DOI Number: 10.37506/v14/i1/2020/ijfmt/192990

Evaluation of Some Blood Parameters in Anemic Patients in Relation to Periodontal Condition

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Abstract

Background: Periodontal diseases are the inflammatory process result from microbial-host interaction in the tissues surrounding the teeth. Gingivitis and periodontitis are the most common type of periodontal diseases. Anemia of the chronic disease(ACD) is common health problem occur in patients with acute or chronic activation of immune system and production of inflammatory cytokines, so it is resemble to periodontal diseases from this aspect.

Aims of the study: To compare the clinical periodontal parameters (plaque index(PLI), gingival index(GI), bleeding on probing(BOP), probing pocket depth(PPD) and clinical attachment level(CAL)) and the levels of hemoglobin(Hb), mean cell volume(MCV), and Mean corpuscular hemoglobin(MCH) in blood, and correlate them in patients with gingivitis, chronic periodontitis(CP) and clinically healthy periodontium.

Materials and method: 90 subjects included in the study with age range from 30-50 years old. There were divided into three groups: 30 patients with chronic periodontitis, 30 patients with gingivitis, and 30 subjects with clinically healthy periodontium. Blood samples were collected from the subjects for automated blood analyzer to determine the levels of Hb, MCV, and MCH, after clinical periodontal examination was done for(PLI,GI,BOP,PPD, CAL).

Results: statistically highly significant differences among the groups (Gingivitis and chronic periodontitis) in PLI, GI and BOP score1**.** The highest mean value of Hb shown in control group(15.33) while the highest mean value of MCV demonstrated in gingivitis group(87.44) and the highest mean value of MCH demonstrated in control group(32.09). The correlation of Hb, MCV, and MCH with clinical periodontal parameter shown almost weak negative correlation.

Conclusion: the periodontal diseases like other inflammatory diseases can lead to development of anemia type(anemia of chronic disease)and the severity of disease increase with increase the severity of periodontal diseases.

Kay Words: *periodontal diseases, Anemia of the chronic disease, HB, MCV, MCH.*

Introduction

Periodontal diseases(PD) are group of inflammatory diseases result from the interaction of periodontal pathogenic bacteria with host, which cause damaging in the tooth supporting tissues[1]. Dental plaque is the main etiological factor of the periodontal diseases, which is a diverse community of microorganisms found on the tooth surfaces as a biofilm[2]. Gingivitis is the reversible inflammatory and more stable type of periodontal disease, characterized by the inflammation of soft tissues surrounding the teeth without formation of pocket and loss of attachment[3]. Periodontitis is a chronic irreversible inflammation caused by specific periodontic pathogenic bacteria mainly anaerobic that accumulate subgingivally in the periodontal pocket. These bacteria and their product (protease, hyaluronidase collagenase, and other endotoxin) cause destruction of alveolar bone and periodontal ligament (PDL)[4,5] , that result periodontal pocket or gingival recession or both and may be lead to loss of tooth[6]. Anemia of the chronic disease (ACD) is the second most prevalent type of anemia after iron deficiency anemia, as a result of neoplastic

conditions, or inflammatory or chronic infection where the bone marrow do not affected and there is a sufficient amount of vitamins and iron that stored[7]. This type of anemia characterized by increase production of pro-inflammatory cytokines like: interferon, tumor necrosis factor(TNF-α) and interleukin 1(IL-1)[8] .The microorganisms or their toxin of the periodontal diseases penetrate the protective barrier of sulcular and junctional epithelium into blood stream cause direct systemic effect (dysfunction or injury of endothelial) or indirectly by their lipopolysaccharides(LPS) which provoke the immune response and produce inflammatory cytokines, so the periodontal diseases resemble other chronic infection can be lead to systemic disease like anemia. This elevation in the production of pro-inflammatory cytokines, lead to change in the iron homeostasis, erythroid progenitor proliferation, production of erythropoietin and the life span of erythrocytes, all of these can be lead to development of ACD[9].

The aim of the present study, evaluate and compare the relationship between the different types of periodontal diseases and anemia by estimation the levels of some blood parameters look like hemoglobin(HGB), mean cell volume(MCV),and mean corpuscular hemoglobin(MCH), to find if the periodontal diseases with different kind of severities can lead to ACD.

Materials and Method

This study is a case-control study, included 90 samples(males and females), age range from(30-50) years old. They were selected from the department of periodontology at Teaching Hospital of College of Dentistry, University of Tikrit and from laboratories of Salah Al-Din Hospital in Tikrit for 3 months from January to March. The inclusion criteria included in the study were : all teeth included in the measurement except third molar teeth, there were at least twenty teeth exist for each patients, should be systemically healthy subjects, the patients with chronic periodontitis must had a probing pocket depth at least ≥4mm for four sits and clinical attachment loss at least 1-2mm, while the patients with gingivitis should had signs and symptoms of gingival inflammation(redness, swelling, bleeding on the probing, other) without loss of the alveolar bone, all these designed according to international classification of periodontal diseases[10,11]. The subjects that classified, as a healthy periodontium should had no signs and symptoms of gingival inflammation and no pocket formation or clinical attachment loss. The exclusion criteria of the study were: smokers, alcoholism, patients subjected to periodontal treatment and/or received course of antimicrobial, anti-inflammatory, or other medication for treatment of anemia in the three month prior to the study and had other systemic diseases. Subject's agreement documented by signing on specially designed informed consent. Patients shared in the study had been divided into three groups: group of 30 patients had chronic periodontitis, group of 30 patients had gingivitis and control group consist of 30 subjects with clinically healthy periodontium. Full information for all participants were taken through specially designed case sheet. 5ml venous blood was collected by using 20-gauge needle with 5 ml syringe under aseptic field from ante - cubital fossa for each subject after the measurement of clinical periodontal parameters by using graduated Michigan O periodontal probe that included (plaque index (PLI)[12] , Gingival index (GI)[12] , bleeding on the probing (BOP)[3], probing pocket depth(PPD)[3] , clinical attachment loss[13]), for four sits (mesial, distal, lingual/palatal, buccal/labial). The collected blood put in the Ethylene diamine tetra acetic acid tube then blood analysis were done for Hb, MCV, MCH. The statistical analysis used in the study were mean, mean percentage, standard deviation(SD), Kruskal-Walis H test, and Simple person's correlation coefficients (r). In the statistical tests, the levels of significant(S) when $0.05 \geq P \geq 0.01$, non-significant (NS) when $P > 0.05$, while highly significant (HS) when $P \leq 0.01$.We certify that this study involving human subjects is in accordance with the Helsinki declaration of 1975 as revised in 2013 and that it has been approved by the relevant institutional Ethical Committee[14]. .

Results

The results in table(1) shows that the high mean value of age parameter appear in CP group(42) and the lowest mean value in control group(31).Table (2) revealed that there are statistically highly significant differences among the groups(Gingivitis and chronic periodontitis) in PLI, GI and BOP score1, also table(3) shown statistically highly significant differences among the groups in Hb, MCV, and MCH. The highest mean value of Hb shown in control group (15.33) and the lowest mean value shown in CP group(10.45). The highest mean value of MCV demonstrated in gingivitis group(87.44) and the lowest mean value demonstrated in CP group(81.43).The highest mean value of MCH shown in control group(32.09) and the lowest mean value demonstrated in control group(22.54) in table(3).

Table(4) revealed, almost non-significant weak correlation of Hb with PLI, GI, BOP, PPD as well as CAL, however the control group in GI show weak positive correlation with Hb. Almost non-significant weak correlation of MCV in all groups with PLI, GI, BOP, PPD and CAL, demonstrated in table(5). Weak positive correlation of MCH with PLI shown in chronic periodontitis group while the other index revealed weak negative correlation with MCH in table(6).

Table (1): Descriptive statistics of age parameter for the study group and control group.

Groups	**NO.**	**Mean**	**SD±**
Chronic periodontitis	30	42	0.24
Gingivitis	30	35	0.36
Control group	30	31	0.54

Table (2): Statistical analysis of clinical periodontal parameters for gingivitis and chronic periodontitis group.

	PLI		**GI**		**BOP score1**		**PPD**		**CAL**	
	mean	±SD	mean	±SD	Mean %	±SD	mean	±SD	mean	±SD
Chronic periodontitis	2.03	0.32	1.73	0.37	35.1	10.12	4.53	0.51	2.68	0.306
Gingivitis	0.81	0.63	1.23	0.45	12.43	9.02	-	-	-	-
Control group	0.28	0.12	0.42	0.13	-	-	-	-	-	-
Kruskal-Wallis H test without control group	89.34		67.21		55.03		-		-	
P-value	HS		HS		HS		-		-	
Sig.	0.000		0.000		0.000		-		-	

Table (3):Statistical analysis of hemoglobin(g/dl), MCV(FL.), and MCH(Pg.)

In blood for gingivitis, chronic periodontitis and control group.

Groups	**HB**		**MCV**		**MCH**	
	mean	±SD	mean	±SD	mean	±SD
Chronic periodontitis	10.45	1.09	81.43	3.31	22.54	2.54
Gingivitis	12.61	1.32	87.44	4.06	25.32	2.15
Control group	15.33	1.29	85.21	4.23	32.09	2.56
Kruskal_Wallis H test without control group	0.453		0.765		0.829	
P-value	0.000		0.000		0.000	
Sig.	HS		HS		HS	

Table (4):Correlation between hemoglobin (g/dl) level with clinical periodontal parameter of gingivitis, chronic periodontitis and control group

Groups	**PLI**			**GI**			**BOP score1**			**PPD**			**CAL**		
	r	P	Sig.	r	P	Sig.	r	P	Sig.	r	P	Sig.	r	P	Sig.
Chronic periodontitis	-0.321	0.604	NS	-0.631	0.419	NS	-0.381	0.421	NS	-0.406	0.316	NS	-0.241	0.094	NS
Gingivitis	-0.036	0.123	NS	-0.143	0.106	NS	-0.345	0.230	NS						
Control group	-0.007	0.074	NS	-0.019	0.053	S	-0.213	0.187	NS						

Table (5): Correlation between MCV (FL) level with clinical periodontal parameter of gingivitis, chronic periodontitis and control group.

Groups	**PLI**			**GI**			**BOP score 1**			**PPD**			**CAL**		
	r	P	Sig.	r	P	Sig.	r	P	Sig.	r	P	Sig.	r	P	Sig.
Chronic periodontitis	-0.213	0.091	NS	-0.670	0.061	NS	-0.421	0.083	NS	-0.502	0.134	NS	-0.321	0.170	NS
Gingivitis	-0.401	0.321	NS	-0.431	0.291	NS	-0.351	0.122	NS						
Control group	-0.451	0.241	NS	-0.356	0.153	NS	-0.241	0.042	S						

Table (6):Correlation between MCH (Pg.) level with clinical periodontal parameter of gingivitis, chronic periodontitis and control group.

Groups	**PLI**			**GI**			**BOP score1**			**PPD**			**CAL**		
	r	P	Sig.	r	P	Sig.	r	P	Sig.	r	P	Sig.	r	P	Sig.
Chronic periodontitis	-0.390	0.056	S	-0.179	0.533	NS	-0.152	0.654	NS	0.530	0.171	NS	0.232	0.543	NS
Gingivitis	-0.033	0.752	NS	-0.102	0.732	NS	-0.219	0.123	NS						
Control group	-0.019	0.024	NS	-0.185	0.321	NS	-0.233	0.932	NS						

Discussion

The results showed that the lowest mean value of age parameter appear in the control group while the highest mean value demonstrate in chronic periodontitis group and this may be due to that the incidence of CP is usually associated with old age [15]. The highest mean value of PLI showed in CP group compared to that in other study group with highly significant differences among the study and control group. Dental plaque has important role in the pathogenesis of periodontal diseases, because it is considered the primary cause of gingivitis and with subsequent accumulation of biofilm in inadequate oral hygiene and absence of mechanical plaque control lead to progression of gingivitis to periodontitis [16].

The highest mean value of GI and BOP score1 revealed in CP group with highly significant difference among the study and control group, and this due to the accumulation of plaque result in alteration of gingival index and beginning of disease process with all signs and symptoms of gingivitis and subsequent development of CP [17]. The lowest mean value of HB, MCV and MCH showed in CP group with highly significant difference among the study group and control group, this due to that the periodontitis caused by specific types of microorganisms mainly gram negative, anaerobic bacteria with high percentage of spirochetes accumulate in gingival sulcus in the periodontal pocket [18], the actual active sits of connective tissue loss showing have a high percentage of *P.gingivalis(P.gingivalis), Aggrigatibacter actinomtcetemcomitance(A.a)*, *Campylobacter rectus(C. rectus),* and etc. ,when it is compared with non-active sits that do not have loss of attachment[19].

These Mo. liberate toxic substances such as lipopolysaccharides, protease, collagenase and other that motivate the innate and adaptive immune system of the host[20]. Antigen presenting cells such as dendritic cells, B cells, and macrophage begin to interact with T cells that lead to differentiation of plasma cells and produce of chronic lesion with beginning the signs and symptoms of inflammation [21]. All these process lead to release of inflammatory cytokines in blood such as TNF-α, IL-6, IL-8 and other from various cells like monocytes, macrophage, fibroblast. The liberation of these cytokines (interleukins' and TNF-α) lead to bone and attachment loss and construes the pathogenesis of periodontal diseases [22, 2].

Previously chronic inflammation or infection may be interpret the underlying cause of ACD, and increase some of inflammatory cytokines such as TNF-α, IL-1 are observed in ACD. These cytokines lead to decrease the life span of RBC and impair erythroids development and reduce erythropoietin response to anemia and abnormality of iron store, in addition the increase production of inflammatory cytokines inhabit the maturation and differentiation of erythrocytes[23,24]. .

Because of the same cytokines observed in ACD and periodontitis and the treatment of periodontal diseases show the improvement of anemia, can proposed the relation between these two diseases, and this agree with Yamamato et al. [25], and Naik et al. [26], this determine the association between blood parameters and periodontitis which the aim of the study. While the almost weak non-significant correlation showing in the study may be due to the small human sample size of data.

So, we can concluded that the periodontal diseases like other inflammatory diseases can lead to development of anemia type(anemia of chronic disease) and the severity of disease increase with increase the severity of periodontal diseases because decrease erythroid proliferation in bone marrow and life cycle of red blood cells decrease because the cytokines prevent release the erythropoietin from kidney[27].

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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