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Original Article

Relation of Iron Deficiency Anemia in Pre-Menopause Women with Calcium and Vitamin D Levels at Teaching Hospital

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ABSTRACT

Background: Iron deficiency anemia (IDA) is a common condition influenced by various factors, such as age, symptom duration, and other biochemical markers. Premenopausal women often experience premenstrual syndrome (PMS), which is frequently associated with reduced blood levels of calcium and vitamin D. Given the worldwide public health concern of osteoporosis, understanding lifetime preventive measures is crucial.

Methods: This study aimed to explore the relationship between IDA and various clinical characteristics in 161 participants. We evaluated parameters including age, symptom duration, and levels of calcium and vitamin D to identify potential associations with IDA. Data for the 161 patients were collected using a predesigned proforma, as approved by the ethics committee. The Chi-square test was employed to determine statistical significance, with a P-value threshold set at 0.05.

Results: The average age of participants was 38.6 years, with the majority (58.4%) reporting symptoms for an average duration of 58.4 months. Among them, 54% had confirmed cases of IDA. However, there was no significant age-related correlation with IDA. Notably, a strong correlation was observed between IDA and low vitamin D levels, which were present in 79.8% of the patients. Conversely, no significant relationship was found between calcium levels and IDA.

Conclusion: Current research underscores the complex interplay between IDA and various clinical factors. Low vitamin D levels appear to be strongly linked with IDA, whereas age and symptom duration are not reliable indicators of the condition. This emphasizes the importance of considering multiple factors in the diagnosis and treatment of IDA, particularly focusing on the potential role of vitamin D in its pathogenesis. Further prospective studies are needed to confirm and expand upon these findings, potentially leading to improved treatment and diagnostic strategies for patients with IDA.

Keywords: Iron Deficiency Anemia, Premenopausal Women, Calcium, Vitamin D, Symptoms, Osteoporosis Prevention.

INTRODUCTION

Iron deficiency, particularly prevalent among young girls and women due to physiological changes and menstruation, is a leading health concern(1). Anemia, a condition often resulting from iron deficiency, can arise from various factors such as dietary insufficiencies, impaired iron absorption, monthly menstrual blood loss, eating disorders, acute and chronic infections, parasitic infestations, and genetic disorders(2). Iron deficiency anemia (IDA) can significantly impact physical functioning, reduce resistance to infections, and impair cognitive abilities and professional performance(2, 3). The World Health Organization reports that over 49% of school-aged children and approximately 42.3% of women aged 15 to 59 in developing countries suffer from iron deficiency anemia. Despite initiatives like nutrition education, parasitic infection treatment and prevention, and the provision of weekly iron supplements, anemia in adolescent girls remains a significant global health challenge(4, 5). Inadequate diagnosis and treatment of iron deficiency in females can lead to severe, long-term health consequences. Among premenopausal women, heavy menstrual bleeding is a common cause of anemia, with 5% to 10% of women in this group presenting with IDA linked to menstrual issues(1, 6). Premenopause typically begins between the ages of 35 and 39, marked by reduced fertility and fecundity as early indicators of ovarian follicle depletion and dysfunction, although monthly cycles may continue(7, 8).

Vitamin D, a fat-soluble vitamin, is essential for maintaining calcium-phosphate balance. Its deficiency can lead to rickets in children and osteomalacia in adults(9, 10). Numerous studies have discussed the role of vitamin D deficiency as a risk factor for infections

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such as tonsillitis, sepsis, influenza, and urinary and vaginal infections(11, 12). Vitamin D is crucial for producing chemokines and regulating immune responses(13, 14). Vitamin D Receptors (VDRs) are present in B & T lymphocytes and dendritic cells, playing a role in immune response regulation. Macrophages, also equipped with VDRs, receive an oxidative boost from vitamin D(15, 16). Research has shown that vitamin D enhances the body's cathelicidin activity, which plays a significant antibacterial role(17, 18).

MATERIAL AND METHODS

This cross-sectional study was conducted from January to November 2023 at the Gajju Khan Medical College and Bacha Khan Medical Complex Teaching Hospital's Gynecology Outpatient Department (OPD). Institutional Ethical Committee approval was obtained prior to initiating the study. Informed consent was provided by all participants after being briefed about the study's objectives and methods. Confidentiality regarding the use of participants' data for research and educational purposes was assured.

A non-probability consecutive sampling method was employed to enroll a total of 161 patients for the study. Visitors to BKMC's medical OPD were invited to participate. Data collection involved a comprehensive approach that included gathering demographic information, conducting physical examinations, and completing a predesigned proforma(19). This proforma was administered to enrolled patients to gather relevant data on their clinical characteristics and medical history. A questionnaire was distributed to female participants to collect information on socioeconomic status, educational background, contraceptive use, abortion history, marital status, and parity. Menopausal women were identified and excluded from specific analyses based on their menopausal status. The date of the last menstrual cycle of premenopausal women was recorded(20).

Pathological investigations were carried out by the hospital's pathology department. The study evaluated the levels of calcium, vitamin D, and iron deficiency anemia in the recruited patients. Data analysis was performed using IBM SPSS software, version 24.0. To explore associations between premenopausal symptoms and various characteristics, continuous variables were summarized, frequencies were calculated, and the Chi-square test was utilized. A p-value of 0.05 or lower was considered statistically significant(20).

RESULTS

In current study examining the relation of Iron Deficiency Anemia (IDA) in pre-menopausal women with Calcium and Vitamin D levels at a teaching hospital, various demographic and clinical variables were analyzed across 161 participants. The average age of the participants was 38.6 years, with a standard deviation of 1.1811. For the duration of complaints, the majority (58.4%) were under 40 years of age, while 41.66% were above 40.

Regarding IDA, 54% of the cases were confirmed (valid), while the remaining 46% were not. Calcium levels were found to be decreased in only 6.2% of the participants, with the vast majority (93.8%) having normal levels. Vitamin D levels, however, presented a different picture, with 55.3% of participants showing decreased levels and 44.7% having normal levels.

In terms of age group, there was no significant difference in the prevalence of IDA between those below 40 years (56%) and those above 40 (52.3%), with a p-value of 0.641. When examining the duration of complaints, 52.6% of women with complaints less than 5 months had IDA, compared to 61.5% of those with complaints lasting more than 5 months, though this difference was not statistically significant (p-value = 0.400).

A closer look at the relationship between calcium levels and IDA revealed that 70% of participants with decreased calcium levels had IDA, compared to 53% of those with normal calcium levels, a difference that was not statistically significant (p-value = 0.287). However, a stark contrast was noted in vitamin D levels; 79.8% of participants with decreased vitamin D levels had IDA, while only 22.3% of those with normal vitamin D levels had IDA, indicating a significant association (p-value = 0.00).

These findings suggest a complex interplay between IDA and vitamin D levels, particularly in pre-menopausal women, while the relationship between IDA and calcium levels appears less pronounced.

Table 1: Age, Complaint Frequency Mean and Standard Deviation

	N	Mean	St div
Age	161	38.6	1.1811
Duration of complaint			
Below 40	94	58.4%	
Above 40	67	41.66%	

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Table 2: Variables With Details

		Frequency	Percentages
Iron deficiency anemia	Valid	87	54%
	Non valid	74	46%
Calcium level	Decrease	10	6.2%
	Normal	151	93.8%
Vit D level	Decrease	89	55.3%
	Normal	72	44.7%

Table 3: Iron Deficiency Anemia

		Iron deficiency anemia			P-value
		Yes	No	Total	
Age group	Below 40	42(56%)	33(44%)	75(100%)	0.641
	Above 40	45(52.3%)	41(47.7%)	86(100%)	
Complaints	<05 months	71(52.6%)	64(47.4%)	135(100%)	0.400
	>05 months	16(61.5%)	10(38.5%)	26(100%)	

Table 4: Variables Versus Iron Deficiency Anemia

Variables		Iron deficiency anemia			P value
		Yes	No	Total	
Calcium level	Decrease	7(70%)	3(30%)	10	0.287
	Normal	80(53%)	71(47%)	100%	
Vit d level	Decrease	71(79.8%)	18(20.2%)	89	0.00
	Normal	16(2.3%)	56(77.8%)	72	

DISCUSSION

In the current study comprising 161 patients, the average age was 38.6 ± 1.811 years, with an average complaint duration of 6.83 ± 4.24 months. Current study analysis did not reveal a strong correlation between the presence of iron deficiency anemia (IDA) and age groups (below and above 40 years). The prevalence of IDA was relatively similar across both age groups, with 67 (41%) women over 40 and 94 (58.4%) under 40. Regarding calcium levels, 10 (6.2%) participants had a history of low calcium levels, in contrast to 151 (93.8%) without such a history. This study did not find a direct correlation between the duration of symptoms and the presence of IDA. Although there is a marginally higher percentage of anemia cases in complaints lasting over five months, the difference is not significant.

Previous research suggests that vitamin D deficiency can influence susceptibility to infections and response to antibiotic treatment. In current study, IDA did not show a significant correlation with calcium levels. However, there was a notable association with vitamin D levels, where a majority of patients with IDA also had lower vitamin D levels. Specifically, 89 (55.3%) of the female patients had lower vitamin D levels, while 72 (44.7%) had normal levels. This finding indicates that premenopausal women often experience vitamin D deficiency, which is a crucial factor affecting bone health. Vitamin D deficiency leads to decreased bone mineral density

(BMD) and a heightened risk of osteoporosis. It results in increased parathyroid hormone (PTH) release, thereby accelerating bone resorption and rapid bone turnover(21).

The age distribution of current study participants was similar to that in the 2018 study by Jackson RT et al., which assessed a comparable age group(17). In current study findings, among women under 40 years, 42 (56.0%) had IDA, while 33 (44.0%) did not. In the over 40 age group, IDA was present in 45 (52.3%) and absent in 41 (47.7%) patients, a difference that was not statistically significant (p-value = 0.641). Further, out of 151 individuals with varying calcium levels, IDA was present in 71 (47.0%) and absent in 80 (53.0%), indicating no significant difference (p-value = 0.287). Among women with a complaint duration of less than 5 months, 71 (52.6%) had IDA, compared to 64 (47.4%) with a complaint duration of more than 5 months. Of the patients who had symptoms for more than 5 months, 16 (61.5%) developed IDA, whereas 10 (38.5%) did not, a difference with minimal significance (p-value = 0.400). Current study also observed a low frequency of severe vitamin D deficiency among premenopausal women(22, 23).

CONCLUSION

Current study reveals that while age and symptom duration are not significant predictors of iron deficiency anemia (IDA), there is a notable link between reduced vitamin D levels and IDA. This highlights the importance of considering a range of factors in diagnosing and treating IDA, especially the role of vitamin D. The findings suggest a need for more research to develop better diagnostic and treatment methods for IDA. Additionally, the study points to a potential increased risk of osteoporosis in premenopausal women in Mardan, particularly those over 40, due to low levels of vitamin D and calcium. We recommend regular monitoring of serum 25(OH)D levels and advise women to consider calcium and vitamin D supplementation, dietary changes, and sun exposure to reduce these risks.

This study is limited by its small sample size, which may not fully represent the broader population. Another limitation is the study's focus on a single educational facility; future research would benefit from being conducted across multiple facilities with diverse clinical characteristics. Additionally, assessing the quality of life of participants using a disease-specific questionnaire would provide more comprehensive insights. The cross-sectional design of this study limits the ability to establish causal relationships. There is also a risk of selection bias due to the use of convenience sampling. Lastly, the single-center nature of this study may limit the generalizability of current study findings. Therefore, future studies should aim to include a more diverse and larger sample size, encompassing multiple centers to enhance the applicability and validity of the results.

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