SD) across anemia subtypes.

Comparison of Mean Laboratory Parameters Across Anemia Subtypes with Standard Deviations

Interpretation:

- **Pie Chart**: Majority had IDA, but 25% had mixed anemia.
- **Bar Graph**: Ferritin is low in only pure IDA; CRP and ferritin are both elevated in mixed/ACD. Accurate subtyping thus requires multiple markers, not just ferritin.

3. Key Insights

- Ferritin alone was unreliable when CRP was raised (i.e., in ACD or mixed anemia).
- Combined use of CRP, ferritin, TIBC, and PBF distinguished subtypes with high diagnostic precision.
- No hemolysis or thalassemia detected after full exclusion panel.

DISCUSSION

A quarter of women with HMB and anemia had mixed etiology—missed if ferritin alone was used (Thomas et al., 2013; Camaschella, 2015). Use of multiple accessible markers enabled clear subclassification for tailored therapy (Girelli et al., 2016). Routine exclusion of hemolytic and hemoglobinopathy disorders minimized confounders.

Strengths:

- Use of commonly available, low-cost tests only.
- Regional data on mixed anemia prevalence with stepwise protocol validated.

Limitations:

- Single-center, cross-sectional; lacks therapy outcome follow-up.

CONCLUSION

A stepwise, inexpensive algorithm combining CRP, iron profile, and PBF ensures accurate subtype diagnosis in women with HMB. Its implementation in Indian tertiary hospitals can significantly reduce misdiagnosis and improve outcomes.

Recommendations

- Incorporate CRP, iron profile, and PBF for all HMB anemia workups.
- Avoid ferritin alone, particularly with elevated CRP.
- Apply subtype-directed therapy; update institutional protocols as needed.

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