



# 临床实用心电图

## 实例分析与解读 (中英对照)

Frank G. Yanowitz 著

王绍军 刘 巍 编译

周玉杰 审校

THE MASTERY  
OF ECG INTERPRETATION



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# INTRODUCTION TO ECG INTERPRETATION

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IHC( Intermountain Healthcare)是美国犹他州一个非盈利性质的、大型的、由多家医院、医生以及保险程序组成的健康机构。

LDS Hospital( Latter-Day-Saints Hospital)是 IHC 之中的一家医院。

# 前言

这本书是献给 Alan E. Lindsay 博士 (1923—1987), 一位心电图专家、老师、朋友、导师和同事。本书中许多精彩的心电图分析、诊断策略和精华均来自于 Alan E. Lindsay 博士个人毕生收藏的心电图宝库。多年来, 这些心电图一直用于训练医学生、护士、住院医师、心脏病研究员和在犹他州盐湖城工作的医生们。当然, 这些心电图也被经常用于许多国家和地区的各类医学会议, 非常实用和简洁易懂, 深受欢迎。

很荣幸这本书能够翻译成中文并出版以纪念和缅怀 Alan E. Lindsay 博士的教学和他那伟大的爱。

读过或学过心电图的医生会经常发现, 有些心电图的诊断标准和心电图术语, 许多书本上的描述并不一致, 老师教得也不完全一样。比如心室肥大的诊断标准, 宽、窄 QRS 心动过速的鉴别等, 各家说法不一。本书的目的就是希望统一心电图的诊断标准, 规范心电图的术语。尽管最近的心电图学已经包含了一部分新的诊断概念, 但还是需要在世界范围内对其进行广泛地交流和比较。重要的是, 我们需要认识和真正掌握心电图诊断技能。要充分利用这个临床医学最有用的工具之一, 只能靠获得大量的阅读心电图的经验后, 将具有相关的病理特征的心电图与临床病人的实际情况相结合, 才能作出准确的判断。这就是 Alan E. Lindsay 教授的精髓所在。

这本书列出了步进式心电图的判读方法(见第二节)。初学者应该按顺序学习。其他人可以选择任何他们感兴趣的章节。希望所有的读者最后都能留下一些热爱和喜欢心电图的体会, 与我和 Alan E. Lindsay 教授共同分享。

本书仅供您参考。所有的材料都是如上所述所提供, 关于资料的精度和操作性不能作任何保证。您阅读本书请接受所有使用本文的风险, 并信赖本文包含的内容。



Alan E. Lindsay 博士  
一位颇具风度、有影响力的老师

编译者

# PREFACE

This booklet is dedicated to the memory of Alan E. Lindsay, MD (1923—1987) master teacher of electrocardiography, friend, mentor, and colleague. Many of the excellent ECG tracings illustrated in this learning program are from Dr. Lindsay's personal collection of ECG treasures. For many years these ECG's have been used in the training of medical students, nurses, house staff physicians, cardiology fellows, and practicing physicians in Salt Lake City, Utah as well as at many regional and national medical meetings.



Dr. Alan Lindsay:

A Teacher of Substance and Style

It is an honor to be able to provide this booklet as well as an interactive ECG website on the Internet in recognition of Dr. Lindsay's great love for teaching and for electrocardiography: <http://library.med.utah.edu/kw/ecg>. This document and the ECG website offer an introduction to clinical electrocardiography.

ECG terminology and diagnostic criteria often vary from book to book and from one teacher to another. In this document an attempt has been made to conform to standardized terminology and criteria, although new diagnostic concepts derived from the recent ECG literature have been included in some of the sections. Finally, it is important to recognize that the mastery of ECG interpretation, one of the most useful clinical tools in medicine, can only occur if one acquires considerable experience in reading ECG's and correlating the specific ECG findings with the pathophysiology and clinical status of the patient.

The sections in this booklet are organized in the same order as the recommended step-wise approach to ECG interpretation outlined in Section 2. Beginning students should first go through the sections in the order in which they are presented. Others may choose to explore topics of interest in any order they wish. It is hoped that all students will be left with some of the love of electrocardiography shared by Dr. Lindsay.

The materials presented in the "Introduction to ECG Interpretation" booklet are for your information only. All of the materials are provided "AS IS" and without any warranty, express, implied or otherwise, regarding the materials' accuracy or performance. You accept all risk of use of, and reliance on, the materials contained in the booklet.

## 心电图基本能力

### ECG 描记正常

- 正常 ECG

### 技术问题

- 导联错误
- 干扰

### 窦性心律/窦性心律失常

- 窦性心律
- 窦性心动过速
- 窦性心动过缓
- 窦性心律失常
- 窦性停搏
- 窦房阻滞, I 型
- 窦房阻滞, II 型

### 其他室上性心律失常

- 房性期前收缩(未下传)
- 房性期前收缩(正常传导)
- 房性期前收缩(伴差异传导)
- 异位房性心律或房速(单点)
- 多点房性心律或房速
- 心房纤颤
- 心房扑动
- 交界性期前收缩
- 交界性逸搏及交界性逸搏心律
- 加速性交界性逸搏心律
- 交界性心动过速
- 阵发性室上性心动过速

### 室性心律失常

- 室性期前收缩
- 室性逸搏及室性逸搏心律

- 室性心动过速(单型)
- 室性心动过速(多型或尖端扭转型室速)
- 心室颤动

### 房室传导

- 1 度房室传导阻滞
- 2 度 I 型房室传导阻滞(文氏型)
- 2 度 II 型房室传导阻滞(莫氏型)
- 高度房室传导阻滞
- 3 度房室传导阻滞(伴交界性逸搏心律)
- 3 度房室传导阻滞(伴室性逸搏心律)
- 房室分离(逸搏)
- 房室分离(夺获)
- 房室分离(房室传导阻滞伴逸搏)

### 室内传导

- 完全性左束支传导阻滞(持续或一过性)
- 不完全性左束支传导阻滞
- 完全性右束支传导阻滞(持续或一过性)
- 不完全性右束支传导阻滞
- 左前分支阻滞(LAFB)
- 左后分支阻滞(LPFB)
- 非特异性室内传导延缓(IVCD)
- 预激综合征(WPW)

### QRS 电轴与电压

- 电轴右偏( $+90^{\circ}$ 至 $+180^{\circ}$ )
- 电轴左偏( $-30^{\circ}$ 至 $-90^{\circ}$ )
- 奇异电轴( $-90^{\circ}$ 至 $-180^{\circ}$ )
- 不确定的电轴
- 肢体导联低电压( $<0.5 \text{ mV}$ )

- 胸导联低电压( $<1.0\text{ mV}$ )

#### 肥厚/增大

- 左房增大
- 右房增大
- 双房增大
- 左室肥大
- 右室肥大
- 双室肥大

#### ST-T 异常, U 波异常

- 早期复极(正常变异)
- 非特异性 ST-T 异常
- ST 段抬高(透壁性损伤)
- ST 段抬高(心包炎)
- 对称性 T 波倒置
- 超急性 T 波
- 显著直立的 U 波
- U 波倒置
- Q-T 间期延长

#### 心肌梗死(急性, 近期, 陈旧)

- 前壁梗死
- 下后壁梗死

- 后壁梗死
- 前间壁梗死
- 前壁梗死
- 前侧壁梗死
- 广泛前壁梗死
- 高侧壁梗死
- 非 Q 波梗死
- 右室梗死

#### 临床问题

- 慢性阻塞性肺疾病
- 低血钾
- 高血钾
- 低钙血症
- 高钙血症
- 地高辛作用
- 地高辛中毒
- 中枢神经系统病变

#### 起搏 ECG

- 心房起搏心律
- 心室起搏心律
- 房室顺序起搏心律



## Basic Competency in Electrocardiography

### NORMAL TRACING

- Normal ECG

### TECHNICAL PROBLEM

- Lead misplaced
- Artifact

### SINUS RHYTHMS/ARRHYTHMIAS

- Sinus rhythm
- Sinus tachycardia
- Sinus bradycardia
- Sinus Arrhythmia
- Sinus arrest or pause
- Sinoatrial block, type I
- Sinoatrial block, type II

### OTHER SV ARRHYTHMIAS

- PAC's (nonconducted)
- PAC's (conducted normally)
- PAC's (conducted with aberration)
- Ectopic atrial rhythm or tachycardia (unifocal)
- Multifocal atrial rhythm or tachycardia
- Atrial fibrillation
- Atrial flutter
- Junctional prematures
- Junctional escapes or rhythms
- Accelerated Junctional rhythms
- Junctional tachycardia
- Paroxysmal supraventricular tachycardia

### VENTRICULAR ARRHYTHMIAS

- PVC's

- Ventricular escapes or rhythm
- Accelerated ventricular rhythm
- Ventricular tachycardia (uniform)
- Ventricular tachycardia (polymorphous or torsades)
- Ventricular fibrillation

### AV CONDUCTION

- 1<sup>st</sup> degree AV block
- Type I 2<sup>nd</sup> degree AV block (Wenckebach)
- Type II 2<sup>nd</sup> degree AV block (Mobitz)
- AV block, advanced (high grade)
- 3<sup>rd</sup> degree AV block (junctional escape rhythm)
- 3<sup>rd</sup> degree AV block (ventricular escape rhythm)
- AV dissociation (default)
- AV dissociation (usurpation)
- AV dissociation (AV block)

### INTRAVENTRICULAR CONDUCTION

- Complete LBBB, fixed or intermittent
- Incomplete LBBB
- Complete RBBB, fixed or intermittent
- Incomplete RBBB
- Left anterior fascicular block (LAFB)
- Left posterior fascicular block (LPFB)
- Nonspecific IV conduction delay (IVCD)
- WPW preexcitation pattern

### QRS AXIS AND VOLTAGE

- Right axis deviation ( +90° to +180° )
- Left axis deviation ( -30° to -90° )

- Bizarre axis (  $-90^{\circ}$  to  $-180^{\circ}$  )
- Indeterminate axis
- Low voltage frontal plane (  $<0.5$  mV )
- Low voltage precordial (  $<1.0$  mV )

### HYPERTROPHY/ENLARGEMENTS

- Left atrial enlargement
- Right atrial enlargement
- Biatrial enlargement
- Left ventricular hypertrophy
- Right ventricular hypertrophy
- Biventricular hypertrophy

### ST - T, AND U ABNORMALITIES

- Early repolarization ( normal variant )
- Nonspecific ST - T abnormalities
- ST elevation ( transmural injury )
- ST elevation ( pericarditis pattern )
- Symmetrical T wave inversion
- Hyperacute T waves
- Prominent upright U waves
- U wave inversion
- Prolonged QT interval

### MI PATTERNS ( acute, recent, old )

- Inferior MI
- Inferoposterior MI

- Inferoposterolateral MI
- Posterior MI
- Anteroseptal MI
- Anterior MI
- Anterolateral MI
- Extensive anterior MI
- High lateral MI
- Non Q-wave MI
- Right ventricular MI

### CLINICAL DISORDERS

- Chronic pulmonary disease pattern
- Suggests hypokalemia
- Suggests hyperkalemia
- Suggests hypocalcemia
- Suggests hypercalcemia
- Suggests digoxin effect
- Suggests digoxin toxicity
- Suggests CNS disease

### PACEMAKER ECG

- Atrial-paced rhythm
- Ventricular paced rhythm
- AV sequential paced rhythm
- Failure to capture ( atrial or ventricular )
- Failure to inhibit ( atrial or ventricular )
- Failure to pace ( atrial or ventricular )

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## Basic Competency in Electrocardiography

(Modified from: ACC/AHA Clinical Competence Statement, JACC 2001; 38: 2091)

In 2001 a joint committee of the American College of Cardiology and the American Heart Association published a list of ECG diagnoses considered to be important for developing basic competency in ECG interpretation. This list is illustrated on the following page and is also illustrated on the website with links to examples or illustrations of the specific ECG diagnosis. Students of electrocardiography are encouraged to study this list and become familiar with the ECG recognition of these diagnoses. Most of the diagnoses are illustrated in this document.

## 解读心电图的基本能力

(修改自: ACC/AHA 临床能力解读, JACC 2001; 38: 2091)

2001 年, 美国心脏病学会(ACC)和美国心脏病协会(AHA)联合发表了一系列有关心电图诊断和临床能力评估的内容, 认为心电图诊断能力是临床医生必须提高的基本技能, 也鼓励医学生学习这些内容, 并掌握心电图的诊断。这些内容本书在后面的章节中将详细陈述。

# 1 THE STANDARD 12 LEAD ECG

The standard 12-lead electrocardiogram is a representation of the heart's electrical activity recorded from electrodes on the body surface. This section describes the basic components of the ECG and the standard lead system used to record the ECG tracings.

The diagram illustrates ECG waves and intervals as well as standard time and voltage measures on the ECG paper.

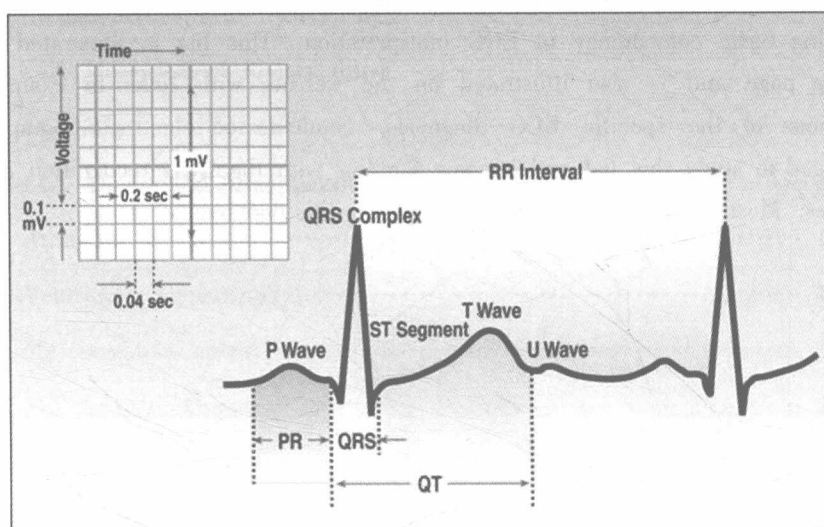


Fig. 1 - 1

## 1.1 ECG WAVES AND INTERVALS—What do they mean?

- (1) P wave: sequential depolarization of the right and left atria
- (2) QRS complex: right and left ventricular depolarization
- (3) ST - T wave: ventricular repolarization
- (4) U wave: an electrical-mechanical event at beginning of diastole
- (5) PR interval: time interval from onset of atrial depolarization(P wave) to onset of ventricular muscle depolarization (QRS complex)
- (6) QRS duration: duration of ventricular muscle depolarization(width of the QRS complex)
- (7) QT interval: duration of ventricular depolarization and repolarization
- (8) PP interval: rate of atrial or sinus cycle
- (9) RR interval: rate of ventricular cycle

# 1 标准 12 导联心电图

标准 12 导联心电图是 10 个电极在体表采集到的心脏电活动的记录。本章主要描述心电图的基本组成和 12 导联体系。

图 1-1 显示了心电图各波波形、各波间期以及测量心电图的标准电压和走纸时间。

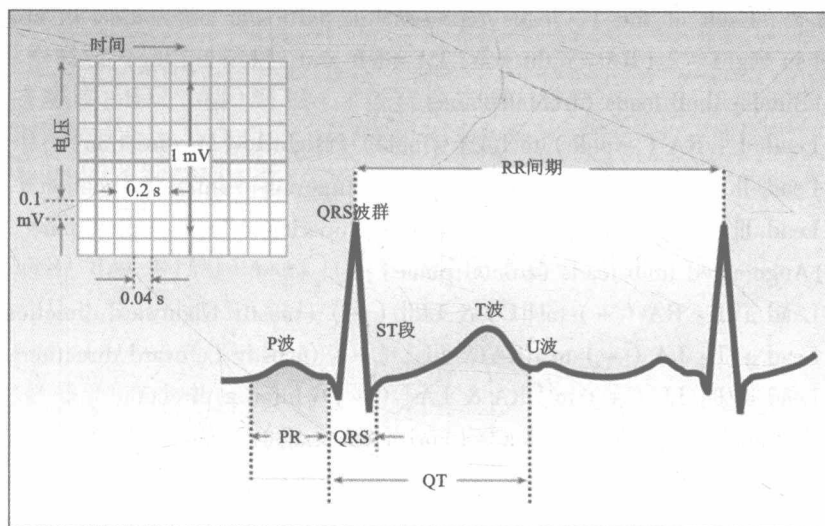


图 1-1

## 1.1 心电图中的各个波和间期代表什么？

- (1) P wave(P 波): 从右心房向左心房除极。
- (2) QRS complex(QRS 波): 右心室和左心室除极。
- (3) ST - T wave(ST 段和 T 波): 心室复极。
- (4) U wave(U 波): 舒张早期的电 - 机械事件。
- (5) PR interval(PR 间期): 从心房开始除极(P 波起始部)到心室肌开始除极(QRS 波起始部)的时间。
- (6) QRS duration(QRS 间期): 心室肌除极时间。
- (7) QT interval(QT 间期): 从心室开始除极到心室复极结束的时间。
- (8) PP interval(PP 间期): 窦性周期, 2 个 P 波之间的时间。
- (9) RR interval(RR 间期): 室性周期, 2 个 R 波之间的时间。

## 1.2 ORIENTATION OF THE 12-LEAD ECG

**1.2.1** It is important to remember that the 12-lead ECG provides spatial information about the heart's electrical activity in 3 approximately orthogonal directions (think: X, Y, Z):

- (1) Right – Left (X)
- (2) Superior – Inferior (Y)
- (3) Anterior – Posterior (Z)

**1.2.2** Each of the 12 leads represents a particular orientation in space, as indicated in Fig. 1 – 2 (RA = right arm; LA = left arm, LL = left leg):

(1) Bipolar limb leads (frontal plane):

- Lead I: RA ( - pole) to LA ( + pole) (Right-to-Left direction)
- Lead II: RA ( - ) to LL ( + ) (mostly Superior-to-Inferior direction)
- Lead III: LA ( - ) to LL ( + ) (mostly Superior-to-Inferior direction)

(2) Augmented limb leads (frontal plane):

- Lead aVR: RA ( + ) to [ LA & LL ] ( - ) (mostly Rightward direction)
- Lead aVL: LA ( + ) to [ RA & LL ] ( - ) (mostly Leftward direction)
- Lead aVF: LL ( + ) to [ RA & LA ] ( - ) (Inferior direction)

(3) “Unipolar” ( + ) chest leads (horizontal plane):

- Leads V1, V2, V3 (mostly Posterior-to-Anterior direction)
- Leads V4, V5, V6 (mostly Right-to-Left direction)

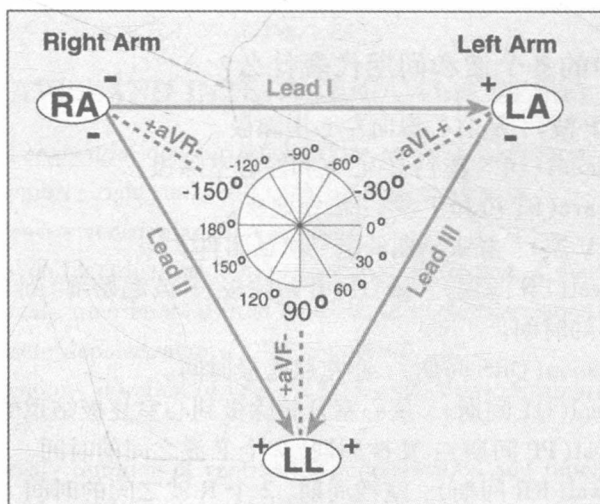


Fig. 1 – 2



## 1.2 12 导联心电图的方向与定位

**1.2.1** 一定要知道 12 导联心电图提供的是一个关于心脏电活动的立体的空间概念, 从 3 个正交的方向去定位(X, Y, Z 轴):

- (1) 右 - 左 (X)
- (2) 上 - 下 (Y)
- (3) 前 - 后 (Z)

**1.2.2** 12 导联中的每一个导联都代表了一个空间的方向, 如图 1-2 所示 (RA = 右上肢; LA = 左上肢, LL = 左下肢)。

(1) 双极肢体导联 (额面):

- I 导联: RA( - 极)到 LA( + 极)(由右向左方向)
- II 导联: RA( - )到 LL( + )(由上向下方向)
- III 导联: LA( - )到 LL( + )(从上到下方向)

(2) 加压肢导联 (额面):

- aVR: RA( + )到 [LA&LL]( - )(向右上方向)
- aVL: LA( + )到 [RA&LL]( - )(向左上方向)
- aVF: LL( + )到 [RA&LA]( - )(向下方向)

(3) 胸导联 (水平面):

- V1, V2, V3(从后向前方向)
- V4, V5, V6(从右向左方向)

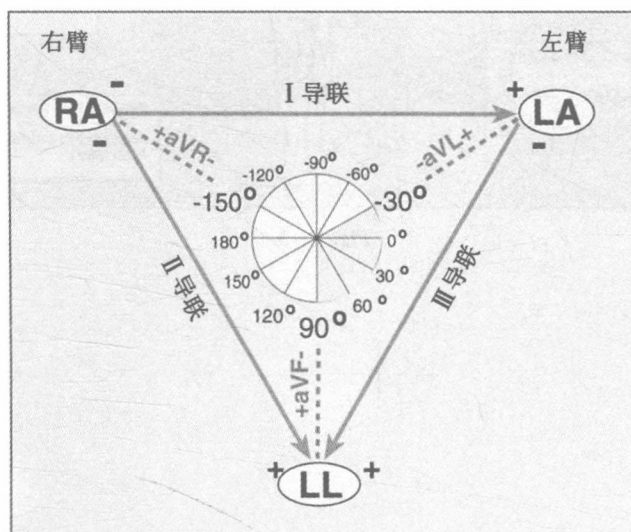


图 1-2