DENTAL CARIES AND PERIODONTAL DISORDERS IN CHRONIC LIVER DISEASE

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ABSTRACT

Bacterial infections are frequent complications in patients with chronic liver disease (CLD). A potential source of infection may be dental foci. This study was carried out to assess the association of CLD with dental caries and periodontal disease. Dental caries and periodontal examinations were performed prospectively in patients with CLD (group A) and controls without any liver disease (group B). Similar examination was also carried out in alcoholics without liver disease (group C) as well as in cases with portal hypertension but no liver disease (group D) i.e. patients with Non Cirrhotic Portal Fibrosis and Extrahepatic portal obstruction. A total of 231 subjects (Group A:83, group B: 75, group C:46 and group D:27) were studied. Group A included 32 cases with chronic hepatitis B&C, 26 with alcoholic cirrhosis, 14 with postnecrotic cirrhosis, and 11 with cryptogenic cirrhosis. Measures of oral hygiene ($p < 0.01$), dental care ($p < 0.001$), and periodontal parameters were worse and the number of teeth requiring treatment ($p < 0.05$) was higher in alcoholics with or without cirrhosis than in healthy subjects and nonalcoholic patients with cirrhosis. Alcoholics had a lower, total number of teeth than patients without alcohol abuse and healthy controls ($p < 0.01$). The dental caries and periodontal status of patients with nonalcoholic cirrhosis did not differ significantly from group B. The severity and duration of liver disease had no influence on dental caries and periodontal disease. The presence of chronic alcohol abuse rather than cirrhosis or portal hypertension is a major predisposing factor for dental caries and periodontal diseases. In alcoholics, these diseases appear to be caused primarily by bad oral hygiene and poor dental care.

MJAFI 2001; 57 : 26-30

KEY WORDS : Alcohol abuse; Chronic liver disease; Dental caries; Periodontal disease.

Introduction

Dental caries and periodontal disease have received little attention in patients with chronic liver diseases (CLD). However, in centres where liver transplantation is an option, dental foci need to be controlled in transplant candidates because of their potential role as source of bacterial infections. Patients with CLD are also susceptible to bacterial infections, which may lead to bacteraemia and eventually to death [1]. Increased susceptibility to infections may be related to compromised function of the immune system in such patients. These immune defects include complement deficiency, impaired Kupffer cell and neutrophil function (decrease in adherence, motility and phagocytotic activity leading to decreased ability to kill bacteria) [2,3]. Periodontal disease and dental caries are also due to bacterial infections [4-7]. Gingival inflammation frequently develops in many immunocompromised states, such as patients with leukemias or other malignancies or those on cancer chemotherapy [8-11]. There are a few reports of higher incidence of periodontal disease in patients with cirrhosis, but no details on etiology are reported [12]. The aim of this prospective study is to assess whether CLD alone can lead to the deterioration of

teeth and periodontium.

Materials and Methods.

Patients : Four groups of patients were subjected to detailed oral examination between 1995-99 at two tertiary care hospitals of Armed Forces at Pune and Chandimandir :

* Group A consisted of patients with chronic liver disease which included chronic hepatitis and cirrhosis of liver. The diagnoses were based on histological criteria or, if liver biopsy was not possible because of reduced blood coagulation, on clinical, serological, and laboratory findings [13]. Severity of cirrhosis was classified according to Child criteria [14].

* Group B consisted of patients who attended gastroenterology OPD and were diagnosed to have functional bowel disease and those attending surgical OPDs for orthopaedic complaints involving long bones. All these subjects had no clinical or biochemical evidence of liver disease. Only subjects consuming less than 60 ml of alcohol per day, with normal transaminases and normal blood glucose levels were included. Patients who were considered immunocompromised for any reason (namely those with diabetes mellitus, uraemia, malignancy of any kind, those on steroids or immunosuppressive drugs or HIV positive individuals) were not included in this group.

* Group C consisted of alcohol dependent patients on psychiatric follow up (for deaddiction) who had no evidence of liver disease.

* Group D consisted of consecutive cases with Portal Hypertension but no liver disease (namely those with Non Cirrhotic Portal Fibrosis and Extrahepatic Portal Obstruction).

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All these patients underwent meticulous dental examination by the same dental team. Each person examined was asked standardized questions regarding alcohol consumption, smoking, dietary habits, dental hygiene and level of education. The dental and periodontal examination included: (a) count of total number of teeth and of the number of carious teeth, including extremely decayed teeth requiring extraction. Twenty-eight teeth were accepted as a functional complement. Third molars were not included. (b) an index of oral hygiene [15] calculated as the plaque-free surface expressed as a percentage of the total surface of all teeth. (c) measurement of the loss of attachment from the cemento-enamel junction to the bottom of the clinical pocket as described by Glavind and Loe [16]. This is an important parameter of periodontal disease because it expresses loss of periodontium.

The results are given as mean $\pm$ SD or mean (range). Student's t-test, Chi-square-test, and Kruskal Wallis test (Chi Square, approximation), were used for statistical analysis [17]. Differences were considered significant when $p < 0.05$.

Results

Group A consisted of 83 patients with CLD which included chronic hepatitis B&C:32, alcoholic cirrhosis: 26, postnecrotic cirrhosis 14, and cryptogenic cirrhosis: 11. Group B had 75 patients (functional bowel disease 53, long bone fractures 22). Group C had 46 alcoholics on follow up in psychiatry OPD, without any liver disease. In addition, 27 cases with portal hypertension but no liver disease (non cirrhotic portal fibrosis: 18 and extrahepatic portal obstruction: 9) were also studied (group D). Age and sex distribution of these patients is summarized in Table-1. Predominant male patients in this study reflect the sex bias of service hospital beds and do not necessarily reflect true sex distribution of disease. Demographic profile of our patients as well as liver function status is outlined in Table-2. This table also outlines daily alcohol consumption, smoking habits, standard of years of education and monthly income reflecting the socio-economic status.

Nine patients with alcoholic cirrhosis had hepatitis B virus infection and four had a hepatitis C virus infection. Because of their history of alcohol abuse ($>100\text{g/d}$ for more than 5 years), these cases were counted among the patients with alcoholic cirrhosis. All Child's B and C patients with CLD received diuretic therapy and all Child's C patients were also given antibiotics intermittently. As a protocol Norfloxacin prophylaxis was advised to 8 patients who were hospitalised with spontaneous bacterial prophylaxis. Further, 14 patients with chronic hepatitis were on interferon treatment for hepatitis B and C.

The index of oral hygiene was significantly worst in patients of group A and C, when compared with group B. ($p < 0.05$) (Table -3). However, patients in group D had no significant difference as compared to group B. Interestingly, even amongst patients with CLD (group A), the index was significantly lower ($p < 0.01$) in alcoholic cirrhosis compared to other forms of CLD. And patients with non-alcoholic CLD had only marginally worse index as compared to group B which did not reach the range of statistical significance.

The total number of teeth were lower in alcoholics with or without liver disease though this difference did not reach the limits of statistical significance. The differences were more obvious in the number of carious teeth requiring treatment (filling or extraction) ($p < 0.05$). Only 2.7% of teeth required treatment in group B while the corresponding results for alcoholics with and without cirrhosis were much higher: 15.1% and 9%, respectively (Fig-1).

No carious teeth were found in 61 of group A, 65 of group B, 24 of group C and 22 of group D subjects ($p < 0.0001$). Even amongst cirrhotic, 28 with chronic hepatitis, 12 with alcoholic cirrhosis, 11 with post necrotic cirrhosis and 9 with cryptogenic cirrhosis were free from carious teeth. ($p < 0.001$).

Because loss of attachment is age dependent, the results are shown separately for each age group (Fig-2). Loss of attachment was largest in alcoholics with or without cirrhosis, which meant the heaviest loss of periodontium. We found significant differences between group B and A, and between patients with nonalcoholic cirrhosis and patients with alcoholic cirrhosis in the age groups 21 and above.

Analysis within the patients with cirrhosis, including severity and duration of disease, did not reveal any significant difference between patients classified in Child class A,B, or C in patients with alcoholic as well as nonalcoholic cirrhosis. Similarly we found no difference between patients in whom cirrhosis had been diagnosed more or less than 3 years previously.

Fig. 1 : Loss of attachment in mm. Group A = Cirrhotics, Group B = Controls, Group C = Alcoholics without cirrhosis and Group D = portal hypertension without cirrhosis. Effect of age is also apparent.

Fig. 2 : Carious teeth requiring filling and need for extraction of tooth in various groups. Group A included CH = chronic hepatitis, ALC = Alcoholic cirrhosis, PNC = Post-necrotic cirrhosis, CC= cryptogenic cirrhosis, Group B = Subjects with no liver disease, Group C = Alcoholics without liver disease and Group D = Portal hypertension without cirrhosis.

TABLE 1
Age distribution and aetiology in the patients studied

Groups	< 20 years	21-30 years	31-40 years	41-50 years	> 50 years
Group A (77 M, 6 F)					
Chronic hepatitis (28 M, 4 F)	0	19	12	1	0
Alcoholic cirrhosis (26 M)	0	2	11	14	1
Postnecrotic cirrhosis (12 M, 2 F)	0	4	9	1	0
Cryptogenic cirrhosis (11 M)	0	3	5	2	1
Group B had (65 M, 10 F)	5	11	31	15	13
Group C (45 M, 1 F)	0	3	14	22	7
Group D (22 M, 5 F)					
Non cirrhotic portal fibrosis (16 M, 2 F)	0	7	11	0	9
Extrahepatic portal obstruction (6 M, 3 F)	7	2	0	0	0

TABLE 2
Demographic and clinical profile of the patient groups studied

Characteristics	Group A	Group B	Group C	Group D
Age (Mean $\pm$ SD)	39.8 $\pm$ 18.7	37.6 $\pm$ 19.2	40.3 $\pm$ 17.5	24.7 $\pm$ 12.7
Sex (% Male)	92.8	86.6	97.8	81.5
Alcohol consumption in ml/day	36.6 (range 10-240)	12.5 (range 0-60)	67.7 (range 90-240)	0
Cigarettes (mean and range) as pack years	7.8 (range 0-40)	3.7 (range 0-14)	13.3 (range 0-45)	1.8 (range 0-12)
Mean time since diagnosis (years)	2.3 $\pm$ 1.9	-	3.4 $\pm$ 2.7	5.3 $\pm$ 2.9
Educational standard*	8	10	8	5
Monthly income in rupees	1287.4 (range < 500 to 8000)	1566.6 (range < 500 to > 10,000)	944.4 (range < 500 to 9000)	698.9 (range < 500 to 5000)
Child A	14	-	-	25
Child B	38	-	-	2
Child C	31	-	-	-

* range nil to graduation

TABLE 3
Indices of oral hygiene, dental findings, and loss of attachment in all groups of subjects. Findings are expressed as mean $\pm$ SD. ('+' denotes not significant, '**' $p < 0.01$, '#' $p < 0.001$)

Groups	Index of oral hygiene	Total number of teeth	Cariou teeth requiring filling	Cariou teeth requiring extraction
Group A (83)				
Chronic hepatitis (32)	33.6 $\pm$ 17.3*	28.3 $\pm$ 6.3*	1.8 $\pm$ 1.1*	1.7 $\pm$ 1.2*
Alcoholic cirrhosis (26)	17.8 $\pm$ 13.9#	22.5 $\pm$ 4.8#	9.3 $\pm$ 6.4#	3.4 $\pm$ 2.4#
Postnecrotic cirrhosis (14)	29.7 $\pm$ 29.2*	27.2 $\pm$ 5.2*	4.2 $\pm$ 2.8*	2.1 $\pm$ 1.8*
Cryptogenic cirrhosis (11)	41.8 $\pm$ 32.3*	26.1 $\pm$ 6.2*	3.8 $\pm$ 1.9*	1.8 $\pm$ 1.3*
Group B (75)	57.6 $\pm$ 39.8	28.7 $\pm$ 6.3	2.3 $\pm$ 1.8	0.8 $\pm$ 1.1
Group C (46)	23.8 $\pm$ 15.5#	24.4 $\pm$ 5.5#	7.3 $\pm$ 3.5#	2.2 $\pm$ 2.8*
Group D (27)				
Non cirrhotic portal fibrosis (18)	54.9 $\pm$ 33.5*	28.4 $\pm$ 5.6*	2.2 $\pm$ 1.6*	1.1 $\pm$ 1.3*
Extrahepatic portal obstruction (9)	55.4 $\pm$ 28.7*	23.9 $\pm$ 6.9*	1.1 $\pm$ 0.8*	0.6 $\pm$ 0.4*

Discussion

In contrast to patients of group B, patients with CLD had significantly advanced dental caries and periodontal disorders. Furthermore, alcoholics with or without cirrhosis had more carious teeth requiring

treatment and a worse condition of the periodontium compared with patients with nonalcoholic cirrhosis and persons without liver disease. Group B subjects could be called healthy controls consisting of normal health-conscious people with a low daily alcohol intake, who either had incidental orthopaedic complaints

or functional bowel disorders. No corrections were made for the socioeconomic status and the level of education, which are independent factors influencing dental hygiene. Based on these observations, it is assumed that alcohol abuse rather than liver disease per se seems to be responsible for dental caries and periodontal disease in patients with cirrhosis.

However, several factors other than alcohol abuse may influence the dental and periodontal status of the patients. Of these factors, higher age and bad oral hygiene were noted to significantly influence the total number of teeth affected. Alcohol abuse, and the presence of cirrhosis had significant impact on the number of carious teeth while bad oral hygiene, higher age, the presence of cirrhosis, cigarette smoking were associated with periodontal disease. However, it must be mentioned that variables used are not truly independent (i.e. age and presence of cirrhosis or poor oral hygiene and alcohol abuse), univariate analysis may have limitations. Severity and duration of liver disease had no significant influence on the severity of dental caries and periodontal disease.

Cariou lesions are decalcifications of dental enamel and dentin. Cariogenic bacteria in dental plaque are necessary for their development [7]. Periodical mechanical removal of dental plaques can therefore decrease the risk of carious lesions, however such visits to dental surgery are uncommon in our population. On the other hand the risk of caries is dependent on the frequency of sugar intake [18]. Furthermore, a deficiency of fluorine [19] and reduced salivation can disturb the recalcification of dental enamel and dentin and can encourage carious lesions [20,21]. Reduced salivation in patients with cirrhosis taking diuretic drugs [22] may be of additional importance for the development of caries.

Periodontal diseases are bacterial infections [4-6], which are also encouraged by poor oral hygiene. For example, *Actinobacillus actinomycetemcomitans* and *Porphyromonas gingivalis* are suspected pathogens [5,6]. Periodontal diseases can cause the destruction of periodontium (loss of attachment) resulting in loss of teeth. Periodontal inflammatory responses triggered by bacteria cause most of the tissue destruction, along with direct destructive effects of the bacteria. It has been recognized that the neutrophils as well as antibody/complement system is critical for protection against periodontal bacteria. Abnormalities in this system often lead to increased susceptibility to periodontal disease [6]. Patients with cirrhosis have an increased susceptibility to bacterial infections and have a compromised function of the immune system

[2,3]. In addition, the nonimmune and immune (secretory immunoglobulin A) components of saliva provide an initial protective barrier against the invasion of foreign pathogens in the oral cavity [21]. Therefore, loss of attachment reflects not only the oral hygiene but also the immune system. The relationship between nutritional factors and maintenance of periodontal health is controversial. The process of tissue repair, including repair of periodontal tissues, is influenced by an adequate supply of nutrients, particularly amino acids, ascorbate, riboflavin, folic acid, vitamin A and zinc [23].

The generally bad condition of teeth and periodontium in alcoholics with and without cirrhosis can be primarily explained by poor oral hygiene and poor dental care. Additionally, male sex (most of the patients with alcohol abuse were men), low socioeconomic status and smoking habits [24] contributed to the high frequency of dental and periodontal disease in alcoholics. Based on the marked differences between patients with alcoholic and nonalcoholic cirrhosis, poor oral hygiene and deteriorating condition of teeth and periodontium may suggest possible alcohol abuse in patients with cirrhosis. Patients with cirrhosis considered for liver transplantation should be carefully examined for the presence of dental foci, which should be treated before transplantation, since they may be a source of bacterial infection if immunosuppressive treatment is initiated.

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