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Salivary gland condition before and after kidney transplantation: evaluation of salivary gland function in patients with end-stage chronic renal failure before and after kidney transplantation

Abstract

The authors conducted a study of the state of the salivary glands in 50 patients with end-stage chronic renal failure. There was a pronounced violation of the function of the salivary glands (SG) in these patients by the type of xerostomy, which led to a change in the qualitative and quantitative indicators of mixed saliva. After the kidney transplant, the function of the SG improved, but did not fully recover. At the same time, there was an improvement in the hygienic condition of the oral cavity. Saliva cleanses the mucous membrane of the mouth from bacteria and food. It also immunoglobulins and lysozyme are involved in the formation of oral immunity. Saliva forms a food lump and makes it easier to swallow food. A decrease in salivation leads to digestive disorders and tooth decay. All patients with end-stage chronic renal failure showed a dysfunction in the work of the SG. A decrease in kidney function led to a change in the composition and nature of salivation. With saliva, toxic products were excreted, which normally were excreted only by the kidneys. Normalisation of salivation occurred after hemodialysis. Patients after kidney transplantation require long-term follow-up and preventive therapy for the salivary glands in order to improve and restore their function. Currently, there is no information in the literature about the state of SG in patients after kidney transplantation. This was the basis for this work.

Keywords: salivary glands, end stage chronic renal failure, kidney transplantation

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Vasily Afanasyev,[1] Dana Youssef[2]
[1]MD, Professor, Head of the Department of Maxillofacial Surgery and Traumatology of the Moscow State Medical and Dental University, Russia
[2]MD, Postgraduate student of the Department of Maxillofacial Surgery and Traumatology of the Moscow State Medical and Dental University, Russia

Correspondence: Vasily Afanasyev, MD, Professor, Head of the Department of Maxillofacial Surgery and Traumatology of the Moscow State Medical and Dental University named after A.I. Evdokimov, Honored Doctor of the Russian Federation, President of the Association of Sialologists of the Russian Federation, Moscow, Tel 8(903) 1593325, Email prof.afanasjev@yandex.ru

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Abbreviations: SG, salivary glands; CRF, chronic renal failure; ES CRF, end stage chronic renal failure;

Na+, sodium; K+, potassium; ALT, alanine aminotransferase; AST, aspartate aminotransferase; PMA, papillary marginal alveolar index; PSG, parotid salivary glands; SSG, submandibular salivary glands

Introduction

Diseases of the salivary glands can be directly related to kidney diseases. Previously, it was found that with the decompensated form of the terminal stage of CRF, the excretion of toxic products was significantly disrupted and they began to accumulate in the body.[1,2]

The decrease in kidney function had a great impact on the qualitative and quantitative composition of salivation. Thus, in patients with CRF, the release of a large amount of toxic products with saliva which under normal conditions were excreted by the kidneys was noted. Normalisation of salivation was observed after hemodialysis, which indicated in favour of the salivary glands taking over functions unusual for them, especially in terms of their allocation of large doses of urea, which led to a decrease in their functional activity.[3]

Studies by M.V. Osokin[4] have shown that in patients with end-stage chronic renal failure (ES CRF) and those on hemodialysis, had damage to the salivary glands with a violation of their function, the development of sialadenosis with the appearance of xerostomia was also revealed.

A decrease in salivation and a change in its qualitative composition led to digestive disorders, the development of caries and its complications.[5–7]

In the available literature, we found information about the qualitative and quantitative parameters of salivary glands and mixed saliva in patients with chronic kidney disease before and after kidney transplantation, which was the basis for this work.

The purpose of this study was to assess the condition of the salivary glands and oral mucosa in patients with chronic kidney disease before and after kidney transplantation in a comparative aspect.

Material and methods

In total, 50 patients with ES CRF were under our supervision. All patients underwent a comprehensive clinical and laboratory examination of salivary glands, oral mucosa and mixed saliva before and 6 months after kidney transplantation.

We studied the state of the parotid salivary glands and submandibular salivary glands salivary glands, assessed the state of the oral mucosa, papillary-marginal-alveolar index (PMA), CPI index, the presence of dry mouth, lips, eyes and tongue.

The function of the salivary glands (sialometry of mixed saliva) was studied, the viscosity and pH of saliva were determined. The biochemical composition of mixed saliva in the dynamics of the process was also studied: before and 6 months after kidney transplantation. The concentrations of total protein, Na+, K+, phosphorus, alkaline phosphatase, ALT and AST, urea, creatinine and α-amylase were determined.

Collection of unstimulated mixed saliva into test tubes was carried out for 10 minutes in the morning on an empty stomach. The biochemical study of saliva was carried out in the biochemical laboratory of the Moscow State Medical University named after A.I.

Evdokimov. To determine analytes in saliva, standard sets of reagents from the company "Vector-Best CJSC" (Russia) and a semi-automatic analyzer "BioChem SA" (USA) were used.

Results

The results of our study showed that during examination, an increase in the size of the parotid salivary glands was detected in 10 (out of 50) and submandibular - in 8 patients (Table 1). Dry mouth, especially at night after hemodialysis, bothered 84% of patients. The oral mucosa was poorly moistened in 37 (74%) patients. The feeling of sand in the eyes bothered 36% (18) of patients. 88% (44) of patients had disturbed sleep and 90% (45) – appetite. Foamy saliva was detected in 18 (36%) patients, which indirectly indicated the presence of xerostomia.

Table 1 Condition of salivary glands and oral cavity before and after kidney transplantation in 50 patients

Indicators	Before kidney transplant		6 months after kidney transplant	
	Patients	%	Patients	%
Increased size of PSG	10	20±5.6%	8	16 ±5.1% [2]
Increased size of SSG	8	16 ±5.1%	7	14±4.9 % [2]
Dry mouth	42	84 ±5.1%	27	54 ±7.0 % [1]
Dry lips	35	70±6.4%	21	42±6.9 % [1]
Feeling of sand in the eyes	18	36±6.7 %	9	18±5.4 % [3]
Disturbed sleep	44	88±4.5 %	25	50±7.0% [1]
Disturbed appetite	45	90 ±4.2%	21	42 ±6.9% [1]
Saliva discharge drop by drop	29	58±6.9%	19	36± 6.9% [3]
Weak moistening of the mucous membrane	37	74± 6.2 %	33	66± 6.6% [2]
Foamy saliva	18	36±6.9 %	15	30± 6.4% [2]
Overlaid tongue	5	10±4.2 %	2	4±2.7% [2]
Sialometry	0.36±0.03 ml/min		0.5±0.02 ml/min	
Viscosity of the saliva	1.02±0.05 см		0.8±0.04 см [1]	
Saliva pH	7.1±0.03 ед.		7.0±0.02 [1]	
CPI index	14.2±0.06		14.4±0.05 [1]	
PMA Index	44.2±0.7%		33.06±0.8% [1]	

With sialometry, the secretion rate was lower than normal and averaged 0.36= 0.03 ml/min (norm = 0.5 ml/min or more). The saliva viscosity of stage 2 (more than 1 cm for the gap between the branches of the tweezers according to the method of Professor V.V. Afanasyev was diagnosed in 27 (54%) patients, in 23 (46%) the saliva viscosity was within 0.7 cm, Stage 1. On average, the saliva viscosity was 1.02±0.05 cm, which was 2 times higher than normal. The pH of saliva averaged 7.1±0.03 units. The CPI index was =14.2±0.06, which indicated in favour of a high level of caries. The degree of gingivitis according to the PMA index before treatment was 44.2±0.7%, which indicated the average severity of gingivitis.

Dynamic examination of patients was carried out 6 months after kidney transplantation (Table 2). At the same time, an increase in the size of the parotid salivary glands was detected in 8 (16%) patients, submandibular - in 7 (14)% of patients, which was less than before treatment. But the data were not reliable (p≥0.05). Complaints of dry mouth and lips after treatment were presented by 54±7.0% and 42±7% of patients, which was significantly lower (p≤0.001) than before kidney transplantation.

Table 2 Composition of mixed saliva before and after kidney transplantation

Indicators	Composition of mixed saliva		
	Before kidney transplant	After kidney transplant	P
Total protein (g/l)control: 3.2 ±0.4	9.1±0.5	7.4±0.05	p≤0.01
Sodium (g/l) control: 1.44 ±0.25	1.40±0.01	1.38±0.01	p≤0.001
Potassium (g/l) control: 0.29 ±0. 12	0.44±0.01	0.40±0.01	p≤0.001
Phosphorus mmol/l control: 4.03 ±0.96	5.2±0.4	5.7±0.2	p≤0.01
Alkaline phosphatase (mmol/L) control: 13.11=3.69	39.2±2.7	32.3±2.1	p≤0.05
Ast E/L control : 20.6 ±1.20	54.5±13.0	31.6±8.2	p≤0.05
Alt E/L control: 18.9 ±2.00	29.7±6.1	1.7±5.4	p≤0.05
Urea mg/l control: 0.09 ±0.021	0.40±0.02	0.30±0.01	p≤0.001
Creatinine mmol/L. control: 12.7 ±2.1	178.6± 17.7	85.4± 5.4	p ≤0.001
Amylase me/L x 103 Control: 92.8 ±69.4	735.2±38.5	612.6±35.2	p ≤0.001

The results of sialometry showed a reliable restoration of the salivation level to normal values, while the rate of secretion of mixed saliva averaged 0.5±0.02 ml/min.

Note: [1]p≤0,001; [2]p≥0.05; [3]p≤0,05

Saliva viscosity significantly decreased after transplantation, but did not reach normal values and averaged 0.8 = 0.04 cm, which corresponded to stage 1.

The pH of saliva decreased slightly significantly and averaged 7.0±0.02 units. The papillary-marginal-alveolar index (PMA) significantly decreased and amounted to 33.06=0.8%, which indicated an improvement in oral hygiene and a decrease in gingivitis.

Analysis of the biochemical composition of mixed saliva in patients with TS CRF showed that the total protein in patients before surgery was significantly increased and amounted to 9.1±0.5 g/l. After transplantation, a slight decrease in protein was noted to 7.4±0.05 g /l, which was associated with a decrease in the inflammatory process in the kidneys and an increase in the level of secretion of mixed saliva.

The content of Na+ and K+ in mixed saliva before kidney transplantation was 1.40±0.01 g/l and 0.44±0.01 g/l. After transplantation, it decreased slightly significantly and amounted to 1.38= 0.01 g/l and 0.40=0.01 g/l. The content of Na+ and K+ depended on the ability of the kidney to carry out reabsorption and secretion of electrolytes by the tubular epithelium.

The kidneys play a leading role in regulating and maintaining the physiological level of P in the body. The reason for the violation of phosphorus-calcium metabolism was ES CRF and a decrease in kidney function, which persisted after their transplantation, which explained

the increased concentration of P in saliva both before surgery (5.2 ± 0.4 mmol/l) and after (5.7±0.2 mmol/l).

Before the operation, we found an increase in the concentration of alkaline phosphatase in the mixed saliva to an average of 39.2±2.7 mmol/l, after transplantation, the concentration of alkaline phosphatase decreased and averaged 32.3±2.1 mmol/l, one did not reach normal values. The activity of alkaline phosphatase increases in diseases accompanied by damage to liver tissue, kidneys and organs.

A long-term violation of phosphorus-calcium metabolism and an increase in the concentration of phosphorus and alkaline phosphatase were previously detected with impaired kidney and liver function. At the same time, the concentration of ALT (29.7±6.1) and AST (54.5±13.0) increased in the saliva of our patients. After kidney transplantation, there was a decrease in concentration: ALT (17.9±5.4) and AST (31.6 ±8.2) to normal values, which indicated the restoration of Ca-R metabolism and improvement of kidney function.

As a result of a violation of the filtering ability of the kidneys against the background of ES CRF, the content of urea and creatinine in mixed saliva increased, that is, there was an increase in the excretion of urea and creatinine with saliva. The concentration of urea and creatinine in saliva before surgery was increased: 0.4±0.02 mg/l and 178.6± 17.7mmol/l. After surgery, their concentration in saliva decreased to 0.3±0.01 mg/l and 85.4±5.4 mmol/l, respectively but did not reach normal values.

Urea and creatinine are important indicators of kidney activity and an increase in their concentration before surgery indicated a compensatory reaction on the part of the SG due to the inability of the kidneys to release toxins in full.

α-amylase is an enzyme that is produced in the pancreas and secreted with the secret of parotid saliva. It breaks down dietary carbohydrates and binds groups of oral streptococci, leading to their death and absorption by macrophages. Prior to kidney transplantation, a significant increase in the activity of mixed saliva α-amylase was established to an average of 735.2±38.5 mmol/l, which indicated a reaction of the LV to the pathological state of the kidneys. After surgery, not complete recovery of α-amylase to 612.6±35.2 mmol/l was noted, which indicated that the function of the salivary glands was not fully restored.

Conclusion

The results of our study showed the presence of pronounced xerostomia with impaired SG function in patients with ES CRF, which led to a change in the qualitative and quantitative indicators of mixed saliva. After kidney transplantation, the function of the SG improved, but did not recover to normal values. Also, there was an improvement in the hygienic condition of the oral cavity.

The increased secretion of salivary urea and creatinine testified in favour of the fact that the salivary glands partially took over the excretory function of the kidneys in CRF. An increase in the concentration of alpha-amylase and total protein in the mixed saliva before kidney transplantation indicated a reaction of the salivary glands to destructive and inflammatory processes in the body.

The results showed in favor of the need for dispensary monitoring of patients after kidney transplantation and preventive therapy of salivary glands in order to improve and restore their function.

Acknowledgments

None.

Conflicts of interest

The author declares no conflicts of interest.

References

1. Bondar TP. Biochemical methods of diagnosis of kidney diseases. Educational and methodical manual for independent work of students. Stavropol State Medical University. Department of Clinical Biochemistry. 14p.
2. Vetchinnikova ON. Kidney transplants and hyperthyroidism. Scientific article. Gbuz mo monica im Vladimirsky. Moscow. 2017;16 p.
3. Vavilova TP, Yanushevich OO, Ostrovskaya IG. Spittle. Analytical capabilities and prospects/ "Binom".- Moscow. 2014;311p.
4. Osokin MV. The state of the salivary glands in patients with chronic renal failure in the terminal stage/ Abstract. dissertations for the degree of Candidate of Medical Sciences. Osokin Mikhail Vladimirovich.
5. Afanasyev VV. Salivary glands, Diseases and injuries: a guide for doctors. Moscow, Geotar-Media. 2012;296p.
6. Breschenko E, Bykov IM. Biochemistry of the oral cavity, oral and gingival fluid, 2018.
7. Vaishnava P, Halbert Rondon-Berrios. Electrolyte and acid-base disorders in kidney transplant recipients. *Front Med*. 2018;5:261.