

异常心电图

心肌缺血与心肌梗死

学习目标

- 1.** 识别典型心肌缺血的心电图改变；
 - 2.** 识别心肌损伤的典型心电图改变；
 - 3.** 识别各期心肌梗死的心电图特征；
 - 4.** 判断前壁、下壁心肌梗死的心电图改变。
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二、心肌缺血与心肌梗死

冠状动脉狭窄



缺血：得不到充分的氧合血液供应；



损伤：心室肌血液供应中断；



梗死：心室肌不能恢复血液供应，发生坏死。

（一）心肌缺血

主要见于冠心病发生冠状动脉供血不足时，根据心室壁受累的层次，大致出现两类心电图的改变。在心电图上则出现典型的心肌缺血型ST段、T波改变。

1. T波改变

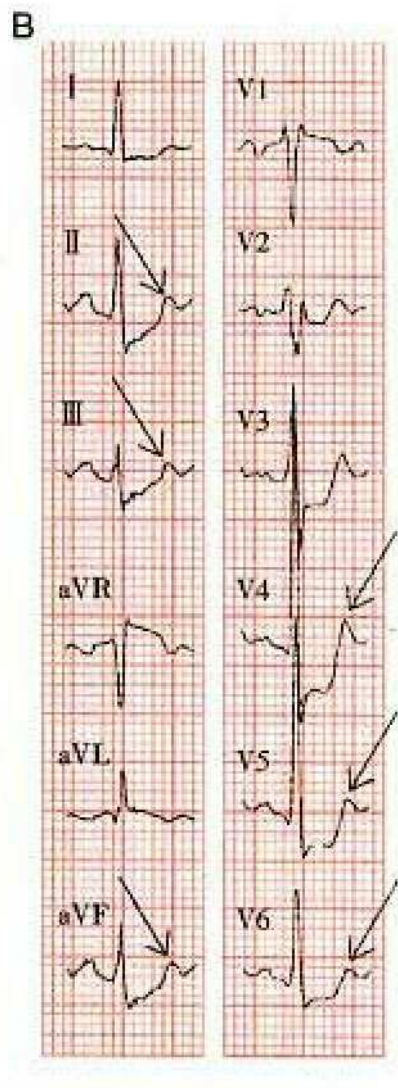
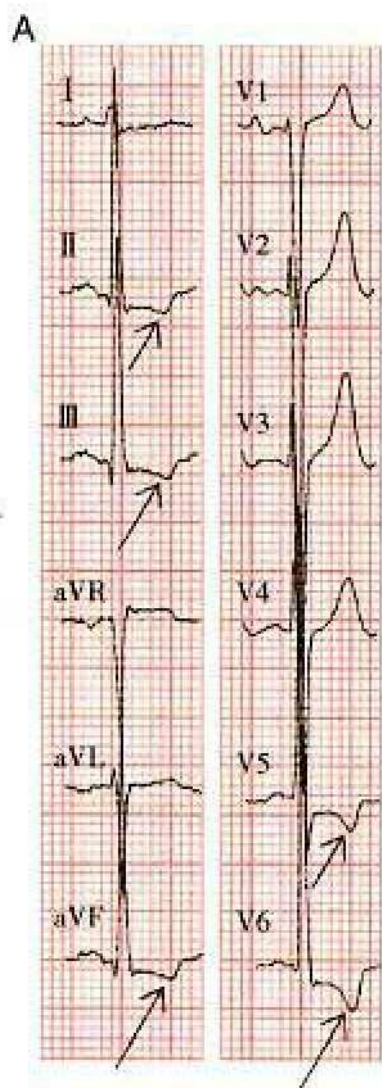
大致出现两种类型的心电图特征。

1) 心内膜下缺血

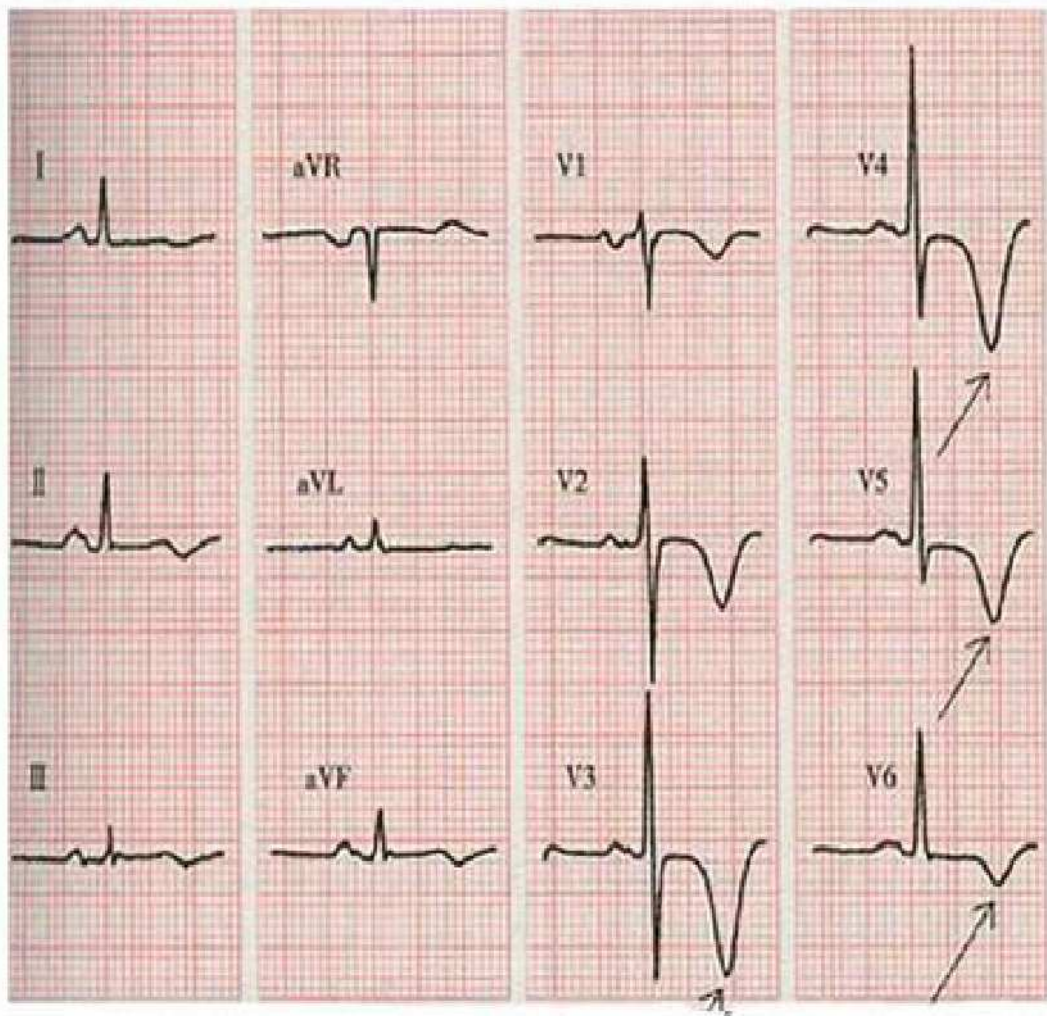
对称性高耸**T**波：与**QRS**主波方向一致。

2) 心外膜下缺血

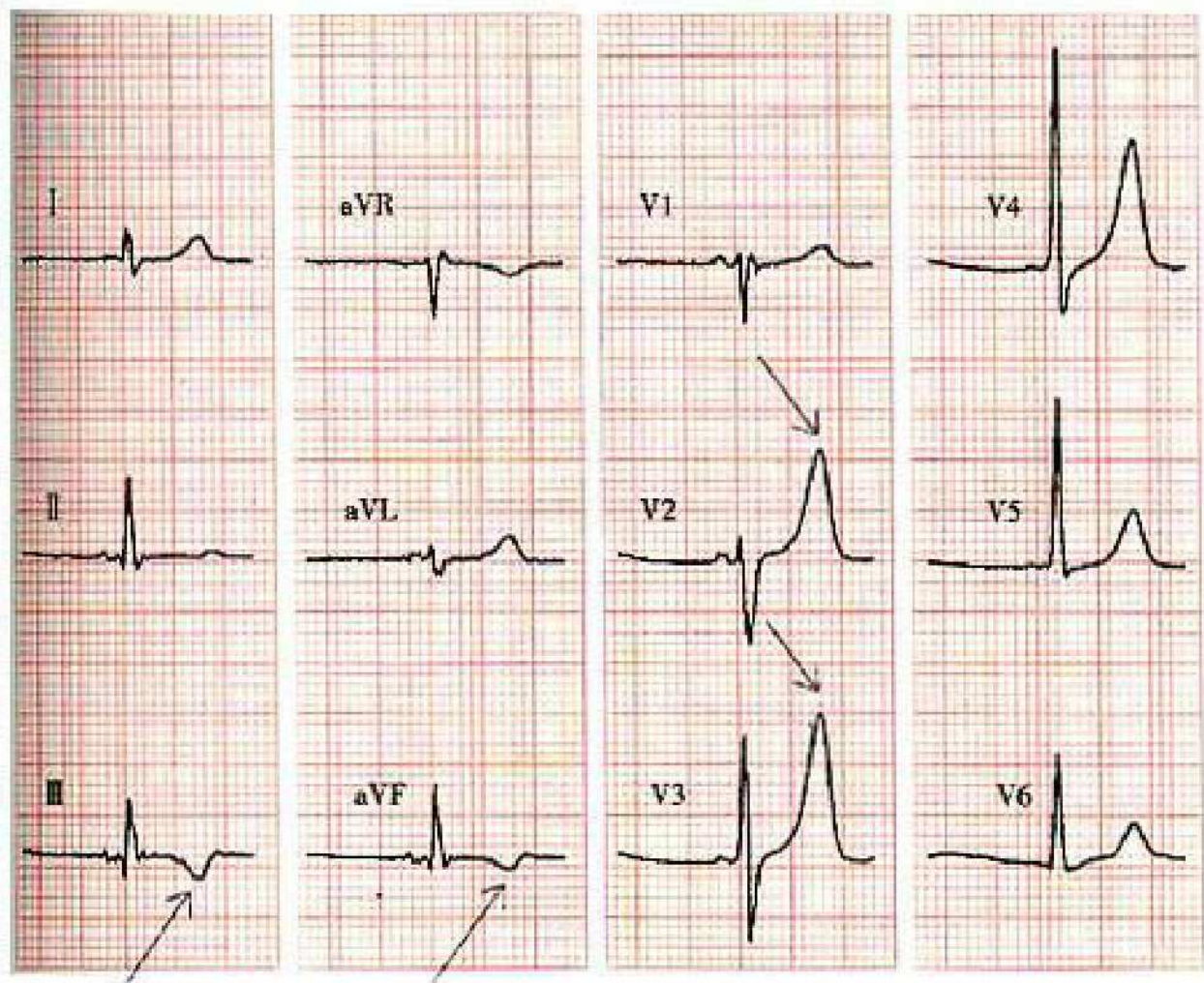
对称性倒置**T**波：与正常方向相反。



qx1 心肌缺血：A 负向 T 波；B 正向 T 波



qx 3 急性心肌缺血发作：箭头示许多导联上与QRS波群主波方向相反的T波



qx 4 心肌缺血：箭头所示为异常方向的 T 波

qx 2

A

B

C



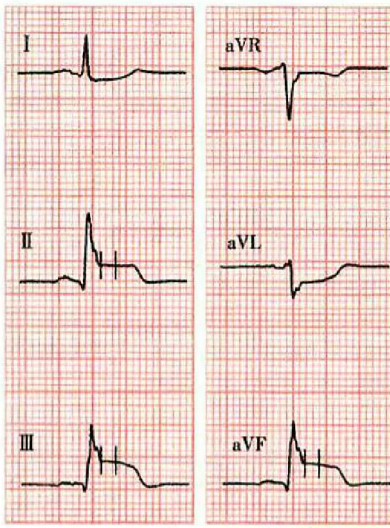
A 静息时正常状态

B 心内膜下缺血

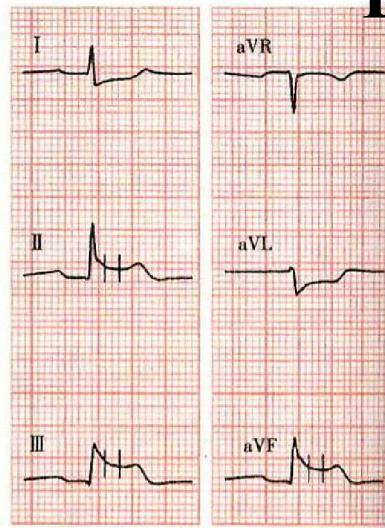
C 心外膜下缺血

2. ST段的改变

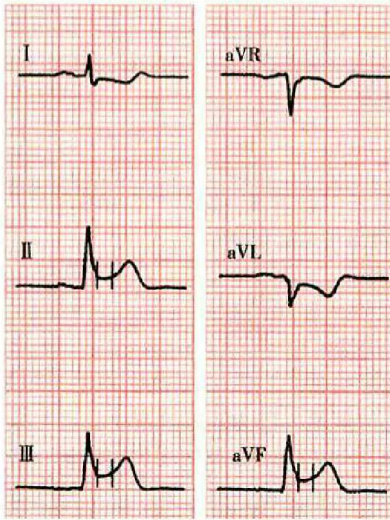
- 相对**T**波而言，**ST**段变化是心肌需求增加所致缺血的可靠指标。
 - **ST**段的偏移可以是水平型、下斜型或上斜型。
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A

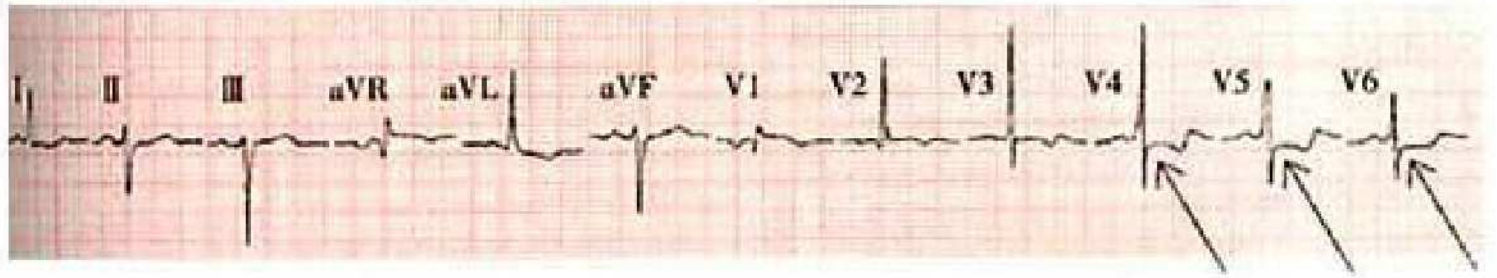
A

B

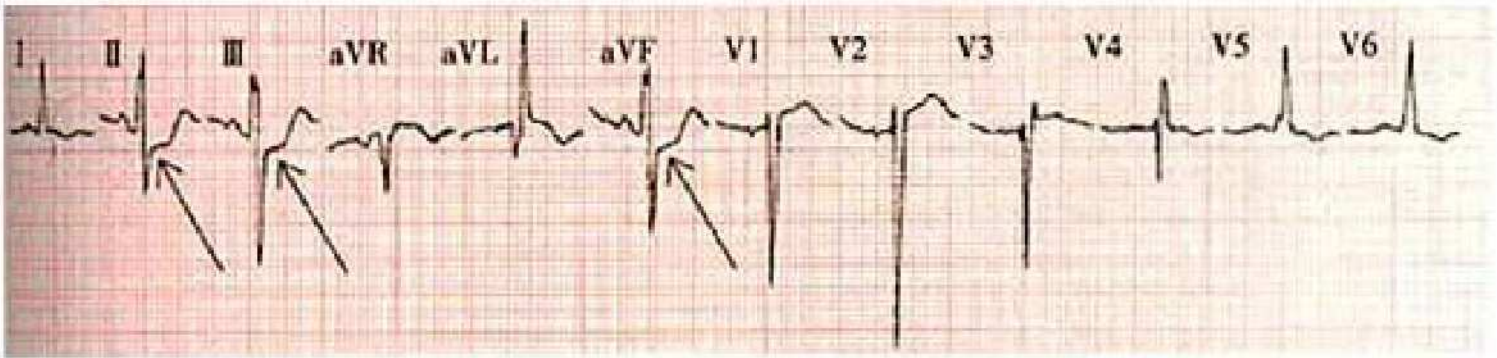
B

**C**
C**A:水平型偏移****B:下斜型偏移****C:下斜型偏移**

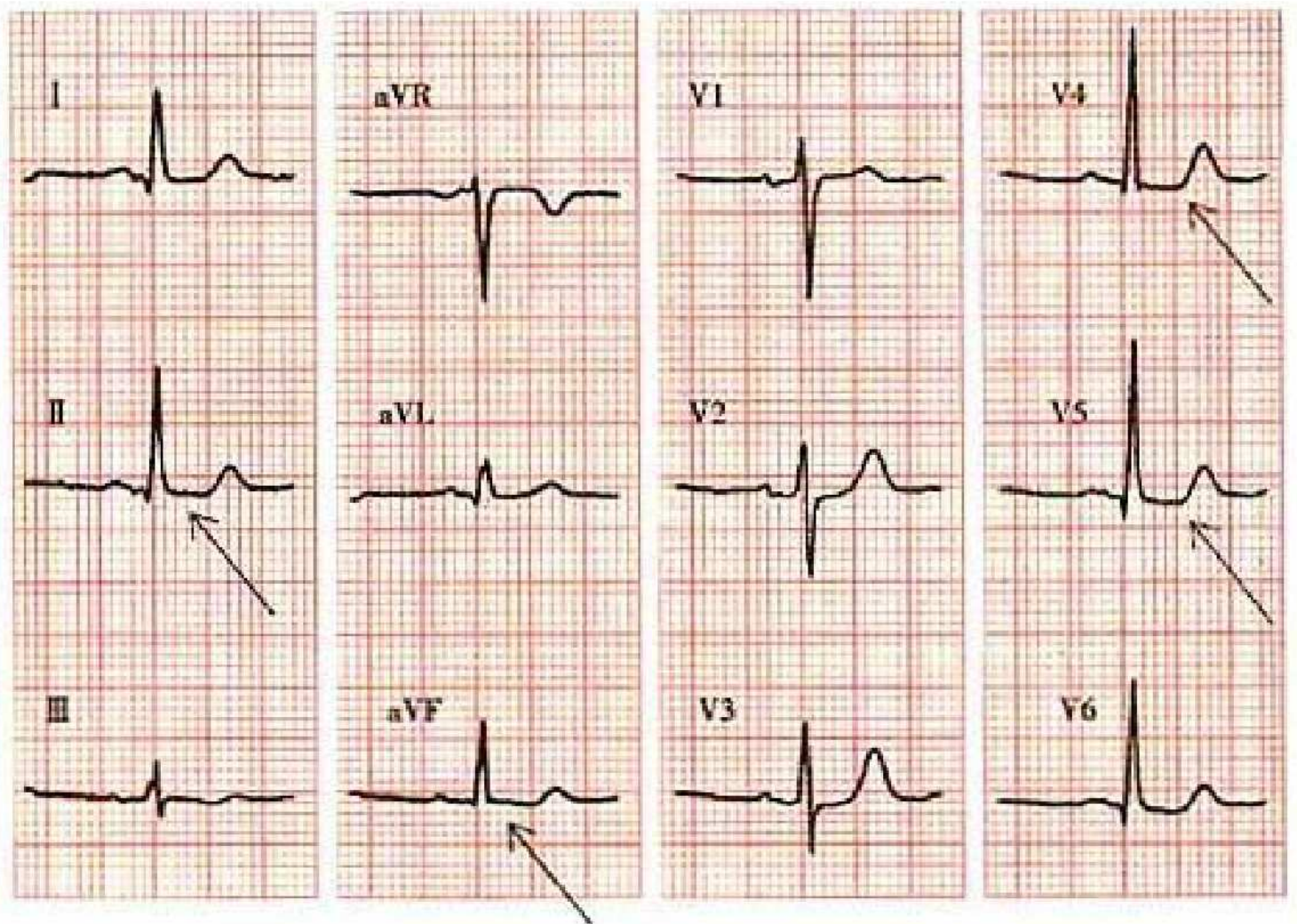
A



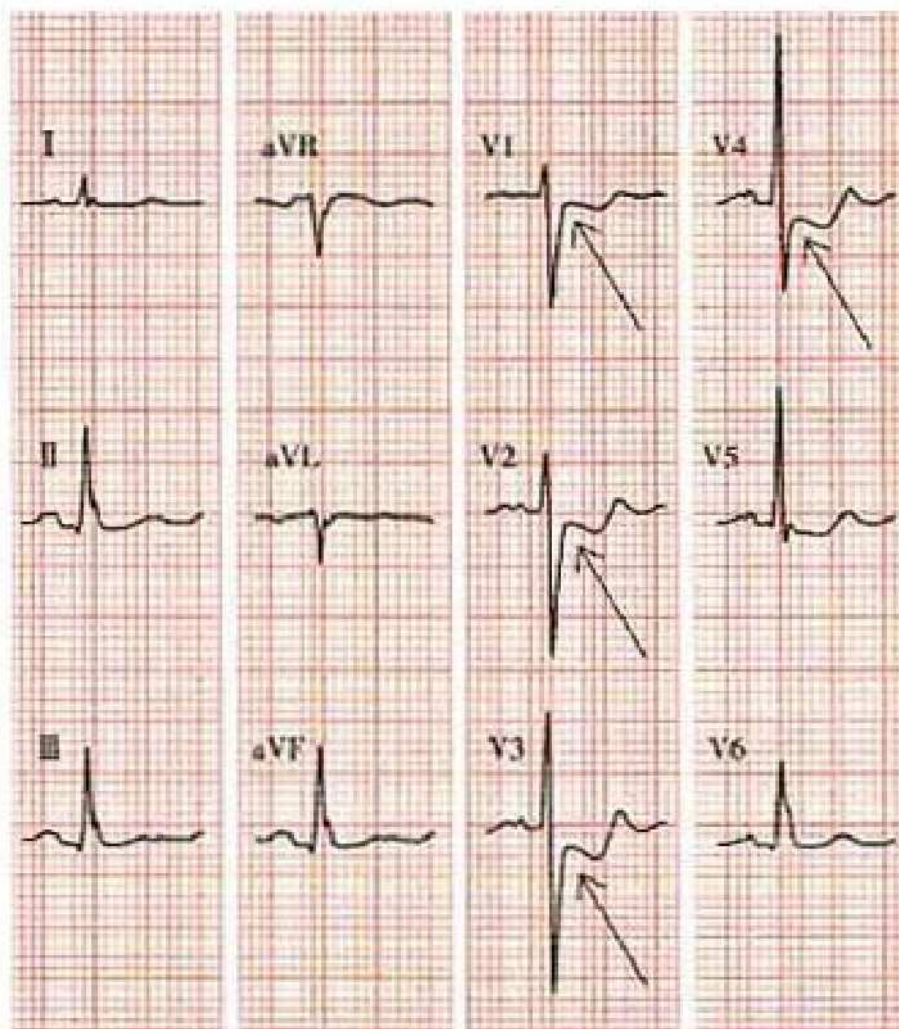
B



qx 6 图 A、B：心肌缺血。箭头所示为压低的 ST 段



qx 7 心肌缺血：箭头所示为许多导联上 ST 段轻度下移

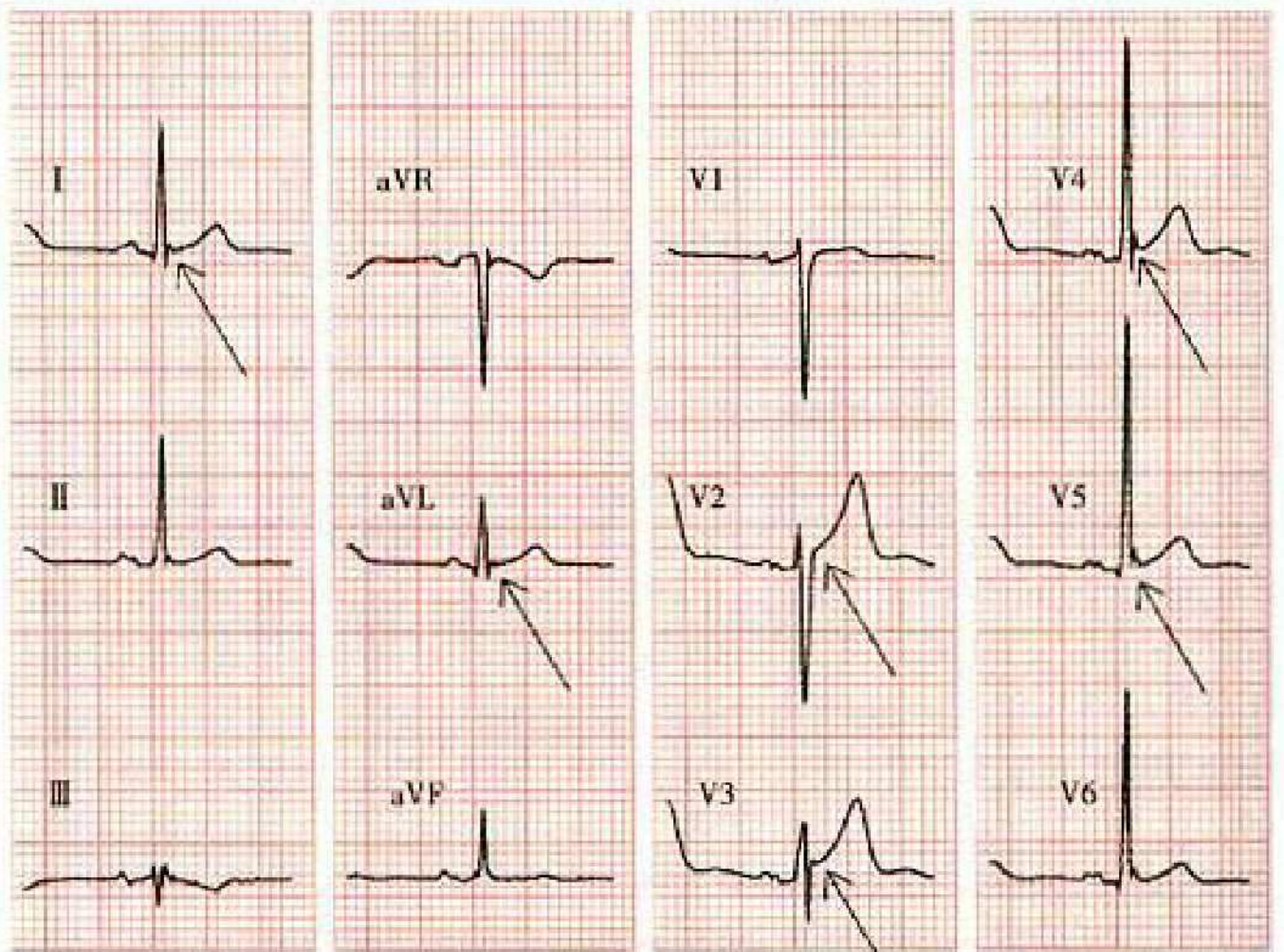


qx 8 心肌缺血、心绞痛发作：V1-V4 导联 ST 段压低

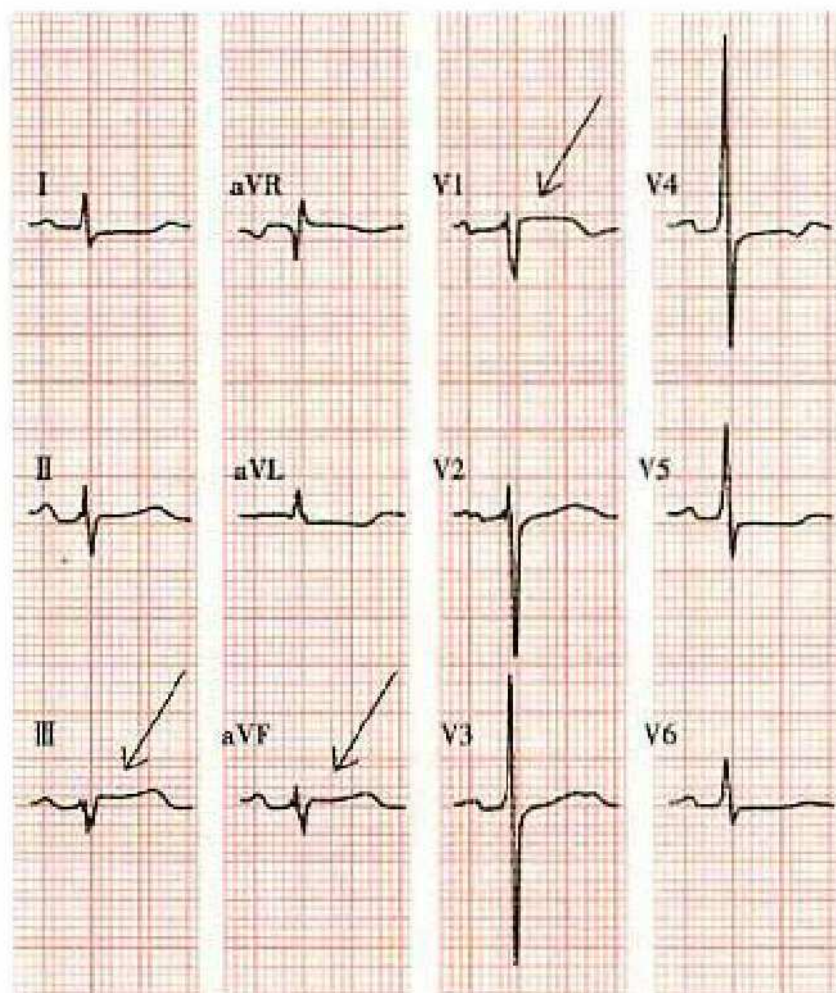
（二）心肌损伤

表现为ST段抬高。

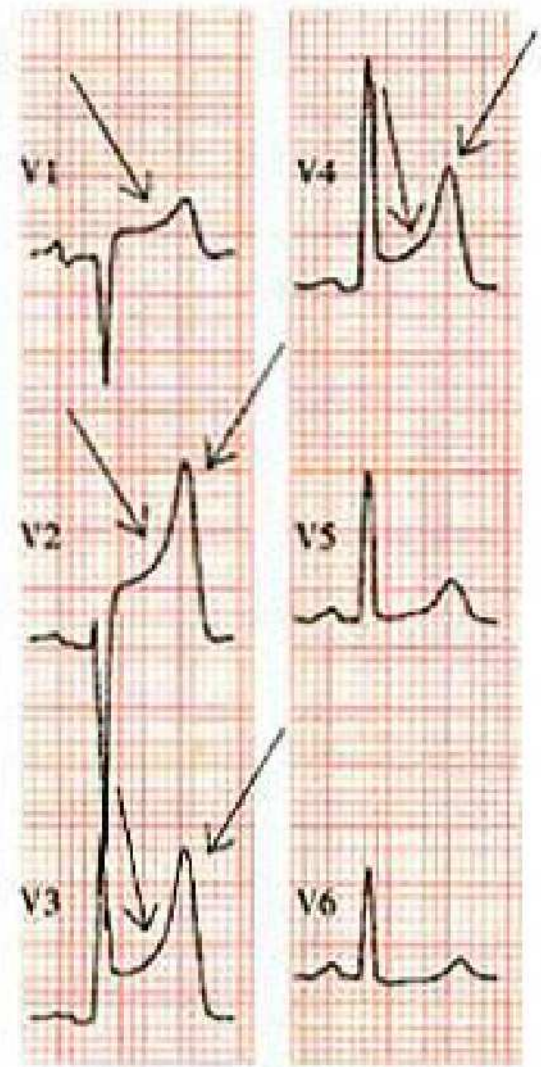
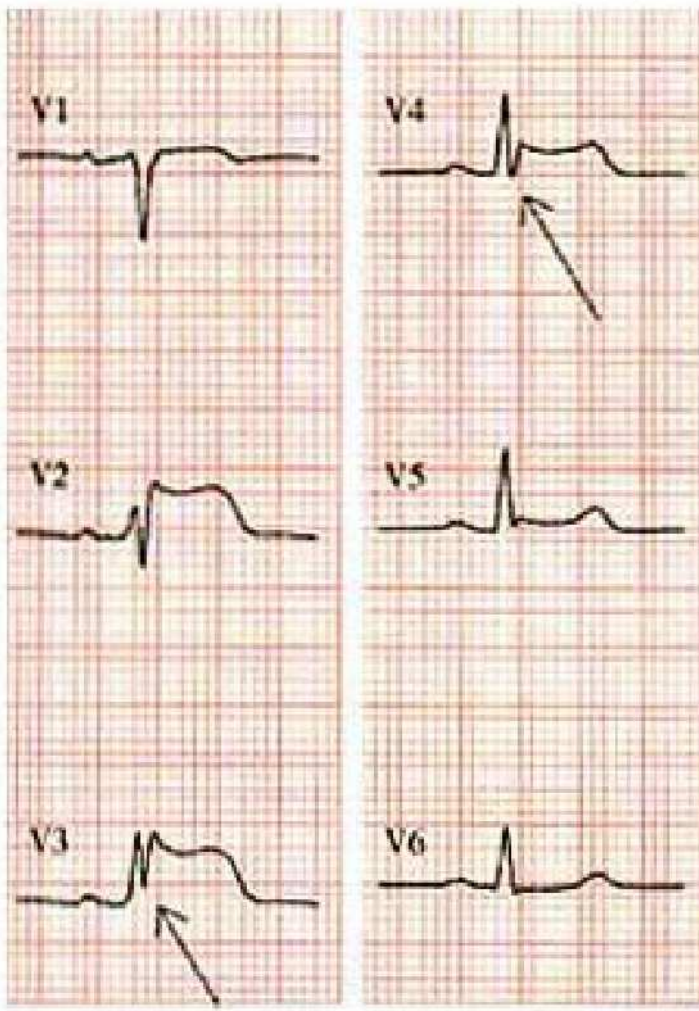
与缺血相同，损伤是可以逆转的并且不会持续存在。



qxss1 心肌缺血所致损伤：箭头示多导联 ST 段抬高



qxss2 下壁心外膜损伤引起的Ⅲ和 aVF 导联 ST 段升高，
右心室心外膜损伤所致的 V1 导联 ST 段升高



qxss3

(三) 心肌梗死

一) 心肌梗死的基本心电图形

缺血 → 损伤 → 坏死

一) 心肌梗死的基本心电图形

1. 缺血型改变——T波的形态、振幅和方向

□ 心内膜下心肌缺血:

T波直立，升支和降支对称，
顶端变为尖耸的箭头状；

□ 心外膜下心肌缺血:

T波由直立变为倒置。

一) 心肌梗死的基本心电图形

2. 损伤型改变——**ST**段的偏移

- ① 超急期**ST**段抬高。
 - ② 损伤期“单向曲线”。
-

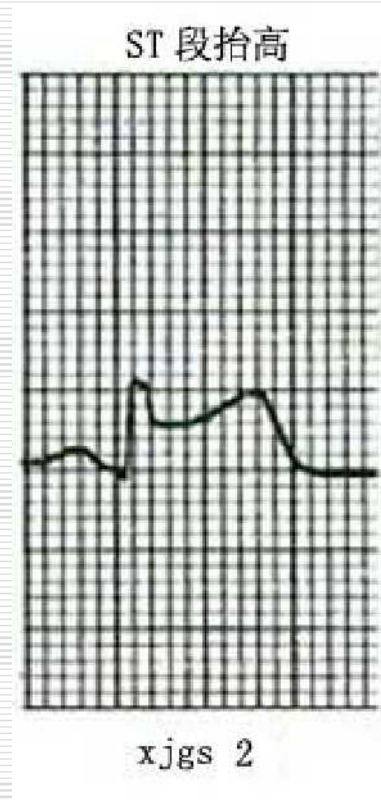
一) 心肌梗死的基本心电图形

3. 坏死型改变—— Q波形成

- 异常宽大增深的Q波形成，
 - Q波时间 $\geq 0.04s$ ，
 - Q / R振幅 $> 1 / 4$ 。
-

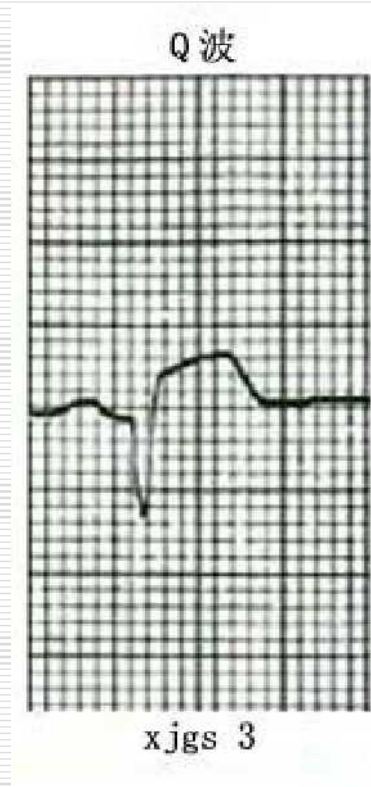
二) 典型心肌梗死发生和衍化顺序

- 1 心室某个区域损伤，面向该区域的导联上 **ST段抬高**；



二) 典型心肌梗死发生和衍化顺序

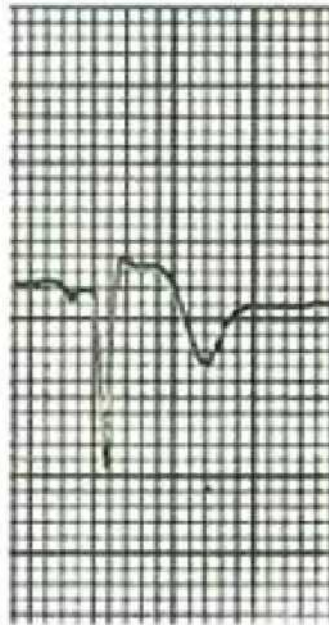
2 面向梗死区域的导联上出现**Q**波；



二) 典型心肌梗死发生和衍化顺序

3 面向梗死区域的导联上出现倒置**T**波;

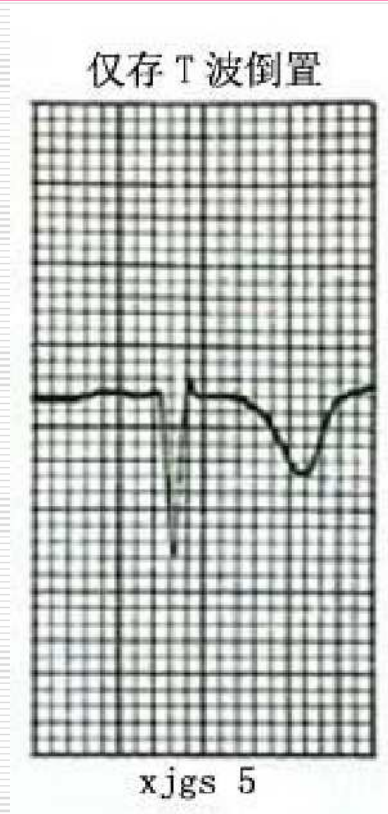
T 波倒置和 ST 段抬高



xjgs 4

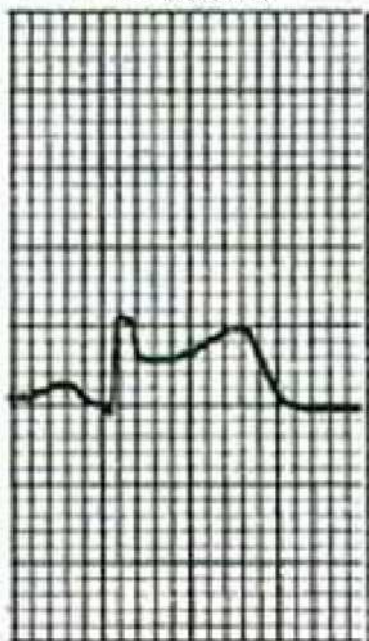
二) 典型心肌梗死发生和衍化顺序

- 4 面向梗死区域的导联抬高的ST段回落到电位线，T波仍倒置。



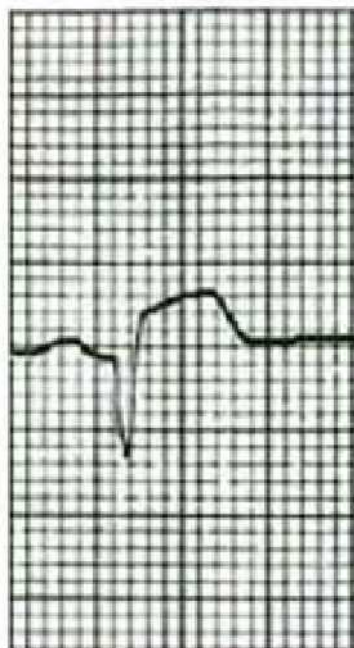
全过程

ST 段抬高



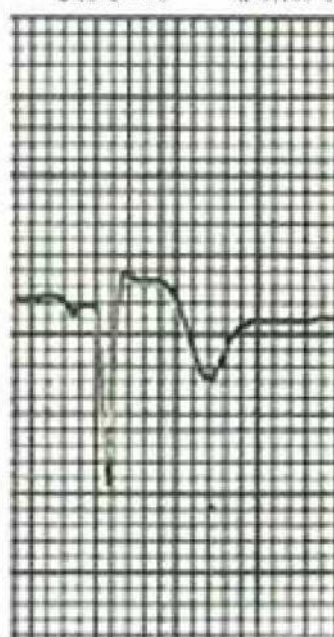
xjgs 2

Q 波



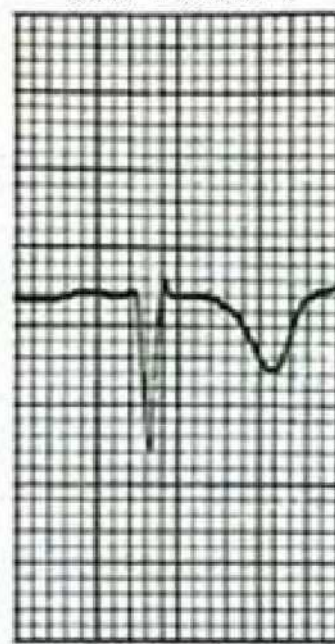
xjgs 3

T 波倒置和 ST 段抬高



xjgs 4

仅存 T 波倒置

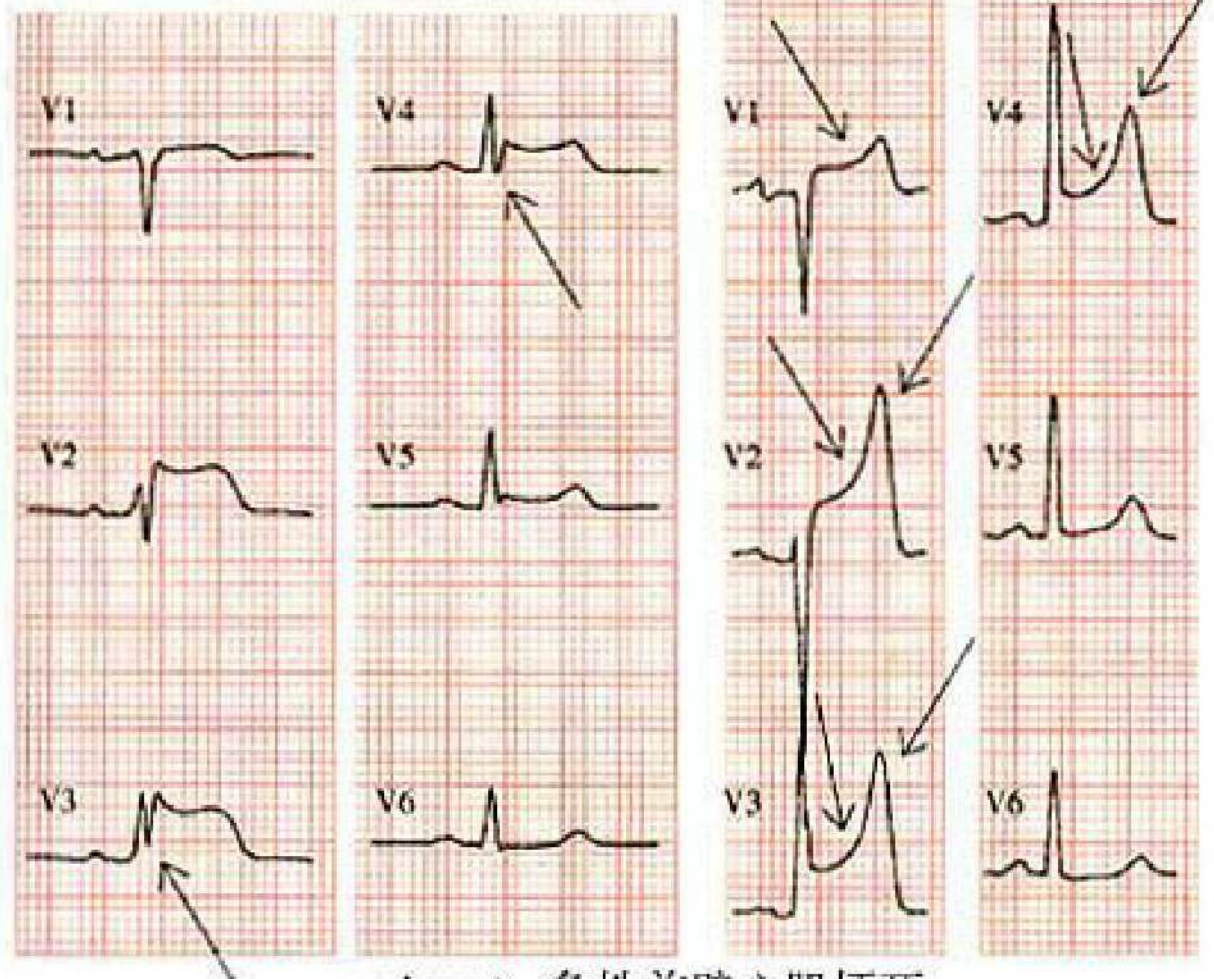


xjgs 5

三) 急性心肌梗死的心电图演变

1 超急期（早期）：急性心肌梗死发生后数分钟或数小时内。

ST段急性损伤性抬高；**T**波高尖。

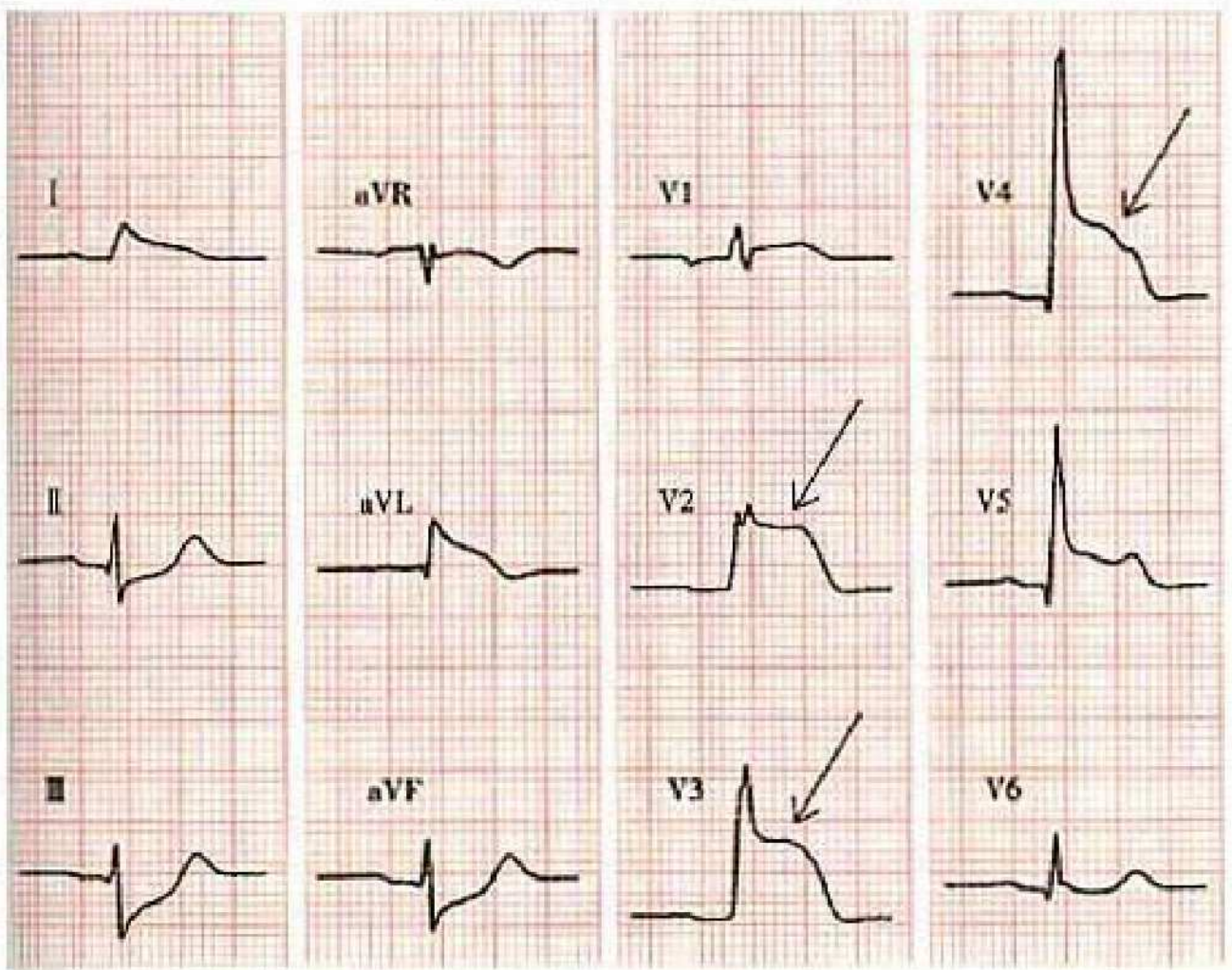


xjgs 6 急性前壁心肌梗死

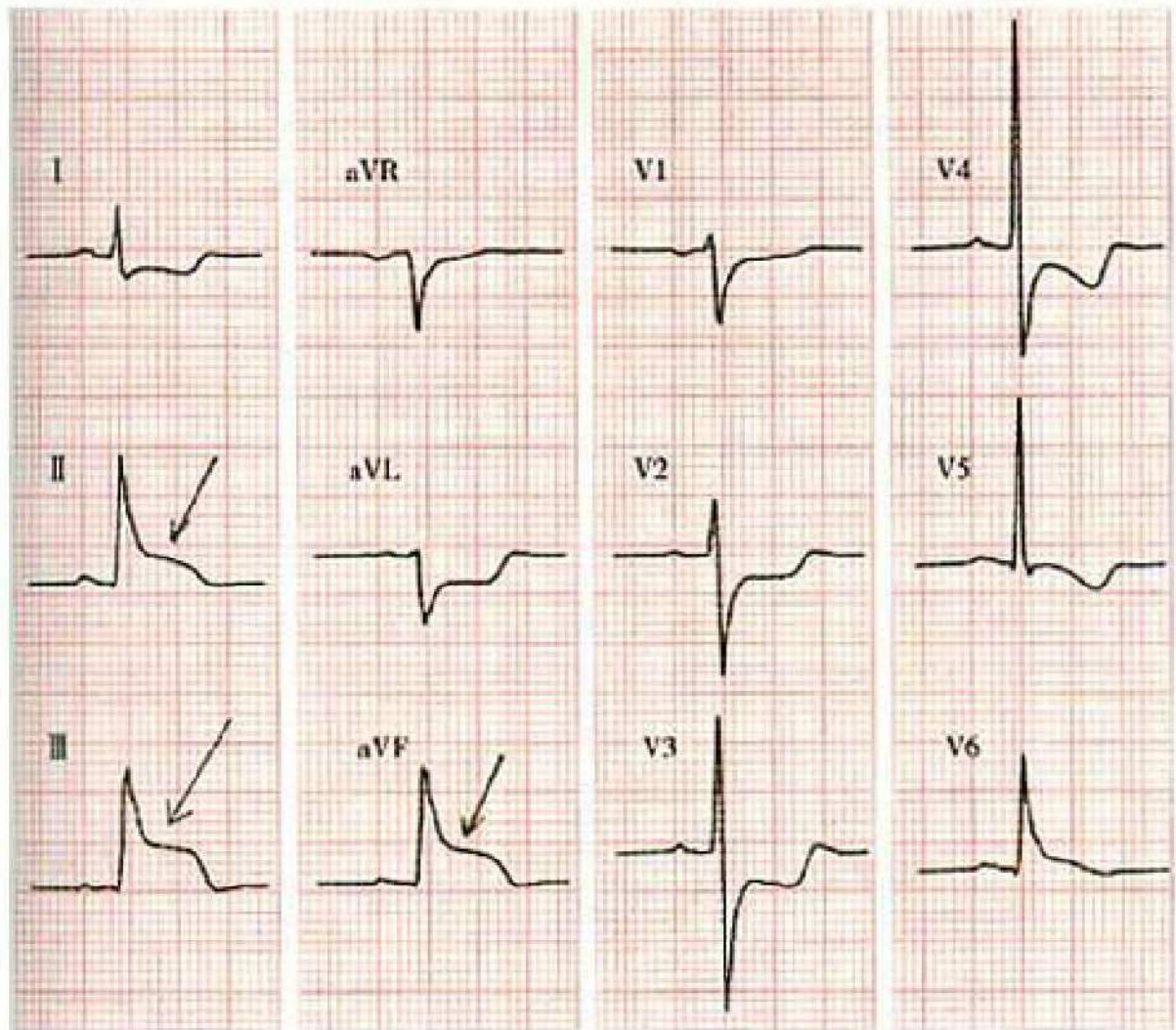
三) 急性心肌梗死的心电图演变

2 急性期：心梗后数小时或数日，持续到数周，是心肌梗死充分发展阶段。是急性心肌梗死最易发生意外的时期。

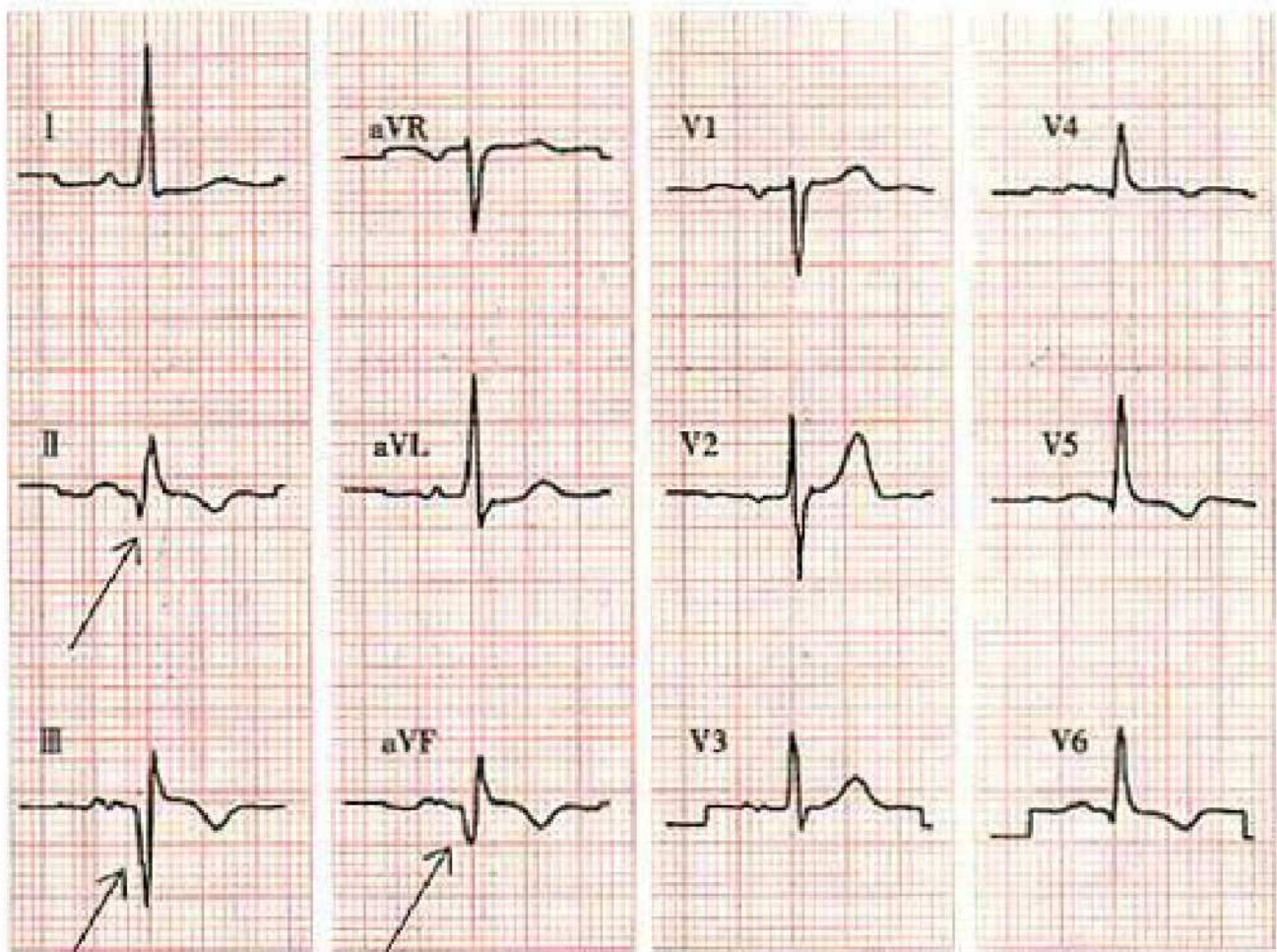
出现异常**Q波**(包括**QS波**)；**ST**段呈弓背向上抬高或与**T**波融合形成单向曲线；**T**波呈对称形倒置。



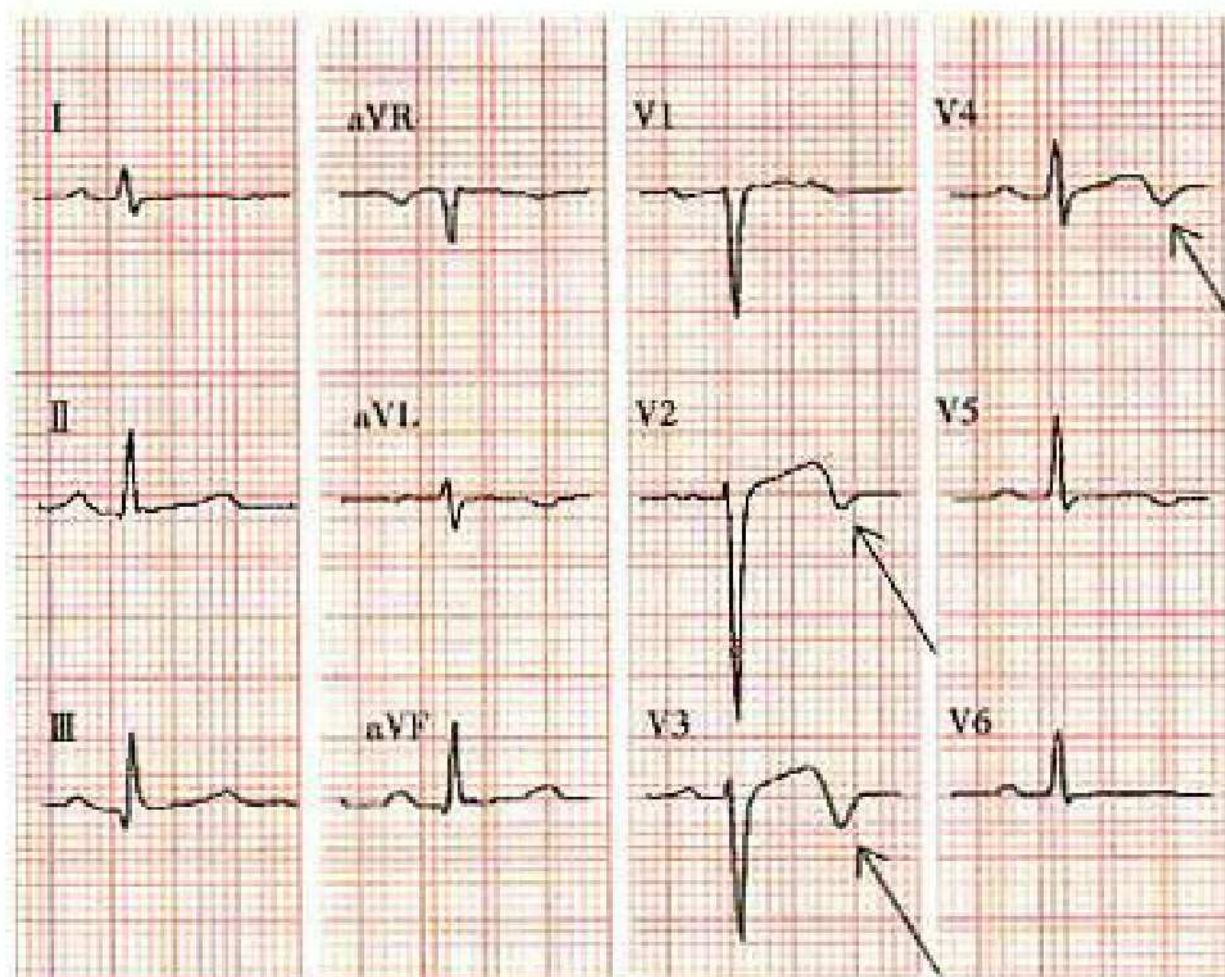
xjgs 7 急性前壁心肌梗死



xjgs 8 急性下壁心肌梗死



xjgs 9 急性下壁心肌梗死 3 天后：箭头示异常 Q 波



xjgs 10 急性前壁梗死 3 天：箭头示 T 波为负向

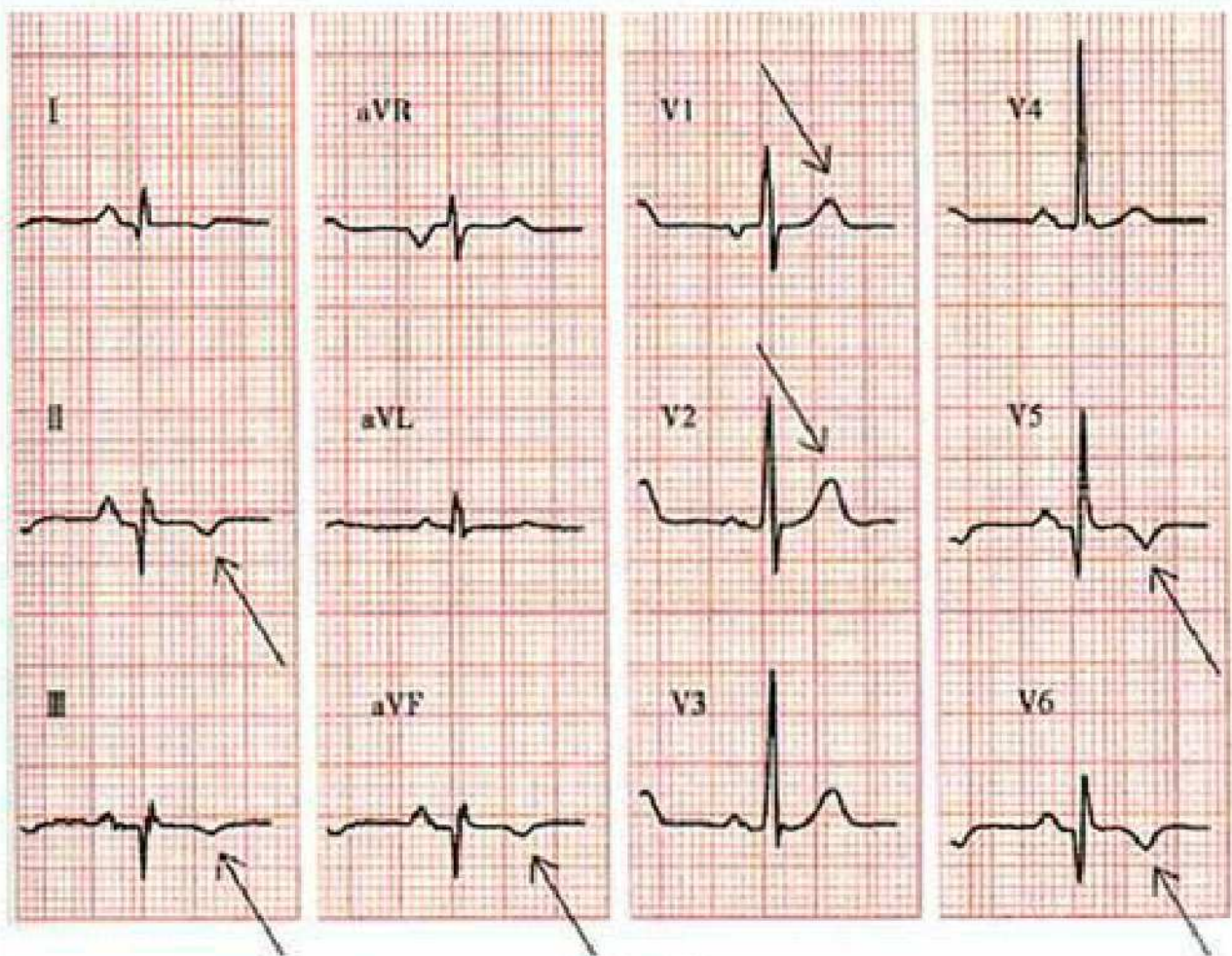
三) 急性心肌梗死的心电图演变

3 近期：梗死后数周至数月。

抬高的**ST**段基本恢复至基线，**R**波振幅下降；

病理性**Q**波存在；

缺血性**T**波逐渐恢复正常或趋于恒定不变或倒置成冠状，即表现为慢性冠状动脉供血不足。



xjgs 11

下后侧壁梗死 5 天：箭头示有异常 Q 波的导联 T 波为负向；异常 R 波导联 T 波正向

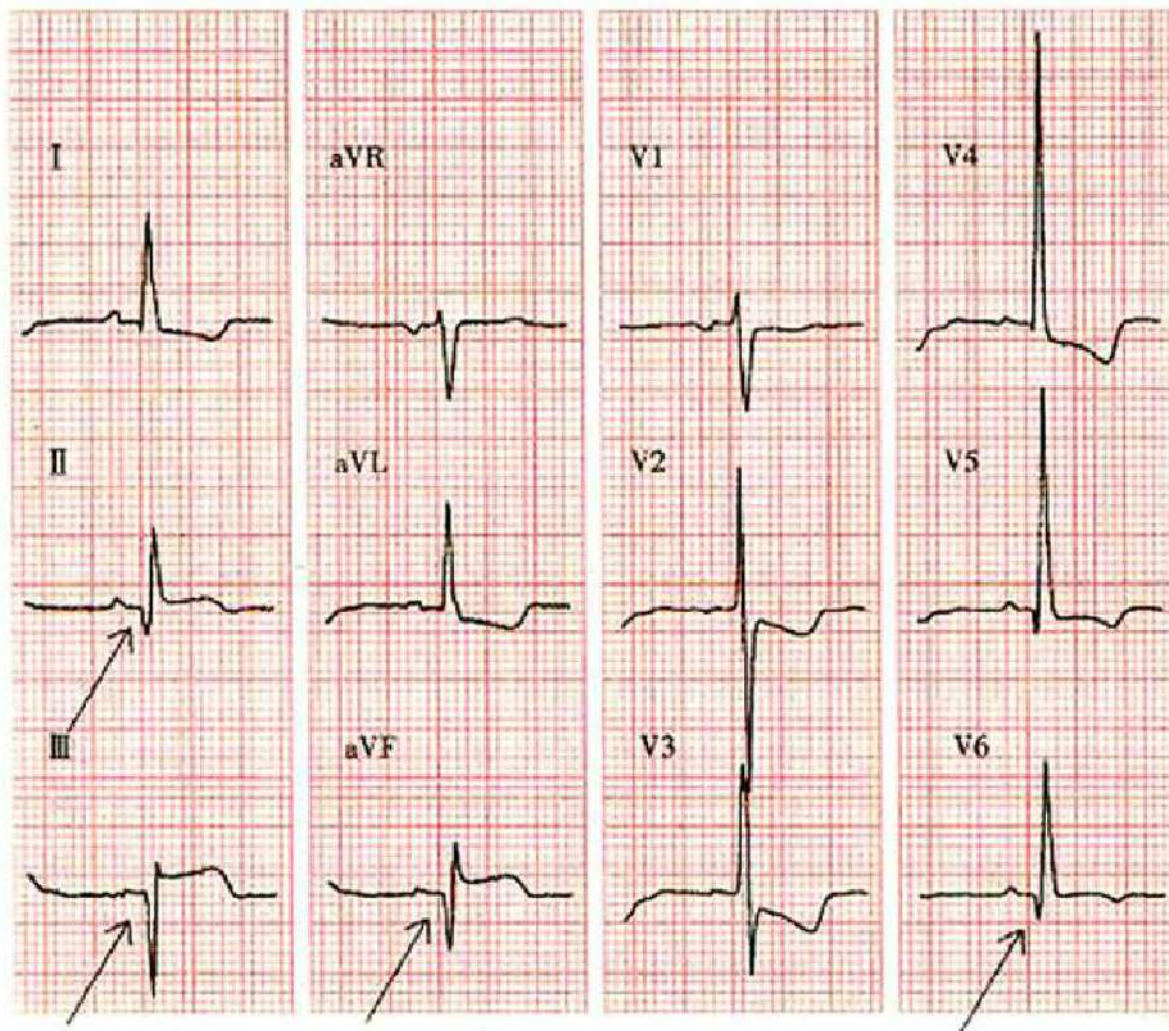
2.急性心肌梗死的心电图演变

4 陈旧期（慢性期）：常在急性心肌梗死后**3~6**个月或更久。

ST段基本正常或正常；

T波可以恢复正常或倒置变浅；

Q波仍存在或消失、变小。



xjgs12 下、后壁心肌梗死

四) 心电图的定位诊断

心肌梗死的发生部位与冠状动脉分支的供血区域相关。临床上，通常根据梗死图形出现的导联来作出梗死部位的定位判断。以左冠状动脉的前降支发生梗死的机会最多。

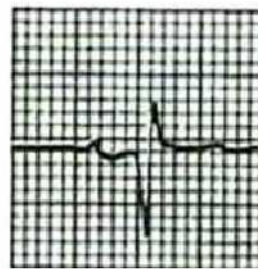
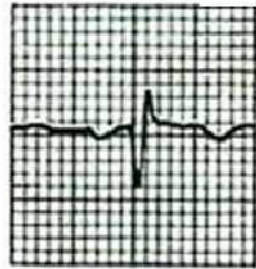
1.前间壁心梗：V1、V2

xjgs 13A 判断前间壁心梗



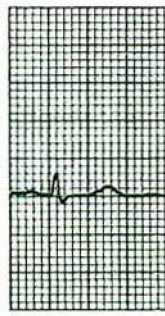
V1

V2

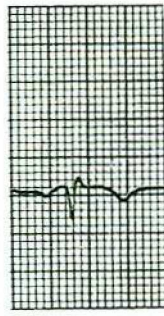


仅 V1 和 V2 导联出现 Q 波

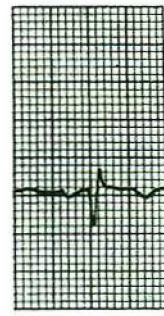
xjgs 13B 前间壁心梗



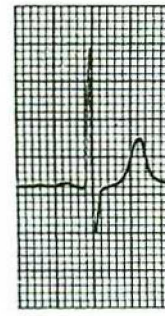
I



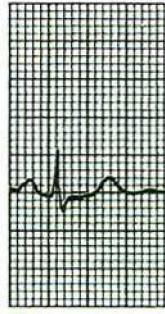
AVR



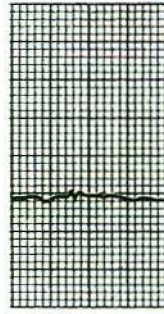
V₁



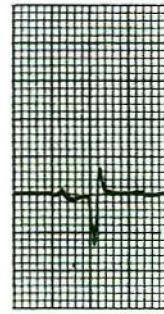
V₄



II



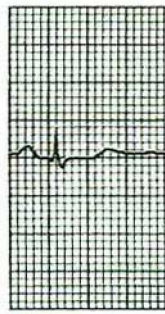
AVL



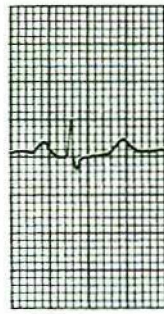
V₂



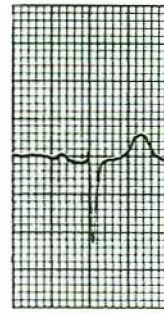
V₅



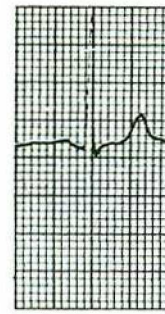
III



AVF

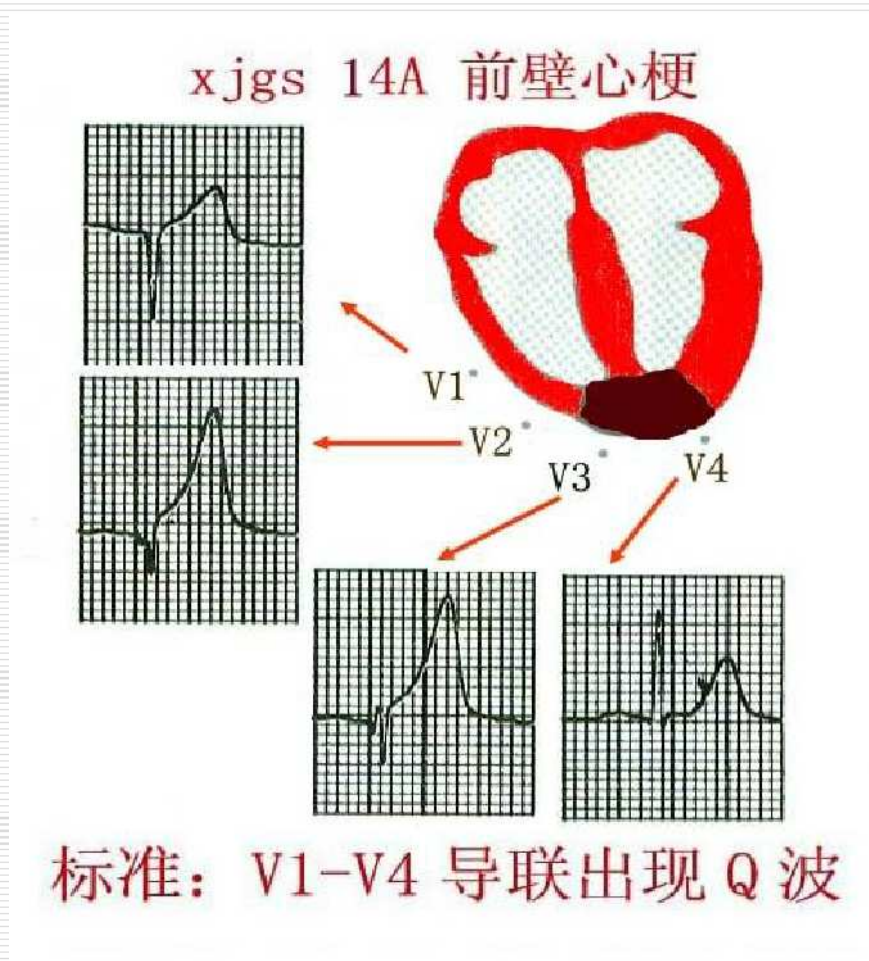


V₃

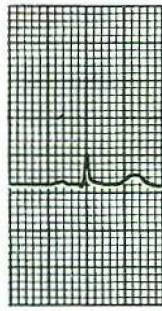


V₆

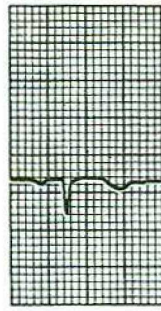
2.前壁心梗：V1、V2、V3、V4



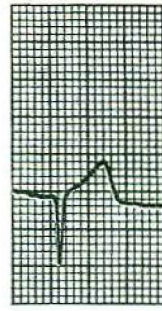
xjgs 14B 前壁心梗



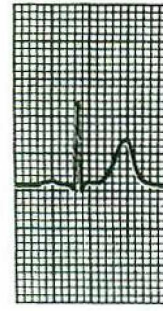
I



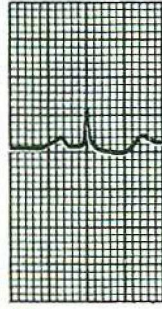
AVR



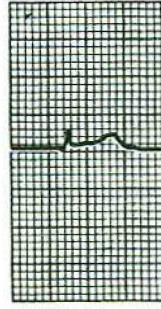
V₁



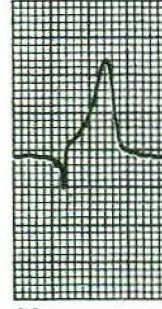
V₄



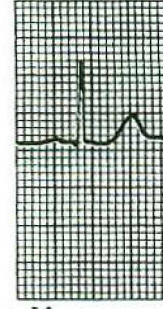
II



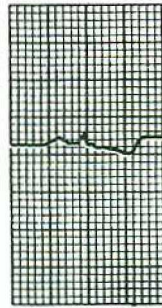
AVL



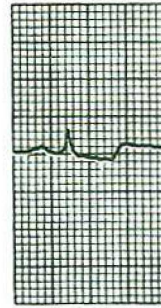
V₂



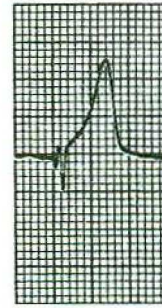
V₅



III



AVF



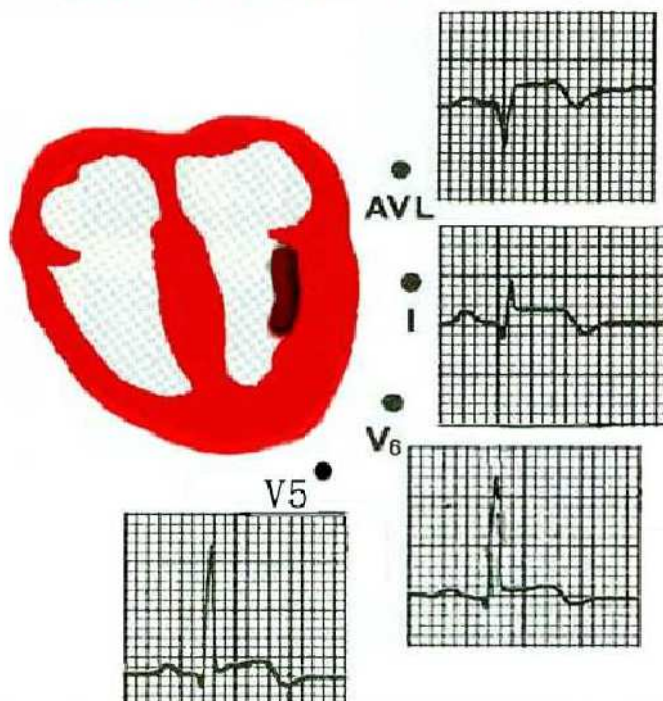
V₃



V₆

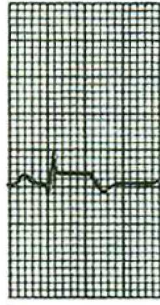
3.侧壁心梗： I、avL

xjgs 15A 侧壁心梗

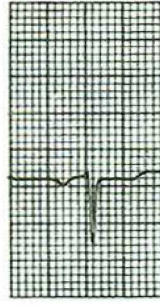


标准： I、AVL、V5 或 V6 出现 Q 波

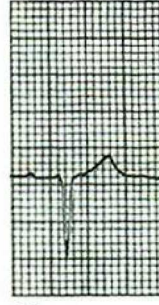
xjgs 15B 侧壁心梗



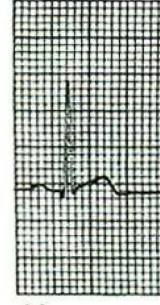
I



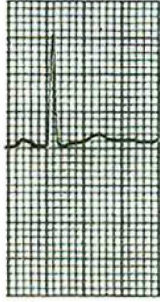
AVR



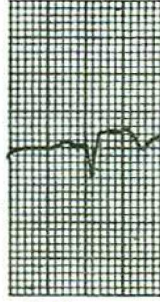
V₁



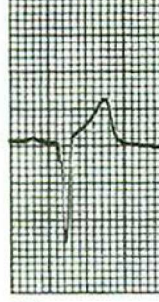
V₄



II



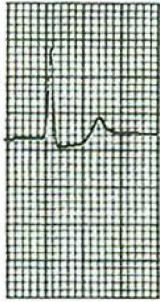
AVL



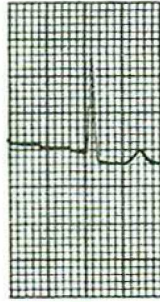
V₂



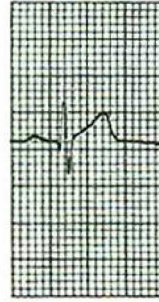
V₅



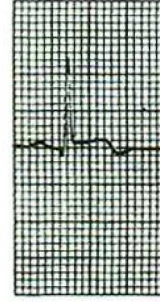
III



AVF



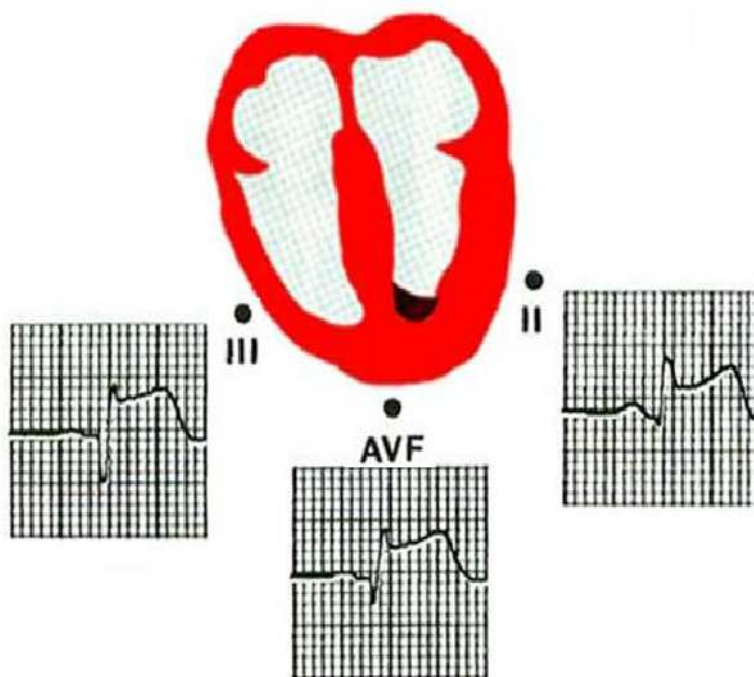
V₃



V₆

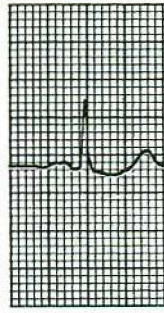
4. 下壁心梗： II、III、aVF

xjgs 16A 下壁心梗

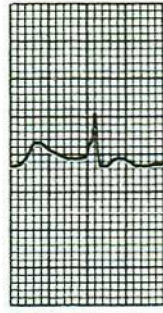


标准： II、III、aVF 导联出现 Q 波

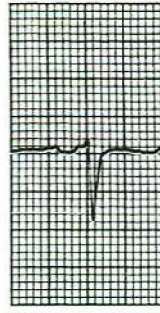
xjgs 16B 下壁心梗



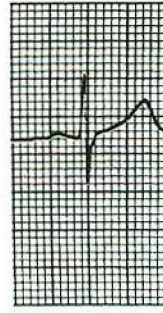
I



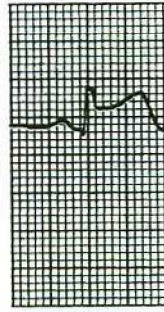
AVR



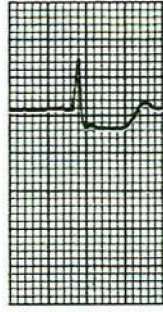
V₁



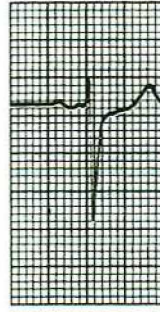
V₄



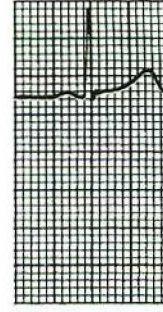
II



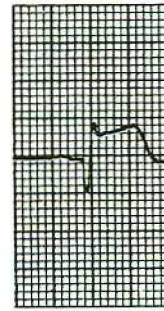
AVL



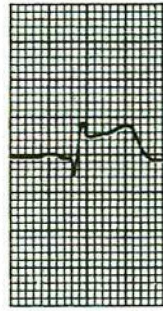
V₂



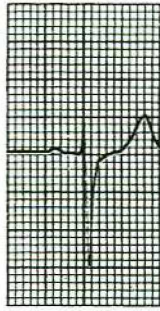
V₅



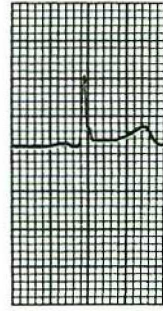
III



AVF

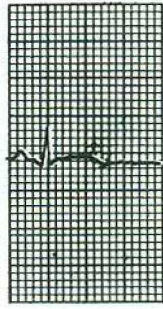


V₃

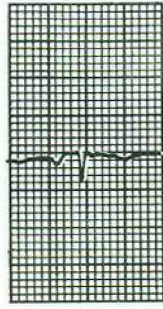


V₆

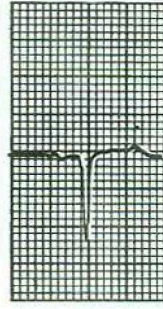
如至少有**2**个代表部位的心电图导联存在病理性**Q**波或**ST**段弓背向上抬高，则支持该部位的心梗。



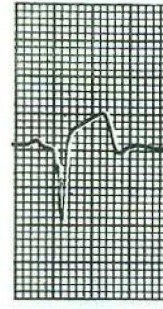
I



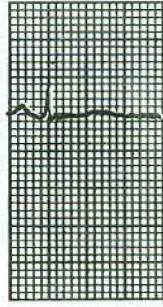
AVR



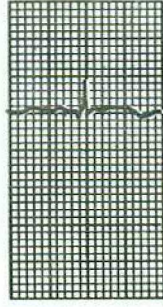
V₁



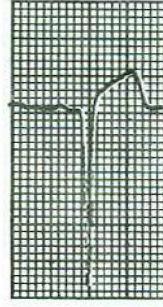
V₄



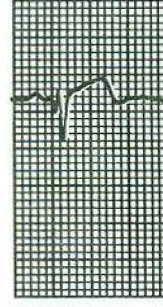
II



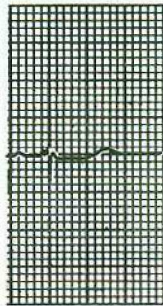
AVL



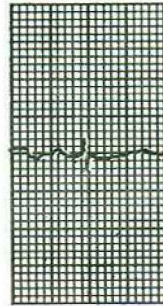
V₂



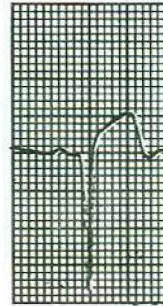
V₅



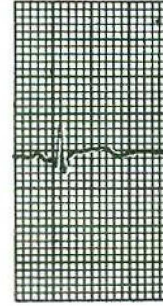
III



AVF

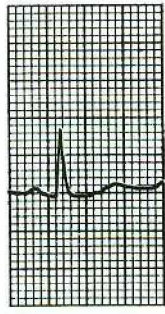


V₃

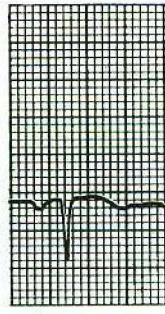


V₆

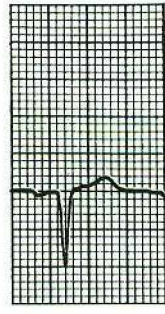
xjgs 18 前间壁心肌梗死



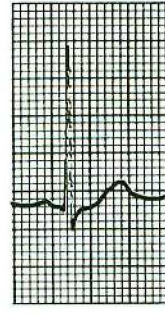
I



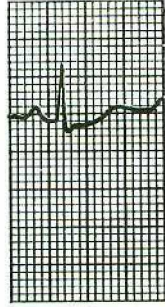
AVR



V₁



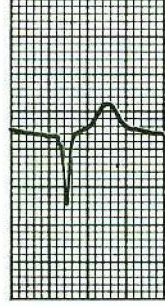
V₄



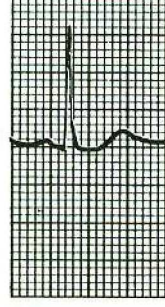
II



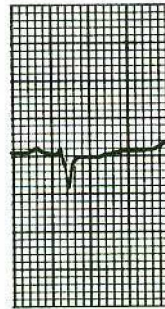
AVL



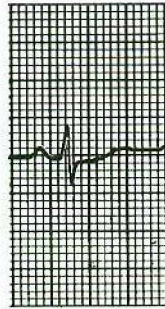
V₂



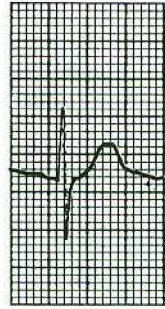
V₅



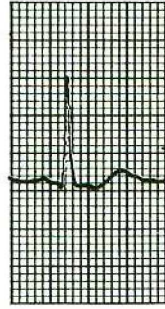
III



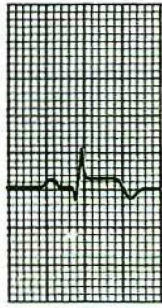
AVF



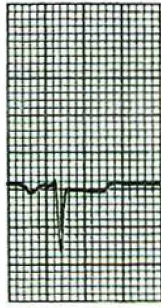
V₃



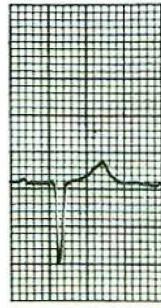
V₆



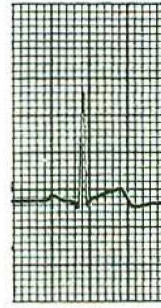
I



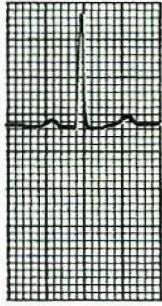
AVR



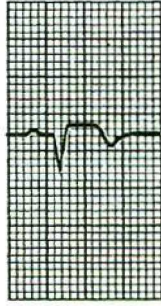
V₁



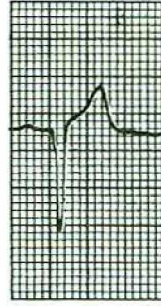
V₄



II



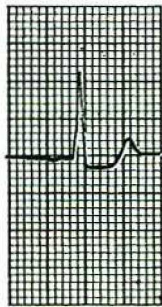
AVL



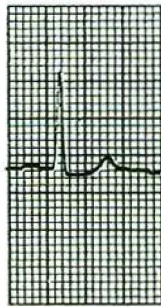
V₂



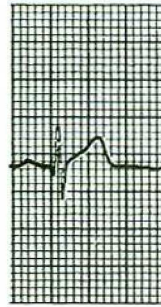
V₅



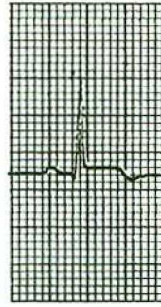
III



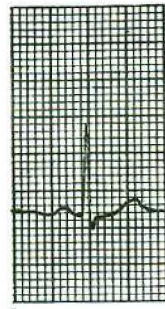
AVF



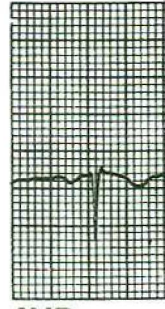
V₃



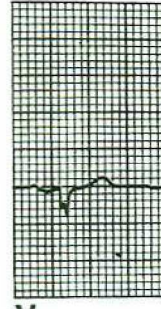
V₆



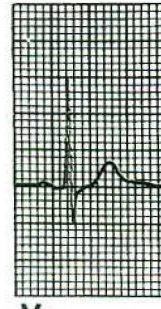
I



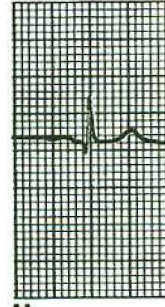
AVR



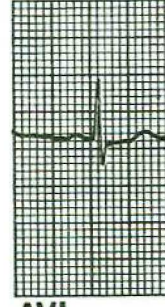
V₁



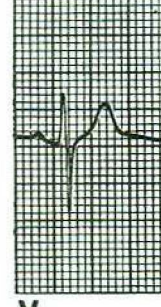
V₄



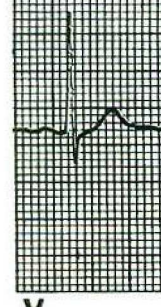
II



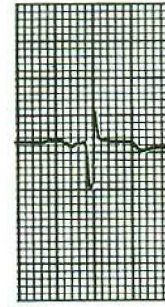
AVL



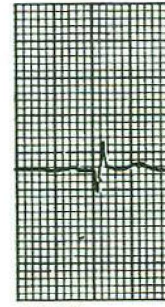
V₂



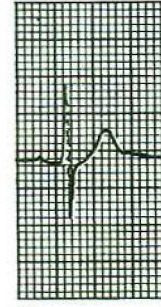
V₅



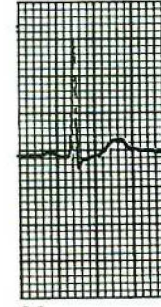
III



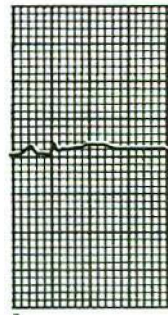
AVF



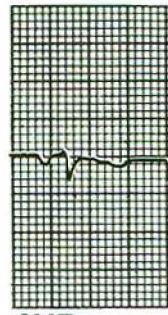
V₃



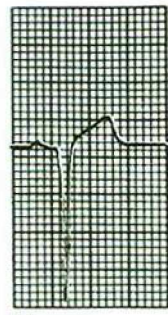
V₆



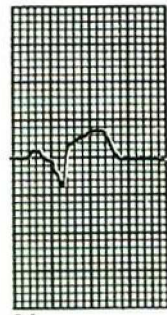
I



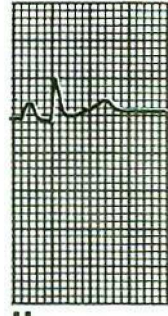
AVR



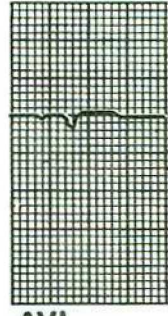
V₁



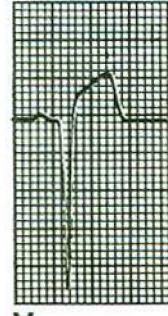
V₄



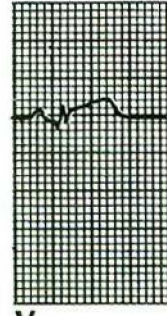
II



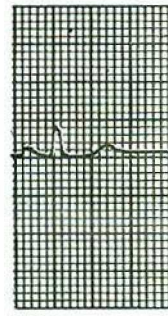
AVL



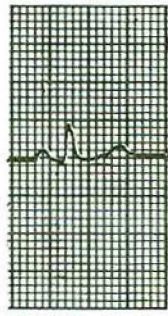
V₂



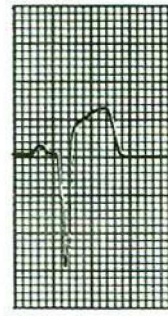
V₅



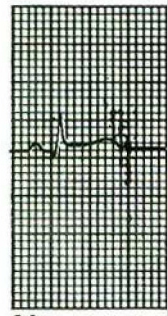
III



AVF

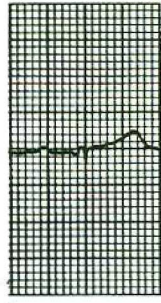


V₃

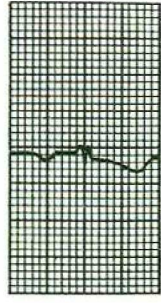


V₆

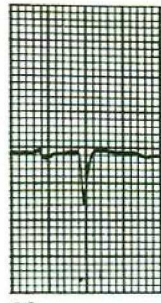
xjgs 22 前壁、侧壁和下壁心肌梗死



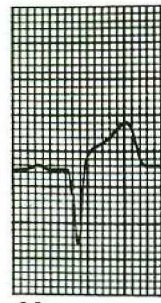
I



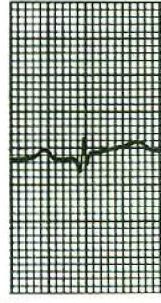
AVR



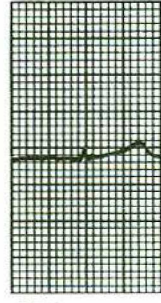
V₁



V₄



II



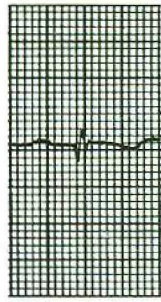
AVL



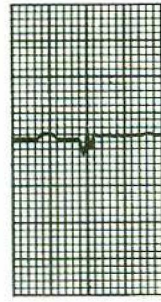
V₂



V₅



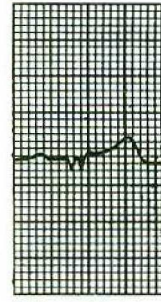
III



AVF



V₃



V₆

五) 特例

II、III、**AVF**导联**ST**段弓背向上抬高，I、**AVL**导联**ST**段压低；

I、**AVL**导联**ST**段弓背向上抬高，II、III、**AVF**导联**ST**段压低。

发生心梗时，在背向梗死区的导联上出现心肌缺血的表现，诊断应以发生弓背向上抬高的导联为依据，这种现象称为心梗时的镜像改变：

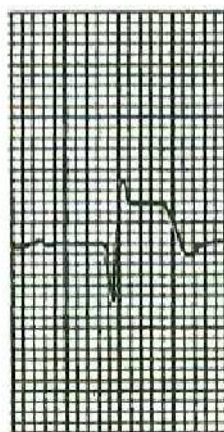
xjgs 23 心梗时的镜像改变

下壁梗死

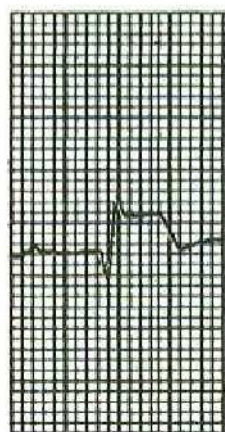
背向梗死区导联上出现的
ST段压低



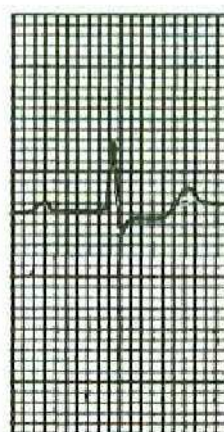
II



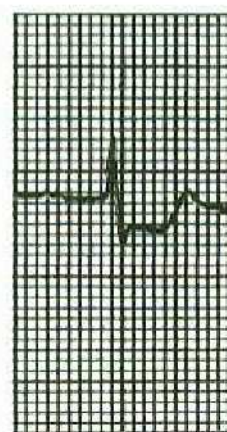
III



AVF



I

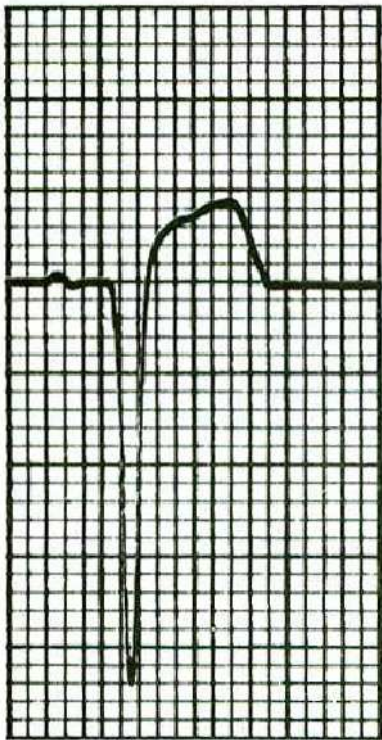


AVL

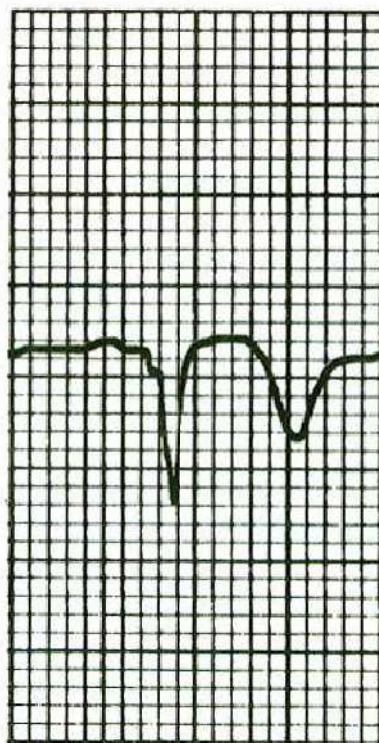
注意:

- **ST**偏移和**T**波形态可以用来判断心梗何时发生:
 - **ST**段抬高则心梗可能处于急性期;
 - **ST**段处于等电位线而**T**波倒置,发生时间难以确定;
 - **ST**段处于基线水平,而**T**波直立,为陈旧性心梗。
 - 单纯以心电图不能准确判断心梗的发生时间。
-

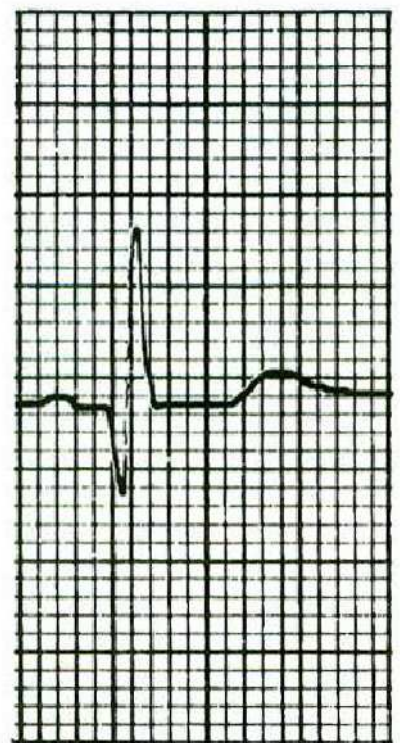
急性心梗



心梗, 时间无法确定



陈旧性心梗



xjgs 25

小结

1 急性心肌梗死心电图改变：

- ① 缺血型：**T波改变**：**T波倒置、尖深、双支对称**，称“**冠状T**”；
 - ② 损伤型：**ST改变**：**ST弓背抬高**，形成单向曲线；
 - ③ 坏死型：**坏死Q波出现**：**Q波时限 ≥ 0.4 秒**，振幅 $> R/4$ 。
-

小结

2 急性心肌梗死心电图诊断的主要依据：

坏死型**Q**波、**ST**段抬高及**T**波倒置同时出现，具有一定的演变规律。

3 心肌梗死的心电图定位诊断：

前间壁：**V1、V2**；

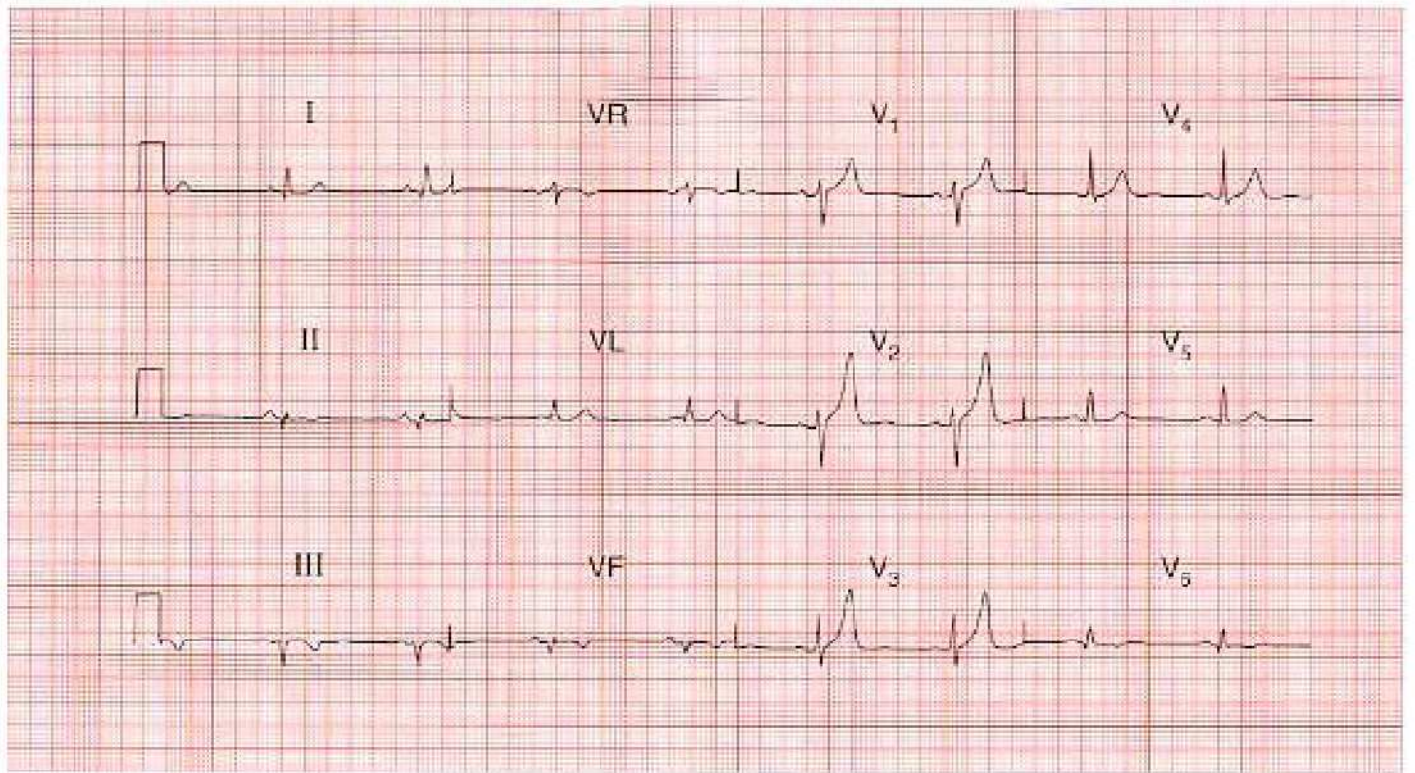
前壁：**V1、V2、V3、V4**；

侧壁：**I、aVL、V5、V6**；

下壁：**II、III、aVF**。

读图练习

图 3



心电图特点：

窦性心律

心电图轴正常

II、III、**aVF**可见**Q**波

II、**V6**导联**T**波双向；III、**aVF**导联**T**波倒置

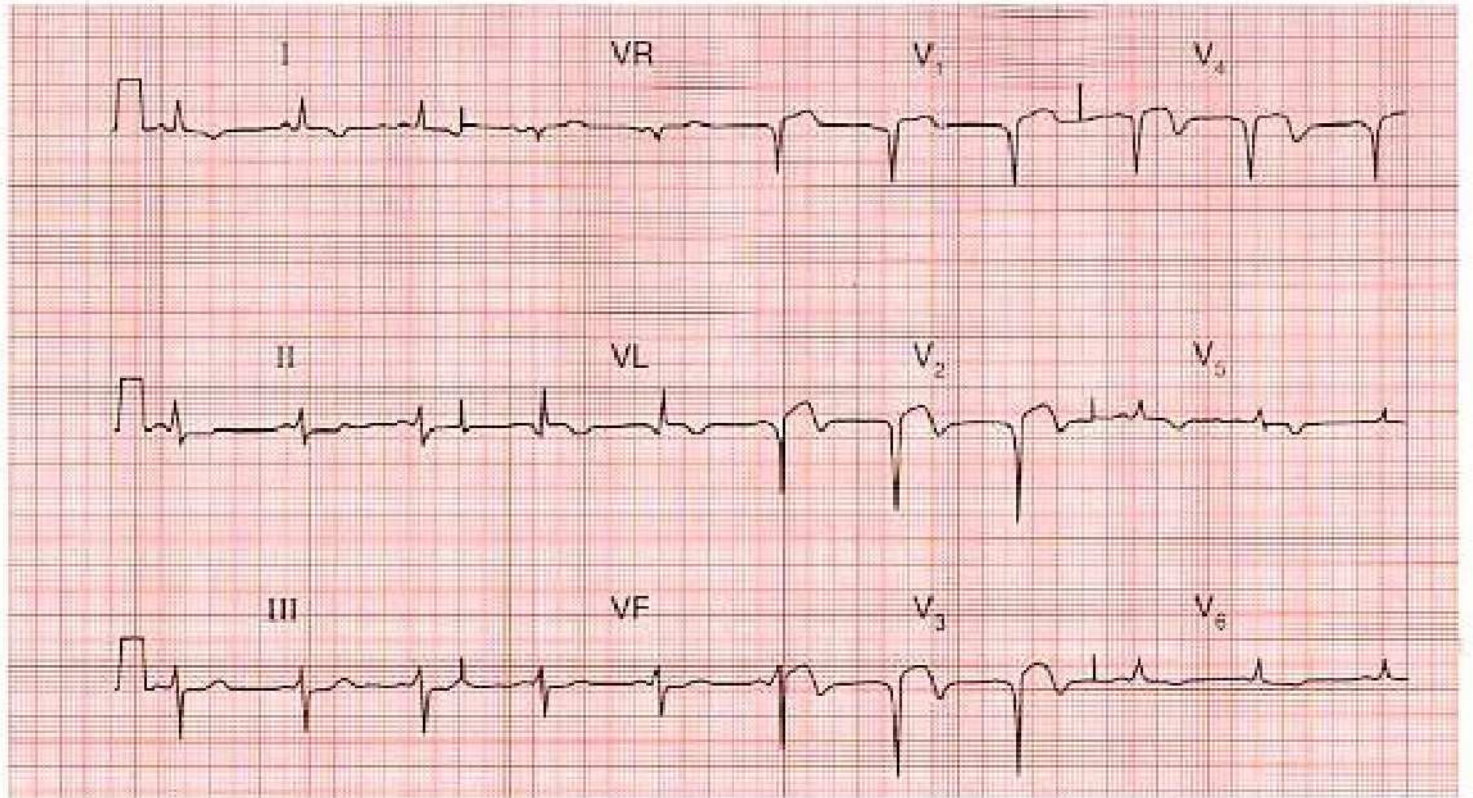
V1-V2导联**T**波明显高尖

心电图诊断：

窦性心律

陈旧性下壁心肌梗死

图 4



心电图特点：

窦性心律

心电轴正常

V2-V4导联可见**Q**波

V2-V4导联**ST**段抬高

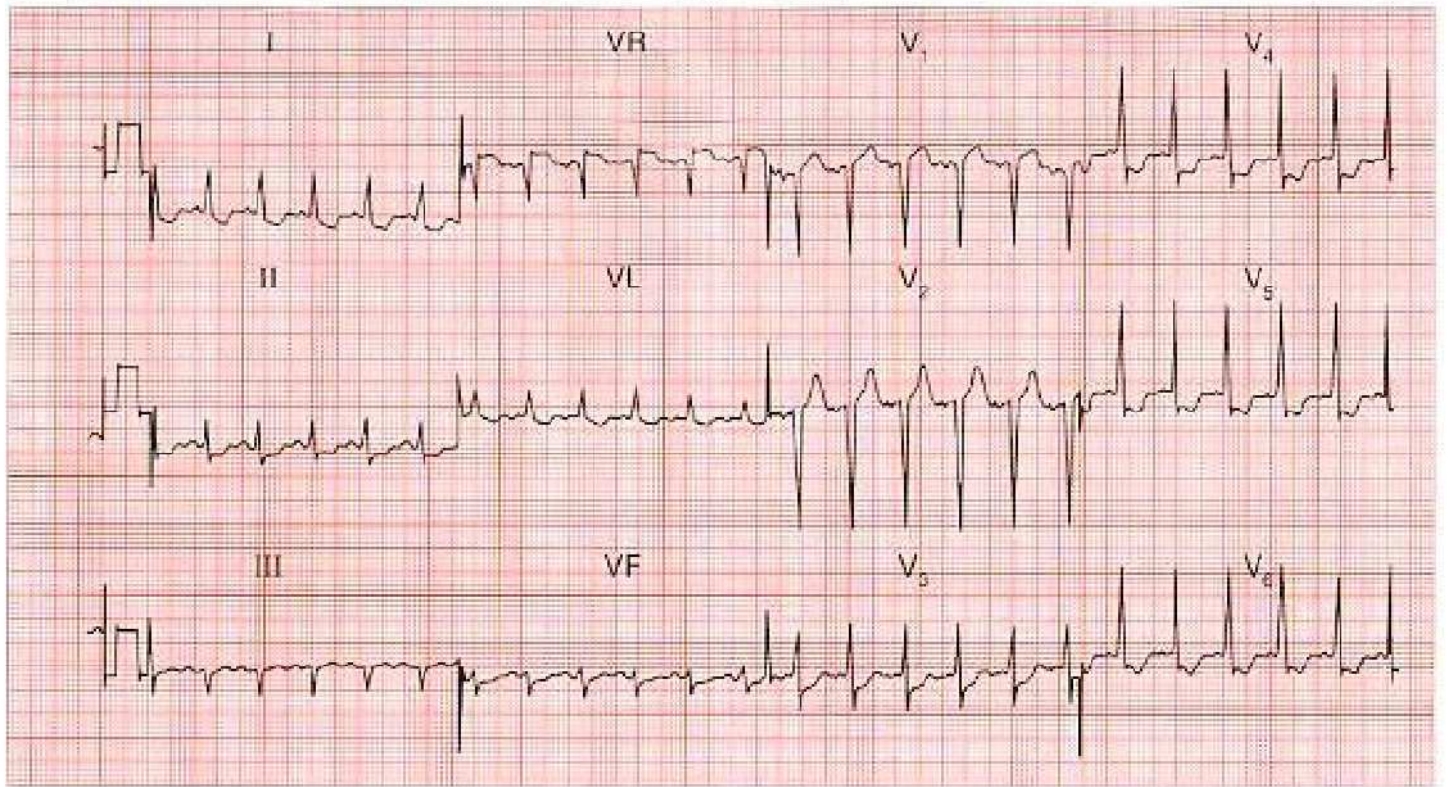
I、aVL、V2-V6导联**T**波倒置

心电图诊断：

窦性心律

急性前壁心肌梗死

图 5



心电图特点：

窦性心律

心电图轴正常

QRS波形态正常

V3-V4导联**ST**段水平型下移, **I**、**aVL**、**V5-**

V6导联下斜型下移。

心电图诊断：

窦性心律

急侧壁心肌缺血
