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STUDY ON DIAGNOSTIC PARAMETERS IN WOMEN OF REPRODUCTIVE AGE GROUP SUFFERING FROM IRON DEFICIENCY ANAEMIA

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ABSTRACT

Iron deficiency anemia, the disease characterized by pallor, dyspnea and edema war described in about 1500 B C in the Papyrus Erbs, an Egyptian manual of therapeutics believed to be the oldest complete manuscript. It was believed to be due to the derangement of kapha or phlegm and was manifested by whiteness of the eyes, skin and finger nails. Charaka described another form of 'Pandu roga' associated with the eating of clay. He treated anemia with iron rust pills. Medical historians have attributed this ancient disease to "Ancylostomal Anemia", a form of iron deficiency aneamia . Iron deficiency anemia is the result of severe degree of iron deficiency. Iron deficiency leads to restriction in the production of haemoglobin. It also causes distortion of red cells with microcytosis and hypochromin and produces deleterious effect on health. Serum ferritin is the best investigation for distinguishing those with iron deficiency from those who were not iron deficient. In pregnant women WHO defined Anemia as a reduction in haemoglobin level <11g/dl. It occurs in 40-80% of the pregnant women, besides being second most common cause of maternal deaths, anaemia is a major cause of puerperal sepsis, ant-partum and post-partum hemorrhage and other complications of pregnancy among pregnant females. The present study was undertaken at Major S.D. Singh Medical College Hospital, Farrukhabad. One hundred patients attending Out-patient department were selected for the study. Detailed history was recorded, clinical examination conducted, blood tests including full blood count, platelet count, absolute blood values, blood film examination, serum ferritin levels etc. Study showed that largest (43%) were suffering from moderate anaemia, 72% were having microcytic hypochromic anaemia. Other parameters eg. RBC count, packed cell volume, Mean corpuscular volume, were also found to be much lower in all types of anaemia. Mean Ferritin level in cases of moderate anaemia was 10.8U/L (Normal value-63ug/L), much below the normal values. Platelet count was found to be normal in majority of cases. Present study has shown a slightly lower prevalence of anaemia in comparison to studies carried out earlier, however it corroborates the fact that problem of iron deficieny anaemia is still prevalent in rural areas among pregnant females, where more concerted efforts are needed to improve health of females.

KEYWORDS : Anaemia in Pregnancy, Hemoglobin Levels, Iron Deficiency Anaemia, Serum Ferritin

Iron deficiency anemia, the disease characterized by pallor, dyspnea and edema war described in about 1500 B C in the Papyrus Erbs, an Egyptian manual of therapeutics believed to be the oldest complete manuscript extent (Haniff, 2007) In ancient Indian medicine it is reported that Sushruta described anemia as a form of 'Pandu roga' or Jaundice. It was believed to be due to the derangement of kapha or phlegm and was manifested by whiteness of the eyes, skin and finger nails. Charaka described another form of 'Pandu roga' associated with the eating of clay. He treated anemia with iron rust pills (Ahmad N., 2011).

In 280 A D, Wang Shu-Ho, using the doctrine of 'the Pulse' diagnosed the deficiency of blood by a superficial and weak pulse (Pai PM, 1975).Medical historians have attributed this ancient disease to "Ancylostomal Anemia", a form of iron deficiency aneamia. (Haniff J, 2007). In 16th century all anemias, irrespective of their causes were grouped under same category given the name "chlorosis" by Jean Varandal.

In France, by the middle of seventeenth century, iron salt and other remedies were used in its treatment.In 1747, Menghini for the first time separated iron from blood ash. Lemery and Deoffy in 1773 demonstrated the presence of iron in the ash of blood.

For 100 years between 1830 and 1930, iron was used for treatment of chlorosis. (Haniff J., 2009). By the beginning of the twentieth century, It had been established that chlorosis was characterized by a decrease in the iron content of blood as seen by the presence of hypochromic erythrocytes.

Anemia is defined as "Haemoglobin level in blood below the lower extreme of the normal range for the age and sex of individual (Farkin, 2008).It is reportedly the most common cause of anaemia in general medical practice (Andrews, 2009).

Iron deficiency anemia is the result of severe degree of iron deficiency. Iron deficiency leads to restriction in the production of haemoglobin. It also causes distortion

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of red cells with microcytosis and hypochromin and produces deleterious effect on health (Hercberg, 2001).Yi-chin Haung et al has shown that recurrence and risk of iron deficiency are more prevalent in females (Huang, 2001).

The screening procedure used most often is blood haemoglobin determination values falling below the cutoff point are considered abnormal. WHO cut off points-12gm/dl for non-pregnant women and 11gm/dl for pregnant women (Andrews, 2009) .

Serum ferritin is the best investigation for distinguishing those with iron deficiency from those who were not iron deficient. Appropriate use of serum ferritin would refute diagnosis of iron deficiency without a bone marrow aspirate in 70% of patients (Gordon, 1990).

Highest incidence of IDA is seen in women of reproductive age. The incidence is much higher in underdeveloped countries to developed countries (Sadeghipour, 1996).

According to WHO, in developing countries the prevalence of anaemia among pregnant women averages 56%, ranging between 35 to 100% among different regions of the world. In Asia the prevalence of nutritional anemia is particularly high in countries such as Bangladesh (74-80%), India (34-69%) and Philippines (42-47%). (Burman, 1971). Since several decades it has been known to be an important problem in most tropical countries. The advances made in the therapy of iron deficiency anemia have greatly minimized the problem of this disease (Mennon, 1954).

`Various studies from different regions of country (India) have reported the prevalence of anaemia to be between 33 and 100%.In India, anaemia is the second most common cause of maternal deaths accounting for 20% of total maternal deaths. Anaemia affects mainly the women in child bearing age group, young children and adolescent girls.

Association of anaemia with adverse maternal outcome such as puerperal sepsis, ante-partum haemorrhage, post-partum haemorrhage and maternal mortality is no longer a debatable subject.

Apart from the risk to the mother, it is also responsible for increased incidence of premature births, low birth weight babies and high perinatal mortality (Gautam, 2002).

In pregnant women WHO defined Anemia as a reduction in Haemoglobin level <11g/dl. It occurs in 40-80% of the pregnant women. Iron and Folic acid deficiencies, malaria, intestinal parasitic infections and hemoglobinopathies are the principal causes of anemia in pregnancy (Meda, 1997).

Haemoglobin level at or below 9 gm/dl requires detailed investigations and appropriate treatment.

Anemia due to Iron deficiency is the commonest malnutrition disorder seen throughout the world and in India.

The single most important cause for the widespread Iron deficiency anemia in our country is inadequate iron intake in the habitual diets compared with the poor bioavailability of dietary iron (Gupta R., 2004).

However, risk factors such as Anemia in pregnancy can be controlled and monitored by good antenatal care and appropriate action, including referral, in accordance to the level of severity of the anemia (Ahmad Z., 1997).

Hence the present study is taken to evaluate the occurrence of Iron deficiency anemia among females of reproductive age group with due importance for assessing the serum ferritin levels.

MATERIALS AND METHODS

The present study was carried out in women of reproductive age group (20-40yrs) who attended the outpatient department from December 2013 to December 2014 at Major S. D. Singh Medical College and Hospital, Farrukhabad. Study was undertaken with the following aims and objectives;

- To evaluate the status of iron deficiency anaemia in women of reproductive age group.
- To know the proportion of iron deficiency anaemia in moderate to severe anaemic patients.

A detailed clinical history of each patient was recorded and a through clinical examination was performed.

Venous blood was collected in all women with aseptic precautions in EDTA anticoagulant for hematological investigations. Separate blood sample was collected for biochemical investigations. Serum was

separated on the same day of blood collection and stored in refrigerator between 2 to 8 degree centigrade. Biochemical study was carried out within three days of blood collection. The hematological investigations were performed on Sysmex KX-21 (Transasia Ltd) with standard calibration using fresh whole blood. As a part of CBC, red blood cell indices (MCV, MCH, MCHC), PCV, RDW, white blood cell count and platelet count were obtained by Sysmex KX-21. Serum ferritin estimation done by biochemical method.

Peripheral blood smear study was performed on each of these patients. A good peripheral smear was made and the blood film was stained by Leishman's stain. Staining characteristics and morphological abnormalities of red blood cells were observed. Their distribution, anisocytosis, poikilocytes, elliptical cells, pessary cells, tear drop cells, white blood cell morphology and platelet morphology were observed.

All inpatients and outpatients women in the reproductive age group (20 to 40 years) having a haemoglobin less than 11gm/dl were included in the study. Patients having history of taking supplemental iron during previous year, history of blood transfusion, family history of anaemia, history of receiving oral contraceptive pills (OCP) were excluded from the study.

RESULTS AND DISCUSSION

Detailed results of the study and various laboratory parameters studied, associated with anaemia in study group are represented in tables from 1 to 12. Maximum patients (40%) were in the age group of 20-25 years (Table 1). Highest prevalence (43%) was observed in the age group of 20-25 years, most of the women were suffering from moderate anaemia (Table 2).

Majority of women suffering from various grades of anaemia have reduced (77%) red blood count (Table 3), packed cell volume was also lower than the normal range as represented in table 4.

Mean corpuscular volume (MCV) was much lower in all cases of patients suffering from mild to severe anaemia (Table 5). Values of Red cell distribution width (RDW) were found to be in variance than the normal values (Table 7).

Table 1 : Age Distribution of Patient Studied

Age in Year	No. of Patients	%
20-25	40	40
26-30	20	20
31-35	13	13
36-40	27	27
Total	100	100.0

Table 2 : Type of Anemia Among Various Age Group (N=100)

Age in Year	Mild Anemia	Moderate Anemia	Severe Anemia	Total
20-25	15	20	8	43
26-30	8	8	4	20
31-35	5	5	2	12
36-40	12	10	3	25
P value >0.05				

Table 3: Relation of RBC Count With Severity of Anemia

RBC	Normal	Reduced
Mild (N=40)	12	28
Moderate (N=43)	11	32
Severe (N=17)	00	17
Total	23	77

Table 4 : Relation of Packed Cell Volume (PCV) with Severity of Anemia

	Packed Cell Volume (%) Normal Range: 30.2-42-3%	
	Range	Mean
Mild (N=40)	23.8-38.1	28.9
Moderate (N=43)	18.6-29.9	24.9
Severe (N=17)	10.8-24.1	20.8
Inference- Severity of anemia significantly associated with PCV with P value <0.001		

Table 5: Relation of Mean Corpuscular Volume (MCV) with Severity of Anemia

	Mean Corpuscular Volume(fl) Normal range: 78.6-102.2%	
	Range	Mean
Mild (N=40)	62.1-79.9	71.9
Moderate (N=43)	58-79.8	68.2
Severe (N=17)	53-66	60.3
Inference- Severity of anemia significantly associated with MCV with P value <0.001		

Table 6 : Relation of RDW (Red Cell Distribution Width) with Severity of Anemia

	Range (Normal=11.5-14.5)	Mean
Mild(N=40)	12.9-25.2	17.6
Moderate(N=43)	12.7-27.6	18.4
Severe(N=17)	18.2-24.3	20.2

Table 7 : Comparison Between Mean Corpuscular Volume and Red Cell Distribution Width Values in Various Types of Anemia

Mean	MCV (fl)	RDW (%)
Mild(N=40)	71.9	17.6
Moderate(N=43)	68.2	18.4
Severe(N=17)	60.2	20.2

Table 8: Serum Ferritin Levels in Various Anaemia Groups

Serum Ferritin Normal range:20-110 µg/L	Range(µg/L)	Mean
Normal N=2	20-110	62.75
Mild ↓ N=11	12.1-18	16.88
Moderate ↓ N=42	6.1-12	10.80
Severe ↓ N=17	<6-6	4.87

Table 9: Relation of Platelets With Severity of Anemia

Platelet Count	Normal	Increased	Decreased
Mild Anemia N=40	33	3	4
Moderate Anemia N=43	34	5	4
Severe anemia N=17	13	1	3

Serum Ferritin levels were found to be much lower in patients suffering from various types of anaemia, Mean values were found to be 16.88, 10.8 and 4.87 in mild, moderate and severe cases of anaemia respectively against a normal mean value of 62.75 µg/L (Table 8). Platelet count in most of the cases was found to be within normal range (Table 9).

Table 10 : Relation of MCV-RDW with Serum Ferritin

No. of women (%)	MCV Normal range: 78.6fl-102.2fl	RDW Normal range: 11.5-14.5	Serum Ferritin Normal range: 20-110 µg/L
70	↓	↑	↓
4	↓	N	N
26	↓	↑	-

Table 11 : Correlation of Age With Type of Anemia (N=98)

Age in yrs	Dimorphic Anemia	Normocytic Hypochromic Anemia	Iron deficiency Anemia	P Value
20-25	4(44.4%)	11(57.9%)	26(37.1%)	<0.1
26-30	0(0%)	3(15.8%)	17(24.3%)	
31-35	0(0%)	2(10.5%)	10(14.2%)	
36-40	5(55.6%)	3(15.8%)	17(24.3%)	
Total	9(100%)	19(100%)	70(100%)	

Further analysis of prevalence of various types of anaemia in different age groups as shown in table 11 shows that majority of women in the study group were suffering from iron deficiency anaemia (71.4%) as against (19.4%) from normocytic hypochromic anaemia and 9.2% from diamorphic anaemia, substantiating the fact that Iron deficiency anaemia is the major anaemia among pregnant Indian women of reproductive age group.

DISCUSSION

Anemia is one of the most common medical conditions met during pregnancy.

This was noted in most of the women attending the antenatal clinic. In the present study, Iron deficiency anemia accounted for 71.4%, dimorphic anemia for 9.2% and Normocytic hypochromic anemia accounts for 19.4%.

In the present study, maximum number of cases were observed between 21-30 years accounting for 60% which correlated closely to observations by Ahmad N (51.8%), Pai PM (62%), Haniff J et al (91.5%).

In the present study, keeping haemoglobin standard as 11gm% maximum number of cases was

Table 12: Parameters in women with IDA with raised RDW N=96

	MCV 78.6-102.2FL		RDW(%) 11.5-14.5		Serum ferritin 20-110µg/L	
	Range	Mean	Range	Mean	N=72	
Mild N=40	62.1-79.9	71.9	12.9-25.2	17.6	Mild decrease 12.1-18	16.88
Moderate N=43	58-79.8	68.2	12.7-27.6	18.4	Moderate decrease 6.1-12	10.8
Severe N=17	53-66	60.3	18.2-24.3	20.2	Severe decrease <6	4.87

Table 13 : Age Distribution of Anemic Cases in Comparison With Other Studies

Authors	20-25 yrs	26-30 yrs	31-35 yrs	36-40 yrs
Ahman N	30.9%	20.9%	2.36%	45.84%
Pai PM	48%	14%	13%	25%
Haniff J et al	53.6%	37.9%	4.2%	4.3%
Present Study	**40%**	**20%**	**13%**	**27%**

Table 14 : Comparative Analysis of Degree of Anemia With Other Studies

Authors	Mild Anemia	Moderate Anemia	Severe Anemia
Ratnam R	30.2%	35.8%	3.3%
Ahmad N	30.17%	50.9%	18.9%
Present Study	40%	43%	17%

Table 15 : Type of Anemia in Comparison With Other Study

Authors	Iron Deficiency	Dimorphic	Normocytic hypochromic
Ratnam R	84%	9%	6%
Present Day	**71.4%**	**9.2%**	**19.4%**

Table 16 : Percentage Distribution of Serum Ferritin in Iron Deficiency Anemia Cases in Comparison With Other Studies

Authors	Serum Ferritin (<15µg/l)
Thoradeniya T	74.2%
Zeben VD	90%
Mast AE	73%
Alper BS	54%
Present study	**97.22%**

Table 17: Severity of Iron Deficiency Anemia in Moderate and Severe Anemic Patients in Comparison With Other Study

Authors	Moderate anemia	Severe anemia
Idris M, Rehman AU	43%	25%
Present Day	42%	17%

Table 18 : Sensitivity or RDW in Comparison With Other Studies

Name of Authors	Sensitivity
Bessman JD	100%
Mc Clure S	100%
Flynn MM	94%
Thompson G	71%
Simel DL	77.1%
Present study	**92.2%**

classified as moderate anemia (43%) and minimum number of cases as classified as severe anemia(17%). According to Ratnam R72 keeping standard as 11 gm%, maximum number of cases classified as severe moderate anemia(35.8%) and minimum number of cases classified as severe anemia (3.3%) which was similar to our study. According to Ahmad N keeping standard as 10gm%, maximum number of cases classified as moderate anemia (50.9%) and minimum number of cases classified as severe anemia(18.9%).

The present study shows maximum number of cases classified as Iron deficiency anemia (71.4%) and minimum number of cases classified as dimorphic anemia (9.2%). According to Ratnam, maximum number of cases classified as Iron deficiency anemia (84%) and minimum number of cases classified as normocytic hypochromic anemia(6%).

Serum Ferritin standard is taken as 20-110 µg/l (by turbilatex ferritin, spinreact-kit method). In the present study serum ferritin were less than 18µg/l in 97.22% cases. So present study correlates with Zeben VD (90%), Thoradeniya T (74.2%), Mast AE (73%), Alper BS (54%). The above studies done by various authors, have considered serum Ferritin levels <15µg/l to be indicative of iron deficiency anemia. Other studies also showed that serum Ferritin levels are useful in determining iron deficiency cases.

Jean pinter et al in their study concluded that the importance of serum ferritin levels provides a clear separation between Iron deficiency anemia (below 20µg/l) and thalassemia major (more than 500µg/l).

Idris M, Rehman AU found that maximum number of cases had moderate iron deficiency anemia (43%) and severe iron deficiency anemia (25%) which was similar to present study.

Hence, iron deficiency anemia is more common in moderate to severe anemic patient when compared to mild anemic patients.

In the present study we have found that RDW increased in 96 cases and in 4 cases it was normal. Our study correlates well with the work of other authors (Table 18). Bessman found sensitivity of RDW to be100%. Mc Clure found it to be 100%. Flynn MM found RDW sensitivity as 94%, Thompson as 71%, whereas Simel found RDW sensitivity to be 77.1%.

Varying selection criteria for cases to be included in the study was probably the contribution factor to the variability in sensitivity of RDW.

Beutler E, in his series of 80 patients with iron deficiency anemia, forund out that in most of his patient's red cell indices indicated the presence of hypochromasia and micocytosis. Among the less severely anemic patients normal red cell indices were common and examinations of stained smears were not superior to determination of red cell indices. The examination of stained smears was important but could not exclude the diagnosis or iron deficiency anemia on the basis of normal appearance of red cells on smear examination alone. This was particularly true in mildly anemic patients.

In present study of 100 women, 85 women had low MCV values and 15 women had normal MCV values, the mean MCV values was decreased as the severity of anemia increased from mild, moderate and severe.

In present study of 100 women, 88 women had low PCV values, 12 women had normal PCV values and the mean PCV values was decreased as the severity of anemia increased from mild to moderate to severe anemia.

In this study examination of stained peripheral smears revealed a microcytic hypochromic anemia in 72 women (72%). Thus our study is in accordance with the study done by Beutler E.

Jen P, in their study concluded that blood smear examination performed no better than RBC indices in detecting probable iron deficiency anemia.

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