Vectorcardiography

Self Assessment

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Preface

The purpose of this book is *not* to discuss in depth various vectorcardiographic findings. The primary intention is to describe common vectorcardiographic abnormalities which are frequently encountered in daily practice. It has been repeatedly emphasized that the vectorcardiographic loop presentation is extremely valuable in teaching electrocardiography. The vectorcardiogram has therefore become one of the routine cardiac laboratory tests in most medical institutions.

The book includes 100 common vectorcardiographic tracings. In each, a short actual case history and X,Y,Z leads are shown to assist the reader in interpreting the given vectorcardiogram. On the reverse of the page showing the vectorcardiogram are the electrocardiogram obtained simultaneously from the same patient and a full analysis of the author's interpretation of the tracing. In this way, each reader can assess not only his vectorcardiographic diagnosis, but also improve his electrocardiographic knowledge. Thus, the book is entitled VECTORCARDIOGRAPHY: Self Assessment, and is intended as a companion volume to ECG DIAGNOSIS: Self Assessment. The arrangement of the text and illustrations is based upon the author's experience in teaching medical students and physicians with various backgrounds in adult cardiology. Particular emphasis is placed on the practical role of vectorcardiology in clinical medicine.

The vectorcardiographic loops and the X,Y,Z leads were recorded by a vectorcardiographic apparatus consisting of a 1507A Vector Programmer, a 1507–11A Lead Network, and a Sanborn 780–6A Visoscope manufactured by Hewlett-Packard Company. Land Pack Film (black and white) Type 107 (3¼ × 4¼ in. print) was used for the photographs of the vectorcardiographic loops and the X,Y,Z leads, both obtained with a Polaroid camera. A Frank lead system was utilized since it is presently considered to be the most useful method for the vectorcardiographic study.

This book will be very valuable to medical students, housestaffs and cardiology fellows. Also, cardiologists can assess their vectorcardiographic as well as electrocardiographic knowledge, and many practicing physicians can improve their electrocardiographic knowledge.

The secretarial burden of manuscript preparation was carried out cheerfully by Miss Theresa McAnally, and I am sincerely thankful for her valuable assistance. The indispensable

cooperation of the Illustration Department of the West Virginia University School of Medicine is sincerely acknowledged.

Finally, I owe deep gratitude and appreciation to my teacher, Dr. Edward Massie, Director of the Heart Station and Professor of Clinical Medicine, Washington University School of Medicine and Barnes Hospital in St. Louis, who taught and inspired me.

Philadelphia E.K.C.

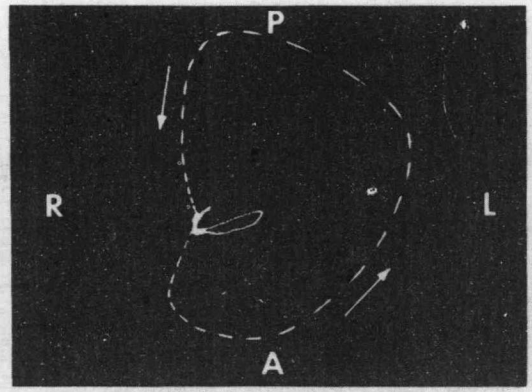
Contents

Figures 13B, 14B, 17B, 21B, 47B, 63B, 69B, 71B, and 78B from Chung EK: Electrocardiography: Practical Applications with Vectorial Principles. Hagerstown, Harper & Row, 1974

CASE 1

The vectorcardiogram, X, Y, Z leads and electrocardiogram were obtained from a 20-year-old female without demonstrable heart disease.

What is the VCG and ECG diagnosis?



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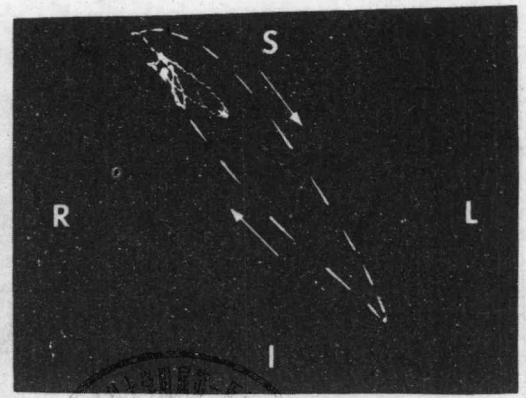

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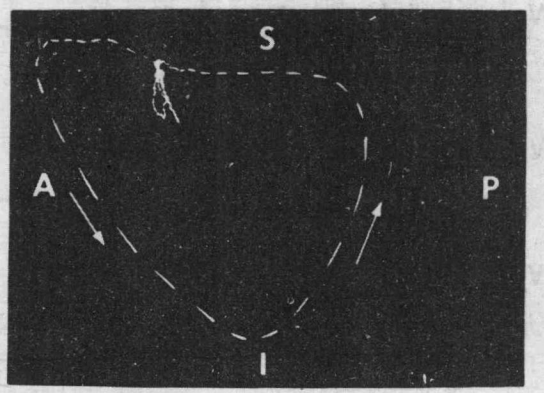

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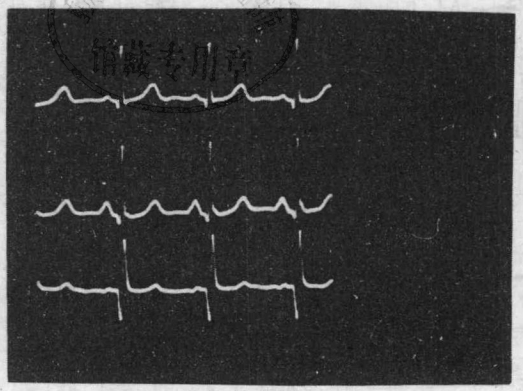


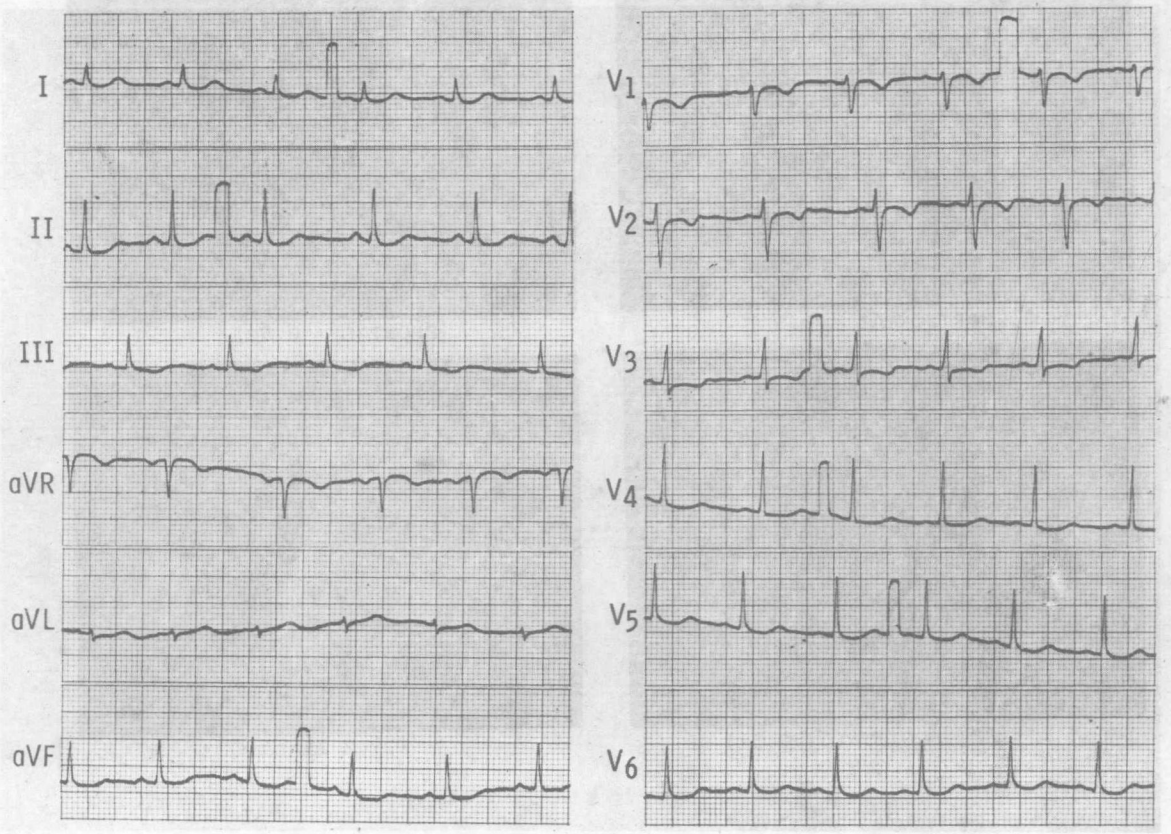
X,Y,Z LEADS

CASE 1: DIAGNOSIS

VECTORCARDIOGRAM: The initial QRS sÊ vector is directed anteriorly, superiorly and to the right. The inscription of the loop is normal, and is counterclockwise in the horizontal as well as the left sagittal planes whereas clockwise in the frontal plane. There is slightly increased anterior force but this finding is not uncommon in healthy young individuals.

The T sÊ loop is concordant to the QRS sÊ loop, but it is directed slightly posteriorly and to the left because of "juvenile T loop pattern." In summary, the VCG finding is within normal limits.

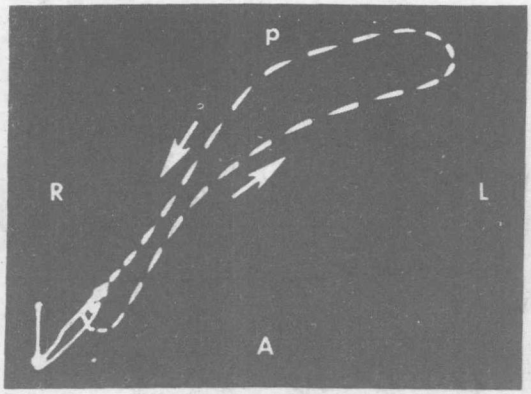
ELECTROCARDIOGRAM: The basic rhythm is sinus arrhythmia with a rate of 75–90 beats/min. The T waves are slightly (but not symmetrically) inverted in leads V_{1-3} because of "juvenile T wave pattern." The ECG tracing is within normal limits.



CASE 2

The vectorcardiogram, X, Y, Z leads and electrocardiograms were obtained from a 45-year-old male with congestive heart failure due to aortic stenosis. His medications include digoxin 0.25 mg and hydrochlorothiazide 50 mg daily.

What is the VCG and ECG diagnosis?



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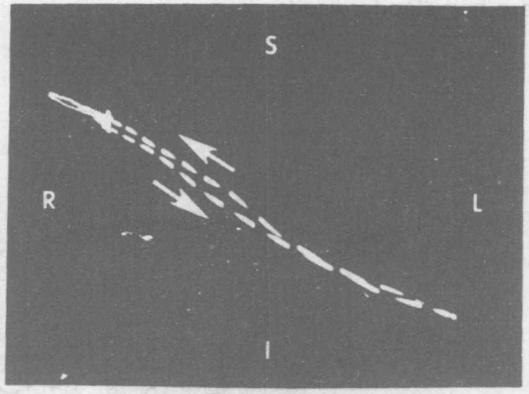

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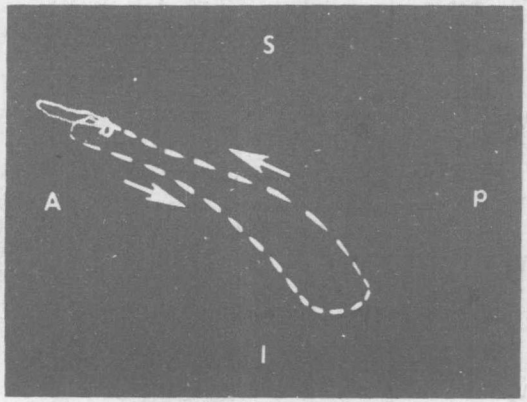

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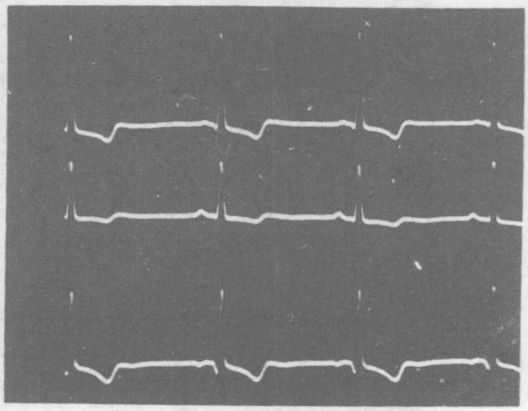
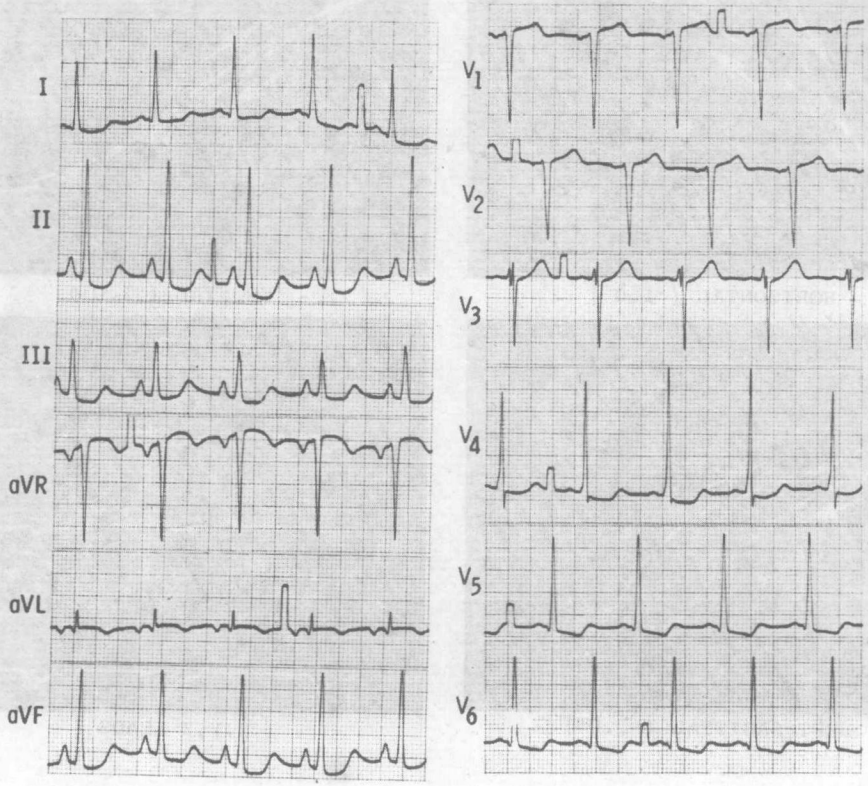


X,Y,Z LEADS

CASE 2: DIAGNOSIS

VECTORCARDIOGRAM: The initial QRS sÊ vector is directed anteriorly, superiorly and to the right. There is markedly increased force posteriorly and to the left. The inscription of the QRS sÊ loop is within normal limits in all planes. The T sÊ loop is 180° discordant to the QRS sÊ loop. The VCG tracing was taken with a half-standardization. A typical finding of left ventricular hypertrophy (systolic overloading pattern) is illustrated in this tracing.

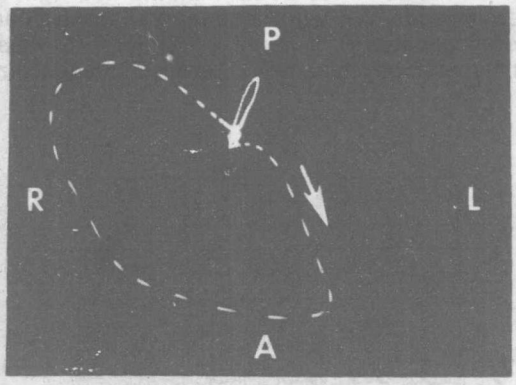
ELECTROCARDIOGRAM: The basic rhythm is sinus with a rate of 86 beats/min. Left ventricular hypertrophy (systolic overloading pattern) is diagnosed on the basis of extremely high left ventricular voltage in leads V_{5-6} with secondary T wave change and a deep S wave in lead V_1. The P waves are taller than expected in leads II, III and aVF because of hypokalemia induced by diuretics. Leads V_{1-6} are half-standardized.



CASE 3

The vectorcardiogram, X, Y, Z leads and electrocardiogram were obtained from a 27-year-old female with pulmonic stenosis.

What is the VCG and ECG diagnosis?



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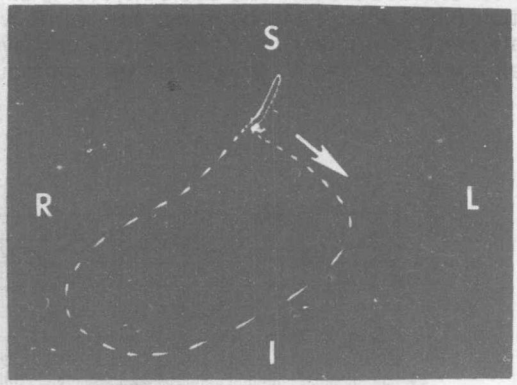

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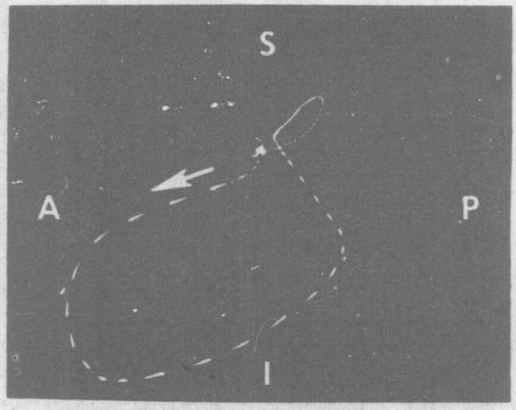

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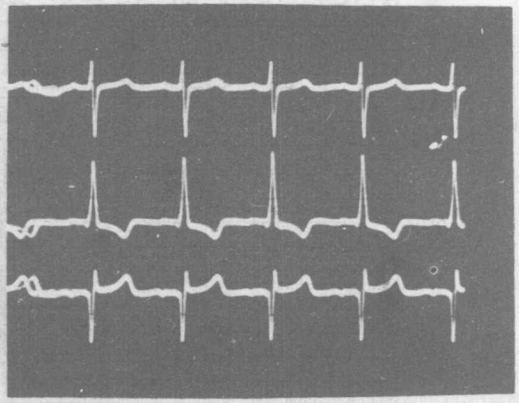


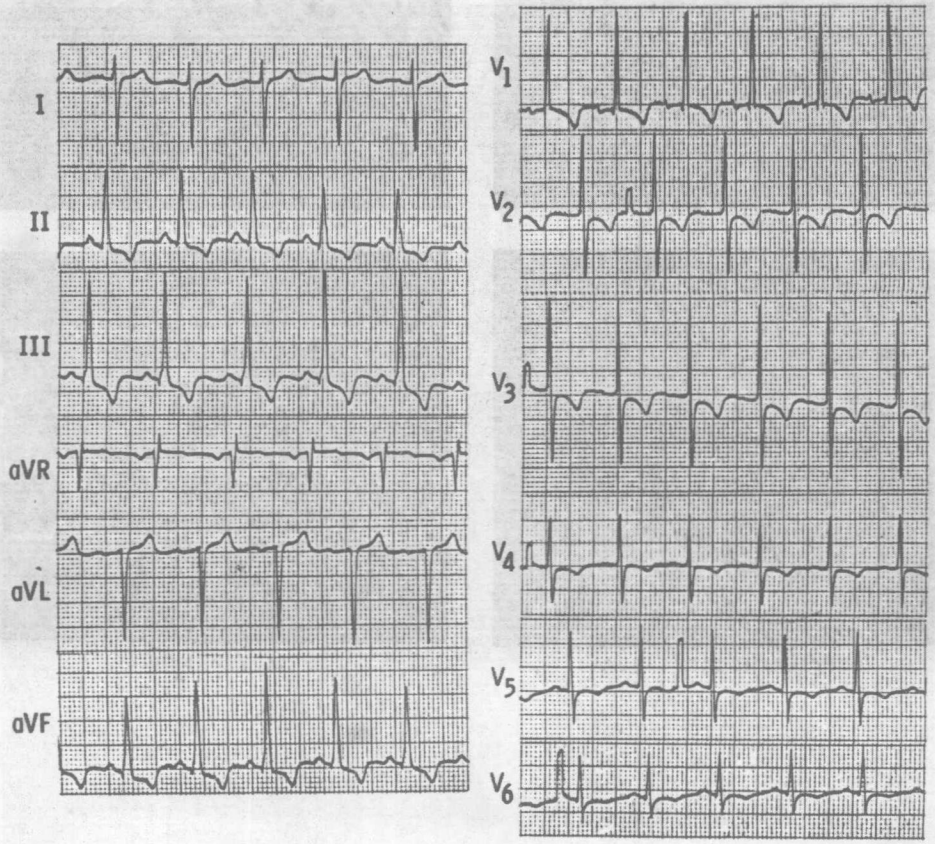
X,Y,Z LEADS

CASE 3: DIAGNOSIS

VECTORCARDIOGRAM: The initial QRS sÊ vector is directed slightly anteriorly, superiorly and to the left. There is markedly increased force anteriorly and to the right. The inscription is clockwise which is reversed in a horizontal plane?

There is a slight S-T vector directed superiorly and to the right. The T sÊ loop is 180° discordant to the QRS sÊ loop in all three planes. The VCG finding is a typical example of right ventricular hypertrophy and this type of the VCG finding is most commonly found in pulmonic stenosis. The VCG tracing is half-standardized.

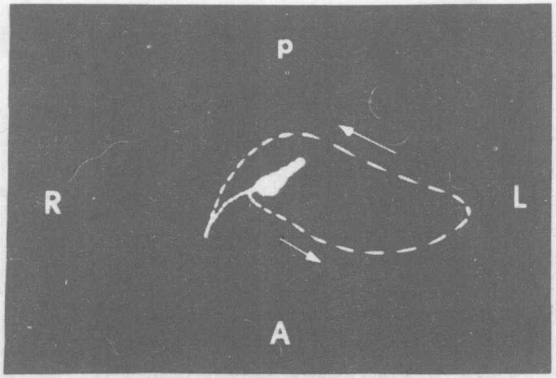
ELECTROCARDIOGRAM: The basic rhythm is sinus with a rate of 100 beats/min. Marked right axis deviation (QRS axis: +110 degrees) and tall R waves in leads V_{1-3} with secondary T wave change indicate right ventricular hypertrophy (systolic overloading pattern). It is not uncommon to observe a small q wave in lead V_1 in severe right ventricular hypertrophy. Leads V_{1-4} are half-standardized.



CASE 4

The vectorcardiogram, X, Y, Z leads and electrocardiogram were obtained from a 68-year-old female.

What is the VCG and ECG diagnosis?



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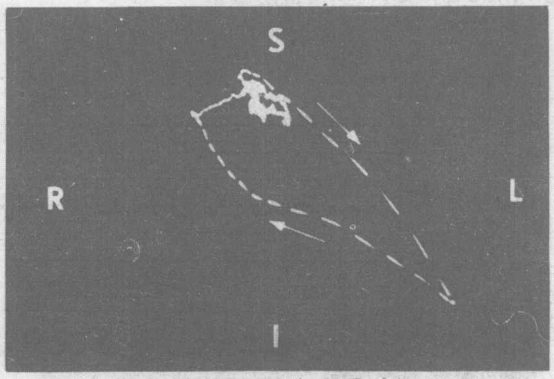

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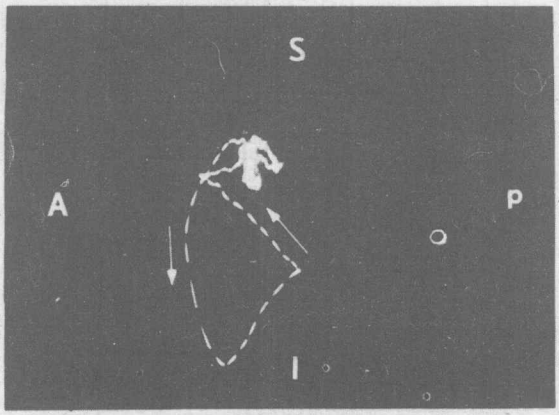

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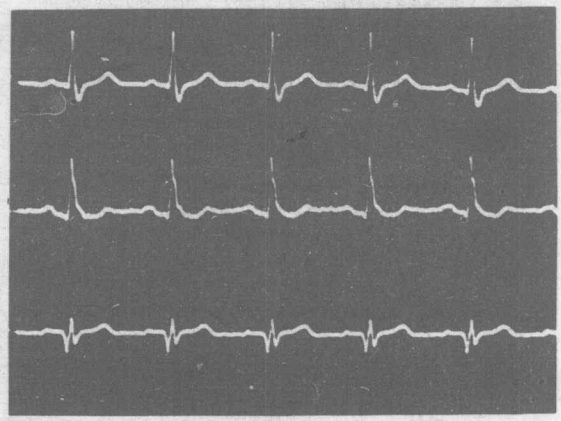
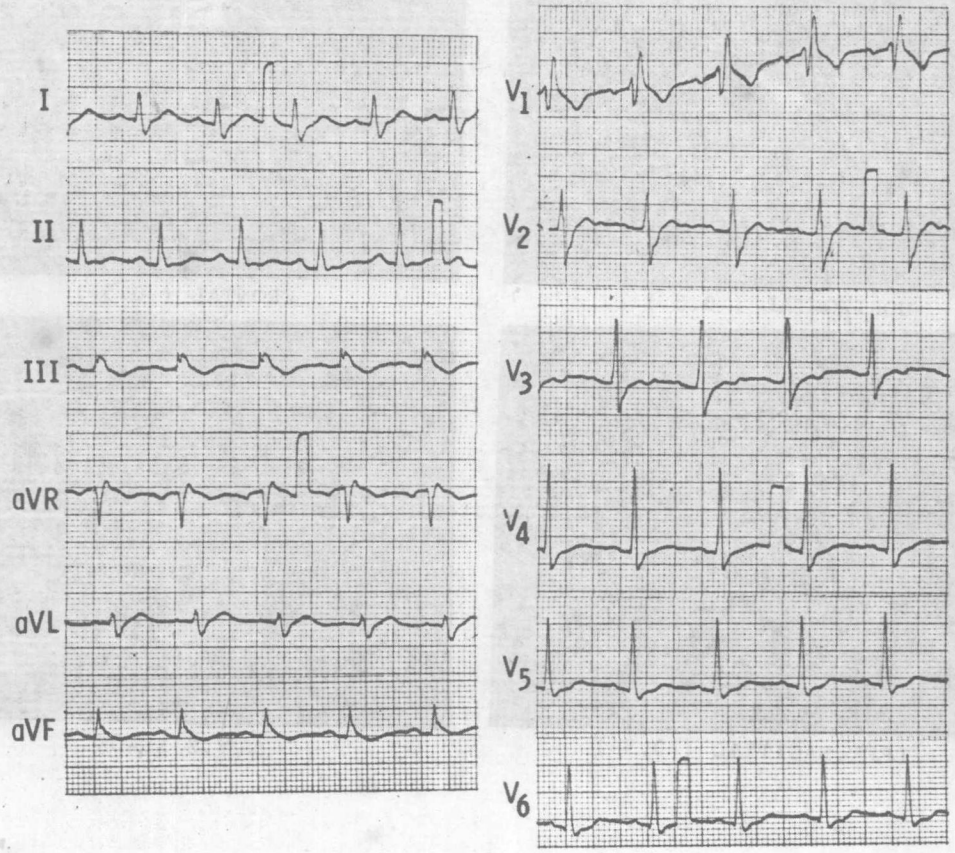


X,Y,Z LEADS

CASE 4: DIAGNOSIS

VECTORCARDIOGRAM: The initial QRS sÊ vector is directed anteriorly, superiorly and to the right. The inscription is normal in all three planes. There is an increased terminal force anteriorly and to the right associated with conduction delay of moderate degree. The VCG finding demonstrates a typical example of right bundle branch block. The T sÊ loop is directed posteriorly, inferiorly and to the left.

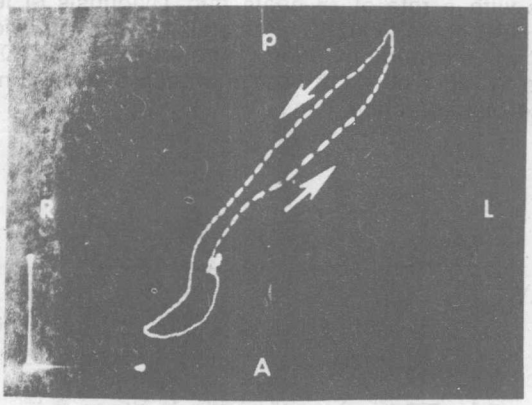
ELECTROCARDIOGRAM: The basic rhythm is sinus with a rate of 96 beats/min. Right bundle branch block is obvious because of wide QRS complex (QRS interval: 0.12 sec) and RR′ pattern in lead V_1 with wide and slurred S waves in leads V_{4-6}.



CASE 5

The vectorcardiogram, X, Y, Z leads and electrocardiogram were obtained from a 73-year-old male with hypertensive heart disease.

What is the VCG and ECG diagnosis?



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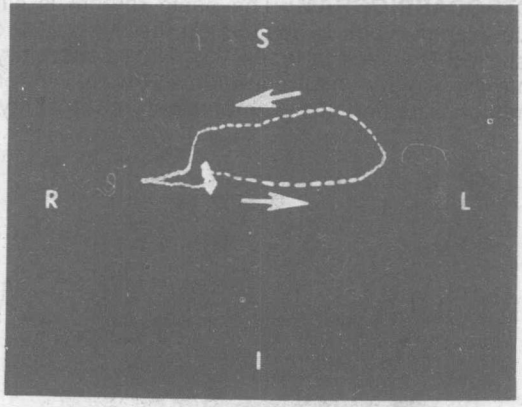

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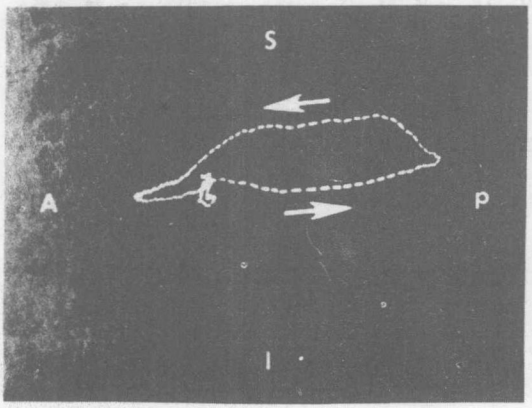

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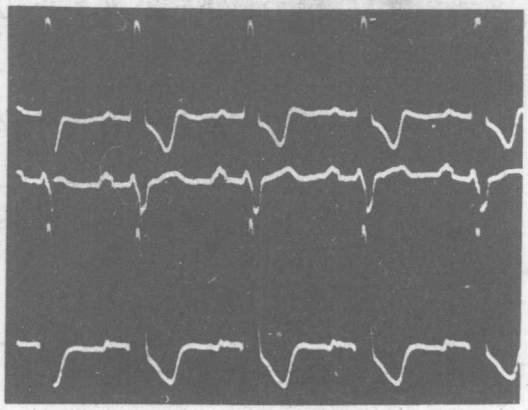


X,Y,Z LEADS

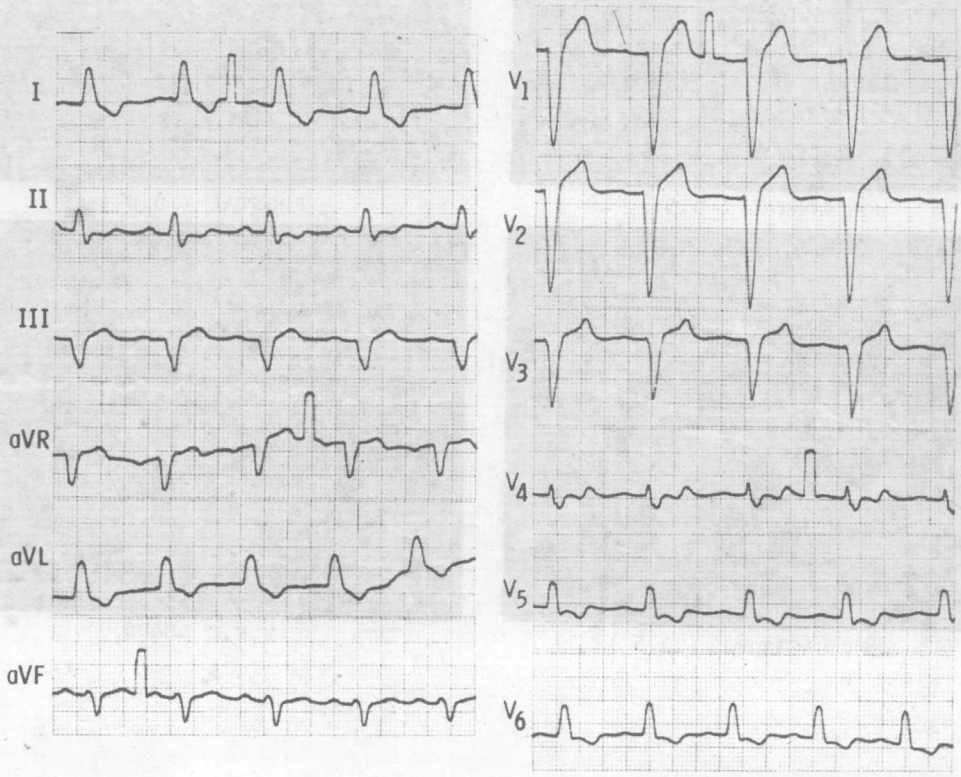
CASE 5: DIAGNOSIS

VECTORCARDIOGRAM: The initial QRS sÊ vector is directed posteriorly, inferiorly and to the left. The loop is displaced far posteriorly and to the left. There is a significant conduction delay involving a midportion as well as an afferent limb of the QRS sÊ loop.

There is marked S-T vector directed anteriorly, superiorly and to the right. The T sÊ loop is 180° discordant to the QRS sÊ loop.

The VCG finding is a typical example of left bundle branch block. It should be noted that the initial septal force may be directed either anteriorly or posteriorly and to the left in a pure left bundle branch block.

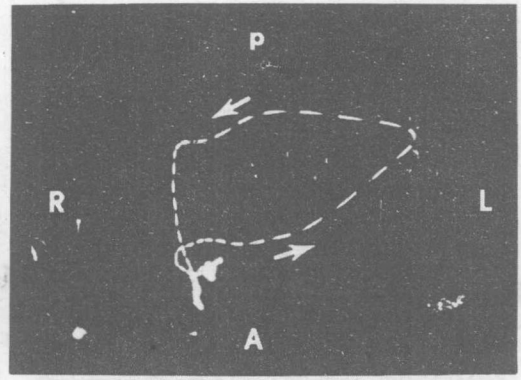
ELECTROCARDIOGRAM: The basic rhythm is sinus with a rate of 78 beats/min. Diagnosis of left bundle branch block is obvious on the basis of wide QRS complex (QRS interval: 0.14 sec) with wide and slurred R waves in leads V_{5-6}. Note secondary T wave change in leads I, aVL and V_{4-6}. The Q-S complexes or very small embryonic R waves in leads V_{1-3} in a pure left bundle branch block are not uncommon. The finding resembles anteroseptal myocardial infarction.



CASE 6

The vectorcardiogram, X, Y, *Z* leads and electrocardiogram were obtained from a 77-year-old male with coronary heart disease.

What is the VCG and ECG diagnosis?



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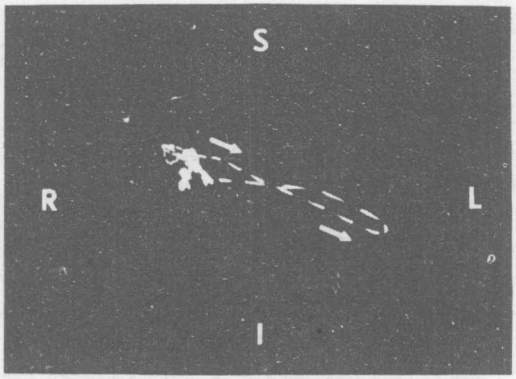

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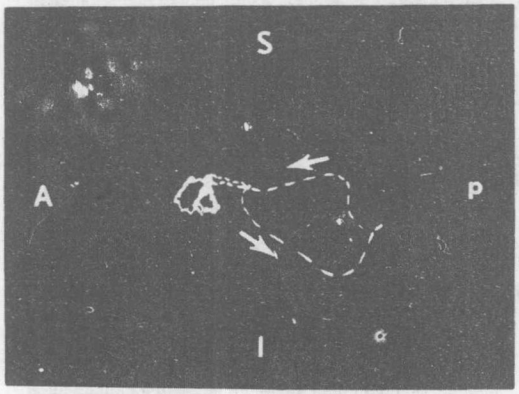

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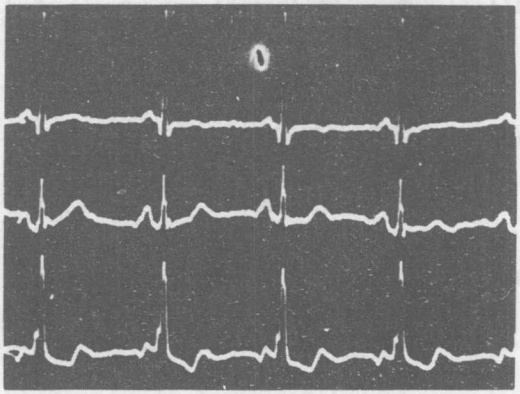

X,Y,Z LEADS