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Periodontal Status of Chronic Renal Failure Patients Receiving Hemodialysis

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Host factors such as systemic diseases, genetic polymorphism or drug usage play a major role in the pathogenesis of periodontal disease by modifying the host response to periodontal infection or altering the susceptibility to infection by periodontal organisms. This study was designed to evaluate the clinical response of patients receiving hemodialysis to existing microbial dental plaque.

Gingival Index (GI) and Plaque Index (PI) scores and probing depths (PD) were recorded for the entire dentition on 36 chronic renal failure patients receiving hemodialysis (H) and 36 systemically healthy individuals (C), matched with the patient group, based on age and extent of plaque accumulation.

No statistically significant difference was observed in the clinical parameters between the two groups (PI: t=1.69 p= 0.096; GI: t=1.057 p=0.294; PD: t=0.01 p=0.99).

In the present study, H patients revealed a similar response to existing bacterial plaque and their periodontal status was comparable to that of the control group. Although patients receiving hemodialysis have been suggested to present a certain degree of immunosuppression, based on the findings of the present study chronic renal failure does not seem to be an additional risk factor for more severe periodontal destruction.

Key Words: Chronic renal failure, hemodialysis, periodontal status

INTRODUCTION

Chronic renal failure is a progressive disease that is characterised by the destruction of the kidneys' functional units, nephrons. Primary reasons for this destruction are diabetes, pyelonephritis, glomerulonephritis, nephrosclerosis, polycystic kidney disease, and collagen vascular disease.[1] Nephrons do not regenerate once destroyed, and the kidney attempts to compensate via hypertrophy of the remaining functional nephrons, thereby maintaining renal function until approximately half of the nephrons are destroyed. Loss of renal function arises with the accumulation of metabolic waste products and with the changes in the normal hemostatic mechanisms that control water and electrolyte balance.[2]

In order to prolong life, dialysis as an artificial means of removing nitrogenous and other toxic products of metabolism from the blood is the treatment of choice.[3] However, all the improvements in techniques of dialysis are in fact only temporary treatment forms until renal transplantation, which is the ideal mode of treatment for chronic renal failure.[4]

Developments overcoming two major obstacles; allograft rejection and infection, have resulted in a significant degree of success in modern transplantation. However, immunosuppression therapy can cause lowered host resistance, which can predispose patients to infection.[5] Actually, one of the major complications in transplant patients is sepsis.[6] Hence, treatment of a patient before transplantation must include elimination of the active infection and minimisation of the possibility of infection after transplantation.[4]

The circumscribed area of tissue infected with exogenous pathogenic micro-organisms which is usually located near a mucous or cutaneous surface is called the 'Focus of infection', while 'Focal infection' refers to the metastasis from the focus of infection by organisms or their toxins that are capable of insuring tissue. Studies are available

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underlining the importance and the impact of oral foci of infection in renal transplantation patients.[4] It has also been revealed that periodontal disease and poor oral health increase the rate of bacteraemia even when no dental procedure is performed.[7]

This study was designed to evaluate the clinical periodontal status of patients receiving hemodialysis, and the potential for chronic renal failure, as an aggravating or contributory factor, to lead to more severe periodontal destruction.

MATERIALS AND METHODS

Experimental groups

This study was conducted on two groups: patients with chronic renal failure receiving hemodialysis (H) and healthy control subjects (C). The H group consisted of 47 patients currently receiving hemodialysis therapy in Cumhuriyet University Faculty of Medicine Hemodialysis clinics. After 11 of them were excluded due to either being edentulous or unwilling to participate in the study; 36 (20 male 16 female) patients remained in the H group. Age distribution of this group is shown in Table 1.

In order to determine the effect of the duration of hemodialysis on clinical periodontal status, the H group was further divided into 3 subgroups as described by Naugle et al.[8]: 1) those who have been on renal dialysis for less than one year, 2) those who have been on renal dialysis for 1 to 3 years, and 3) those on renal dialysis for longer than 3 years.

The control group consisted of 36 (20 male 16 female) patients, who attended the Cumhuriyet University Faculty of Dentistry Department of Periodontology for periodontal treatments and who were otherwise healthy. The control group were matced with the H group in age, sex and Plaque Index (PI).[9]

None of the patients had received antibiotic or periodontal therapy for at least six months and there was no history of previous treatment for their renal failure.

Written informed consent was obtained from all participants.

Clinical studies

After explaining the experimental design to the participants, Gingival Index (GI) scores, PI[9] scores and Probing depths (PD) were recorded for the entire dentition of all participants. All clinical measurements were performed by the same clinician.

GI based on a scale of 0 to 3, has been widely used in a number of clinical studies to assess inflammation. A score of 0 indicates clinically healthy gingiva, 1 mild inflammation, 2 moderate inflammation and 3 severe inflammation.

PI based on the amount of microbial dental plaque on tooth surface and uses a 0 to 3 scale. A score of 0 indicates no plaque on the tooth, 1 hardly visible thin film of plaque, 2 moderate plaque at gingival margin, and 3 heavy plaque extending into the interdental area.

Periodontal probing was performed on 6 sites on every tooth with the help of periodontal probe. Probing depth is the clinical measurement of periodontitis and directed primarily toward evaluating the position of the epithelial gingival attachment level with the tooth surface. Episodic loss of attachment and an increase in the attachment following therapy at various sites in the mouth can be evaluated with repeated periodontal probing.

Statistical analysis

Student t-test was used to analyse the difference between the means of the two groups regarding clinical parameters. One-way analysis of variance (ANOVA) was used to determine the differences in clinical parameters among subgroups. All analyses were made at the 0.05 level of significance.

RESULTS

Mean ± S.D. values for age, PI, GI and PD scores are shown in Table 1. No statistically significant difference was observed in age, GI, PI or PD between the H and C groups. (age: t=0.062, p=0.951; PI: t=1.69 p=0.096; GI: t=1.057 p=0,294; PD: t=0.01 p=0.99). (Table 1)

Means and S.D. for age, PI, GI and PD of the

subgroups are shown in Table 2. Among subgroups no statistical difference was found in age, GI, PI or PD.(Age: f=2.27, sig=0.8; PI: f=0.43 sig=0.65; GI: f=1.22 sig=0.307; PD: f=1.516 sig=0.234). (Table 2)

Both groups were pooled and tabulated in group form as described by Naugle, et al.[8] (Table 3).

Table 3 shows that none of the patients receiving hemodialysis displayed clinical periodontal health characterised as the absence of gingival inflammation, suggesting various degrees of periodontal involvement in 100% of the sample. The most common form of the periodontal disease in the group was mild to moderate severe gingivitis found in 16 (44%) patients.

DISCUSSION

Altered cellular immunity together with malnutrition resulting from protein restricted diets leads to an immunodeficient state in chronic systemic uremia.[10,11] Several studies indicated that, serum concentrations of IgG, IgM and IgA are subnormal in one third of these patients, and that complement C3 levels are reduced in 90%.[12] However, in accordance with the results of Oshrain, et al.[13] and Yamalik, et al.,[14] we found no statistical significance in GI and PD scores between patients

Table 1. Data Regrading Age, GI, PI and for Hemodialysis and Control Groups (Mean ± S.D.)

Group	n	Age	PI	GI	PD (mm)
Hemodialysis	36	50.4 ± 14.2	2.2 ± 0.6	1.5 ± 0.3	1.8 ± 0.6
Control	36	50.2 ± 12.4	1.9 ± 0.6	1.4 ± 0.5	1.8 ± 0.8

Table 2. Data Regarding Age, GI, PI and PD Scores of the Subgroups Based on Duration of Hemodialysis (Mean ± S.D.)

Group	n	Age	PI	GI	PD (mm)
Less than 1 year	11	44.8 ± 14.6	2.11 ± 0.7	1.49 ± 0.4	1.59 ± 0.7
1 to 3 years	13	58.5 ± 13.5	2.13 ± 0.5	1.59 ± 0.3	1.86 ± 0.5
Greater than 3 year	12	46.6 ± 11.1	2.14 ± 0.6	1.62 ± 0.3	1.97 ± 0.5

Table 3. Pooled Sample Score Variations for the H and C Group

	Criteria	H		C	
		n	%	n	%
0	Absence of signs of inflammation	0	0	1	3
1	Mild to moderate inflammatory gingival changes, limited to papillary areas only	6	17	6	17
2	Mild to moderately severe gingivitis extending marginally	16	44	14	39
3	Severe gingivitis characterised by marked redness, swelling, tendency to bleed & ulceration, not necessarily extending around the tooth	5	14	7	19
4	When the pockets of any two recorded areas extend apically to the CEJ, not more than but including 3 mm	6	17	1	3
5	When the pockets of any two recorded areas extend apically to the CEJ from 3 to 6 mm, inclusive	3	8	3	8
6	When the pockets extend more than 6 mm, apically to the CEJ in any of the 2 measured areas	0	0	4	11

receiving hemodialysis and their age matched counterparts; furthermore, their plaque accumulation levels were similar. This result supports the suggestion that although uremic state causes immunosuppressed state as a result of increased toxins, the host is still able to mount a partial response to bacterial challenge, due to the fact that these patients are not completely immunodeficient. Analysis of the effect of the duration of hemodialysis on the periodontal tissues of patients with chronic renal failure showed no difference among the three subgroups, which is in accordance with the results of Naugle et al.8. Although there was a tendency for all clinical parameters to increase with the duration of hemodialysis, this did not reach a significant level. However this tendency might indicate the presence of an inverse relationship between duration of chronic renal failure, which is a chronic and deteriorating process, and the quality of personal and oral hygiene.

The essential concern in chronic renal failure is that every chronic renal failure patient receiving hemodialysis is in fact a renal transplant candidate as it offers the best opportunity for resumption of normal daily activities and full rehabilitation in end-stage renal disease. But as the period between finding a suitable kidney for the patient and transplantation is generally very short, it is almost impossible to treat all the existing oral focal infections within this limited time. Therefore, the dental/oral/periodontal health of these patients must be achieved in this relatively longer hemodialysis period and maintained till successful transplantation. The 100% prevalence of a form of periodontal disease in our H group underlines the necessity for periodontal monitoring in renal transplant candidates. In a study by Yamalik et al.,[4] which obtained information from 22 hemodialysis centres in 12 countries, 18% of these centres did not include a dental examination within the routine protocol for renal transplantation; furthermore 50% of them did not suggest that periodontal disease was the source of infection. Nevertheless, Page[15] revealed that periodontal diseases might effect systemic status by the subgingival biofilm, which acts as a reservoir for gram-negative bacteria, and by the periodontium that contains inflammatory mediators. Page[15] further suggested the subgingival biofilm acts as a reservoir for lipopolysaccharides, other bacterial metabolites and living micro-organisms. Also the periodontium in periodontal disease contains TNF-α, IL-1β, IFN-γ and PGE2 in high concentrations. As Schafer, et al.[16] and Naylor, et al.[17] pointed out, even simple tooth brushing can cause asymptomatic bacteraemia. Recent studies have indicated relations between periodontitis and coronary heart disease,[18] preterm low birth weight[19] and diabetes.[20] Based on such data it is essential to perform the necessary periodontal therapy and close periodontal monitoring before renal transplantation.

As a result, although patients receiving hemodialysis have a certain degree of immunosuppression they still can achieve a similar response to existing bacterial plaque with their systemically healthy counterparts to periodontal pathogens. Therefore chronic renal failure does not seem to be additional risk factor for severe periodontal destruction. Consequently, it may be suggested that, instead of the secondary effects of hemodialysis therapy, the primary cause of the periodontal disease, which is seen in patients receiving hemodialysis, is the amount of plaque. That means that, in order to deal with the graft rejection caused by infection, periodontal therapies should be performed before renal transplantation. We should always remember that treating periodontal diseases will be much harder after renal transplantation because of the inverse effect of immunosupresive therapy.

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