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RESEARCH ARTICLE

IMPACT OF CHRONIC RENAL FAILURE ON ORAL HEALTH: ACROSS SECTIONAL STUDY

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Abstract

Objectives: To evaluate the oral manifestations and radiographic findings and to correlate these findings with stages III, IV and V chronic renal failure patients.

Methods: 100 patients diagnosed as having stages III, IV and V chronic renal failure were clinically examined, detailed case history and oral manifestations were recorded in specially prepared proforma. Community periodontal index (CPI) and Decayed Missing Filled Teeth Index (DMFT) Index were assessed and patients were subjected to radiographic examination using orthopantomographs for evaluation of teeth and jaw bones.

Results: Incidence of oral manifestations and radiographic findings were significantly higher in chronic renal failure patients; especially in stage V followed by stage IV & III. Mean scores of CPI Index and loss of attachment were significant in stage V when compared to stage IV and III where as that of DMFT Index scores were found to be high in stage III followed by IV and V.

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Introduction

Wide arrays of systemic diseases encountered in internal medicine have manifestations in the yawning abyss that internists call the oral cavity. The oral cavity is well be thought of as the mirror of body because oral manifestations accompany many systemic diseases. Most of these manifestations are nonspecific but should alert the clinician to the possibility of concurrent systemic diseases or latent systemic diseases that may develop subsequently and may therefore be useful in diagnosing the disorder, determining treatment requirements, or assessing the prognosis of the disease in question. The incidence (10% to 15% annual growth) of chronic renal failure (CRF) continues to rise worldwide and, as a consequence, increasing numbers of individuals with such disease will probably continue to require oral health care.¹²

The literature reveals limited studies on oral manifestations and radiographic findings of teeth and jawbones in patients with stage III, IV and V CRF which can be used as marker for the assessment of status of kidney failure. Hence, an attempt has been made in the present study to evaluate the oral manifestations and radiographic findings in patients with CRF and to correlate these findings between patients with stages III, IV and V CRF.

MATERIAL & METHOD:

100 Patients reporting to the Institute of Nephro-Urology, Bangalore, diagnosed with CRF were selected according to inclusion and exclusion criteria. They were explained about the details of study procedure and written

informed consent was obtained. CRF patients were divided in to three subgroups stage III, IV and V according to National Kidney Foundation's Dialysis Outcome Quality Initiative criteria. Stage I and II were not considered on account of absence of clinical and laboratory findings of CRF.

Inclusion Criteria:

Subgroup I- Patients with stage III renal failure having glomerular filtration rate between 30 to 60 ml/ min.

Subgroup II- Patients with stage IV renal failure having glomerular filtration rate between 15 to 30 ml/ min.

Subgroup III- Patients with stage V renal failure having glomerular filtration rate < 15 ml/ min and on hemodialysis.

Exclusion Criteria:

-CRF patients on renal transplant, suffering from salivary gland diseases, HIV/ AIDS, those on radiotherapy or chemotherapy for any malignancy.

-CRF patients on any medication like antidepressants, anticholinergic affecting saliva.

-CRF patients who are chronic smokers, alcoholics or Non ambulatory patients were exclude.

A detailed case history was recorded for all the patients and data regarding renal function test, advised in Institute of Nephro-Urology, Bangalore, was carefully documented. Glomerular filtration rate (GFR) of study group was estimated using the Modification of Diet in Renal Disease (MDRD) formula, which gives a better indication of the GFR than the use of serum creatinine alone. This formula uses the serum creatinine in combination with age, gender, weight, and race. $GFR = 175 \times (\text{standardized serum creatinine})^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ if female})$. Following case history a through clinical examination was carried out for all the patients. CPI and DMFT Index were performed. Patients were also subjected for radiographic evaluation of teeth and jaw bones using Orthopantomograph.

Chi-square test has been used to assess the association between categorical variables. For continuous variables, t-test/ANOVA has been used to find out significant differences, if any. Level of significance is fixed at 5%. For comparison of CPI Index, loss of attachment and DMFT index between different stages of CRF, ANOVA followed by post-hoc test using Bonferroni method was used.

RESULTS:

The 100 subjects in study group were in the age range of 18-50 years with a mean age of 41 years. Number of subjects in three stages of CRF was 31(31%) in stage III, 33(33%) in stage IV and 36(36%) in stage V. Gender distribution in the study group showed that 63(63%) were males and 37(37%) were female. In the present study diabetes mellitus was found to be the major etiologic factor of CRF in 47(47%) of the patients followed by hypertension 41(41%), chronic glomerulus nephritis 9(9%) and obstructive uropathy 3(3%) {Graph1}.

98(98%) of CRF patients presented with oral manifestations, with pallor of oral mucosa 87(87%) being the most common followed by significant calculus formation 85(85%), bleeding from gingiva and inflammation 82(82%), coated tongue 73(73%), dry fissured lips 71(71%), dryness of mouth 46(46%), uremic odour 36(36%), metallic taste 35(35%), burning of oral mucosa 32(32%), angular cheilitis 19(19%), candida infection 15(15%), erosive glossitis 14(14%) and ulcerative stomatitis 9(9%). Comparison of Oral manifestations across the stages of study group (graph 2), Radiographic findings in study group (graph 3) & comparison across the study group (graph 4) is illustrated by respective graphs. Results of the study revealed that frequency & severity of oral lesions & radiographic finding increases with increase in stages of renal failure.

Statistically significant association was found between CPI Index, loss of attachment and stages of renal disease ($P < 0.001$), which was substantial in CRF stage V when compared to stage III and IV. No statistically significant difference was obtained between DMFT Index and stages of renal failure (Table 1) but scores of DMFT Index was high in stage III followed by stage IV and V. Highly significant difference was obtained between study group and control group in relation to oral manifestations, radiographic findings, CPI Index, loss of attachment and DMFT Index with $p < 0.001$. Mean scores of CPI Index and loss of attachment was significant in study group were as that of DMFT Index was significant in control group (Table 2).

Table1: Community Periodontal Index, loss of attachment and DMFT Index across stages of study group:

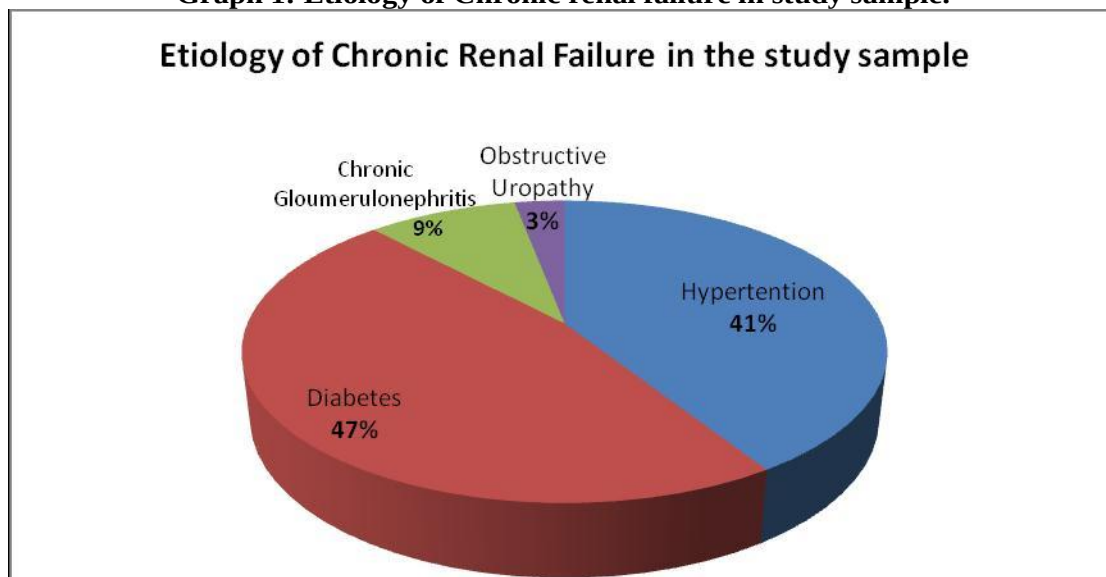
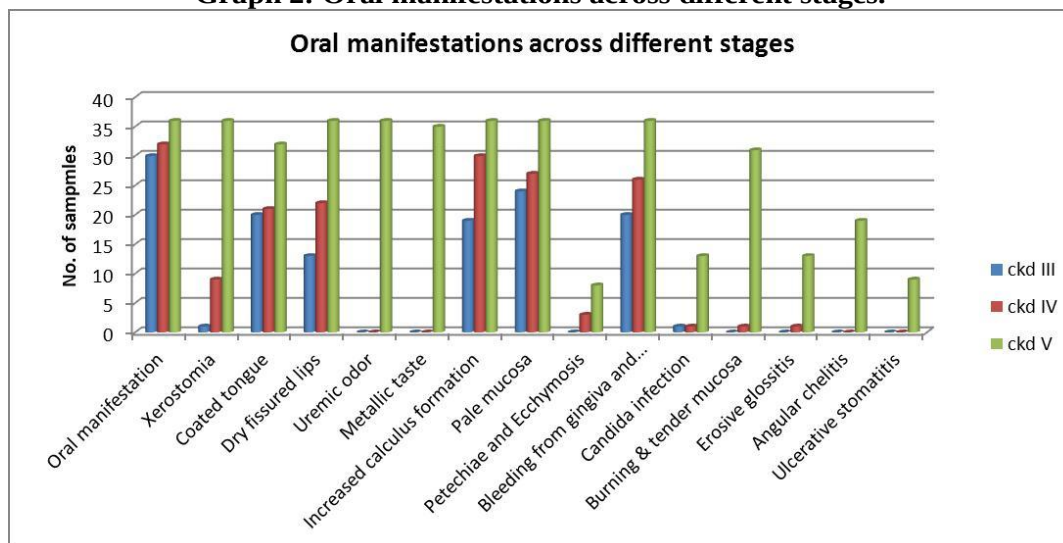
Parameter	Stage	Mean±SD	95% Confidence Interval for Mean		Min	Max	F	P-Value	Significantly different from
			Lower Bound	Upper Bound					
CPI	CRF III	3.00±0.51	2.81	3.19	2	4	23.652	<0.001*	CRF V
	CRF IV	3.21±0.81	2.92	3.50	0	4			CRF V
	CRF V	3.91±0.28	3.82	4.01	3	4			CRF III, CRF IV
Loss of attachment	CRF III	2.03±0.54	1.83	2.23	1	3	34.837	<0.001*	CRF V
	CRF IV	2.27±0.76	2.00	2.54	0	4			CRF V
	CRF V	3.22±0.54	3.04	3.41	2	4			CRF III, CRF IV
DMFT index	CRF III	1.19±1.27	0.73	1.66	0	6	0.149	0.861	---
	CRF IV	1.36±1.51	0.83	1.90	0	8			---
	CRF V	1.41±2.16	0.68	2.15	0	13			---

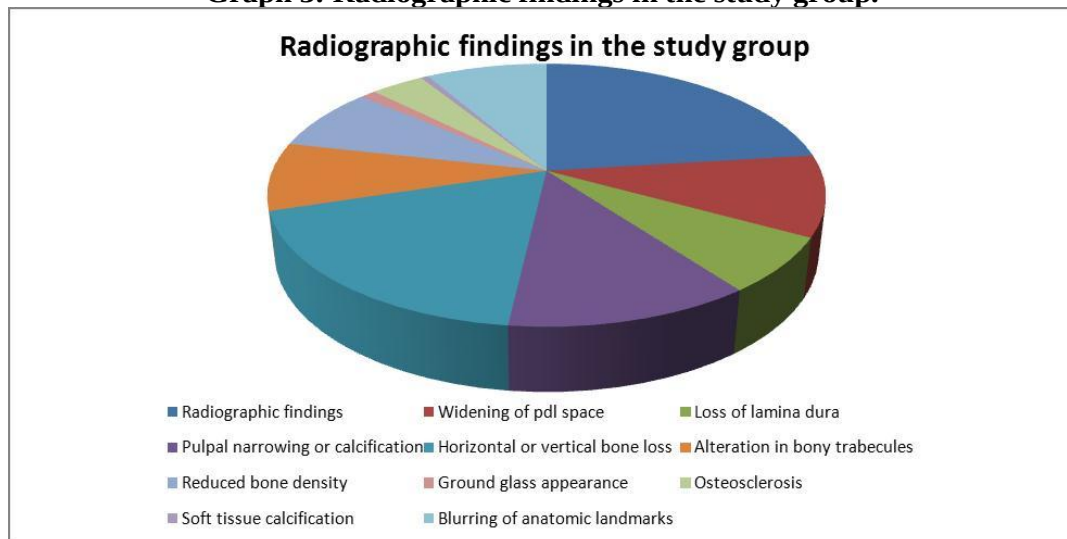
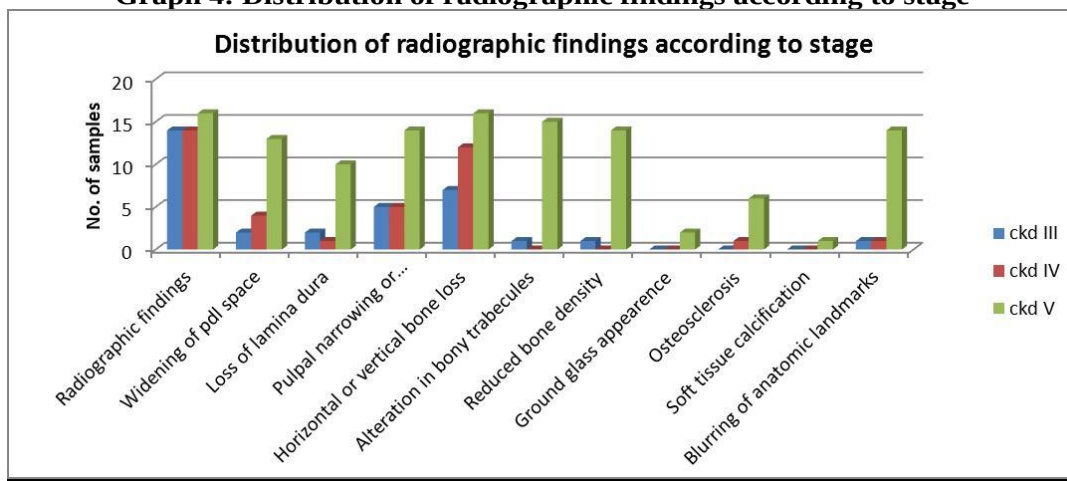
*denotes significant difference

Table2: Community Periodontal Index, loss of attachment and DMFT Index between study group and control group:

Parameter	Group	n	Mean	Std dev	Mean difference	t	P-Value
CPI	Study group	100	3.40	0.70	0.760	5.912	<0.001*
	Control group	50	2.64	0.83			
Loss of attachment	Study group	100	2.54	0.81	0.900	6.650	<0.001*
	Control group	50	1.64	0.72			
DMFT index	Study group	100	1.33	1.71	-2.270	-4.644	<0.001*
	Control group	50	3.60	3.24			

*denotes significant difference

Graph 1: Etiology of Chronic renal failure in study sample.**Graph 2: Oral manifestations across different stages.**

Graph 3: Radiographic findings in the study group.**Graph 4: Distribution of radiographic findings according to stage**

DISCUSSION:

CRF is a relatively common systemic disease that expresses loss of functional capacity of the nephrons, independent of its etiology. Although acute renal failure is reversible in the majority of cases, CRF presents a progressive course towards terminal renal failure (TRF), even if the cause of the initial nephropathy disappears.¹⁰ The degree of renal failure could alter the balance of the stomatognathic system, thus conditioning the prevalence of oral diseases. Researchers estimate that up to 90 % of renal patients show oral symptoms.⁵

In the present study diabetes mellitus was found to be the major etiologic factor of CRF in 47(47%) of the patients. The pathogenesis of diabetic nephropathy is intimately related to generalize diabetic microangiopathy. CRF patients 98(98%) presented with oral manifestations when compared to control group which is analogous to the results shown by De Rossi SS et al (1996)⁸, Garcia E D I R et al (2006)⁶ and Cervero A J et al (2008)³. Pallor of oral mucosa which is usually the result of anemia is very common in CRF patients. Increased calculus formation reported in 85% of the patients is due to excess of urea in the saliva which is hydrolysed by bacteria with the release of ammonia, leading to an elevation of pH in the dental plaque and further promoting calcium and phosphorus precipitation. Uremic odor was present in 36% and metallic taste in 35% of the patient's results from the increased concentration of urea in saliva and its posterior transformation into ammonium. Ulcerative uremic stomatitis was observed in 9% of the CRF patients. Uremic stomatitis is believed to be a chemical like burn caused due to increased level of ammonia in saliva. 88% of CRF patients in the present study showed radiographic changes. Results of our

study are in accordance with Bras J et al (1982)², Galili D (1991)¹¹, Damm DD (1997)⁴, who discussed that radiographic alterations of the jaw bones in chronic renal failure are common and are the result of renal osteodystrophy (ROD). Mean scores of CPI Index and loss of attachment was significant in study group were as that of DMFT Index was not significant. High scores of CPI index may be attributed to many bacterial species with a high potential virulence, such as *A. actinomycetemcomitans* and *P. gingivalis*, are able to colonize, grow and cause periodontal tissue damage. A diminished prevalence of caries has been observed and attributed to a protective effect on the part of increased urea and ammonia concentration in saliva leading to higher pH levels, which inhibits cariogenic bacterial (*Streptococcus mutans*) growth and neutralizes bacterial plaque acids (Gavalda C 1999⁷, Klassen J T 2002⁹, Bayraktar G et al 2008¹).

Conclusion:

CRF is becoming a major global health problem with wide spectrum of oral manifestations affecting the hard and soft tissues of the oral cavity. The disease increases patient morbidity and mortality and puts a major economic burden on the health care system. The incidence of CRF continues to rise worldwide and, as a consequence, there is increase in the number of individuals with such disease requiring oral health care. Early diagnosis of oral manifestations affecting the hard and soft tissues of the oral cavity & there appropriate management can improve the patients quality of life.

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