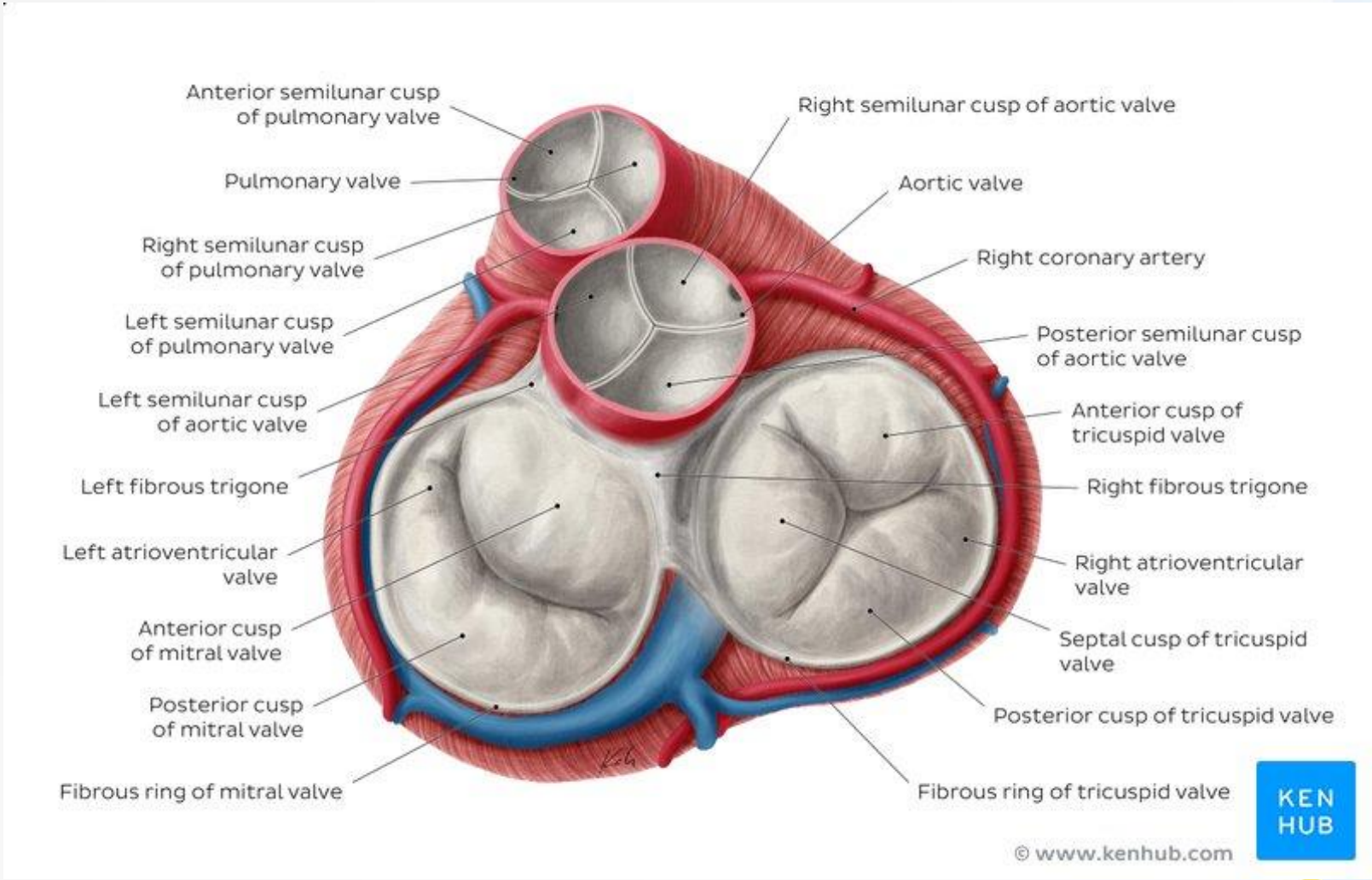
ECG LOCALISATION OF CULPRIT VESSEL IN STEMI

DR K V PATIL
SR CARDIOLOGY
CALICUT MEDICAL COLLEGE

- ECG - a key test for the diagnosis and management of acute and chronic coronary syndromes
- factors determining waveforms
  - the duration of the ischemic process (acute versus evolving versus chronic)
  - extent (size and degree of transmural involvement)
  - topography (anterior versus inferior-posterior-lateral or right ventricular)
  - presence of other underlying abnormalities (e.g., prior infarction,LBBB, Wolff-Parkinson-White syndrome, or pacemaker patterns)

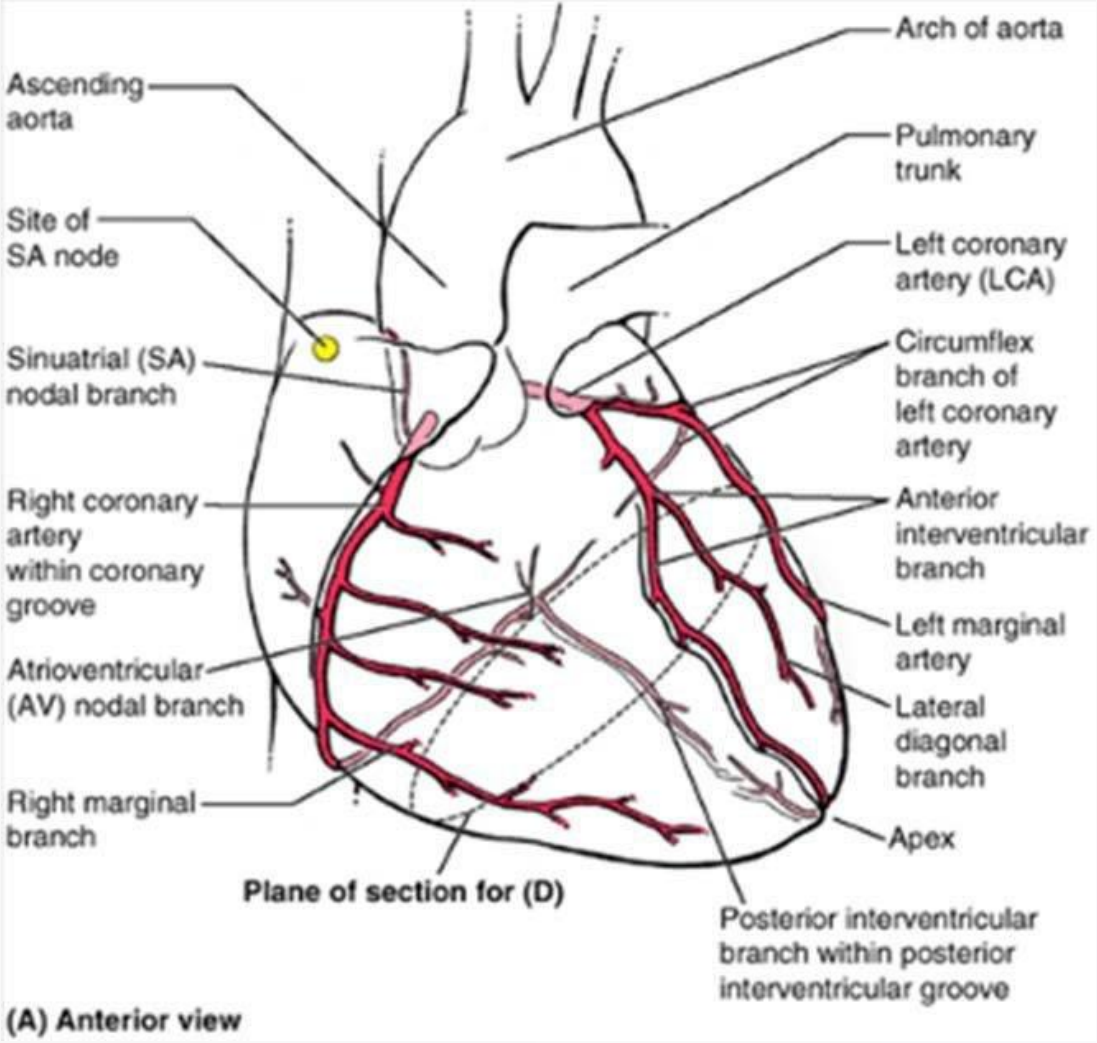
CORONARY CIRCULATION



- LMCA
  - LAD
  - LCX
  - Ramus intermedius(20%)
- RCA

Right coronary artery

- runs forward between the pulmonary trunk and the right auricle
- descends vertically in the right atrioventricular groove
- continues posteriorly along the atrioventricular groove towards crux cordis to anastomose with the left coronary artery in the posterior interventricular groove


Arch of aorta
Ascending aorta
Pulmonary trunk
Site of SA node
Left coronary artery (LCA)
Sinuatrial (SA) nodal branch
Circumflex branch of left coronary artery
Right coronary artery within coronary groove
Anterior interventricular branch
Left marginal artery
Atrioventricular (AV) nodal branch
Lateral diagonal branch
Right marginal branch
Apex
Plane of section for (D)
Posterior interventricular branch within posterior interventricular groove
(A) Anterior view

Right coronary artery

- Atrial branches
  - artery of the sinuatrial node
- Conus artery
- anterior ventricular branches
  - acute marginal branch
- Posterior ventricular branches
- Posterior descending artery (PDA) and Posterolateral (PL)
  - AV node branch

LEFT MAIN CORONARY ARTERY

- usually larger than the right coronary artery
- passes forward between the pulmonary trunk and the left auricle
- enters the atrioventricular groove and divides into an anterior interventricular branch (LAD) and a circumflex branch

Left anterior descending (LAD)

anterior interventricular groove to apex of the heart to posterior interventricular groove - anastomoses with the terminal branches of the right coronary artery

(type1,2 or 3)

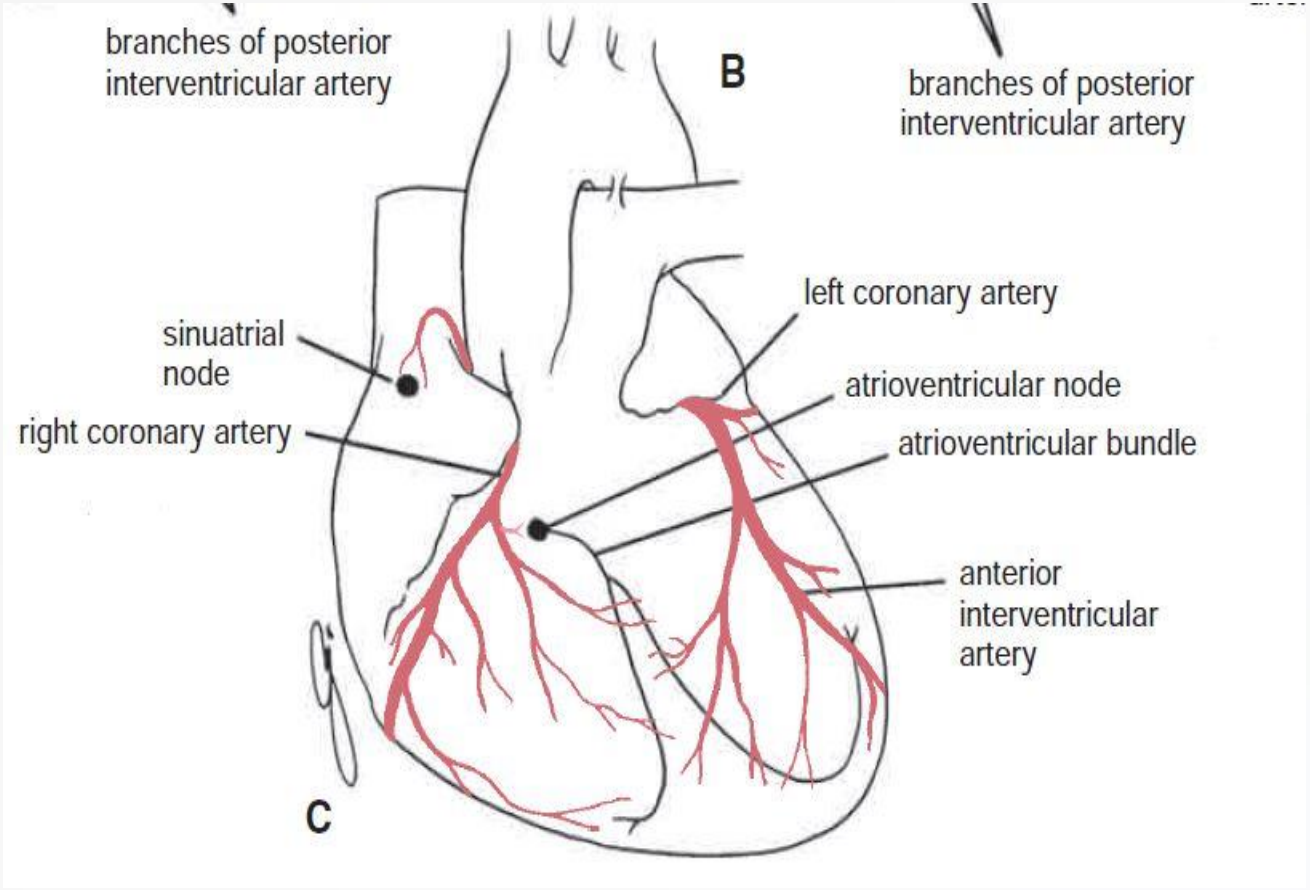
- diagonal branches (D1, D2...)
- septal branches (S1,S2,S3)
- small left conus artery

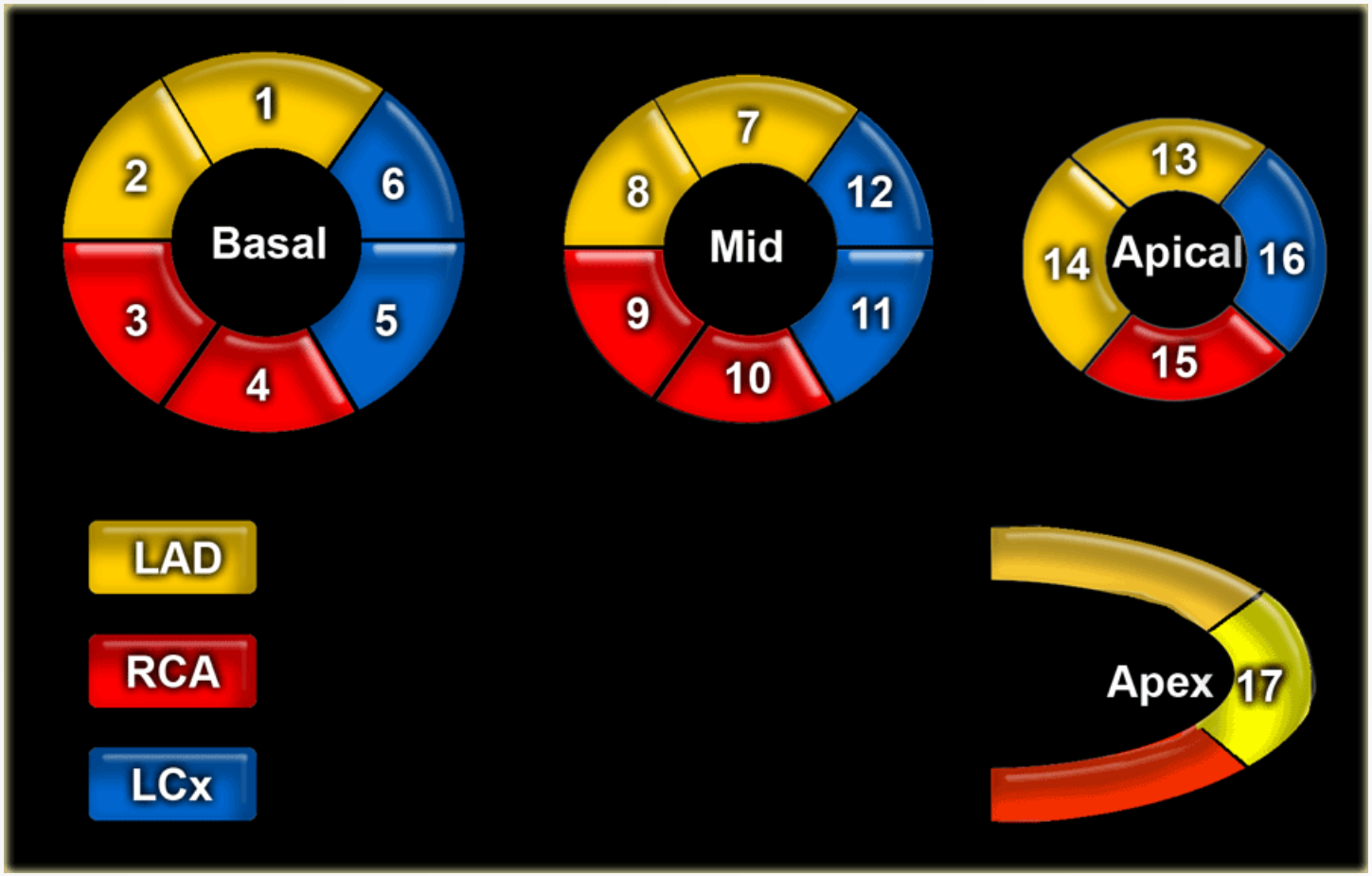
- Circumflex (Cx)

  winds around the left margin of the heart in the atrioventricular groove

  - Atrial branches (SA node 40%)
  - Marginal branches (M1,M2)
  - Anterior ventricular and posterior ventricular branches

- LAD :
  - anterior, lateral, anterior two-thirds of septum
  - frequently the inferoapical segments of the left ventricle
  - proximal part of bundle branches

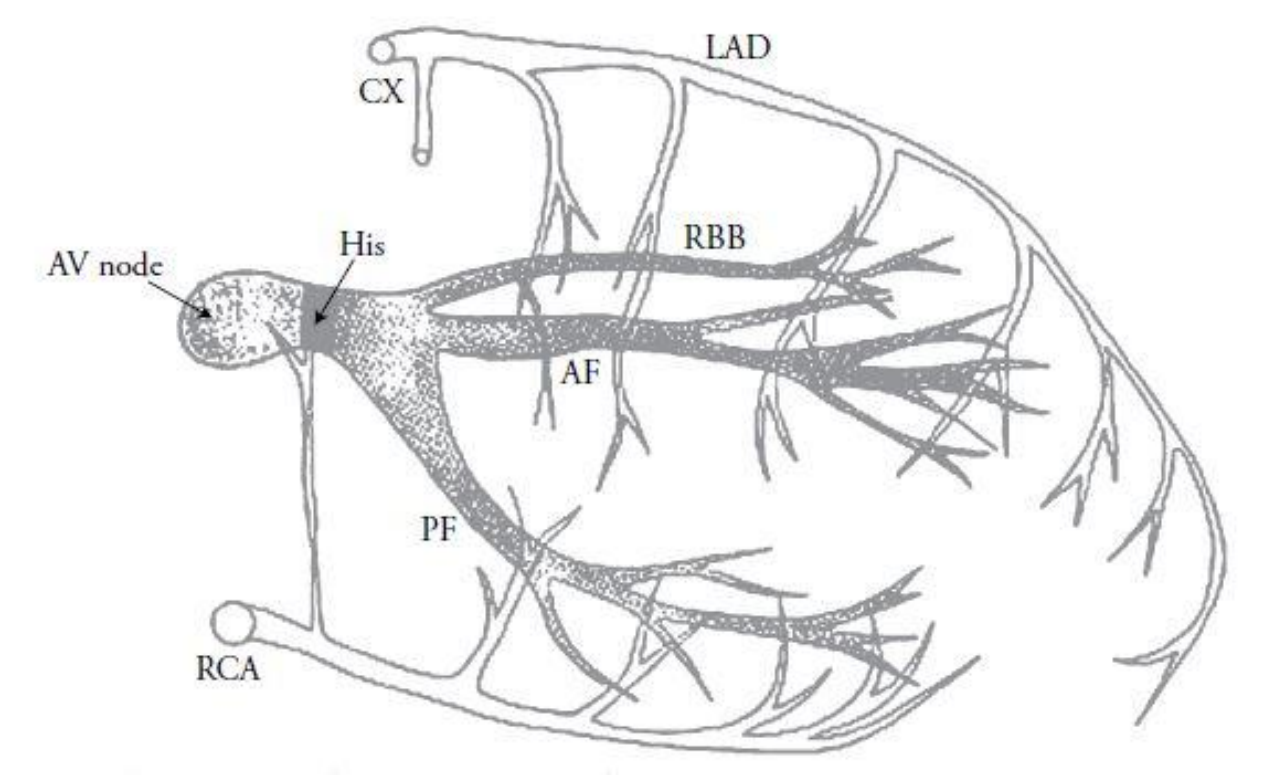

branches of posterior interventricular artery
B
branches of posterior interventricular artery
left coronary artery
sinuatrial node
atrioventricular node
right coronary artery
atrioventricular bundle
anterior interventricular artery
C


1
2
6
Basal
3
5
4
7
8
12
Mid
9
11
10
13
14
16
Apical
15
Apex
17
LAD
RCA
LCx

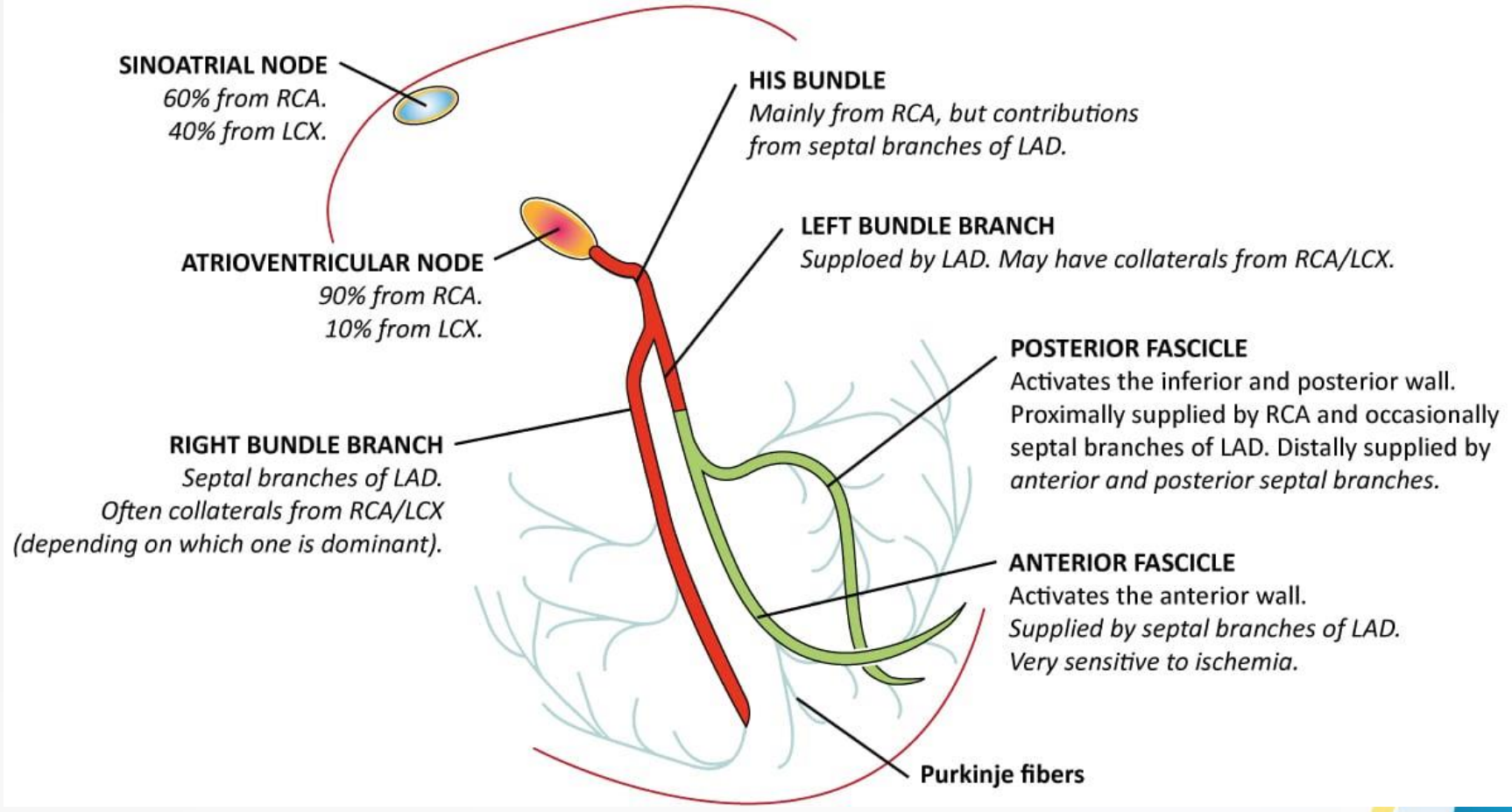
- RCA
  - sinus node (60%),
  - AV node
  - posteromedial papillary muscle
  - inferior part of LV, RV, and variably also the posterior and lateral segments

- Circumflex branch
  - Posterior wall and variably inferior and lateral segments

Conduction system - blood supply



The components of the conduction system and their vascular supply

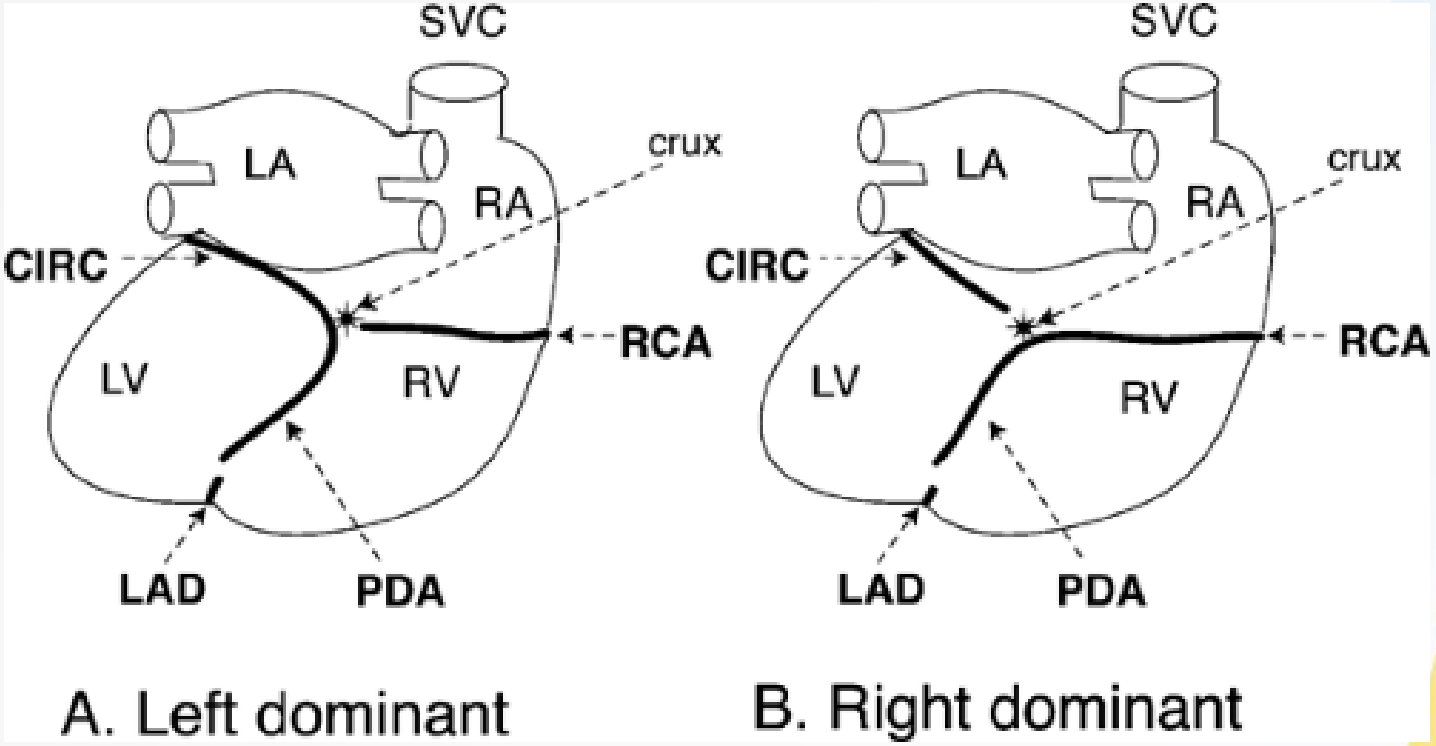


- SA node – RCA in 60%
- AV node – RCA in 90%
- Bundle of His – mainly RCA
- RBB – LAD
- LBB – Ant branch – LAD
  L Post branch – LAD & Posterior Desend A

Dominance

- Giving rise to posterolateral branches & PDA

- AV nodal branch

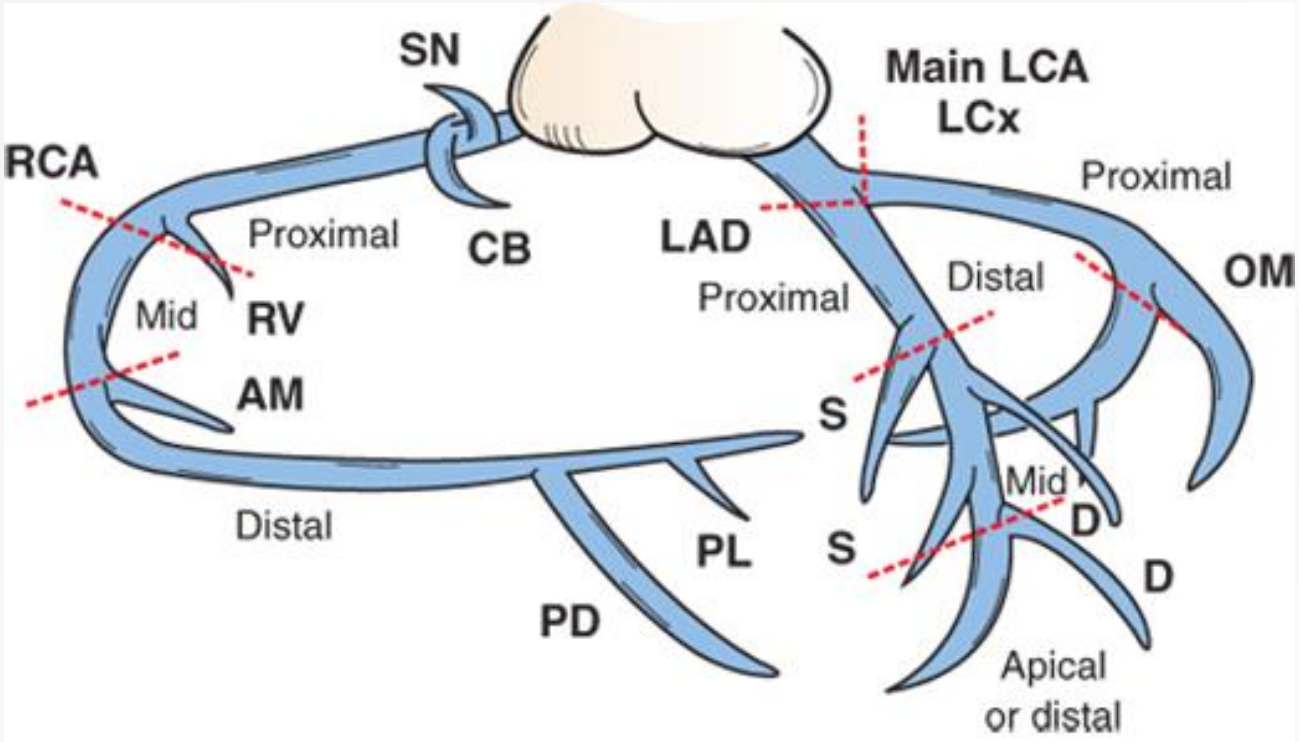

SVC
LA
RA
crux
CIRC
RCA
LV
RV
LAD
PDA
A. Left dominant
SVC
LA
RA
crux
CIRC
RCA
LV
RV
LAD
PDA
B. Right dominant

- RCA - 80%
- LCX - 10%
- Co - dominant – 10%

TABLE 20.6 Classification of Coronary Segments from SYNTAX Score

SEGMENT	DESCRIPTION	CASS NUMBER
Left main	From ostium of LCA until bifurcation into LAD and left Cx branches.	11
LAD proximal	Proximal to, and including, first major septal branch.	12
LAD middle	LAD immediately distal to origin of first septal branch and extending to the point where LAD forms an angle (RAO view). If this angle is not identifiable, this segment ends at one-half the distance from the first septal to the apex of the heart.	13
LAD distal	Terminal portion of LAD, beginning at end of previous segment and extending to or beyond apex	14
Major diagonal branches	LAD branches, sequentially numbered	15 first diagonal 16 second diagonal 29 third diagonal
Intermediate ramus	Branch from trifurcating left main other than proximal LAD or Cx; belongs to Cx territory.	28
Proximal Cx	Main stem of Cx from its origin from left main to and including origin of first OM branch.	18
Distal Cx	Stem of Cx distal to origin of most distal OM branch and running along posterior left atrioventricular grooves. Caliber may be small or artery absent.	19
OM branches	Cx branches, sequentially numbered	20 first OM 21 second OM 22 third OM
PL branches from Cx	PL branch originating from distal Cx	24 first PL 25 second PL 26 third PL
RCA proximal	From ostium to one-half the distance to acute margin of heart.	1
RCA mid	From end of first segment to acute margin of heart.	2
RCA distal	From acute margin of heart to origin of posterior descending artery.	3
Posterior descending	Branch running in the posterior interventricular sulcus	4 if from RCA 27 if from Cx
PL branches from RCA	Posterolateral branch originating from distal coronary artery distal to crux.	6 first PL 7 second PL 8 third PL

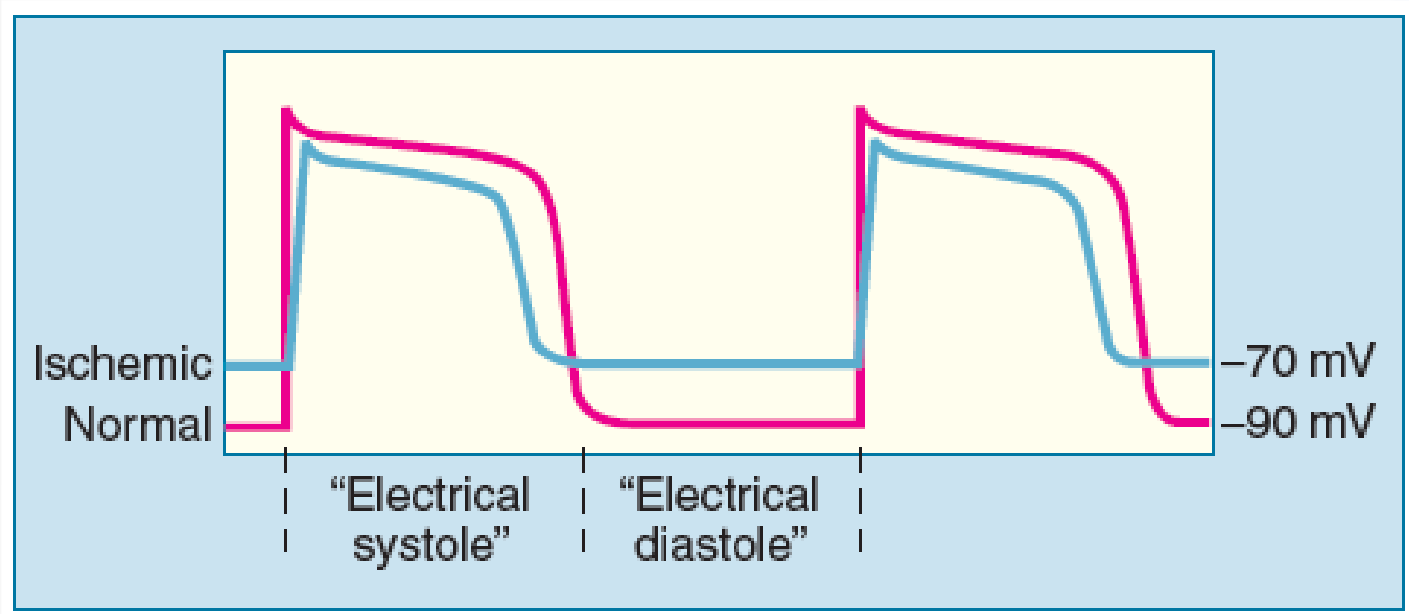
CASS, Coronary artery surgery study; *LAD,* left anterior descending artery; *RCA,* right coronary artery; *Cx,* circumflex artery; *RAO,* right anterior oblique; *OM,* obtuse marginal; *PL,* posterolateral.
Modified from www.syntaxscore.com.



Current of injury

- Deviation of the ST segment - earliest and most consistent ECG finding during acute severe ischemia

- Acute ischemia
  - reduction in resting membrane potential, duration of action potential and rate of rise and amplitude of phase 0 in the ischemic area


Ischemic
Normal
–70 mV
–90 mV
"Electrical systole"
"Electrical diastole"

- Voltage gradient between normal and ischemic zones that leads to current flow between these regions

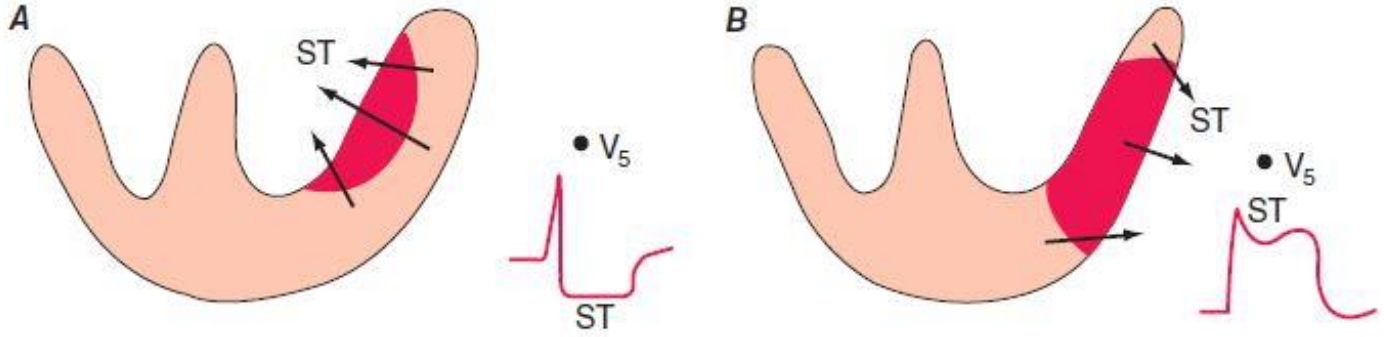


FIGURE 268-11 Acute ischemia causes a current of injury. With predominant subendocardial ischemia (***A***), the resultant ST vector will be directed toward the inner layer of the affected ventricle and the ventricular cavity. Overlying leads therefore will record ST depression. With ischemia involving the outer ventricular layer (***B***) (transmural or epicardial injury), the ST vector will be directed outward. Overlying leads will record ST elevation.

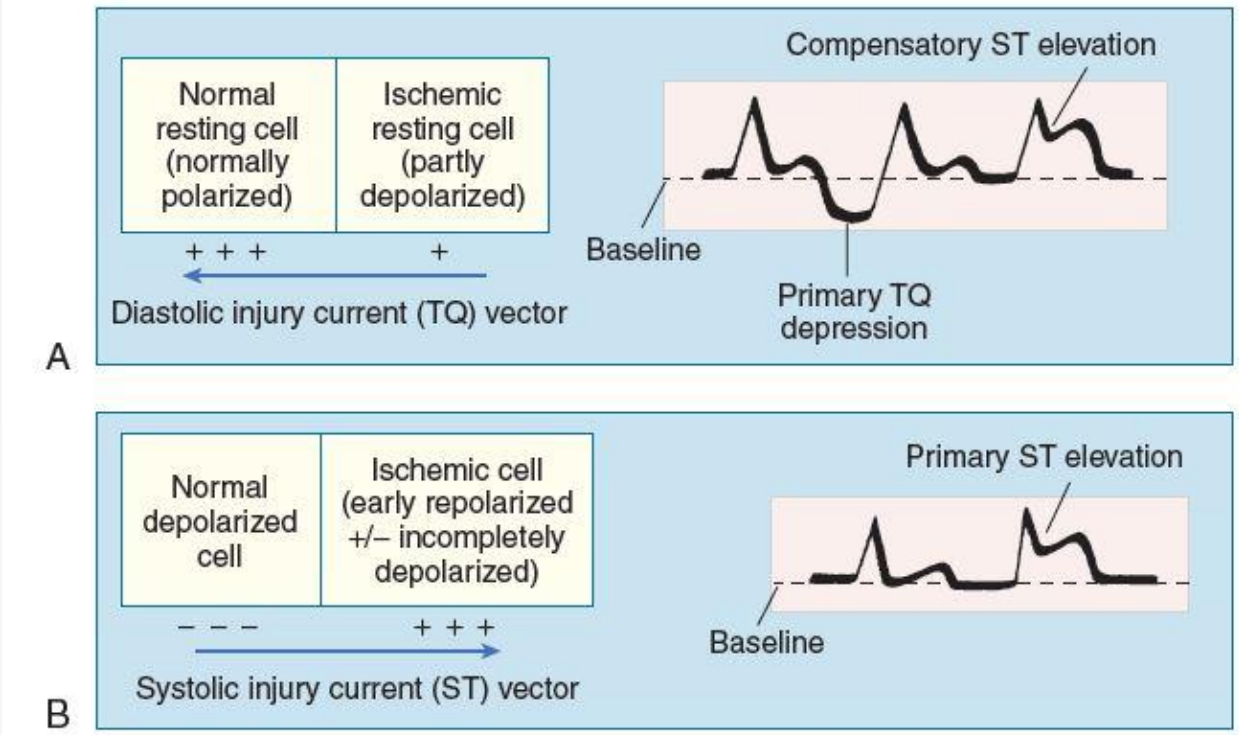
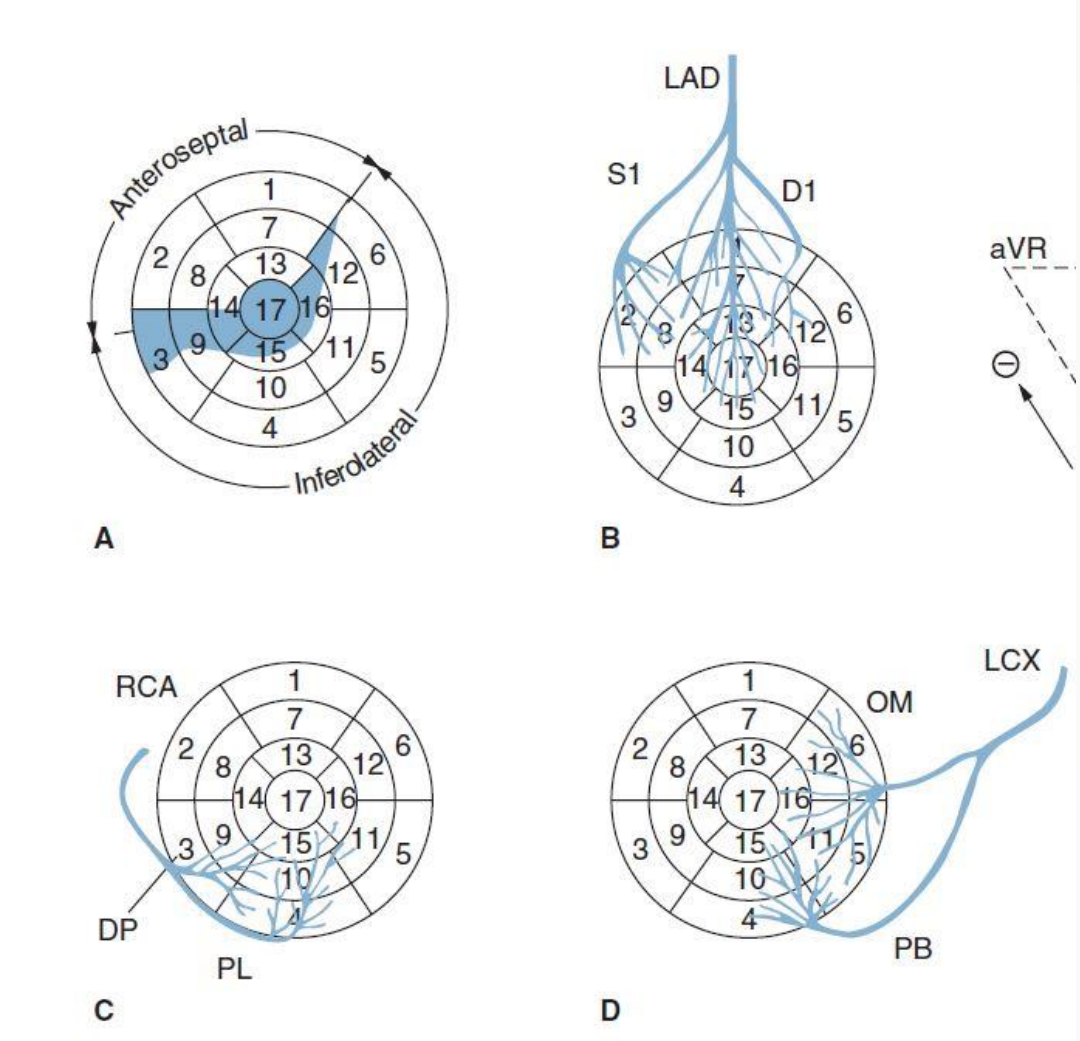


FIGURE 12.29 A simplified scheme of the pathophysiology of ischemic ST elevation. Two basic mechanisms have been advanced to explain the ST elevation seen with acute myocardial injury. **A,** Diastolic current of injury. In this case (first QRS-T complex), the ST vector will be directed away from the relatively negative, partly depolarized ischemic region during electrical diastole (TQ segment), and the result will be primary TQ depression. Conventional alternating current ECGs "compensate" for the baseline shift, and apparent ST-segment elevation (second QRS-T complex) results. **B,** Systolic current of injury. In this scenario, the ischemic zone will be relatively positive during electrical systole because the cells are repolarized early, and the amplitude and upstroke velocity of their action potentials may be decreased. This so-called systolic injury current vector will be oriented toward the electropositive zone, and the result will be primary ST-segment elevation. In clinical recordings, the contributions of diastolic and systolic injury currents to the observed ST-segment elevation cannot be determined (see text).

- Reciprocal ST-segment depression in leads reflecting contralateral surface of heart
- decreased R wave amplitude or Q waves
- posterior or lateral infarction - increase R wave amplitude in lead V1 and sometimes V2

- infarction size -
  - amount of ST segment elevation and depression
  - number of leads in which these changes are present

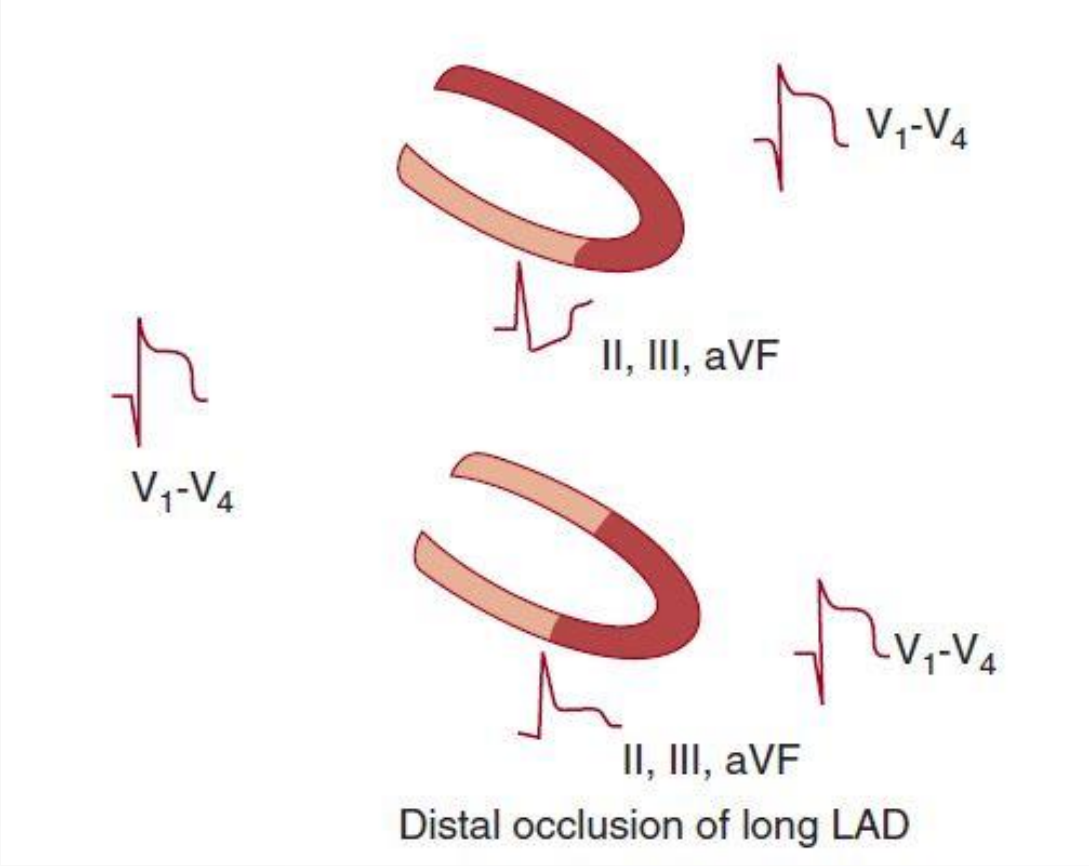

Anteroseptal
Inferolateral
1
7
13
12
6
2
8
14
17
16
3
9
15
11
5
10
4
A
LAD
S1
D1
aVR
B
RCA
DP
PL
C
LCX
OM
PB
D

AWMI
(Anteroseptal zone)

Types of LAD occlusion

- Proximal to 1st septal and 1st diagonal branch
- Distal to S and D
- Proximal to D1 but distal to S1
- Proximal to S1 but distal to D1
- Selective D1–D2occlusion
- Selective S1–S2 occlusion

- STE in V2, V3, V4
- Behaviour of ST in other leads depends on the presence of ischemia in three vectorally opposite areas
  - Basoseptal area (1st septal branch)
  - Basolateral area (1st diagonal branch)
  - Inferoapical area (when LAD wraps around apex)

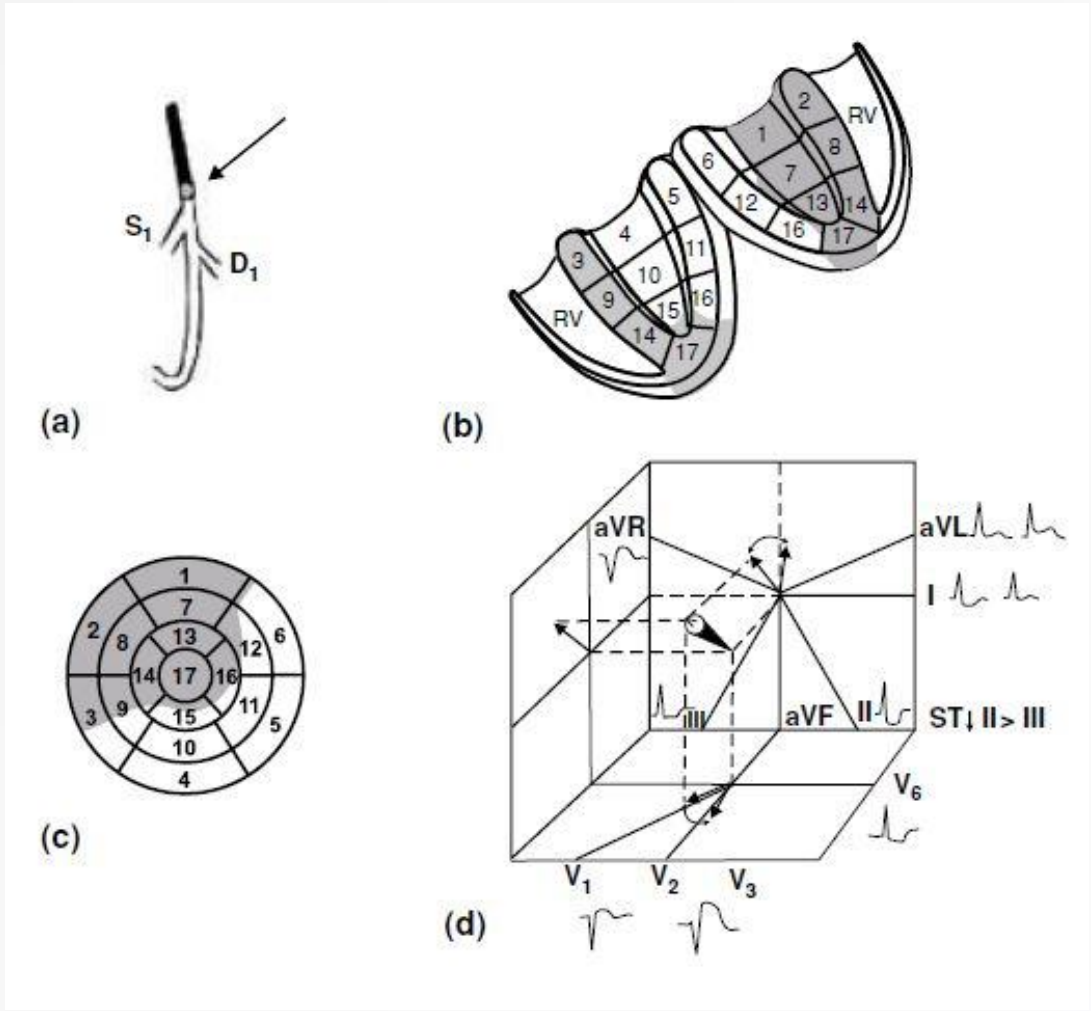


Distal occlusion of long LAD

Proximal LAD occlusion

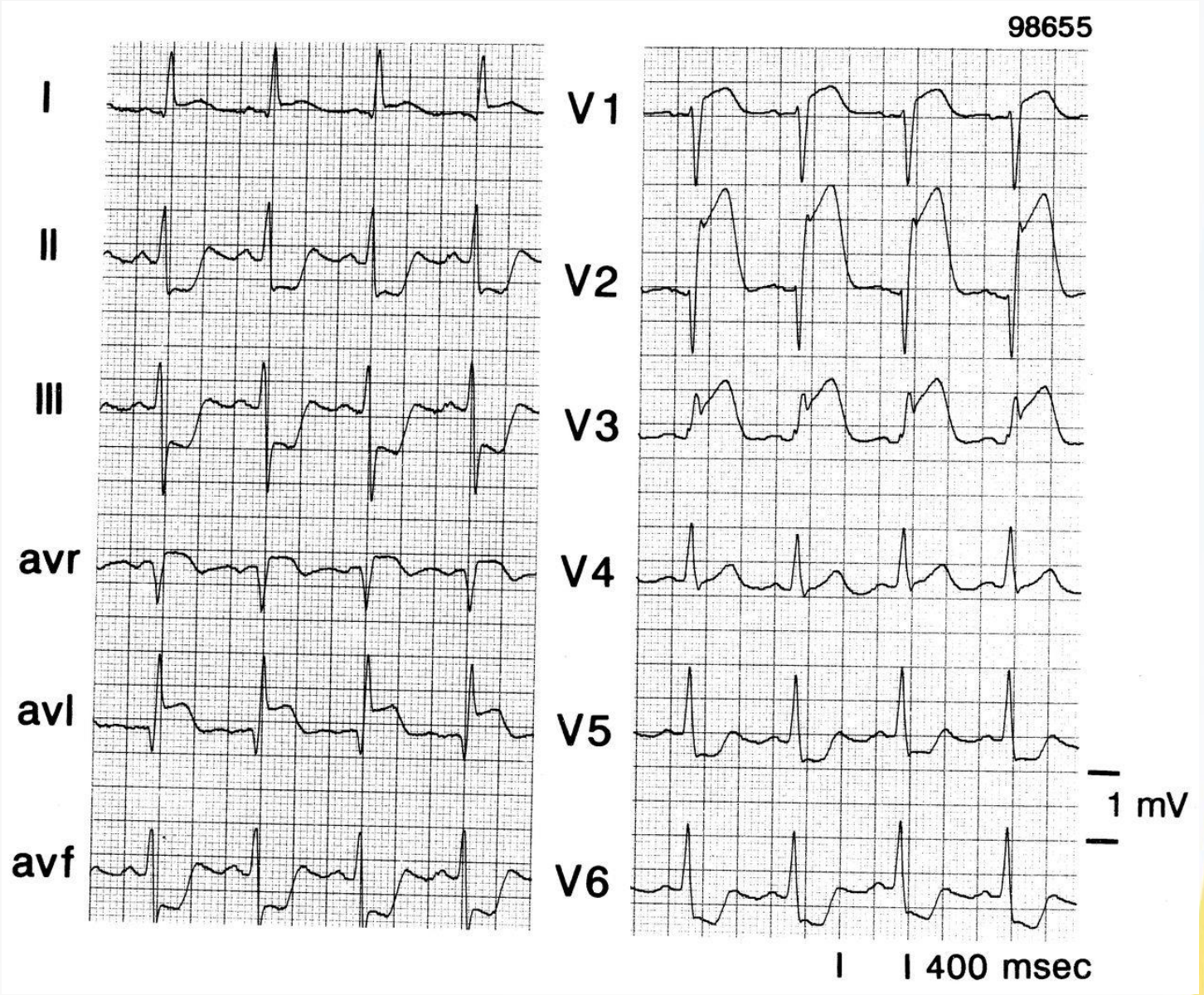
- Injury vector -
  - anteriorly and upward
  - to the right or the left,

    (depending on whether septal – the most frequent or lateral involvement predominates)
- ST-segment elevation from V1 to V4, and in aVR
- anterolateral area predominant - ST elevation also seen in aVL and I


S1
D1
(a)
RV
RV
(b)
(c)
aVR
aVL
I
III
aVF
II
ST↓ II> III
V6
V1
V2
V3
(d)

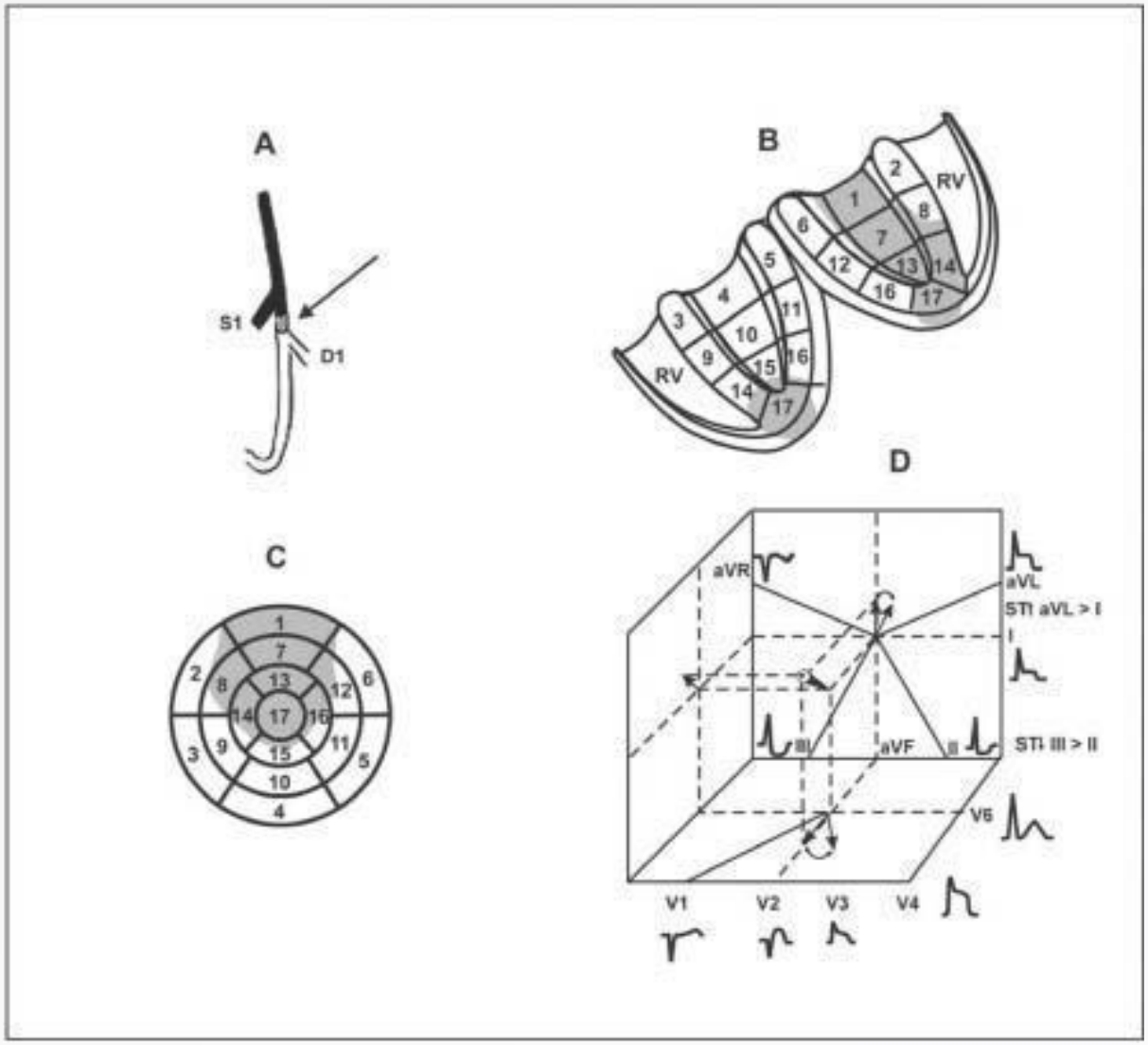
Proximal LAD occlusion (Dominance of Basal area)

- ST depression in the inferior wall (III +aVF ≥2.5 mm) is quite suggestive of a proximal occlusion of LAD above D1
- ST↑ aVR and V1 + ST↓ V6 > 0 : occlusion above S1
- STE aVR and STE in V1 ≥ 2.5 mm
- ST depression in inferior leads and in V5
- Abnormal Q in aVL


98655
I
II
III
avr
avl
avf
V1
V2
V3
V4
V5
V6
1 mV
400 msec

Occlusion proximal to D1 branch but distal to the S1 branch

injury vector is directed anteriorly, upward, and somewhat to the left

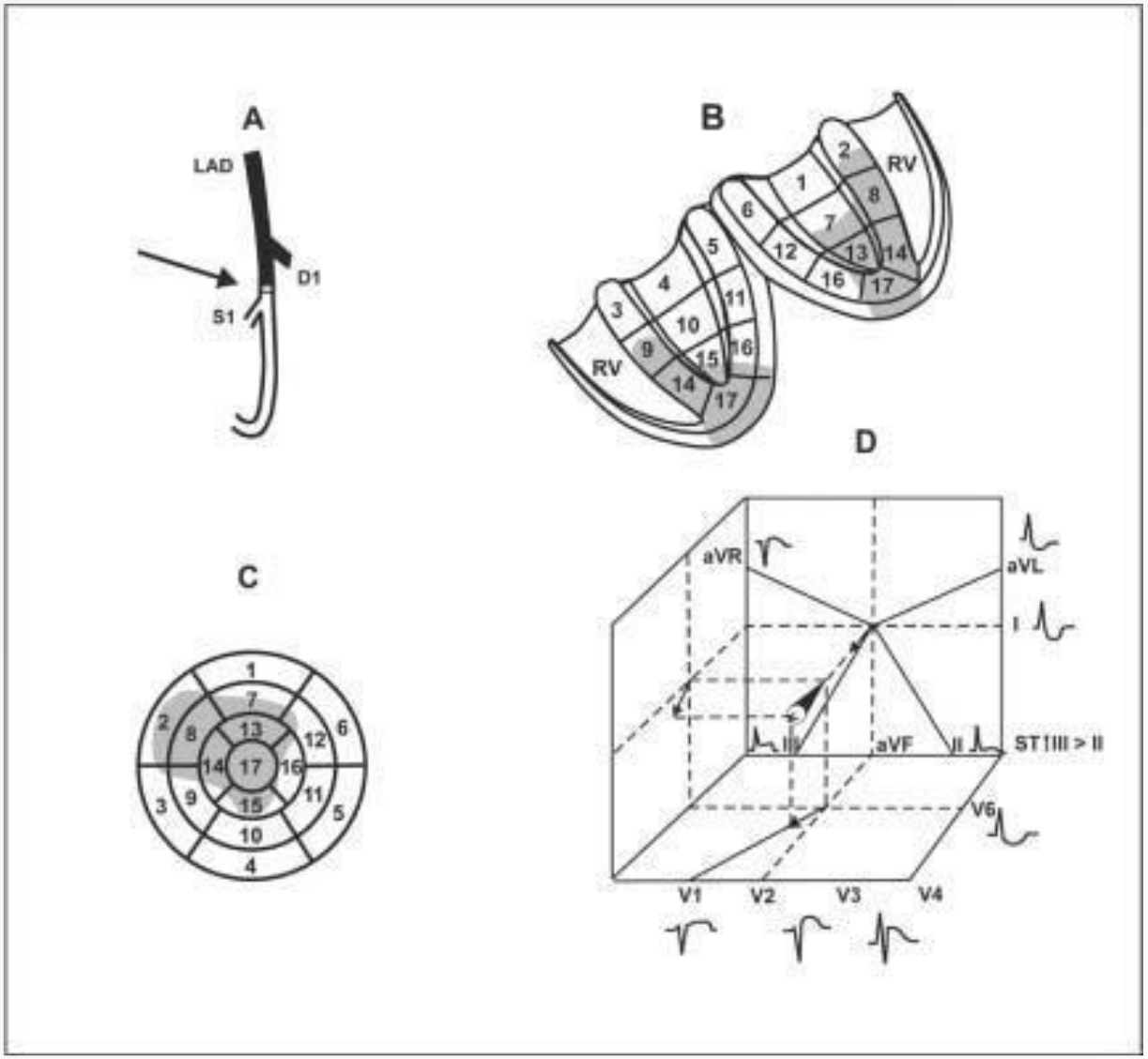

A
S1
D1
B
RV
RV
C
D
aVR
aVL
STI aVL > I
I
III
aVF
II
STI III > II
V6
V1
V2
V3
V4

- ST-segment elevation from V2−3 to V5−6 but not usually in V1
- ST elevation in lead I and especially in aVL
- ST-segment depression in the inferior leads (III+aVF≥2.5mm)
- ST depression in III > II

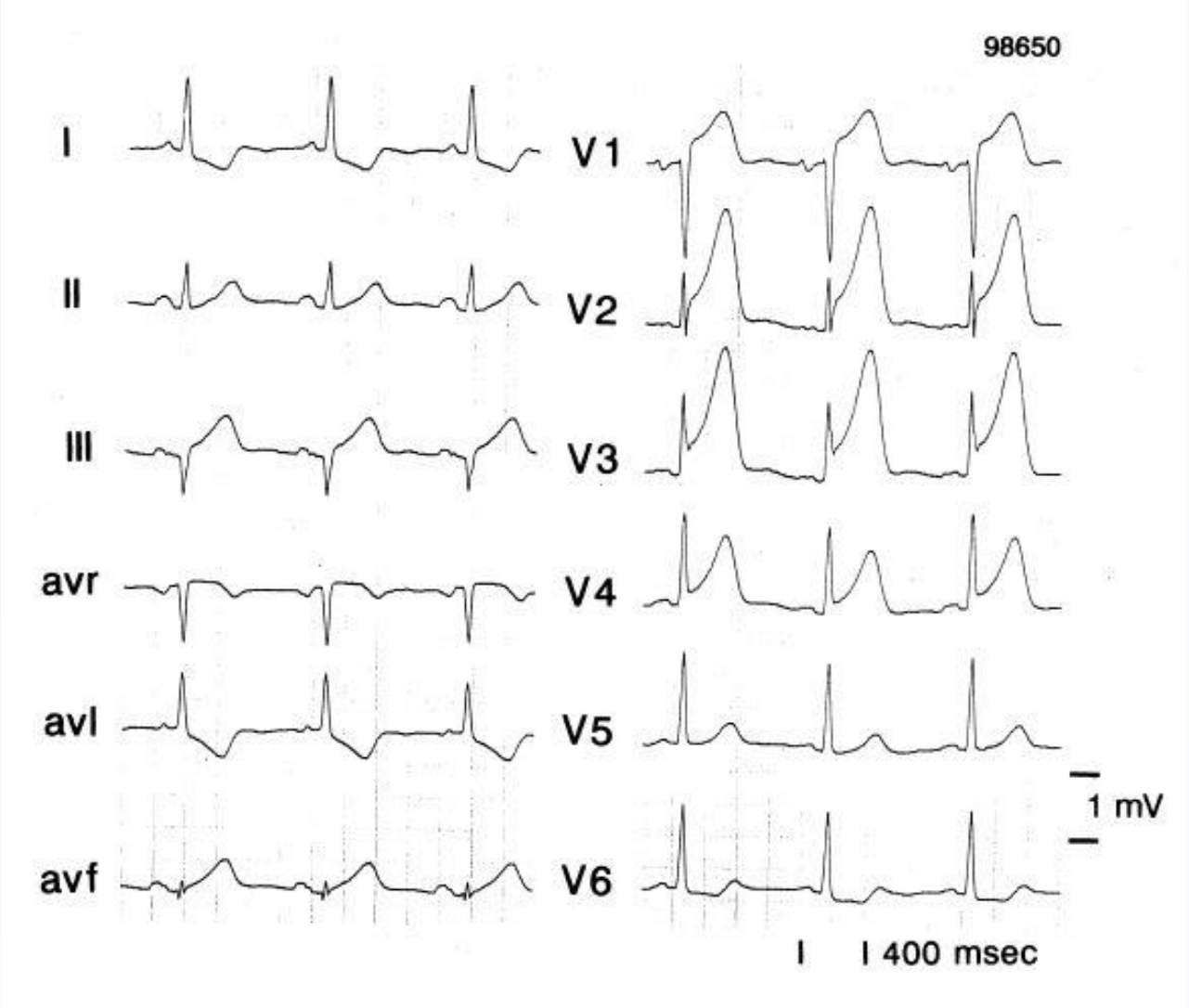

98653
I
II
III
avr
avl
avf
V1
V2
V3
V4
V5
V6
1 mV
400 msec

Occlusion proximal to the S1 branch but distal to the D1 branch

injury vector is directed anteriorly, to the right (and sometimes downward, especially if the LAD is long and wraps around the apex)

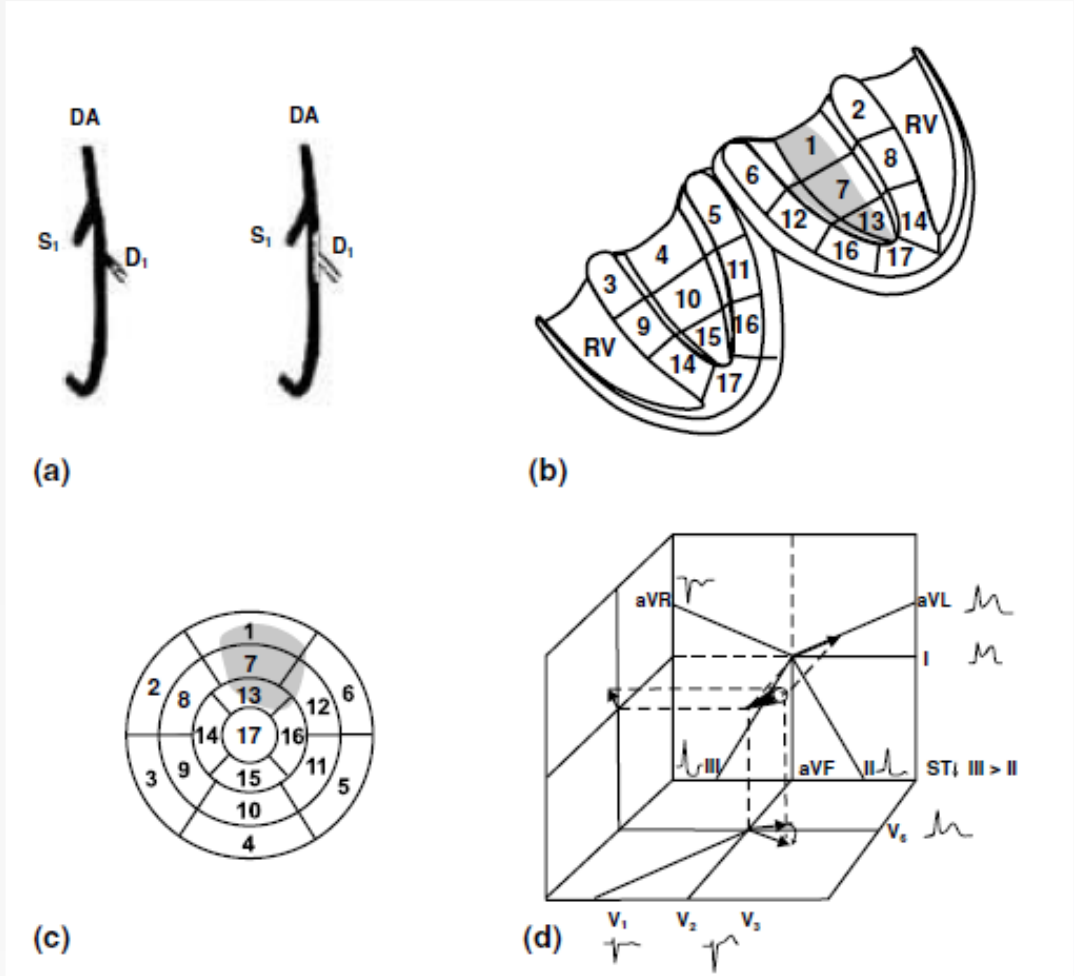

A
LAD
D1
S1
B
RV
RV
C
D
aVR
aVL
I
II
aVF
II
ST↑III > II
V6
V1
V2
V3
V4

- ST-segment elevation from V1 to V4
- isoelectric or elevated ST-segment in the inferior leads (III than in II)
- ST-segment depression in V6 and aVL (highly specific)
- STE in V3R

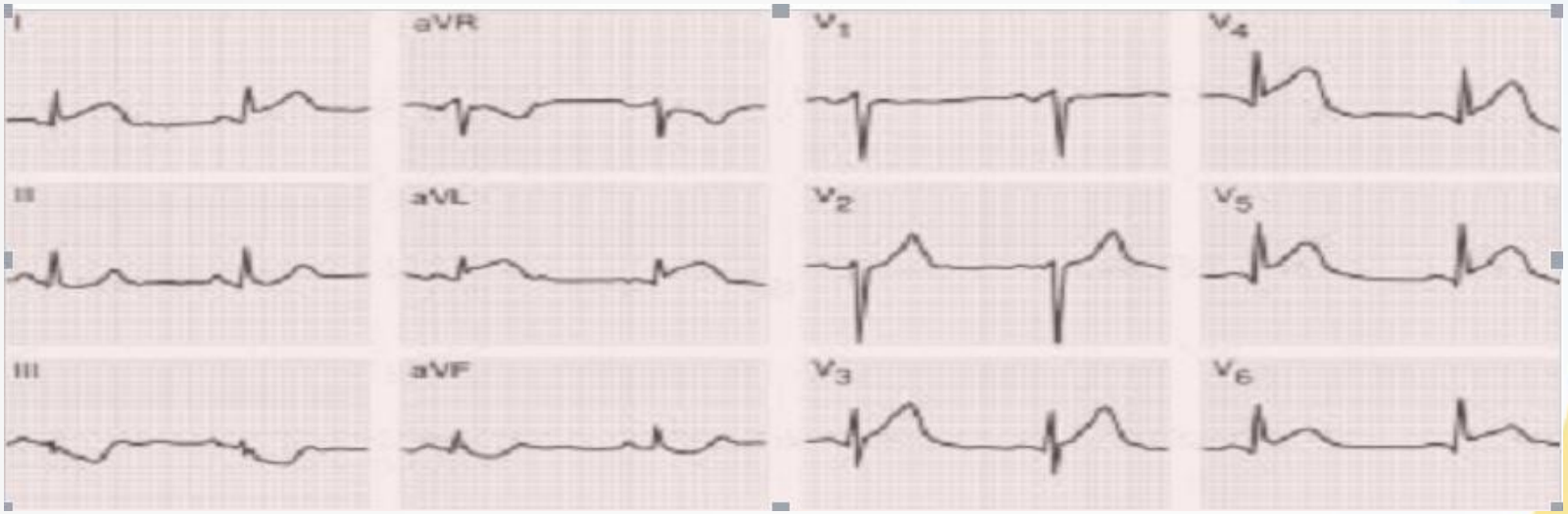

98650
I
II
III
avr
avl
avf
V1
V2
V3
V4
V5
V6
1 mV
1 400 msec

selective occlusion of the D1 branch

injury vector is directed upward, to the left and forward

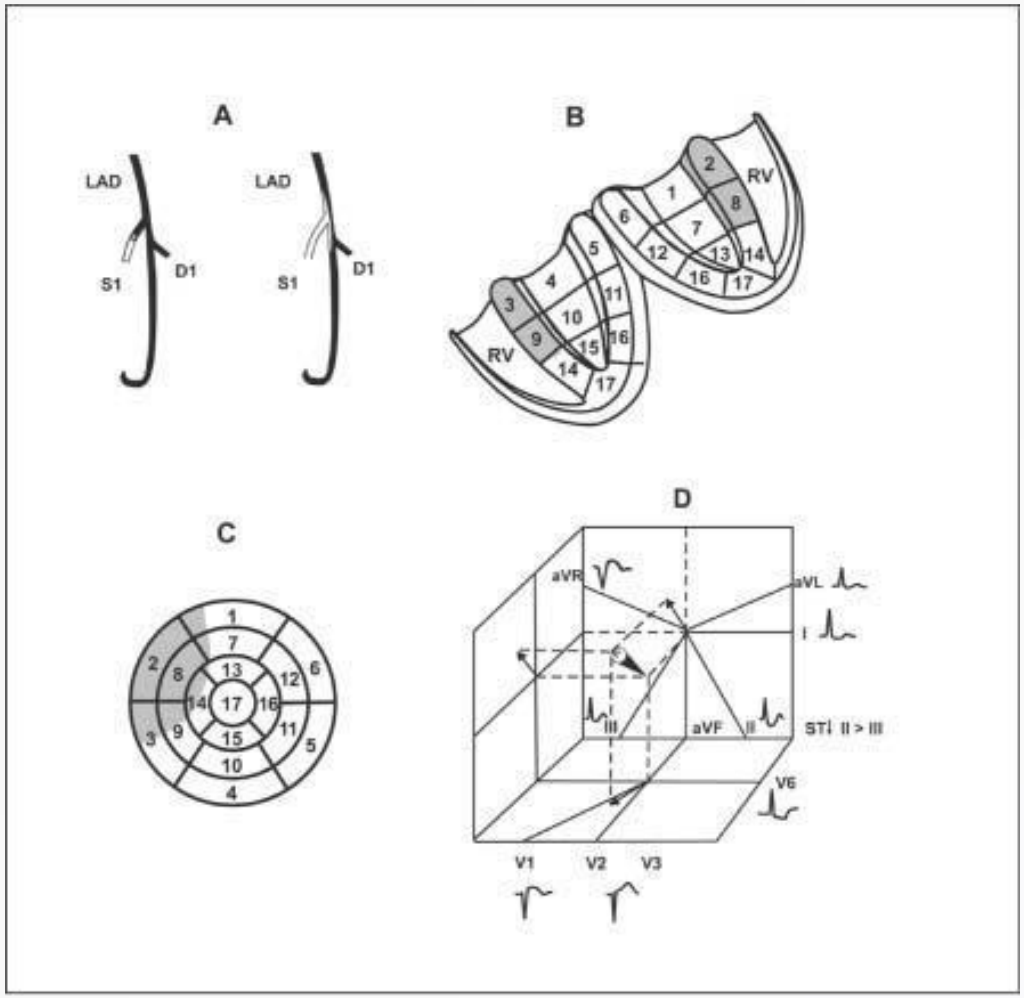

DA
DA
S1
D1
S1
D1
(a)
RV
RV
(b)
(c)
aVR
aVL
I
III
aVF
II
STI III > II
V6
V1
V2
V3
(d)

- ST-segment elevation in I, aVL
- ST-segment elevation in V2−3 to V5−6
- ST-segment depression in II, III, and VF (III > II)

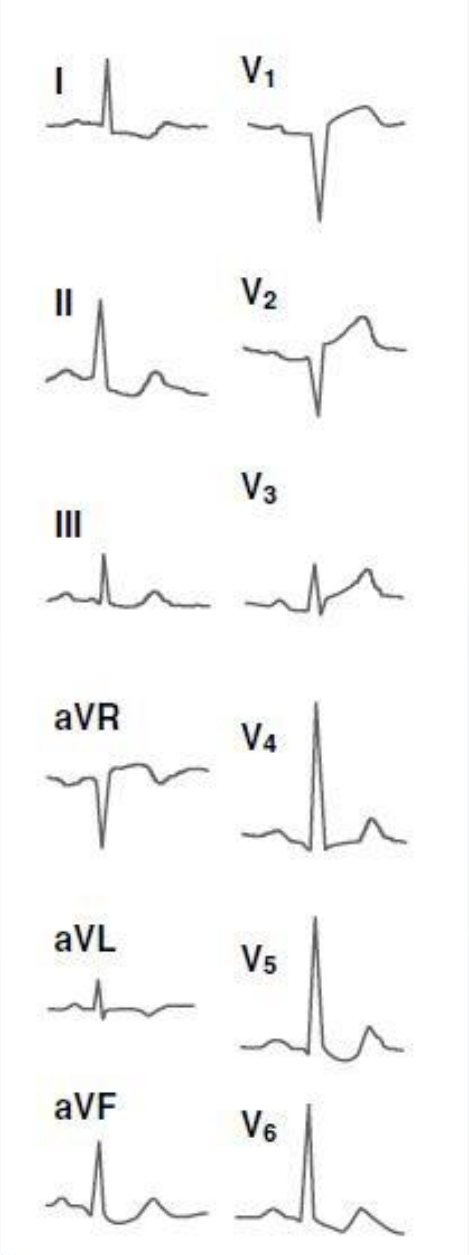

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

selective occlusion of the S1 branch

injury vector is directed anteriorly,upward, and to the right


A
LAD
S1
D1
LAD
S1
D1
B
RV
RV
C
D
aVR
aVL
I
III
aVF
II
ST↓ II > III
V6
V1
V2
V3

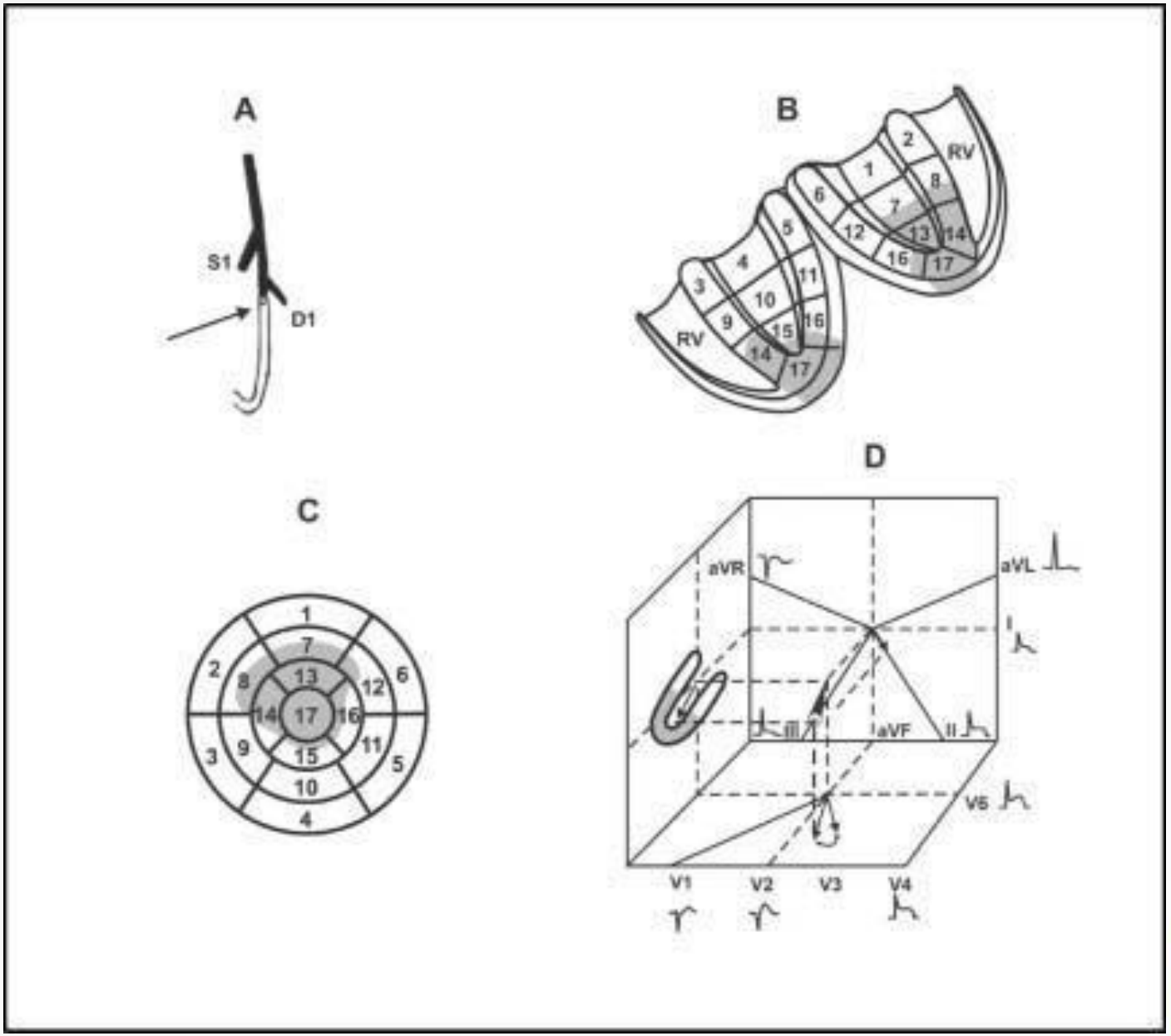
- ST-segment elevation in V1, V2, and aVR
- ST depression in II, III,aVF(II>III)
- lack of ST elevation in aVL



Occlusion distal to the S1 and D1 branches

injury vector is directed anteriorly and often rather to the left (to the apex), but not upward

Long LAD: injury vector directed downward


A
S1
D1
B
RV
RV
C
D
aVR
aVL
I
III
aVF
II
V5
V1
V2
V3
V4

- STsegment elevation fromV2−3 toV4−6 but not inV1
- slight ST-segment depression in aVR and elevation in II, III, and VF (II > III)

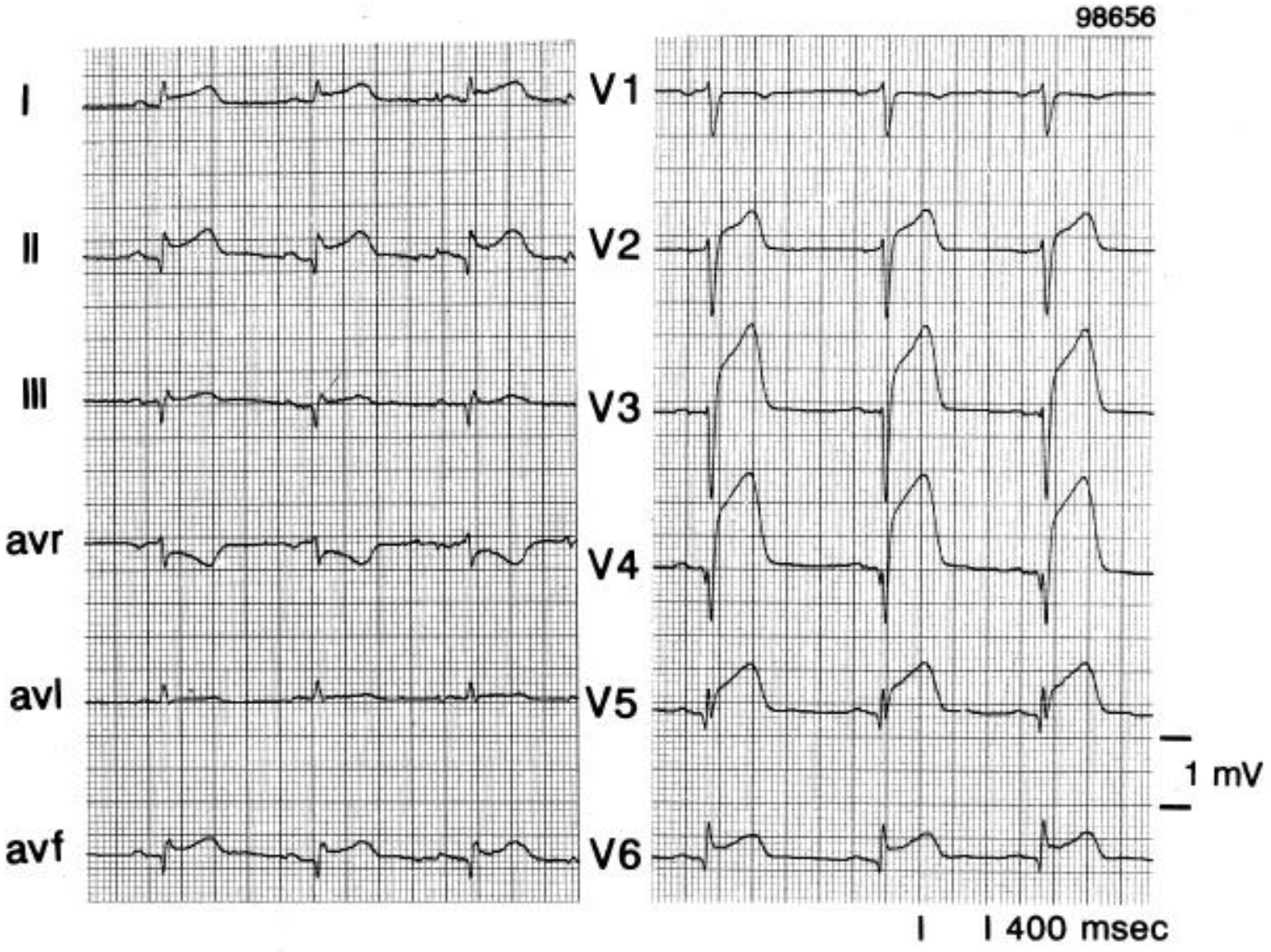

98656
I
II
III
avr
avl
avf
V1
V2
V3
V4
V5
V6
1 mV
I 400 msec

Table 2 ST elevation in precordial leads (especially V_1 to V_{3-4}) and inferior leads (II, III, VF).

Leads	*RCA (proximal RCA)*	*LAD*[†]
V_1 to V_{3-4}	Usually ST↑ ($V_1 > V_{3-4}$)*	Usually ST↑ ($V_{3-4} > V_1$)
Inferior leads	Usually ST↑ greater than that in precordial leads	ST↑ usually much lesser than that in precordial leads
I and aVL	ST depresssion (usually the sum $\geq$ 5 mm)	Usually not ST depression especially in I

* In exceptional cases of very dominant RCA occluded proximally, the ST elevation may be seen in all the precordial leads. In V_1 to V_{3-4} due to proximal occlusion and in V_{5-6} due to very dominant RCA (local injury vector) (see Figure 28 and Case 12).

† Distal occlusion of long LAD or distal occlusion of LAD + total occlusion of RCA with colateral vessels.

Table 4. Electrocardiographic Predictors of LAD Occlusion Site

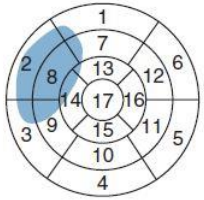
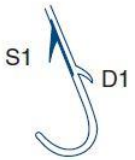
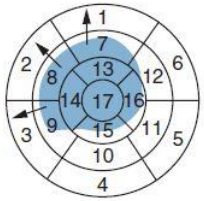
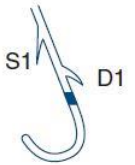
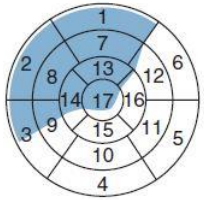
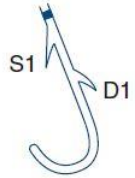
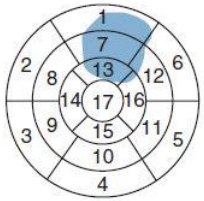
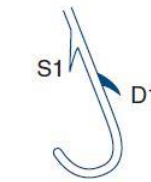
$ST\uparrow_{V1}$ >2.5 mm	proximal to S1
cRBBB	proximal to S1
$ST\uparrow_{aVR}$	proximal to S1
$ST\downarrow_{V5}$	proximal to S1
Q_{aVL}	proximal to D1
Inferior $ST\downarrow$ ≥1.0 mm	proximal to S1/D1
$Q_{V4–6}$	distal to S1
$ST\downarrow_{aVL}$	distal to D1
Absence of inferior $ST\downarrow$	distal to S1/D1

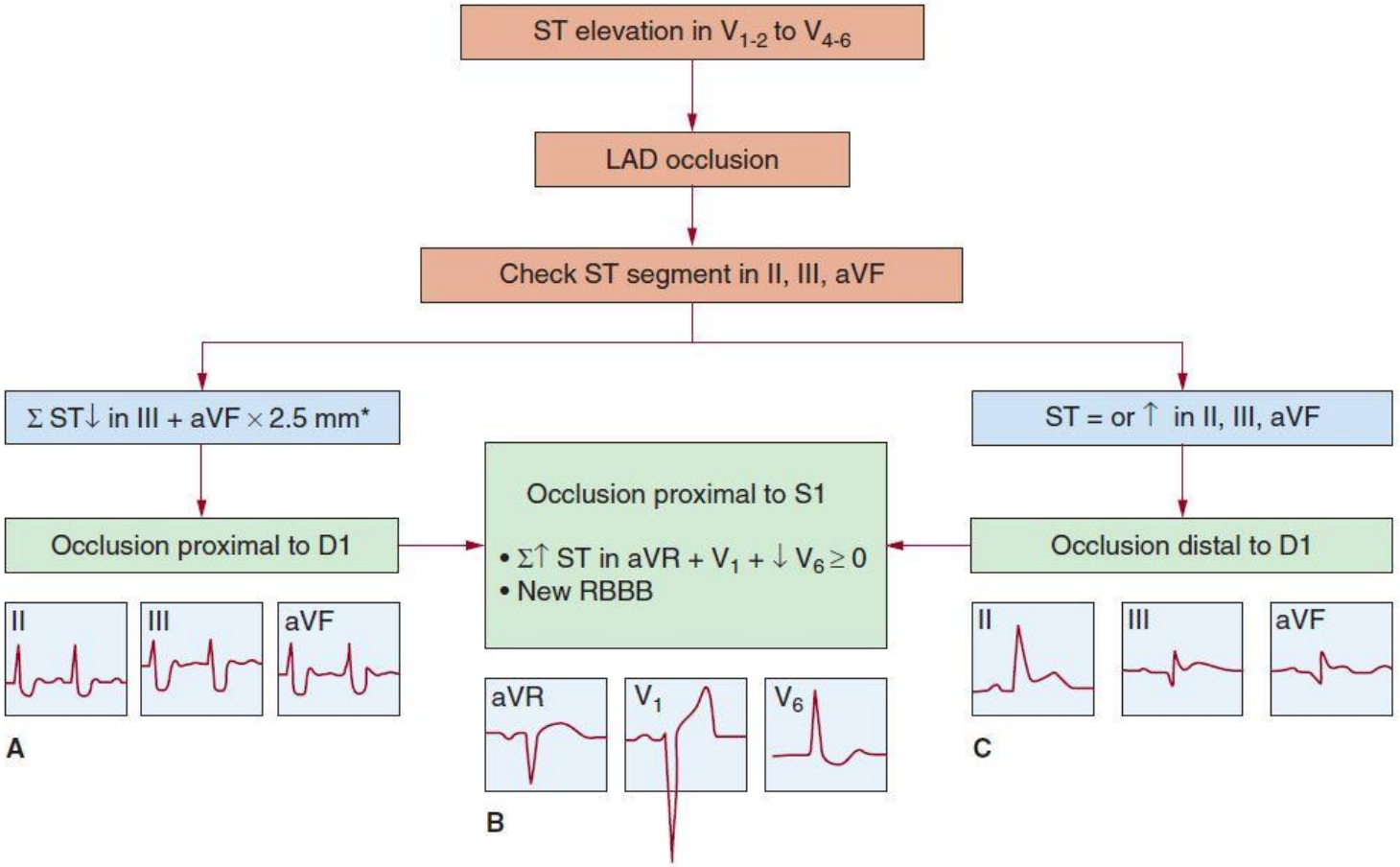
a Most prominent pattern of **ST elevation in precordial leads I and aVL*** **(anteroseptal zone)**

Occluded artery	*Injured myocardial area (see Figure 7)*	*Leads with ST changes*
1. LAD occlusion proximal to D_1 and S_1	Extensive anteroseptal zone (especially 1, 2, 7, 8, 13, 14, 16, and 17 segments)	• ST↑ in V_1 to V_{4-5} and aVR • ST↓ in II, III, aAVF, and often V_{5-6}
2. LAD occlusion proximal to D_1 but distal to S_1	Anteroseptal or extensive anterior (especially 1, 7, 13, 14, 16, and 17 segments)	• ST↑ in V_2 to V_{5-6}, I, VL • ST ↓ in II, III, and aVF
3. LAD occlusion distal to D_1 and S_1	Apical (especially 13, 14, 15, 16, 17, and part of 7 and 8 segments)	• ST↑ in V_2 to V_{4-5} • ST↑ or = in II, III, and aVF If LAD is short less evident changes

a Most prominent pattern of **ST elevation in precordial leads I and aVL*** **(anteroseptal zone)**

Occluded artery	*Injured myocardial area (see Figure 7)*	*Leads with ST changes*
4. LAD occlusion proximal to S_1 but distal to D_1	Anteroseptal (especially 2, 8, 13, 14, 15, 16, and 17 segments)	• ST↑ in V_1 to V_4, V_5, and aVR • ST↑ or = in II, III, and aVR • ST↓ in V_6
5. LAD subocclusion including D_1 but not S_1, or selective D_1 occlusion	Anterolateral limited (especially 7, 13, 12, and part of 1 and 16 segments)	• ST↑ in I, aVL, and sometimes V_2–V_{5-6} • ST↓ in II, III, aVF (III > II)
6. LAD subocclusion including S_1 but not D_1, or selective S_1 occlusion	Septal (especially 2, 8, and sometimes part of 1, 3, 9, 14 segments)	• ST↑ in V_{1-2}, aVR • ST↓ in I, II, III, aVF, V_6 (II > III)

	Name	Type	ECG pattern	Infarction area (CE-CMR)	Most probable place of occlusion
Anteroseptal zone	Septal	A1	Q in V_1-V_2 SE: 100% SP: 97%		LAD 
	Apical anterior	A2	Q in V_1-V_2 to V_3-V_6 SE: 85% SP: 98%		LAD 
	Extensive anterior	A3	Q in V_1-V_2 to V_4-V_6, I and aVL SE: 83% SP: 100%		LAD 
	Mid-anterior	A4	Q (qs or qr) in aVL (I) and sometimes in V_2-V_3 SE: 67% SP: 100%		LAD 

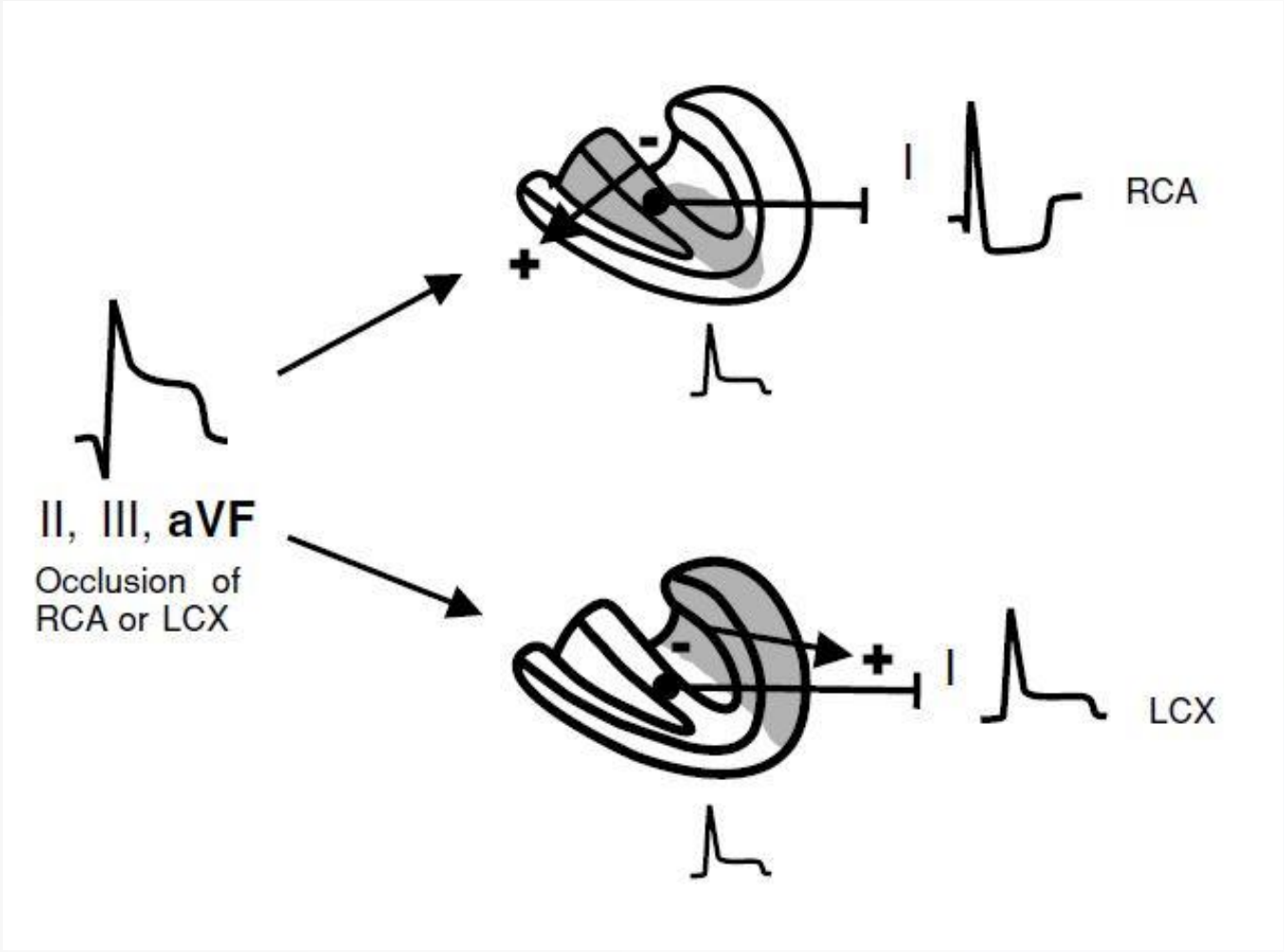


* Cases with ST depression < 2.5 mm are difficult to classify in respect to D1, but if Σ↑ ST aVR + V_1 + ↓ ST V_6 < 0, are usually distal to S1.

FIGURE 12–59. Algorithm to precisely locate the left anterior descending (LAD) occlusion in the case of an evolving myocardial infarction with ST elevation in precordial leads (see the text for details).

IWMI

(Inferolateral zone)


II, III, aVF
Occlusion of
RCA or LCX
-
+
I
RCA
-
+
I
LCX

- RCA occlusion proximal to the RV branches
- RCA occlusion distal to the RV branches
- Very dominant RCA occlusion

- LCX occlusion proximal to first OM branches
- First OM occlusion
- Very dominant LCX occlusion

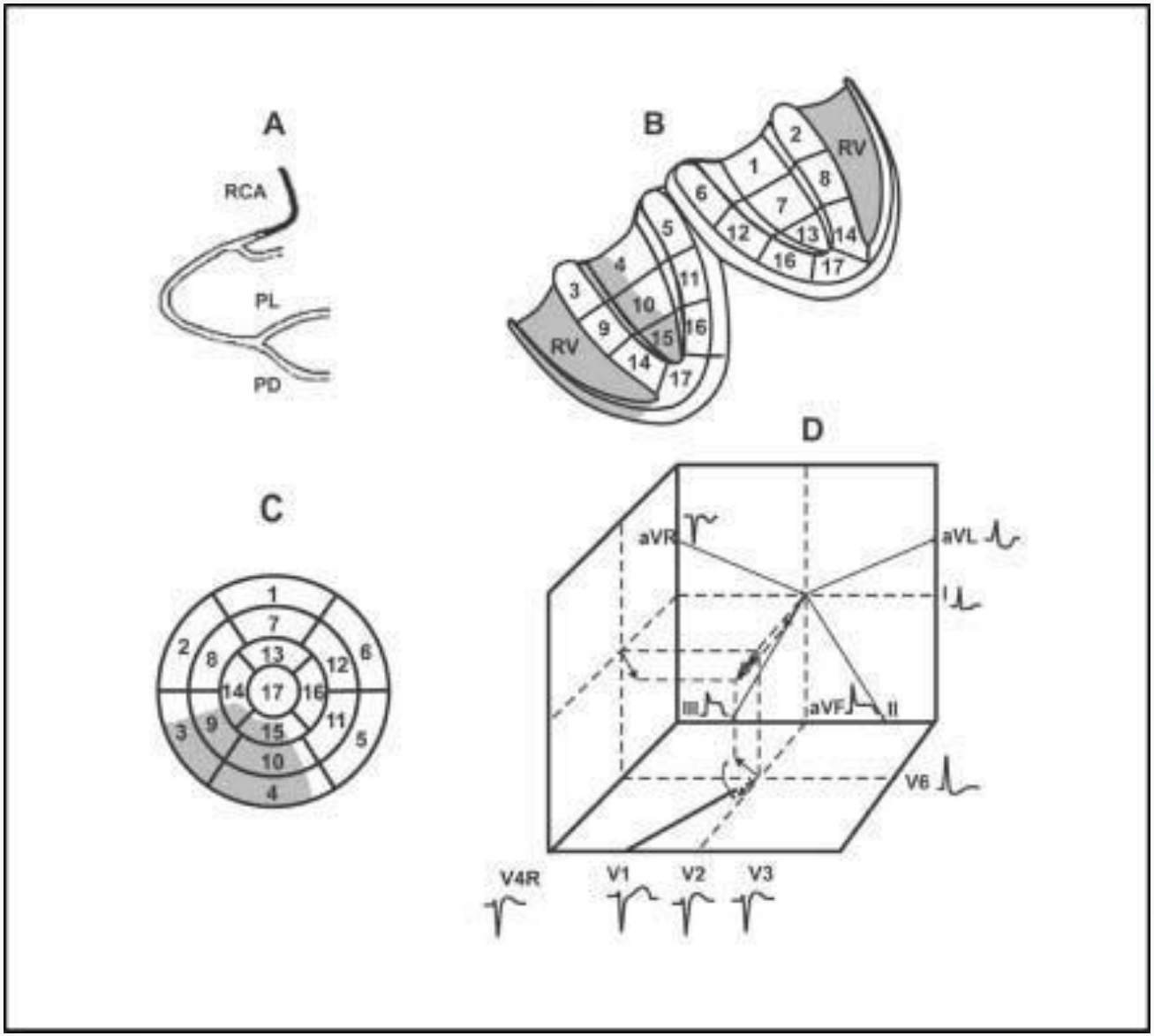
Right coronary	Circumflex coronary
Inferoseptal ischemia	Inferoposterolateral ischemia
Vector directed to III	Directed to II
STE III > II	STE II > III
ST depression in aVL>I	STE I or aVL or both
RV can be involved	True PWMI can occur

V5 and V6 are of little value in differentiating between RCA or Cx occlusion. STE in these leads implies a larger area at risk

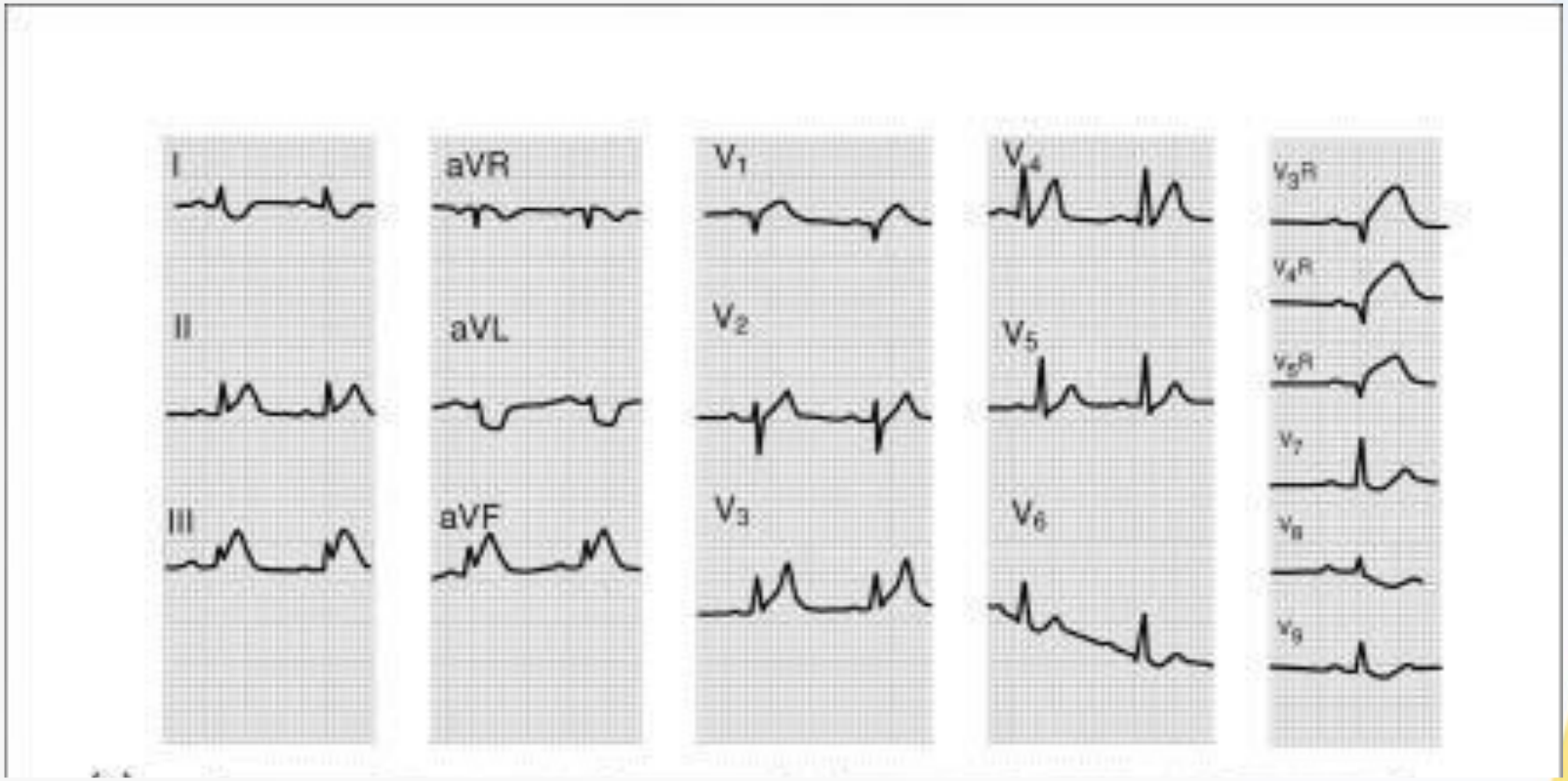
- In case of LCX occlusion posterior wall involvement is almost obligatory
- Absence of precordial ST depression in inferior wall infarction is therefore strongly suggestive of RCA involvement

RCA occlusion proximal to the RV branches

- injury vector always directed downward, posteriorly, and to the right

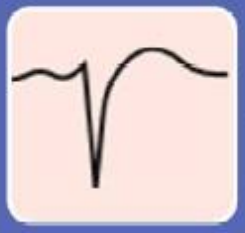

A
RCA
PL
PD
B
RV
RV
C
D
aVR
aVL
I
III
aVF
II
V6
V4R
V1
V2
V3

- ST-segment elevation in II, III, and aVF (III>II)
- ST-segment depression in V6, I, and aVL (aVL > I)
- ST-segment depression in V1−3 is generally absent
- ST-segment elevation V3R and V4R
- V4R: distinguishing between occlusion of the RCA proximal to the RV branch from an occlusion of the RCA distal to the RV branch and from an occlusion of the LCX


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
V3R
V4R
V5R
V7
V8
V9

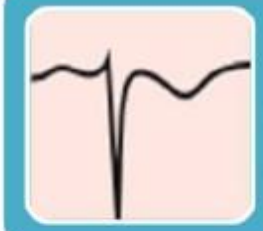
Proximal RCA Occlusion

- ST-elevation > 1 mm
- +ve T wave



Distal RCA Occlusion

- No ST-elevation
- +ve T wave

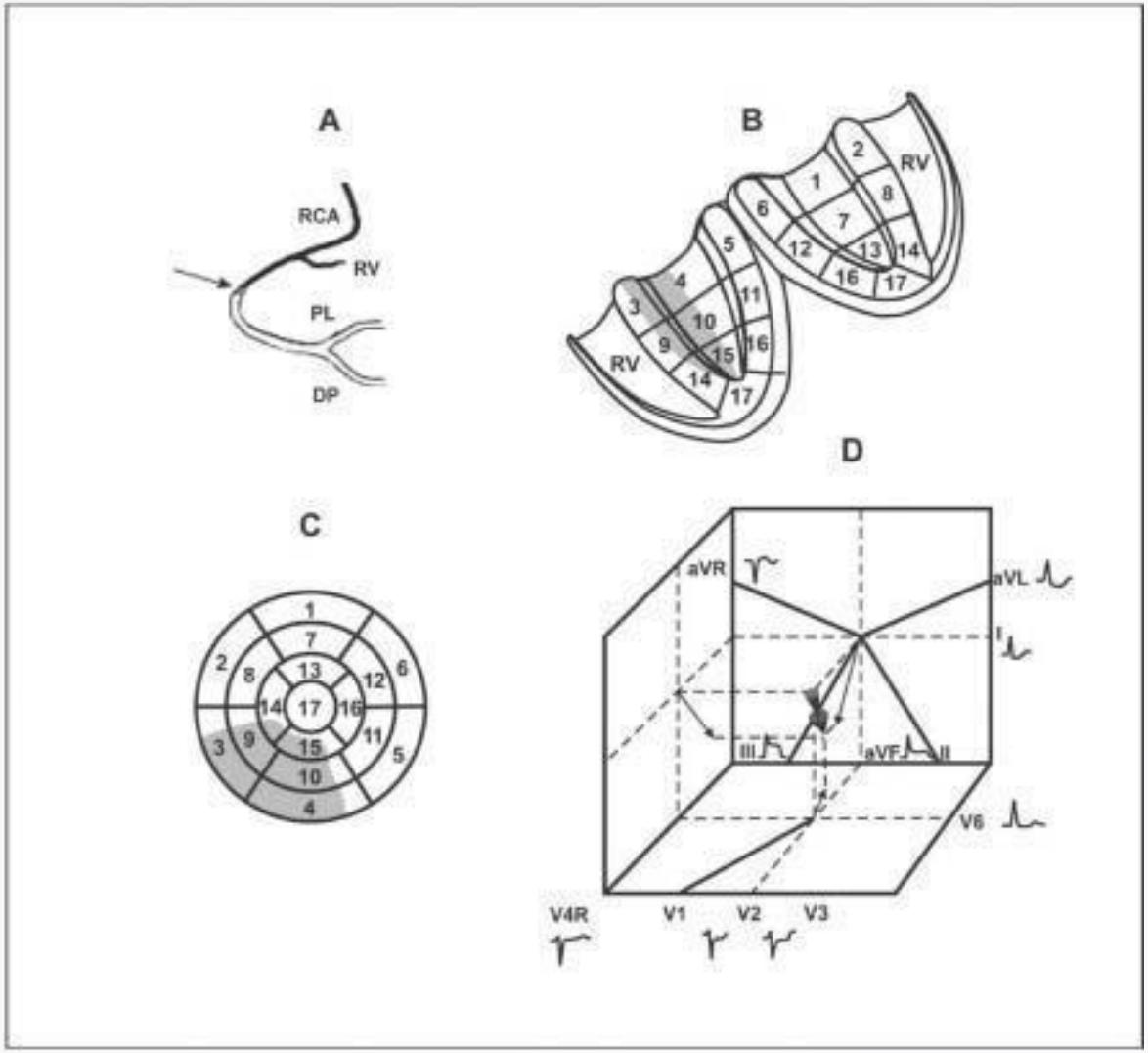


LCx Occlusion

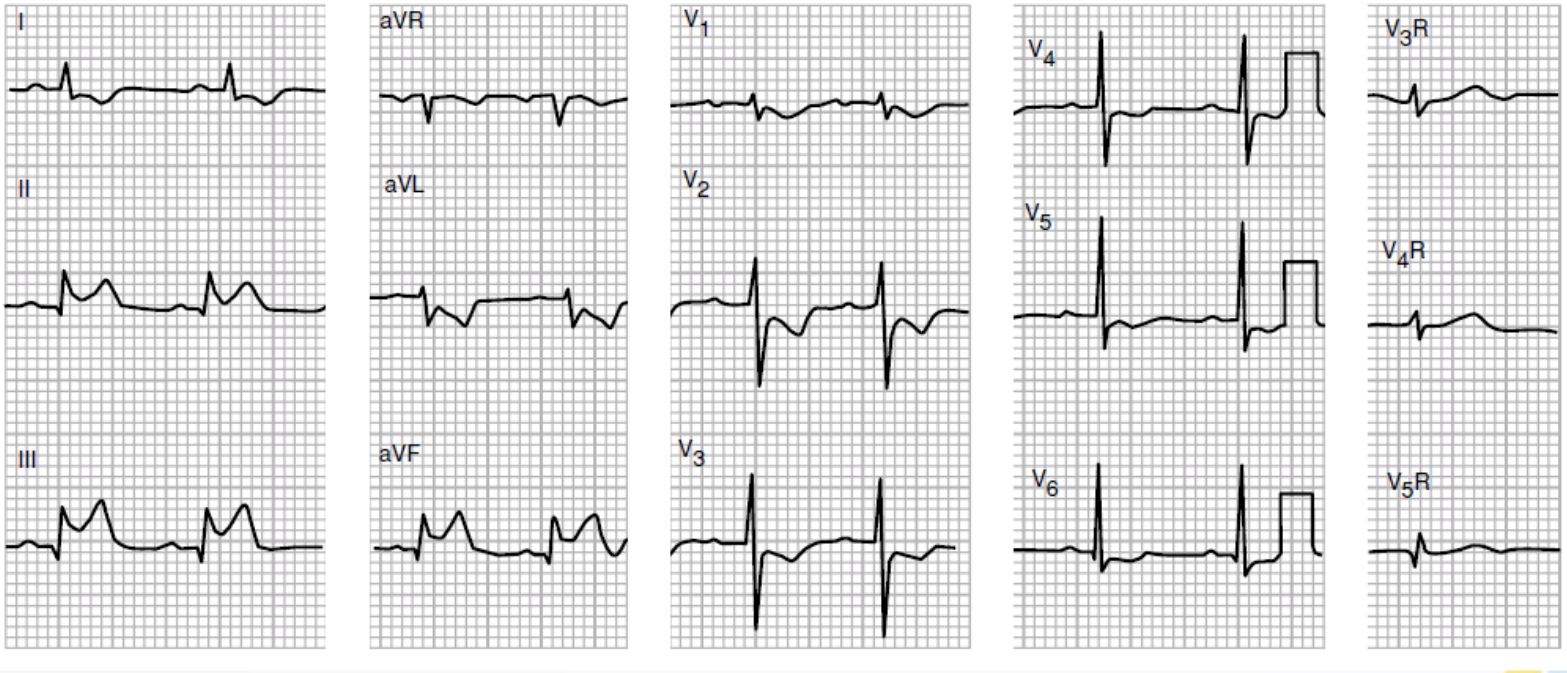
- ST-depression > 1 mm
- -ve T wave

RCA occlusion distal to the RV branches

- injury vector is directed downward, to the right (less so than occlusion proximal to the RV branches), and posteriorly (more downward than posteriorly)

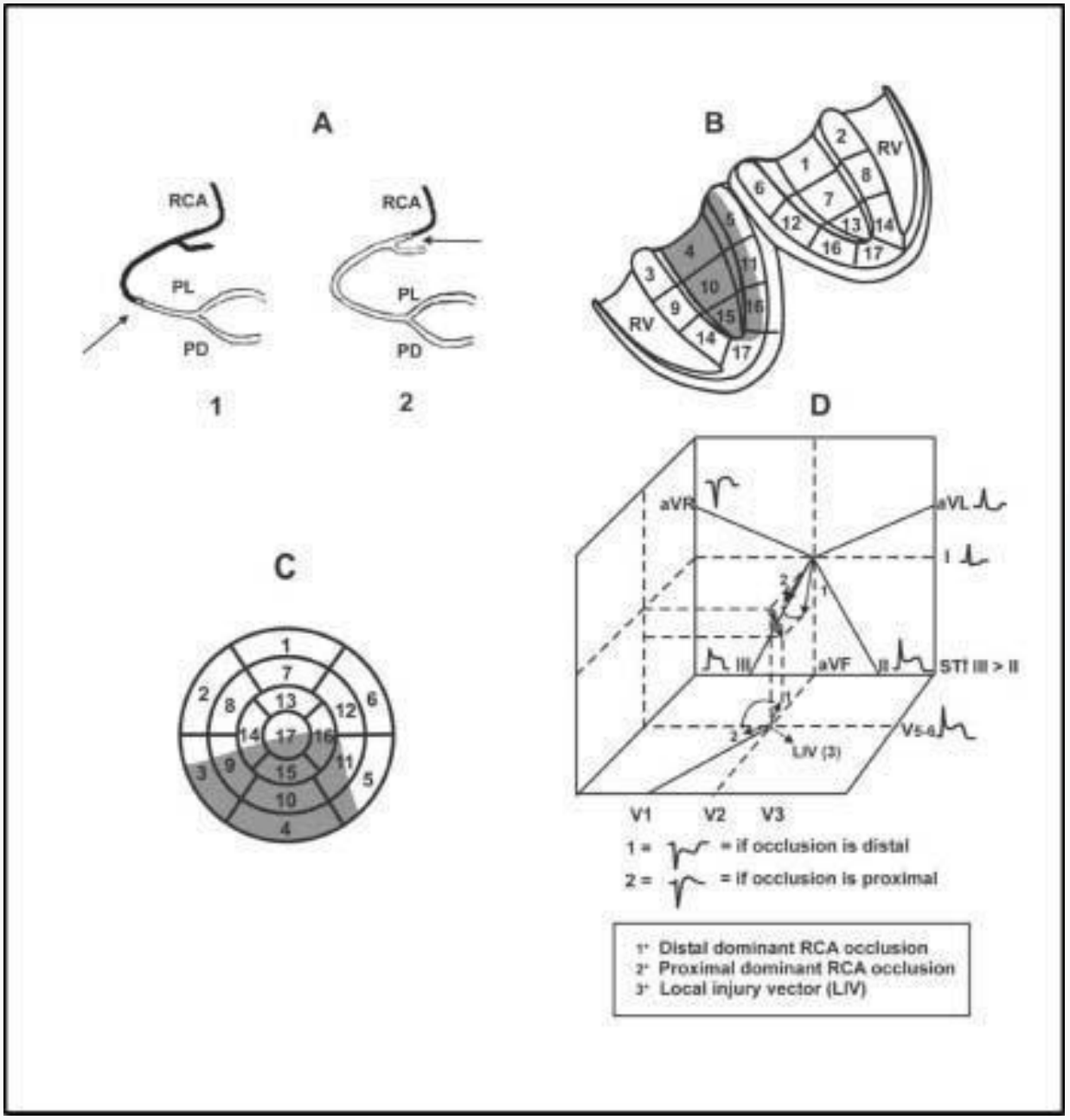

A
RCA
RV
PL
DP
B
RV
RV
C
D
aVR
aVL
I
III
aVF
II
V6
V4R
V1
V2
V3

- more ST-segment elevation in II, III, and VF (III > II) than ST-segment depression in V1−3
- ST-segment depression in lead V6, I, and even more in aVL

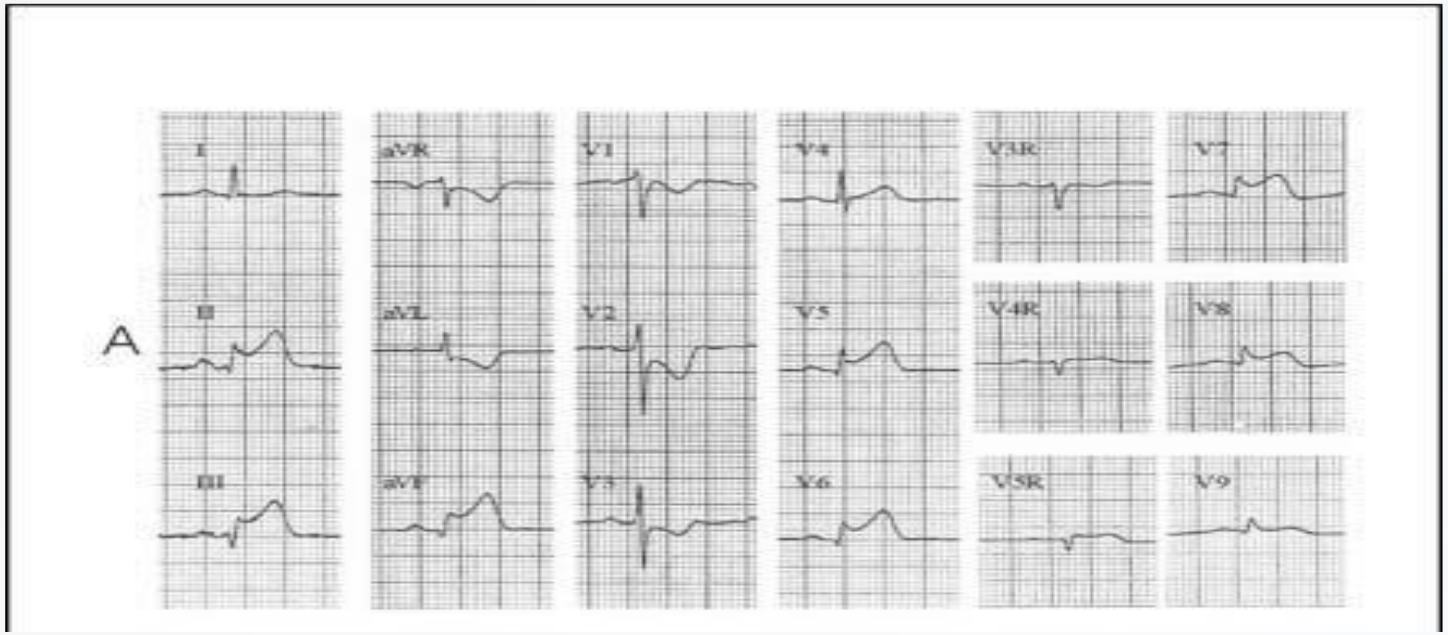

I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
V3R
V4R
V5R

Very dominant RCA occlusion

- injury vector is directed downward and posteriorly and to the right
- In presence of occlusion proximal to the RV branches, the injury vector more directed to right(may fall in the positive hemifield of V1)

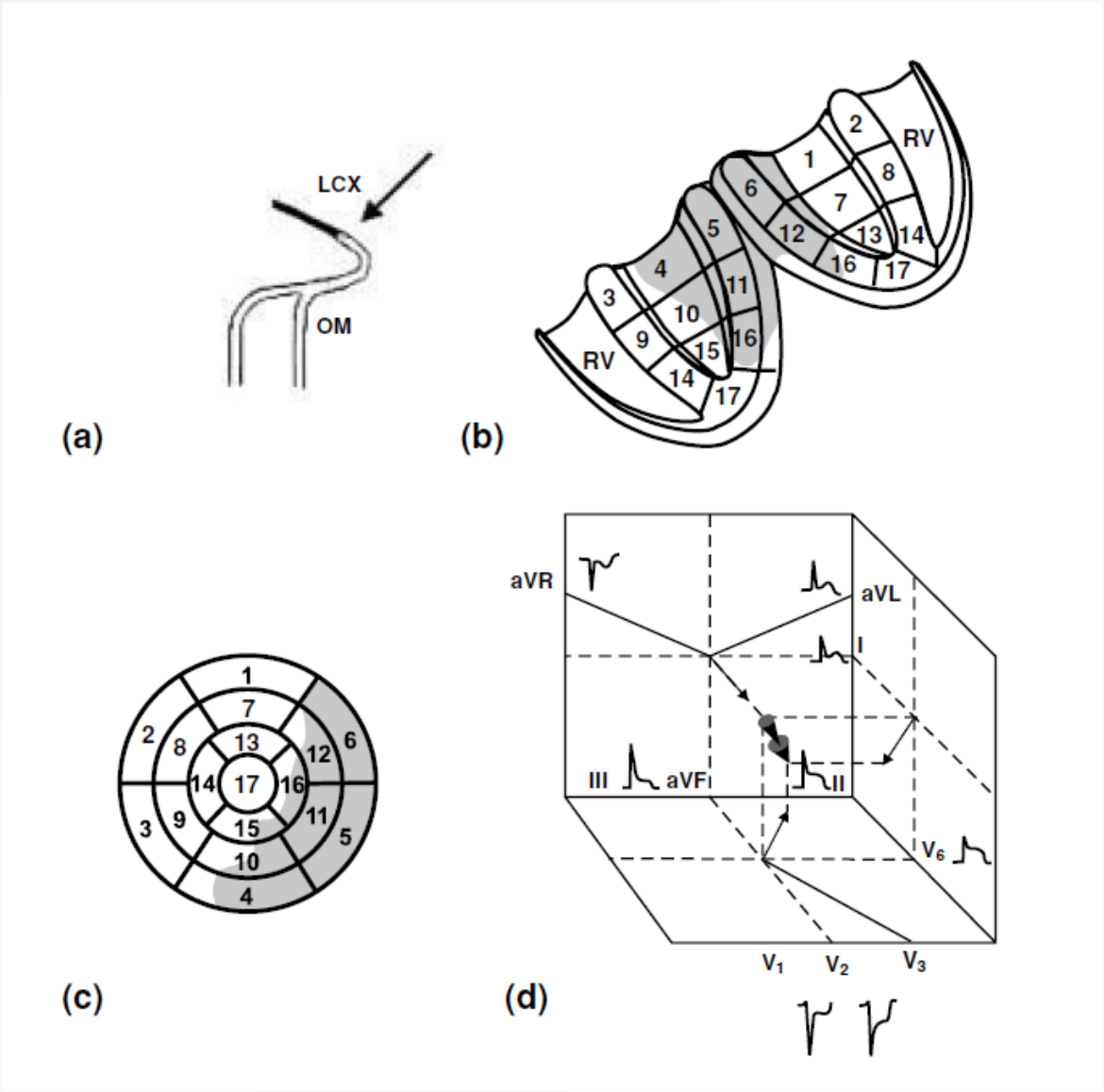

A
RCA
PL
PD
1
RCA
PL
PD
2
B
RV
RV
C
D
aVR
aVL
I
III
aVF
II
STI III > II
V5-6
LIV (3)
V1
V2
V3
1 = = if occlusion is distal
2 = = if occlusion is proximal
1° Distal dominant RCA occlusion
2° Proximal dominant RCA occlusion
3° Local injury vector (LIV)

- ST isoelectric or having slight elevation in V1 and sometimes elevated in V2−4 - occlusion proximal to RV branches
- occlusion distal to the RV branches - ST depression in V1−3
- ST-segment elevation ≥2 mm is usually seen in V5−6 (local injury vector)


A
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
V3R
V4R
V5R
V7
V8
V9

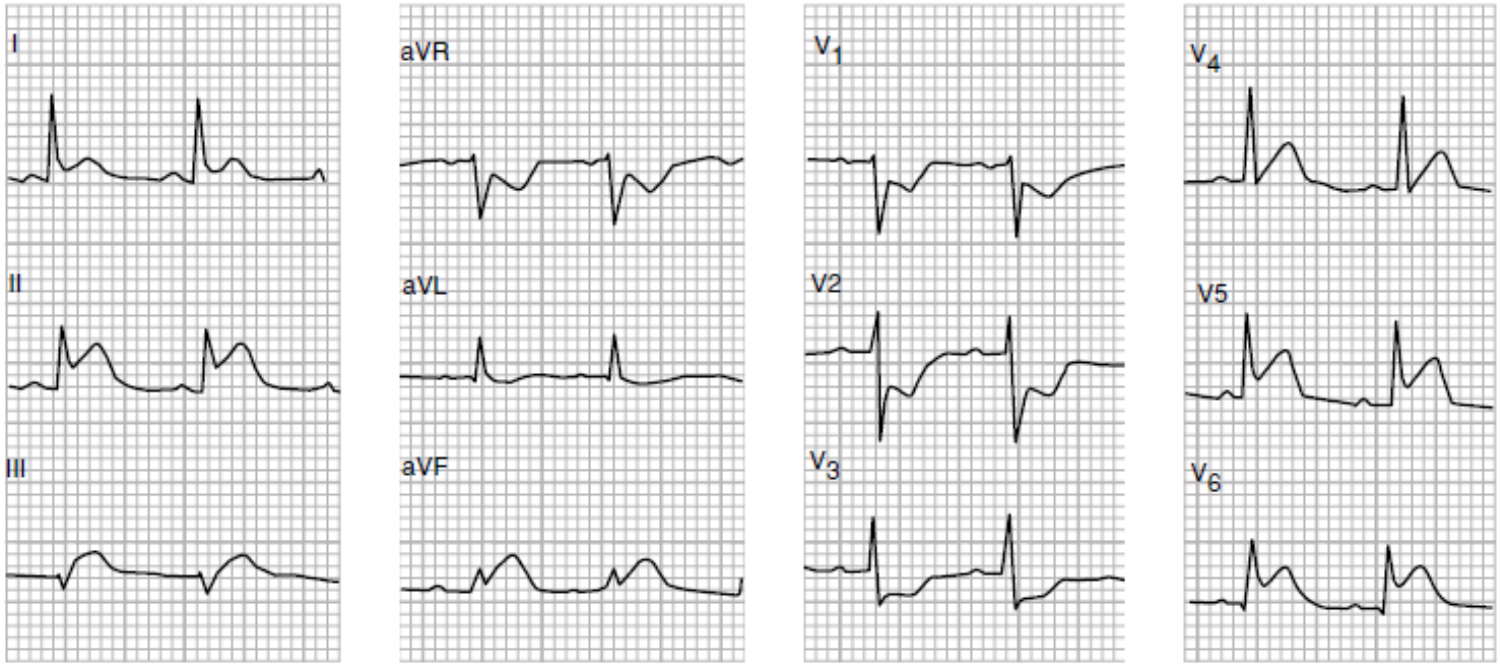
LCX occlusion proximal to first OM branches

- injury vector is directed leftward and more posteriorly than downward


LCX
OM
(a)
RV
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
RV
(b)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
(c)
aVR
aVL
I
III
aVF
II
V6
V1
V2
V3
(d)

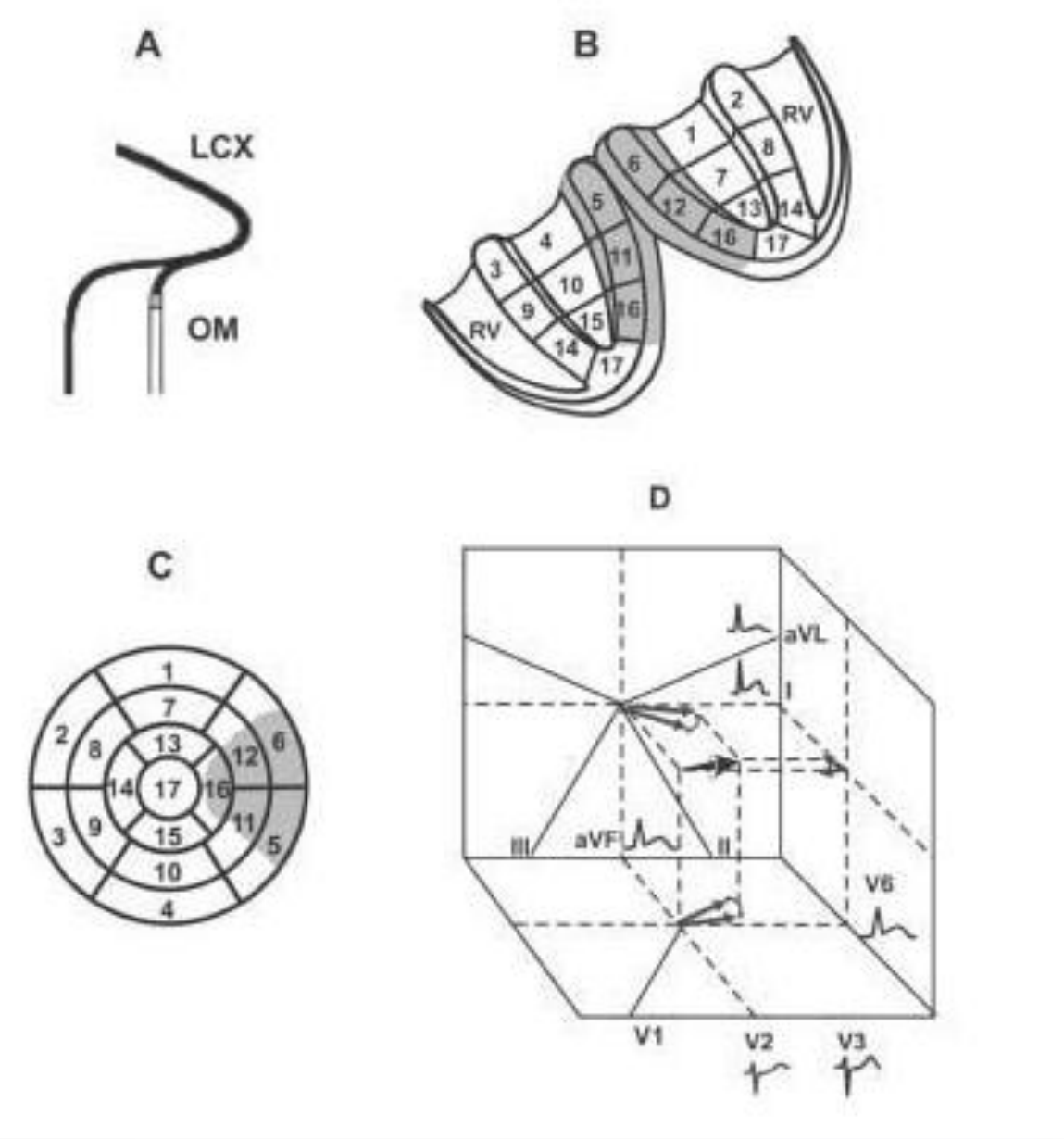
- ST elevation in II is greater than or equal to that in III

- ST-segment depression in V1−3 of a higher voltage than the ST elevation in II, III, and aVF

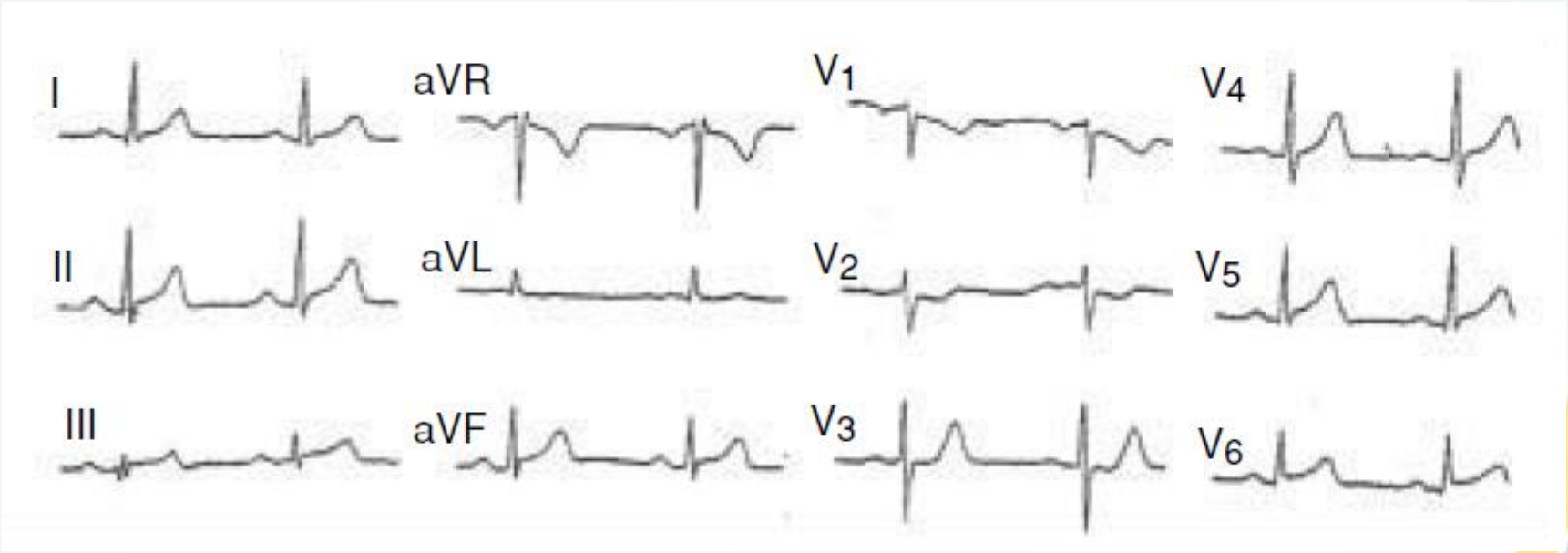

I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

Occlusion of the first OM branch

- injury vector is directed to the left and somewhat posteriorly
- as well as somewhat upward or downward


A
LCX
OM
B
RV
RV
C
D
aVL
I
III
aVF
II
V6
V1
V2
V3

- Slight ST-segment elevation in lateral wall leads (I, aVL, V5−6) and sometimes also in the inferior leads (especially II and aVF)
- slight ST-segment depression maybe seen fromV1 toV3 (in contrast to first diagonal branch occlusion-injury vector anteriorly)

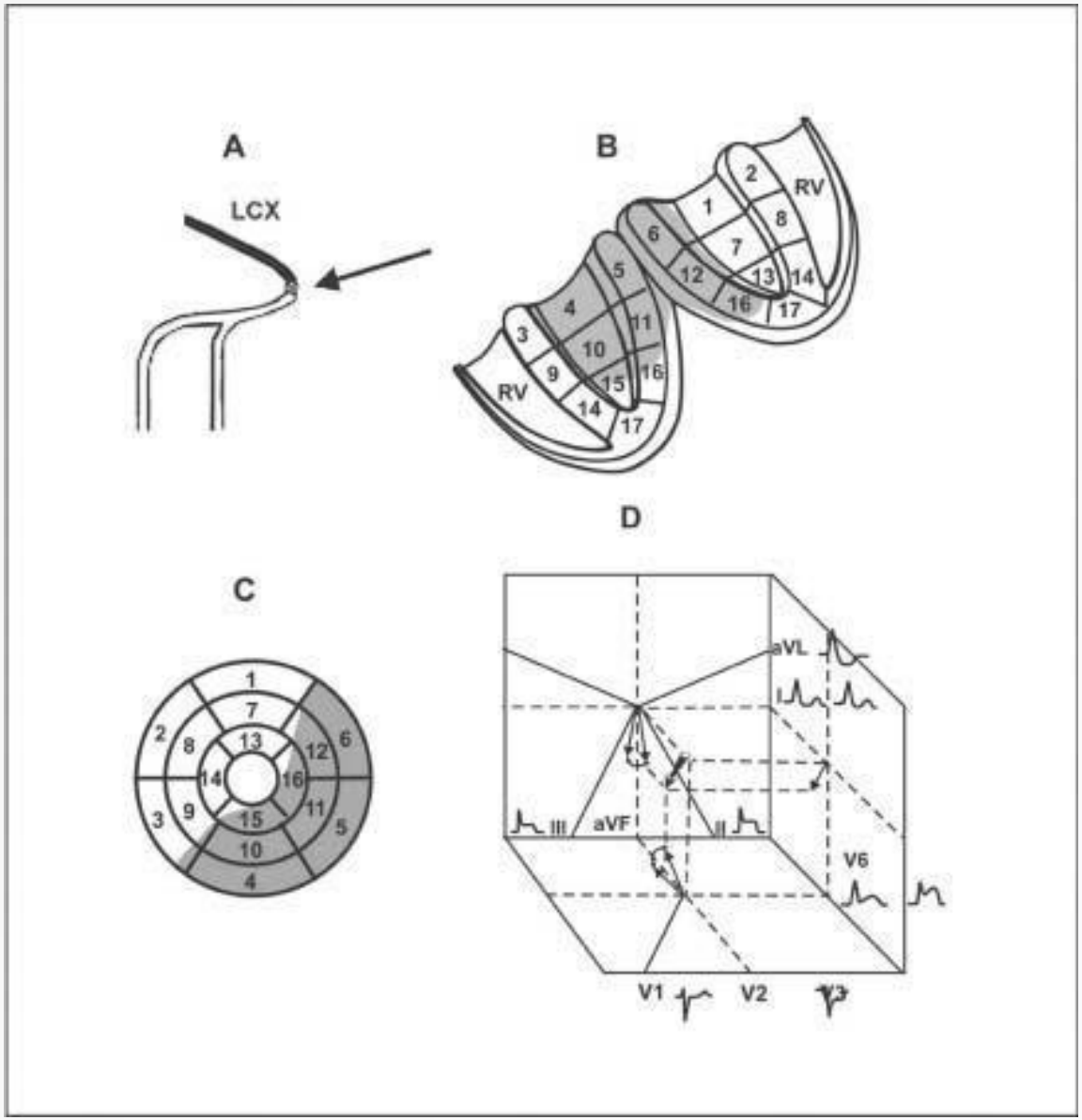

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

OM VS D1 occlusion

OM	D1
• Injury vector left, *posterior*, some what upward or downward • STE I, aVL, and V5−6 • STE may in II and aVF • Slight STD in V1-V3	• Injury vector is directed leftward, but upward and somewhat *anteriorly* • STE I, aVL, and V5−6 • STE in precordial leads • ST-depression II, III, aVF

Occlusion of a very dominant LCX

- injury vector is located often in the FP between+60◦and +90◦-- may fall in the negative hemifield of aVL but is usually still in the positive hemifield of lead I

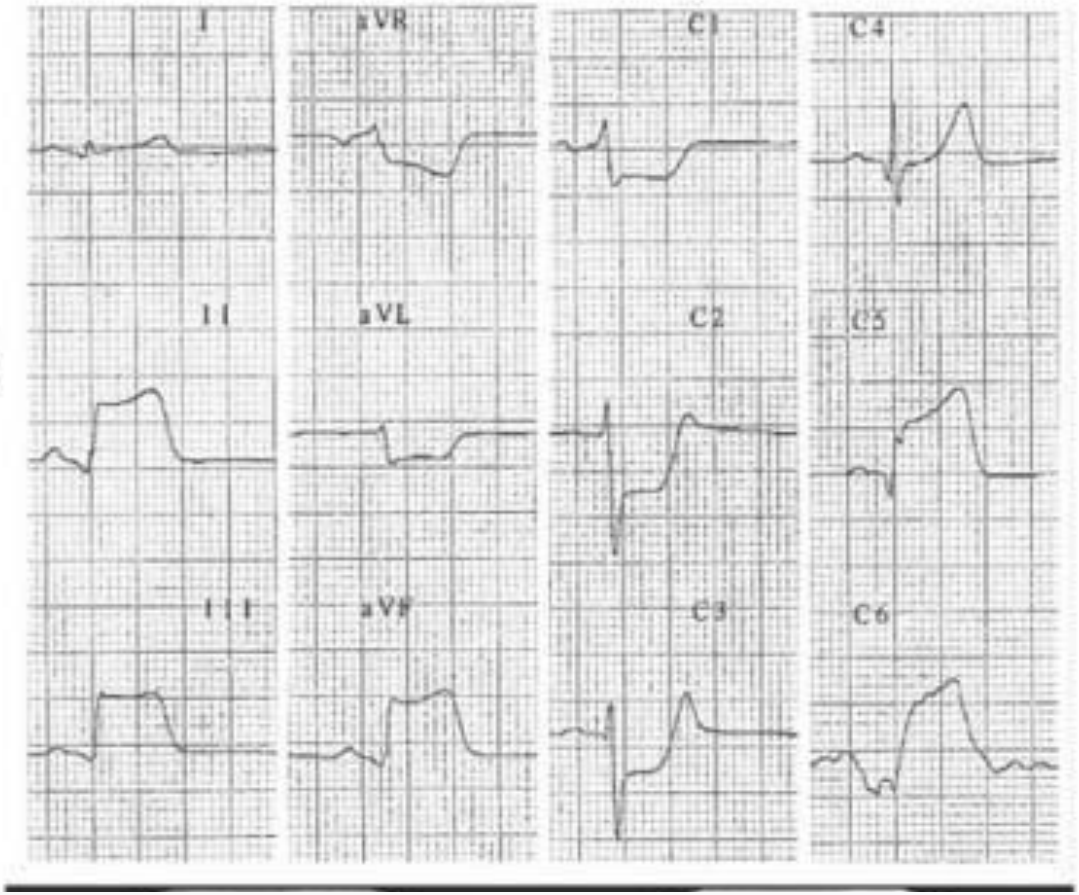

A
LCX
B
RV
RV
C
D
aVL
I
III
aVF
II
V6
V1
V2
V3

- ST-segment elevation in II, III, and VF often smaller than ST depression in V1−3
- If ST elevation in II, III, and aVF is equal or superior to ST depression in V1−3, usually the ST elevation in II is greater than that in III and in lead I there is no clear ST depression (in contrast to proximal occlusion of a very dominant RCA)

- ST elevation in V5−6 in the occlusion of a very dominant LCX more evident than in a case of a very dominant RCA

- Distal occlusion of a very dominant LCX ECG characteristics very similar to distal occlusion of a short RCA

A

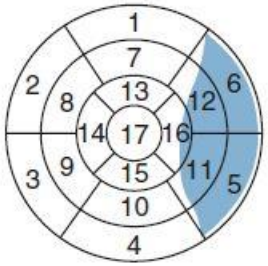
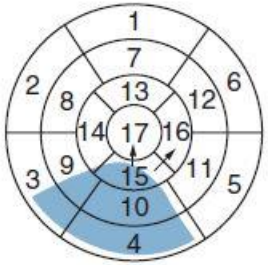
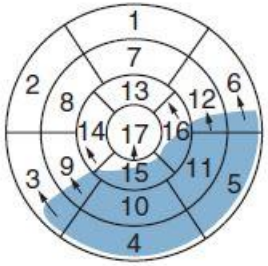


b Most prominent pattern of **ST elevation in inferior and/or lateral leads**† **(inferolateral zone)**

Occluded artery (RCA vs LCX)	*Injured myocardial wall (see Figure 7)*	*Leads with ST changes*
7. RCA occlusion proximal to the RV branches	Same as type 8 plus injury of RV	• ST↑ in II, III, and aVF with III > II • ST↓ in I, aVL • ST↑ in V_4R with T+ • ST isoelectric or elevated in V_1
8. RCA occlusion distal to the RV branches	Inferior wall and/or the inferior part of the septum (especially 3, 4, 9, 10, 14, and 15 segments)	• ST↑ in II, III, and aVF with III > II • ST↓ in I and aVL • ST↓ in V_{1-3} but if affected zone is very small, almost no ST↓ in V_{1-2}
9. Very dominant RCA occlusion	Great part of inferolateral zone (especially 3, 4, 5, 9, 10, 11, 14, 15, 16, and 17 segments). Injury of RV if RCA is proximally occluded	• ST↑ in II, III, aVF with III > II • ST↓ in V_{1-3} < ST ↑ in II, III, aVF. If the RCA is proximally occluded ST in V_{1-3} is = or ↑ • ST↓ in I and aVL with VL > V1 • ST ↑ in $V_{5-6} \geq 2$ mm

b Most prominent pattern of **ST elevation in inferior and/or lateral leads**† **(inferolateral zone)**

Occluded artery (RCA vs LCX)	*Injured myocardial wall (see Figure 7)*	*Leads with ST changes*
10. LCX occlusion proximal to first OM branches	Lateral wall and inferior wall, especially the inferobasal segment (espe- cially 4, 5, 6, 10, 11, 12 segments)	• ST↓ in V_{1-3} (mirror image) greater than ST↑ in inferior leads • ST↑ in II, III, aVF (II > III) • Usually, ST↑ in V_{5-6} • ST↑ in I, VL (I > VL)
11. First OM occlusion	Lateral wall (especially 6, 12, and 16 segments)	• Often ST ↑ in I, aVL, V_{5-6} and/or in II, III, aVF. Usually slight • Often slight ST ↓ in V_{1-3}
12. Very dominant LCX occlusion	Great part of inferolateral zone (especially 3, 4, 5, 6, 9, 10, 11, 12, 15 and 16 segments)	• ST ↑ in II, III, aVF (II ≥ III) often greater than ST ↓ in V_{1-3} • The ST may be depressed in aVL but usually not in I • ST elevation in V_{5-6} is sometimes very evident

Inferolateral zone	Lateral	B1	RS in V_1-V_2 and/or Q wave in leads I, aVL, V_6 and/or diminished R wave in V_6 SE: 67% SP: 99%		LCX 
	Inferior	B2	Q in II, III, aVF SE: 88% SP: 97%		RCA LCX 
	Infero-lateral	B3	Q in II, III, Vf (B2) and Q in I, VL, V_5-V_6 and/or RS in V_1 (B1) SE: 73% SP: 98%		RCA LCX 

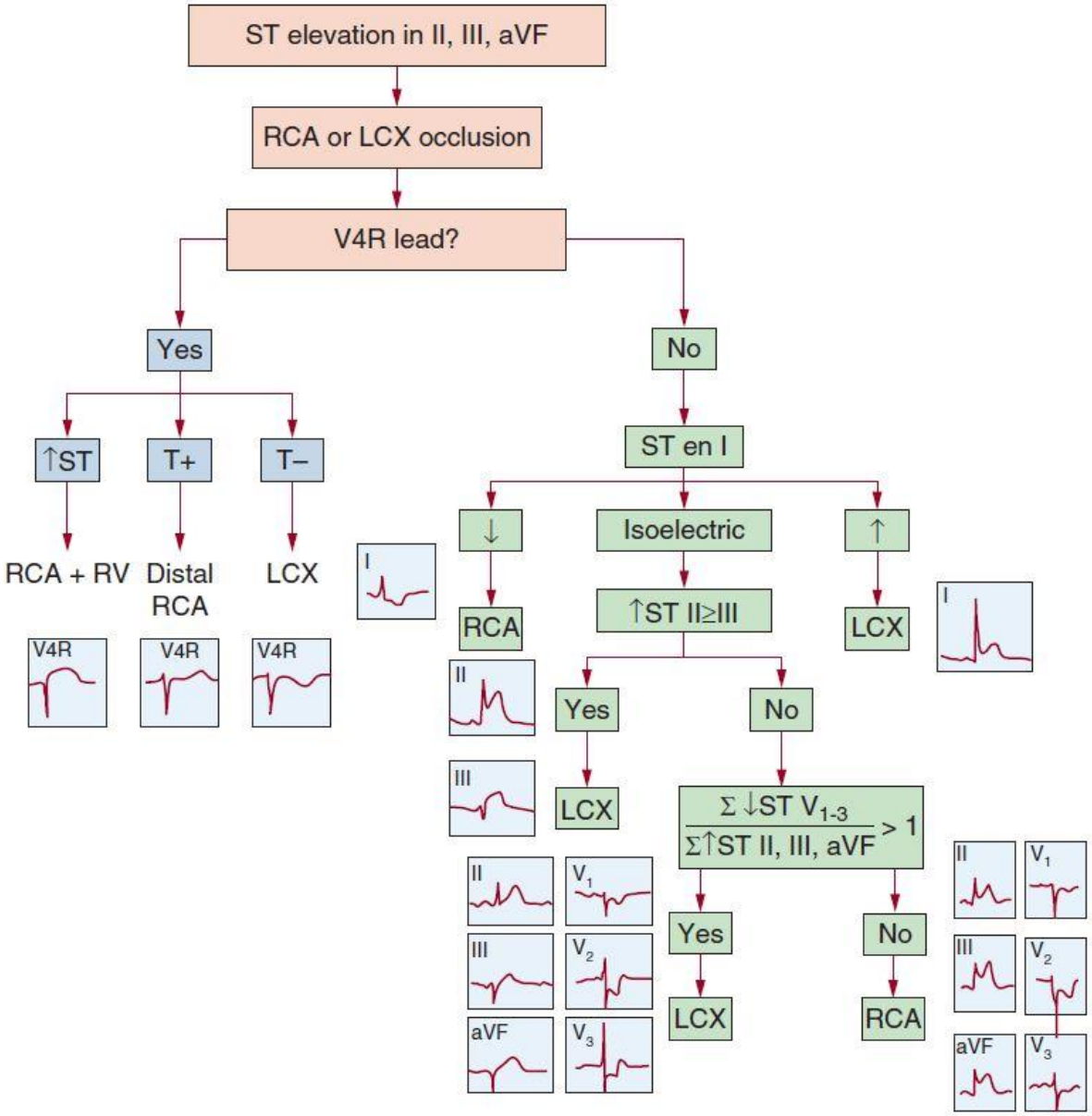
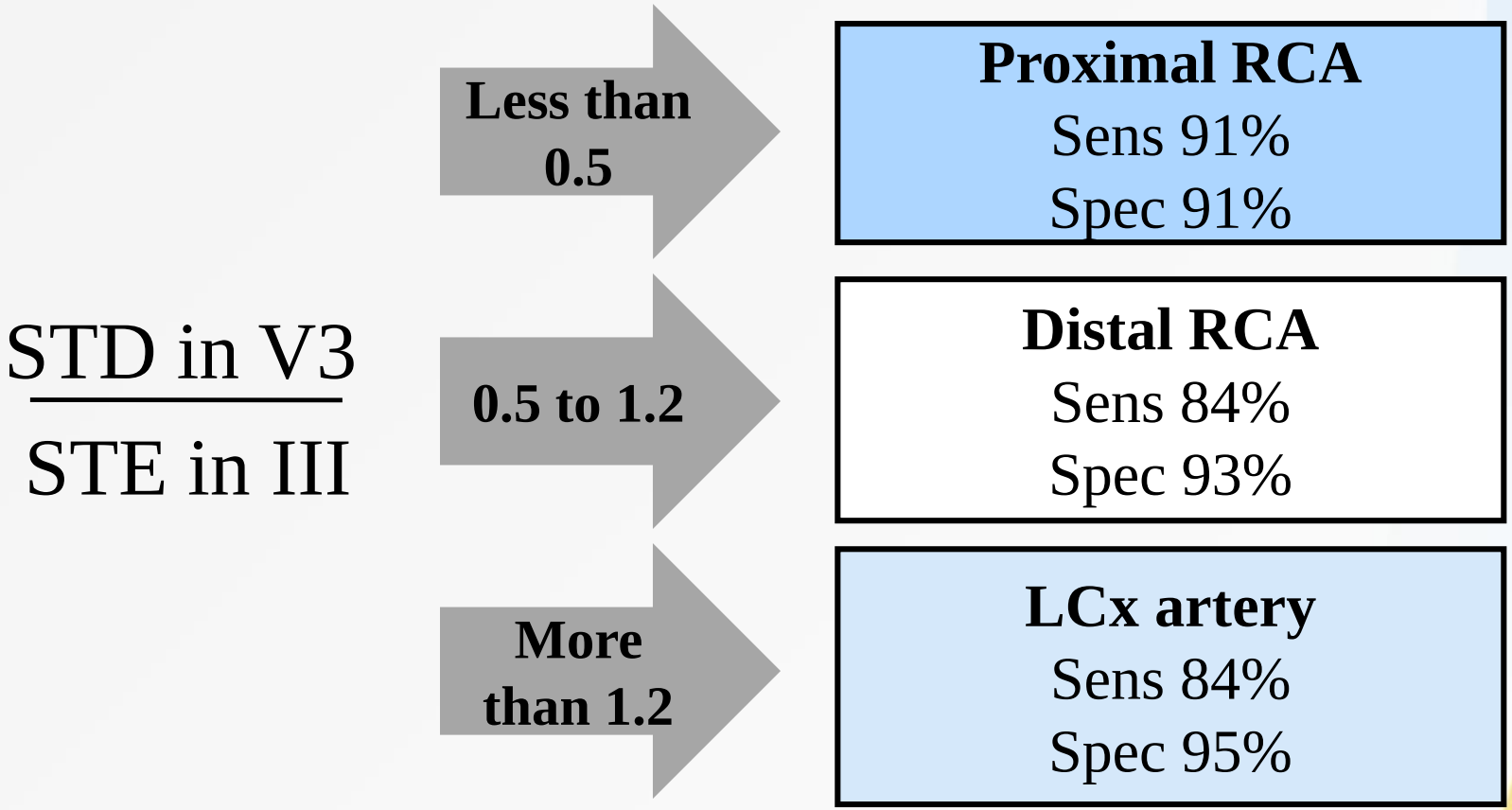


FIGURE 12–58. Algorithm to predict the culprit artery (right coronary artery [RCA] versus left circumflex artery [LCX]) in case of evolving myocardial infarction with ST elevation in inferior leads (see text for details).

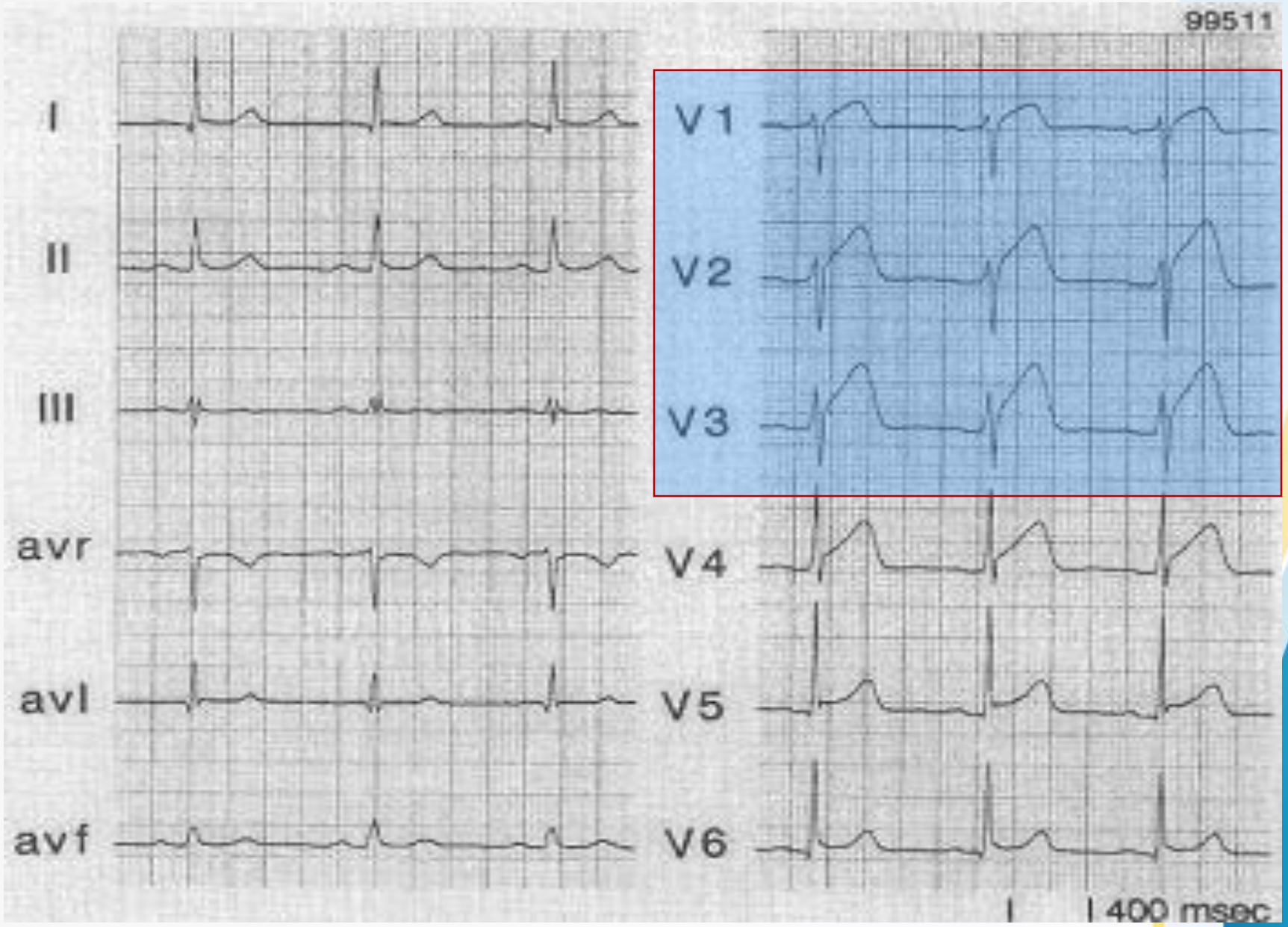


Kosuge M, *Kimura K, Ishikawa T et al. New electrocardiographic criteria for predicting the culprit artery in inferior wall acute myocardial infarction. Am J Cardiol, 1998; 82: 1318–1322*

Isolated RVMI

- Minor changes in inferior leads, but STE prominent in leads V1 and V2 and right precordial leads (V3R and V4R)

- Due to either a small or collaterally filled RCA or an occlusion of an RV branch only

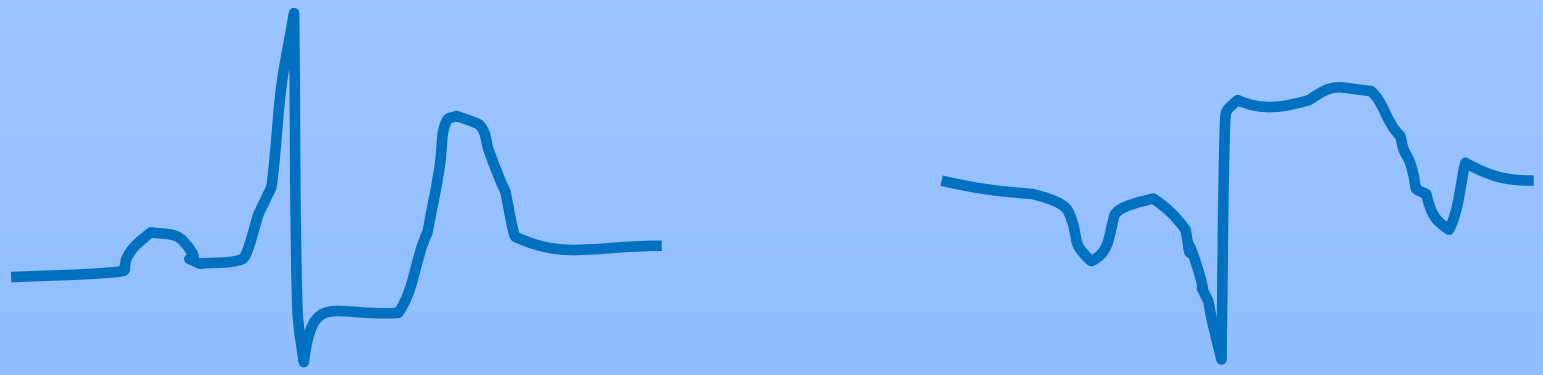

99511
I
II
III
avr
avl
avf
V1
V2
V3
V4
V5
V6
400 msec

PWMI

- Can occur both in RCA and Cx artery involvement
- ST depression in the precordial leads
- May extend from V1 to V6 and indicate larger MI
- Maximal ST depression in V4 – V6 is seen more in three vessel disease and lower LVEF

True PWMI

- ST depression in V1, R/S >1, and upright T wave



V1

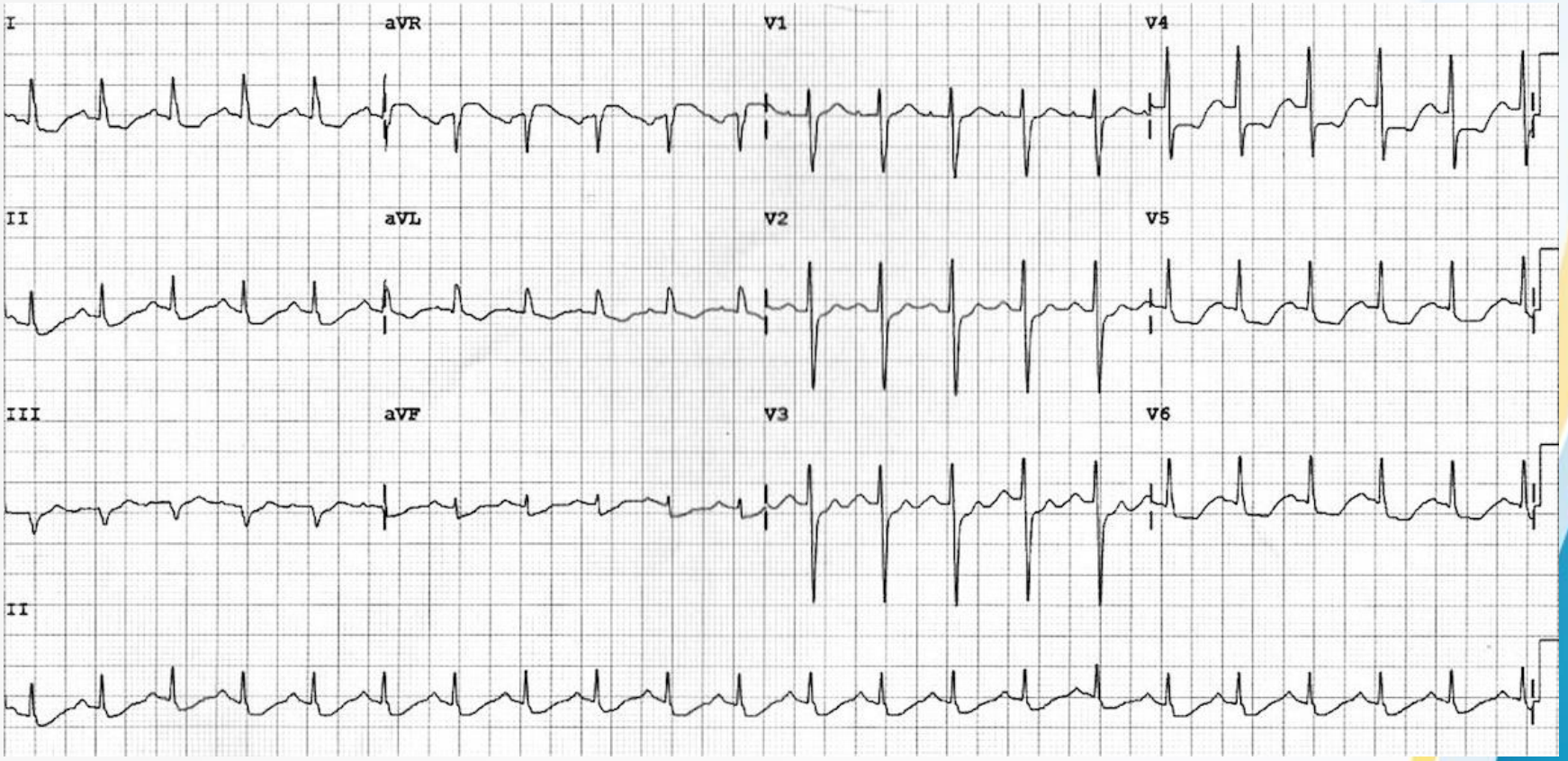
V9

Left main stem occlusion or triple vessel disease

- Lead aVR ST segment elevation with less ST segment elevation in lead V1(81% sensitivity, 80%specificity)

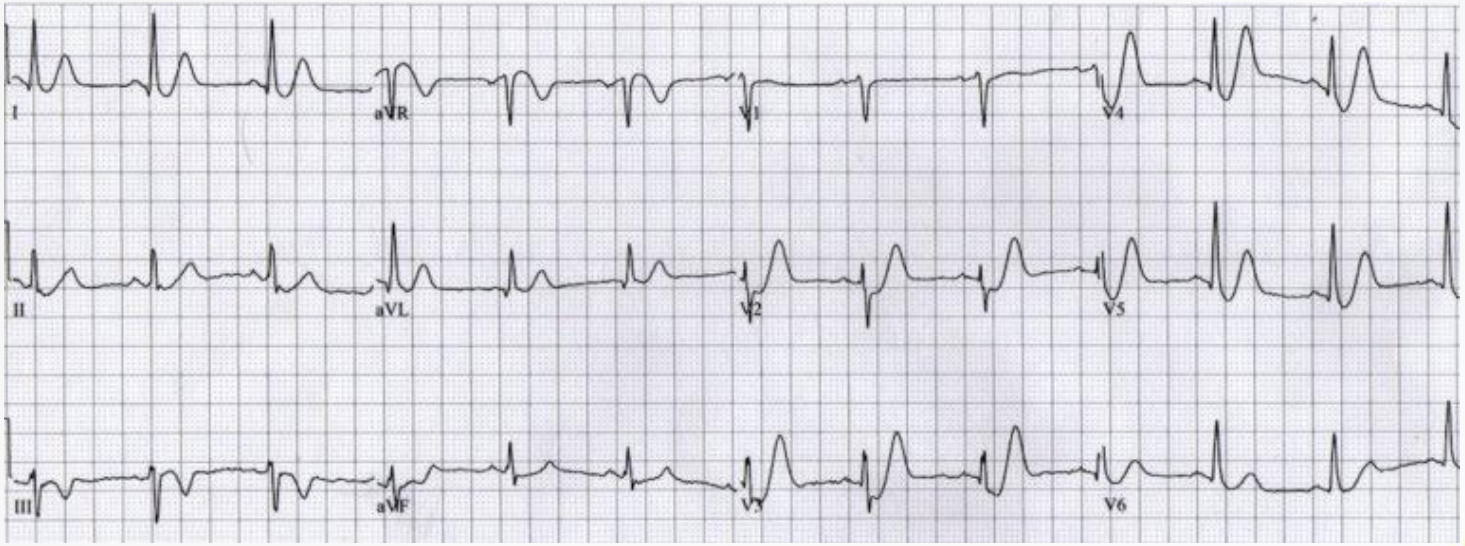
Yamaji H et al J Am Coll Cardiol 2001;38:1348-1354

- Marked down sloping ST depression in I, II, and V4 – V6
- High mortality rate in those with higher STE in aVr


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

de Winter sign

- ST-segment depression at the J-point with upsloping ST-segments and tall, symmetrical T-waves in the precordial leads



AV conduction disturbances

- AV nodal delay and block occurs with proximal RCA invt, frequently with RVMI
- Higher in-hospital morbidity & mortality

Sub AV conduction disturbances

- RBBB with or without hemiblock during acute AWMI indicates proximal LAD
- BBB or CHB indicates poor prognosis
- LAHB in acute IWMI indicates additional LAD disease

Atrial infarction

- Signs of atrial MI are seen in PTa segment
- PTa segment elevation occurs in I, II, III, V5 or V6 or a depression in precordial leads
- Occurs in 10 % of inferoposterior MI
- Isolated occurrence is rare
- Proximal RCA or Cx

Limitations

- Assessment of the site of occlusion of coronary vessel by ECG is most reliable in case of 1st MI

- Impaired
  - Multivessel disease
  - Collateral circulation
  - When ventricular activation is prolonged as in
    - LVH
    - Preexistent LBBB
    - Preexcitation
    - Paced rhythm

THANK YOU