

# Healthy Heart

Volume-3 | Issue-35 | October 5, 2012

Price : ₹ 5/-

**Honorary Editor :**

Dr. Joyal Shah



## From the desk of Editor:

*ECG - a basic and easily available tool to reach the diagnosis related Ischemic heart disease.*

*If properly studied it gives lot of information about the pathology, site and artery involved in the ischemic process.*

*The following content was gathered during my study period which i know will help us a lot in day to day practice and also will brush up our knowledge.*

**- Dr. Joyal Shah**

## ECG and IHD

### LOCALIZATION OF ISCHMIEA OR INFARCTION

- ECG leads are helpful in localization of ischemia or infarction.
- ECG changes in one or more of precordial leads (V1-V6): anterior.

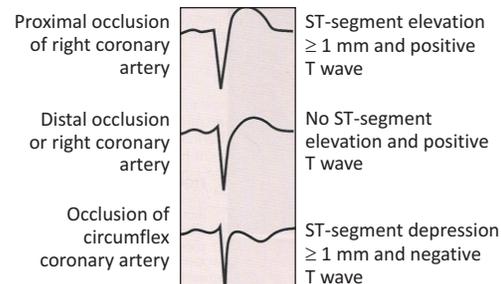
ECG changes in V1-V2 are usually designated as anterior ischemia or infarction while ECG in V1-V6 are designated as extensive anterior.

- ECG changes in one or more of precordial leads from V1 to V6 and leads I and aVL : anterolateral.
- ECG changes in V1-V4 : anteroseptal.
- ECG changes in V5-V6 : apical or lateral.
- ECG changes in II,III and aVF : inferior wall.
- ECG changes in II,III, aVF and V5-V6; inferolateral.

ECG changes of ST segment depression and tall R and T waves in V1-V2 are diagnostic of true posterior wall infarction. However, ST segment elevation is recorded in leads V7-V9.

### Right Ventricular Infarction

- Pathological studies show the incidence of RV infarct in 14-36%.
- The clinical diagnosis of RV infarction is only 20% , while with echocardiogram and nuclear studies it is about 40%.



- RV infarction usually causes loss of R wave in leads V3R and V4R. Elevation of ST segment in right precordial leads is the most important diagnostic sign. Hence, ST segment elevation in right chest leads, V1 and V3R-V6R (V3R and V4R are more sensitive) must be sought in the presence of inferior wall infarction.

Following are the Diagnostic Criteria for Infarction

- ST segment elevation in V3R or V4R with a sensitivity of 100% and specificity of 68%.
- ST segment elevation in V6R and V7R with 100% sensitivity.
- ST segment elevation in V1-V3.
- ST segment elevation in V1 and ST segment depression in V2.
- ST segment depression in V2 :  $\geq 50\%$  ST elevation in aVF.
- ST segment elevation in lead III > ST elevation in lead II.

### Atrial Infarction

The atrial infarction mostly found in

#### Cardiologists

Dr. Anish Chandarana (M) +91-98250 96922 Dr. Keyur Parikh (M) +91-98250 26999  
 Dr. Ajay Naik (M) +91-98250 82666 Dr. Milan Chag (M) +91-98240 22107  
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 Dr. Chintan Sheth (M) +91-91732 04454

#### Neonatologist and Pediatric Intensivist

Dr. Amit Chitaliya (M) +91-90999 87400

#### Cardiac Electrophysiologist

Dr. Ajay Naik (M) +91-98250 82666

extensive ventricular myocardial infarction, and suspect when an atrial arrhythmia develops in a patient with a large ventricular infarction.

### Characteristics of atrial infarction

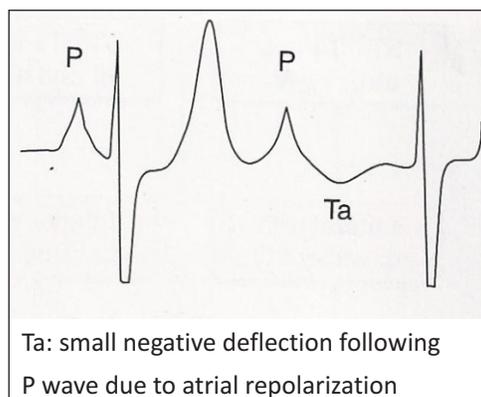
1. Atrial infarction occurs in 7-17%.
2. Mostly associated with ventricular infarction.
3. Right atrium and appendages are more involved.
4. Aluminium phosphate poisoning mimics atrial infarction.
5. Atrial arrhythmias, atrial rupture and thrombus formation are complications of atrial infarction.

- It occurs in 7-17%. The right atrial infarction is more common and the atrial appendage is commonly affected.
- Isolated atrial infarction, which is rare, usually presents with CHF.
- The ECG changes of atrial infarct are found in poisoning with aluminium phosphate.

Following is the ECG diagnostic criteria proposed by Chi Kong Liu et al (1961)

#### i) Major criteria

- Elevation of PTa of  $> 0.5$  mm in V5-V6 with a reciprocal depression in V1-V2.



- Elevation of PTa of  $> 1.5$  mm in any precordial lead or  $> 1.2$  mm in I-III with atrial arrhythmias.

- Elevation of PTa in I with reciprocal depression in II and III.
- ii) **Minor Criteria alone is not regarded as an evidence of atrial infarction.**
  - Abnormal P morphology: Irregular or notched (M or W)
  - PTa depression with reciprocal changes

### PREDICTION OF THE SITE OF CORONARY ARTERY OCCLUSION

The ECG provides information about the site of occlusion of coronary arteries in patients with myocardial ischemia or ischemia or infarction.

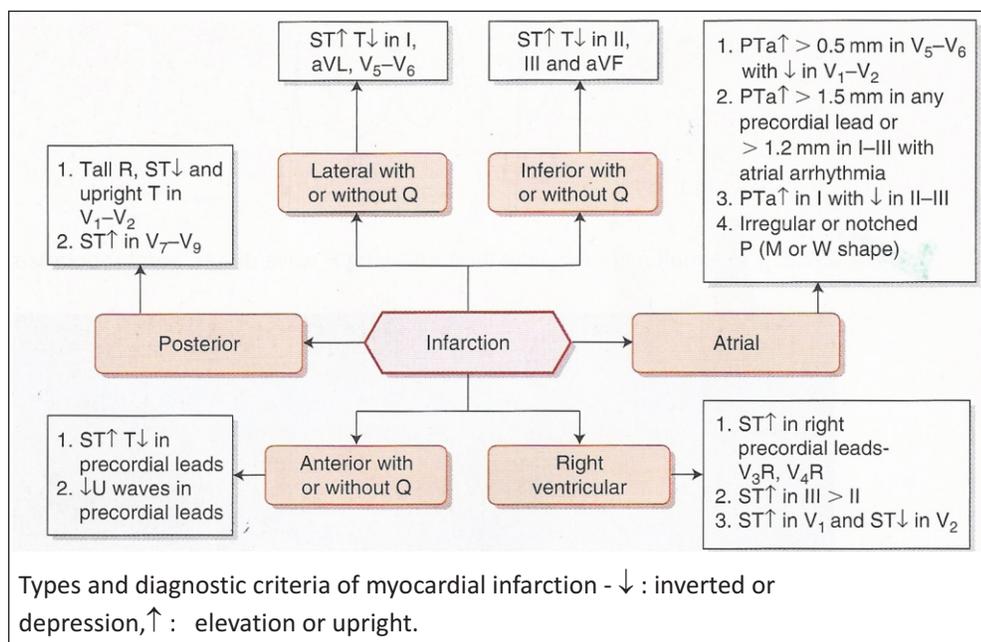
#### A) Occlusion of Coronary Artery

- Occlusion of right coronary artery (RCA) causes inferior, posterior, posterior, inferoposterior, inferolateral, and RV MI.
- Occlusion of left circumference (LCx) causes posterior and lateral infarctions (posteroapical, posterolateral, posterobasal, inferolateral or high lateral MI). Occlusion of the dominant LCx causes inferoposterior and posterolateral infarctions.

- Occlusion of left anterior descending (LAD) causes anteroseptal and anterior MI. Proximal LAD occlusion can also result in bundle branch block (BBB) and left anterior fascicular block.

#### B) Coronary Artery Occlusion and ECG Correlation

- Presence of abnormal Q waves in leads I, aVL, and V1, V4 associated with LAD occlusion and in leads II, III and aVF associated with LCx or RCA occlusion.
- In anterior MI, ST elevation is less frequent in lead V1 than in leads V2, and V3. Absence of ST in V1 in anterior MI suggests the presence of a large conal branch of RCA protecting the septum, conversely ST elevation in V1 suggests either absents or small conal branch of RC.
- i) Predicting RCA or LCx Occlusion in Inferior Wall MI
  - ST segment elevation in III  $>$  II: RCA occlusion with a sensitivity of 99% and a specificity of 100%, while ST segment elevation in II  $>$  III: LCx occlusion with a sensitivity of 93% and a specificity of 100%.



- In inferior infarction, ST elevation in lead III > II, especially when combined with ST elevation in V1 is a powerful predictor of RCA occlusion proximal to acute marginal branch.
- In inferior MI with ST elevation in lateral leads V5 and V6 or I and aVL is a sensitive and specific marker for LCx lesion.
- Inferior MI with ST depression in V1-V3 is more often associated with LCx occlusion (71%) than of RCA occlusion (40%).
- Similarly reciprocal changes (i.e. ST segment depression) in aVL predict LCx occlusion while reciprocal changes in V4 – V6 predict multivessel occlusion.
- Ratio of ST segment depression in V3 to ST segment elevation in III has 91% sensitivity and specificity.
- <0.5 predicts proximal RCA occlusion.
- 0.5 - < 1.2 predicts distal RCA occlusion.
- $\geq 1.2$  predicts LCx occlusion
- Abnormal R in V1 consistent with posterior infarction is highly specific for LCx occlusion.
- ii) Predicting LAD Occlusion Site in anterior Wall Infraction
  - The ECG criteria for localization of site of LAD occlusion are less sensitive (50-85%) but are more specific (90-100%).
  - LAD lesions proximal to the first septal branch (S1) have sensitivity of about 50% and specificity of 90-100% while LAD lesions proximal to first diagonal branch (D1) have sensitivity of about 60% and specificity of 90%.
  - LAD lesion distal to S1 have sensitivity of about 25% and specificity of 88% while LAD lesions distal to D1 have low (about 10-20%) sensitivity but are highly specific (100%).
- In anterior MI, presence of reciprocal ST depression in inferior leads suggests a proximal LAD lesion. Similarly ST elevation (also in leads I and aVL) is predictive of proximal (proximal to D1) LAD lesion.
- Type III LAD occlusion is recognized by the presence of ST depression with upright T waves in lead III.
  - (a) ST segment depression of  $\geq 1$  mm in inferior leads predicts proximal LAD occlusion (proximal to septal (S1) or diagonal (D1) branch).
    - (i) Following are the ECG predictors of LAD occlusion proximal to S1 branch.
      - ST segment elevation in V1 of > 2.5mm
      - ST segment elevation in aVR
      - Associated with complete RBBB
      - ST segment depression in V5
    - (ii) Following is the ECG predictor of LAD occlusion proximal to D1 branch.
      - Abnormal Q waves in aVI
      - ST segment elevation in I and aVL.
  - (b) Absence of ST depression in inferior leads predicts mid to distal LAD occlusion (distal to S1 or D1 branch)
    - (i) Following is the ECG predictor of LAD occlusion distal to S1 branch.
      - Presence of abnormal Q waves in V4 – V6
    - (ii) Following is the predictor of LAD occlusion distal to D1 branch.
      - ST segment depression in aVL.
      - RBBB occurs in 3-29% patients with AMI, often accompanied by left anterior fascicular block and LAD is usually involved.

- The mortality rate is higher in patients with new onset RBBB than in those with old RBBB, in contrast to AMI patients with an old LBBB have higher mortality than in those with recent onset LBBB.

## MI in LBBB

### The LBBB

- Affects both early and late phases of ventricular depolarization
- Alters the sequence of repolarization, with ST segment and T wave vectors directed opposite to QRS complex, producing secondary ST-T changes

These changes may mask and mimic the ECG findings of MI. Hence the ECG diagnosis of MI in the presence of LBBB is more difficult and sometimes confusing. Following is the ECG diagnostic criteria of MI in presence of LBBB

- i. Based on GUSTO-1 trial (Global Utilization of Streptokinase and Tissue plasminogen activator for occluded coronary arteries)
  - ST segment elevation of  $\geq 1$ mm with concordant (positive) QRS complex 5 scores
  - ST segment depression of  $\geq 5$  mm with discordant (negative) QRS complex 2 scores
  - ST segment depression of  $\geq 1$  mm in V1, V2, or V3: 3 scores

For diagnosis a total score of  $\geq 3$  is a must which yields a sensitivity of 78% and specificity of 90%

- ii. Other diagnostic ECG criteria which are less sensitive and specific are as follows:
  - R wave regression from V1 to V4
  - QS pattern in V1-V4
  - Presence of Q waves in two contiguous precordial or limb leads. Abnormal Q wave should be  $\geq$

20ms in V4 or  $\geq 30$  ms in V5, V6, II and III.

## Other ECG changes in patients of MI with LBBB

1. Presence of abnormal Q waves
2. Notching of S waves (Cabrera sign)
3. Regression of R waves in precordial leads (V1-V6)
4. Notching of R waves (Chapman Sign)
5. LAD

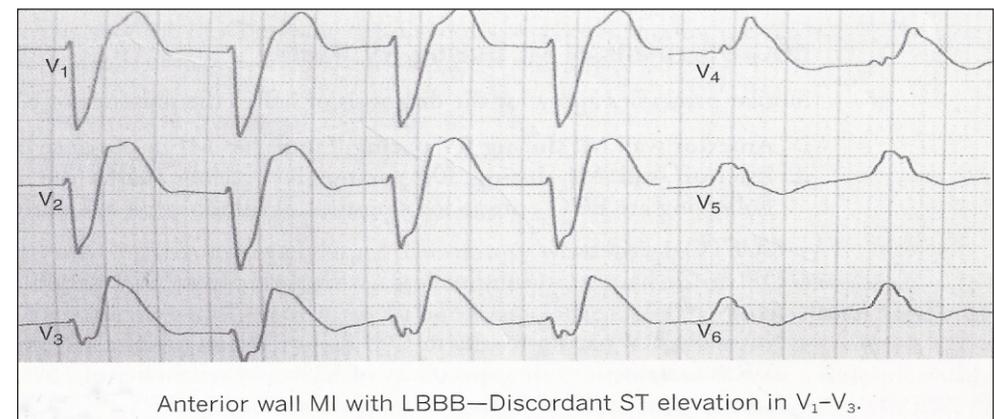
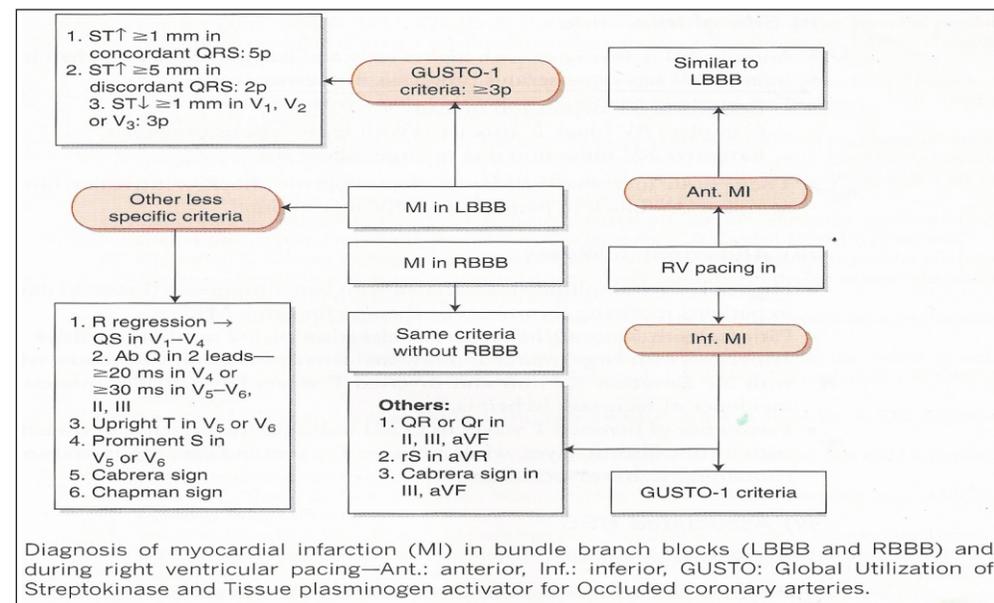
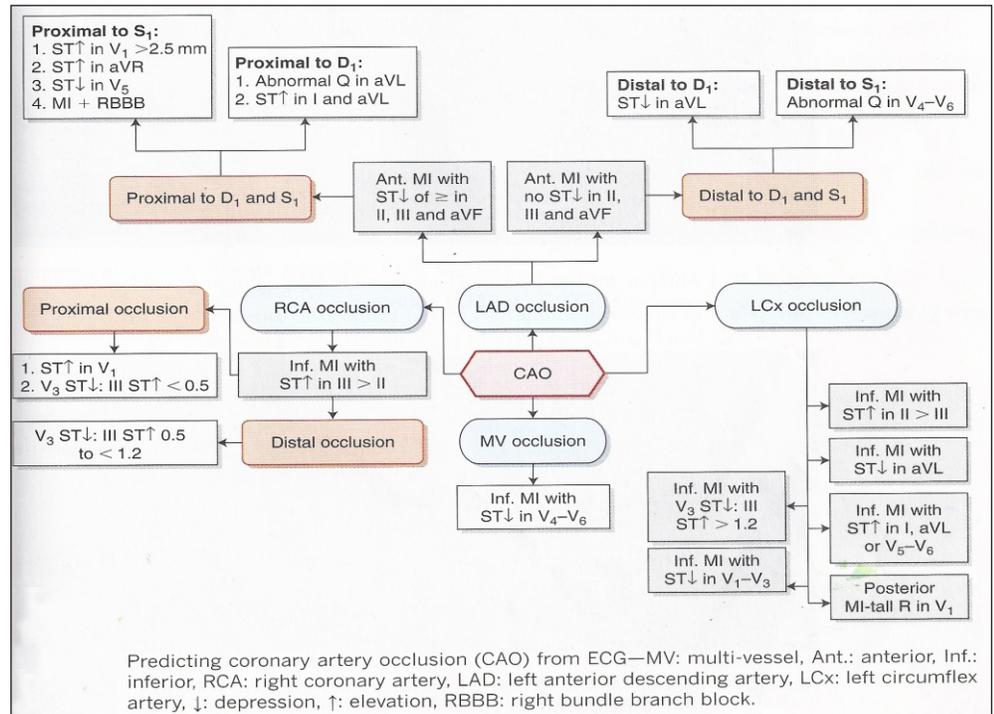
- Positive T wave in V5 or V6
- Notching of  $\geq 0.05$  s in the ascending limb of S wave in V3 or V4-V5 (Cabrera sign)
- Notching of  $\geq 0.05$ s in the ascending limb of R wave in I, aVL, V5 or V6 (Chapman sign)
- Terminal prominent S wave in V5 or V6
- LAD

## ECG Diagnosis of MI During RV pacing

Similar principles apply for the diagnosis of MI in the presence of RV pacing.

- i. Anterior wall MI during RV pacing: Similar to MI in presence of LBBB.
- ii. Inferior wall MI during RV pacing: RV pacing masks the inferior wall MI. following are ECG criteria for diagnosis of inferior wall MI during RV pacing:

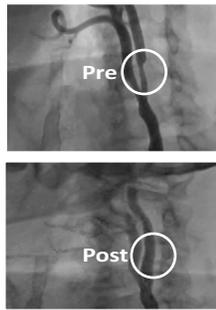
- GUSTO-1 criteria
- QR or Qr pattern in inferior leads with a specificity of 100% but with low sensitivity (15%)
- Normally, RV pacing results in QS, R, or qR pattern in aVR, hence rS pattern in aVR is diagnostic with a specificity of 52% and sensitivity of 15%
- Cabrera sign in III, aVF leads is insensitive.



## Endovascular Cases at CIMS

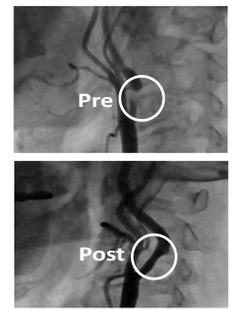
### Case-1 : Left Internal Carotid Artery

64 year male, Hypertension, DM, CRF, S/P CABG, Carotid Doppler was suggestive of 60 % left ICA lesion. Angio reviled 80 % lesion. Patient was symptomatic.



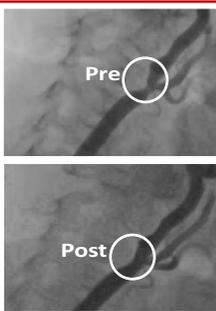
### Case-2 : Left Internal Carotid Artery

78 year male, Carotid Doppler was suggestive of 80 % left ICA lesion. Angio reviled ulcerated and calcified tortuose lesion. Patient was differed by surgeons due to high risk other co-morbit conditions. Successful angioplasty with help of distal protection device was done.



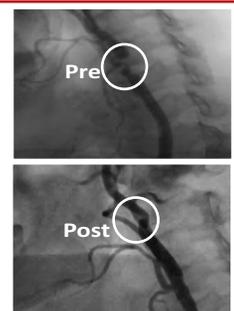
### Case-3 : Right Internal Carotid Artery (Asymptomatic)

69 year male, C/O DM for 20 years. On routine body check up found to have 80 % right ICA lesion. Angio reviled the same and angioplasty was done successfully.



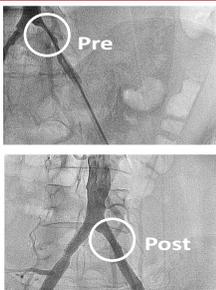
### Case-4 : Left ICA PTA + Stenting Done

65 year male, C/O HTN for 3-4 years, Right hemiparesis on 13/07/09, CT Angio : left ICA 90 % lesion. Lesion was ulcerated at the origin of left ICA. Distal protection device (angioguard) was used. Followed by which stenting was done with self expandable stent.



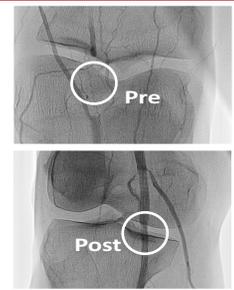
### Case-5 : Bilateral common iliac artery

Patient had severe Left Lower Limb Claudication. Angio reviled 90 % left CIA occlusion and 80 % right CIA. Bilateral CIA stenting was done with good end result. Patient become Asymptomatic.



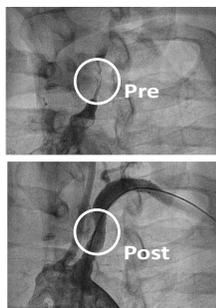
### Case-6 : PTA + Stenting of Right Popliteal Artery done

Patient has sudden occlusion of right popliteal artery with severe rest pain and ischemic changes in right lower limb. Successful plasty with long balloon (PTA) was done. Patient limb was salvaged.



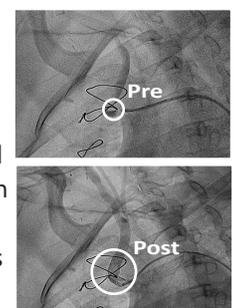
### Case-7 : Left Subclavian Artery

Patient presented with symptoms of subclavian steal. On investigation was found to have disparity in radial pulse and pressure. His angio revealed 100 % occurred left subclavian artery. Stenting was done successfully. Patient was relieved of his symptoms.



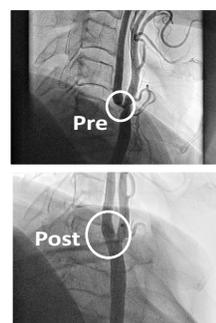
### Case-8 : PTA + Stenting in Right Aorta Carotid bypass graft

A patient of Takayasu's disease with Occluded B/L Subclavian Arteries had recurrent syncope post Aorto Right Carotid Bypass (PTFE Graft 7mm) Critical Stenosis in graft at its origin. Successful plasty with distal protection of only surviving graft was done.



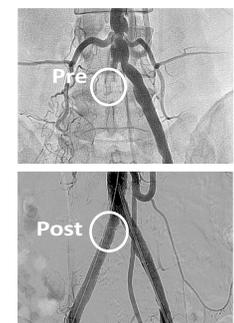
### Case-9 : Right ICA using MOMA device

MOMA device - an proximal protection device, which blocks antegrade flow in artery and thereby prevent spillage of emboli to distal vessel. A new tool in carotid angioplasty procedure. Done very rarely in our country was used in this patient of Right internal carotid artery block and subsequently stenting it. Procedure was completed with excellent end result.



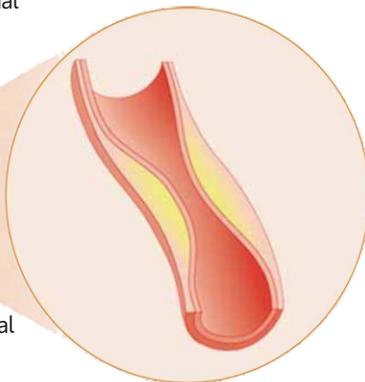
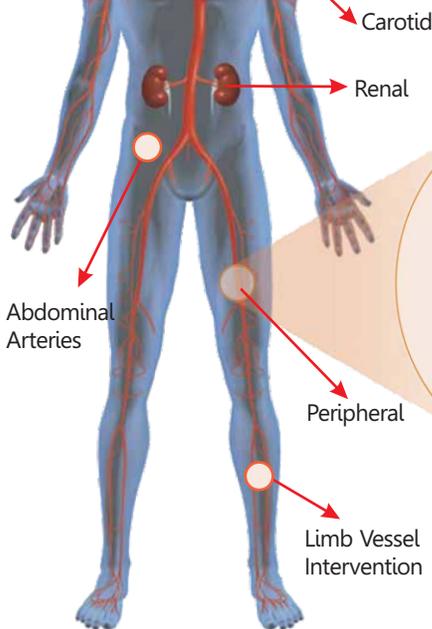
### Case-10 : Total Occlusion of Right Common Iliac Artery.

60 year old male with severe Claudication pain. Totally occluded right CIA was open with a specialize device (PIONEER) an ultra sound guided re-entry device. Double barrel technique was used for stenting with excellent end result.



## Endovascular Peripheral Workshop

January 3-4, 2013



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MD, FACS  
USA



**Dr. Rajesh Dave**  
MD, FACC, FSCAI  
USA



**Dr. Ashit Jain**  
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- Renal Artery Stenosis
- Acute Limb Ischemia
- Critical Limb Ischemia
- Varicose Veins
- Dialysis access procedures
- Pulmonary embolism
- Thoracic outlet syndrome
- Uterine fibroids
- Vascular malformations
- Venous insufficiency and venous ulcers
- Claudication
- Aortoiliac occlusive disease
- Femoropopliteal Disease
- Brachiocephalic Arterial Disease
- Venous Thromboembolic Disease
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- Infrapopliteal Peripheral Arterial Disease
- Intracranial Arterial Stenotic Disease
- Vertebral Arterial Disease

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Time : **2.00 pm - 6.00 pm**

You may call any of our CIMS Cardiologists or Vascular Surgeons listed on the front page



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