

Archives of Clinical Immunology

Review Article

Predictors of relapse rate in adults with autoimmune disease with autoimmune thyroiditis

Torres P^{1*}, Martinez M² and Castro D³

¹Division of Allergy and Immunotherapy, Yamuna Institute for Advanced Allergy and Immunotherapy, Mexico

²Department of Clinical Immunology, Vistula Research Center for Clinical Immunology, Chile

³Department of Clinical Allergy and Immunotherapy, Ebro Institute of Allergy and Immunotherapy, Chile

*Address for Correspondence: Paula Torres, Division of Allergy and Immunotherapy, Yamuna Institute for Advanced Allergy and Immunotherapy, Mexico; E-mail: paula.torres@yamuna.edu

Received: 23 August 2025; Accepted: 27 November 2025; Published: 2 March 2026.

Citation of this article: Torres P, Martinez M, Castro D (2026) Predictors of relapse rate in adults with autoimmune disease with autoimmune thyroiditis. Arch Clin Immunol, 1(1): 01-06. DOI: [10.5281/zenodo.22812494](https://doi.org/10.5281/zenodo.22812494)

Copyright: © 2026 Paula Torres, et al. This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Autoimmune thyroiditis frequently clusters with other autoimmune diseases, and this polyautoimmunity may alter the risk of relapse after apparent remission or after treatment withdrawal.

Objective: This review synthesizes published evidence on predictors of relapse in adults with autoimmune thyroiditis, with particular attention to comorbid autoimmune disease, antibody trajectory, and modifiable risk factors.

Methods: We conducted a narrative synthesis of prospective cohort studies, randomized trials, population surveys, and systematic reviews addressing thyroid autoantibody status, TSH-receptor antibody status, polyautoimmunity, postpartum thyroiditis, and modifiable factors in adults with autoimmune thyroiditis.

Findings: Rising or persistent thyroid antibody titer predicts progression and relapse across phenotypes; TSH-receptor antibody positivity at antithyroid drug withdrawal predicts Graves' relapse; comorbid type 1 diabetes roughly doubles to triples postpartum thyroid dysfunction risk; and selenium supplementation lowers antibody titer without a proven effect on hard relapse endpoints.

Conclusions: Antibody status and trajectory remain the most reproducible relapse predictors in autoimmune thyroiditis, and their predictive value is sharpened by accounting for comorbid autoimmune disease, supporting closer, comorbidity-aware surveillance around antithyroid drug withdrawal and the postpartum period.

Keywords: autoimmune thyroiditis; relapse; polyautoimmunity; thyroid autoantibodies; postpartum thyroiditis

1. Introduction

Autoimmune thyroiditis, encompassing both the hypothyroid Hashimoto phenotype, diagnosed on the combination of antibody positivity, characteristic ultrasound appearance, and biochemical hypothyroidism [1], and the hyperthyroid course of Graves' disease, rarely occurs as an isolated diagnosis. Both phenotypes follow a course of propagation and, in a substantial minority, progression or relapse that is driven by ongoing intrathyroidal and systemic autoimmune activity rather than a single fixed insult [2,3]. Chronic lymphocytic infiltration of the thyroid shares genetic susceptibility loci, regulatory T-cell defects, and environmental triggers with a wider family of organ-specific and systemic autoimmune conditions, so that adults presenting with thyroid autoimmunity frequently already carry, or go on to develop, a second autoimmune diagnosis such as type 1 diabetes, celiac disease, rheumatoid arthritis, vitiligo, or pernicious anemia [4,5]. This clustering, often termed polyautoimmunity, is not a statistical curiosity: it changes the natural history of thyroid autoimmunity itself, because the same immune dysregulation that predisposes to a second disease also appears to predispose to a less stable, more relapsing thyroid course after treatment or apparent remission [6,7].

Relapse in this context takes several clinically distinct forms. In Graves' disease it means recurrent hyperthyroidism after a course of antithyroid drugs is withdrawn; in Hashimoto thyroiditis and postpartum thyroiditis it means a return of thyroid dysfunction, or progression from subclinical to overt disease, after a period of biochemical stability; and across both phenotypes it can mean the conversion from one direction of dysfunction to the other, mediated by fluctuating TSH-receptor antibody function [8]. Understanding what predicts these events matters because relapse drives repeated drug exposure, surgical or radioiodine referral, and, in adults who already carry a second autoimmune disease, an added burden of

monitoring and cardiovascular and metabolic risk [9,10].

A substantial literature has accumulated on candidate predictors of relapse: antibody titer and its trajectory, TSH-receptor antibody status at treatment withdrawal, goiter size and thyroid echogenicity, genetic and familial autoimmune load, smoking, iodine and selenium status, and the specific physiological stress of pregnancy and the postpartum period. This review synthesizes that evidence as it applies to adults in whom autoimmune thyroiditis coexists with, or clusters alongside, other autoimmune disease, with the aim of identifying which predictors are consistently reproducible across cohorts and which remain uncertain enough to warrant caution in clinical counseling.

2. Methods

We conducted a narrative synthesis of the peer-reviewed literature on autoimmune thyroiditis, thyroid autoimmunity relapse and progression, polyautoimmunity, and modifiable risk factors for thyroid autoimmune activity in adults. Sources were identified through structured searches of PubMed/MEDLINE for combinations of the terms "autoimmune thyroiditis," "Hashimoto," "Graves' disease," "relapse," "recurrence," "thyroid peroxidase antibody," "TSH-receptor antibody," "polyautoimmunity," "postpartum thyroiditis," and "selenium," supplemented by hand-searching the reference lists of major cohort studies, systematic reviews, and society guidelines. Priority was given to prospective cohort studies with defined relapse endpoints, randomized trials of chelation-independent interventions such as selenium supplementation, population-based epidemiological surveys, and systematic reviews or meta-analyses that pooled relapse rates across smaller series. Case reports and non-peer-reviewed sources were excluded. Because included studies used heterogeneous relapse definitions, follow-up intervals, and antibody assays, findings are synthesized narratively and illustrative summary figures are presented as approximate, rounded

values drawn from the cited primary sources rather than as a pooled meta-analytic estimate.

3. Results

Polyautoimmunity and the comorbidity burden in autoimmune thyroiditis

Population and clinic-based series consistently find that adults with autoimmune thyroiditis carry other autoimmune diagnoses at rates several-fold higher than the general population. In a large United Kingdom case-control series, Boelaert and colleagues reported that patients with Graves' disease or Hashimoto thyroiditis had significantly elevated odds of pernicious anemia, rheumatoid arthritis, systemic lupus erythematosus, Addison's disease, celiac disease, and vitiligo compared with euthyroid controls, with the strongest associations seen for pernicious anemia and vitiligo [4]. Fallahi and colleagues, reviewing a large clinical series alongside the literature, likewise found that roughly one in ten adults with autoimmune thyroiditis carried a second clinically apparent autoimmune disease, most often type 1 diabetes, celiac disease, or rheumatoid arthritis [5]. Type 1 diabetes and autoimmune thyroiditis co-occur particularly often, reflecting shared HLA and CTLA-4 susceptibility, and pediatric and adult diabetes cohorts both report thyroid autoantibody positivity at two to three times the rate seen in the non-diabetic population [11,12]. Celiac disease shows a comparable bidirectional association, with thyroid autoimmunity overrepresented among celiac patients and vice versa, an overlap attributed in part to shared chromosome 6p and 2q risk loci and in part to gluten-driven mucosal immune activation that may itself sustain systemic autoreactivity [13]. Family-based and twin studies reinforce that this clustering is substantially heritable rather than purely coincidental: Brix and colleagues estimated that genetic factors account for the large majority of liability to Graves' disease in Danish twin cohorts, and systematic reviews of family aggregation across autoimmune diseases find that a first-degree relative with one autoimmune disease

meaningfully raises the risk of a different autoimmune disease in the proband, not only recurrence of the same one [14,7]. Somers and colleagues, synthesizing population and family data, described this pattern as reflecting overlapping rather than fully distinct etiological pathways across the autoimmune disease spectrum [15], a conclusion consistent with genome-wide association work identifying shared susceptibility loci across autoimmune thyroid disease, type 1 diabetes, and celiac disease [16,17].

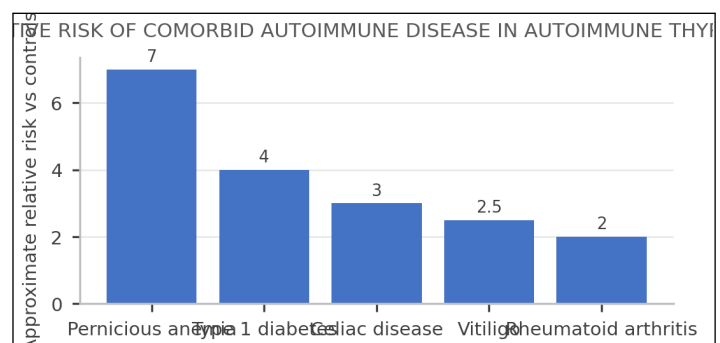


Figure 1: Approximate relative risk of selected comorbid autoimmune diseases in adults with autoimmune thyroiditis compared with euthyroid, antibody-negative controls, drawn from case-control and cohort series [4,5,11].

Antibody titer, TSH trajectory and echogenicity as predictors of relapse

Within autoimmune thyroiditis itself, the single most consistently reproduced predictor of both progression to overt disease and relapse after apparent remission is the level and persistence of thyroid autoantibodies. In the Amsterdam AITD cohort, Effraimidis and colleagues followed euthyroid first-degree relatives of patients with autoimmune thyroid disease prospectively and found that baseline thyroid peroxidase antibody positivity, and a rising antibody titer over time, predicted subsequent progression to overt hypo- or hyperthyroidism far more strongly than baseline TSH alone [18]. Strieder and colleagues, in the same cohort tradition, identified antibody positivity together with a family history of autoimmune thyroid disease and elevated baseline TSH as the dominant risk factors for incident thyroid dysfunction

among at-risk relatives [19]. Population surveys give these observations their epidemiological anchor: the Whickham Survey twenty-year follow-up found that women with both elevated TSH and positive thyroid antibodies at baseline progressed to overt hypothyroidism at a substantially higher annual rate than either abnormality alone, on the order of a several-fold increase in incident disease [20], and the United States NHANES III survey confirmed that antibody positivity was the strongest independent correlate of an abnormal TSH across a large representative population [21]. Denmark's national epidemiological data similarly show that overt autoimmune hypothyroidism clusters tightly with antibody-positive subclinical disease rather than arising unpredictably from a euthyroid, antibody-negative state [22].

Table 1: Antibody-based and clinical predictors of relapse or progression across autoimmune thyroiditis phenotypes [18,19,20,22].			
Predictor	Phenotype studied	Direction of association	Source
Rising or persistent TPOAb/TgAb titer	Euthyroid relatives; subclinical disease	Higher progression to overt dysfunction	[18]
Baseline antibody positivity + family history	At-risk first-degree relatives	Higher incident thyroid dysfunction	[19]
Elevated TSH + antibody positivity (combined)	Population cohort (Whickham)	Markedly higher progression to overt hypothyroidism	[20]
Antibody-positive subclinical disease	National epidemiological registry	Tight clustering with overt autoimmune hypothyroidism	[22]

TSH-receptor antibody status and relapse after antithyroid drug withdrawal

In Graves' disease specifically, relapse after a finite course of antithyroid drugs is common and TSH-receptor antibody status at the time of withdrawal is the most extensively validated predictor. A systematic review and meta-analysis by Struja and colleagues pooling multiple cohorts found that persistently positive TSH-receptor antibodies at the end of antithyroid drug treatment

carried a markedly higher risk of relapse within the following one to two years than negative status, although the discriminatory performance of TSH-receptor antibody testing alone remained imperfect, supporting composite rather than single-marker prediction [23]. Laurberg and colleagues, in a five-year prospective randomized comparison of antithyroid drugs, surgery, and radioiodine, likewise found that TSH-receptor antibody trajectory after treatment tracked closely with subsequent hyperthyroid relapse, and that antibody levels frequently remained detectable for years after apparent clinical remission [24]. Vitti and colleagues, characterizing clinical predictors of durable remission after antithyroid drug withdrawal, found that smaller goiter size, milder biochemical hyperthyroidism at diagnosis, and antibody normalization during treatment were each independently associated with sustained remission, while their absence flagged patients at materially higher relapse risk [25]. Azizi and Malboosbaf's systematic review of long-term antithyroid drug treatment found that extending drug courses well beyond the conventional twelve-to-eighteen-month duration reduced relapse rates without a proportionate rise in adverse events, a finding incorporated into contemporary American Thyroid Association and European Thyroid Association guidance on individualizing treatment duration in higher-risk patients [26,9,10].

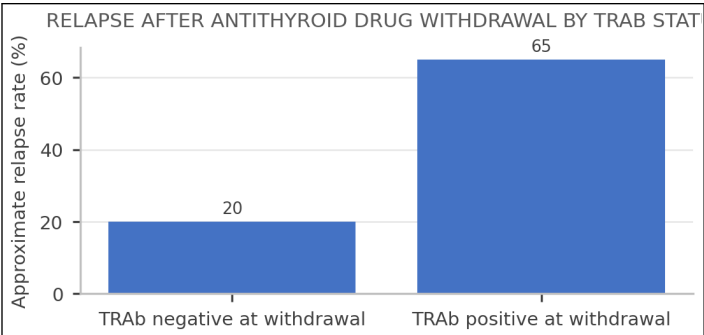


Figure 2: Approximate one-to-two-year relapse rate after antithyroid drug withdrawal in Graves' disease, by TSH-receptor antibody status at the time of discontinuation, synthesized from pooled cohort and meta-analytic data [23,24].

Postpartum thyroiditis, comorbid autoimmunity and modifiable factors

Pregnancy and the postpartum period represent a distinct, physiologically driven relapse window. Alvarez-Marfany and colleagues, following women with insulin-dependent (type 1) diabetes prospectively through pregnancy and the postpartum period, found that postpartum thyroid dysfunction occurred at roughly two to three times the rate reported in non-diabetic postpartum cohorts, directly linking comorbid autoimmune disease to postpartum thyroid relapse risk [27]. Stagnaro-Green's review of postpartum thyroiditis situates thyroid peroxidase antibody positivity in early pregnancy as the strongest single predictor of postpartum thyroid dysfunction, with higher titers conferring higher risk [28], and Premawardhana and colleagues' long-term follow-up found that both antibody titer and a hypoechoic ultrasound pattern at presentation predicted which women with postpartum thyroiditis went on to permanent hypothyroidism rather than full recovery, giving clinicians two low-cost, complementary tools for risk-stratifying relapse to chronic disease [29].

Modifiable and environmental exposures also shift relapse and progression risk, though generally more modestly than antibody status. Smoking has an unusual, direction-dependent effect: active smoking is associated with a lower prevalence of thyroid autoantibodies and a lower risk of Hashimoto thyroiditis, but a substantially higher risk of Graves' disease and Graves' orbitopathy, and Effraimidis and colleagues found that smoking cessation itself provoked a measurable rise in thyroid peroxidase and thyroglobulin antibody titers within the following year, suggesting that quitting smoking can unmask or accelerate latent thyroid autoimmunity even as it improves other health outcomes [30,31]. Selenium status has been studied specifically as a modifiable lever on antibody titer: Gärtner and colleagues showed in a randomized trial that selenium supplementation significantly lowered thyroid peroxidase antibody

concentrations in patients with autoimmune thyroiditis over three to six months [32], and subsequent systematic reviews and meta-analyses by Toulis and colleagues and by Wichman and colleagues confirmed a consistent, if modest, antibody-lowering effect across pooled trials, though neither established a durable effect on clinical relapse or progression to hypothyroidism [33,34]. Guideline bodies have accordingly stopped short of recommending routine selenium supplementation outside of research or highly selected settings [35].

Table 2: Postpartum, comorbid-autoimmunity and modifiable predictors of thyroid autoimmune relapse or progression [27,29,32,31].		
Factor	Setting	Effect on relapse/progression risk
Comorbid type 1 diabetes	Postpartum follow-up	Roughly two- to three-fold higher postpartum thyroid dysfunction
High TPOAb titer + hypoechoic ultrasound	Postpartum thyroiditis cohort	Predicts progression to permanent hypothyroidism
Selenium supplementation	Randomized trial, autoimmune thyroiditis	Significant fall in TPOAb titer; relapse effect unproven
Smoking cessation	Prospective antibody-negative cohort	Measurable rise in TPOAb/TgAb titer within one year

4. Discussion

Read together, this literature supports a layered model of relapse prediction in adults with autoimmune thyroiditis rather than any single decisive test. Antibody status, whether thyroid peroxidase, thyroglobulin, or TSH-receptor antibody depending on phenotype, is the most reproducible predictor across every clinical context examined here: progression from euthyroid to overt disease in at-risk relatives [18,19], relapse after antithyroid drug withdrawal in Graves' disease [23,24], and conversion from postpartum thyroiditis to permanent hypothyroidism [29,28]. Its predictive value is nonetheless probabilistic rather than binary; meta-analytic pooling of TSH-receptor antibody testing at antithyroid drug withdrawal, for instance, still leaves a meaningful minority

of antibody-negative patients who relapse and antibody-positive patients who do not [23], which is why guideline bodies recommend combining antibody status with clinical features such as goiter size, initial disease severity, and treatment duration when counseling individual patients [25,10].

The comorbid-autoimmunity dimension adds a second, partly independent layer. Adults who already carry a second autoimmune diagnosis, most commonly type 1 diabetes or celiac disease, appear to experience a less stable thyroid course, as shown most directly by the elevated postpartum thyroid dysfunction rate in women with type 1 diabetes [27] and more generally by the shared genetic architecture linking autoimmune thyroid disease to the broader autoimmune disease cluster [16,17,7]. This has a practical implication that the literature has not always made explicit: clinicians managing thyroid autoimmunity in a patient with an existing autoimmune diagnosis should treat that comorbidity itself as a relapse risk marker, prompting closer antibody and TSH surveillance rather than the standard interval used for thyroid autoimmunity occurring in isolation, particularly across the postpartum window and after antithyroid drug withdrawal, when relapse risk is concentrated [4,5].

Modifiable factors occupy a more modest but still clinically relevant place in this model. Selenium supplementation reliably lowers antibody titer without a clearly demonstrated effect on hard relapse or progression endpoints [33,34], and smoking's paradoxical, phenotype-dependent effect means that a single blanket recommendation cannot be given without specifying which direction of thyroid autoimmunity is at issue [30,31]. These factors are best framed to patients as adjuncts to antibody-based and clinical surveillance rather than substitutes for it. The principal limitation of the underlying evidence base is heterogeneity: relapse definitions, follow-up duration, and antibody assay platforms differ substantially across the cohorts

synthesized here, which limits precise quantitative pooling and is why this review reports approximate, rounded risk patterns rather than a single unified relapse-risk score; a harmonized, prospective, comorbidity-stratified relapse registry would be the logical next step for resolving that heterogeneity.

5. Conclusion

Across the phenotypes of autoimmune thyroiditis, relapse risk in adults is predicted most consistently by thyroid autoantibody status and trajectory, whether measured as thyroid peroxidase and thyroglobulin antibodies in Hashimoto thyroiditis and postpartum thyroiditis or as TSH-receptor antibodies in Graves' disease, and this predictive value is measurably sharpened when clinicians account for the presence of a second, comorbid autoimmune disease, which the literature consistently links to a less stable thyroid course [4,5,27]. Clinical, genetic, and modifiable factors, including goiter size, treatment duration, family history, and selenium and smoking status, refine but do not replace antibody-based risk stratification [25,23,33]. For adults with autoimmune thyroiditis who also carry another autoimmune diagnosis, the evidence supports closer, comorbidity-aware antibody and TSH surveillance around the highest-risk windows, antithyroid drug withdrawal and the postpartum period, rather than a uniform monitoring interval applied without regard to polyautoimmune status.

6. References

1. Caturegli, P., De Remigis, A., Rose, N.R. (2014) Hashimoto thyroiditis: clinical and diagnostic criteria. *Autoimmunity Reviews*, 13(4-5): 391-397.
2. Weetman, A.P. (2003) Autoimmune thyroid disease: propagation and progression. *European Journal of Endocrinology*, 148(1): 1-9.
3. Effraimidis, G., Wiersinga, W.M. (2014) Mechanisms in endocrinology: autoimmune thyroid disease: old and new players. *European Journal of Endocrinology*, 170(6):

-
- R241-R252.
4. Boelaert, K., Newby, P.R., Simmonds, M.J., Holder, R.L., Carr-Smith, J.D., Heward, J.M., et al. (2010) Prevalence and relative risk of other autoimmune diseases in subjects with autoimmune thyroid disease. *American Journal of Medicine*, 123(2): 183.e1-183.e9.
 5. Fallahi, P., Ferrari, S.M., Ruffilli, I., Elia, G., Biricotti, M., Vita, R., Benvenaga, S., Antonelli, A. (2016) The association of other autoimmune diseases in patients with autoimmune thyroiditis: review of the literature and report of a large series of patients. *Autoimmunity Reviews*, 15(12): 1125-1128.
 6. Anaya, J.M. (2010) The autoimmune tautology. *Arthritis Research and Therapy*, 12(6): 147.
 7. Cardenas-Roldan, J., Rojas-Villarraga, A., Anaya, J.M. (2013) How do autoimmune diseases cluster in families? A systematic review and meta-analysis. *BMC Medicine*, 11: 73.
 8. McLachlan, S.M., Rapoport, B. (2013) Thyrotropin-blocking autoantibodies and thyroid-stimulating autoantibodies: potential mechanisms involved in the pendulum swinging from hypothyroidism to hyperthyroidism or vice versa. *Thyroid*, 23(1): 14-24.
 9. Ross, D.S., Burch, H.B., Cooper, D.S., Greenlee, M.C., Laurberg, P., Maia, A.L., et al. (2016) 2016 American Thyroid Association guidelines for diagnosis and management of hyperthyroidism and other causes of thyrotoxicosis. *Thyroid*, 26(10): 1343-1421.
 10. Kahaly, G.J., Bartalena, L., Hegedus, L., Leenhardt, L., Poppe, K., Pearce, S.H. (2018) 2018 European Thyroid Association guideline for the management of Graves' hyperthyroidism. *European Thyroid Journal*, 7(4): 167-186.
 11. Kakleas, K., Soldatou, A., Karachaliou, F., Karavanaki, K. (2015) Associated autoimmune diseases in children and adolescents with type 1 diabetes mellitus (T1DM). *Autoimmunity Reviews*, 14(9): 781-797.
 12. Kahaly, G.J., Hansen, M.P. (2016) Type 1 diabetes associated autoimmunity. *Autoimmunity Reviews*, 15(7): 644-648.
 13. Ch'ng, C.L., Jones, M.K., Kingham, J.G. (2007) Celiac disease and autoimmune thyroid disease. *Clinical Medicine and Research*, 5(3): 184-192.
 14. Brix, T.H., Kyvik, K.O., Christensen, K., Hegedus, L. (2001) Evidence for a major role of heredity in Graves' disease: a population-based study of two Danish twin cohorts. *Journal of Clinical Endocrinology and Metabolism*, 86(2): 930-934.
 15. Somers, E.C., Thomas, S.L., Smeeth, L., Hall, A.J. (2006) Autoimmune diseases co-occurring within individuals and within families: a systematic review. *Epidemiology*, 17(2): 202-217.
 16. Simmonds, M.J. (2013) GWAS in autoimmune thyroid disease: what have we learnt? *Nature Reviews Endocrinology*, 9(5): 277-287.
 17. Tomer, Y., Huber, A. (2009) The etiology of autoimmune thyroid disease: a story of genes and environment. *Journal of Autoimmunity*, 32(3-4): 231-239.
 18. Effraimidis, G., Strieder, T.G., Tijssen, J.G., Wiersinga, W.M. (2011) Natural history of the transition from euthyroidism to overt autoimmune hypo- or hyperthyroidism: a prospective study. *European Journal of Endocrinology*, 164(1): 107-113.
 19. Strieder, T.G., Prummel, M.F., Tijssen, J.G., Endert, E., Wiersinga, W.M. (2003) Risk factors for and prevalence of thyroid disorders in a cross-sectional study among healthy female relatives of patients with autoimmune thyroid disease. *Clinical Endocrinology*, 59(3): 396-401.
 20. Vanderpump, M.P., Tunbridge, W.M., French, J.M., Appleton, D., Bates, D., Clark, F., et al. (1995) The incidence of thyroid disorders in the community: a twenty-year follow-up of the Whickham Survey. *Clinical Endocrinology*, 43(1): 55-68.
 21. Hollowell, J.G., Staehling, N.W., Flanders, W.D., Hannon, W.H., Gunter, E.W., Spencer, C.A., Braverman, L.E. (2002) Serum TSH, T4, and thyroid antibodies in the United States

- population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). *Journal of Clinical Endocrinology and Metabolism*, 87(2): 489-499.
22. Carle, A., Laurberg, P., Pedersen, I.B., Knudsen, N., Perrild, H., Ovesen, L., et al. (2006) Epidemiology of subtypes of hypothyroidism in Denmark. *European Journal of Endocrinology*, 154(1): 21-28.
23. Struja, T., Fehlberg, H., Kutz, A., Guebelin, L., Degen, C., Mueller, B., Schuetz, P. (2017) Can we predict relapse in Graves' disease? Results from a systematic review and meta-analysis. *European Journal of Endocrinology*, 176(1): 87-97.
24. Laurberg, P., Wallin, G., Tallstedt, L., Abraham-Nordling, M., Lundell, G., Torring, O. (2008) TSH-receptor autoimmunity in Graves' disease after therapy with anti-thyroid drugs, surgery, or radioiodine: a 5-year prospective randomized study. *European Journal of Endocrinology*, 158(1): 69-75.
25. Vitti, P., Rago, T., Chiovato, L., Pallini, S., Santini, F., Fiore, E., Rocchi, R., Martino, E., Pinchera, A. (1997) Clinical features of patients with Graves' disease undergoing remission after antithyroid drug treatment. *Thyroid*, 7(3): 369-375.
26. Azizi, F., Malboosbaf, R. (2017) Long-term antithyroid drug treatment: a systematic review and meta-analysis. *Thyroid*, 27(10): 1223-1231.
27. Alvarez-Marfany, M., Roman, S.H., Drexler, A.J., Robertson, C., Stagnaro-Green, A. (1994) Long-term prospective study of postpartum thyroid dysfunction in women with insulin dependent diabetes mellitus. *Journal of Clinical Endocrinology and Metabolism*, 79(1): 10-16.
28. Stagnaro-Green, A. (2004) Postpartum thyroiditis. *Best Practice and Research Clinical Endocrinology and Metabolism*, 18(2): 303-316.
29. Premawardhana, L.D., Parkes, A.B., Ammari, F., John, R., Darke, C., Adams, H., Lazarus, J.H. (2000) Postpartum thyroiditis and long-term thyroid status: prognostic influence of thyroid peroxidase antibodies and ultrasound echogenicity. *Journal of Clinical Endocrinology and Metabolism*, 85(1): 71-75.
30. Prummel, M.F., Wiersinga, W.M. (1993) Smoking and risk of Graves' disease. *JAMA*, 269(4): 479-482.
31. Effraimidis, G., Tijssen, J.G., Wiersinga, W.M. (2009) Discontinuation of smoking increases the risk for developing thyroid peroxidase antibodies and/or thyroglobulin antibodies: a prospective study. *Journal of Clinical Endocrinology and Metabolism*, 94(4): 1324-1328.
32. Gartner, R., Gasnier, B.C., Dietrich, J.W., Krebs, B., Angstwurm, M.W. (2002) Selenium supplementation in patients with autoimmune thyroiditis decreases thyroid peroxidase antibody concentrations. *Journal of Clinical Endocrinology and Metabolism*, 87(4): 1687-1691.
33. Toulis, K.A., Anastasilakis, A.D., Tzellos, T.G., Goulis, D.G., Kouvelas, D. (2010) Selenium supplementation in the treatment of Hashimoto's thyroiditis: a systematic review and a meta-analysis. *Thyroid*, 20(10): 1163-1173.
34. Wichman, J., Winther, K.H., Bonnema, S.J., Hegedus, L. (2016) Selenium supplementation significantly reduces thyroid autoantibody levels in patients with chronic autoimmune thyroiditis: a systematic review and meta-analysis. *Thyroid*, 26(12): 1681-1692.
35. Garber, J.R., Cobin, R.H., Gharib, H., Hennessey, J.V., Klein, I., Mechanick, J.I., et al. (2012) Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. *Thyroid*, 22(12): 1200-1235.