

# Screening of thyroid function and autoantibodies in patients with alopecia areata: A systematic review and meta-analysis



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**Background:** Several studies have reported associations between alopecia areata and diverse thyroid diseases.

**Objective:** To investigate the odds ratio and prevalence rate of thyroid dysfunction and autoimmune thyroid diseases in patients with alopecia areata.

**Methods:** A systematic review of the studies published before March 20, 2018, was performed by using the MEDLINE, Embase, Web of Science, and Cochrane Library databases. The clinical and laboratory findings associated with thyroid dysfunction and autoimmunity were extracted for quantitative analysis.

**Results:** A total of 50 studies were analyzed. Patients with alopecia areata had higher odds of abnormal findings on thyroid function tests, thyroid dysfunction, positive thyroid autoantibodies, and autoimmune thyroid diseases. Moreover, their prevalence rate was much higher than that in the general population.

**Limitations:** The heterogeneity in baseline characteristics and outcome reporting across the studies.

**Conclusion:** Current evidence suggests that thyroid dysfunction and autoimmune thyroid diseases are more prevalent in patients with alopecia areata. Clinicians may be encouraged to screen for the associated signs and symptoms to achieve better outcomes. (J Am Acad Dermatol 2019;80:1410-3.)

**Key words:** alopecia areata; autoantibody; autoimmune; comorbidities; comorbidity; dysfunction; hyperthyroidism; hypothyroidism; screening; thyroid; thyroiditis.

**A**lopecia areata (AA) is an autoimmune disorder associated with diverse systemic and psychiatric conditions.<sup>1,2</sup> In several studies, an association between AA and thyroid diseases has been reported, and many practitioners perform thyroid function and autoantibody tests for patients with AA in daily practice.<sup>3,4</sup> On the other hand, some studies have shown an inconsistent association between them and have discouraged routine work-up for thyroid diseases in patients with AA.<sup>5,6</sup> This systematic review and meta-analysis aimed to investigate the association between AA and diverse

*Abbreviation used:*

AA: alopecia areata

thyroid diseases and to estimate their odds and mean prevalence rate in patients with AA versus in the general population.<sup>7</sup>

## MATERIALS AND METHODS

Two main reviewers independently searched the MEDLINE, Embase, and Cochrane databases and

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Web of Science for studies published before March 20, 2018, using key words *alopecia areata*, *thyroid*, *comorb\**, *prevalen\**, *associ\**, *relation\**, and *risk\**. Observational studies that investigated thyroid diseases or their associated laboratory findings were included, whereas studies limited to pediatric patients, any case reports, and reviews were excluded.

The case-control studies were evaluated to quantify the odds ratio and number needed to screen for thyroid dysfunction, autoimmune thyroid diseases, and their associated laboratory findings in patients with AA versus in non-AA controls. To estimate the mean prevalence rate in patients with AA, the results of both cross-sectional and case-control studies were synthesized. A random-effects model was used because of the heterogeneity of the studies. All analyses were performed by using Comprehensive Meta-Analysis software (version 3.3.0, Biostat, Englewood, NJ).

## RESULTS

In total, 17 comparative case-control studies of patients with AA and non-AA controls (Supplemental Table I<sup>2,5,6,8-21</sup>; available at <http://www.jaad.org>) and 33 noncomparative cross-sectional studies (Supplemental Table II<sup>3,4,22-52</sup>; available at [http://](http://www.jaad.org)

[www.jaad.org](http://www.jaad.org)) were identified. The mean prevalence rate of thyroid diseases and their associated laboratory findings in patients with AA are summarized in Table I, and their meta-analyzed odds ratio and numbers needed to treat compared with the non-AA controls are presented in Fig 1.

## DISCUSSION

Patients with AA had higher odds of thyroid dysfunction and were more likely to have abnormal findings on free triiodothyronine, free thyroxine, and thyrotropin levels. Moreover, autoimmune thyroid diseases were significantly prevalent in patients with AA. The positive screening rates for thyroglobulin and thyroid peroxidase antibodies were significantly higher in patients with AA. The prevalence of thyroid dysfunction and positive autoantibody rates were much higher in patients with AA than in the general population in the United States.<sup>7</sup>

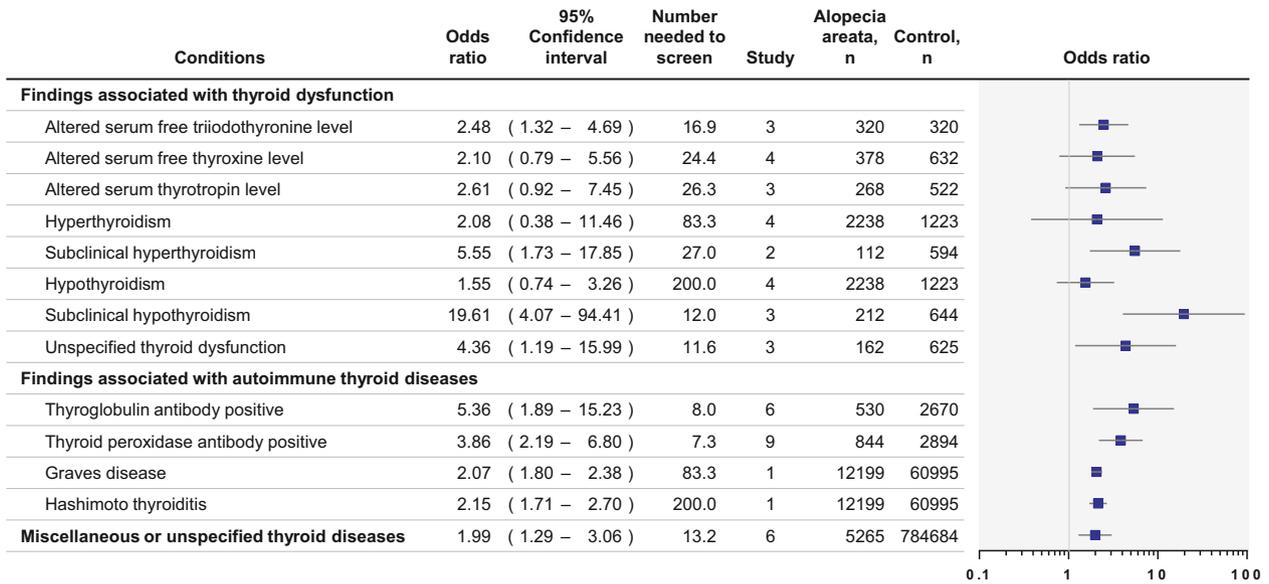
A limitation of this study is the baseline heterogeneity of the included studies. Moreover, in many studies, a clear distinction between overt and subclinical disease was not made. Further subgroup analysis or meta-regression with patient characteristics, including patient age and AA

### CAPSULE SUMMARY

- Although an association between alopecia areata and thyroid diseases has been suggested, quantification is required to measure the usefulness of screening.
- This meta-analysis suggests that it might be beneficial to screen for the signs and symptoms associated with thyroid dysfunction and autoimmune thyroid diseases in patients with alopecia areata.

**Table I.** Prevalence of thyroid dysfunction, autoimmune thyroid diseases, and abnormal findings on thyroid function and autoantibody tests in patients with alopecia areata

Condition	Prevalence in patients with alopecia areata, %	95% confidence interval, %	Study	Alopecia areata, n	Prevalence in the general US population, % <sup>7</sup>
Findings associated with thyroid dysfunction					
Altered serum free triiodothyronine level	7.0	4.4-11.0	8	787	—
Altered serum free thyroxine level	6.5	3.9-10.6	11	2292	—
Altered serum thyrotropin level	10.0	4.3-21.4	9	1074	7.9
Hyperthyroidism	1.1	0.5-2.4	12	4677	0.5
Subclinical hyperthyroidism	3.4	0.1-10.6	3	242	0.7
Hypothyroidism	2.3	1.2-4.3	14	4879	0.3
Subclinical hypothyroidism	9.3	6.1-14.1	5	420	4.3
Thyroid dysfunction	13.3	7.2-23.2	5	437	—
Findings associated with autoimmune thyroid diseases					
Thyroglobulin antibody—positive	16.5	10.4-25.2	10	836	10.4
Thyroid peroxidase antibody—positive	17.6	12.6-24.0	15	1512	11.3
Graves disease	1.4	0.5-4.2	4	14301	—
Hashimoto thyroiditis	2.9	0.9-8.6	4	12642	—
Miscellaneous or unspecified thyroid diseases	8.6	6.4-11.5	23	13740	—



**Fig 1.** Summary of case-control studies. The forest plot shows the meta-analyzed odds ratio of thyroid dysfunction, autoimmune thyroid diseases, and their associated laboratory findings in patients with alopecia areata versus in the controls.

subtype, were restricted owing to limited data in the literature.

**CONCLUSION**

Our study shows that patients with AA have a higher prevalence of thyroid dysfunction than the general population. Although no interaction or causality between AA and thyroid dysfunction has been identified, the current evidence suggests the need for increased screening of thyroid function and thyroid autoantibodies in patients with AA. Further studies examining potential mechanisms and interactions are needed.

**REFERENCES**

- Lee S, Lee H, Lee CH, Lee WS. Comorbidities in alopecia areata: a systematic review and meta-analysis. *J Am Acad Dermatol.* 2019;80(2):466-477.e16.
- Conic RZ, Miller R, Piliang M, Bergfeld W, Atanaskova Mesinkovska N. Comorbidities in patients with alopecia areata. *J Am Acad Dermatol.* 2017;76:755-757.
- Baars MP, Greebe RJ, Pop VJ. High prevalence of thyroid peroxidase antibodies in patients with alopecia areata. *J Eur Acad Dermatol Venereol.* 2013;27:e137-e139.
- Seyrafi H, Akhiani M, Abbasi H, Mirpour S, Gholamrezanezhad A. Evaluation of the profile of alopecia areata and the prevalence of thyroid function test abnormalities and serum autoantibodies in Iranian patients. *BMC Dermatol.* 2005;5:11.
- Barahmani N, Schabath MB, Duvic M. History of atopy or autoimmunity increases risk of alopecia areata. *J Am Acad Dermatol.* 2009;61:581-591.
- Kaur G, Kuldeep CM, Bhargava P, Mathur DK, Sharda S, Chaturvedi P. Insignificant correlation between thyroid hormone and antithyroid peroxidase antibodies in alopecia

- areata patients in northern Rajasthan. *Int J Trichology.* 2017; 9:149-153.
- Hollowell JG, Staehling NW, Flanders WD, et al. Serum TSH, T(4), and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). *J Clin Endocrinol Metab.* 2002;87:489-499.
- Seo HM, Han SS, Kim JS. Cancer risks among patients with alopecia areata: a population-based case-control study in Korea. *J Am Acad Dermatol.* 2018;78:209-211.
- Wang HF, Gan HH, Mei LH, Yang G, Fang F. The association between alopecia areata and thyroid autoimmunity in Chinese adult patients: a controlled study. *Biomed Res.* 2017;28:3517-3521.
- Bin Saif GA. Severe subtype of alopecia areata is highly associated with thyroid autoimmunity. *Saudi Med J.* 2016;37: 656-661.
- Noso S, Park C, Babaya N, et al. Organ specificity in autoimmune diseases: thyroid and islet autoimmunity in alopecia areata. *J Clin Endocrinol Metab.* 2015;100:1976-1983.
- Diaz-Angulo S, Lopez-Hoyos M, Munoz-Cacho P, Lopez-Escobar M, Gonzalez-Lopez MA. High prevalence of thyroid autoimmunity in patients with alopecia areata and vitiligo: a controlled study. *Australas J Dermatol.* 2015;56:142-143.
- Rahnama Z, Farajzadeh S, Mohamamdi S, Masoudi MA. Prevalence of thyroid disorders in patients with alopecia areata. *J Pak Assoc Dermatol.* 2014;24:246-250.
- Nguyen TQ, Goh C. Identifying the relationship between thyroid disease and alopecia areata, lichen planopilaris, and frontal fibrosing alopecia. *J Investig Med.* 2014;62:167.
- de Hollanda TR, Sodre CT, Brasil MA, Ramos ESM. Quality of life in alopecia areata: a case-control study. *Int J Trichology.* 2014;6:8-12.
- Bakry OA, Basha MA, El Shafiee MK, Shehata WA. Thyroid disorders associated with alopecia areata in Egyptian patients. *Indian J Dermatol.* 2014;59:49-55.
- Serarslan G, Savas N, Yenin JZ. Is atopy and autoimmunity more prevalent in patients with alopecia areata? A comparative study. *J Eur Acad Dermatol Venereol.* 2012;26:720-723.

18. Chu SY, Chen YJ, Tseng WC, et al. Comorbidity profiles among patients with alopecia areata: the importance of onset age, a nationwide population-based study. *J Am Acad Dermatol*. 2011;65:949-956.
19. Angulo SD, Hoyos ML, Cacho PM, et al. Thyroid autoimmunity in alopecia areata. *Allergy*. 2010;65:462.
20. Thomas EA, Kadyan RS. Alopecia areata and autoimmunity: a clinical study. *Indian J Dermatol*. 2008;53:70-74.
21. Puavilai S, Puavilai G, Charuwichitratana S, Sakuntabhai A, Sriprachya-Anunt S. Prevalence of thyroid diseases in patients with alopecia areata. *Int J Dermatol*. 1994;33:632-633.
22. Vano-Galvan S, Fernandez-Crehuet P, Grimalt R, et al. Alopecia areata totalis and universalis: a multicenter review of 132 patients in Spain. *J Eur Acad Dermatol Venereol*. 2017;31:550-556.
23. Erpolat S, Sarifakioglu E, Ayyildiz A. 25-hydroxyvitamin D status in patients with alopecia areata. *Postepy Dermatol Alergol*. 2017;34:248-252.
24. Shahzadi N, Pal SS, Asad F, Rani Z, Khurshid K. Frequency of autoimmune disorders in patients of alopecia areata. *J Pak Assoc Dermatol*. 2016;26:112-117.
25. Gerin F, Albayrak H, Soydan Z, et al. Evaluation of the prevalence of thyroid autoantibodies in patients with alopecia areata. *Acta Physiol (Oxf)*. 2016;218:34.
26. Kurtipek GS, Cihan FG, Demirbas SE, Ataseven A. The frequency of autoimmune thyroid disease in alopecia areata and vitiligo patients. *Biomed Res Int*. 2015;2015:435947. <https://doi.org/10.1155/2015/435947>.
27. Lyakhovitsky A, Shemer A, Amichai B. Increased prevalence of thyroid disorders in patients with new onset alopecia areata. *Australas J Dermatol*. 2015;56:103-106.
28. Jang YH, Park KH, Kim SL, et al. Alopecia areata in the elderly: a 10-year retrospective study. *Ann Dermatol*. 2015;27:411-416.
29. Guruprasad P, Chalam KV, Priyadarshini T, Sunandini PA. A clinical and investigatory study of alopecia areata with special reference to systemic associations in 100 patients. *J Evol Med Dental Sci*. 2015;4:13919-13930.
30. Ranawaka RR. An observational study of alopecia areata in Sri Lankan adult patients. *Ceylon Med J*. 2014;59:128-131.
31. Lee NR, Kim BK, Yoon NY, Lee SY, Ahn SY, Lee WS. Differences in comorbidity profiles between early-onset and late-onset alopecia areata patients: a retrospective study of 871 Korean patients. *Ann Dermatol*. 2014;26:722-726.
32. Aghaei S, Saki N, Daneshmand E, Kardeh B. Prevalence of psychological disorders in patients with alopecia areata in comparison with normal subjects. *ISRN Dermatol*. 2014;2014:304370.
33. Wu MC, Yang CC, Tsai RY, Chen WC. Late-onset alopecia areata: a retrospective study of 73 patients from Taiwan. *J Eur Acad Dermatol Venereol*. 2013;27:468-472.
34. Qadim HH, Majidi J, Navasi MS, Fadaei R, Goldust M. Results of blood cells counting, fasting blood glucose, rheumatoid factor, C reactive protein, antinuclear antibodies and thyroid function tests in patients with alopecia areata. *J Med Sci*. 2013;13:50-55.
35. Huang KP, Mullangi S, Guo Y, Qureshi AA. Autoimmune, atopic, and mental health comorbid conditions associated with alopecia areata in the United States. *JAMA Dermatol*. 2013;149:789-794.
36. Ahmed I, Nasreen S, Jehangir U, Wahid Z. Clinical spectrum of alopecia areata and its association with thyroid dysfunction. *J Pak Assoc Dermatol*. 2012;22:207-212.
37. Tang MM, Gill P, Thevarajah S. Clinical pattern, management and outcome of alopecia areata of a multi ethnic population in Kuala Lumpur Hospital, Malaysia. *Exp Dermatol*. 2010;19:600.
38. Ejaz A, Jameel K, Suhail M. Pattern and profile of alopecia areata in Pakistan. *J Pak Assoc Dermatol*. 2009;19:136-140.
39. Goh C, Finkel M, Christos PJ, Sinha AA. Profile of 513 patients with alopecia areata: associations of disease subtypes with atopy, autoimmune disease and positive family history. *J Eur Acad Dermatol Venereol*. 2006;20:1055-1060.
40. Jain S, Marfatia YS. Alopecia areata—pattern in industrial city of Baroda. *Indian J Dermatol Venereol Leprol*. 2003;69:81-82.
41. Tan E, Tay YK, Goh CL, Chin Giam Y. The pattern and profile of alopecia areata in Singapore—a study of 219 Asians. *Int J Dermatol*. 2002;41:748-753.
42. Tak WJ, Chung YS, Ro BI. A clinical study on alopecia areata (1996-2000) (VI). *Korean J Dermatol*. 2002;40:791-800.
43. Sharma VK, Sialy R, Kumar B, Gupta S. Evaluation of thyroid function in North Indians with alopecia areata: response to intravenous injection of 100 micrograms thyrotropin releasing hormone (TRH). *J Dermatol*. 1999;26:339-342.
44. Recupero SM, Abdolrahimzadeh S, De Dominicis M, et al. Ocular alterations in alopecia areata. *Eye (Lond)*. 1999;13(Pt 5):643-646.
45. Sharma VK, Dawn G, Kumar B. Profile of alopecia areata in northern India. *Int J Dermatol*. 1996;35:22-27.
46. Safavi KH, Muller SA, Suman VJ, Moshell AN, Melton LJ 3rd. Incidence of alopecia areata in Olmsted County, Minnesota, 1975 through 1989. *Mayo Clin Proc*. 1995;70:628-633.
47. Ro BI. Alopecia areata in Korea (1982-1994). *J Dermatol*. 1995;22:858-864.
48. Wang SJ, Shohat T, Vadheim C, Shellow W, Edwards J, Rotter JI. Increased risk for type I (insulin-dependent) diabetes in relatives of patients with alopecia areata (AA). *Am J Med Genet*. 1994;51:234-239.
49. Shellow WV, Edwards JE, Koo JY. Profile of alopecia areata: a questionnaire analysis of patient and family. *Int J Dermatol*. 1992;31:186-189.
50. De Waard-van der Spek FB, Oranje AP, De Raeymaecker DM, Peereboom-Wynia JD. Juvenile versus maturity-onset alopecia areata—a comparative retrospective clinical study. *Clin Exp Dermatol*. 1989;14:429-433.
51. De Weert J, Temmerman L, Kint A. Alopecia areata: a clinical study. *Dermatologica*. 1984;168:224-229.
52. Friedmann PS. Alopecia areata and auto-immunity. *Br J Dermatol*. 1981;105:153-157.

**Supplemental Table I.** Characteristics and main findings of comparative studies

Study name	Study population (all patients [n], female patients [n], mean age [y])	Control setting (all patients [n], female patients [n], mean age [y])	Finding	Patients with AA, n	Controls, n
Seo et al, 2018 <sup>8</sup>	AA (12199, 6240, NA)	Age, sex-matched (60995, 31200, NA)	Graves disease	279	682
Kaur et al, 2017 <sup>6</sup>	AA (110, 39, 23.6)	Age, sex-matched (110, 48, 24.8)	Hashimoto thyroiditis	106	248
			ft3 level high	12	6
			ft3 level low	4	3
			ft4 level high	5	4
			ft4 level low	5	9
Wang et al, 2017 <sup>9</sup>	AA aged >18 y (158, 74, 40)	Age, sex-matched (158, NA, NA)	Anti-TPO antibody	5	4
			Thyroid disease	54	25
			Thyroid antibody	44	22
			Anti-Tg antibody	22	14
			Anti-TPO antibody	38	17
			ft3 level high	12	4
			ft4 level high	14	5
Conic et al, 2017 <sup>2</sup>	AA (584, 400, 35.54)	Age-matched (172, 126, 35.8)	Thyrotropin level high	11	8
			Thyroid disease	110	13
Bin Saif GA, 2016 <sup>10</sup>	AA (100, 52, 22.7)	Age, sex-matched (50, 26, 23.9)	Thyroid disease	27	2
			Antithyroid antibody	22	2
			Anti-TPO antibody	5	0
			Anti-Tg antibody	11	1
Nosso et al, 2015 <sup>11</sup>	AA (110, 76, 37.5)	Unspecified (1818, NA, NA)	Subclinical hypothyroidism	47	22
			Antithyrotropin receptor antibody	32	210
			Anti-TPO antibody	32	403
Diaz-Angulo et al, 2015 <sup>12</sup>	AA (54, 28, 44.2)	Age, sex-matched (282, NA, NA)	Anti-Tg antibody	12	5
			Anti-TPO antibody	5	3
			Thyroid dysfunction	12	7
			Hypothyroidism	0	2
			Hyperthyroidism	3	2
			Subclinical hypothyroidism	5	0
			Subclinical hyperthyroidism	4	3
Rahnama et al, 2014 <sup>13</sup>	AA (52, 23, 30.1)	Age, sex-matched (52, 31, 31.8)	Anti-TPO antibody	6	3
			Thyrotropin abnormal	4	2
			ft3 abnormal	7	2
			ft4 abnormal	6	4
Nguyen and Goh, 2014 <sup>14</sup>	AA (50, NA, NA)	Unspecified (31, NA, NA)	Thyroid dysfunction	8	5
de Hollanda et al, 2014 <sup>15</sup>	AA aged >18 (37, 23, 35.9)	Age, sex-matched (49, 23, 34.6)	Thyroid disease	3	1
Bakry et al, 2014 <sup>16</sup>	AA (50, 13, 26.4)	Age, sex-matched (50, 15, 25.9)	Anti-Tg antibody	23	0
Serarslan et al, 2012 <sup>17</sup>	AA (81 [43 children excluded], 31, 33.27)	Age, sex-matched (114, NA, NA)	Anti-TPO antibody	24	0
			Thyroid disease	19	25
Chu et al, 2011 <sup>18</sup>	AA (4334, 2211, 32.2)	Unspecified (784158, 372820, NA)	Thyroid disease	311	31738

Continued

**Supplemental Table I. Cont'd**

Study name	Study population (all patients [n], female patients [n], mean age [y])	Control setting (all patients [n], female patients [n], mean age [y])	Finding	Patients	
				with AA, n	Controls, n
Angulo et al, 2010 <sup>19</sup>	AA (58, 29, 50.0)	Unspecified (312, 235, 44.8)	Anti-TPO antibody	13	10
			Anti-Tg antibody	8	2
			Thyrotropin level high	2	1
			Thyrotropin level low	3	3
			ft4 level high	4	1
			ft4 level low	1	3
			Thyroid dysfunction	11	11
			Overt hypothyroidism	1	6
			Subclinical hypothyroidism	4	0
			Overt hyperthyroidism	3	2
			Subclinical hyperthyroidism	2	3
			Barahmani et al, 2009 <sup>5</sup>	AA (2055, 1476, 38.5)	Unspecified (558, 361, 40.8)
Hypothyroidism	48	11			
Thomas and Kadyan, 2008 <sup>20</sup>	AA (71, 20, NA)	Age, sex-matched (71, NA, NA)	Thyroid disease	13	4
			Hypothyroidism	10	2
			Hyperthyroidism	2	2
Puavilai et al, 1994 <sup>21</sup>	AA (152, 71, 29.3)	Age, sex-matched (152, NA, NA)	Anti-microsomal antibody	7	5
			Thyroid dysfunction	0	0

AA, Alopecia areata; *ft3*, free triiodothyronine; *ft4*, free thyroxine; NA, not available; *Tg*, thyroglobulin; *TPO*, thyroid peroxidase.

**Supplemental Table II.** Characteristics and main findings of descriptive studies

Study name	Study population (all patients [n], female patients [n], mean age [y])	Finding	Patients with AA, n
Vano-Galvan et al, 2017 <sup>22</sup>	Alopecia universalis or totalis (132, 92, NA)	Thyroid disease	26
Erpolat et al, 2017 <sup>23</sup>	AA (41, 15, 32.8)	Hashimoto thyroiditis	4
Shahzadi et al, 2016 <sup>24</sup>	AA (120, 57, 22.3)	Hyperthyroidism	1
Gerin et al, 2016 <sup>25</sup>	AA (448, NA, NA)	Hypothyroidism	5
		Anti-TPO antibody	24
		Anti-Tg antibody	12
		ft3 level low	2
		ft4 level low	13
Kurtipek et al, 2015 <sup>26</sup>	AA (92, 37, 26.2)	Anti-TPO antibody	13
		Anti-Tg antibody	2
		Thyrotropin level high	7
		ft4 level high	5
		ft3 level high	1
		Graves disease	7
Noso et al, 2015 <sup>11*</sup>	AA (110, 76, 37.5)	Hashimoto thyroiditis	4
		Thyroid disease	19
		Thyrotropin level high	13
Lyakhovitsky et al, 2015 <sup>27</sup>	AA (78, 32, 32.7)	Overt hyperthyroidism	1
		Overt hypothyroidism	1
		Subclinical hypothyroidism	12
		Hypothyroidism	1
		Hypothyroidism	5
Jang et al, 2015 <sup>28</sup>	AA aged >60 y (35, NA, NA)	Thyroid disease	5
Guruprasad et al, 2015 <sup>29</sup>	AA (100, 49, NA)	Thyroid disease	5
Ranawaka, 2014 <sup>30</sup>	AA (290, 126, 31.8)	Thyroid disease	94
Lee et al, 2014 <sup>31</sup>	AA (871, 426, NA)	Thyroid disease	1
Aghaei et al, 2014 <sup>32</sup>	AA (40, 22, NA)	Anti-TPO antibody	23
Baars et al, 2013 <sup>3</sup>	AA (130, 85, 33.2)	Hypothyroidism	1
		Hyperthyroidism	1
		Subclinical hypothyroidism	6
		Subclinical hyperthyroidism	1
		Thyroid disease	4
		Anti-microsomal antibody	4
Wu et al, 2013 <sup>33</sup>	AA with age of onset >50 y (73, 49, 60)	Anti-Tg antibody	3
		Thyrotropin level high	3
		Thyrotropin level low	2
Qadim et al, 2013 <sup>34</sup>	AA (58, 25, 30.1)	ft3 level high	3
		ft3 level low	2
		ft4 level high	1
		ft4 level low	3
		Thyroid disease	309
		Anti-TPO antibody	72
		Thyrotropin level high	130
Thyrotropin level low	12		
Huang et al, 2013 <sup>35</sup>	AA (2115, 1304, 42)	ft4 level high	21
		ft4 level low	8
		Antithyroid antibody	8
		Hyperthyroidism	1
		Hypothyroidism	9
Tang et al, 2010 <sup>37</sup>	AA (200, 84, NA)	Thyroid disease	4
Ejaz et al, 2009 <sup>38</sup>	AA (83, 23, NA)	Hyperthyroidism	1
Goh et al, 2006 <sup>39</sup>	AA (512, 381, 36.3)	Thyroid disease	98

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**Supplemental Table II. Cont'd**

Study name	Study population (all patients [n], female patients [n], mean age [y])	Finding	Patients with AA, n
Seyrafi et al, 2005 <sup>4</sup>	AA (123, 66, 24.1)	Thyroid dysfunction	11
		Anti-Tg antibody	36
		Thyrotropin abnormal	10
		fT3 abnormal	3
		fT4 abnormal	4
Jain and Marfatia, 2003 <sup>40</sup>	AA (150, 56, NA)	Hypothyroidism	2
Tan et al, 2002 <sup>41</sup>	AA (219, 122, 25.2)	Thyroid disease	5
Tak et al, 2002 <sup>42</sup>	AA (732, 342, 26.8)	Thyroid disease	8
Sharma et al, 1999 <sup>43</sup>	AA (1700, NA, NA)	Graves disease	1
		Hyperthyroidism	3
		Hypothyroidism	5
		Antithyroid antibody	5
		fT3 level high	3
Recupero et al, 1999 <sup>44</sup>	AA (62, 29, 24.7)	fT3 level low	1
		fT4 level high	3
		Thyroid disease	24
		Thyroid disease	8
		Graves disease	3
Sharma et al, 1996 <sup>45</sup>	AA (292, 149, NA)	Hashimoto thyroiditis	8
Safavi et al, 1995 <sup>46</sup>	AA (905, 393, 28.9)	Thyroid disease	6
Ro, 1995 <sup>47</sup>	AA (517, 362, NA)	Thyroid disease	76
Wang et al, 1994 <sup>48</sup>	AA (800, NA, NA)	Thyroid disease	94
Shellow et al, 1992 <sup>49</sup>	AA (209, 115, NA)	Antithyroid antibody	14
		Thyrotropin level high	3
		Thyrotropin level low	1
		fT4 level high	18
		fT4 level low	1
De Waard-van der Spek et al, 1989 <sup>50</sup>	AA (100, 66, NA)	Hyperthyroidism	1
		Hypothyroidism	1
		Antibody against thyroid gland	24
		Antibody against thyroid colloid	7
		Antibody against thyroid cytoplasm	9
De Weert et al, 1984 <sup>51</sup>	AA (108, 73, NA)	Anti-microsomal antibody	2
		Hyperthyroidism	1
		Hypothyroidism	1
Friedmann et al, 1981 <sup>52</sup>	AA (108, 73, NA)	Thyroid disease	4

AA, Alopecia areata; NA, not available; fT3, free triiodothyronine; fT4, free thyroxine; TPO, thyroid peroxidase; Tg, thyroglobulin.

\*This is a case-control study, and its baseline characteristics of patients with AA were extracted.