

# The Effectiveness of the Therapeutic and Diagnostic Algorithm of Complex Surgical Treatment of Diffuse Toxic Goiter

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**Abstract** Relevance. Reducing the incidence of diffuse toxic goiter is one of the urgent problems of endocrine surgery. According to some authors, it reaches 48% of all thyroid diseases. Purpose of the study. To develop and give a comparative assessment of the effectiveness of a therapeutic diagnostic algorithm for complex surgical treatment of diffuse toxic goiter. Material and methods. The clinical material consisted of 582 patients with diffuse toxic goiter, who were treated and examined at the Regional Multidisciplinary Clinic of the city of Bukhara from 2011 to 2021. The initial diagnosis was necessarily carried out by an endocrinologist. Examination of patients was complex and included clinical, laboratory and instrumental research methods. Results. The results of surgical methods for the treatment of diffuse toxic goiter can sometimes be very disappointing. Intraoperative bleeding, especially from the remaining thyroid tissue, requiring repeated coagulation does not always achieve the desired effect. Moreover, as clinical cases have shown, complications of this kind are often the causes of other, no less dangerous types of complications that can affect both the immediate results of surgical treatment and long-term ones. Conclusion. The use of a complex surgical method of treatment based on the diagnostic and treatment algorithm developed by us in patients with diffuse toxic goiter made it possible, in comparison with the control group of patients, to increase the number of good and satisfactory results of treatment by 11.6%, to reduce unsatisfactory results of treatment by 2, 7 times and avoid recurrence of thyrotoxicosis.

**Keywords** Diffuse toxic goiter, Thyrostatic therapy, Thyroidectomy, Disease recurrence, Postoperative complications, Diagnostic and treatment algorithm

## 1. Introduction

Patients with large diffuse toxic goiters often present with local compression symptoms, including dysphagia, neck tightness, and airway obstruction, that require surgical management [4-9].

Reducing the incidence of diffuse toxic goiter is one of the urgent problems of endocrine surgery. According to some authors, it reaches 48% of all thyroid diseases [5].

When choosing a method for treating diffuse toxic goiter, many specialists consider a complex consisting of the patient's age, the degree of thyrotoxicosis, and the results of an emergency (intraoperative) histological examination [15].

The literature contains information on the development of programs for adequate preoperative examination, preparation of patients for surgery, a standardized method with a reliable determination of the mass of the remnant of the thyroid gland, a morphometric study of the removed part

of the thyroid gland, the study of late results and their comparison with the preoperative clinical picture [18-20].

However, these methods do not allow to achieve the desired result, due to their routine and unified approach in different forms of the course of the disease.

## 2. The Purpose of Our Study

To develop and give a comparative assessment of the effectiveness of a therapeutic diagnostic algorithm for complex surgical treatment of diffuse toxic goiter.

## 3. Material and Methods

The clinical material consisted of 582 patients with diffuse toxic goiter, who were treated and examined at the Regional Multidisciplinary Clinic of the city of Bukhara from 2011 to 2021. All patients consented to the examination and inclusion in the study. For inclusion in the study, an act of the decision of the local ethical committee on the conduct of the study in 2020 was received under the number No. 0251. The initial diagnosis was necessarily carried out by an

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endocrinologist.

All patients were divided into 2 groups: control, which included 293 (50.3%) patients and the main - 289 (49.7%) patients with diffuse toxic goiter. A distinctive feature of the main group of patients was the use of new approaches in the complex surgical treatment of diffuse toxic goiter.

Given the different duration of the preoperative period of conservative therapy based on the intake of Mercazolil 15 mg (3 tablet), all patients in both the control and main groups were divided by us into 3 subgroups: Subgroup I, 194 (33.3%) patients received thyrostatic conservative therapy for up to 1 year; II subgroup, 231 (39.7%) patients - from 1 to 3 years; III subgroup, 157 (27%) patients - more than 3 years.

The distribution of subgroups of patients by study groups showed that, both in the control and the main groups, patients with long-term preoperative thyrostatic conservative therapy from 1 to 3 years were the most represented - 129 (44.0%) patients in the control and 102 (35.3%) patients in the main, respectively.

Patients in the age range from 31 to 70 years old (mean  $50.5 \pm 18.7$  years) were predominant. There were 514 women (88.3%), men - 68 (11.7%).

Among the complications of diffuse toxic goiter were compression syndrome (105 patients - 18.04%), thyrotoxic heart (359 patients - 61.7%), exophthalmos (177 patients - 30.4%), intolerance to Mercazolil 15 mg (3 tablet) (49 patients - 8.4%), leukopenia (96 patients - 16.5%), toxic hepatitis (7 patients - 1.2%).

To achieve compensation for thyrotoxicosis, all patients underwent preoperative preparation. It consisted in the appointment of Mercazolil and beta-blockers before the operation at the outpatient stage. The criteria for compensation of the disease were the normalization of the level of free  $T_4$  in the blood, the achievement of norm systole (heart rate less than 90 beats per minute), target values of arterial systolic pressure.

Examination of patients was complex and included clinical, laboratory and instrumental research methods.

The main indicators that determine the results of the operation were: the development of a relapse of the disease, the presence of persistent postoperative complications (manifestations of hypoparathyroidism, various types of dysphonia). The results were considered good if there was no recurrence of thyrotoxicosis, there were no persistent changes in phonation, hypocalcemia. At the same time, in some patients, when using additional examination methods, some functional disorders that do not have clinical manifestations and do not require medical correction could be detected. The results were considered satisfactory if there was no recurrence of thyrotoxicosis, but mild and moderate clinical manifestations of dysphonia, hypocalcemia requiring medical correction were noted. When using instrumental methods of research, changes caused by paresis of the larynx and hypoparathyroidism were revealed. At the same time, patients did not require the use of special methods of treatment and observation of a specialist.

The results were considered unsatisfactory in the development of a relapse of the disease, the formation of persistent paresis of the larynx and hypoparathyroidism, which required medical correction, as well as the use of special methods of treatment and constant monitoring by a specialist.

## 4. Results and Discussion

In total, according to the results of treatment of patients in the control group, good results were achieved in 37.5% of cases (110 patients). In 136 (46.4%) patients, the results of treatment were stated as satisfactory. Unsatisfactory results were stated in 47 (16.0% of patients).

Among patients of subgroup I, good (47.6%) and satisfactory (46.6%) treatment results were noted to a greater extent. In 6 (5.8%) patients, the results of surgical treatment of diffuse toxic goiter were unsatisfactory.

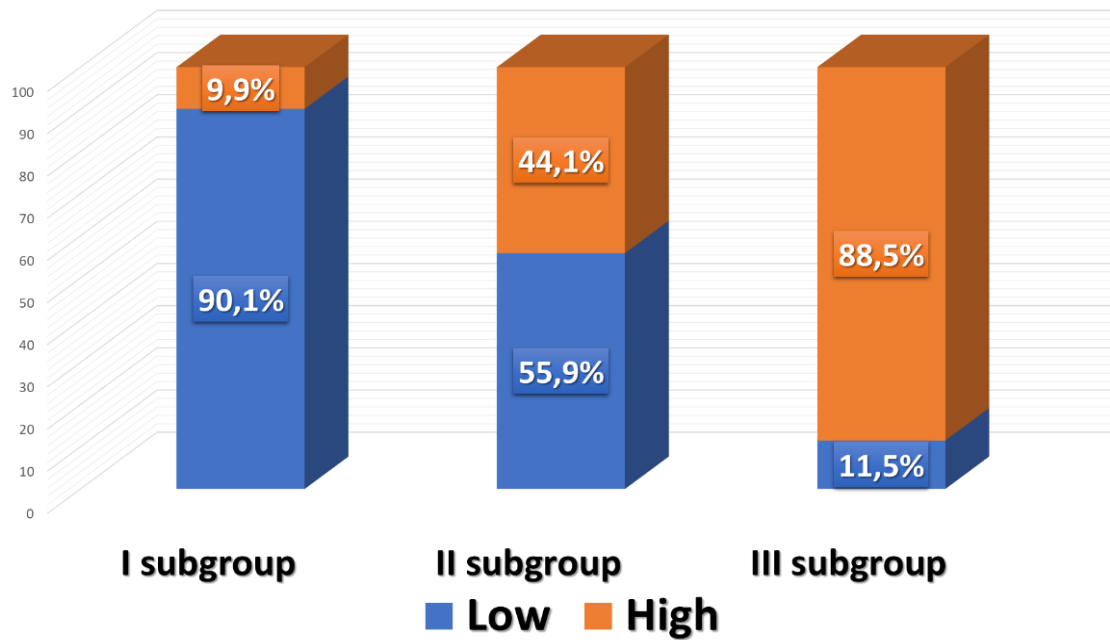
Among the patients of subgroup II, who took Mercazolil for 1 to 3 years, in most cases, 61 (47.3%) patients had satisfactory results of surgical intervention. In 49 (38.0%) patients, the results of the surgical operation were excellent, and in 19 (14.7%) patients, they were not satisfactory.

In the III subgroup of patients, as in the previous one, many patients (44.3%) completed treatment after surgery with satisfactory results. However, in contrast to subgroups I and II, the results of unsatisfactory results were 16.4% more than good ones.

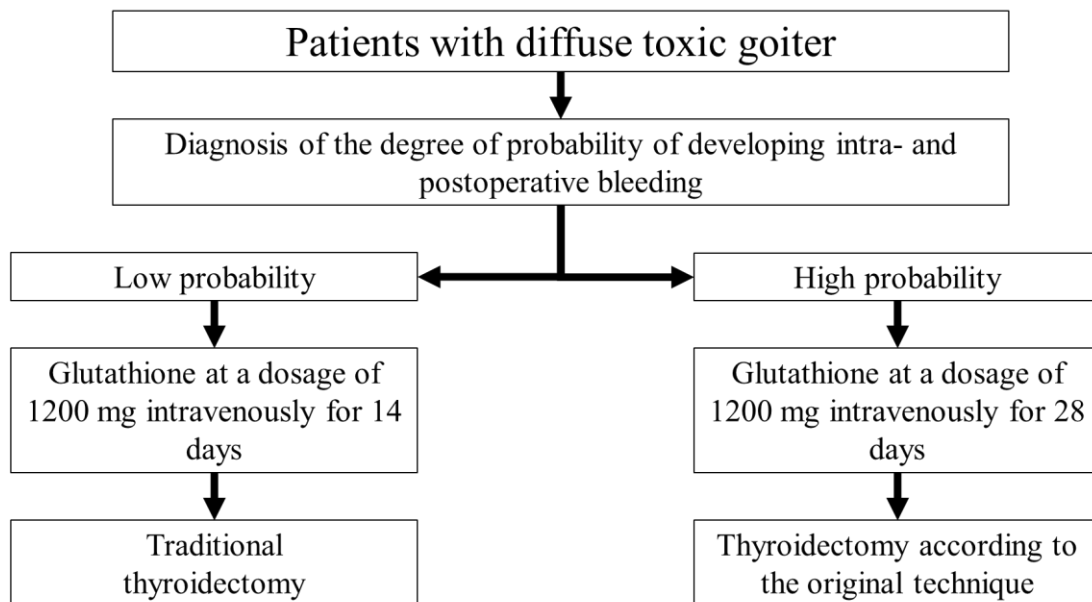
Thus, as presented in clinical cases, the results of surgical methods for the treatment of diffuse toxic goiter can sometimes be very disappointing. Intraoperative bleeding, especially from the remaining thyroid tissue, requiring repeated coagulation does not always achieve the desired effect. Moreover, as clinical cases have shown, complications of this kind are often the causes of other, no less dangerous types of complications that can affect both the immediate results of surgical treatment and long-term ones [19].

The development of criteria for the method for predicting postoperative complications and the choice of a method for treating patients with diffuse toxic goiter made it possible to randomize them in patients of the main group according to the degree of prognostic probability of the treatment outcome (Fig. 1).

In subgroup I of patients, the probability of postoperative complications was low in 90.1% of cases. Only in 9.9% of patients it was in the category of high risk of postoperative complications. It should be noted that the probability among patients of subgroup III was diametrically opposite - 88.5% with a high probability and 11.5% with a low probability. But in our opinion, the category of patients of subgroup II is interesting, where the division of patients according to the level of probability of developing postoperative complications was 44.1% high versus 55.9% with low probability [16].



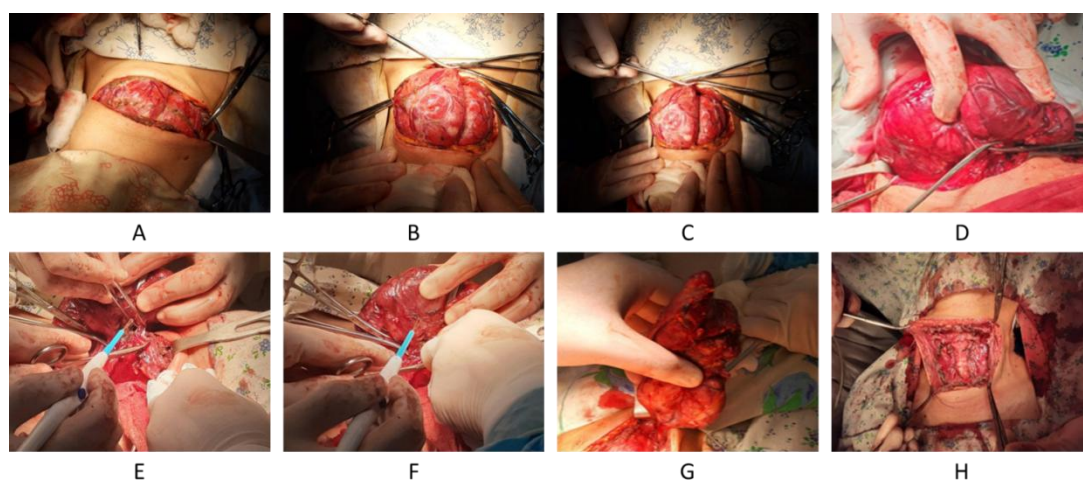
**Figure 1.** The nature of the change in the level of probability of developing intraoperative and postoperative complications in patients with diffuse toxic goiter



**Figure 2.** Scheme of the diagnostic and treatment algorithm for the complex surgical treatment of diffuse toxic goiter

Thus, the division of patients into subgroups according to the duration of conservative therapy, as shown by the results of our studies, cannot fully ensure the reliability of the prognostic probability of developing intra- and postoperative complications bleeding. On the other hand, the method of forecasting developed by us once again confirmed the high reliability of the values, which is characterized by the objectification of the initial state of the patient. This ultimately allows not only to make an appropriate decision on the method of treatment, but also to determine the options for approaching therapeutic measures and serve as the basis for compiling a treatment and diagnostic algorithm [17].

At the first stage of the treatment and diagnostic algorithm, the level of probability of developing intra- and postoperative complications of thyroidectomy is determined (Fig. 2). At a low level of probability, in patients of the main group, we used Glutathione at a dosage of 1200 mg slowly intravenously in saline 50-200 ml in 15 minutes for 14 days. With a high probability of intra- and postoperative bleeding, glutathione was used for 28 days. Glutathione is known to be a hepatoprotector, antioxidant, immunomodulator and detoxifier. Its use is known, namely in cases of violation of lipid peroxidation and antioxidant system.



**Figure 3.** Stages of advanced thyroidectomy in patients with a high probability of intra- and postoperative bleeding (explanation in the text of the case study)

Meanwhile, in cases where there is endothelial dysfunction, the use of this drug, of course, can only be preparatory in nature, and the issue of solving the problem is possible only through the development of effective methods of thyroidectomy.

The predominance of cases of endothelial dysfunction naturally determines, along with systemic disorders in the blood coagulation system, but also the high vulnerability of the thyroid vessels. Minimal trauma to the thyroid gland during thyroidectomy has become possible due to the improvement of the surgical technique, which is very acceptable in patients with a high probability of postoperative bleeding [16].

The method of total thyroidectomy improved by us is based on preliminary ligation of the vessels of the thyroid gland after total mobilization of the organ, separating it from the thyroid muscles. This allows not only to visualize the entire organ, but also to use a minimum number of hemostatic clamps and naturally reduce trauma to the thyroid gland, reduce intraoperative bleeding and conduct a complete visualization of all important elements in the surgical field. The operation technique is presented in the following specific example.

Extract from the protocol of the operation. After triple treatment of the surgical field with iodine and alcohol under general endotracheal anesthesia, a semilunar incision was made along the anterior surface of the neck, up to 7.0 cm long. Hemostasis. Layered dissected mus. Platysma and thyroid muscles, the thyroid gland was exposed (Fig. 3-A), which was diffusely hyperplastic, with nodules, soft-elastic consistency. The diameter of the right lobe was  $8.0 \times 7.0 \times 6.0$  cm, the left lobe -  $6.0 \times 5.0 \times 4.0$  cm. Nodules of a parenchymal nature were  $1.0 \times 1.0$  cm in size.), total thyroidectomy was performed (Fig. 3-E-G). Hemostasis control is dry (Fig. 3-H), parathyroid lymph nodes are not enlarged. The wound was washed with a solution of Novocain, dried, and sutured in layers in a deaf way. The skin was sutured with plastic continuous suture. Aseptic bandage. Macro preparation: Thyroid tissue, diffusely

hyperplastic, nodular changes, soft-elastic consistency. Macro preparation sent for morphological verification.

Thus, the solution of the problem of the surgical method for the treatment of diffuse toxic goiter, as shown by our example, makes it possible to prevent both increased traumatization of the thyroid gland and thereby reduce the likelihood of tissue traumatization, and, accordingly, reduce the likelihood of bleeding.

The use of the diagnostic and treatment algorithm developed by us in the complex treatment of patients with diffuse toxic goiter made it possible to achieve good treatment results in 49.1% of cases. Almost the same number were patients with satisfactory results of treatment (45.0%) and 5.9% of patients had unsatisfactory results of treatment.

When analyzing the results of treatment among patients of the main group, cases of good and satisfactory treatment results prevailed in all subgroups of patients (Table 1). Among the unsatisfactory results of treatment of patients in subgroup I, there were no.

**Table 1.** Results of treatment in the main group of patients

TREATMENT RESULTS	SUBGROUPS OF PATIENTS						TOTAL	
	I		II		III			
	n	%	n	%	n	%	n	%
Good ones	48	52,7	50	49,0	44	45,8	142	49,1
Satisfactory	43	47,3	49	48,0	38	39,6	130	45,0
Unsatisfactory	0	0	3	2,9	14	14,6	17	5,9
TOTAL	91	31,5	102	35,3	96	33,2	289	49,7

A detailed comparative analysis of the results of treatment, based on the registration of postoperative complications, showed that intra- and postoperative bleeding was reduced from 8.9% in the control group to 2.8% in the main group. In the main group, the majority were patients of subgroup III - 7 (2.4%). Among patients of subgroup II, bleeding was noted only in 1 (0.3%) case. Among the patients of subgroup I, there were no cases with intra- and postoperative bleeding [12-19].

Hoarseness or aphonia, fatigue when talking, moderate

difficulty in breathing, choking after taking liquid food, sometimes paroxysmal dry cough on the 1st day after surgery in patients of the main group were noted in 11 (3.8%) cases, which was in 2.5 times less than in the control group of patients. In 3 (1.0%) cases, these changes were noted by us among patients of subgroup II and in 8 (2.8%) cases among patients of subgroup III.

The use of a treatment and diagnostic algorithm made it possible to reduce the number of cases of hypoparathyroidism from 42 (14.3%) cases in the control group to 18 (6.2%) cases in the main group of patients. Postoperative hypoparathyroidism was detected in patients only in subgroup III.

A study of the clinical and hormonal status among patients of the main group found that 7 (2.4%) patients developed a relapse of thyrotoxicosis, 10 (3.5%) patients remained euthyroid, and 272 (94.1%) patients achieved hypothyroidism. Thyrotoxicosis recurrence during the period of our observation among the patients of the main group was not revealed by us.

## 5. Conclusions

Thus, the use of a complex surgical method of treatment based on the diagnostic and treatment algorithm developed by us in patients with diffuse toxic goiter made it possible, in comparison with the control group of patients, to increase the number of good and satisfactory results of treatment by 11.6%, to reduce unsatisfactory results of treatment in 2.7 times and avoid recurrence of thyrotoxicosis.

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