



"STUDY TO DETERMINE USEFULNESS OF RDWI IN DIAGNOSIS OF IRON DEFICIENCY ANAEMIA."

Pathology

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ABSTRACT

Introduction Iron deficiency is the most common nutritional deficiency in both developing and developed countries. In era of rising cost consciousness, efficient diagnostic approaches, which can rule in or rule out diseases with sufficient accuracy so testing is minimized. RDWI has more specificity for IDA than RDW. So it can rule out IDA better than RDW. RDWI appears to be a reliable and useful index for initial screening of microcytic hypochromic anemia and is better than RDW in differentiating iron deficiency anemia and beta thalassemia trait. **Material And Methods** Total 400 patients were included who were suspected for anemia during OPD visit. We have calculated RDWI of all patients using automated hematology analyzer using blood collection in EDTA vacutainer. Serum ferritin levels were also estimated using automated biochemistry using ELISA as principle method. **Result:** There was total 66 patients having <220 RDWI and 7 patients of these 66 patients were having <15 ng/ml serum ferritin. Sensitivity of RDWI to diagnose IDA was as good as 92.78 % in this study. The specificity and positive predictive value were 19.47% and 26.94% respectively. Negative Predictive Value (NPV) of RDWI to diagnose IDA was 89.39 %. were having S.ferritin <15 ng/ml.

KEYWORDS

Iron deficiency anaemia, RDWI, Serum ferritin.

INTRODUCTION

Iron deficiency is the most common nutritional deficiency in both developing and developed countries. In era of rising cost consciousness, efficient diagnostic approaches, which can rule in or rule out diseases with sufficient accuracy so testing is minimized. Bone marrow studies are invasive methods and serum ferritin, serum transferrin, and serum iron are relatively expensive while RDW alongside other indices, are a part of routine blood counts in laboratories using automated hematology analyzers. RDWI has more specificity for IDA than RDW. So it can rule out IDA better than RDW. RDWI appears to be a reliable and useful index for initial screening of microcytic hypochromic anemia and is better than RDW in differentiating iron deficiency anemia and beta thalassemia trait. 4,5

AIMS

- To determine the usefulness of RDWI in diagnosis of IDA

OBJECTIVES

- To determine Specificity, Sensitivity, Positive predictive value (PPV), Negative predictive value (NPV) of RDWI in diagnosis of IDA.
- To compare the diagnostic accuracy of RDWI with RDW in case of IDA.
- To compare the diagnostic accuracy of RDWI with RBC indices (Hb, MCV, RBC count and MCH, MCHC, Hct, RDW) in IDA.
- To compare the diagnostic accuracy of RDWI against known Red cell Mathematical formulas in case of IDA.

MATERIAL AND METHODS

Total 400 patients were included who were suspected for anemia during OPD visit. We have calculated RDWI of all patients using automated hematology analyzer using blood collection in EDTA vacutainer. Serum ferritin levels were also estimated using automated biochemistry using ELISA as principle method from plain vacutainer sample of below all patients in Government Medical College & Sir T Hospital, Bhavnagar, Gujarat. Patients referred for hematological evaluation are studied starting from 1st June 2020 to 31st May 2021 that is 1 year duration. We have divided patients into iron deficiency anemia (IDA) and non-iron deficiency anemia (non-IDA) using cut off value of serum ferritin ≤ 15 ng/ml for IDA [1] RDWI is a cell counter based formula, calculated as $(MCV \times RDW) / RBC$. Cut off value of RDWI is >220 for IDA and <220 for non-IDA was taken. [2]

RESULTS

We have collected total 400 patients which are every sixth patient visiting hematology department for hematological evaluation. Total 97 cases of IDA (iron deficiency anemia) and 303 cases of non-IDA (normal or high serum Ferritin level) were detected. In IDA (n=97)

cases, 77 (79.4%) were females and 20 (20.6%) were males patients. In female IDA cases highest numbers seen in third decade of life. In male IDA cases highest numbers seen in fifth decade of life.

Table no.1 shows 90 patients are true positive case with iron deficiency.

Test result	IDA (S.ferritin <15 ng/ml)	Non-IDA S.ferritin >15 ng/ml)	TOTAL
Positive (>220 RDWI)	90 (TP)	244 (FP)	234
Negative (<220 RDWI)	7 (FN)	59 (TN)	66
TOTAL	97	303	400

Table no-2: Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) of RDWI to diagnose IDA (n=400)

SENSITIVITY	TP/ (TP+FN)	92.78 %
SPECIFICITY	TN / (FP+TN)	19.47 %
PPV	TP/ (TP+FP)	26.94 %
NPV	TN / (FN+TN)	89.39 %
ACCURACY	(TP+TN)/(TP+FP+TN+FN)	37.25%

There was total 66 patients having <220 RDWI and 7 patients of these 66 patients were having <15 ng/ml serum ferritin. Sensitivity of RDWI to diagnose IDA was as good as 92.78 % in this study. The specificity and positive predictive value were 19.47% and 26.94% respectively. Negative Predictive Value (NPV) of RDWI to diagnose IDA was 89.39 %. were having S.ferritin <15 ng/ml.

Table no. 3 shows comparison of RDWI with RBC indices (Hb, MCV, RBC count and MCH, MCHC, Hct, RDW) in IDA.

Table no- 3: Comparison of Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) of Hb, RBC, MCV, MCH, MCHC, Hct, RDW, RDWI for Serum ferritin

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	ACCURACY
RDWI	92.78%	19.47%	26.94%	89.39%	37.25%
RDW	54.64%	57.42%	29.12%	79.81%	56.75%
Hb(g/dl)	97.9%	49.17%	38.15%	98.67%	61%
MCV(fl)	68.0%	58.74%	34.55%	85.16%	61%
MCH (pg)	67%	61.0%	35.51%	85.25%	62.5%
MCHC	19.58%	90.75%	40.42%	77.90%	73.5%

Hct	93.81%	57.42%	41.36%	96.66%	66.25%
RBC count	72.16%	59.73%	36.45%	87.01%	62.75%

DISCUSSION

The aim of the study is to find out usefulness of RDWI to diagnose IDA in all patients irrespective of the cause of anemia like bleeding, hemoglobinopathy. So we have focused more on RDWI rather than other indices. In present study, sensitivity and negative predictive value (NPV) of RDWI to diagnose IDA was 92.78 % and 89.39 % respectively which is well correlated with other studies mentioned in table no.4.

Table no- 4 : Comparison of Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) of RDWI to diagnose IDA

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Present study	92.78	19.47	26.94	89.39
Jameel et al	88	86	91	88
Nesa et al	84.7	80.7	81.3	80.7
Valiya et al	98	74.72	80.99	97.29
Vibha et al	85	91	-	-
Bhusan et al	63.49	99.66	90.91	98.10
Aysel et al [4]	76.4	83.1	80	80

However specificity and positive predictive value (PPV) of RDWI in our study was 19.47 % and 26.94 respectively which is lower than other studies. Other studies have found specificity and positive predictive value (PPV) of RDWI in range of 74 % to 99 %. The high sensitivity means the index is able to predict more IDA cases. But the low specificity in the present study was due to the inclusion of more patients of anemia of other unknown causes. Discrepancies in present study with other studies could be attributed by SARS covid-19 virus pandemic. The disadvantage of this situation is that more patients of SARS covid-19 and unknown etiology were enrolled in the study.

Ferritin is a key mediator of immune dysregulation, especially under extreme hyperferritinemia, via direct immune-suppressive and pro-inflammatory effects, contributing to the cytokine storm I. In one study with 20 COVID-19 patients, it was found that individuals with severe and very severe COVID-19 exhibited increased serum ferritin^[5].

CONCLUSION

The aims of this study are fulfilled with the following conclusions.

1. Specificity, Sensitivity, Positive predictive value (PPV), Negative predictive value (NPV) of RDWI in diagnosis of IDA is 92.78%, 19.47%, 26.94%, 89.39% respectively.
2. The diagnostic accuracy of RDWI and RDW is 37.25% and 56.75% respectively in cases of IDA.
3. The diagnostic accuracy of RDWI is 37.25% and RBC indices-Hb, MCV, RBC count and MCH, MCHC, Hct, RDW is 61%, 61%, 62.75%, 62.5%, 73.5%, 66.25%, 56.75% respectively.
4. The diagnostic accuracy of Red cell Mathematical formulas-England & Fraser, Mentzer, Srivastva, Shine & Lal, Green & King, Ricerca is 29.25%, 26.5%, 25.5%, 30.7%, 45.25%, 60.75% respectively in cases of IDA.

During study duration, SARS COVID-19 pandemic was active and infected asymptomatic patients have visited our institute for the treatment of other illness. So unavoidable inclusion of these patients in our study may be gave lower diagnostic accuracy than other study. From above conclusions we can use RDWI to screen IDA in non availability of Serum ferritin and when values of RBC indices available from fully automated cell counter^[5].

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