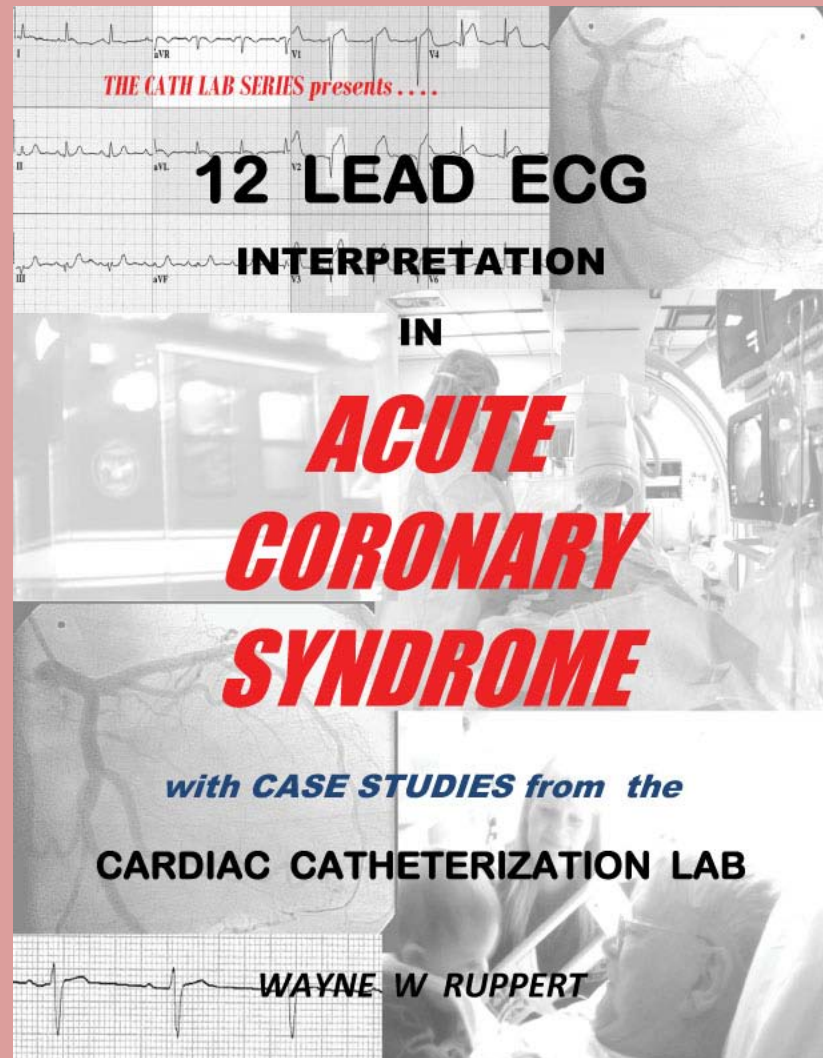


# ECG Hypertrophy Review

by: Wayne W Ruppert, CMT, CCCC, NRP

With excerpts from:

Copyright 2010



# **CHAMBER ENLARGEMENT**

**ABNORMAL ENLARGEMENT OF ONE OR MORE CHAMBERS OF THE HEART.**

## **MECHANISMS:**

- SYSTOLIC OVERLOAD (PRESSURE)**
- DIASTOLIC OVERLOAD (VOLUME)**

# **CHAMBER ENLARGEMENT**

## **SYSTOLIC OVERLOAD**

**A CONDITION WHERE THE HEART MUST OVERCOME UNUSUAL RESISTANCE TO EJECT BLOOD. THIS RESULTS IN MUSCLE THICKENING, or HYPERTROPHY.**

- VALVULAR STENOSIS**
- SYSTEMIC HYPERTENSION**
- PULMONARY HYPERTENSION**
- CONGENITAL ABNORMALITIES**

# **CHAMBER ENLARGEMENT**

## **DIASTOLIC OVERLOAD**

**A CONDITION WHERE DURING DIASTOLE, THE CHAMBER IS OVER-ENGORGED BY EXCESSIVE BLOOD VOLUME. THIS RESULTS IN "STRETCHING" or DILATION OF THE CHAMBER.**

- VALVULAR REGURGITATION**
- FLUID VOLUME OVERLOAD**

# **CHAMBER ENLARGEMENT**

---

## **EKG CHANGES**

**INCREASE IN CHAMBER SIZE and/or MASS RESULTS IN AN INCREASE IN AMPLITUDE and/or TIME IN ORDER TO ACHIEVE DEPOLARIZATION.**

**SIMPLY PUT, THE EKG WAVEFORMS ARE BIGGER AND LONGER THAN NORMAL IN CHAMBER ENLARGEMENT.**

# **CHAMBER ENLARGEMENT**

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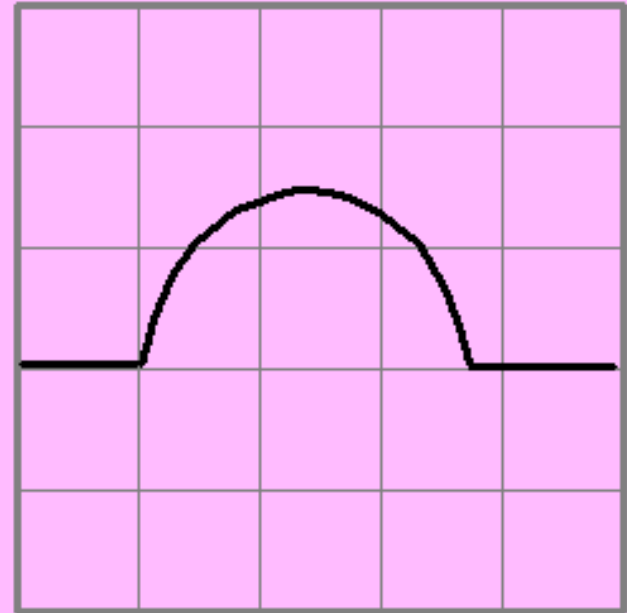
## **ATRIAL ENLARGEMENT**

---

- WE USE LEADS II and V1**
- FIRST, LOOK AT LEAD II TO SEE IF THE P-WAVE IS TOO HIGH OR TOO LONG . . .**

# THE P WAVE

- SHOULD BE UPRIGHT, CONVEX-SHAPED DOME IN ALL LEADS EXCEPT AVR and V1
- SHOULD BE LESS THAN .2 mv (2 mm) HIGH
- SHOULD BE LESS THAN 100 ms ( 2.5 mm ) LONG



# **CHAMBER ENLARGEMENT**

## **ATRIAL ENLARGEMENT**

- **IF THE P-WAVE IN LEAD II IS TOO LARGE ( < 2 mm HIGH and/or 2 1/2 mm LONG ) WE KNOW ATRIAL ENLARGEMENT EXISTS.**
- **THEN WE EXAMINE THE SHAPE OF THE P-WAVE IN LEAD II . . .**



# **CHAMBER ENLARGEMENT**

## **ATRIAL ENLARGEMENT**

- IF THE P-WAVE IS TOO HIGH IN LEAD II, WE SUSPECT RIGHT ATRIAL ENLARGEMENT.**
- IF THE P-WAVE IS TOO LONG IN LEAD II, WE SUSPECT LEFT ATRIAL ENLARGEMENT.**

# **CHAMBER ENLARGEMENT**

---

## **ATRIAL ENLARGEMENT**

---

- **P-WAVES THAT ARE "POINTY" IN LEAD II (as opposed to rounded) FAVOR RIGHT ATRIAL ENLARGEMENT**
- **P-WAVES THAT LOOK LIKE THE LETTER " M " FAVOR LEFT ATRIAL ENLARGEMENT**

# **CHAMBER ENLARGEMENT**

---

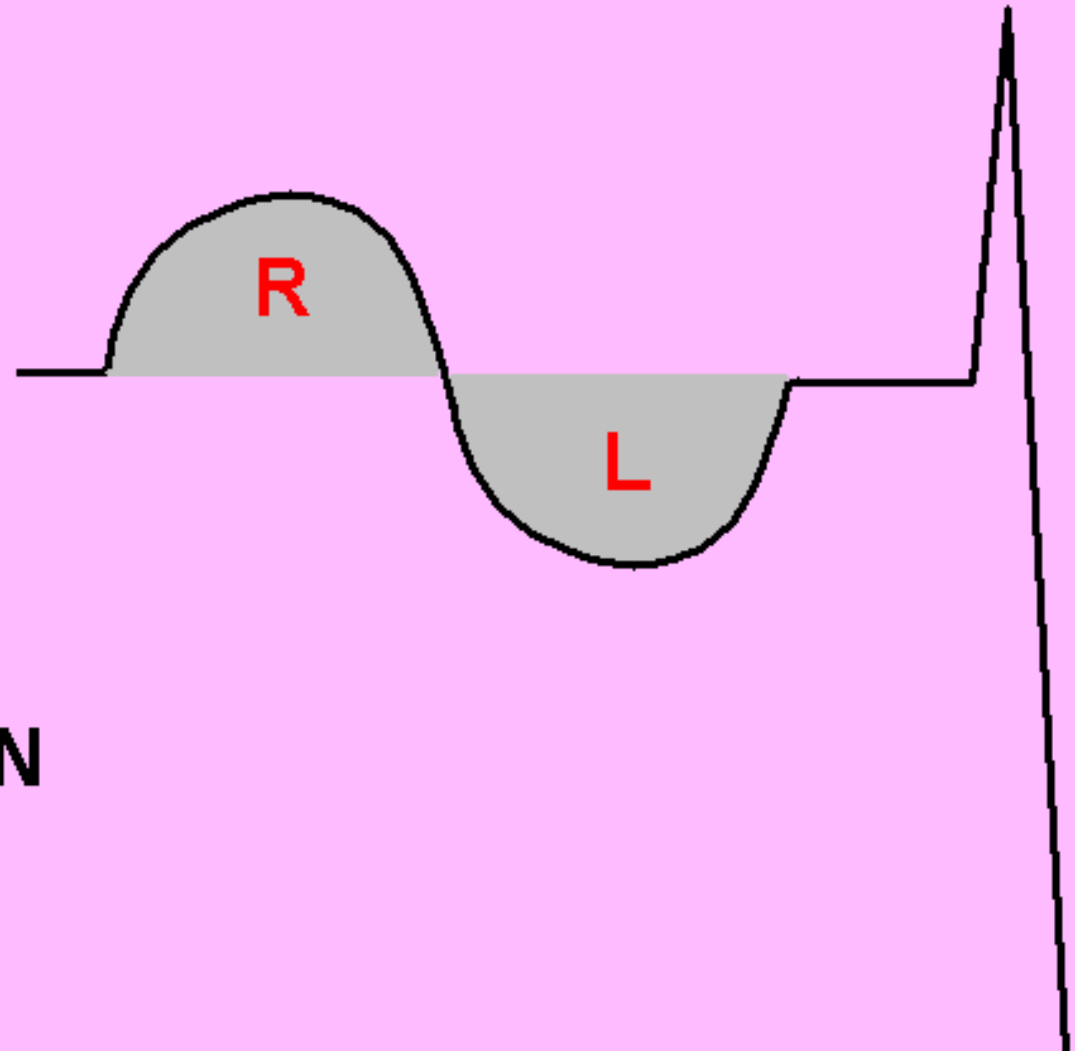
## **ATRIAL ENLARGEMENT**

---

**THEN, WE GO TO LEAD V-1 FOR  
FURTHER INFORMATION . . .**

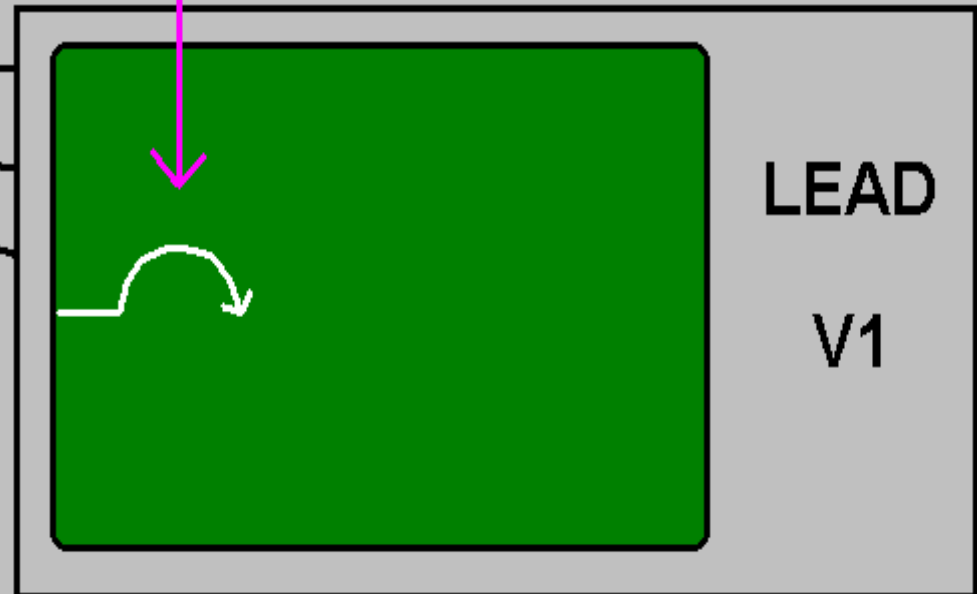
# THE P WAVE

- WHEN THE P WAVE IS BI-PHASIC IN V1, IT DISPLAYS BOTH R and L ATRIAL DEPOLARIZATION



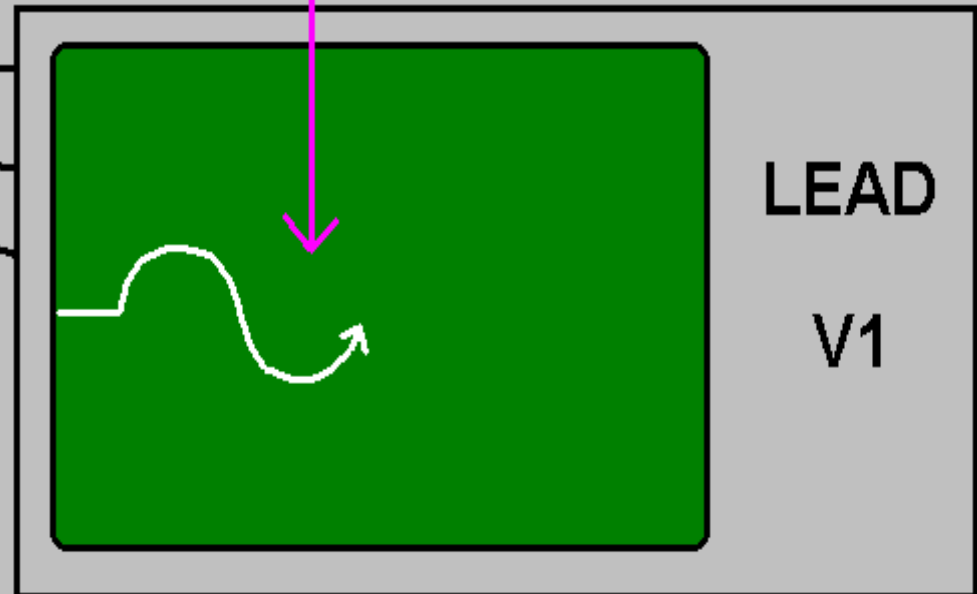
# RIGHT ATRIAL DEPOLARIZATION

FIRST 1/2 of  
P WAVE



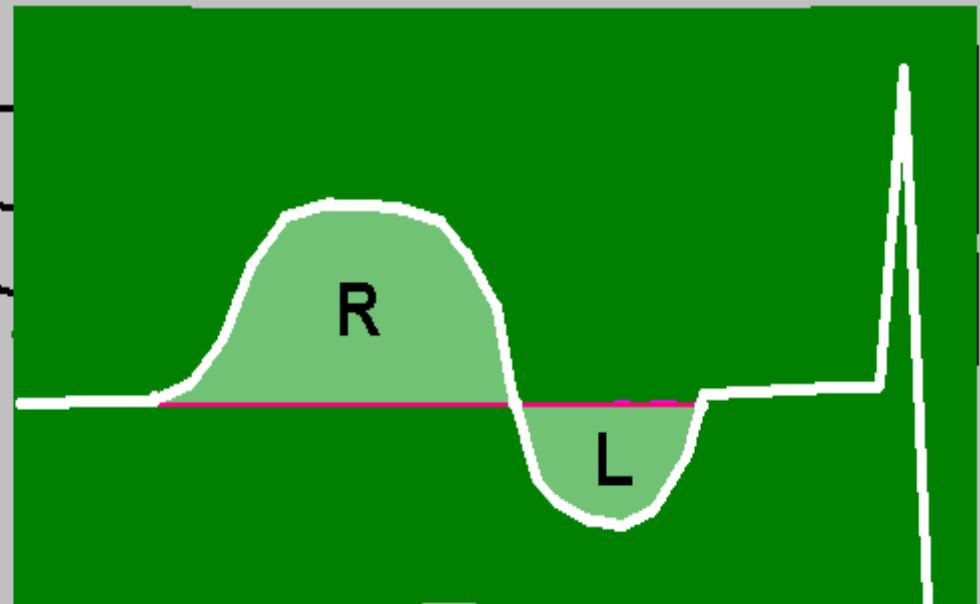
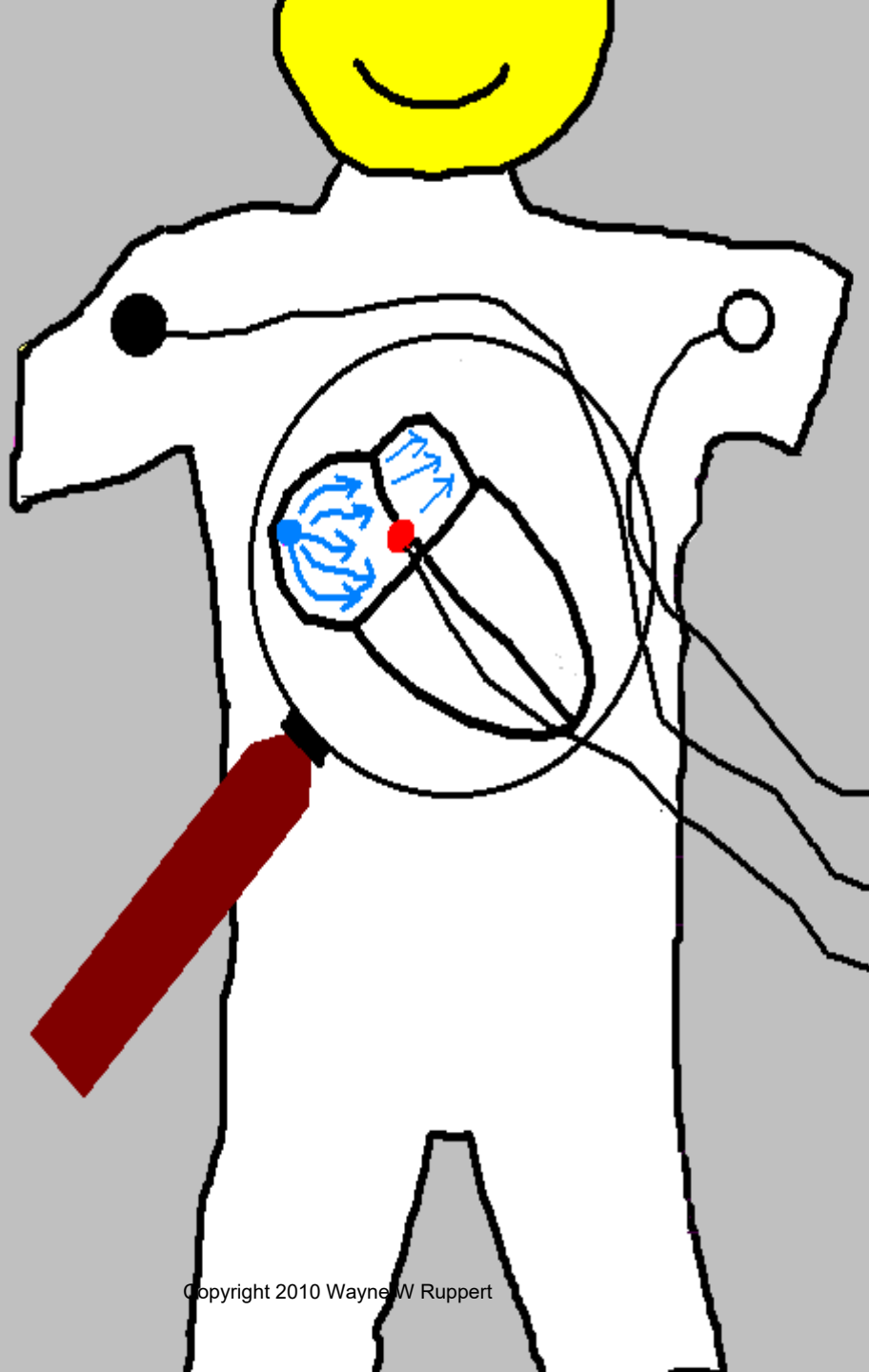
# LEFT ATRIAL DEPOLARIZATION

LAST 1/2 of  
P WAVE



# RIGHT ATRIAL ENLARGEMENT

## P-WAVE IN V1



29 yr  
Male Black  
Room:ER  
Loc:3 Option:28

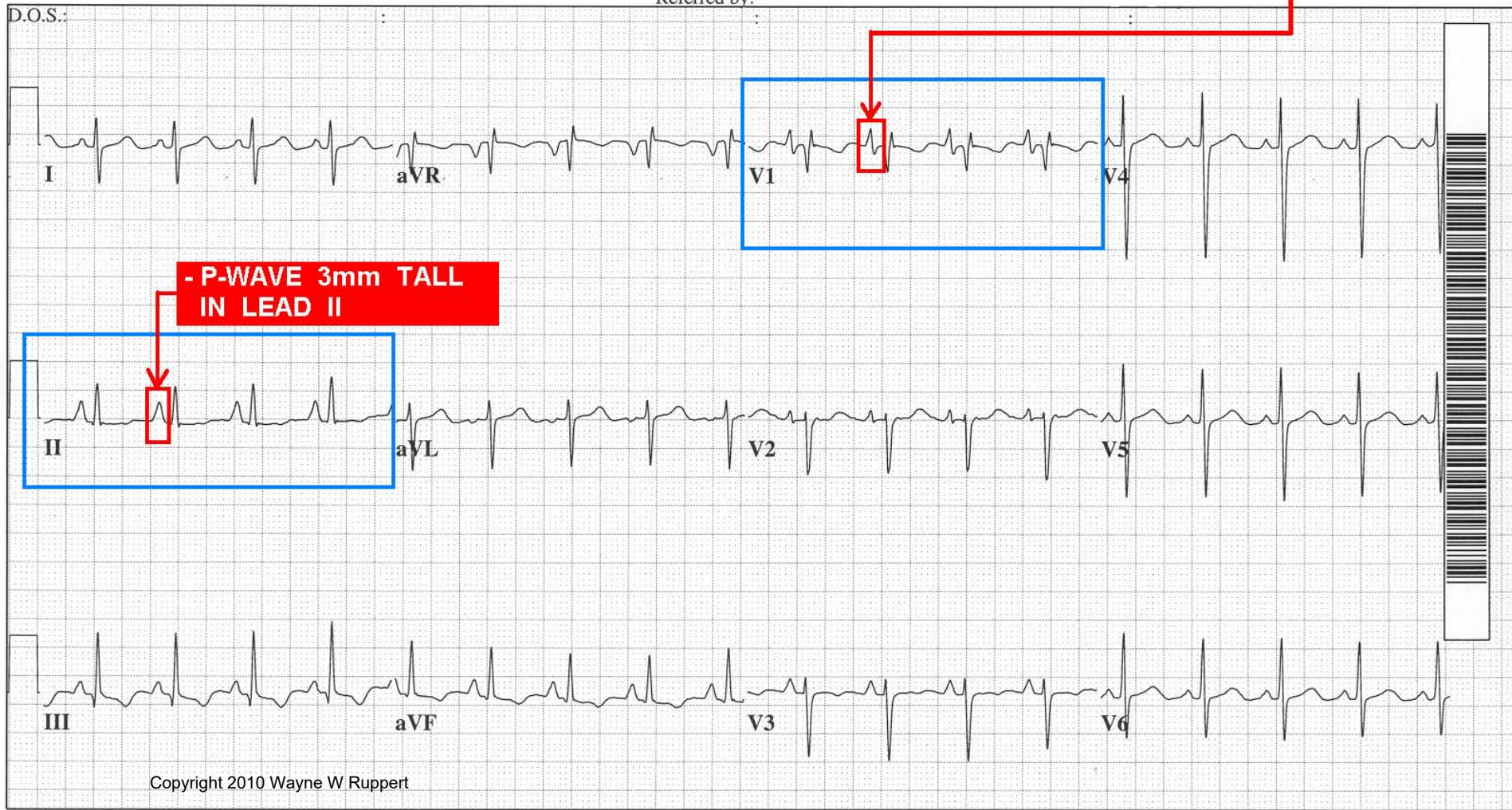
Vent. rate 107 BPM  
PR interval 132 ms  
QRS duration 80 ms  
QT/QTc 310/413 ms  
P-R-T axes 67 105 -32

Sinus tachycardia  
**Right atrial enlargement**  
Rightward axis  
Pulmonary disease pattern  
RSR' or QR pattern in V1 suggests right ventricular  
T wave abnormality, consider inferior ischemia  
Abnormal ECG  
When compared with ECG of 01-OCT-1998 21:45  
T wave inversion more evident in Inferior leads ...

**- POSITIVE DEFLECTION  
TALLER (more  
dominant) IN LEAD  
V1**

**EKG CLASS #WR03446043**

Referred by:



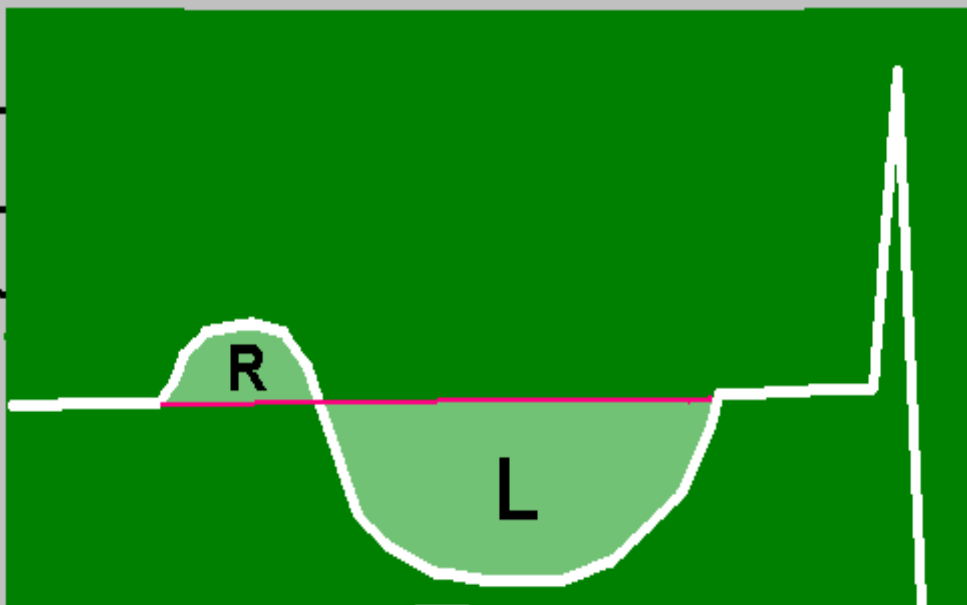
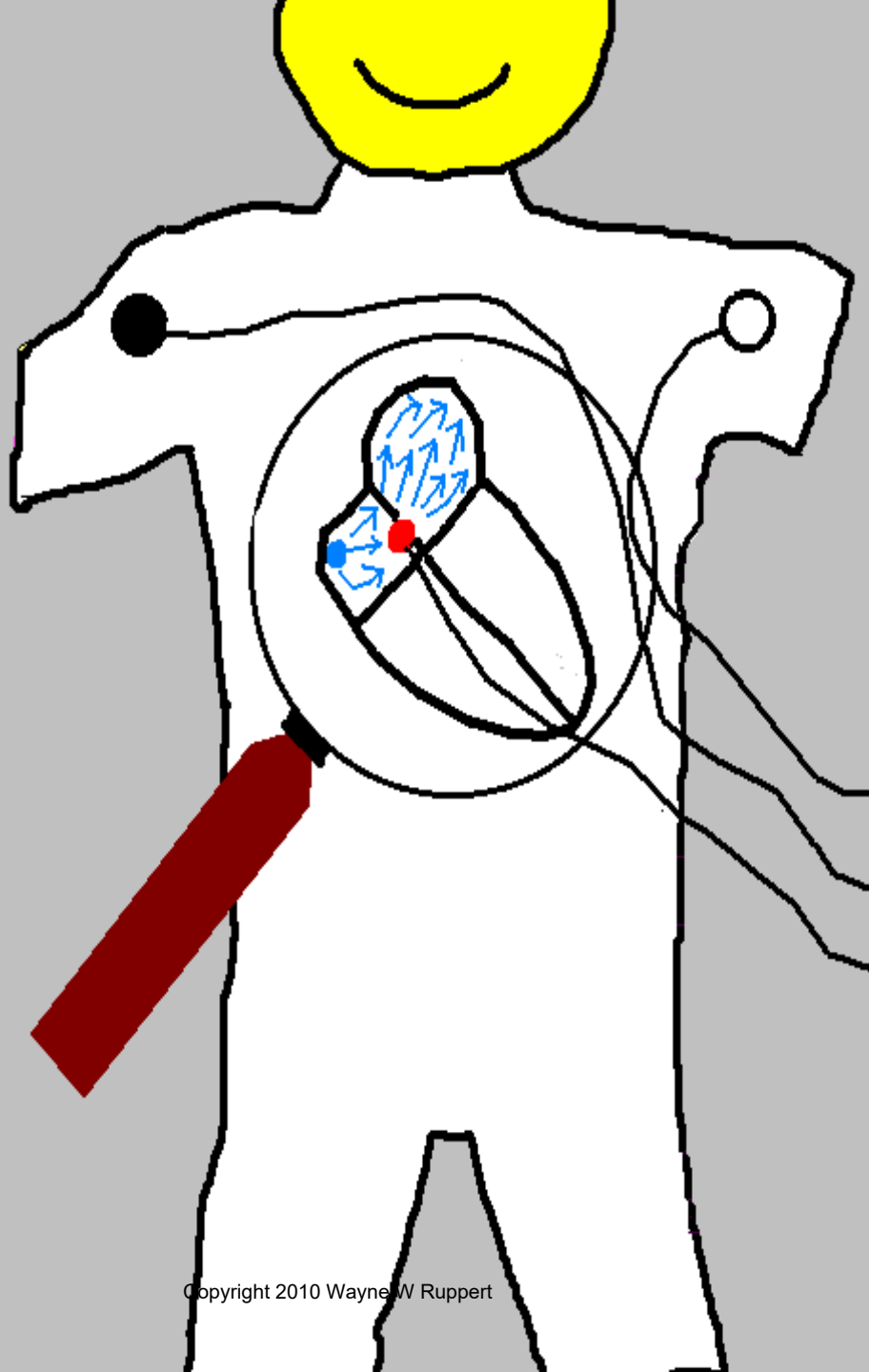
**- P-WAVE 3mm TALL  
IN LEAD II**

**- POSITIVE DEFLECTION  
TALLER (more  
dominant) IN LEAD  
V1**



# LEFT ATRIAL ENLARGEMENT

## P-WAVE IN V1



77 yr  
Male Caucasian  
Room:S 1  
Loc:3 Option:10

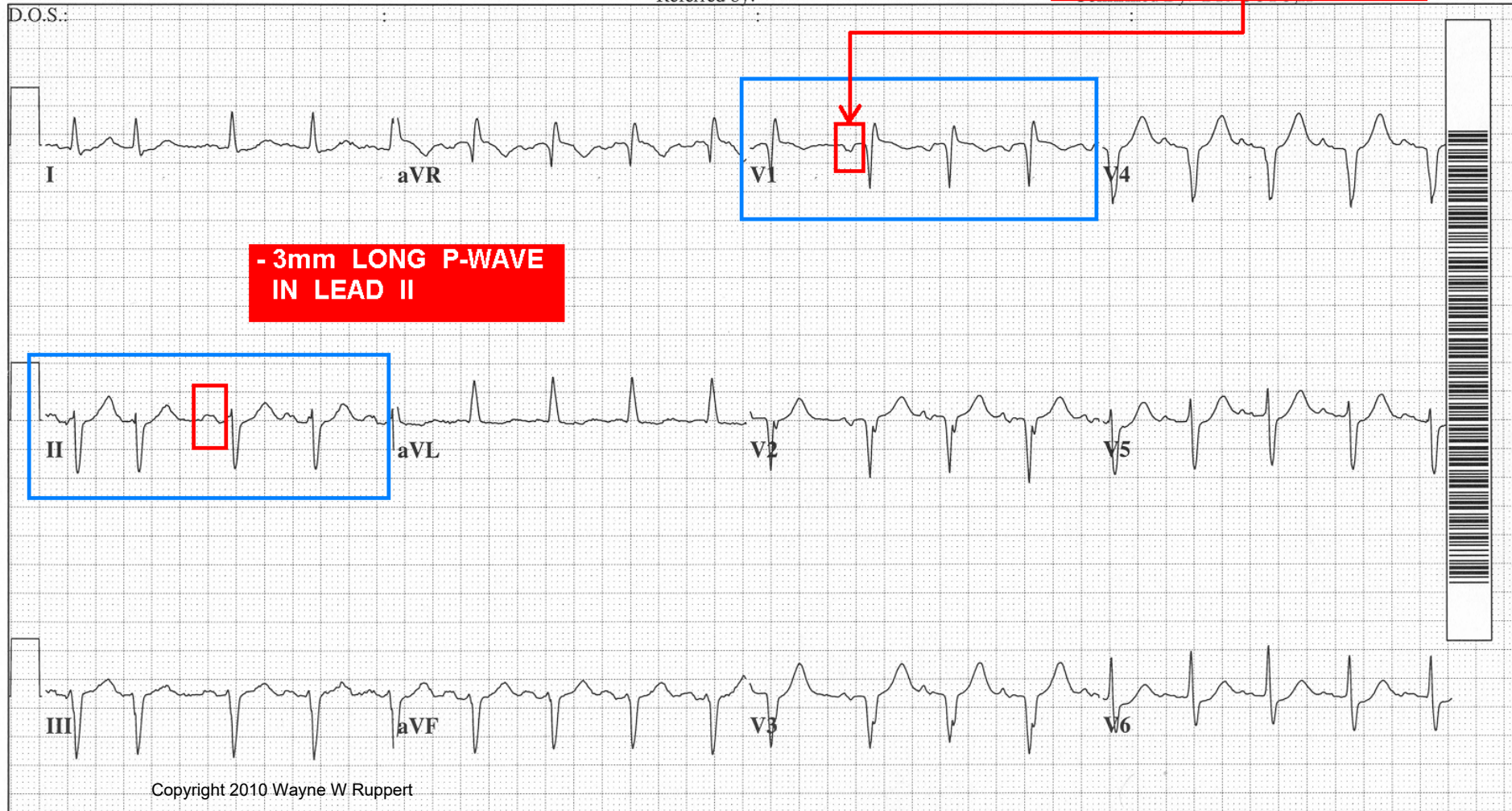
Vent. rate 106 BPM  
PR interval 170 ms  
QRS duration 104 ms  
QT/QTc 374/496 ms  
P-R-T axes 67 -66 70

Sinus tachycardia with occasional Premature supraventricular complexes  
**Left atrial enlargement**  
Left axis deviation  
Incomplete right bundle branch block  
Anteroseptal infarct , age undetermined  
Abnormal ECG  
No previous ECGs available

**- NEGATIVE DEFLECTION P-WAVE IN LEAD V1**

**EKG CLASS #WR03651849**

Referred by:



# **CHAMBER ENLARGEMENT**

## **VENTRICULAR ENLARGEMENT**

**I USE SEVERAL TECHNIQUES FOR IDENTIFYING RIGHT AND LEFT VENTRICULAR HYPERTROPHY.**

**1. AXIS OF LEAD I and V1**

# CHAMBER ENLARGEMENT

## VENTRICULAR ENLARGEMENT

|           | I   | V1  |
|-----------|---|---|
| NORMAL    |    |    |
| LVH       |    |    |
| RVH       |   |   |
| LVH & RVH |  |  |

# **CHAMBER ENLARGEMENT**

## **VENTRICULAR ENLARGEMENT**

**I USE SEVERAL TECHNIQUES FOR IDENTIFYING RIGHT AND LEFT VENTRICULAR HYPERTROPHY.**

- 1. AXIS OF LEAD I and V1**
- 2. PRESENCE OF ATRIAL HYPERTROPHY**

# **CHAMBER ENLARGEMENT**

---

## **VENTRICULAR ENLARGEMENT**

---

***IMPORTANT NOTE !!***

**ENLARGEMENT OF THE RIGHT OR LEFT VENTRICLE IS FREQUENTLY ACCOMPANIED BY ENLARGEMENT OF THE CORRESPONDING ATRIUM !**

***- THIS MAY BE A HELPFUL CLUE IN DIAGNOSING THE EKG !***

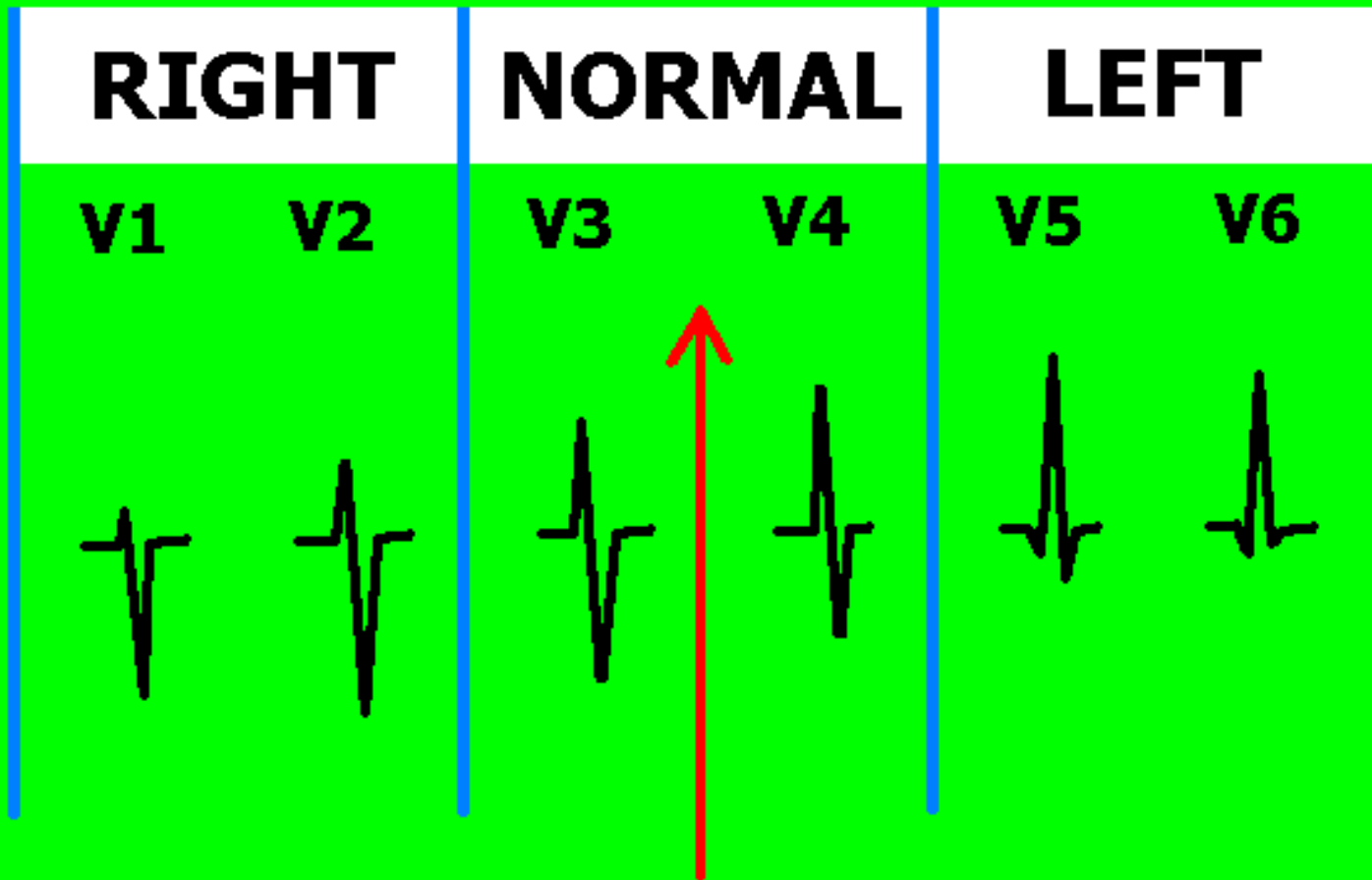
# **CHAMBER ENLARGEMENT**

## **VENTRICULAR ENLARGEMENT**

**I USE SEVERAL TECHNIQUES FOR IDENTIFYING RIGHT AND LEFT VENTRICULAR HYPERTROPHY.**

- 1. AXIS OF LEAD I and V1**
- 2. PRESENCE OF ATRIAL HYPERTROPHY**
- 3. R-WAVE PROGRESSION OF V LEADS**

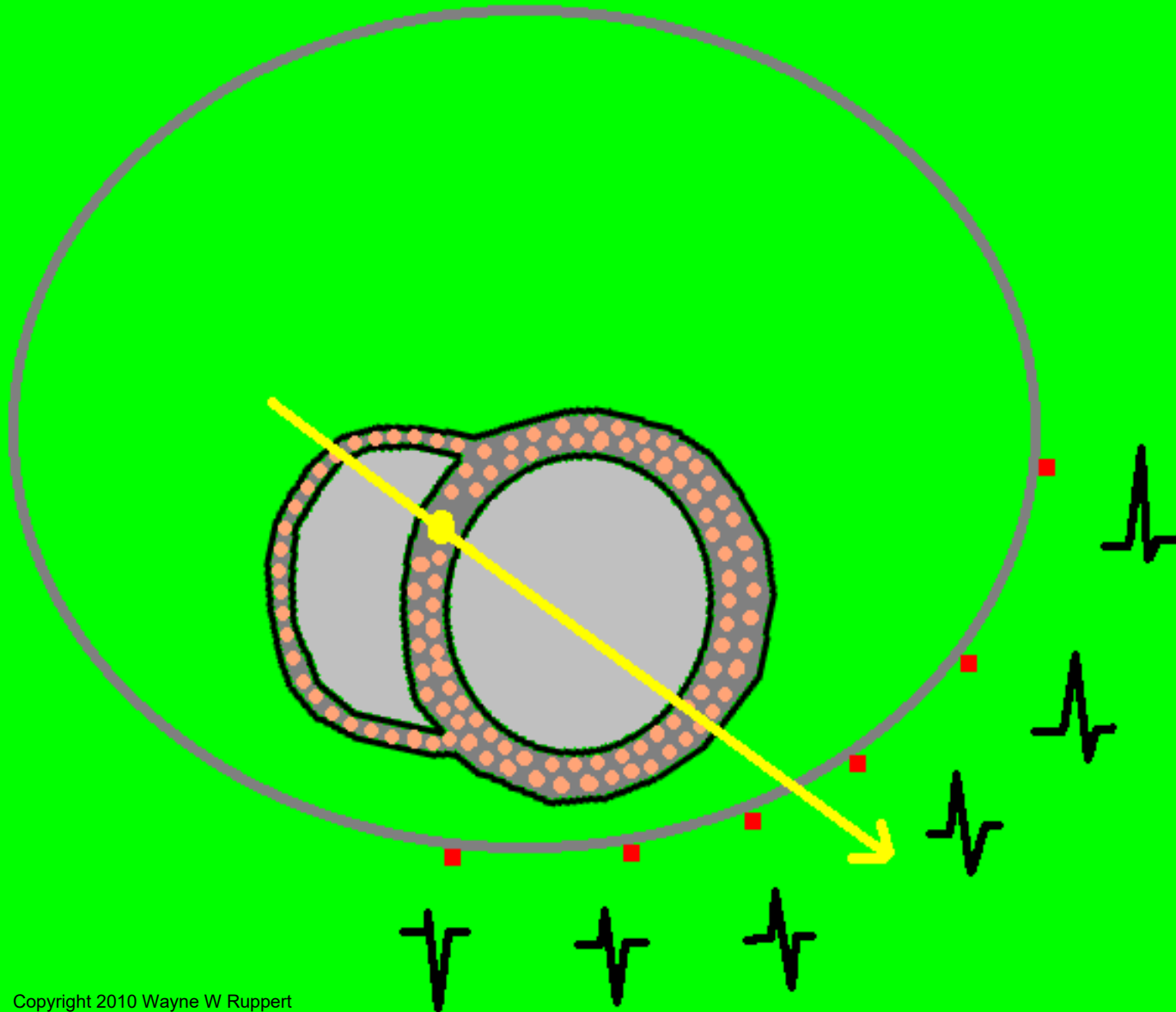
# AXIS ROTATION



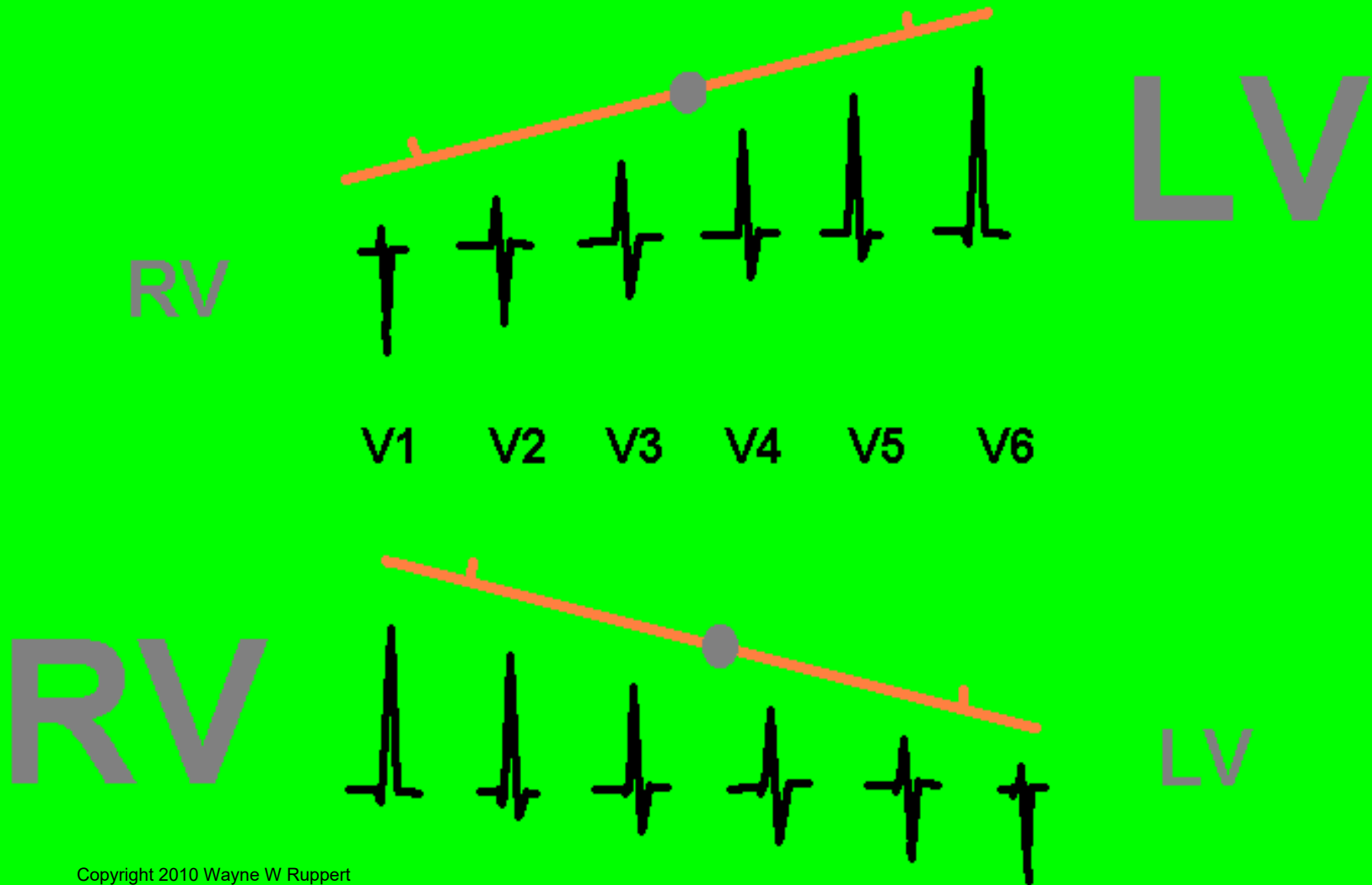
**TRANSITION SHOULD  
OCCUR IN LEADS V3 or V4**



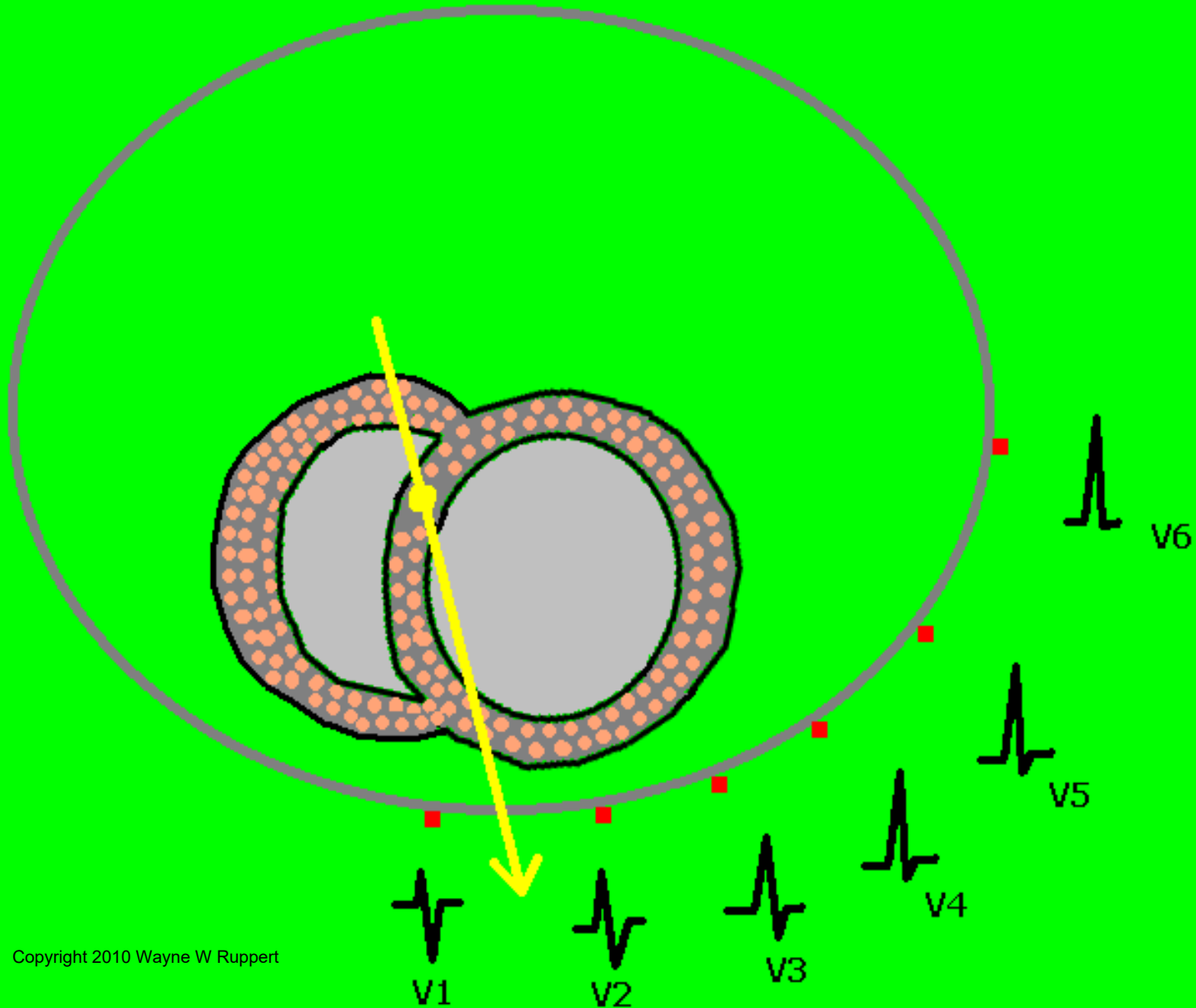
# NORMAL TRANSITION



# "SEE-SAW EFFECT" of RVH on R WAVE PROGRESSION

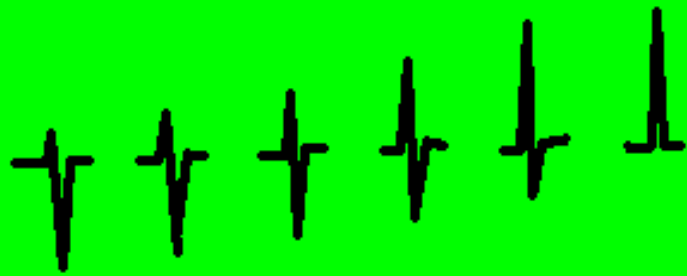


# RIGHT VENTRICULAR HYPERTROPHY



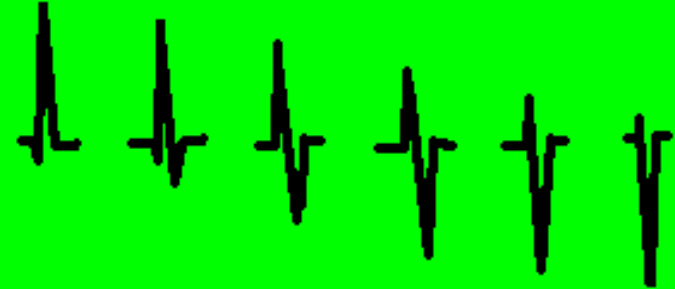
# REVERSE R WAVE PROGRESSION COMMON CAUSES

**NORMAL**



V1 V2 V3 V4 V5 V6

**REVERSE**



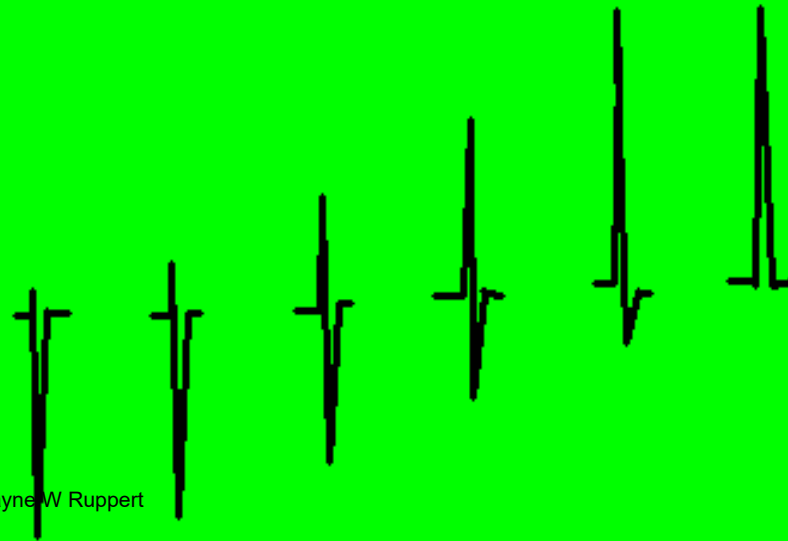
V1 V2 V3 V4 V5 V6

1. RIGHT VENTRICULAR HYPERTROPHY
2. VENTRICULAR RHYTHMS
3. WOLF-PARKINSON-WHITE
4. OLD POSTERIOR-LATERAL MI

# "EXAGGERATED" QRS SIZE in V leads FROM LEFT VENTRICULAR HYPERTROPHY

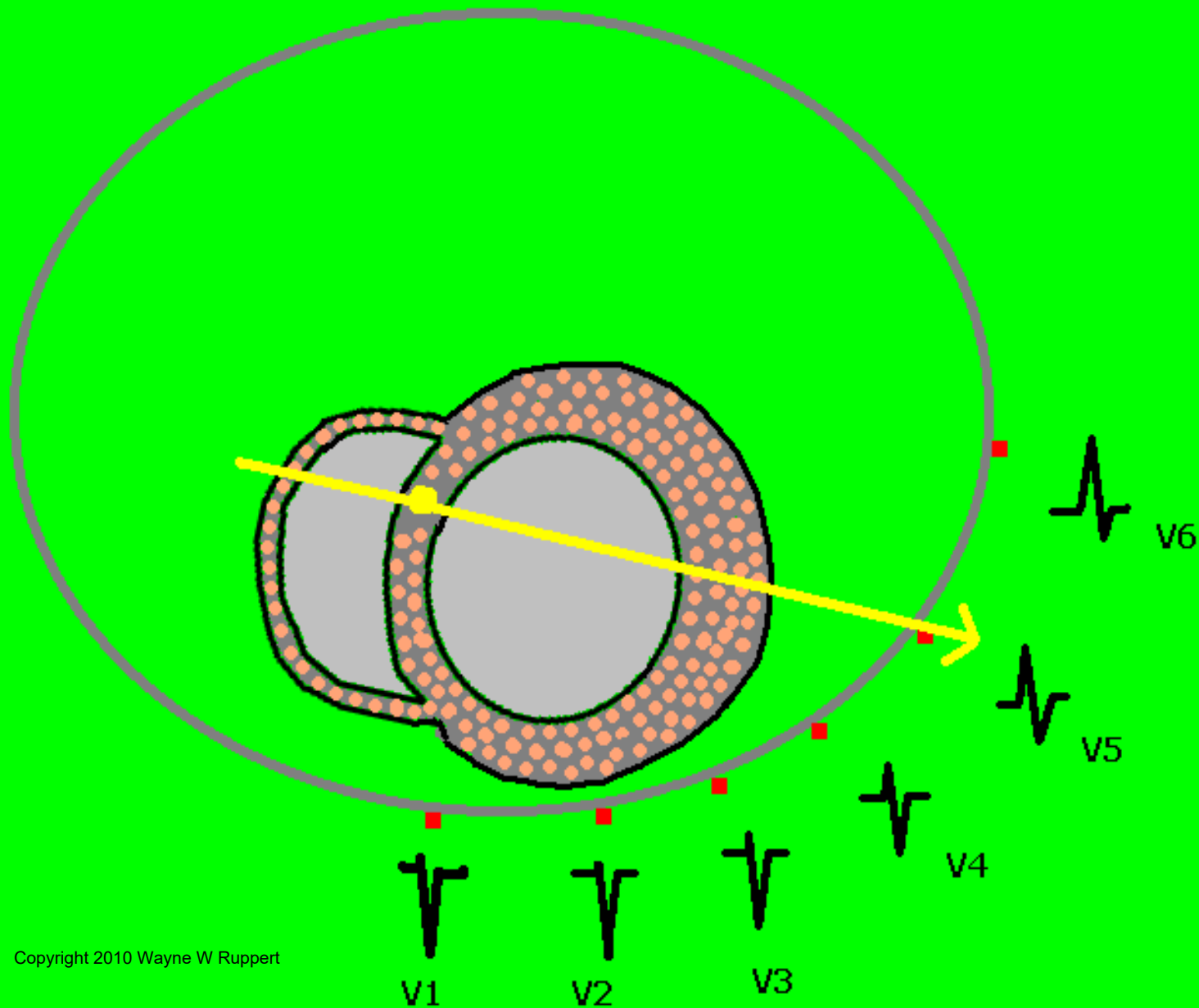


NORMAL



LVH

# LEFT VENTRICULAR HYPERTROPHY



# **CHAMBER ENLARGEMENT**

## **VENTRICULAR ENLARGEMENT**

**I USE SEVERAL TECHNIQUES FOR IDENTIFYING RIGHT AND LEFT VENTRICULAR HYPERTROPHY.**

- 1. AXIS OF LEAD I and V1**
- 2. PRESENCE OF ATRIAL HYPERTROPHY**
- 3. R-WAVE PROGRESSION OF V LEADS**
- 4. STRAIN PATTERN OF T WAVES  
IN V1 - V2 and V5 - V6**

# CHAMBER ENLARGEMENT

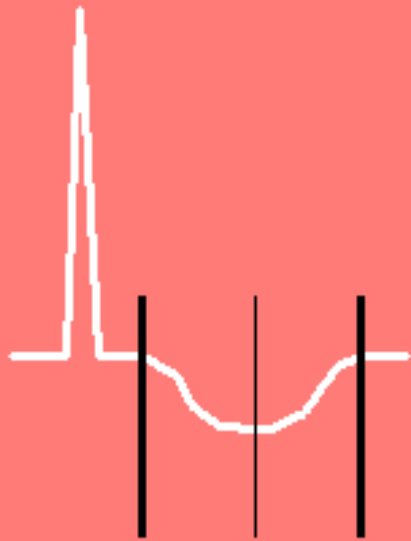
---

## VENTRICULAR STRAIN PATTERNS

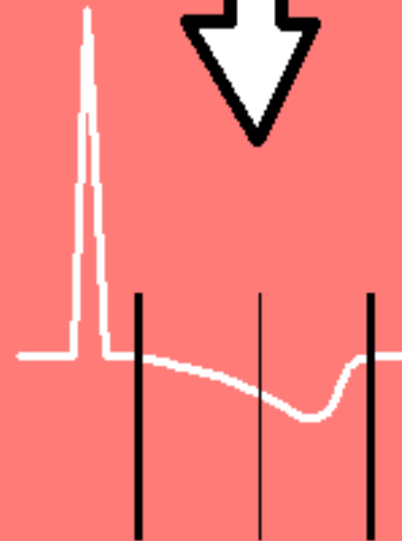
---



T-WAVES ARE INVERTED  
and ASYMMETRICAL



**symmetrical**



**asymmetrical**



# CHAMBER ENLARGEMENT

---

## VENTRICULAR STRAIN PATTERNS

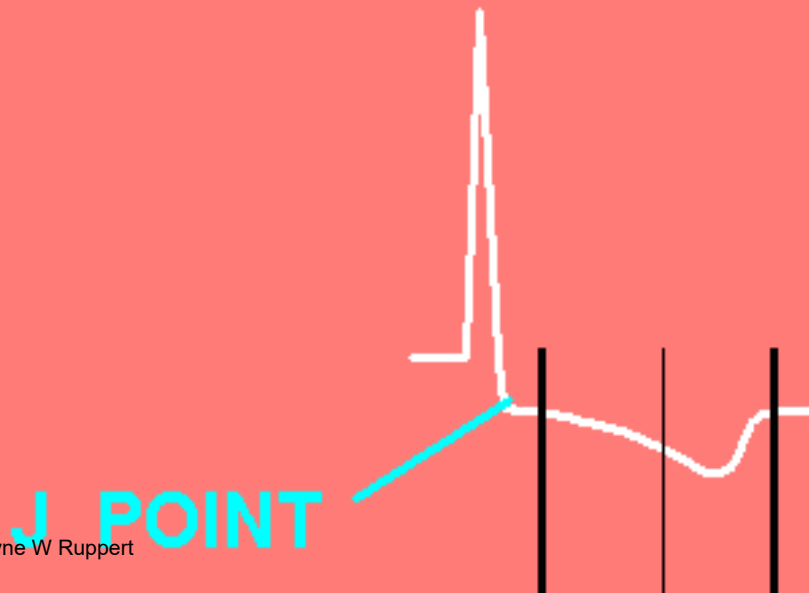
---



**T WAVES ARE INVERTED  
AND ASYMMETRICAL**



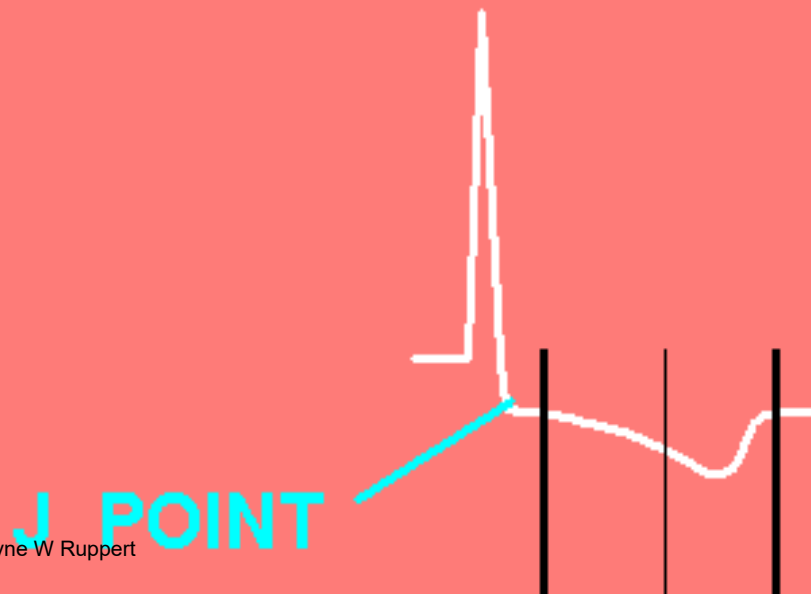
**THERE MAY BE S-T SEGMENT  
DEPRESSION**



# CHAMBER ENLARGEMENT

## VENTRICULAR STRAIN PATTERNS

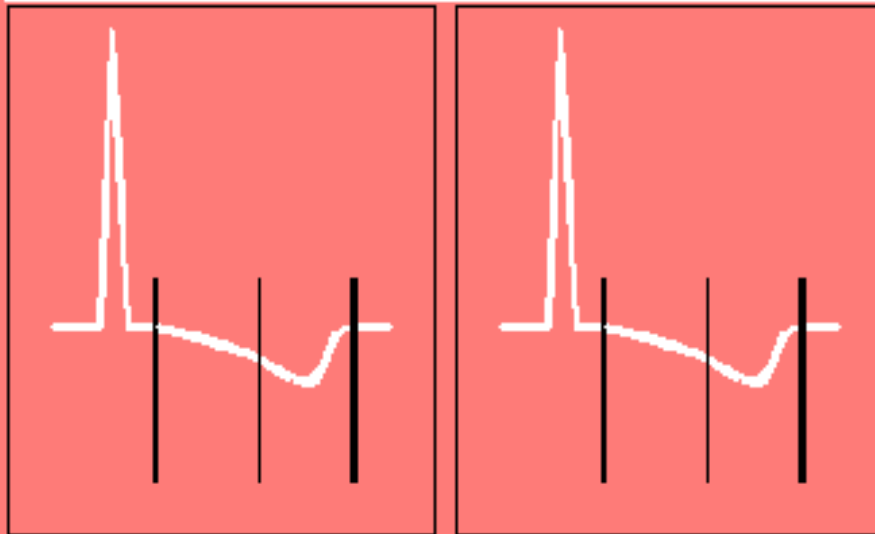
STRAIN PATTERNS ARE INDICATIVE OF SYSTOLIC OVERLOAD -- THE VENTRICLES HAVING TO OVERCOME GREAT FORCE TO EXPEL BLOOD.



# CHAMBER ENLARGEMENT

## VENTRICULAR STRAIN PATTERNS

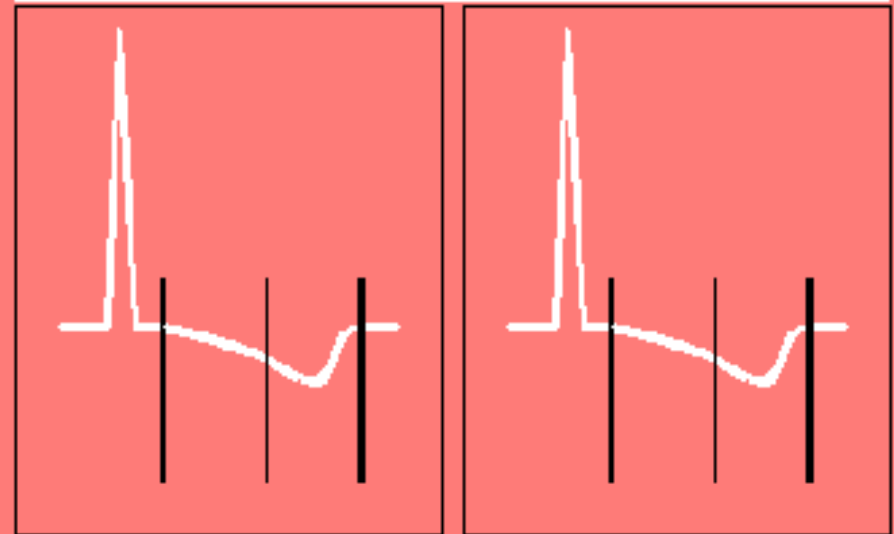
### RVH



V1

V2

### LVH



V5

V6

# **CHAMBER ENLARGEMENT**

## **VENTRICULAR ENLARGEMENT**

**I USE SEVERAL TECHNIQUES FOR IDENTIFYING RIGHT AND LEFT VENTRICULAR HYPERTROPHY.**

- 1. AXIS OF LEAD I and V1**
- 2. PRESENCE OF ATRIAL HYPERTROPHY**
- 3. R-WAVE PROGRESSION OF V LEADS**
- 4. STRAIN PATTERN OF T WAVES  
IN V1 - V2 and V5 - V6**
- 5. MATHEMATICAL FORMULAS**

# **CHAMBER ENLARGEMENT**

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## **\* MATHEMATICAL FORMULAS FOR DETERMINING LVH and RVH**

---

### **LVH**

- R-WAVE V1 + S-WAVE LEAD III > 25mm
- R-WAVE V5 or V6 > 26mm
- S-WAVE V1 + R-WAVE V5 or V6 > 35mm
- LARGEST R-WAVE + LARGEST S-WAVE in V-LEADS > 45mm

### **RVH**

- R-WAVE V1 + S-WAVE V5 or V6 > 10.5mm
- rSR' in V1 where R' ≥ 10mm

14-JUL-1997 14:30:58

ST. JOSEPH'S HOSPITAL-ER ROUTINE RETRIEVAL

17 yr  
Male Black  
Room:ER  
Loc:3 Option:16

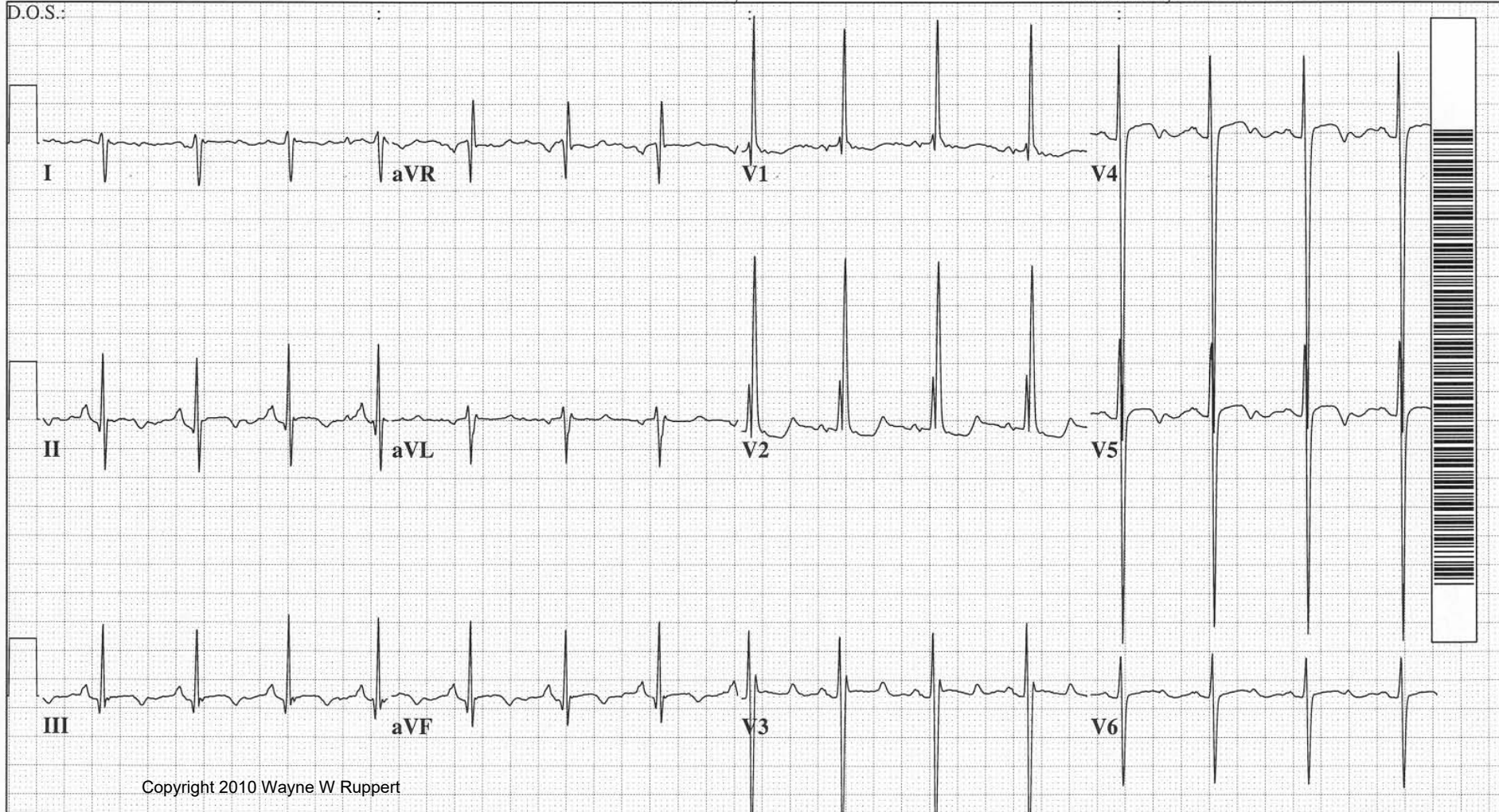
Vent. rate 90 BPM  
PR interval 136 ms  
QRS duration 94 ms  
QT/QTc 378/462 ms  
P-R-T axes 77 123 58

Normal sinus rhythm  
Right atrial enlargement  
Right axis deviation  
Incomplete right bundle branch block , plus right ventricular hypertrophy  
NORMAL SINUS INFERIOR LATERAL CHANGES  
Abnormal ECG

### EKG CLASS #WRO3616941

Referred by:

Confirmed By:



17 yr  
Male Black  
Room:ER  
Loc:3 Option:16

Vent. rate 90 BPM  
PR interval 136 ms  
QRS duration 94 ms  
QT/QTc 378/462 ms  
P-R-T axes 77 123 58

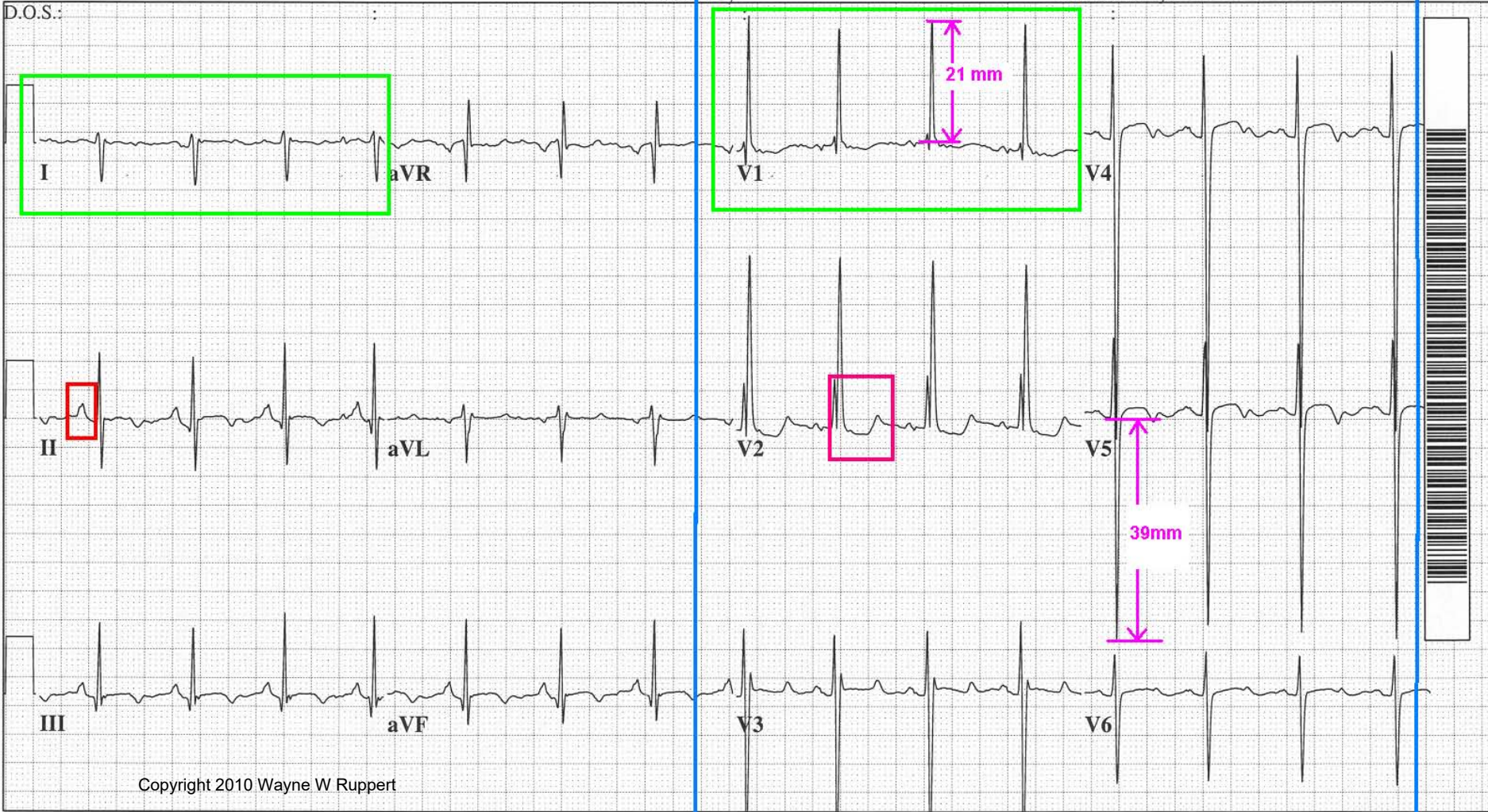
Normal sinus rhythm  
**Right atrial enlargement**  
Right axis deviation  
Incomplete right bundle branch block,  
**plus right ventricular hypertrophy**  
NORMAL SINUS INFERIOR LATERAL  
Abnormal ECG

**- REVERSE AXIS LEADS I and V1**  
**- RIGHT ATRIAL HYPERTROPHY**  
**- REVERSE R-WAVE PROGRESSION IN V-LEADS**  
**- R-WAVE V1 + S-WAVE V5 or V6 > 10.5mm (TOTAL = 60 mm !)**  
**- RV STRAIN PATTERN IN V2**

**EKG CLASS #WRO3616941**

Referred by:

Confirmed By:



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53 yr  
Male Caucasian  
Room:ER S3  
Loc:3 Option:18

Vent. rate 100 BPM  
PR interval 198 ms  
QRS duration 186 ms  
QT/QTc 380/490 ms  
P-R-T axes 79 163 -20

Normal sinus rhythm  
Left atrial enlargement  
Right bundle branch block , plus right ventricular hypertrophy  
Left posterior fascicular block  
\*\*\* Bifascicular block \*\*\*  
NONSPECIFIC ST CHANGES  
Abnormal ECG  
When compared with ECG of 21-APR-1996 11:44,  
No significant change was found

**EKG CLASS #WR03028722**

Referred by:

Confirmed By:



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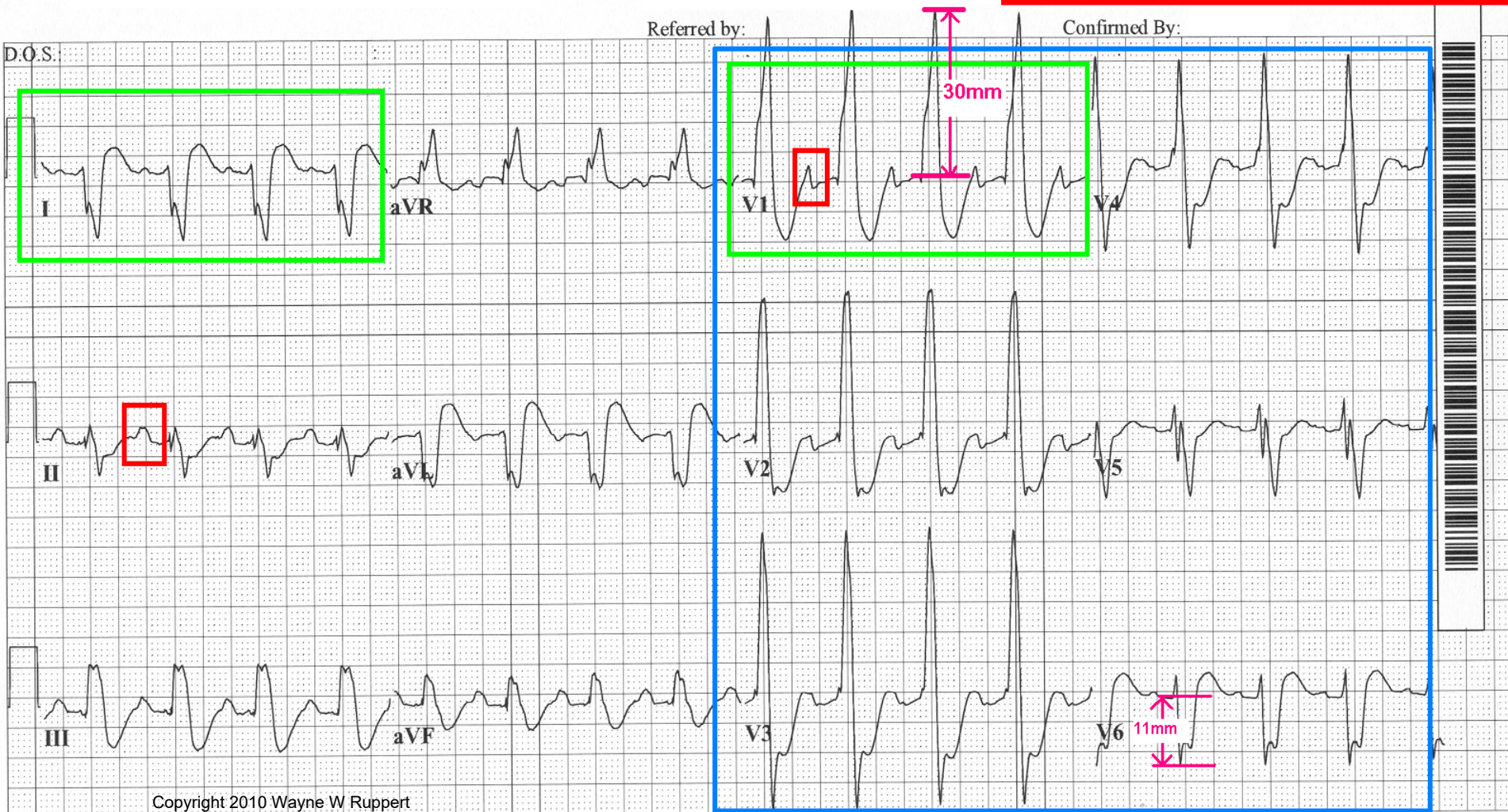
53 yr  
Male Caucasian  
Room:ER S3  
Loc:3 Option:18

Vent. rate 100 BPM  
PR interval 198 ms  
QRS duration 186 ms  
QT/QTc 380/490 ms  
P-R-T axes 79 163 -20

Normal sinus rhythm  
**Left atrial enlargement**  
Right bundle branch block,  
**plus right ventricular hypertrophy**  
Left posterior fascicular block  
\*\*\* Bifascicular block \*\*\*  
NONSPECIFIC ST CHANGES  
Abnormal ECG

- "REVERSE" AXIS LEAD I and V1  
- RIGHT ATRIAL ENLARGEMENT  
- REVERSE R-WAVE PROGRESSION IN THE V-LEADS  
- R-WAVE IN V1 + S WAVE V5 or V6 > 10 mm (41 mm) !!

EKG CLASS #WR03028722



Referred by:

Confirmed By:



53 yr  
Male Black  
Room:ER  
Loc:3 Option:23

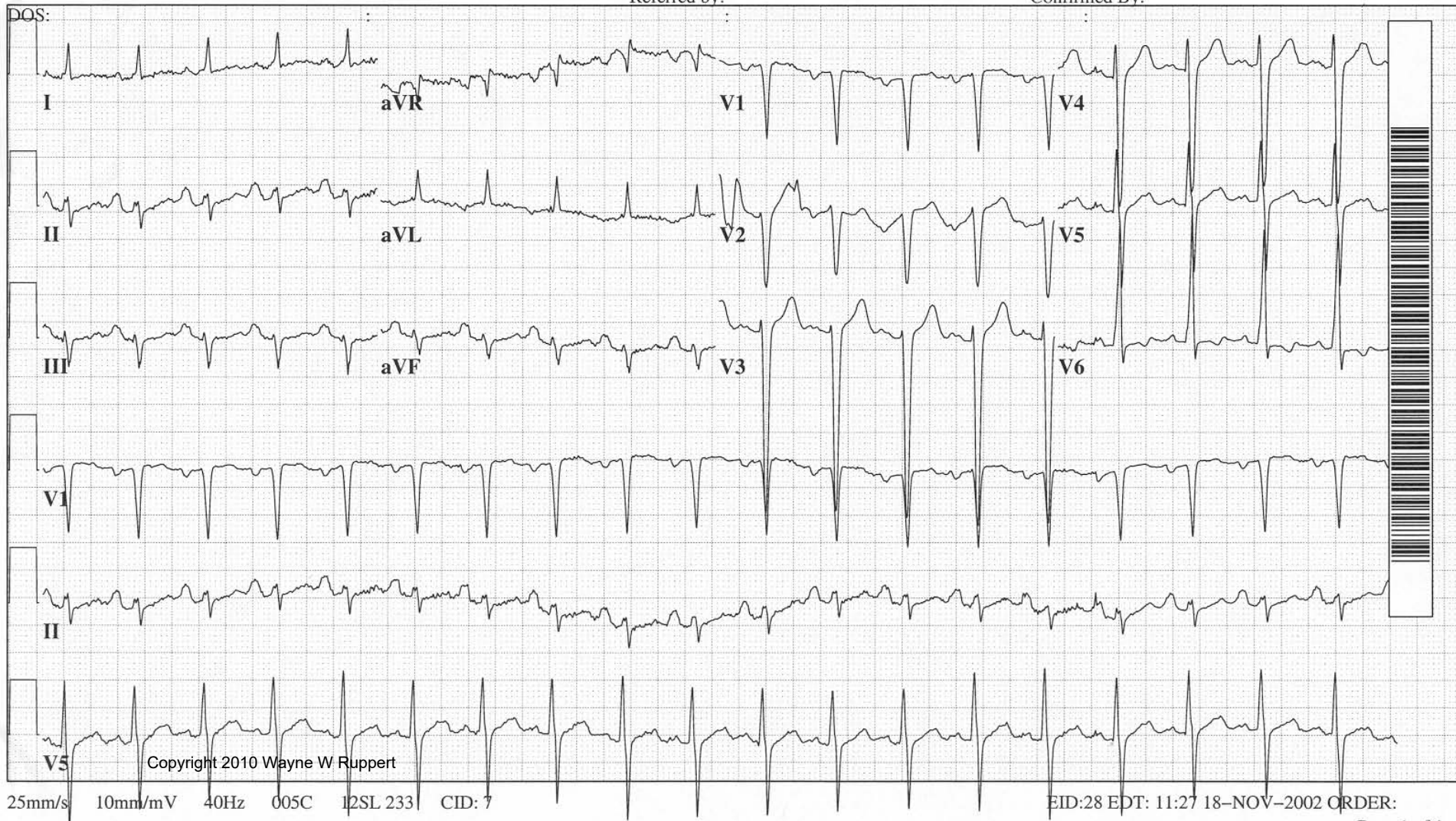
Vent. rate 115 BPM  
PR interval 160 ms  
QRS duration 92 ms  
QT/QTc 316/437 ms  
P-R-T axes 76 -39 59

**\*\*UNEDITED COPY - REPORT IS COMPUTER GENERATED ONLY, WITHOUT PHYSICIAN INTERPRETATION**  
Sinus tachycardia  
Possible Left atrial enlargement  
Left axis deviation  
Left ventricular hypertrophy  
Abnormal ECG  
No previous ECGs available

**EKG CLASS #WR03896717**

Referred by:

Confirmed By:



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53 yr  
Male Black  
Room:ER  
Loc:3 Option:23

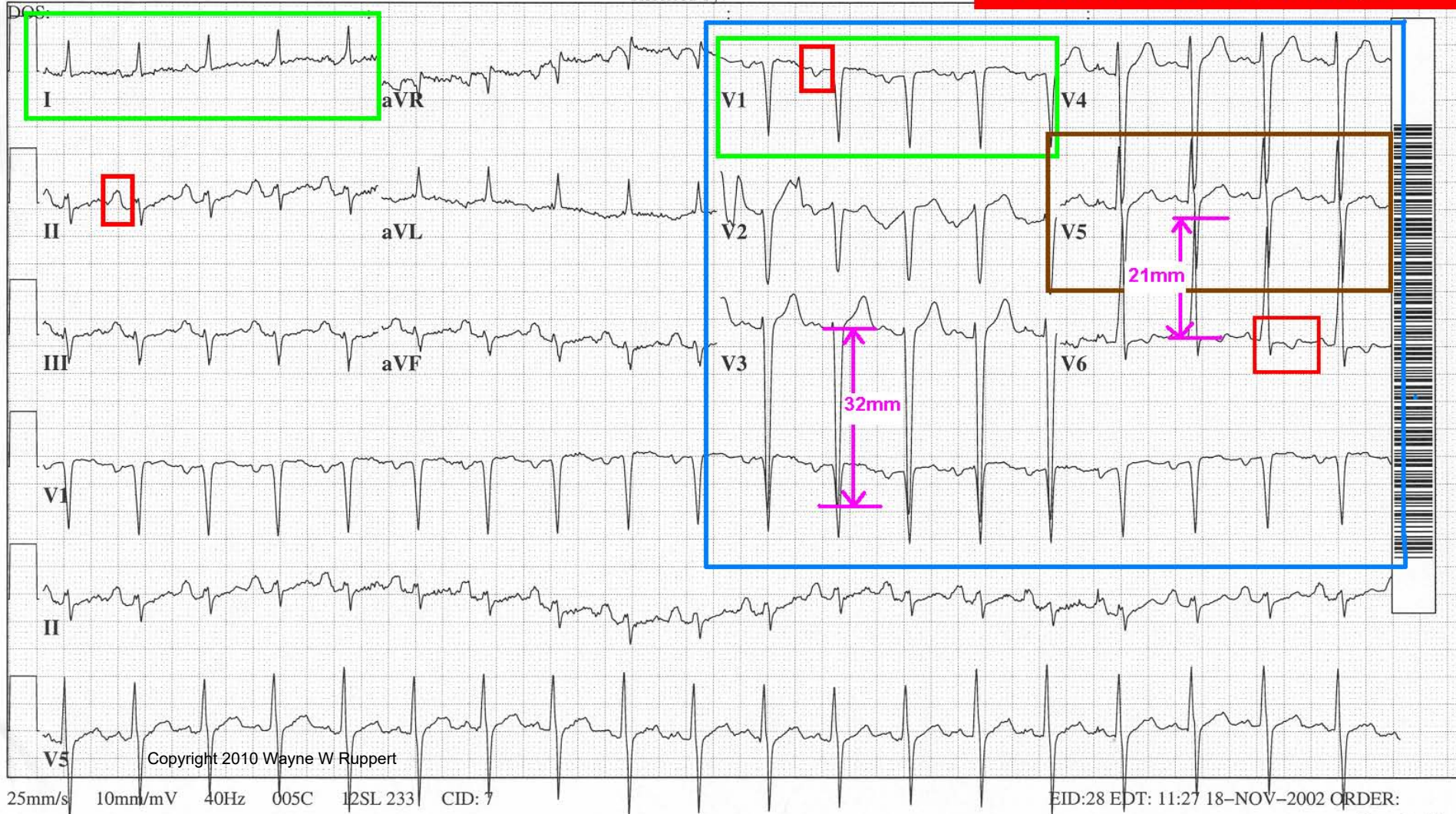
Vent. rate 115 BPM  
PR interval 160 ms  
QRS duration 92 ms  
QT/QTc 316/437 ms  
P-R-T axes 76 -39 59

\*\*UNEDITED COPY - REPORT IS CO  
PHYSICIAN INTERPRETATION  
Sinus tachycardia  
Possible Left atrial enlargement  
Left axis deviation  
Left ventricular hypertrophy  
Abnormal ECG  
No previous ECGs available

**- LEAD I and V2 AXIS NORMAL  
- LEFT ATRIAL ENLARGEMENT  
- "EXAGGERATED" R-WAVE  
PROGRESSION IN V-LEADS  
- TRANSITION IS LATE -- V-5  
- LV STRAIN PATTERN IN V6  
- BIGGEST R-WAVE + S-WAVE IN  
V-LEADS > 45mm ( 53 mm ) !!**

**EKG CLASS #WR03896717**

Referred by:



42 yr  
Male Black  
Room:ER  
Loc:3 Option:23

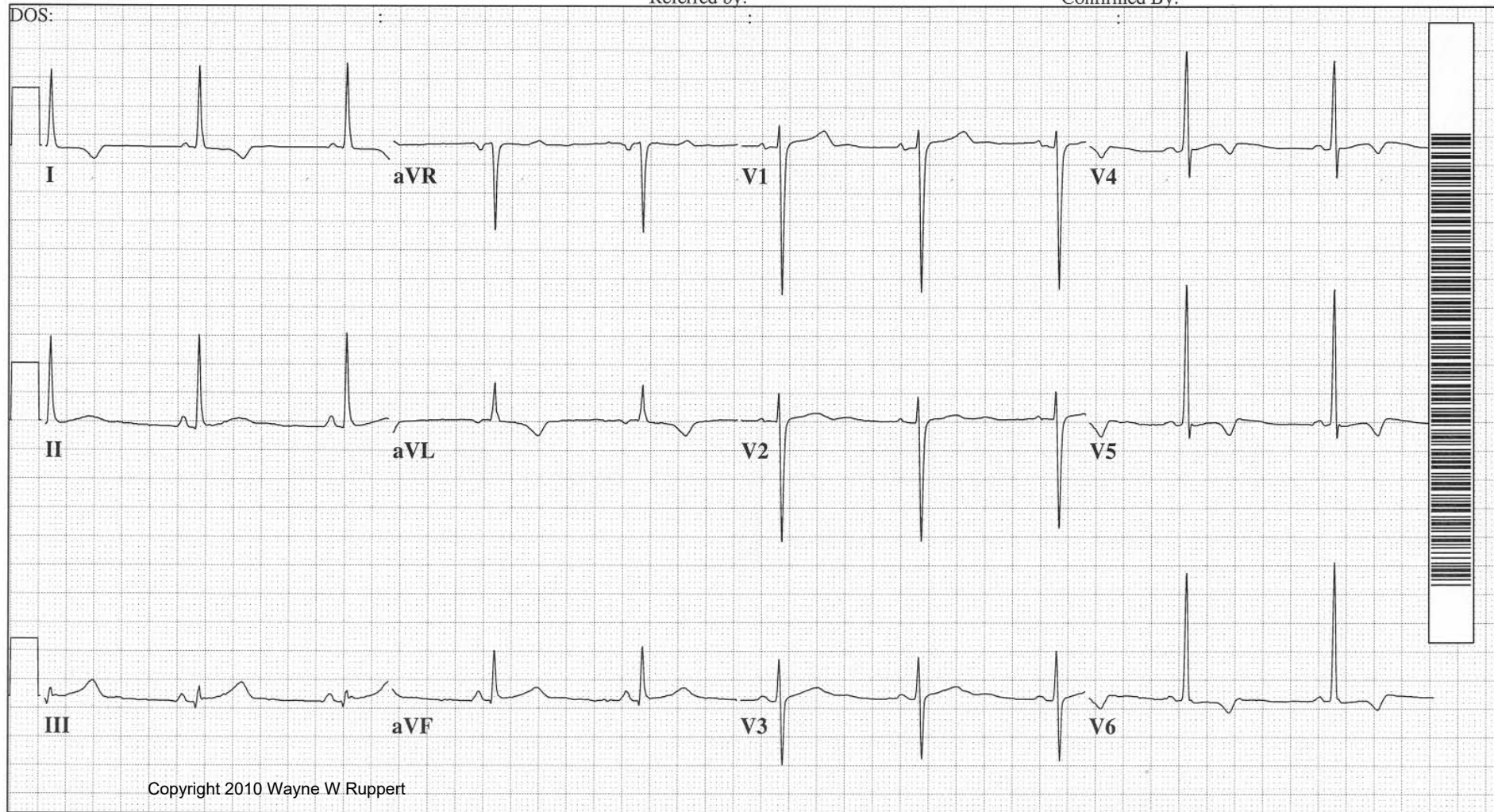
Vent. rate 58 BPM  
PR interval 126 ms  
QRS duration 88 ms  
QT/QTc 412/404 ms  
P-R-T axes 63 36 114

Sinus bradycardia  
Voltage criteria for left ventricular hypertrophy  
T wave abnormality, consider lateral ischemia  
Abnormal ECG  
When compared with ECG of 04-AUG-2000 09:04,  
T wave inversion now evident in Lateral leads

**EKG CLASS #WR03177260**

Referred by:

Confirmed By:



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42 yr  
Male Black  
Room:ER  
Loc:3 Option:23

Vent. rate 58 BPM  
PR interval 126 ms  
QRS duration 88 ms  
QT/QTc 412/404 ms  
P-R-T axes 63 36 114

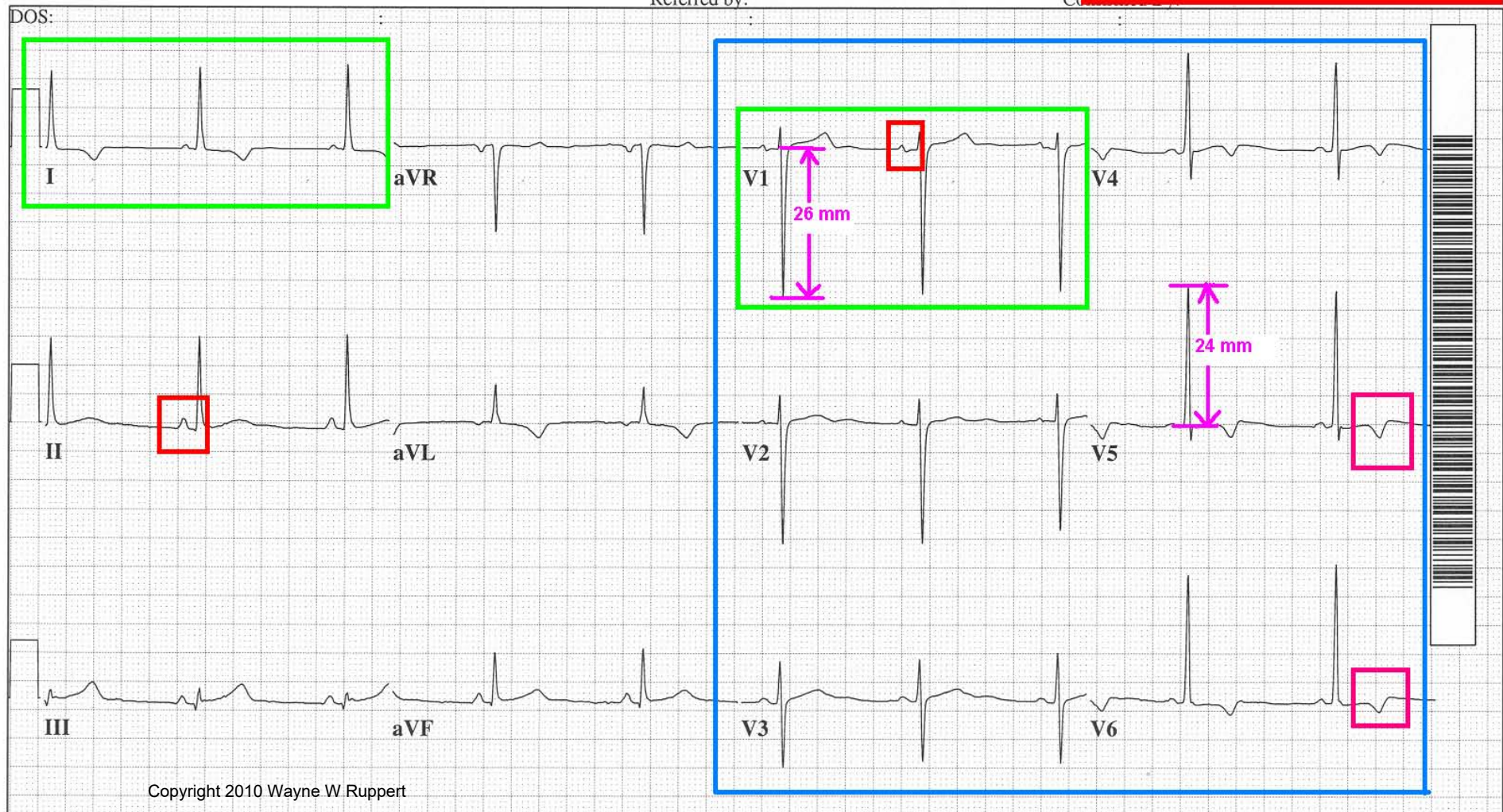
Sinus bradycardia  
**Voltage criteria for left ventricular hypertrophy**  
T wave abnormality, consider lateral ischemia  
Abnormal ECG  
When compared with ECG of 04-AUG-2000 09:04  
T wave inversion now evident in Lateral leads

- LEAD I and V1 AXIS NORMAL  
- NO ATRIAL HYPERTROPHY  
- "EXAGGERATED" R-WAVE PROGRESSION IN THE V-LEADS  
- S-WAVE V1 + R-WAVE V5 or V6 > 35mm ( 50 mm ) !  
- STRAIN PATTERN V3 - V6 vs. LATERAL ISCHEMIA

**EKG CLASS #WR03177260**

Referred by:

Cc



# **CHAMBER ENLARGEMENT**

---

## **CASE STUDY 1:**

**61 y/o MALE C/O EXERTIONAL  
DYSPNEA and WEAKNESS,  
INCREASING OVER THE LAST  
SEVERAL MONTHS.**

**EKG REVEALS . . .**

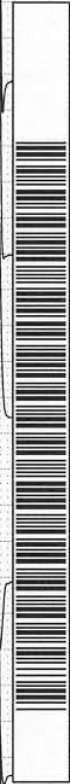
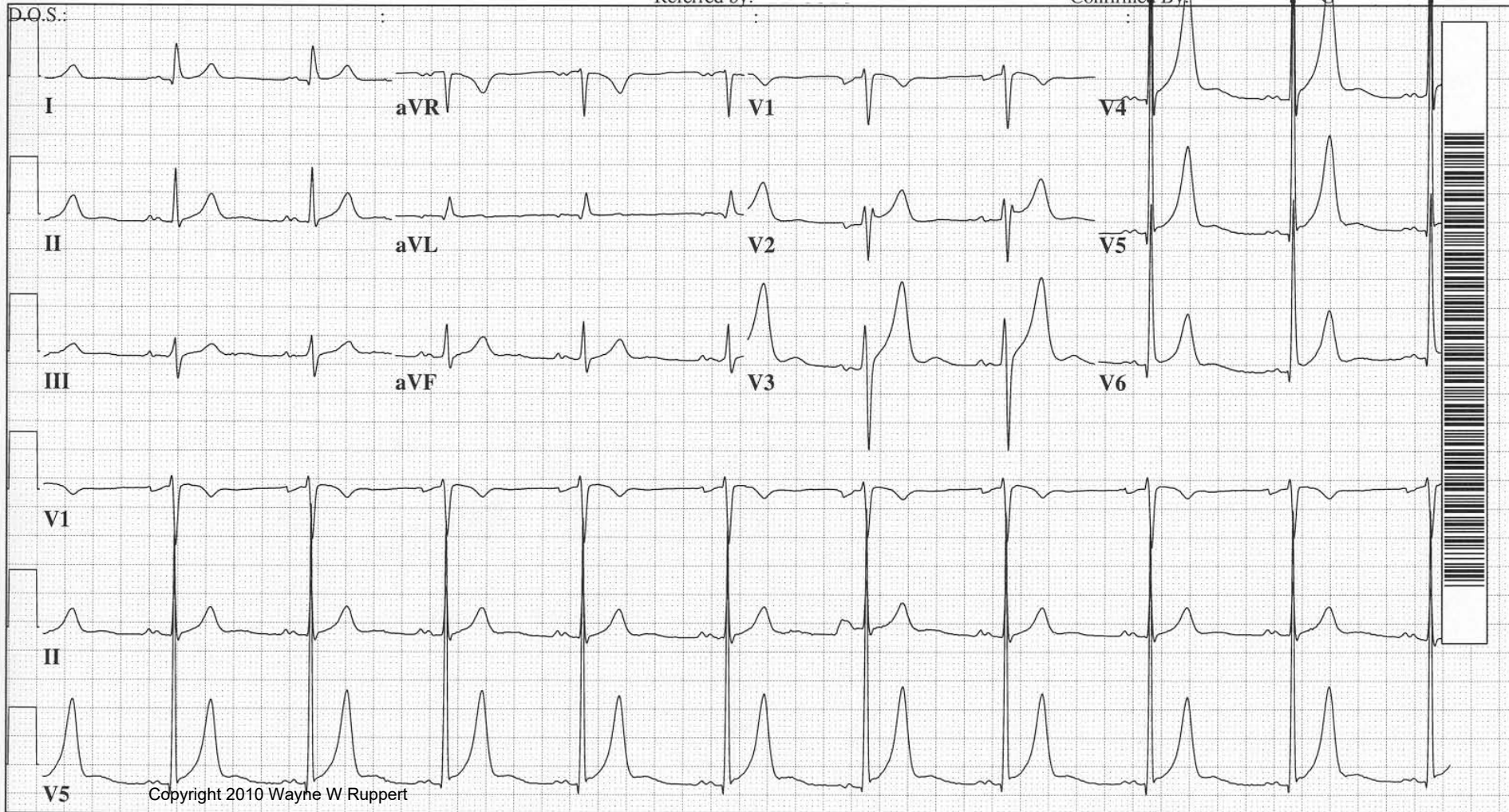
61 yr  
 Male Black  
 Loc:7 Option:35

|              |          |     |
|--------------|----------|-----|
| Vent. rate   | 60       | BPM |
| PR interval  | 176      | ms  |
| QRS duration | 90       | ms  |
| QT/QTc       | 400/400  | ms  |
| P-R-T axes   | 62 33 60 |     |

Normal sinus rhythm  
 Voltage criteria for left ventricular hypertrophy  
 Abnormal ECG  
 When compared with ECG of 02-SEP-2002 09:00,  
 Vent. rate has decreased BY 44 BPM

**EKG CLASS #WR03503400**

Referred by: \_\_\_\_\_ Confirmed By: \_\_\_\_\_



61 yr  
Male Black  
Loc:7 Option:35

Vent. rate 60 BPM  
PR interval 176 ms  
QRS duration 90 ms  
QT/QTc 400/400 ms  
P-R-T axes 62 33 60

Normal sinus rhythm  
Voltage criteria for left ventricular hypertrophy  
Abnormal ECG  
When compared with ECG of 02-SEP-2002 09:00,  
Vent. rate has decreased BY 44 BPM

- BIGGEST S-WAVE + R-WAVE IN V-LEADS > 45mm ( 57 mm )!!

EKG CLASS #WR03503400

- 3mm LONG, "M" SHAPED P-WAVE IN LEAD II

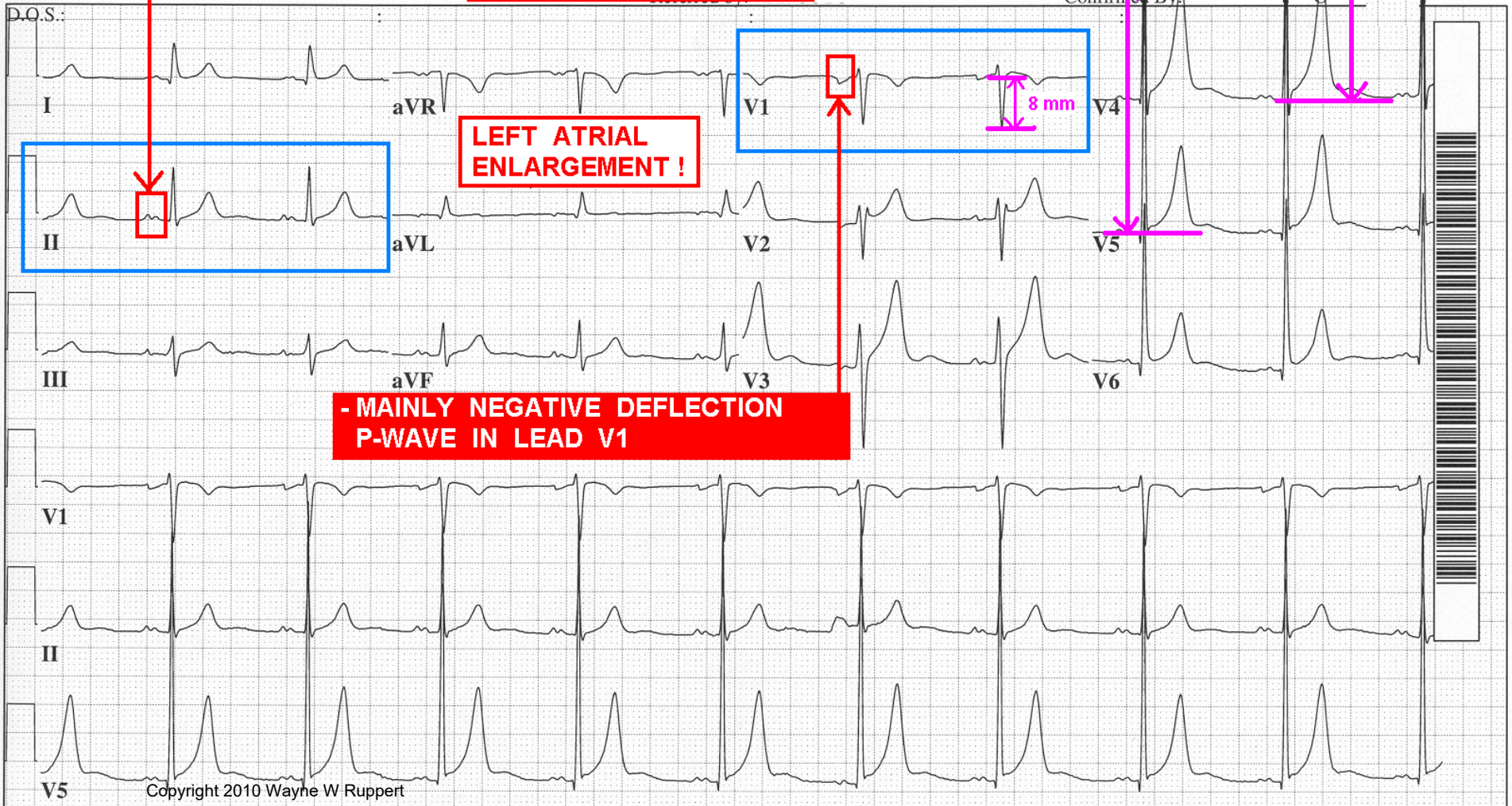
LEFT ATRIAL ENLARGEMENT !

- MAINLY NEGATIVE DEFLECTION P-WAVE IN LEAD V1

Confirmed By: [Signature]

49 mm

8 mm



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# CHAMBER ENLARGEMENT

---

## CASE STUDY 1:

THE EKG COMPUTER MISSED THE LEFT ATRIAL ENLARGEMENT, WHICH IS A KEY FACTOR IN THE DIAGNOSIS OF THE PATIENT'S CONDITION.



WHAT ARE SOME COMMON CAUSES OF LEFT ATRIAL AND LEFT VENTRICULAR ENLARGEMENT ??

# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 1:**

**COMMON CAUSES OF LEFT ATRIAL  
and LEFT VENTRICULAR ENLARGEMENT:**

- AORTIC VALVE STENOSIS**
- COARCTATION OF THE AORTA**
- MITRAL REGURGITATION**
- SYSTEMIC HYPERTENSION**

# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 1:**

**WHAT ASPECT OF THE PHYSICAL EXAMINATION COULD AID YOU IN MAKING A DIAGNOSIS ?**

# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 1:**

**WHAT ASPECT OF THE PHYSICAL EXAMINATION COULD AID YOU IN MAKING A DIAGNOSIS ?**

**AUSCULTATION OF HEART SOUNDS . . .**

# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 1:**

**WHAT ASPECT OF THE PHYSICAL EXAMINATION COULD AID YOU IN MAKING A DIAGNOSIS ?**

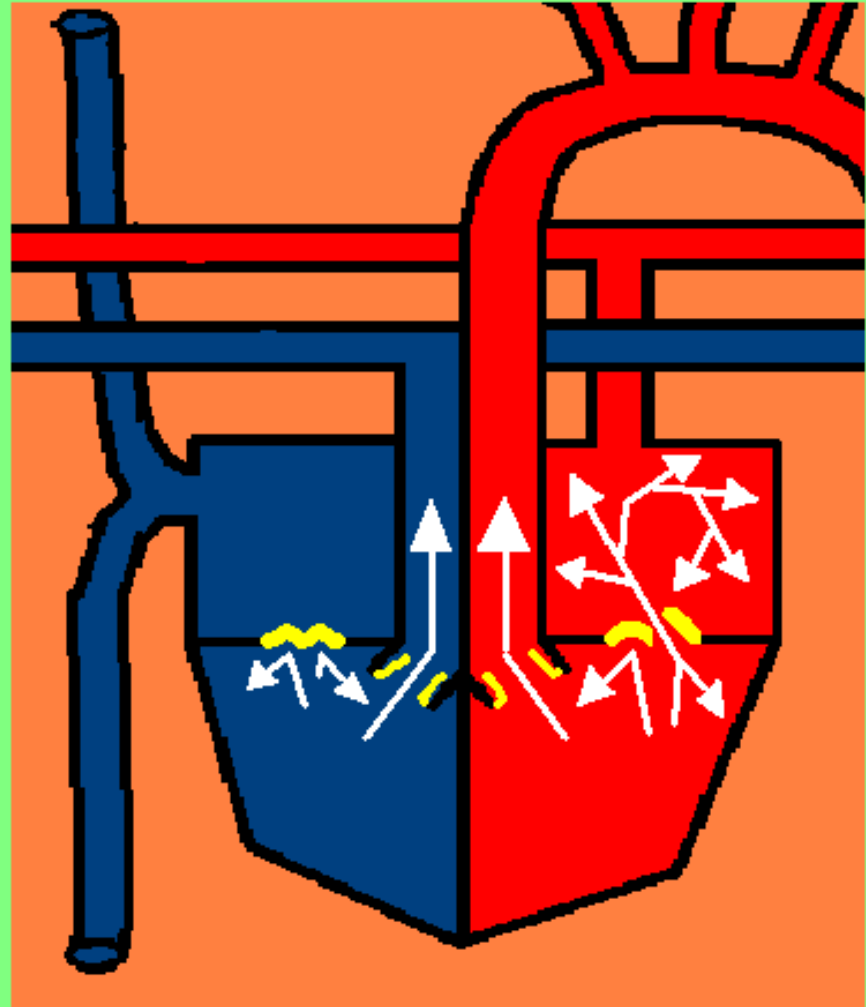
**AUSCULTATION OF HEART SOUNDS . . .**

**THIS PT. EXHIBITED A PRONOUNCED SYSTOLIC ( S-1 ) MURMUR -- STRONGLY INDICATING MITRAL VALVE REGURGITATION.**

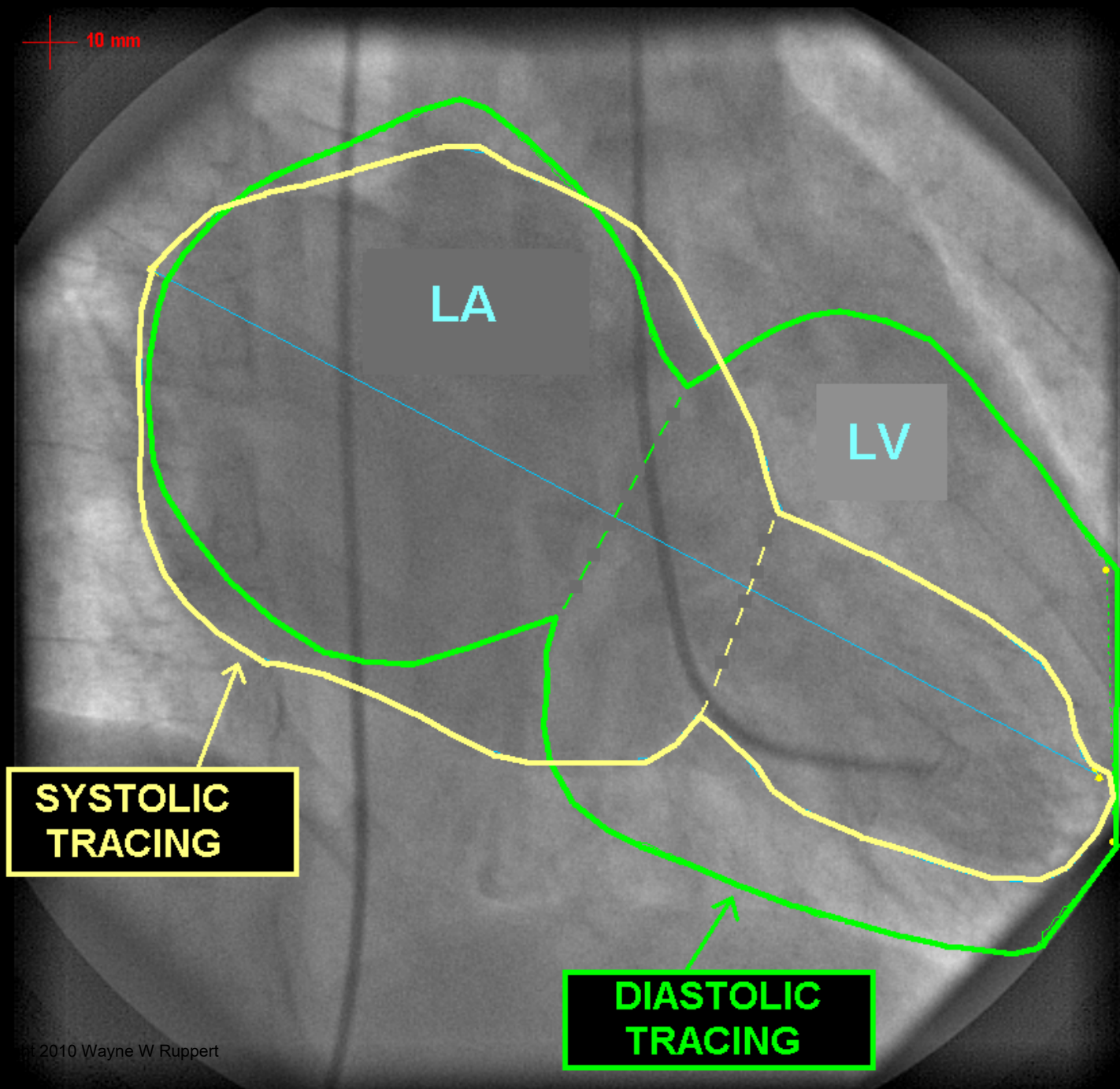
# CAUSE OF SYSTOLIC (S 1) MURMUR

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- ❑ **DAMAGE TO MITRAL and/or TRICUSPID VALVE(s)**
- ❑ **CAUSES REGURGITATION**



10 mm



LA

LV

**SYSTOLIC TRACING**

**DIASTOLIC TRACING**

# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 1:**

## **SUMMARY**

**EKG FINDINGS OF LEFT ATRIAL and VENTRICULAR ENLARGEMENT, COMBINED WITH A PRONOUNCED S-1 HEART MURMUR INDICATE MITRAL REGURGITATION. THE LEFT VENTRICULOGRAM OBTAINED DURING CARDIAC CATHETERIZATION CONFIRM THE DIAGNOSIS. THIS PATIENT WAS SENT FOR A SURGICAL CONSULTATION.**



# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 2:**

**59 y/o FEMALE C/O SHORTNESS OF BREATH WITH MINIMAL EXERTION. LONG HISTORY OF COPD AND CIGARETTE SMOKING. PT. DENIES CHEST PAIN / PRESSURE.**

**EKG REVEALS . . .**

59 yr  
 Female Caucasian  
 Room:328  
 Loc:5 Option:5

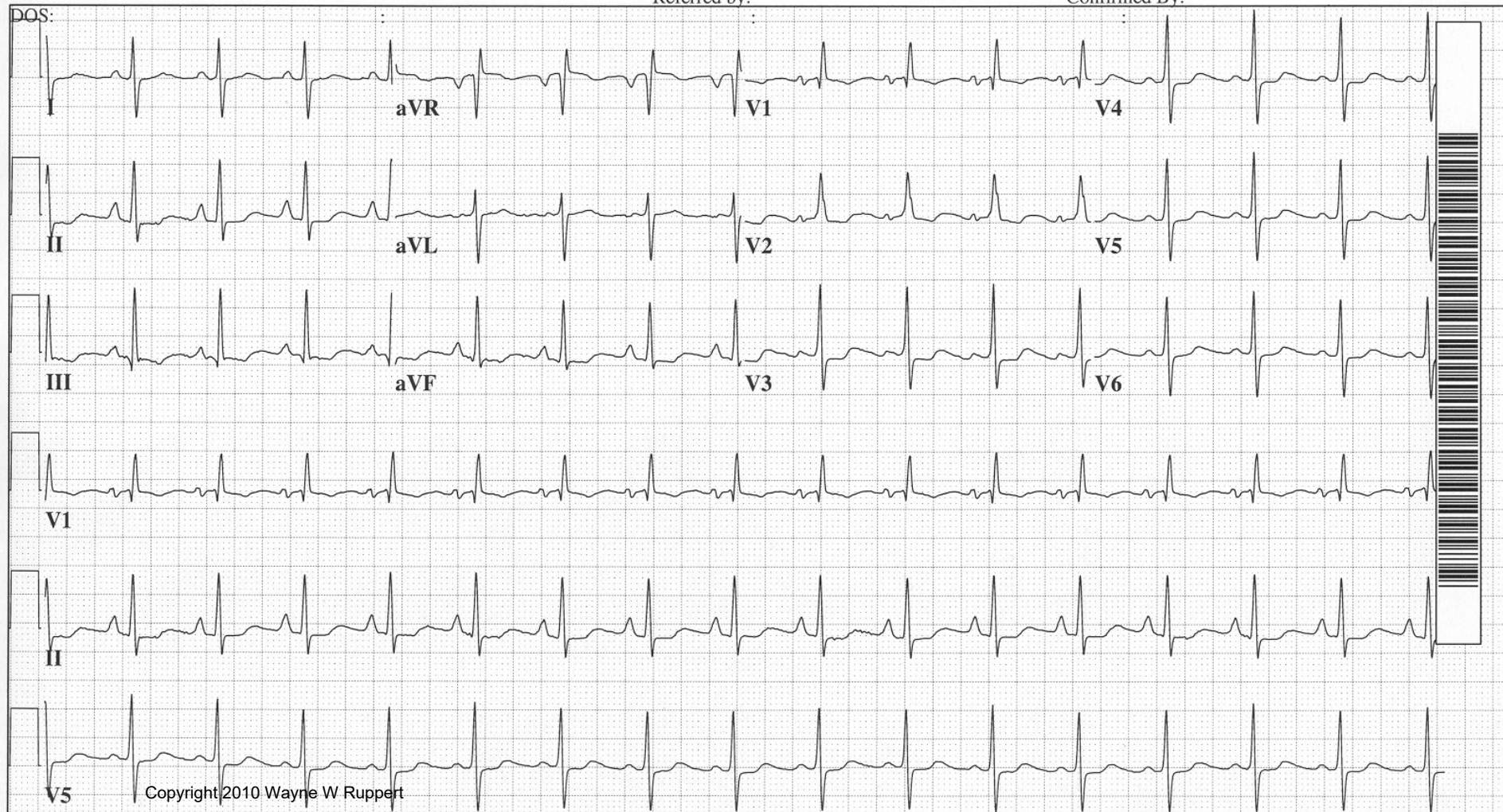
Vent. rate 97 BPM  
 PR interval 140 ms  
 QRS duration 88 ms  
 QT/QTc 318/403 ms  
 P-R-T axes 62 95 5

Normal sinus rhythm  
 Right atrial enlargement  
 Possible Right ventricular hypertrophy  
 ST & T wave abnormality, consider inferior ischemia  
 Abnormal ECG  
 When compared with ECG of 03-SEP-2003 07:35,  
 Inverted T waves have replaced nonspecific T wave abnormality in Inferior leads

**EKG CLASS #WR03295653**

Referred by:

Confirmed By:



59 yr  
 Female Caucasian  
 Room:328  
 Loc:5 Option:5

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 PR interval 140 ms  
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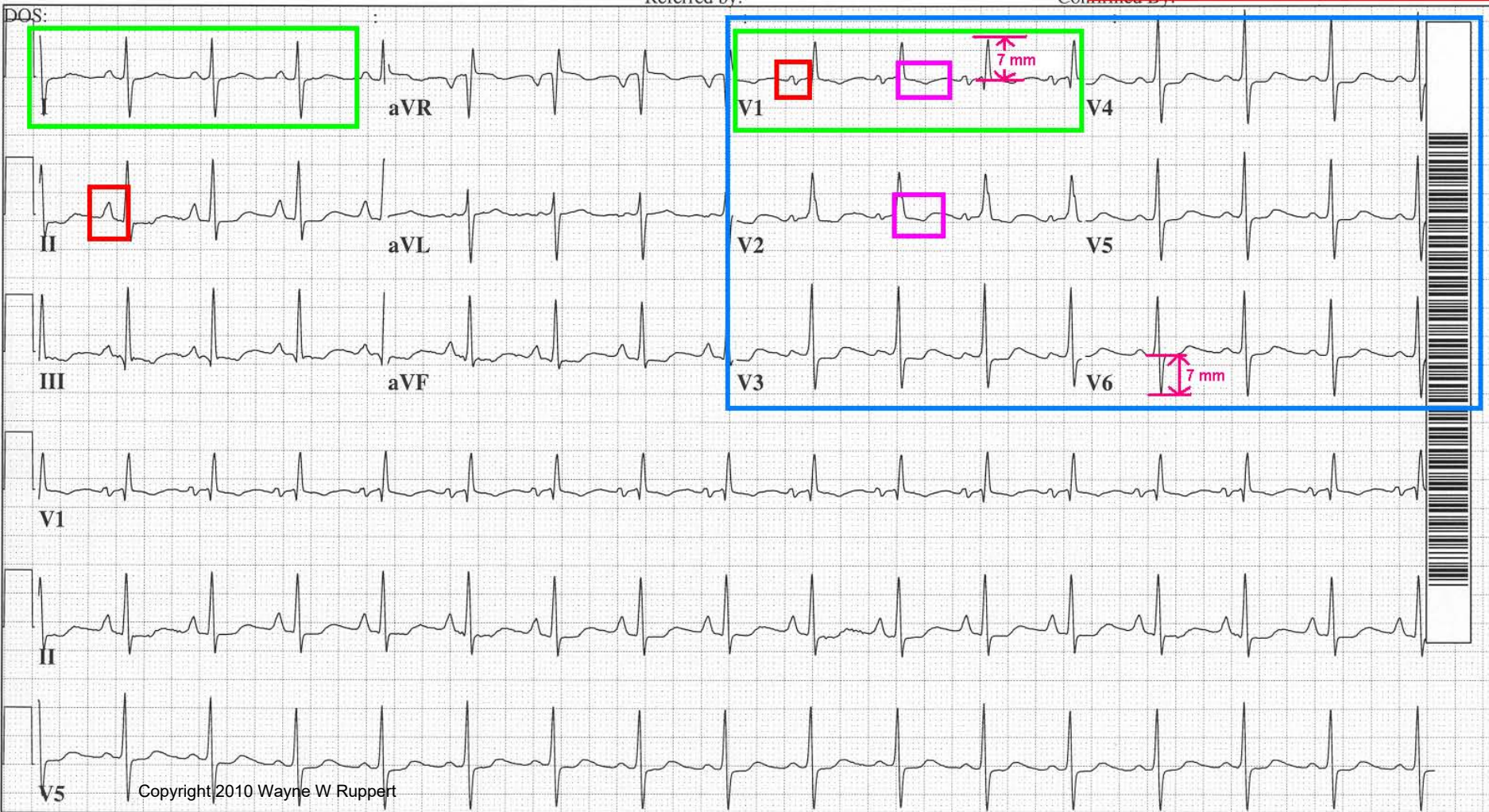
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 ST & T wave abnormality, consider inferior ischemia  
 Abnormal ECG  
 When compared with ECG of 03-SEP-2003 07:35,  
 Inverted T waves have replaced nonspecific T wave  
 abnormality in Inferior leads

- REVERSE AXIS IN LEAD I & V1  
 - RIGHT ATRIAL HYPERTROPHY  
 - REVERSE R-WAVE  
 PROGRESSION IN V-LEADS  
 - POSSIBLE R-VENTRICULAR  
 STRAIN PATTERN IN V1, V2  
 - R-WAVE V1 + S-WAVE V5 or  
 V6 > 10mm ( 14 mm )

**EKG CLASS #WR03295653**

Referred by:

Continued by:



# **CHAMBER ENLARGEMENT**

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## **CASE STUDY 2:**

**BASED ON THE PT'S Hx OF COPD AND CIGARETTE ABUSE, AND THE EKG FINDINGS OF R ATRIAL AND R VENTRICULAR ENLARGEMENT, WE SUSPECT PRIMARY PULMONARY HYPERTENSION AS A POSSIBLE DIAGNOSIS. THE CATH LAB R HEART STUDY REVEALS . . .**

**BUT FIRST, LET'S SEE A "NORMAL"  
RIGHT VENTRICULAR PRESSURE TRACING . . . .**

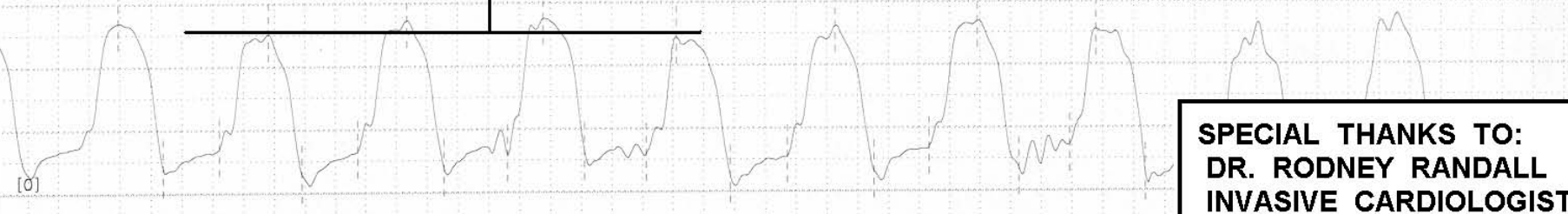


**NORMAL  
RIGHT VENTRICULAR  
PRESSURE**

RV [100] \_\_\_\_\_ 100 mmHg

\_\_\_\_\_ 50 mmHg

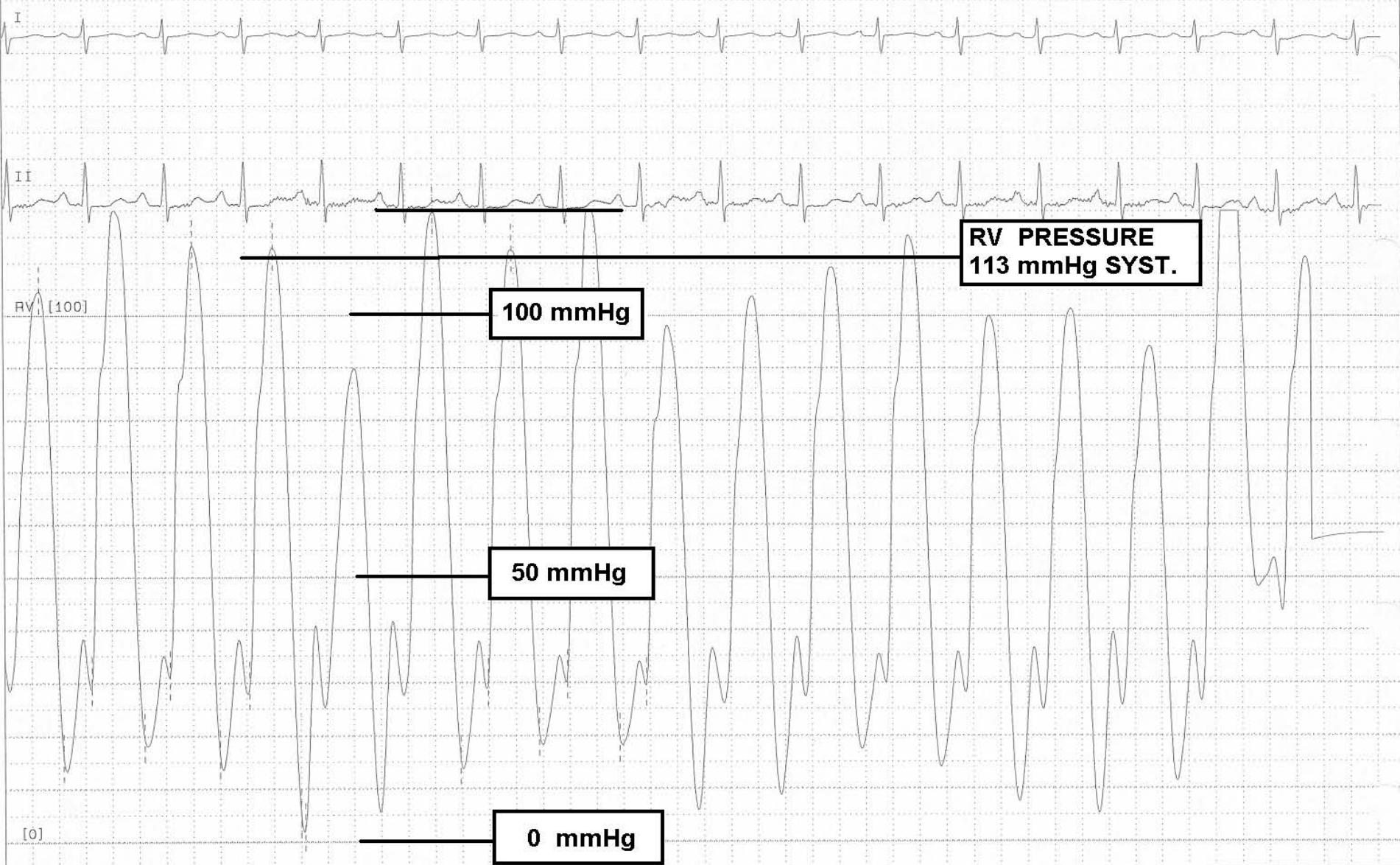
**RV = 26 mmHg SYSTOLIC**



**SPECIAL THANKS TO:  
DR. RODNEY RANDALL  
INVASIVE CARDIOLOGIST  
ST. JOSEPH HOSPITAL  
TAMPA, FL**

**# WR031187574**

**RIGHT VENTRICULAR PRESSURE = 113 mmHg SYSTOLIC**  
**- EXTREME RIGHT VENTRICULAR HYPERTROPHY**  
**- Dx: PULMONARY HYPERTENSION (PCW = 24 normal)**



# VENTRICULAR SYSTOLE

pulmonary artery (PA)  
17-32 mmhg

aorta 90-140 mmhg

pulmonary vein  
6 - 21 mmhg

pulmonary vascular resistance  
11 mmhg

