

Doppler ultrasonographical findings in the differential diagnosis of post-partum thyroiditis

Feyzi Gokosmanoglu,¹ Ceyhun Varim,² Erkan Aksoy³

Abstract

Objective: To investigate the effects of haemodynamic indices on colour Doppler ultrasound in differential diagnosis in patients with postpartum thyroiditis and with Graves' disease.

Methods: The cross-sectional study was conducted at the Endocrinology Polyclinic of Medical Park Hospital, Ordu, Turkey, from March 2017 to May 2018 and comprised patients referred from the Gynaecology Department for routine check-up after parturition within the first 6 months. The patients were divided into two groups. Group 1 had postpartum thyroiditis patients and Group 2 had those of Graves' disease. In both groups, parameters measured were peak systolic velocity, end-diastolic velocity and resistive index of the inferior thyroid artery with proper angle (45-60°) on colour Doppler ultrasound. Data was analysed using SPSS 20.

Results: Of the 42 subjects, 18(42.85%) were in Group 1 and 24(57.14%) were in Group 2. Peak systolic velocity and end-diastolic velocity values of the inferior thyroid artery were higher in Group 2 compared to Group 1 ($p<0.05$), while the resistive index value was significantly higher in Group 1 compared to Group 2.

Conclusion: Due to its wide availability, the use of colour Doppler ultrasound parameters indicating parenchymal perfusion were found to be broadly useful in distinguishing between postpartum thyroiditis and Graves' disease.

Keywords: Postpartum thyroiditis, Graves' disease, Colour Doppler ultrasound. (JPMA 70: 999; 2020)

DOI: <https://doi.org/10.5455/JPMA.13040>

Introduction

Post-partum thyroiditis (PPT) is defined as the development of hypothyroidism, thyrotoxicosis, or both, after birth, in women without clinical evidence of thyroid disease before the pregnancy. It is seen in postpartum women at a rate of 7-10%.¹ Ultrasonographic (USG) findings during the progression of this autoimmune disease vary at a great deal parallel to the dynamic nature and histopathological changes of it.² Graves' hyperthyroidism disease (GH) is an autoimmune situation caused by antibodies that stimulate the thyroid-stimulating hormone receptor antibody (TRab). GHD affects 0.2% of pregnant women. It is difficult to diagnose and manage GHD correctly and effectively in pregnancy and the post-partum period because pregnancy changes the physiology of the thyroid.³

In thyroid diseases, colour Doppler imaging is a promising diagnostic imaging method. Changes in the Resistive Index (RI) values in patients who have normal gray-scale findings especially require the addition of the colour Doppler imaging to routine USG examination. However,

the use of colour Doppler USG in thyroid disease is a relatively new and promising concept.⁴

Diffuse hypoechoic, heterogeneous, hypervascular, and hypovascular areas are revealed by Doppler USG with progress in the effects of autoimmunity on the thyroid gland in patients diagnosed with thyroiditis. The current study was planned to examine the effect of haemodynamic indices on differential diagnosis in colour Doppler USG in patients diagnosed with PPT and GHD.

Patients and Methods

The cross-sectional study was conducted from March 2017 to May 2018 at the Endocrinology Polyclinic of Medical Park Hospital, Ordu, Turkey, and comprised patients referred from the Gynaecology Department for routine check-up after parturition within the first 6 months.

The patients were divided into PPT and GHD groups. Those having history of other autoimmune diseases, male gender, those who received radiotherapy in the head and neck, pregnancy and immunosuppressive drug use, and patients <18 years of age were excluded.

Clinical and serological data recorded was age, anti-thyroperoxidase autoantibodies (TPOAb), anti-thyroglobulin antibody (TgAb), TSH, TRab, B-mode USG, colour Doppler USG of inferior thyroidal artery, peak

.....
¹Department of Endocrinology, Medical Park Hospital, Ordu, ²Department of Internal Medicine, Sakarya University, Sakarya, ³Department of General Surgery, Medical Park Hospital, Ordu, Turkey.

Correspondence: Ceyhun Varim. Email: ceyhunvarim@yahoo.com

systolic velocity (PSV), end diastolic velocity (EDV) and RI values as measured using the proper angle (45-60°).

The diagnostic procedures of PPT depended on the stage of the disease. It was distinguished from GHD in the thyrotoxic phase because TSH is suppressed, and serum free triiodothyronine (FT3) and free thyroxine (FT4) are increased. In Graves' disease, while radioactive iodine intake is high, it is low in PPT, but this test is not used during breastfeeding. As such, in such cases, TRab level is important. TRab is negative in almost all PPT patients. In addition, increased hypoechogenicity is detected in many PPT cases in thyroid USG. In the post-partum period, PPT appears within approximately 3-6 months, while GHD appears later than 6 months. GHD diagnosis was made by considering TRab positivity, increased hypoechogenicity in thyroid USG, hyperplasia, increased blood build-up, and clinical eye findings.⁵

Serum TSHFT3, FT4, TgAb, TPOAb and TRab were assessed using automated dimmuno chemiluminescent assay (ICMA) kits (Abbott, IL, the USA). Thyroid USG was performed with a high-resolution device (Philips Affinity 70 Ultrasound; Philips North America Corporation, USA) equipped with 5-12 MHz wide-band linear series probe. All the procedures were performed by an experienced professional.

Data analysis was done using SPSS 20. Values for mean $\pm$ standard deviation (SD) in descriptive analysis were compared using independent samples t-test and Mann Whitney U test. $P < 0.05$ was considered significant.

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the institutional ethics committee.

Results

Of the 42 subjects, 18(42.85%) were in the PPT group with a mean age of 28.6 ± 12.3 years and 24(57.14%) were in the

Table-1: Demographic characteristics.

Parameters	Group 1 (mean/SD)	Group 2 (mean/SD)	P-value
Age (years)	28.6 ± 12.3	35.2 ± 8.7	0.658
TSH (μ IU/ml)	<0.001	<0.001	-
TPOAb (IU/mL)	42.15 ± 13.9	76.8 ± 21.5	0.341
TgAb (IU/mL)	71.54 ± 23.4	83.52 ± 17.9	0.754
TRab (U/L)	2.4 ± 1.89	32.3 ± 12.65	<0.001

SD: Standard deviation; TPOAb: Anti-thyropoxidase autoantibodies; TgAb: Anti-thyroglobulin antibody; TRab: Thyroid stimulating hormone (TSH) receptor antibody.

Table-2: Comparison of Doppler US haemodynamic parameters between the groups.

Parameters	Group 1 (mean/SD)	Group 2 (mean/SD)	P-value
PSV (cm/s)	11.9 ± 4.2	21.3 ± 6.7	0.036
EDV (cm/s)	5.8 ± 2.5	12.7 ± 3.1	0.012
RI	0.53 ± 0.06	0.43 ± 0.18	<0.001

SD: Standard deviation; PSV: Peak systolic velocity; EDV: End-diastolic velocity; RI: Resistive index. $P > 0.05$ - Mann-Whitney U test for all parameters.

GHD group with a mean age of 35.2 ± 8.7 years (Table-1).

PSV was 11.9 ± 4.2 cm/s in the PPT group and it was 21.3 ± 6.7 cm/s in the GHD group ($p = 0.036$). EDV was 5.8 ± 2.5 cm/s in the PPT group and 12.3 ± 6.7 cm/s in the GHD group ($p = 0.012$). RI values in the PPT group was 0.53 ± 0.06 and 0.43 ± 0.18 in the GHD group ($p < 0.001$) (Table-2).

Discussion

The current study examined the effects of PPT and GHD on thyroid parenchymal blood build-up. In the examinations, the thyroid artery PSV was able to distinguish the underlying cause of PSV thyrotoxicosis effectively. In patients with diffuse autoimmune thyroiditis, in colour Doppler USG, it is generally accepted that the intra-parenchymal blood flow is increased at the onset and peak of the disease.⁶ The current study found that thyroid parenchymal blood-flow was decreased in PPT cases compared to the GHD patients.

PSV was determined to be significantly lower in PPT when compared with hyperthyroid postpartum thyroiditis PSV 9.4 ± 3.4 cm/s and GHDPV 19.8 ± 7.0 cm/s. With a cut-off level of 15 cm/s, PSV makes us foresee the correct diagnosis of postpartum women with hyperthyroidism. In the present study, it was determined that the PSV level was an independent marker between hyperthyroid PPT and GHD.⁷ In our study, PSV was 11.9 ± 4.2 cm/s in PPT patients; and 21.3 ± 6.7 cm/s in GHD patients ($p = 0.036$). In GHD patients, the blood-flow was increased in the inferior thyroid artery. Decrease in the vascular resistance and the expression of the endothelial growth factor may cause the increased parenchymal blood flow. In studies conducted to date, the usability of PSV measurement of the inferior thyroidal artery with colour Doppler USG has been investigated in the differential diagnosis of thyrotoxicosis. It was reported in previous studies that a qualitative intra-parenchymal analysis may exceed the limits in differential diagnosis of diffuse hyper functional thyroid disease.⁸

In previous studies, inferior thyroid artery PSV and EDV values were high at a significant level when compared with PPT patients. In characteristic analysis, in the

differentiation between GHD and PPT, the sensitivity of the EDV 13.2 cm/s cut-off value was 89.3%, while specificity was 88.6%.⁹ In our study, the inferior thyroid artery EDV in GHD patients was 12.7 ± 3.1 cm/s, which was higher than PPT patients at a statistical level. In previous studies, it was shown that there was a definite intersection point between the thyroid parenchymal blood build-up in people with euthyroidism, thyroiditis or GHD.¹⁰ The current study determined that the EDV value was increased in GHD patients compared to PPT cases. In PPT cases, inflammation and thyrocyte destruction may have reduced the parenchymal blood build-up.

The increase in the parenchymal blood build-up of the thyroid tissue and the increase in the PSV and EDV are both explained by the decrease in RI.¹¹ In one study, in euthyroid adults, the mean PSV value was 16.94 ± 5.3 cm/s and RI was 0.5 ± 0.13 .¹² In previous studies, a higher RI showed a vascular bed blood-flow with a higher impedance. In situations such as liver cirrhosis, renovascular atherosclerosis, renal transplant rejection, parenchymal infiltration and oedema, resistance to vascular flow because of fibrosis develops which may be detected non-invasively with the increase in RI in Doppler USG.^{13,14} The current study determined that RI was low in GHD patients, and high in PPT cases. This increase in parenchymal blood build-up in GHD may be explained by the decrease in vascular resistance.

Conclusion

Thanks to its wide usability, it is believed that considering the vascular Doppler USG parameters, which are indicators of parenchymal blood build-up, to differentiate between thyroid diseases will contribute greatly to the diagnosis.

A major limitation of the study was the small sample size. It was not calculated initially.

Disclaimer: None to declare

Conflict of Interest: None to declare

Funding Sources: None to declare

References

- Smith A, Eccles-Smith J, D'Emden M, Lust K. Thyroid disorders in pregnancy and postpartum. *Aust Prescr.* 2017; 40:214-9.
- Wu H, Zhang B. Ultrasonographic appearance of focal Hashimoto's thyroiditis: A single institution experience. *Endocr J.* 2015;62:655-63.
- Alexander EK, Pearce EN, Brent GA, Brown RS, Chen H, Dosiou C, et al. 2017 Guidelines of the American Thyroid Association for the Diagnosis and Management of Thyroid Disease During Pregnancy and the Postpartum. *Thyroid.* 2017; 27:315-89.
- Sarikaya B, Demirbilek H, Akata D, Kandemir N. The role of the resistive index in Hashimoto's thyroiditis: a sonographic pilot study in children. *Clinics Sao Paulo.* 2012;67:1253-7.
- Ide A, Amino N, Kang S, Yoshioka W, Kudo T, Nishihara E, et al. Differentiation of postpartum Graves' thyrotoxicosis from postpartum destructive thyrotoxicosis using antithyrotropin receptor antibodies and thyroid blood flow. *Thyroid.* 2014;24:1027-31. doi: 10.1089/thy.2013.0585.
- Tae KK, Eun JL. The value of the mean peak systolic velocity of the superior thyroidal artery in the differential diagnosis of thyrotoxicosis. *Ultrasonography* 2015;34:292-6. doi: 10.14366/usg.14059.
- Gaberšček S, Osolnik J, Zaletel K, Pirnat E, Hojker S. An Advantageous Role of Spectral Doppler Sonography in the Evaluation of Thyroid Dysfunction During the Postpartum Period. *J Ultrasound Med* 2016;35:1429-36. doi: 10.7863/ultra.15.07033.
- Kim TK, Lee EJ. The value of the mean peak systolic velocity of the superior thyroidal artery in the differential diagnosis of thyrotoxicosis. *Ultrasonography.* 2015;34:292-6.
- Zuhur SS, Ozel A, Kuzu I, Erol RS, Ozcan ND, Basat O, et al. The Diagnostic Utility of Color Doppler Ultrasonography, Tc-99m Pertechetate Uptake, and TSH-Receptor Antibody for Differential Diagnosis of Graves' Disease and Silent Thyroiditis: A Comparative Study. *Endocr Pract* 2014;20:310-9. doi: 10.4158/EP13300.OR
- Zhao X, Chen L, Li L, Wang Y, Wang Y, Zhou L, et al. Peak systolic velocity of superior thyroid artery for the differential diagnosis of thyrotoxicosis. *PLoSOne* 2012;7:e50051.
- BianchiniHöfling D, Marui S, Buchpiguel CA, Cerri GG, Chammas MC. The End-Diastolic Velocity of Thyroid Arteries Is Strongly Correlated with the Peak Systolic Velocity and Gland Volume in Patients with Autoimmune Thyroiditis. *J Thyroid Res.* 2017; 2017:1924974.
- Joish UK, Kavitha Y, Reddy RH, Prabhu AS, Kumar MC, Siddharth MC. Doppler indices of superior thyroid artery in clinically euthyroid adults. *Indian J Radiol Imaging.* 2018; 28:10-3.
- Afif AM, Chang JP, Wang YY, Lau SD, Deng F, Goh SY, et al. A sonographic Doppler study of the hepatic vein, portal vein and hepatic artery in liver cirrhosis: Correlation of hepatic hemodynamics with clinical Child Pugh score in Singapore. *Ultrasound* 2017;25:213-21. doi: 10.1177/1742271X17721265.
- Ghonge NP, Mohan M, Kashyap V, Jasuja S. Renal Allograft Dysfunction: Evaluation with Shear-wave Sonoelastography. *Radiology.* 2018; 288:146-52.