Recent Progress in Interactive Blended Learning of Cardiovascular Medicine

AACOM/AODME Annual Conference, Washington, DC

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Disclosures

• None
Blended Learning

Components
• Face-2-Face
• Online activities

Rationale
• Multiple Sites
• Multiple Students
• Consistency
• Remove Didactic Burden
• Off hours engagement
Blended Learning

- Email
- Podcasts
- Recordings
- Video Conferencing
- Self Reflection
- Discussion Boards
- Online Quizzes
- Website Tours
- Blogs
- Texting
- Computer Based Simulations
Blended Learning

- Blackboard
- Content
- Discussion Boards
- Group Assignments
- Blogs
- Online training (Open School)
- Menu-driven simulations
Aspects of Online Cardiology Blended Learning

- Establish an Online Forum
  - Initiate case based learning
  - Use the cases intersperse with evidence based medicine
  - Link to trials and media to augment learning

- Educational Lecture series
  - Establish mandatory lectures
  - Create additional lectures

- Develop a database of evidence-based medicine
  - Quick links to relevant books/journals
  - Includes landmark trials and review articles

- Interactive learning tools to practice skills
Collective Database/Interactive Forum

Announcements

New Announcements appear directly below the repositionable bar. Reorder by dragging announcements to new positions. Move priority announcements above the repositionable bar to pin them to the top of the list and prevent new announcements from superseding them. The order shown here is the order presented to students. Students do not see the bar and cannot reorder announcements.

Welcome to Clinical Cardiology!

Posted on: Thursday, February 22, 2018 5:26:26 AM EST

Welcome everybody to your Clerkship in Clinical Cardiology. This is a blackboard site designed for your ease and to help you best to prepare and understand the world of Cardiovascular medicine. It is designed to be both informative and interactive. Please see the Lecture Recordings section for the majority of the course content including Dr. Kornberg and various other attending’s materials. The Lecture Recordings are all under the tab on the left side of the Blackboard page. The mandatory lectures for the cardiology rotation are the lectures on: H&P, Hypertension, Hyperlipidemia, MI, Peripheral Vascular Disease, CHF, Aortic Stenosis, Dr. Clay’s Mitral Valvular disease, PVCs and SVTs.***

**The Discussions section** is for the assigned weekly discussion boards and the Assignments tab for weekly and monthly assignments. See the Course Information tab for assignment and additional background information for the course. Additional Content tab is there for a number of older articles. ECG Practice and Heart Sounds are a fantastic supplement to Dubin and Bates’s Physical Examination. If you have any questions I can answer, please post them to the discussion board or feel free to email me at jasonk@pcom.edu and I will get back to you as soon as possible. Case #1 will open one day prior to the start of your clerkship rounds***

Please review the Introduction to Clinical Cardiology Course Video under the Course Information tab prior to starting rotations. This should better summarize the flow of the Blackboard course.

Best of luck in your Cardiology rotations

Jason Kaplan D.O.

Online Preceptor for Clinical Cardiology
Online Forum

Case studies will be posted on discussion boards weekly. You will be given a patient scenario (with a brief medical history) that will be followed by questions. The cases are evolving. This means that new questions will be added as you respond. You are required to respond to one case study per week, but it is important to keep the discussion going until the case study concludes. We will review the answers in my follow up posts. It is mandatory to answer at least one set of questions each week (this is usually 3-4 questions) reading and citing reputable sources for your responses.

***See discussion post example in this thread***
Online Forum Objectives

• Morning Report styles cases
  – Present patient cases with high yield questions/responses
  – Introduce evidence-based medicine/clinical trial data
  – Link to studies/reviews
  – Multimedia resources for concept clarification
    • Exam findings
    • ECG examples
    • Audio clips
56 yo male presents with an episode of chest pressure. It started 15 minutes before arrival to the emergency department. The chest pressure is unlike anything he's ever had before. It came on at rest as a substernal pressure that make him sweaty and somewhat short of breath. The chest pressure did not radiate. After onset, the sensation scared him enough to call 911. In the ambulance, he was given sublingual nitro which barely touched him chest pressure. Upon arrival in the ED, he was given morphine which minimally decreased the pain. Patient admits to regular exercise. He has never seen a cardiologist, never had an echo, stress test or cath. Denies palpitations, lightheadedness or dizziness.

Past medical history: HTN, HLD
Past surgical history: tonsillectomy
Social history: smokes ½ pack per day for 20 years. Denies Alcohol or drug use
Family History: Father had a history of MI and HLD in his 60s


Awake alert Moderate distress
Atraumatic normocephalic
PERRL EOMI
Mmm
Supple no JVD, but there are cannon a waves
CTA b/1 no w/7/r
Brady +S1, S2 1/6 SEM at the apex
Soft flat NT/ND +BS
LE without cyanosis/edema
AAOx3 non-focal
Anxious
OSE: T1-T4 F SLRL

Labs: Sodium 136, Potassium 4.2, Creatinine 1.02 Glucose 110, AST 80, ALT 60, Trop 0.06, WBC 12.9, Hgb 12, Plts 352

CXR: no active disease

ECG as attached below

What do you think is the working diagnosis at this time?

What does the ECG show?

Is there more than one problem seen on this ECG?

What is the underlying reasoning for each of these problems in detail?

Case #3.jpg (434.614 KB)

• Initial open ended questions
• Laboratory data interpretation
• ECG interpretation
RE: Case #1

1. What do you think is the working diagnosis?

Based on the patient’s symptoms -- sub-sternal chest pain at rest, dyspnea, diaphoresis -- along with his history of HTN, hyperlipidemia, a family history of an MI and HLD, elevated troponins, ST elevations in leads II, III, and aVF, points to a working diagnosis of an inferior wall STEMI.

2. What does the ECG show?

The ECG shows ST elevations in leads II, III, and aVF with reciprocal changes in leads 1 and aVL, suggesting an inferior wall STEMI.

3. Is there more than one problem seen on this ECG?

Yes, the EKG shows several abnormalities. In terms of rate, the EKG displays bradycardia (~35 BPM), and irregular rhythm, ST depressions in V2-V5 and varying and unsynchronized p waves throughout, which indicates a 3rd degree (complete) AV heart block.

4. What is the underlying reasoning for each of these problems in detail?

Myocardial infarction is due to irreversible death of cardiac myocytes, caused by an inadequate blood supply to heart cells. This infarct is likely caused by the rupture of cholesterol plaques that may occlude the coronary arteries. ST segment elevation in II, III, and aVF suggests inferior wall MI, meaning that most likely, the right coronary artery (RCA) is the occluded vessel. ST segment depression in leads V2-V5 may indicate anterior wall intramural ischemia.

Complete AV block is also associated with an inadequate blood supply to the SA node, which is responsible for producing regular contractile signals. The SA node received blood from the SA artery, which is a branch of the RCA. With this vessel occluded, it makes sense that there would be disruption of the SA node, leading to the patient’s bradycardia.

Additionally, the canon A waves seen in complete heart block that were described in the prompt occur because atrial and ventricular systole are occurring simultaneously. The increased pressure being pushed against the closed AV valves lead to the visible canon A waves.

• Creates student-teacher interaction to generate questions
• Article provided for clarification
Excellent guys! This is indeed an Inferior STEMI. There is ST segment elevation in II, III and aVF with reciprocal changes in lead 1 and aVL. If you look at the ST depressions in precordial leads, they are predominantly in the anterior leads. If V1-V4 represents the anterior wall, and the posterior wall is behind the anterior wall, then ST depressions in the anterior leads may represent posterior ST Elevation. If you look, these ST depressions look like inverted ST elevations. To confirm this, we can place leads V7-V9 on a patient that would be directly overlying the posterior wall. These should demonstrate ST segment elevation. If you are unsure what this means, please feel free to email me.

**How might I confirm that this is an RV infarct by ECG?**

Agreed, this is complete heart block (CHB). The R-R intervals are dissociated from the P-P intervals. The reason it occurs in inferior STEMI is because there is decreased blood flow to the AV Nodal artery (link) coming off of the RCA. This implies a high RCA lesion. CHB in the face of an inferior STEMI may get better after acute therapy. CHB either way is a poor prognostic indicator, however CHB with an anterior wall STEMI is a VERY poor prognostic indicator. In order to have CHB in an anterior STEMI, there must be marked ischemia to the anteroseptal wall. Data shows a nearly 2 fold increase in mortality with CHB in anterior STEMI v an inferior STEMI with CHB.

*Cannon A waves* (link) are seen in CHB seen when ventricular systole and atrial systole occur at the same time. The contraction of ventricular systole would keep the AV valve shut during the atrial systole. The increased pressure against the closed AV valve produces large A waves that are easy to see on jugular examination.

*As you have pointed out, this is a STEMI. What happens pathophysiologically at the level of the coronaries during ACS/STEMI/STEMI? (What happens that starts the cascade and what happens during it?) Big concepts not every detail!*
Medical Video Multimedia

Resources including:
• Harrison’s IMed
• Bates’ Phys Exam
• Otto’s Echo
• YouTube
• UpToDate
• Etc

Cannon A Waves
33,995 views

A 65-year-old man presented with an abrupt onset of heart palpitations and dyspnea during the previous hour. He had had three similar episodes but had no other known conditions. Examination of the jugular venous pulsation revealed cannon atrial waves. Learn more at http://nej.md/15j8V1

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**Right coronary artery** wraps postero-inferiorly to the diaphragmatic surface.

- **Atrioventricular (AV) nodal a.**
  Supplies AV node.

- **Posterior interventricular (IV) a.**
  Supplies diaphragmatic side of ventricles & IV septum.

**Clinical correlation:** stenosis of right coronary a. can lead to disruption of normal heart rhythm ("heart block").
Video Lecture Series

• Collection of Online Lectures
  – Provide a list of appropriate CV subject (MI, CHF, etc)
  – Create basic mandatory lectures to supplement on-site Clinical Clerkship learning
  – Additional non-mandatory lecture recordings for other CV topics for avid learner
  – Establish videos viewable on computers and mobile devices
Video Lecture Series

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Video Lecture Series

Philadelphia College of Osteopathic Medicine
Acute Coronary Syndrome (ACS)

- A term used to describe pts with acute CP and other symptoms of myocardial ischemia
- It is really talking about three things
  - Unstable Angina (USA/UA)
  - Non ST Segment Elevation MI (NSTEMI)
  - ST Segment Elevation MI (STEMI)
Database of Evidence-Based Medicine

• Develop a database of Evidence-Based Medicine:
  
  – Create a folder of articles to supplement each topic
  – Divide the articles
    • Landmark trial
    • Interesting studies
    • Review articles
    • Guidelines
    • Search engines/Books/Journal
  – Review videos from symposiums of ground breaking topics
Reviews, Scoring systems and Guidelines

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<th>Category</th>
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<td>Physiological Predictors of ACS</td>
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<td>Management of STEMI</td>
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<td>Mechanisms of ACS</td>
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<td>Chest Pain/ACS Evaluation - HEART Score</td>
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<td>2017 ACC/AHA Quality Measures for NSTEMI/STEMI</td>
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Landmark Trials

- DAPT Trial - Dual Antiplatelet Therapy post MI
- SAVE Trial - Captopril in Acute MI with Drop in LV Function
- VALIANT Trial - Valsartan vs Captopril in Acute MI with drop in LV Function
- GISSI-3 Trial - Lisinopril in Acute MI
- IMPROVE-IT Trial - Ezetimibe + Statin post ACS
- AVOID Study - Oxygen in Acute MI
- DETOX-SWEDEHEART Trial 2017 - Oxygen in Normoxic patients post MI
Resources

Online resources in the Cardiology Blackboard site can be found in multiple areas to supplement your daily experiences in your clinical cardiology clerkships as well as for further studies. Lectures have been recorded by numerous Cardiology Instructors and can be found under the Lecture Recordings tab.

Within the Lecture Recordings individual folder, there are folders containing Supplemental Material to help give further context to the videos provided. Additional material will be added on a daily basis.

Harrison's Principles of Internal Medicine (link) is one of the best resources out there for a review of general medicine and pathophysiology.

For the latest journal and review articles, resources such as PubMed (link), the New England Journal of Medicine (link), and Journal of the American College of Cardiology (link) can be extremely useful.

If there is an additional resource that is not yet listed, please post to the discussion forum regarding questions and materials or email me at JasonKa@pcom.edu.
Interactive Materials and Mobile Applications

• Link to Engaging Content for home studies:
  – ECG interpretation
  – Heart Sounds
  – Echocardiography basics

• Populate a list of useful tools for students on Clerkship
  – CV Mobile Applications/Tools
Question: 54 year-old male status post mitral valve replacement with complaint of palpitations. What is the rhythm? **Difficulty rating**

a) Sinus tachycardia
b) Paroxysmal supraventricular tachycardia (PSVT), probable atrial tachycardia
c) Atrial flutter
d) Multifocal atrial tachycardia (MAT)
e) Atrial fibrillation (AF)

Your Answer: 

Show Answer
ECG Wave-Maven

**Question:**

54 year-old male status post mitral valve replacement with complaint of palpitations. What is the rhythm? **Difficulty rating**

- a) Sinus tachycardia
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- e) Atrial fibrillation (AF)

This ECG shows a regular paroxysmal supraventricular tachycardia (PSVT) at rate of 160 beats per minute with apparent positive P waves in lead II superimposed on the preceding T waves, suggesting atrial tachycardia with 1:1 AV conduction. There is borderline left axis deviation and non-specific ST-T wave changes. Very deep S waves in the right-mid precordial leads raise strong consideration of underlying left ventricular hypertrophy. See also Case # 222

**Answer:**

The patient was treated with adenosine without change in rhythm, and then was given intravenous verapamil, unmasking atrial tachycardia with variable AV conduction. He was treated successfully with radiofrequency (RF) ablation of a high right atrial focus during a cardiac electrophysiology procedure.

There are no atrial flutter (F) waves and the regularity of the R-R intervals excludes atrial fibrillation or MAT. The very high resting rate is strongly against sinus tachycardia in a subject of this age.
Mobile CV Applications for iPhone/Android

<table>
<thead>
<tr>
<th>Cardio iPhone Apps</th>
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<tbody>
<tr>
<td>Build Content</td>
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<tr>
<td>Duke Heart App (Made for Cardiology Fellows/Residents/Students) - Free</td>
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<tr>
<td>American College of Cardiology Guidelines - Free</td>
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<tr>
<td>HeartEvidence Lite - Free</td>
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<tr>
<td>OxMD Calculator - Common Calculations Needed in Medicine - Free</td>
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<tr>
<td>Cardiology Tools by Epocrates - Free</td>
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<tr>
<td>ASCVD Risk Estimator - Free</td>
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<tr>
<td>CARDIO3 - Atlas of Interventional Cardiology - Free</td>
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<tr>
<td>iCath - Free</td>
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<td>iImplant Cardiac Devices - Free</td>
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Mobile CV Applications for iPhone/Android

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<td>ilmplant Cardiac Devices - Free</td>
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<tr>
<td>GoodRx (Helps find most inexpensive pharmacy drug prices) - Free</td>
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<td>Journal Club - Landmark CV Trials and more</td>
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<td>EchoSource</td>
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<tr>
<td>CathSource</td>
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<tr>
<td>Heart Murmur Pro - Heart Sound Database</td>
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</table>
Conclusions

- Give students materials to study at home and on-site
- Challenge them beyond the questions asked on round morning report forums
- Use medical multimedia and trial links to augment forum cases
- Create a growing list of mobile applications – their phones never leave their sides
- Interactive content to keep them engaged
- Site director integration

- The hardest part is to organize the site to prevent student overload
Thank you!
References

- Stravredes T, Hereder T. A guide to online course design. 2014
Rapid Interpretation of EKG's

**Author:** Dale Dubin, MD  
**Affiliation:**  
**Publisher:** Cover Publishing Company  
**Publication Date:** 2000

**Description:**
The reader's rapid assimilation of medical concepts is the key to the continuing success of this best-selling book. A caption explains the concept illustrated on each page, and a few simple sentences reinforce the concept with interactive (programmed) learning, which links to the following page. Dr Dubin's light and entertaining style, known worldwide, makes learning enjoyable. Practice twelve-lead tracings at the end establish self-confidence, and summarised reference sheets with examples (designed to be shared) provide an excellent review.

**Table of Contents**

- **FRONT MATTER**
- **CHAPTER 1: BASIC PRINCIPLES**
- **CHAPTER 2: RECORDING THE EKG**

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Rate
Before you begin, look at this chapter’s summary on pages 334 and 335.

When reading an EKG, you should first consider the rate.

Note: The sign in this picture is not informing the driver about the rate of his race car. The man holding the sign is a physician who has been monitoring the driver’s transmitted EKG. The sign is telling the driver about his current heart rate (he’s a little excited).

<table>
<thead>
<tr>
<th>When examining an EKG, you should determine the __________ first.</th>
</tr>
</thead>
<tbody>
<tr>
<td>rate</td>
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<tr>
<td>The rate is read as cycles per ________________.</td>
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<tr>
<td>minute</td>
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</tbody>
</table>

Now, let’s examine where and how the normal heart rate originates...

The SA Node (Sinus Node), the heart’s pacemaker and the dominant center of automaticity, generates a Sinus Rhythm. The SA Node paces the heart in the normal rate range of 60 to 100 per minute.
# Heart Sounds

## Description of Sounds

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<tr>
<th>Description</th>
<th>Sounds</th>
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<tbody>
<tr>
<td>Normal heart sounds</td>
<td><img src="image1" alt="Normal" /></td>
</tr>
<tr>
<td>Murmurs</td>
<td><img src="image2" alt="Audio examples" /></td>
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<tr>
<td>Aortic stenosis (early)</td>
<td><img src="image3" alt="AS early" /></td>
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<tr>
<td>Aortic stenosis (late)</td>
<td><img src="image4" alt="AS late" /></td>
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<td>Mitral regurgitation</td>
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<td>Pulmonic stenosis</td>
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<td>Aortic insufficiency</td>
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<tr>
<td>Mitral stenosis</td>
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<td>Benign murmur</td>
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<td>Atrial septal defect</td>
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<td>Ventricular septal defect</td>
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<td>$S_3$</td>
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<tr>
<td>$S_4$</td>
<td><img src="image16" alt="S4" /></td>
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**Transducer Position:** The transducer is placed 2-3 inches to the left of the sternum in the 4th or 5th rib interspace. The notch on the transducer should be facing towards the 10 o’clock position toward the right shoulder. From this position, the standard view can be obtained. By manipulating the tip of the transducer, the RV inflow view and PA long axis view can also be obtained as shown on the additional tabs above.

If the heart is viewed anteriorly, this is how it would appear to lie in the chest. The light blue trapezoid demonstrates how the ultrasound beam slices through the heart to obtain a 2D image.

As one can see, the most anterior structure is the right ventricular outflow tract here, just below the PA and in the far field we have the left ventricle, left atrium and descending aorta.
In the appropriate standard view shown above, the apex should not be visible. The left ventricle should be oriented almost horizontally. The right ventricular outflow tract, left ventricular anterosepctum and inferolateral wall are visualized here as shown above with other key structures labeled. Note the RVOT is seen, and not the right ventricle. Posterior to the left atrium one can sometimes see the proximal descending thoracic aorta. RVOT – right ventricular outflow tract, AML - anterior mitral valve leaflet, PML - posterior mitral valve leaflet, LA - left atrium, LV – left ventricle, AV – aortic valve, and DA – descending aorta.

**Zoomed in View of Aortic and Mitral Valve**

Content on this page requires a newer version of Adobe Flash Player.