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Practical Aspects of Parenchymatous Parotitis' Stage Diagnostics in An Exacerbation Period

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***Abstract**: Comparative evaluation of the effectiveness of biochemical indices of blood serum and mixed saliva of patients with parenchymatous parotitis in an exacerbation period at the stage of admission with complete blood count indices as well as with the results of sialography of this group's patients was done. High correlation coefficients are discovered in biochemical fluids on the indices of complete protein, chlorides, ALT, phosphatase, amylase in all the forms of parenchymatous parotitis. Complete blood count indices happened to be noninformative for the diagnostics of the form of parenchymatous parotitis. Informative indices of mixed saliva gotten can be used in the process of patients' examination, suffering from parenchymatous parotitis in an exacerbation period for the identification of the form, severity level, prognosis of the disease and planning of an adequate treatment as a high-precision, noninvasive, pathognomonic test.*

***Keywords**: parenchymatous parotitis, sialography, parotid glands, parotid ducts, chronic parotitis, contast mass, blood serum, parenchyma, saliva's amylase*

I. Introduction

Timely and correct diagnostics of saliva glands' diseases remains a topical problem of modern medicine [2,6,7]. It was established that in more than 70% of cases there is a discrepancy between the patient's diagnosis at admission to a specialized health care setting, not to mention the diagnostics of the form and the stage of the disease [7]. This situation is due not only to an increase in the total number of patients, the lack of common algorithms, standardized criteria and efficient methods of diagnostics, but also due to the fact that various diseases of salivary glands have similar clinical symptoms together with the course of chronic parotitis on the background of concomitant somatic pathology. Differental diagnostics requires a great deal of clinical experience and the use of special equipment [4]. It is necessary to keep in mind that the identification of the form of chronic parotitis with the use of different methods of diagnostics should be done after the remission of acute inflammation.

Experience gotten during recent years shows that the number of advanced and complicated forms of chronic parotitis does not tend to decrease. At the same time it is not always possible to stop the pathological process at the later stage with the conservative treatment. All the above mentioned can be attributed to the complexity of diagnostics and the establishment of the disease's form at the stage of patients' examination, followed by drowing patogenetically reasonable treatment plan.

Biophysical and biochemical studies of saliva are of great interest at the present level of the dental surgery development. Accumulated experimental and clinical material of research on the use of these methods in various areas of medicine allows to speak with confident about their high diagnostic value [3,4].

Improvement of methods of differential diagnostics of various forms and inflammatory phases of diseases of major salivary glands in an exacerbation period**,** prognosis of their course and the possibility of the development of some complications, as well as the development of effective methods of treatment assessment continue to be practically important at present.

Therefore, a perspective direction in solving the problem is the search of parameters, information content of which is retained at the transition from blood serum to the saliva.

II. Materials And Methods

In the course of the research a female group of 96 people with somatic disease in anamnesis, except patients having insular diabetes, at any stage of compensation, with acute attack of parenchymatous parotitis without abscess formation in the gland was selected. They were hospitalized into the department of maxillofacial surgery of "Town's clinical hospital №11, Omsk city, Russian Federation.

A parallel study of complete blood count, biochemical testing of blood and mixed saliva of all the patients was performed. According to the results of biochemical testing of blood and mixed saliva in the direction of their deterioration as compared to normal indices 3 groups of patients were formed(group 1 -33 people, group 2 – 35 people, group 3 – 28 people). The age of patients ranged from 45 to 65 years old.

The laboratory determined the biochemical indices of blood serum and mixed saliva content of chloride, glucose, total protein, urea, bilirubin, creatinine, ALT, AST, amylase and phosphatase activity). At the same time, indices of complete blood count were studied in every group of patients. At the end of the patient's period of treatment and after decrease of acute inflammation, the artificial contrasting of the salivary gland on the affected side was performed.

Statistical analysis was performed using the software package Statistica 6.0 (StatSoft). The arithmetical means (M), the standard error from the arithmetical means(m), median (Me) and the interval of means between 5-95% were calculated. Two types of statistic criterion were applied according to the form of differentiation: parametrical (T-Student's criteria) and non-parametrical (U-Wilcokson's criteria). Correlation analysis with the Pearson's and Kendel's correlation coefficient calculation was done to identify the attendance between various indicators.

III. Results And Its Discussion

The biochemical indices of blood serum and mixed saliva of the first group's patients were compared to those ones of the second group's patients on the background of the exacerbation of parenchymatous parotitis on the first stage. (**Tables 1, 2**).

Table1. Results of biochemical blood testing

Parameters	Group1 (n=33)	Group 2 (n=35)	Group 3 (n=28)	Δ,%	Norm
Chlorides, mmol/l	65,2±3,2*	71,8±11,8*	91,8±12,3*	+10,2/+22,1/+8,8	95,9-109,9
Complete Protein gr/l	64,6±1,8	69,1±3,5	74,5±2,8	+5,9/+15,3/+6,7	65-85
Glucose, mmol/l	4,5±0,3	4,5±0,2	4,5±0,2	±0/±0/±0	3,88-6,1
ALT, U/l	15,4±5,2*	24,7±3,7*	30,1±5,9*	+14,4/+17,1/+55,8	5-30
AST, U/l	29,4±5,5	30,2±5,1	31,1±4,2	-1,6/-1,0/-2,8	8-40
Phosphatase, U/l	107,4±6,1*	154,5±14,9*	188,7±13,0*	-53,7/-72,4/-139,9	130±8,62
Amylase, U/l	51,5±4,1*	65,4±21,7*	87,2±12,6*	-26,0/-37,0/-84,3	50,6±1,62
Creatinine, mcmol/l	60,5±2,6	79,1±4,3	86,5±5,1	+15,1/+37,5/+48,8	53,0-106,1
Urea, mcmol/l	3,8±0,2	4,7±0,4	5,4±0,3	+13,3/+14,9/+27,9	2,50-8,32
Bilirubin, mcmol/l	8,3±0,6	9,0±1,2	9,3±1,1	+14,9/+16,3/+14,3	8,5-20,5

%- difference between the indices of the first and the second groups, the second and the third groups, the third and the first groups; 100% - indices of the first group;

Δ* the reliability of different indices, $p<0.05$.

As can be seen from the data blood indices of group 1 and 2 listed in **Table 1**, such parameters as glucose, urea, bilirubin were not significantly altered when used as biosubstrate in the blood serum ($p>0.05$). Alteration of the other parameters in the fluid between the groups compared is statistically reliable ($p<0.05$). Creatinine is an exception, its indices in the blood serum are increased in Group 2 ($p<0.05$). It should be pointed out that the increase of amylase activity indices is established when compared with the referent outside indices of blood serum. One of the reasons of such hyperamylasemia is an inflammatory process of a salivary gland, that have reliable differences between the groups 1 and, which is not contrary to the clinical picture and severity of the disease. Speaking about the other parameters it should be mentioned that the content of chlorides is altered (downwards in group 1) and the phosphatase activity is also changed (downwards in group 2) if compared with the referent indices (($p<0.05$). Phosphatase activity is increasing in inflammation of soft tissues of the maxillofacial area with the progress of the disease. However, data on this enzyme's activity are very contradictory [1].

Such indices of blood as glucose, urea, bilirubin, if compare them between groups 2and 3, are also not significantly altered ($p>0.05$). The other indices of blood serum between the groups compared vary significantly ($p<0.05$), except for creatinine. Increase of creatinine in blood serum is observed when there are metabolic derangements taking place in the structure of the salivary glands and it is directly dependent on the severity of the pathological process [1] . It is evident that the results gotten do not contradict, but confirm the

clinical picture and those ones known from the information published in medical literature. The content of chlorides is altered (upwards in group 3) and phosphatase activity is altered (downwards in group 2) as well. Increase of chlorides level in blood in group 3 is an unfavorable symptom, as chloride is a toxic substance. Its sharp increase contributes to the destruction of living cells, thus suppressing the process of growth and proliferation of tissues [1].

As can be seen from the data blood indices of group 1 and 3 listed in **Table 1**, such parameters as glucose, urea, bilirubin were not significantly changed as well ($p>0.05$). The remaining indices of blood serum between the groups under comparison are reliably altered: ALT, phosphatase activity, amylase and chloride. ($p<0.05$).

Table 2. Results of biochemical blood testing of mixed saliva

Parametres	Group 1 (n=33)	Group 2 (n=35)	Group 3 (n=28)	Δ,%	Norm
Chlorides, mmol/l	11,62±2,66*	31,4±8,5*	38,8±4,6*	+184,5/+178,5/+276	8,46-16,9
Complete Protein gr/l	4,15±1,21	6,97±2,37	8,13±2,23	+4,6/+58,8/+44,2	1,0-3,0
Glucose, mmol/l	0,021±0,008	0,028±0,005	0,027±0,009	±0/±0/±0	0,06-0,17
ALT, U/l	57,4±12,7*	88,8±12,1*	107,8±19,3*	+14,4/+31,3/+96,5	16±2
AST, U/l	123,7±15,2	128,4±10,9	133,4±11,5	-0,9/-3,5/-5,5	33±8
Phosphatase, U/l	56,1±5,8*	41,8±6,5*	34,1±8,9*	-59,1/-29,5/-6,9	16±2
Amylase, U/l	1931,5±305,8*	2278,9±169,1*	3007,4±147,8*	-45,0/-23,0/-87,8	529,6±20,6
Creatinine, mcmol/l	27,7±5,6	19,7±4,9	15,9±6,1	-19,9/-31,8/-49,8	2,0-10,0
Urea, mcmol/l	13,6±2,1	10,46±1,7	8,52±1,1	-11,7/-19,6/-20,8	1,83

%- difference between the indices of the first and the second groups, the second and the third groups, the third and the first groups; 100% - indices of the first group; Δ* the reliability of different indices.
Δ* the reliability of different indices, $p<0.05$.

A more complicated situation is observed when comparing the indices of mixed saliva with the normal ones (**Table 2**), since there are no generally accepted criteria for such indices. Therefore, any comparison with the referential limits in this case is debatable [1].

Special attention should be paid to the high indices of amylase activity in all the groups compared ($p<0.05$).These saliva amylase indices are an order higher than those for blood serum. Increase is observed during the transition from group 1 to group 2 ($p<0.05$), from group 2 to group 3 ($p<0.05$), from group 1 to group 3 the mixed saliva's amylase activity Data on the mixed saliva's amylase activity are complimented with the data on blood's indices. So, the mixed saliva's amylase activity indices increase with the progression of inflammation in the soft tissues of the maxillofacial zone, determining the severity of the pathological process [1].

It can be supposed that saliva, being a more dynamic medium, if compared with blood, reflects pathological changes in the organism quicker, making its use for diagnostic purposes really appropriate [1].

Such indices of blood as glucose, urea, bilirubin do not change significantly when using both biological fluids: blood serum and mixed saliva as a biosubstrate. It can be observed from the data listed in **Table 2**. Therefore, these indices can be excluded from the algorithm of patients' examination with acute attack of parenchymatous parotitis. It should be mentioned that the content of creatinine in blood serum increases during the inflammatory process ($p<0.05$), but in mixed saliva it decreases. Since urea and creatinine determine the level of residual nitrogen in human's saliva, apparently, these indices are reduced at the transition of the inflammatory process in the later stage of the disease, involving urological bacteria of salivary sediment [1].

The severity of the illness can be judged by the terms changes of mixed saliva indices and it is possible to observe them in the dynamics. Increase in the chloride content, amylase and phosphatase activity decrease are significant at the transition from group 1 to group 2, from group 2 to group 3, from group 1 to group 3.

A marked change in the relevant general clinical blood parameters (ESR, white blood cells) was observed while examining patients with acute exacerbation of inflammation in the salivary gland. **Table 3** presents the average means of the main laboratory tests of the patients with acute exacerbation of parenchymatous parotitis.

Table 3. Results of general clinical blood's tests.

Parametres	Group 1 (n=33)	Group 2 (n=35)	Group 3 (n=28)	Δ,%	Norm
Erythrocytes, $x10^{12}$cells/l	3,1±0,5	3,4±0,3	3,9±0,4	-1,8/-1,1/-4,2	4-5,1
ESR, mm/h	32±3*	42±6*	59±10*	+45,4/+89,9/+69,7	0-10
White blood cells, $x10^{9}$ cells/l	9,9±0,3*	10,8±0,6*	14,5±0,4*	+38,1/+79,9/+56,3	4-10

Eosinophiles, %	7±2	7±2	8±2	±0/±0/±0	0-5
Basophilic cells, %	3±2	4±2	4±2	±0/±0/±0	0-1
Lymphocytes, %	35±4	39±3	44±4	-2,4/-6,7/-3,3	18-30

%- difference between the indices of the first and the second groups, the second and the third groups, the third and the first groups;

100% - indices of the first group;

Δ* the reliability of different indices ($p<0.05$).

These data indicate the absence of any significant changes in laboratory means of blood parameters during exacerbation of chronic parotitis in all groups on all parameters ($p> 0.05$).

According to the complete blood count in all the groups, we can speak about the shift, taking in account a wide range of indices of such parameters as ESR from 30 to 65 mm/l and the number of white blood cells from 9.9 to 15.0 $x10^9$ cells/l.

Analysis of the complete blood count's indices gives the opportunity to establish the existence of similar manifestations among the patients of all the clinical groups at the pre-admission stage.

Sialographical study of parotid glands was performed at the final stage of patients' examination, after the relief of acute inflammatory process immediately before discharging them from the hospital.

All the data gotten during these tests allow to judge about the structural state of the parenchyma and ducts, and in most cases, helped to differentiate the various forms of chronic parotitis, as well as to assess the value of a screening study of biochemical parameters of blood and saliva mixed in the differential diagnostics of various forms of chronic parotitis at the pre-admission stage.

Table 4. Results of artificial contrast study of parotid glands

Признаки	Group 1 (n=33)	Group 2 (n=35)	Group 3 (n=28)
Vague picture of salivary gland's parenchyma	33 (100%)	35 (100%)	28 (100%)
Rounded cavities in parenchyma up to 0.5 mm	33 (100%)	32 (91,4%)	23 (82,1%)
Rounded cavities in parenchyma over 0.5 mm	0 (0%)	16 (45,7%)	28 (100%)
Extravasation of the contrast mass in the thickness of the parenchyma	2 (6,1%)	17 (48,6%)	20 (71,4%)
Dilatation of the excretory ducts	0 (0%)	13 (37,1%)	28 (100%)
Dilatation of the main excretory duct	0 (0%)	3 (8,6%)	24 (85,7%)
Vague ducts of small order	0 (0%)	31 (88,6%)	28 (100%)
Clear ducts of small order	33 (100%)	1 (2,9%)	0 (0%)
Broken contour of the ducts of small order	6 (18,2%)	35 (100%)	28 (100%)
Small order ducts are not defined	0 (0%)	0 (0%)	20 (71,4%)

According to the data of **Table 4** and **Fig. 1**, rounded cavities to 0.5 mm in diameter predominate on the background of the vague picture of parenchyma along with some cavities enlarged in diameter, filled with contrast substance. The main parotid duct is unchanged, has clear contours. In this case ducts of the higher order (II-V) are detected. They have a form of peculiar collaterals interconnecting cavities that also have clear but broken contour. This sialogram is typical for the primary forms of chronic parotitis. **Fig. 1** – is the sialogram of a patient from Group 1.

Fig.1 Sialogram of a patient, Group 1.

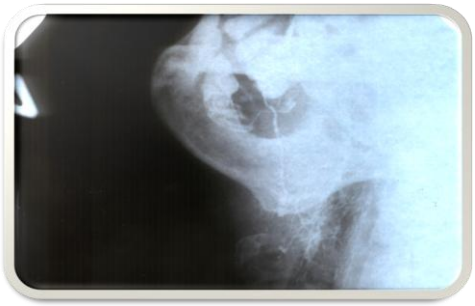

Fig.2 Sialogram of a patient, Group 2.

According to the data of **Table 4** and **Fig. 2**, there are a lot of rounded cavities of different diameters on the background of the vague picture of parenchyma. The main parotid duct is unchanged. Its widening can be observed only in isolated cases. At the same time, ducts of smaller order, connecting the cavities with indistinct broken contours, do not always retain the form of collaterals. At the same time, there are isolated cases of small clusters of contrast medium, i.e. extravasation of the contrast medium in the interior gland parenchyma. This sialogram is typical for clinically severe forms of chronic parotits. **Fig. 2** – is the sialogram of a patient from Group 2.

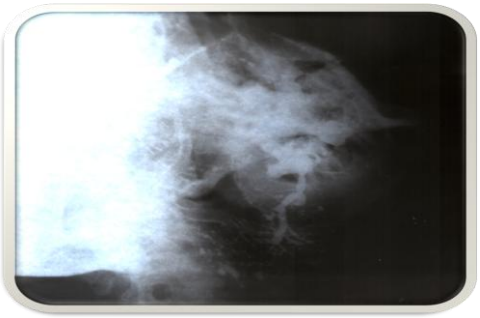

Fig.3 Sialogram of a patient, Group 3

Fig.4 Sialogram of a patient, Group 4.

As can be seen from the data of **Table 4** and **Fig. 3** and **4**, there is a large number of rounded in shape cavities of more than 0.5 mm. in diameter on the background of a vague picture of the parenchyma. The main parotid duct is widened retaining its clear contours. At the same time, ducts of smaller order do not always retain the form of collaterals and in isolated cases they are not visualized. The accumulation of contrast medium in the form of spots, 1-2 mm in the diameter, with unclear contour are visualized. It can be explained by the extravasation of the contrast medium as a result of the duct's wall permeability and parenchymal imbibition enhance, that occurs with the loosening of the basal membranes of intralobular ducts caused by the development of cell-rounded periductal infiltrates. This sialogram is typical for late forms of chronic parotitis. **Fig. 3 and 4** – is the sialogram of a patient from Group 3.

IV. Conclusion

The correlative interconnection of oral fluid metabolism and blood's serum indices detected, allows us to suggest that saliva is included into the functional system of human's organism and can change its parameters (chlorides, ALT, phosphatase, amylase) with various forms of chronic parotitis during exacerbation period. The results of this research confirm the perspective of salivadiagnostics' development that gives the opportunity to obtain diagnostically valuable information for deciding on the form of the chronic parotitis during the exacerbation at the pre-hospital stage with noninvasive method, when traditional methods of diagnostics are contraindicated.

At the course of the research the possibility of monitoring of main pathochemical symptoms that define the form of parenchymatous parotitis during the exacerbation according to the parameters of mixed saliva at the pre-hospital stage is studied. The obtained data of oral fluid metabolism parameters at the pre-hospital stage are valuable for the disease's degree of severity establishment as well as for the prognosis and pathogenically reasonable correction of doctor's list of prescriptions during the patient's staying in hospital. Exacerbations of chronic parotitis occur on the background of somatic pathologies of different degrees of compensation. So, the data of salivadiagnostics can be used by intern-doctors at the stage of patients' admission for the prescription list's correction with the aim of pathochemical symptoms and syndromes of somatic pathologies monitoring.

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