



## Original article

## Atrioventricular block in patients with thyroid dysfunction: Prognosis after treatment with hormone supplementation or antithyroid medication

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## ABSTRACT

**Background:** Hypothyroidism is a reversible cause of atrioventricular (AV) block. Few reports have described reversible AV block caused by hyperthyroidism. However, it is unknown whether patients with AV block are expected to have a benign course after the initiation of appropriate therapy for thyroid dysfunction.

**Methods:** The study group consisted of patients with II or III degree AV block and bradyarrhythmia ( $\leq 40$  bpm) excluding patients with myocardial infarction, electrolyte abnormalities, digitalis toxicity, and vasovagal syncope. Thyroid dysfunction is diagnosed when thyroid stimulating hormone and thyroxine levels are not in defined normal ranges. AV block was determined by surface electrocardiogram (ECG). The cause and effect relation between AV block and thyroid dysfunction was evaluated.

**Results:** Of 668 patients, 29 (4.3%) had hypothyroidism (19 overt) and 21 (3.1%) had hyperthyroidism (8 overt). The most frequent ECG finding was complete AV block (27 of 50 patients). Ten patients had bradyarrhythmia and 13 had second-degree AV block. Euthyroid state was achieved in 10 hypothyroidic (34%) and in 7 hyperthyroidic patients (33%) with hormone replacement and antithyroid therapy, respectively, during the follow-up period ( $\leq 21$  days). Thyroid dysfunction was found to be not related with AV block in 40 patients (80%). However, in 4 of 10 patients with AV block related to thyroid dysfunction the resolution of AV block occurred after the placement of pacemaker ( $>21$  days). Overall, 44 of 50 (88%) patients with AV block in association with thyroid dysfunction were implanted with a permanent pacemaker. Of 6 patients who did not receive a pacemaker, 2 had complete AV block and 4 had bradyarrhythmia.

**Conclusion:** AV block associated with thyroid dysfunction needs great attention regardless of type of the thyroid disease. Patients with II and/or III degree AV block in the setting of thyroid dysfunction almost always need permanent pacemaker insertion even after normalization of thyroid status.

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### Introduction

Hypothyroidism is not an uncommon cause of complete atrioventricular (AV) block in clinical practice. Also, hyperthyroidism is thought to be a reversible cause of AV block [1–3]. According to contemporaneous guidelines pacemaker implantation is generally considered unnecessary in patients with “thyroid dysfunction associated with AV block” (TDAB) [4]. However, it is not known whether patients with TDAB can expect a benign course after the initiation of appropriate medical therapy. Moreover, the time course between the initial therapy for thyroid dysfunction and recovery of AV block is not clear. Hence, the appropriate strategy for patients with AV

block in association with thyroid dysfunction remains challenging for physicians. We examined the clinical course of consecutive patients admitted to our institution with the diagnosis of “AV block” and hypo/hyperthyroidism.

### Methods

We reviewed patients who had second-degree or third-degree AV block, and bradyarrhythmia (average heart rate  $\leq 40$  bpm on 24-h Holter monitoring) from our institution between January 2008 and June 2009. In addition, using the same criteria for patient selection, we collected patients prospectively beginning from June 2009. Shortly, all hospitalized patients to the department of cardiology with symptomatic AV block between January 2008 and July 2010 were evaluated. Patients with concomitant myocardial infarction, electrolyte abnormalities, digitalis toxicity, and vasovagal

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**Table 1**  
Classification of second- or third-degree AV block and bradyarrhythmia based upon electrocardiographic characteristics.

	AV-nodal block	Infranodal AV block	Undetermined level of AV block
Second-degree AV block	PR increment preceding a blocked P (Wenckebach) and narrow QRS	Constant PR interval preceding blocked P	PR increment (Wenckebach) preceding a blocked P and wide QRS
Third-degree AV block	Escape rhythm has narrow QRS and rate $\geq 40$ beats/min	Escape rhythm has wide QRS and rate $< 40$ beats/min	Escape rhythm has wide QRS and rate $\geq 40$ beats/min
Bradyarrhythmia	f waves with irregular narrow QRS	f waves with regular wide QRS	f waves with irregular wide QRS

AV, atrioventricular; f, fibrillatory.

**Table 2**  
The level of AV block based upon the surface electrocardiographic findings in patients with thyroid dysfunction.

	Subclinical hypothyroidism n (%)	Subclinical hyperthyroidism n (%)	Overt hypothyroidism n (%)	Overt hyperthyroidism n (%)	p
AV-Nodal	4 (40)	8 (61.5)	7 (36.8)	4 (50)	0.568
Infranodal	4 (40)	3 (23.1)	11 (57.9)	3 (37.5)	
Undetermined	2 (20)	2 (15.4)	1 (5.3)	1 (12.5)	

Mean values (SD) and % (n) are reported for continuous and categorical variables, respectively.  
AV, atrioventricular.

syncope were excluded. Also, patients who were taking beta-blockers, nondihydropyridine calcium-channel blockers, and class I and III antiarrhythmics were excluded from this study. Thyrotropin (thyroid stimulating hormone, TSH) and thyroxin levels were studied from all hospitalized patients with AV block. Thyroid dysfunction was defined according to the value of the TSH and thyroxin. TSH level above the normal range ( $\geq 5$  mIU/L), with or without thyroxin depletion ( $< 2$  ng/L) was defined as overt or subclinical hypothyroidism, respectively. Decreased level of TSH ( $< 1$  mIU/L), with or without elevated thyroxin ( $> 5$  ng/L) level was defined as overt or subclinical hyperthyroidism, respectively. Etiology of thyroid dysfunction was not sought for inclusion or exclusion. Patients who were on treatment for thyroid dysfunction before admission with AV block are classified as hypo or hyperthyroidic, according to their previous diagnosis irrespective of the level of TSH during the index hospitalization. All of the patients with abnormal TSH level were consulted by the endocrinologist and appropriate treatment with antithyroid medication or hormone supplementation have been started in hospital. Twelve of 29 hypothyroidic and 2 of 21 hyperthyroidic patients had been treated before the admission with AV block, and they all had normal TSH value during admission. Permanent pacemaker was implanted to all of the patients who had been treated for thyroid dysfunction before the admission with AV block.

The type and level of AV block were determined by the surface electrocardiogram (ECG) [5–9] (Table 1). Patients were classified into two groups to define a relationship between thyroid dysfunction and AV block: (1) AV block related to thyroid dysfunction: TDAB that resolved after the appropriate treatment and did not recur during the follow-up period ( $\leq 21$  days); (2) AV block not related to thyroid dysfunction—incidental block (IB): AV block that never resolved within 3 weeks after initiation of medication or resolved but relapsed in spite of continuation of the therapy and normalization of TSH level. All patients were monitored continuously until they had improved AV conduction or received an implanted pacemaker. If AV block did not resolve within 4–6 days a pacemaker implantation was decided. Patients with resolved AV block were followed in hospital up to 3 weeks. Recurrent cases were identified by routine ECG that was obtained twice a day or by ECG that was obtained in case of bradycardia-related symptoms. Permanent pacemaker was implanted for all of the patients with recurrence of AV block during follow-up. Patients who recovered apparent normal AV conduction after normalization of the thyroid status were recommended to visit arrhythmia polyclinic, for

evaluation of AV conduction with surface ECG, within one month after discharge. Patients who had abnormal TSH level at the time of pacemaker placement have been followed until they had normal TSH level to reveal the exact relation between the thyroid dysfunction and an AV block. Patients with improved AV conduction and no pacemaker dependency at pace rate of 40 bpm were classified as an AV block related to thyroid dysfunction. Those who had persistent AV block and/or pacemaker dependency at pace rate  $\leq 40$  bpm were defined as IB. Collection and analyses of data were authorized by the ethics committee of the hospital.

#### Statistical analysis

Quantitative variables were expressed as mean value  $\pm$  SD, and qualitative variables were expressed as percent (%). Categorical data were compared using the Chi-square test or Fisher's exact test. Logistic analysis was applied for multivariate analysis. A *p*-value  $< 0.05$  was considered statistically significant. All statistical studies were carried out using NCSS 2007 (Number Cruncher Statistical System) and PASS 2008 Statistical Software Program (NCSS, Kaysville, UT, USA).

#### Results

Among the 668 study patients (mean age  $68.2 \pm 15.4$  years, 337 women), 50 patients (7.4%) had the diagnosis of thyroid dysfunction during the hospitalization for AV block. Of these 19 patients (2.8%) had overt hypothyroidism (mean age  $67.73 \pm 9.04$  years, 17 women), 8 patients (1.1%) had overt hyperthyroidism (mean age  $67.75 \pm 11.27$  years, 6 women), 10 patients (1.4%) had subclinical hypothyroidism (mean age  $69.10 \pm 11.10$  years, 4 women), and 13 patients (1.9%) had subclinical hyperthyroidism (mean age  $71.92 \pm 15.56$  years, 9 women). In 36 of 50 (72%) patients with thyroid dysfunction, the diagnosis was established during the index hospitalization. The AV block type was similar in all four subclinical or overt hypo/hyperthyroidism groups (Table 2). Although there was no effect of comorbidities on the reversibility of AV block, diabetes mellitus and hypertension were common in patients with hypothyroidism (Table 3).

TSH level was normalized in 10 patients with hypothyroidism after the hormone supplementation therapy. While, AV block was resolved and never recurred in 5 patients, 3 patients had sustained AV block and 2 patients had recurrence of AV block despite

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