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TITLE: BUNDLE BRANCH BLOCK AS A TEMPORARY PHENOMENON IN THYROTOXICOSIS
REPORT OF A CASE

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Bundle Branch Block as a Temporary Phenomenon in Thyrotoxicosis

Report of a Case...

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The following, in-so-far as we are aware, is the first recorded instance of bundle branch block associated with thyrotoxicosis in which normal conduction was restored following partial thyroidectomy. Of added interest was the fact that this occurred in a young female twenty-seven years of age who presented no definite evidence of heart disease following the relief of the thyrotoxicosis. Indeed, all attempts to re-induce the bundle branch block after thyroidectomy were unsuccessful.

A review of the literature concerning the association of bundle branch block with hyperthroidism discloses only fifteen cases in all. Five cases are reported by Gordon, Soley, and Chamberlain (1); four of their patients were over forty-two years of age, the fifth being thirty-one years old, and in all the conduction defect is ascribed to co-existing coronary heart disease. Gordon et al do not state whether intraventricular conduction in any of their cases reverted to normal after thyroidectomy. Five more cases of right bundle branch block are mentioned by Goodall and Rogers who do not describe the age nor sex of the patients. Coelho (3) describes one case of prolonged QRS duration without giving any clinical details. Dameshek (4) describes one case in a sixty year old female. Ramos, Melo and Ferraz (5) found two cases of bundle branch block among seventy hyperthroid patients. Rose, Wood, and Margolies (6) describe a twenty-nine year old woman whose right bundle branch block has persisted for the three years of observation, and who has shown no other evidence of heart disease. The rarity of bundle branch block in thyrotoxicosis is further emphasized by the fact that no mention of bundle branch block is made in several comprehensive articles on the electrocardiogram in hyperthyroidism(7-14); and in the standard texts, only Thomas (15) mentions the occurrence of bundle branch block in thyrotoxic heart disease. In no case report that we have seen has there been described reversion to normal intraventricular conduction after treatment of the

hyperthyroidism.

CASE REPORT

FK, a twenty-seven year old single woman serving in the women's reserve of the U.S. Navy, was referred to the cardiac clinic on May 30, 1944, for examination. Past history revealed that she was born and raised in the Middle West and had the usual childhood diseases. At the age of eleven she developed a simple goiter which was treated with iodized salt, and which remained asymptomatic. There was no history of rheumatic fever, scarlet fever, diphtheria, or kidney disease. An appendectomy had been performed in January 1944. Present illness began insidiously during the spring of 1944. The patient's only complaint was of rapid heart action, although later on she recalled a five pound weight loss, slight nervousness, irritability and a fine tremor of the hands.

Physical examination revealed a slightly overweight, nervous female with exophthalmos. The thyroid gland was large and firm without nodules, the right lobe being larger than the left; both a bruit and thrill were present. The skin was warm, and there was a continuous fine tremor of the hands. The heart was not enlarged, the BP was 160/82, the rhythm was regular at 132, and a faint pulmonary systolic murmur was heard which became louder when the patient was recumbent. The remainder of the physical examination disclosed no abnormalities.

X-ray examination of the heart was reported as follows: " Lungs clear. Aortic configuration of the heart and slight elongation of the aorta". The basal metabolic rate was + 35% and + 40%. An electrocardiogram (Fig.1A) showed a rate of 120 and right bundle branch block with the QRS duration 0.13 seconds. Blood cholesterol was 125 mg %.

The patient was transferred to the hospital and, after preparation with Lugol's solution, underwent a partial thyroidectomy on July 3, 1944. A bilaterally enlarged diffuse toxic goiter was found on operation. Her symptoms disappeared and she was discharged to duty on August 12, 1944.

Except for a week's hospitalization for sinusitis in September 1944, the patient was well until December 20, 1945, when she contracted scarlet fever. Her convalescence was slow and was complicated by a recurrence of hyperthyroidism. The BMR on several occasions was +45%. One electrocardiogram was taken and reported as showing QRS duration 0.12 seconds with slurred QRS complexes, but the tracing was not preserved. In February 1946 the patient underwent a second sub-total thyroidectomy. The report of the pathologist was "Toxic hyperplasia of the thyroid showing regressive

change". Following operation, the basal metabolic rate was plus 4%. In June 1946, she was again seen in the cardiac clinic, and the electrocardiogram taken at that time (Fig. 1B) showed normal conduction at a rate of 62.

During the following year the patient gradually developed symptoms of hypothyroidism, with BMR's ranging from -20 to -30%. Treatment was started with thyroid extract, gr. 1½ daily, which raised the BMR to about -15% and caused symptoms to disappear.

In October 1947 an attempt was made to see if the bundle branch block would recur following exhausting exercise on the treadmill. Intraventricular conduction remained normal, but partial A-V block did develop transiently as shown by an increase in the duration of the PR interval from 0.19 to 0.32 seconds at a maximum heart rate of 140. (Fig.2).

A second attempt was then made by giving the patient six grains of thyroid extract daily for two weeks. Twice weekly her BMR was determined and electrocardiograms were taken before and after exercise. During this time her BMR rose from -20% to -3% and her resting pulse from 45 to 60. The electrocardiograms again showed transient lengthening of the PR interval after exercise but at no time did any change appear in the QRS complexes.

In view of the reported occurrence (16) of bundle branch block following startle, a third attempt was made by firing a rifle unexpectedly under the bed on which the patient was lying while having an electrocardiogram recorded. No conduction abnormalities developed, although the tracing showed lowering of "T" waves in Lead II.

At present, four years after she was first found to have bundle branch block, she has no cardiac symptoms and physical examination is normal. The pulmonary systolic murmur has disappeared and the blood pressure now is 110/72. X-ray examination of the heart is reported: "Re-examination of the chest reveals slight decrease in the cardiac measurements and in the cardio-thoracic ratio since the previous examination in 1944". The electrocardiogram is within normal limits with the subject at rest.

DISCUSSION

We have ascribed the bundle branch block in this case to hyperthyroidism, for it was present in-so-far as we know, only when the patient had an elevated metabolic rate, and it was not reproduced during tachycardia caused by exercise or by startle. There is no evidence of pre-existing heart disease, nor is there any evidence of organic heart diseast at present, four years after operation. The fact that bundle branch block is rare in young women makes the chance finding of a transient bundle branch block in our case a most remote possibility. Whether or not a relationship exists between the length-

ening of the PR interval following exercise noted at present, and the occurrence of the bundle branch block during thyrotoxicosis is not known.

The mechanisms by which hyperthroidism causes cardiac abnormalities have been the subject of much discussion. Most authors are agreed that the development of hyperthyroidism in an individual with pre-existing organic heart disease will cause earlier onset of failure due to the increased demands made upon the circulatory system by the hypermetabolism. Several theories have been put forward, however, in an attempt to explain how thyrotoxicosis can cause reversible arrhythmias and congestive failure in the apparently normal heart. An early, and now largely discarded, explanation of the problem ascribed the cardiac strain to pressure of the enlarged thyroid upon the trachea, veins, or cardiac nerves. Later a toxin liberated by the thyroid was hypothesized with specific action localized in the myocardium. Goodall and Rogers (2) support this theory with post mortem evidence of focal myocardial necrosis in nine cases of thyrotoxicosis. At present, as summarized by Rose (17), the cardiac abnormalities seen in thyrotoxicosis are ascribed to (1) increased cardiac work secondary to increased body metabolism, (2) increased metabolism of the heart muscle itself, and (3) the influence of pre-existing or coincidental cardiovascular disease. In the case reported, there is insufficient evidence to add weight to any theory, although it is tempting to postulate a focal lesion such as Goodall and Rogers describe interfering with conduction through the right bundle branch.

SUMMARY

(1) The case of a young woman with hyperthyroidism and associated right branch block is presented, and the literature concerning the co-existence of these two conditions is reviewed.

(2) It is believed that this is the first reported case in which intraventricular conduction returned to normal after treatment of the hyperthyroidism.

(3) Right bundle branch block is added to the other well known functional abnormalities of the heart in hyperthroidism which may disappear after thyroidectomy.

BIBLIOGRAPHY

(1) Gordon, G.; Soley, M.; and Chamberlain, F.: Electrocardiographic Features Associated with Hyperthyroidism
Archives Int. Med. 73: 148-153 , Feb. 1944

(2) Goodall, J.S., and Rogers, L.: The Electrical and Histological Manifestations of Thyrotoxic Myocarditis.
Brit. Med. J. 1 : 1141-1142, 1927

(3) Coelho, E. Les Troubles Cardioques Dans la Maladie de Basedow et le Myxoedeme.
Ann. de Med. 30: 272-290, 1931

(4) Dameshek, W. The Heart in Hyperthyroidism
Boston M&S. J. 190: 487-497, 1924

(5) Ramos, J.; deMelo, H.K.; and Ferraz, W.P.G. : O Coracao no Hipertiroidismo
Hospital, Rio de Janeiro: 29, 739-745 1946

(6) Rose, E.; Wood, F.C..; and Margolies, A.: The Heart in Thyroid Disease. II The Effect of Thyroidectomy on the Electrocardiogram.
J. Clin. Investig. 14: 497-504, 1935

(7) Krumbhaar, E.B.: Electrocardiographic Observations in Toxic Goitre.
Am. J. M Sc, 155: 175-203, 1918

(8) White, P.D. and Aub, J.C.: The Electrocardiogram in Thyroid Disease
Arch. Int. Med. 22: 766-769. 1918

(9) Kerr, W. J. and Hensel, G.C.: Observations of the Cardiovascular System in Thyroid Disease.
Arch Int. Med. 31: 398-410, 1923.

(10) Willius, F.A.; Boothby, W.M.; and Wilson, L.B.: The Heart in Exophthalmic Goiter and Adenoma with Hyperthroidism
M. Clin North Am. 7: 189-219, 1923

(11) Smith, F.J.; and Colvin, L.T.: Certain Cardiovascular Features of Hyperthyroidism.
Ann. Clin. Med. 5: 616-625, 1927

(12) McQuire, J. ; and Foulger, M.: The Influence of Thyroid Extract and Hyperthyroidism on the Electrocardiogram, with Special Reference to the "T" Waves.
Am. Heart J. 8: 114-120, 1932

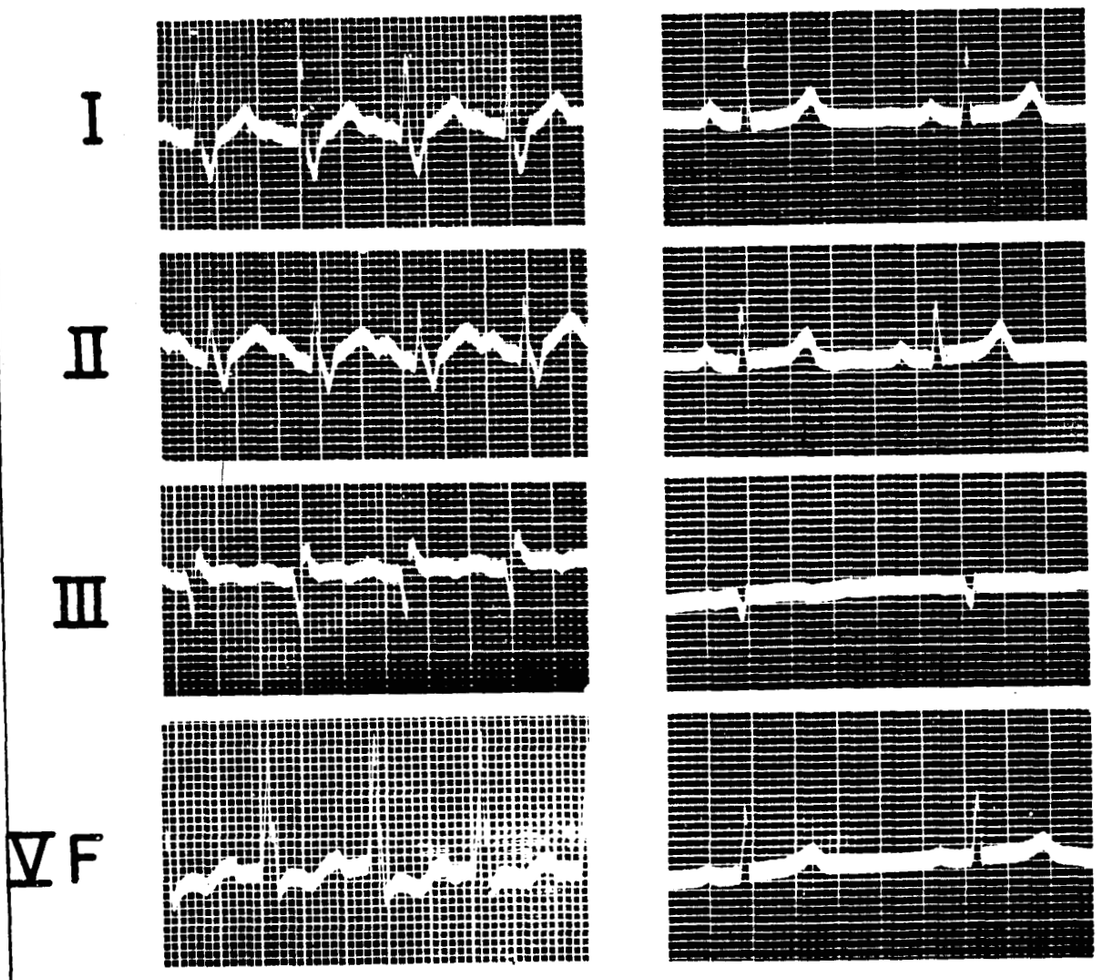
(13) Don, C.S.D. and Langley, G.J.: Some Aspects of the Electrocardiogram in Toxic Goitre.
Quart. J. Med. I : 9-15, 1932

(14) Maher, C.C. and Sitler, W.W.: Cardiovascular State in Thyrotoxicosis.
J AMA 106, 1546-1557, 1936

(15) Thomas, H.M. in Stroud's " Diagnosis and Treatment of Cardio-Vascular Disease".
F.A. Davis Co. Philadelphia, 1941.

(16) Graybiel, A.; McFarland, R.A.; Gates, D.C.; and Webster, F.A. : An Analysis of the Electrocardiograms Obtained from 1,000 Young Healthy Aviators.
Am. Heart J. 27: 524-549, 1944

(17) Rose, E.: The Heart in Thyroid Disease.
Am. Practitioner 1 : 125-132, 1946



MAY 1944 A

JUNE 1946 B

Fig. 1 A: Bundle branch block during thyrotoxicosis and B: Normal rhythm following thyroidectomy.

A lead I
PR =0.17 sec.

B lead I
PR =0.20 sec.

C lead aVf
PR =0.32 sec.

D lead V4
PR = 0.17 sec.

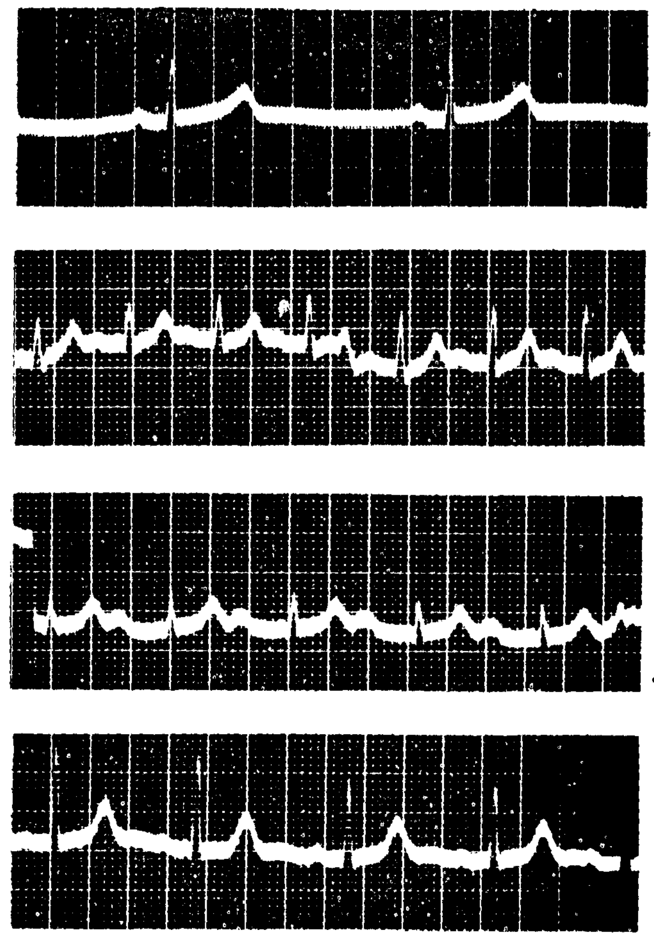


Fig. 2 Changes in PR Interval Before (A) an after Exercise