ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 3, Issue – 2, March - 2020, Page No. : 112 - 117

Dental Calculus as a Risk Factor in Adult Patients with and Without Chronic Kidney Disease

[1]Viniti Goel, Professor, Bhojia Dental College & Hospital, Baddi

[2]Suresh Goyal, ,Pulmonologist, IVY Hospital, Mohali

[3]Sumit Kaushal, Reader, National Dental College & Hospital, Derabassi.

[4]Balaji Manohar, Professor and Head, Pacific Dental College and Hospital, Udaipur.

[5]Navneet Kaur, Senior Lecturer, National Dental College & Hospital, Derabassi.

[6]Er. Lakshay Goyal, Engineer

Corresponding Author: Dr. Navneet Kaur, Senior Lecturer, National Dental College & Hospital, Derabassi.

Citation of this Article: Viniti Goel, Suresh Goyal, Sumit Kaushal, Balaji Manohar, Dr. Navneet Kaur, Er. Lakshay Goyal, "Dental Calculus as a Risk Factor in Adult Patients with and Without Chronic Kidney Disease", IJDSIR- March - 2020, Vol. – 3, Issue -2, P. No. 112 – 117.

Copyright: © 2020, Dr. Navneet Kaur, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background and objectives: chronic kidney disease (CKD) is an important, chronic, non-communicable disease epidemic that affects the world. Only a few studies are done in our literature to assess biochemical parameters and oral health status in young patients of CKD. CKD, also known as chronic renal disease, is a progressive and irreversible loss in kidney function over a period of months leading to a decline in the glomerular filtration rate. This study was aimed to assess the calcium content in dental calculus as a risk factor in young adults with or without chronic kidney disease.

Materials and methods: Data were collected from 75 subjects between 18 to 65 years age who presented to department of nephrology, udaipur government general hospital, kurnool from february 2008 to january 2010. Out of these 75 subjects, group a constituted of 25 subjects suffering from stage i and stage ii chronic kidney disease. Group b constituted of 25 subjects suffering from stage iii to stage v chronic kidney disease. Group c constituted of 25 subjects having moderate to advanced periodontitis and not suffering from chronic kidney disease. The hematological examination was performed to analyze serum creatinine level in all the subjects. Calculus sample was obtained from all the subjects and was analyzed for calcium levels.

Results: When comparison was done for the GFR between group b and group c, it was observed to be highly significant (p=0.000) and for group c and group a, it was observed to be significant. (p= 0.011). When comparison was done for the level of calcium in calculus between group b and c there was a significant correlation (p=0.42) observed. When the comparison for the level of calcium in

calculus between group c and group as was done, the observation was significant p= (0.045).

Conclusion: There is evidence for the benefit of periodontal treatment on the success of kidney transplant surgery, but more clinical studies need to be conducted. Therefore, it can be concluded that periodontal diseases may be an overlooked source in advanced stages of chronic renal failure patients.

Keywords: dental calculus; calcium; chronic kidney disease; chronic periodontitis.

Introduction

The studies of periodontal status in adults with chronic kidney disease (CKD) performed in the past 10 years are scarce. Chronic kidney disease is a proinflammatory state in which the discrepancies in vitamin D_3 metabolism affects the calcium and phosphorus metabolism and hence the alveolar bone.[1] The quantity and quality of salivary secretions are important in patients with chronic kidney disease, as the changes in salivary composition may affect the deposition of calculus on the tooth surfaces.[2,3] The accelerated calculus formation in chronic kidney disease is due to elevated concentration of potassium, phosphate, calcium and urea in blood as well as saliva.[2,4]

Material and Methods

After approval by the institution two hospitals department of Nephrology, Udaipur; 50 confirmed cases of chronic kidney disease (Stage I- Stage V) of either sex suffering from chronic periodontitis were selected to participate in the study. 25 patients suffering from chronic periodontitis visiting the out-patient department of Periodontics, Pacific Dental College and Hospital, Udaipur were also selected for the study. The patients were enrolled between February 2008 to January 2010. Kidney disease outcomes quality initiative (K/DOQI) guideline has differentiated between the 5 Stages of Chronic kidney disease on the basis of Glomerular filtration rate which is universally adopted.[5]

Five stages of chronic kidney disease on the basis of Glomerular Filtration Rate

Stage	Description	GFR (ml/min/1.73m^2
Normal kidney function	Healthy kidneys	≥ 90
Stage I	Kidney damage with normal or high GFR	≥ 90
Stage II	Kidney damage** and mild decrease in GFR	60 – 89
Stage III	Moderate decrease in GFR	30 -59
Stage IV	Severe decrease in GFR	15-29
Stage V	Kidney failure	<15

Estimating the creatinine clearance from prediction equations

Cockcroft and Gault Equation:

$$\text{Creatinine clearance (ml/minute)} = \frac{(140\text{-Age}) \times \text{Weight} \times (0.85 \text{ if female})}{72 \times \text{Serum Creatinine}}$$

Study Design: The study design consists of total 75 subjects between age group of 18-65 years.

Group A: constituted of 25 subjects suffering from stage i and stage ii chronic kidney disease.

Group B: constituted of 25 subjects suffering from stage iii to stage v chronic kidney disease.

Group C: constituted of 25 subjects having moderate to advanced periodontitis and not suffering from chronic kidney disease.

Figure 1 subjects who had undergone any form of periodontal treatment and under medication for the same for the last 6 months and subjects with habit of tobacco chewing or smoking were excluded from the study. The hematological examination was performed to analyze serum creatinine level in all the subjects. According to calculus component of OHI-S **6**; calculus sample was obtained from all the subjects and was analyzed for calcium levels.

© 2020 IJDSIR, All Rights Reserved

Biochemical Analysis (Figure2)

Calculus was removed with a sickle scaler from all the teeth according to the calculus component of OHI-S index **(figure 3).** Saliva and calculus samples were transported in separate metal free glass ware in an ice box at 0° -2° c and then stored at -80°. On quantitative calculus analysis [7], the individual calculus samples were blotted with filter paper to remove adhering saliva. Each sample was left for 48 hours in a dessicator containing $cacl_2$ as dehydrating agents **(figure 4).** After dehydration for 48 hours the calculus sample was weighed **(figure 5).** 10 mg of calculus powder was treated with 2.5 ml of aquaregia 1:3 (hno_3: hcl) solution. Heating was done for until 0.1 - 0.2 ml of residue was left in the beaker. This residue was dissolved in warm distilled water to obtain 1 ml of total solution and filtered. The filtrate was used for the estimation of calcium content of calculus in a chem well arts automatic analyzer **(figure 6).** The estimation of calcium levels was done using the kit supplied by **accurex bio medical pvt. Ltd [8].** The reagents in kit are as follows; **(figure 7)**

Reagent 1: standard calcium-10mg per 100 ml

Reagent 2: amp buffer solution (2 amino-2 methyl-1-propanol) (ph-11.7)

Reagent 3: o-cresophthale in complex one solution

Procedure: Take 3 test tubes labeled as blank (b), standard (s) and test (t). In the 'test' test tube put 0.01 ml of saliva /calculus filtrate. Then put 0.01 ml of calcium standard, in the standard test tube. In the blank test tube add 0.01 ml of de-ionized water. Now add 0.5ml of reagent 2 in all the three test tubes. Shake it properly and then add 0.5 ml regent 3 in all the test tubes. Instrument is set at 0 by using a blank at 37˚c at 578 nm wave length. Mix well and after 5 min read the absorbance of standard and the absorbance of test against blank. The calculation of concentration of calcium in the sample is calculated in mg /100 ml as per the formula.

$$\text{Calcium in mg\%} = \frac{\text{Absorbance of sample}}{\text{Absorbance of Standard}} \times 10$$

Results

Glomerular filtration rate (GFR)

For the subjects of group a mean GFR was 83.74 ± 25.96. For group b the mean GFR was 7.56 ± 4.27 and for group c the mean GFR was 99.50 ± 14.25. When comparison was done for the GFR between group b and group c using independent student's t- test it was observed to be highly significant (p=0.000) and for group c and group a it was observed to be significant. (p= 0.011) **(table 1 & 2)**

Biochemical parameters

Calcium content in calculus

For the subjects of group a, the mean calcium level in calculus was 28.90 ± 6.99. For group b mean calcium level in calculus was 28.69 ± 05.97 and in group c the mean calcium level in calculus was 24.44 ± 08.25. When comparison was done for the level of calcium in calculus between group b and c using student's t-test there was a significant correlation (p=0.42) observed. However, when the comparison for the level of calcium in calculus between group c and group a was done, the observation was significant p= (0.045) **(table 1, 2)**

Glomerular filtration rate and calcium content in calculus

When comparison of glomerular filtration rate and calcium content in calculus of group a using pearson's correlation was done there was no significant correlation (p = 0.712) when comparison of glomerular filtration rate and calcium content in calculus of group b was done a highly significant negative correlation was seen (p= 0.003). When comparison of glomerular filtration rate and

© 2020 IJDSIR, All Rights Reserved

calcium content in calculus of group c was done, no significant correlation was observed (p =0.576)

Discussion

Chronic kidney disease is accompanied by progressive destruction of nephron mass and azotemia and frequently causes hypocalcemia and hyperphosphatemia[9]. Dental calculus is a risk factor for periodontal disease, which in turn is a potential cause of sustained systemic inflammation in patients with chronic kidney disease.[10, 11]. Gavalda c found calculus indices to be significantly higher among patients with chronic renal failure because increased calculus deposits in the patients with renal pathology could likewise be attributed to poor oral hygiene and increased loss of periodontal attachment. The group b subjects (chronic kidney disease stage iii - v) showed significant levels of calcium content present in calculus as compared to subjects without chronic kidney disease which was similar to the study by naito y et al (1997) on calcium phosphate stone formation in pathogenesis of renal stone diseases. Periodontal health in chronic kidney disease patients correlated with the higher levels of serum creatinine compared to patients without chronic kidney disease which was similar to the study reported by lingam et al (2017)[12], bayraktar g et al (2009)[13], yeon jung kim et al (2017)[14] and bibi g et al (2008)[15] vijayan m et al (2014)[16] rajasekar p et al(2015)[17] soroye mo et al (2016)[19]. These patients needs to be on a strict periodontal maintenance program to prevent the development of inflammation, which can have detrimental effect. Because there is no protocol for the standard of dental care in patients before and after kidney transplant surgery, more studies need to be performed to develop standardized care plan for these patients.

Conclusion

There is a possible association between the severity of renal dysfunction in young patients and the formation of dental calculus—an additional manifestation of disturbed ca–p homeostasis. Dental calculus may contribute as a major component in saliva which may cause periodontal disease in ckd patients. Therefore, it can be concluded that periodontal diseases may be an overlooked source in advanced stages of chronic renal failure patients.

References:

1. Kally wh, mirahmadi mk, simon jhs, gorman jt. Radiographic changes of the jaw bones in end stage renal disease. J oral surg 1980; 50:372-81.
2. Epstein sr, mandel i, scopp iw. Salivary composition and calculus formation in patients undergoing hemodialysis. J periodontol 1980; 51(6):336-8.
3. Obry f, belcourt ab, frank rm, geisert j, fischbach m. Biochemical study of whole saliva from children with chronic renal failure. Asdc j dent child 1987; 54(6):429-32.
4. Martins c, siqueira wl, de oliveira e, primo ls, nicolau j. Salivary analysis of patients with chronic renal failure undergoing hemodialysis. Spec care dentist 2006; 26(5):205-8.
5. Dobbelstein h. Immune system in uremia. Nephron 1976; 17(6):409-14.
6. Green jc, vemillion jr, calif f. The simplified oral hygiene index. J am dent assoc 1964; 68(1):7-13.
7. Verma a. Biochemical impact of magnesium plus pyridoxine and potassium citrate therapy on serum and urinary profile of urolith formers. 1995, dissertation submitted to university of rajasthan, jaipur.
8. Ray sarkar bc, chauhan ups. A new method for determining micro quantities of calcium in biological materials. Anal bioch 1967; 20(1):155-66.
9. Kleeman cr, bernstein d. Chronic renal failure. Its effect on calcium, phosphorus and osseous metabolism unified approach. Calif med 1961; 94(6):335-8.

© 2020 IJDSIR, All Rights Reserved

10. Gavaldá c, bagán jv, scully c, silvestre fj, milián ma, jiménez y. Renal hemodialysis patients: oral, salivary, dental and periodontal findings in 105 adult cases. Oral dis 1999; 5(4):299-302.
11. Hilana paula carillo artese, celso oliveira de sousa, ronir raggio luiz, carmelo sansone, maria cynésia medeiros de barros torres. Effect of non-surgical periodontal treatment on chronic kidney disease patients. Braz oral res. 2010 oct-dec;24(4):449-54.
12. Souza cm, braosi apr, luczyszyn sm, casagrande rw, filho rp, riella m c, ignácio s a, trevilatto p c. Oral health in brazilian patients with chronic renal disease. Rev méd chile 2008;136:741-6.
13. Lingam amara swapna, pradeep koppolu , jyothi prince. Oral health in diabetic and nondiabetic patients with chronic kidney disease.saudi j kidney dis transpl 2017;28(5):1099-1105.
14. Bayraktar g, kurtulus i, duraduryan a, cintan s, kazancioglu r, yildiz a, bural c, bozfakioglu s, besler m, trablus s, issever h. Dental and periodontal findings in hemodialysis patients. Oral dis 2007; 13(4):393-7.
15. Yeon jung kim , luciana martins de moura , christiane peres caldas , caroline perozini , gilson fernandes ruivo , debora pallos. Evaluation of periodontal condition and risk in patients with chronic kidney disease on hemodialysis .einstein. 2017;15 (2):173-7.
16. Bibi g, green y, nagler rm. Compositional and oxidative analysis in the saliva and serum of predialysis chronic kidney disease patients and end-stage renal failure patients on peritoneal dialysis. Ther apher dial 2008; 12(2):164-70.
17. Vijayan m, ravi r, abraham g, ravi r, mathew m. Chronic kidney disease, a herculean task. Open urol nephrol j 2014;7:56-9.
18. Rajasekar p, sameeraja v, poornima b. Etiological spectrum of chronic kidney disease in young: a single center study from south india. J integr nephrol androl 2015;2:55-60.
19. Soroye mo, ayanbadejo po. Oral conditions, periodontal status and periodontal treatment need of chronic kidney disease patients. J oral res rev 2016;8:53-8.

Legends Table

Table 1: Comparison of GFR, Calcium content in Calculus (CC) in between Group B and Group C

	Group	No.	Mean	Standard Deviation	Significance	
GFR	B	25	07.5696	04.27248		
	C	25	99.5040	14.25589	0.000	HS
CC	B	25	28.6952	05.97188		
	C	25	24.4416	08.25768	0.042	S

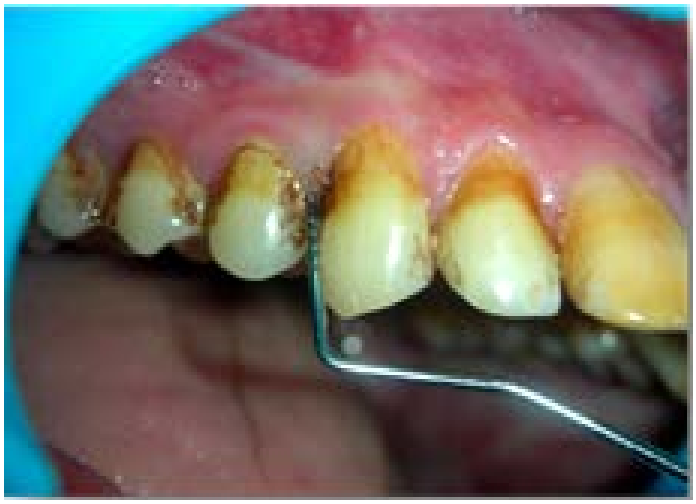
HS- Highly Significant; S- Significant

Table 2: Comparison of GFR, Calcium content in Calculus (CC) in between Group A and Group C

	Group	N	Mean	Standard Deviation	Significance	
GFR	A	25	83.7488	25.96397		
	C	25	99.5040	14.25589	0.011	S
CC	A	25	28.9040	06.99735		
	C	25	24.4416	08.25768	0.045	S

S- Significant

Figure 1: Probing Pocket Depth



© 2020 IJDSIR, All Rights Reserved

Figure 2: Reagent Pack

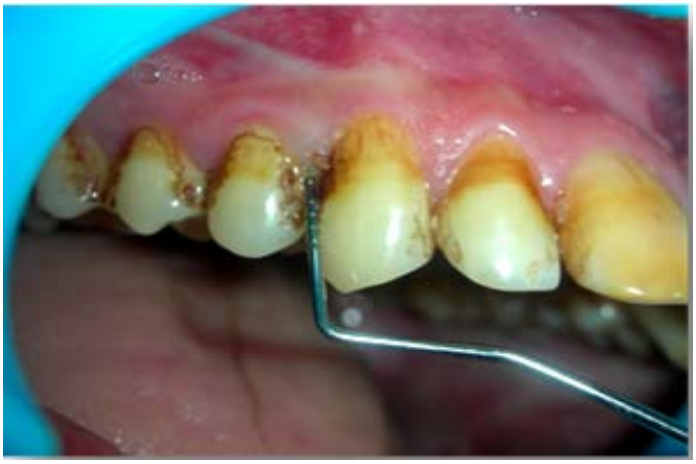


Figure 3: Calculus Sample

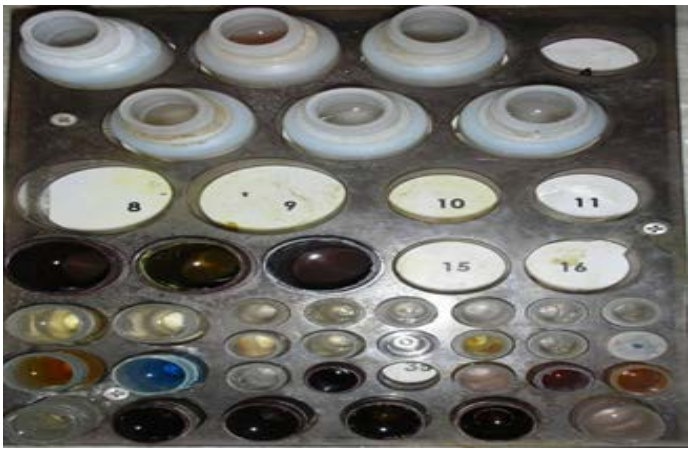


Figure 4: Dessicator

Figure 5: Weighing Machine for Weighing Calculus

Figure 6: Chemwell Art Automated Analyzer

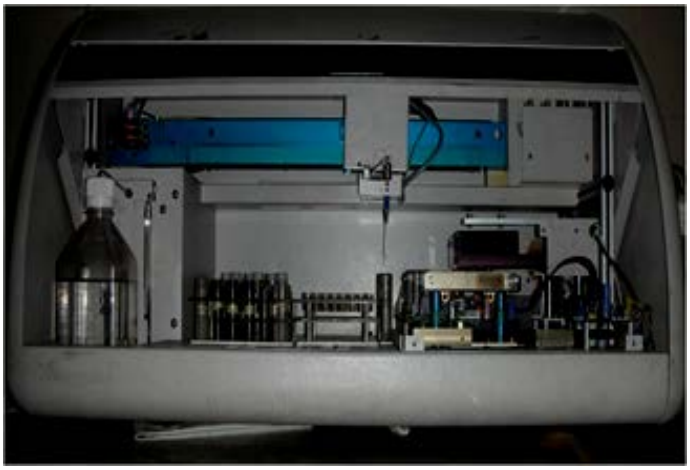


Figure 7: Reagents for Biochemical Analysis of Calcium content in Calculus and Saliva

© 2020 IJDSIR, All Rights Reserved