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Protein Metabolism Disorders in Patients with Purulent Wounds with Thyrotoxicosis Against Diabetes Mellitus

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ABSTRACT

Introduction: The course of purulent wounds against the background of diabetes and the accompanying thyrotoxicosis is one of the urgent tasks of modern purulent surgery

Objective: Improving the results of treatment of purulent wounds in patients with a combined pathology of thyrotoxicosis with diabetes mellitus, by studying disorders of protein metabolism.

Methods: A retrospective analysis of the clinical course of purulent surgical diseases associated with thyrotoxicosis in patients with diabetes mellitus (DM) and an assessment of protein metabolism disorders in this category of patients was performed. Thyrotoxicosis in combination with diabetes was diagnosed in 104 (16.8%) of 619 patients treated in the clinical base of BSMI

Results: In patients with purulent surgical diseases associated with thyrotoxicosis on the background of diabetes, there is a pronounced violation of protein metabolism, which negatively affects the course of the wound process.

Conclusion: Timely correction of hormonal disorders in thyrotoxicosis and hyperglycemia leads to better treatment results. Such patients must be treated by an endocrinologist.

Key Words: Purulent surgical diseases, Endocrine system, Phlegmon, Hydradenitis, Purulent lymphadenitis, Panaritium, Phlegmon

INTRODUCTION

The problem of studying the pathogenesis and treatment of wounds and wound infections with diabetes mellitus is one of the most important sections of scientific and practical medicine. Issues of treating wounds and wound infections are sufficiently reflected in the scientific works of many scientists.^{1,2} However, the course of purulent wounds against the background of diabetes and the accompanying thyrotoxicosis is one of the urgent tasks of modern purulent surgery. In recent years, cases of combined pathology of thyrotoxicosis with diabetes have become more frequent in patients with purulent surgical diseases.³ In this regard, the course of the wound process in this category of patients is important. The complex pathogenetic mechanism for the development of diabetes is systemic. On the one hand, microcirculatory disorders, ischemia, tissue hypoxia, the development of oxidative disorders in cells with diabetes mellitus.^{3,4} and on the other hand, hemodynamic disorders,

inhibition of the immune system, and metabolic disorders in thyrotoxicosis negatively affect the outcome of purulent surgical diseases.⁵⁻⁷ Decreased resistance to infection and the frequent occurrence of purulent-inflammatory diseases in patients with diabetes are caused by impaired immunological and plastic processes in the tissues. This is based on insulin deficiency that has an active effect on all metabolic processes.^{2,4,8} All this leads to a slowdown in regeneration and reparative processes.

The thyroid gland is an organ of the endocrine system and, among other functions, performs the function of supporting homeostasis in the body. In diseases of the thyroid gland, hormonal imbalance occurs.^{9,10} The effect of thyroid hormones on protein metabolism depends on the concentration of hormones. In small concentrations, they exert anabolic effects on protein metabolism, increase protein synthesis, and inhibit their breakdown, causing a positive nitrogen balance. At high concentrations, thyroid hormones have a

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strong catabolic effect on protein metabolism, causing increased protein breakdown and inhibition of their synthesis.^{11,12}

There remain many questions regarding the mechanism of action of both diseases on the course of the wound process. Solving these problems will help achieve better results in the treatment of purulent wounds with the combined pathology of thyrotoxicosis and diabetes mellitus.^{13,14}

MATERIALS AND METHODS

In the clinical base BSMI, for the period from the year 2009 to 2019, 619 patients with purulent surgical diseases suffering from various forms of diabetes were hospitalized. Of these, 104 (16.8%) patients were diagnosed with thyrotoxicosis. The age of patients ranged from 20 to 64 years, the average age of which was 42 years with Men 364 (58.8%) and women 255 (41.2%). The examined patients were divided into the following two groups: Group I - 515 patients with purulent wounds of various localizations against diabetes mellitus without thyrotoxicosis. Group-II - 104 patients with purulent wounds on the background of diabetes mellitus and thyrotoxicosis, 47 men (45.2%), and 57 women (54.8%).

The prognostic coefficient (PC) of the course of the wound process was determined by the formula of M.F. Mazurik (1984):

OBP (total plasma protein) and OBRO (total protein of wound discharge)

With a decrease in PC below the norm (1.2-1.3), patients were transfused with protein preparations taking into account the indications. In all patients in dynamics, we performed pH - metre of wound exudate was performed. The data obtained were processed using standard statistical methods of correlation analysis.

RESULTS AND DISCUSSION

Demographic Characteristics

As can be seen from Table 1, in the first group there were 515 (83.2%) patients, 307 (59.6%) of them were men and 208 (40.4%) were women aged 19 to 80 years (mean age was 48, 4 ± 2.1 years). In group II - 47 (45.2%) and 57 (54.8%) aged 19 to 75 years (average age was 49.4 ± 1.8 years).

Table 1: Patient characteristics by gender and age.

Groups	Age										Overall
	Under 19 yr		20-44 yr		45-59 yr		60-75 yr		75 years and more		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
I	14	8	112	81	143	92	23	18	15	9	515
II	2	3	15	17	16	21	11	12	3	4	104
Overall	27 (4.4%)		225(36.3%)		272(44%)		64 (10.3%)		31 (5%)		619

Most patients (74.4%) were of the most working-age from 20 to 59 years old. Following types of purulent surgical diseases were noted: Abscesses - 127 (20.5%), phlegmon of various localizations - 104 (16.8%), purulent diseases of soft tissues of different localizations (panaritium, phlegmon of the hand and foot, perineal phlegmon, hydradenitis, purulent lymphadenitis, suppurative cyst of the coccyx, suppurative echinococcus of the liver) - 302 (48.7%), and postoperative purulent wounds - 86 (13.4%) patients. Traditional treatment methods were accepted for all patients with purulent surgical diseases - opening a purulent focus, debridement, and applying a water-soluble ointment under a dressing. The volume of surgical interventions consisted of the opening, rehabilitation, and drainage of purulent cavities under general anaesthesia, taking into account the anatomical location, size, and stage of the purulent process. All patients underwent a

common set of examinations: clinical blood and urine tests, a biochemical blood test, a coagulogram, a blood group, and a Rhesus factor, and a panoramic x-ray of the chest organs.

Severity of diabetes

A decrease in the resistance to the infection as well as frequent occurrence of purulent-inflammatory diseases in patients with diabetes is caused by impaired immunological and plastic processes in the tissues. Hyperglycemia and insulin deficiency have an active effect on metabolic processes that lead to impaired protein metabolism. Of the total number of patients (619), diabetes of various severities was primarily detected where patients are classified as 214 (34.5%) patients with mild diabetes, 315 (50.8%) with moderate conditions, and 90 (14.5%) patients with severe complications (Table 2). A diabetic history revealed that out of 619 patients,

diabetes was detected in 412 (66.5%) patients for the first time, 207 (33.4%) patients had 4 years or more, the average duration of the disease was 11 years.

Table 2: Diabetes of various severities.

Severity	Glycemia (mmol/l)
Mild (214)	8.3 – 9.9
Moderate (315)	10.1 – 16.7
Severe (90)	16.7 – 20.5

Purulent surgical diseases against diabetes mellitus often have an asymptomatic course and the cause is unclear. They can be single, multiple, limited, extensive, and widespread.

All patients complained of hyperthermia from 38 to 41 degrees, chills, general weakness. Many were worried about the pain in the area of the purulent focus. Along with clinical manifestations, hyperglycemia indicators were analyzed. At the same time, persistent hyperglycemia and glucosuria were detected in these patients. In patients with a mild form of the disease, glucosuria did not occur. In severe diabetes mellitus, the development of a purulent process was accompanied by an increase in temperature to 39-40°C. In some patients, the consciousness was darkened. The purulent process preceded with high hyperglycemia, expressed by glucosuria, ketonuria. Pronounced functional impairment of the kidneys and liver, a significant increase in the number of leukocytes in peripheral blood, and an increase in ESR were also found.

Clinical blood counts did not always correspond to morphological changes: in 18 patients (43%), leukocytosis was lower than $9.0 \times 10^9 / l$, and in 14 patients (32%) the percentage of stab forms did not exceed 10, which was observed in most cases in patients of advanced and senile age and, possibly, this is due to the activity of the body during this period of life and due to the presence of diabetes mellitus. The maximum values of these indicators in the remaining patients reached: leukocytosis - $26.4 \times 10^9 / l$, metamyelocytes - 2%, stab - 32%, toxic granularity ++. Of the biochemical parameters, creatinine, urea, ALT, and AST increased most often in 27 patients (49%). Total bilirubin increased in 113 patients (23.6%) to $25.8 \mu\text{mol} / L$. All this leads to a slowdown in regeneration and reparative processes in the wound. Clinically, when diabetes is combined with thyrotoxicosis, patients usually complaints of palpitations, at times a feeling of lack of air, stuck in the throat, insomnia, neurosis, weakness, and rapid fatigue. We have distributed patients into three groups according to the clinical course: mild thyrotoxicosis, moderate severity, and severe severity with combined pathology with purulent surgical diseases and diabetes. With a mild degree of thyrotoxicosis in patients with purulent surgical diseases, nervous excitability, irritability, decreased performance, weight loss by 10 = 15%, constant tachycardia, pulse

rate up to 100 beats per minute were observed. Metabolism increased by 30%, A / D within normal limits.

With moderate severity, severe irritability, irritability, and weight loss of 20% or more were observed. Tachycardia pulse 100-120 beats per minute. Basal metabolism increases by 30-60%. A / D is increased by 140/60 mm Hg. Ophthalmopathy and severe sweating. With a severe degree of goitre in patients with purulent surgical diseases, there was strong excitability of the nervous system, severe irritability, complete loss of performance, weight loss by 50%, tachycardia, pulse more than 120 beats per minute, arrhythmia, basal metabolism increases by more than 60%, heart failure, paroxysmal tachycardia, liver damage, psychoses, delusions, hallucinations, and severe ophthalmopathy. A big difference in systolic and diastolic pressure, the difference is more than 40% .

Along with clinical manifestations, the data of hormonal tests of the thyroid gland in patients with purulent surgical diseases associated with endocrine pathologies were analyzed. At the same time, in patients with a mild degree of thyrotoxicosis, no particularly pronounced hormonal disorders were noted. However, with moderate goitre severity, a decrease in TSH activity (thyroid-stimulating hormone) was accompanied by an increase in the levels of T-3 (triiodothyronine) and T-4 (thyroxine). An increase in the activity of anti-thyroid peroxidase (Anti TPO) in these patients indicates an autoimmune nature of the disease; *i.e.* the immune system is suppressed with thyrotoxicosis. More pronounced hormonal disorders were observed in severe goitre with thyrotoxicosis. Thus, with a decrease in TSH activity, the level of thyroid hormones T-3 and T-4 increased sharply, while an increase in the activity of Anti TPO was observed.

All these violations aggravated the course of the wound process, which was manifested in the slowing down of the wound clearing time, the transition of the wound process from the first to the second phase.

These disorders were aggravated by a combination of diabetes mellitus with thyrotoxicosis, so with an increase in TSH total protein and total bilirubin decrease ($r = -0.3, p < 0.05$), and with an increase in T4 and blood toxins (urea and creatinine: $r = 0.3, p < 0.05$, $r = 0.4, p < 0.05$, respectively). In general, the data obtained correspond to the main links in the pathogenesis of both diseases (diabetes mellitus and thyrotoxicosis) in Table 3. The analysis of the data revealed that patients have both direct and inverse dependence of metabolic parameters on the level of hormones TSH and T4 in the blood, which corresponds to the literature data. There is a direct relationship between the level of T4 and indicators of protein metabolism (urea, creatinine, total protein), and an inverse relationship with TSH.

Table 3: Clinical and Laboratory manifestations

Severity	Clinic	Laboratory
Lightweight (67)	Nervous irritability, irritability, sweating. Working capacity is reduced, constant tachycardia, pulse up to 100 beats per minute. Weight loss by 10-15%. Metabolism increases by 30%. A / D does not change or is slightly elevated. Noophthalmopathy.	T-3 free; 1.5 - 3.0 ng / dl T-3 gen: 0.8 - 2.5 ng / dl T-4 free: 0.8 - 2.5 ng / dl T-4 total: 4.4 - 11.0 g / dl TSH: 0.3 - 4.0 mmE / l Anti TPO: 0 - 34 U / ml.
Moderate (31)	Severe nervous irritability, irritability, severe sweating. Working capacity is reduced, constant tachycardia, pulse up to 120 beats per minute. Weight loss by 20% or more. Metabolism is increased by 60%. A / D rises 140/60 mm hrtst rises. Ophthalmopathy.	T-3 freedom; 3.0 - 3.5 ng / dL T-3 gen: 2.5 - 3.0 ng / dl T-4 free: 2.5 - 3.0 ng / dl T-4 total: 11.0 - 11.5 ng / dl TTG: 0.1 - 0.2 mmE / L Anti TPO: 34 - 36 U / ml.
Severe (6)	Strong irritability of the nervous system, severe irritability, severe sweating. Complete loss of performance, decreased, constant tachycardia, pulse more than 120 beats per minute, arrhythmia, heart failure, paroxysmal tachycardia. Liver damage. Psychoses, hallucinations. Weight loss by 50%, the main metabolism rises more than 60%. The difference between systolic and diastological A / D is more than 40%. Severe ophthalmopathy.	T-3 free; more than 3.5 ng / dl T-3 total: more than 3.0 g / dl T-4 free: more than 3.0 g / dl T-4 total: more than 11.5 g / dl TSH: 0.03 and below mmE / l Anti TPO: above 36 IU / ml.

Thus, in persons suffering from thyrotoxicosis against the background of diabetes, significant changes in metabolism occur. In particular, this applies to indicators of carbohydrate metabolism (glucose), protein (urea, creatinine, and total protein), and fat (cholesterol, HDL, LDL, and weight loss). Such shifts can be explained primarily based on the influence of thyroid hormones and hyperglycemia on metabolic processes in the body which, in turn, negatively affects the course of the wound process. This is mainly reflected in the slowdown in wound healing by 3.4 days then in patients with purulent wounds on the background of diabetes mellitus without thyrotoxicosis. In street II-gr, suffering from thyrotoxicosis and diabetes mellitus, the total blood protein decreases sharply to 57.5 g/l, and the loss of protein with exudate from the wound

increases, which amounted to 56.5 g/l. Then, as in the I-gr as compared with the II-gr, the level of these indicators is disturbed to a lesser extent. As a result, on the 6th day, the wound process transitions to the second phase, and on the 13th day, the transition to the third phase of healing occurs in the first group of patients. In the second group of patients suffering from diabetes and thyrotoxicosis at the same time, the timing of wound healing slows down. As you can see in the table, the transition to the second phase occurs on the 9th day, and the transition to the third phase of healing occurs on the 17th day (Table 4). All this is due to the negative influence of both concomitant pathologies on the healing of the wound process, due to a violation of protein metabolism.

Table 4: Comparative dynamics of PK indicators according to Mazurik (protein + exudates) and wound healing in 1-2 patient groups

Group of sick	Overall White in blood g / l	white. exudate. g / l	PC according to M.F. Mazurik	days	days
				Phase II transition	Phase III transition
I-gr (515)	68.1±2.8*	56.9±1.8	1.1±0.02*	6	13
II-gr (104)	57.5±3.1	56.5±0.02*	1.0±0.03*	9	17

Note: * - p < 0.05 - reliability indicator.

CONCLUSION

Indicators characterizing blood protein and loss of protein with exudate from a wound according to Mazurik in patients with thyrotoxicosis against the background of diabetes mel-

litus are in close relationship with the levels of hyperglycemia and hormones TSH, T4 in the blood. The timing of wound healing in patients with thyrotoxicosis against the background of diabetes is slower than in patients with purulent wounds associated with only diabetes. It is necessary to

further develop ways of correcting protein metabolism disorders in patients with purulent wounds with thyrotoxicosis against the background of diabetes mellitus.

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